SPACE SCIENCES

U.S.-Soviet rocket soundings

U.S. and Soviet researchers plan to launch a total of 50 sounding rockets during August from the National Aeronautics and Space Administration's Wallops Flight Center on the Virginia coast. The project is the latest in a series of attempts to reconcile systematic measurement differences that have plagued an international meteorology data-exchange program since it began more than five years ago.

The exchange agreement between NASA and the Soviet Academy of Sciences was made in August 1971, calling for prompt (within seven days) transfer of meteorological sounding-rocket data gathered along two meridians of longitude, 60°E and 70°W. The goal was to provide continuity over the Eastern and Western Hemispheres in the study of cyclic processes in the tropical stratosphere, large-scale strato-mesospheric processes and seasonal transitions of circulation and "interseasonal phenomena." Data exchange began in January 1972, and differences soon began to show.

The Eastern Hemisphere, according to analysis of the data, appeared to be consistently colder than the Western Hemisphere. Both countries began looking for sources of error, with the United States conducting a special series of day-night launches that did, in fact, lead to temperature corrections up to about 60 kilometers. The measurements were still not in line, however, and the World Meteorological Organization sponsored two series of launchings, in 1972 and 1973, to compare instrumentation, as well as techniques of calibration, measurement and processing. (These launchings, conducted from Wallops and from French Guiana, also included participants from Japan, France and the United Kingdom.) The tests revealed, for example, that Soviet measurements in the Eastern Hemisphere were about 18°C lower than NASA readings from the Western Hemisphere. There were also differences in wind velocities.

Pinning down the discrepancies enabled researchers to work out approximate correction factors for the two data sets. In this month's tests, the U.S. team hopes to improve the correction for radiation effects, particularly above 60 km, while their Soviet counterparts are concentrating on improvements in data reduction, the parachute descent system (which affects the time spent at different altitudes) and temperature sensors. Most of the rockets—U.S. Super Lokis and Soviet M-100B's—will be fired in pairs; a successful dual launch is considered to be one with launch times within 30 minutes, data-gathering regions within 50 km horizontally, temperature data covering 30 to 65 km in altitude, wind data covering 30 to 60 km and with both rockets launched on the same side of twilight. The launches are to run from Aug. 10 to Aug. 23.

Titan transitions

The redoubtable Titan III rocket, which has been sending payloads into space for more than a dozen years, is coming to the end of one road and starting on another.

On Sept. 1, the second of the two Voyager spacecraft will be carried aloft from Cape Canaveral, on the way to rendezvous with Jupiter and Saturn, by the last of the Titan III/Centaur boosters. In this combination, the former military missile is topped by the exotic, liquid-hydrogen-burning Centaur upper stage, which offers nearly twice the efficiency of more conventionally-fueled boosters such as the huge Saturn 5. Future interplanetary missions requiring the Titan's strength will be launched from the space shuttle, aided by a variety of upper stages that will be shuttled up with their payloads.

The Air Force, meanwhile, which is developing one such ride-along booster known as the Interim Upper Stage (IUS), has announced plans to adapt the shuttle IUS for use with the Titan III in as many as 23 missions in the 1980s on occasions when the shuttle is inappropriate or unavailable.

PHYSICAL SCIENCES

Carry on, theta pinch

Ashes to ashes,
Dust to dust,
If it weren't for the quartz plugs,
the plasma would bust.

How do you prevent things from coming out of the ends of an open tube? Why, you plug the ends of course. But if you were a plasma physicist and the tube was a theta pinch, you didn't. At least not till recently. In the July 18 PHYSICAL REVIEW LETTERS are two papers telling how some physicists in New Mexico found that this seemingly common-sense solution really does help confine a thermonuclear plasma in a straight tube.

A linear theta pinch is a tube in which the plasma of ions and electrons is levitated by a magnetic field. The pinch part comes when the field is suddenly increased in strength. This pinches the plasma down toward the axis of the cylinder, and experimenters hope it will increase density and temperature to the point where nuclear fusions become numerous.

One of the problems with a linear theta pinch is that when you pinch it, the plasma has a tendency to shoot out the ends. Two means of solving this problem are to eliminate the ends by bending the cylinder into a torus or to arrange some kind of magnetic mirrors at the ends that would bounce the plasma back. Both these solutions lead to new problems, so the search goes on.

Robert C. Malone of Los Alamos Scientific Laboratory and Richard L. Morse of the University of Arizona show theoretically how the insertion of quartz plugs into the ends of the tube might help, and R.J. Commisso, C.A. Ekdahl, K.B. Freese, K.F. McKenna and W.E. Quinn of Los Alamos have shown with an experiment on Scylla IV-P, a five-meter long theta pinch, that the theory seems to work. One of the long-held fears of plasma physicists has been that any solid object placed where the plasma might contact it would degrade the plasma by cooling it or contaminating it with material abraded from the solid. Apparently that is not a detriment here. In fact, the experimenters note that material abraded from the quartz plugs actually helps enhance plasma confinement.

Computerizing star beats

A number of stars are known to pulse—they beat in and out like giant physical hearts. Pulsation indicates a complicated astrophysics and raises a number of fascinating questions for astronomers. How long will pulsing stars pulse? Will the rate change? Might the stars explode? Why do they pulse? What relevance has the physics of pulsing stars to the physics of nonpulsing stars, etc., etc.?

More and more nowadays, when complicated physical processes are in question, physicists resort to computer models to test hypothese that either cannot be worked out experimentally, would be too cumbersome to experiment with or would take too long a time to observe.

From Dartmouth College now comes news of a computer program that astrophysicists hope will enable them to follow the evolution of a class of pulsating stars named for Beta Canis Majoris. This class is particularly interesting because it represents something of a rare minority among pulsing stars, nonradial pulsers. The model will allow researchers directed by Alan H. Karp to predict the behavior and spectra of Beta Canis Majorids at various stages in their life histories.

Most pulsing stars seem to pulse radially—evenly in all directions—but Beta Canis Majorids pulse nonradially or lopsidedly. As if that weren't enough there is another suspected complication: Karp believes there is also differential motion, gas moving faster in the outer layers than in the inner ones.