A SOVIET SALUTE

A station in space

Another space drama began unfolding this week—the slow deliberate, suspenseful kind the Soviets provide the world. It began April 19 with the launch of a new type of unmanned research laboratory, "Salyut" (salute), believed to be the hub or core to which other spacecraft, such as a manned Soyuz-type craft, could dock.

The anticipation for such a multivehicle mission began in earnest this month during the 24th Party Congress and the Soviet celebration of Cosmonaut Day, April 12, when news from Moscow was peppered with descriptions of "the second decade of manned space flight." Most prominent were explanations of the values of both manned and unmanned earth-orbiting laboratories. These, said Academician Mstislav V. Keldysh, president of the Academy of Sciences of the U.S.S.R., would be used to benefit mankind by performing such tasks as "meteorological investigations, geological prospecting, communications, astronomical research and experiments in geophysics."

Several characteristics of this week's launch led Western observers to believe that Salyut could or would be joined soon by one or more manned craft. First was the omission in the Tass and Pravda accounts of the word "automatic," excessively used to describe all unmanned craft. Second were the Salyut's orbital parameters—apogee, 138 miles, perigee, 124 miles, and inclination, 51.6 degrees (almost the same as those used for the manned Soyuz flights). And finally, the lab was being tracked both from land stations and Soviet vessels in the Atlantic, another procedure associated with manned flights.

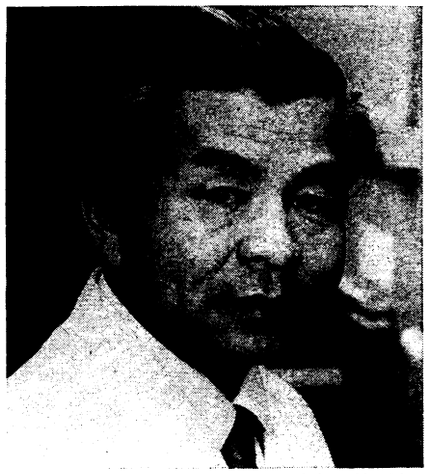
Such a lab has been one goal of the Soviet space program from the beginning. Soyuz 4 and 5 docked to form a four-room spacecraft in January 1969. The simultaneous flights of Soyuz 6, 7 and 8 were highlighted by the first welding of metals in space (supposedly for construction). And the record 18-day flight of Soyuz 9 last summer (SN: 6/6/70, p. 552) was primarily to test human responses to prolonged weightlessness.

One description of such a space station outlines a lab that could house 24 cosmonauts for up to five years (the crew would alternate). Pilot-Cosmonaut Vladislav Volkov says the outward appearance of such a station would be "like a propeller screw consisting of two radially arranged cylinders—wings—fixed to the central cylinder." Each wing "has six compartments each about 14.8 feet in diameter. The central cylinder has a laboratory for experiments in zero gravity. Every 'wing' has its own living compartment, air-lock chamber, commander compartment, laboratory compartment, working compartments and warehouse."

The first space station of this second decade may not be as complex as the one described by Cosmonaut Volkov, but there was little doubt that Salyut is an integral and important step. The ensuing weeks should tell the story. □

EXPERIMENTAL BIOLOGY

Bridging a gap



Johns Hopkins

Dr. Hsu: Next, an artificial placenta.

In 1878 a German named Schenk put some rabbit eggs in a culture dish and added sperm—nothing happened. Since then biologists around the world have been trying to fertilize mammalian eggs outside the uterus. Their various reports of success were greeted with skepticism until 1959 when Dr. M. C. Chang of the Worcester Foundation of Experimental Biology reported that he had fertilized a rabbit egg and replanted it in another rabbit that became pregnant and gave birth.

Having achieved external fertilization, the next step in this area of experimental embryology would be complete *in vitro* growth of the embryo. Unfortunately growth stops when the cells begin to form into specialized organs, the stage at which the blastocyst would normally attach itself to the wall of the uterus. Once this stage has been passed, growth in an artificial womb can take place (SN: 7/5/69, p. 12). Therefore, reaching and passing this stage of development has been a major research goal.

This gap in the knowledge of embryo development may have been bridged. Last week at the Federation of American Societies for Experimental Biology's annual meeting in Chicago Dr. Yu-Chih Hsu of the Johns Hopkins University School of Hygiene and Public Health announced that he has developed mouse embryos beyond the implantation stage.

To provide a surface for implantation Dr. Hsu coated culture dishes with rat tail collagen, a protein substance. He then placed fertilized mouse eggs in the dishes and waited for results. On day three of incubation the blastocysts began to attach themselves to the collagen. Cells that would normally form the placenta began to spread into the underlying collagen, and the embryo remained visible as a rounded, dense cell mass in the center.

Between the fourth and sixth days the embryos reached the yolk sac stage, and 80 to 95 percent of them ceased to differentiate. The remaining 5 to 20 percent continued to develop rapidly and three cell layers were differentiated.

After 10 to 14 days of cultivation brilliant red blood islands showed up on the yolk sac. A network of blood vessels developed and the primitive red blood cells were pumped back and forth by rhythmical contractions of 70 to 80 beats per minute. The contractions invariably ceased after three or four days and there was no further development.

Because, as Dr. Hsu puts it, "all the embryos developed *in vitro* seem to be defective in one organ or the other with the present method," he concludes that "the supply of nutrients and gases may be inadequate for further embryonic development."

With these findings Dr. Hsu has filled an existing gap in the field of developmental embryology. He believes that now is the proper time to begin work on the next step—the development of an artificial placenta that can supply the necessary nutrients and gases to the embryo. □

QUASAR CHANGES

Illusion of plus-c velocity

Quasars have been hogging much of the astronomical news lately. Internal structures in quasars—objects that radiate energy at rates among the highest in the universe—began to be observed a few months ago.

The evidence is showing that swift, violent, large-scale internal changes take place in quasars. Recently a group of astronomers—Drs. Curtis A. Knight, Douglas S. Robertson, Alan E. E. Rogers, Irwin I. Shapiro and Alan R. Whitney of the Massachusetts Institute of Technology; Thomas A. Clark of the Goddard Space Flight Center; Richard M. Goldstein of the Jet Propulsion Laboratory and Gerard E. Marandino and Nancy R. Vandenberg of the University of Maryland—reported observations of the internal structure of the quasars 3C 279 and

3C 273 (SN: 4/10/71, p. 245). Structure in the same quasars is now reported by another group: Dr. Marshall Cohen and graduate students George Purcell and David Schaffer of California Institute of Technology, Dr. David Jauncey of Cornell University and Drs. Barry Clark and Kenneth Kellerman of the National Radio Astronomy Observatory. Drs. W. Donaldson and H. Smith of the Jodrell Bank Observatory report internal structure in quasar 3C 147.

The original report by Dr. Knight and his colleagues indicated that 3C 279 most likely consisted of two equally bright components. Last week great excitment was generated at a symposium in Boston when it was reported that four months' watching shows that if there are indeed two components, they appear to be separating from each other at a velocity much greater than the speed of light. "If we blindly go ahead and assume [that quasar red shifts are reliable measures of distance]," says Dr. Shapiro, "then we get 10c" 10 times the speed of light.

Nobody wants to believe that any physical object is going faster than light. Some, like Dr. Geoffrey Burbidge of the University of California at San Diego, argue that the red shifts are not reliable guides: The quasars are much nearer than they appear to be and therefore the speed of separation is much less.

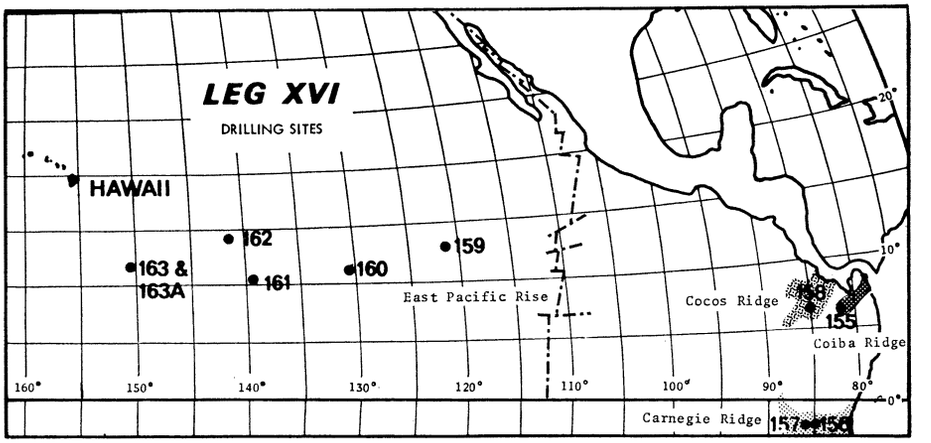
But, Dr. Shapiro counters, the recent work of Dr. James E. Gunn of Caltech (SN: 3/20/71, p. 193) associating a quasar with a group of galaxies convinces him that the red shifts are reliable distance indicators. It therefore becomes necessary to explain the speed as a geometric illusion.

One possibility is that one object is moving toward us and the other away. This could give the impression of a relative velocity greater than the actual velocity of either. Another possibility arises from the nature of the observations, which are made by combining signals received at widely separated telescopes. This gives a one-dimensional view along the projection on the quasar of the baseline between the telescopes. Matter driven by some explosion in the quasar could be crossing the projection of the baseline nearly simultaneously at different points, giving the illusion in one dimension of rapid sideways motion.

The second explanation, expansion of a single object, is favored by Dr. Kellerman and his associates. For two components to appear equally bright, he says, the one moving away would have to be just that much brighter than the approaching one to compensate for the apparent dimming brought about by recession, an unlikely situation to happen at random. □

ZIPPERING-UP THE TRENCH

How the Isthmus of Panama got there



E. Cherry Doyle

Leg 16 finding: Panama was thrust up when ridge parts sealed a trench.

The Isthmus of Panama is a peculiar feature. Not only is the connection of two continents by such a narrow tongue of land unique, but the Isthmus is also the only barrier to the world-wide circulation of water. Its creation out of oceanic material some 10 million years ago must have caused severe changes in the distribution of marine life and in local climates.

Scientists on Leg 16 of the National Science Foundation's Deep Sea Drilling Project, led by Drs. Tjeerd H. van Andel and G. Ross Heath of Oregon State University, believe they have found how this land bridge between North and South America was created.

The scientists had hypothesized that 10 million to 15 million years ago the trench that now extends along the western coast of North America as far south as Costa Rica extended southward across a deep water connection between the Caribbean and the Pacific. The Pacific crustal plate was sliding under the Caribbean. At the same time, there was an ocean ridge extending eastward from the present position of the Galapagos Islands. This ridge, the scientists believe, split lengthwise as a rift zone grew from its eastern end. The southern half of the ridge—the Carnegie Ridge—remained near the equator; the northern half broke into several pieces that drifted northward. As pieces of the ridge reached the trench they sealed it up from south to north. The jamming of crustal materials into the trench lifted the western edge of the Caribbean plate, forming the Isthmus of Panama.

The researchers drilled three holes: one on the stationary portion of the ridge at the equator, the other two on blocks thought to have drifted northward. At the bottom of all three holes the researchers found identical equatorial sediments. Equatorial waters are highly productive, producing unique and easily identifiable sediments that consist entirely of the remains of microscopic plants and animals. This equatorial type of deposition could not have occurred at the present positions of the northern ridge segments, Dr. van Andel asserts; the ridges must have originally been located at the equator.

The northern holes, however, show gradual changes as the deposits become younger. The abundance of fossils decreased as the blocks passed through the less fertile waters north of the equator. Volcanic ash, clay and other materials of continental origin appeared in increasing quantities. The drift apparently began in the east. The western ridge, the Cocos, is just now running up against the continent.

"The trench is getting zippered-up from the southeast," Dr. van Andel says, and there is no reason why it won't continue. In another 10 million years, he predicts, the Cocos Ridge will seal the trench and lift Acapulco 1,000 feet in the air.

In an entirely separate study, the Leg 16 scientists drilled at five sites about midway between Hawaii and Central America. The discovery that metal deposits were forming in a rift zone in the Red Sea had led them to examine other rift zones, such as the East Pacific Rise, for further evidence of the nature and distribution of ore bodies. At one site between two fracture zones west of the East Pacific Rise, Dr. Heath reports, they found unusually high concentrations of metals.

South of Hawaii near the equator is one of the most biologically productive areas of the ocean. A zone of strong upwelling brings nutrients to the surface. The productivity of this area is greatly influenced by the climate of the rest of the world. During ice ages, for instance, ocean circulation becomes more intense and life is spread over a wider area. Cores from this part