

the wide variation among individuals in their resistance to disease," the authors declare, "may conceivably be answered by more intensive study of the prenatal nutrient needs of mother and her fetus."

But they caution pregnant women not to dose themselves with large amounts of any vitamin, particularly the B vitamins. Studies have suggested that the 15-odd B vitamins work synergistically, that is, as a complex, and if one B vitamin is consumed in much bigger quantities than the others, the effects can be harmful. □

## White dwarf stars, not black holes?

Among the newest discoveries in X-ray astronomy are the pulsating X-ray sources that are identified with binary star systems. There is a current opinion that at least some of them may be black holes (SN: 1/13/73, p. 28). Another suggestion is now put forth in the March 15 *ASTROPHYSICAL JOURNAL LETTERS* by Kenneth Brecher and Philip Morrison of Massachusetts Institute of Technology. They favor degenerate white dwarf stars.

Brecher and Morrison argue for the superiority of their model on the ground that it predicts more characteristics of the observed systems. It makes a connection between the X-ray pulse period and the orbital period of the binary system, namely, that they are about equal. It permits a calculation of the luminosity of the X-ray source from the angular momentum, mass and magnetic field of the star.

The Brecher-Morrison model also explains the curious phenomenon of spin-up. At least two of the X-ray binaries show pulse rates that increase with time. According to theory this would mean that the source's rotation around its axis was gradually accelerating. The Brecher-Morrison calculation shows that in certain cases of flattened (ellipsoidal shaped) rotating bodies such a spin-up will occur. For rigid bodies like neutron stars (another possible candidate) spin-up will not happen.

Furthermore the model presents no dynamical problems about the existence of degenerate white dwarfs in bound binary systems. To produce a neutron star requires an explosion, which would have blown the binary system apart. Finally there is no need of a black hole even when the X-ray body is so massive that one might expect one, since "for any value of [mass] an equilibrium rotating stellar configuration exists for some value of [angular momentum]." The equilibrium would halt the object's tendency to collapse further and form a black hole. □

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## Twice round the world by Boomerang balloon

High-altitude balloons fill a unique niche in space and stratospheric research. Altitudes of 80,000 feet and higher in the earth's atmosphere are too low for most satellites and too high for most aircraft. Besides balloons are much cheaper than either satellites or aircraft. NASA has been putting about a million dollars a year into research and development of balloon materials and techniques to exploit this area.

Now a milestone has been reached. Scientists recovered for the first time last month a balloon scientific payload after a long-duration, twice-around-the-world flight. The project is called Boomerang and is designed to demonstrate the feasibility of using balloons for long-duration research. The project is funded by NASA and managed by the National Scientific Balloon Facility of the National Center for Atmospheric Research.

The first flight was primarily an engineering test, but the balloon carried 90 pounds of scientific instruments to study cosmic rays and the effects of radiation on corn seedlings and other vegetation. The instruments also collected micrometeorite particles. Victor Hopper of the University of Melbourne is now analyzing the results.

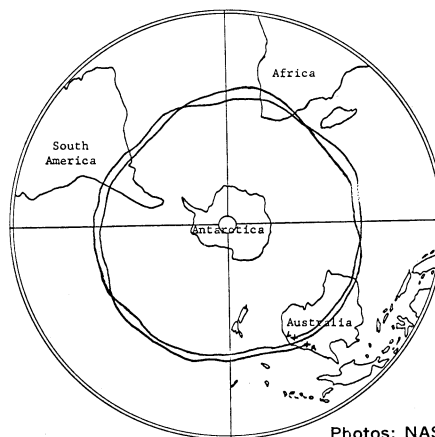
Boomerang I was launched Jan. 24 from an airfield at Oakey, Australia. The balloon made two orbits over Australia, South America and Africa in 36 days and covered 46,000 miles at altitudes of 80,000 feet. Conventional balloons are not capable of orbiting the earth. Boomerangs are. They are super-pressure balloons, 65 feet in diameter, made of bilaminate polyester 0.002 inches thick. They have a tensile strength of 10,000 pounds per square inch and are designed to float their payloads at constant-density altitudes. The ultimate goal of Project Boomerang is to build super-pressure balloons that will orbit at altitudes of 130,000 feet, stay aloft six months, and carry as much as 500 pounds of scientific instruments.

The Boomerangs are king-sized versions of the much smaller GHOST (Global Horizontal Sounding Technique) balloons, developed by Vincent E. Lally's group at NCAR (SN: 4/18/70, p. 393). The GHOST balloons are designed to provide information about atmospheric circulation in the Southern Hemisphere. Although they have stayed up for as long as 441 days and 35 orbits, they carry simple, light-weight payloads that are not recovered.

A second balloon in the Boomerang series was launched only four days after Boomerang I and is still aloft. Long-duration flights in the Southern Hemi-



Boomerang balloon ready for launch.



Photos: NASA

Orbital paths of the 36-day flight.

sphere can be made only during the summer months, December through March. During this time the easterly circulation in the stratosphere follows a pattern known as zonal flow—air at 80,000 feet moves around the globe at a constant latitude, veering neither to the north or south. The winds drop off sharply as the season ends. This is why the second balloon, launched only four days after the first, is taking about a month longer to complete its trip. When it finally finishes its second orbit over Australia later this month, engineers will release its payload by radio command from earth. □

## A problem on ERTS

The video tape recorder aboard the Earth Resources Technology Satellite (SN: 3/31/73, p. 214) has been turned off. The recorder developed sporadic bursts of noise that degraded the recorded images. Images transmitted live are not affected. If the recorder cannot be fixed, ERTS I coverage will be restricted to the North and South American continents.

Since its launch in July, ERTS has photographed the entire North American continent more than 10 times. It has also obtained images of all the major land masses on earth at least once. □

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