science news
OF THE WEEK

59 days in space: Return from the longest

The return to earth this week of the Skylab 2 astronauts—just in time to celebrate NASA's 15th birthday Oct. 1—is being heralded by some in the space world as the greatest space flight yet. The mission lasted longer than any other one; the astronauts seemed to have adapted to weightlessness (indications are they adapted fully by day 39), and on top of that they accomplished all the science planned and some not planned. They traveled 24 million miles in orbit, never became too bored and set all kinds of records.

Astronauts Alan L. Bean, Jack R. Lousma and Owen K. Garriott splashed down in the Pacific Sept. 25 after a record 59 days, 11 hours and 9 minutes in space. They were a bit shaky on their return to earth's gravity, but, as they say, happy to be home to earth.

They brought back with them 18 miles of magnetic tape—remote sensing data of the earth's resources—and 16,800 frames of film of earth. These include high resolution photographs of most of the United States. Unusual targets such as Mt. Ararat in Turkey near the border of the U.S.S.R., linear and circular features of drainage systems in the western United States, crustal fractures and patterns of glacial land forms in the Big Horn Mountains of Wyoming and Montana and newborn islands in the Pacific are among the photographs. Geologists examining Skylab 1 data have already located new mineral deposits in Nevada near Ely. Large swaths of Europe, Asia, Australia, Japan, South America and Africa are on film. Geologists hope to find new sources of water from the photographs of the drought-stricken areas of Africa.

The three Skylab 2 space men spent 305 hours observing the sun (SN: 9/15/73, p. 166). What solar physicists have already seen from the television transmissions "represents a true breakthrough, or revolution in solar astronomy," says Robert W. Noyes of the Smithsonian Center for Astrophysics in Cambridge. What is yet to come from the 77,600 frames of film are new models of the sun and perhaps a better understanding of how it works.

The parttime astronomers photographed Scorpio X-1, the brightest X-ray source yet found in the galaxy. The source has an optical counterpart that may or may not be the same as the X-ray source. Sco X-1 is a weak emitter of radio waves. "It is not an ordinary star," says Allen Krieger of the American Science and Engineering. It does not appear to be a black hole, a pulsar, quasar or neutron star either. What it is is a mystery.

The crew also worked with manufacturing and materials processing in space. Samples of material welded and brased in weightlessness have been returned. The astronauts completed all of the space furnace experiments as well as others in processing materials originally planned for the last Skylab mission in November. Engineers hope to determine the effects of zero gravity on crystal growth, phase changes and solidification of certain materials. Thermal convection, for example, does not occur in liquids in weightlessness. This allows solids to form uniformly. Physicists hope the results will provide new insights into molecular engineering, leading to materials that are stronger and more heat-resistant.

Also returned to earth was Arabella, the space spider. Her companion, Anita, died a week earlier, pobably because she didn't suck enough juice from the astronauts' meat. Garriott's minnows are also back on earth. Some of the larger minnows are dead; the younger minnows, the first creatures known to be born in weightlessness, are alive. They didn't have the problems swimming in weightlessness their elders did. If both spider and minows survive, biologists want to see how readily they readapt to gravity.

All this and more.

Yet, other than several thousand anxious scientists and those intimately connected with the space program, Americans appear to have become blasé about the first operational laboratory in space. In an atmosphere of high food prices, unavailable gasoline and distrustfulness of government, even the heroic feats of space repair work—and of the ingenious engineers in Houston—have become old hat.

Recalibrating the radiocarbon clock

The greatest thing since sliced bread, as far as archaeologists were concerned, was the development of the radiocarbon (C^{14}) dating technique. For the past 25 years they have employed it extensively in dating objects up to 40,000 years old. But in recent years researchers have double checked some radiocarbon dates against objects of a known age and found that not all C^{14} dates are as accurate as they were thought to be. Some dates were found to be off by as much as 750 years. Now researchers at the University of Pennsylvania Museum have solved part of the problem.

Radiocarbon dating is based on the assumption that organic matter, while it is alive, absorbs atmospheric C^{14} at a steady rate. When the organic material dies it stops absorbing C^{14} and the radioactive carbon begins to decay. The rate of decay or half-life of C^{14} is known (5,730 years) and from the amount of C^{14} left in an organic sample its date of death can be determined. The error

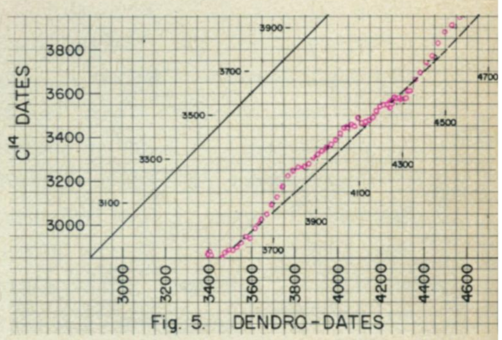


Fig. 5

in the method comes about because, contrary to what was believed, the amount of C^{14} in the atmosphere has fluctuated during past times. So for most periods, archaeologists must apply corrections to radiocarbon dates to get true ages.

One way of arriving at the proper corrections is by cross-dating radiocarbon dates with known dates. Some of the most accurately dated organic samples to do this with are trees whose annual rings can be counted. The science is known as dendrochronology, and E. K. Ralph, H. N. Michael and M. C. Han have used it with bristlecone pines, the oldest known living trees. Samples of these trees, found mostly in the

manned mission

Living in space has indeed become routine. Oddly enough, if one believes what NASA has been saying, that is precisely what NASA hoped Skylab would prove: that living and working in space could be useful and as commonplace as working in an office. That, after all, is the gospel of the space shuttle. If the Skylab 2 astronauts readapt to living in gravity as easily as the first Skylab crew did, NASA will have come a long way toward proving that living in space is feasible.

But this second successful Skylab mission—twice as long as the first—poses again an even greater challenge to NASA. Now that it can be done and done with lots of science, is it necessary? NASA thinks it is. So do many who have a long-range concept of the future of man in this solar system. But these questions, posed now, have social and economic implications. What NASA has done—and will do one more time with Skylab 3—is to provide a challenging option for the nation. □

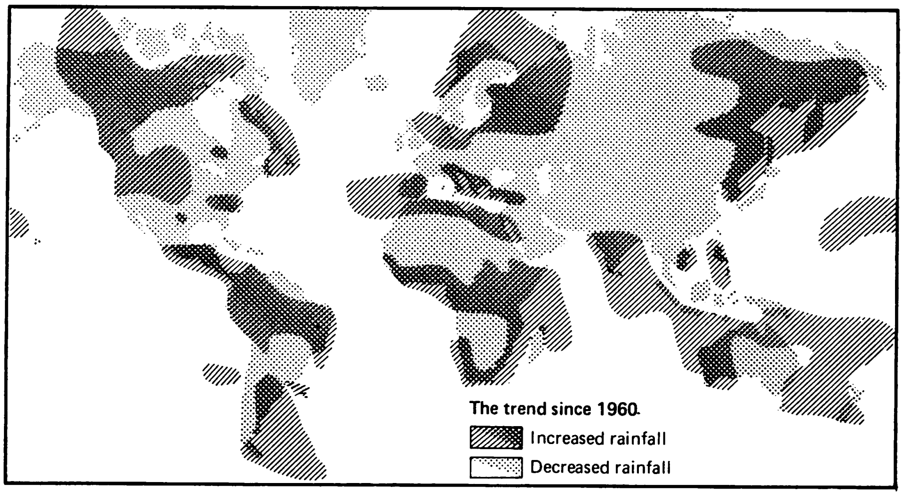
C-14 Date	Range or Mid-Point for Corrected Date	C-14 Date	Range or Mid-Point for Corrected Date
2960 BC	3610 BC	3260 BC	3820-3850 BC
2970 BC	3620 BC	3270 BC	3850-3880 BC
2980 BC	3620 BC	3280 BC	3880 BC
2990 BC	3630 BC	3290 BC	3890 BC
3000 BC	3640 BC	3300 BC	3900 BC
3010 BC	3650 BC	3310 BC	3900-3920 BC

Univ. of Penn.

Graph, table give corrected dates.

mountains of California, have been shown to be about 8,000 years old.

By comparing 631 radiocarbon dates obtained from samples of bristlecone pine with the wood's true age, they have established correction factors for 85 percent of the radiocarbon dates falling between 1849 A.D. and 5383 B.C. Going back in time prior to 700 B.C., the corrected dates become increasingly older than the C^{14} dates—by as much as 600 years. Since 700 B.C. the trend of the correction is mixed—sometimes older, sometimes younger. The corrections are in close agreement with similar work done at the University of Arizona and the University of California at La Jolla.



Drought: A southward shift of world climate

Ndarairwa, nyamwaka musrasha makoto

"I have been told," goes the song, from the Shona people of Rhodesia, "this year do not throw away the chaff." The message: Save even your poorest food, for the famine is coming. Curt Wittig, recording the traditional music of Africa, heard the warning song this summer, surrounded by the parched desolation of a four-year-long drought.

Yet not all of southern Africa is so afflicted—even as the song was heard, drenching rains were falling within frustrated eyesight across the mountains of Mozambique to the east. Hardest hit is a vast band across the center of the continent, from Mauritania on the west coast through Mali, Niger, Chad, Sudan, and extending all the way to India. This is the monsoon belt, where from October to May torrential rains have in the past soaked the land enough to make up for the rest of the year's drought.

In recent years, however, the monsoons seem to have moved down toward the equator, leaving 12 dusty months a year in their stead. In fact, a British meteorologist believes, much of the rainfall pattern of the world appears to be moving mysteriously southward.

In much of Europe, according to Derek Winstanley, formerly of the Anti-Locust Research Centre in London, rainfall has been decreasing for years. In the subtropical zone to the south, including northern Africa and the Middle East, measurements from 10 widely spaced meteorological stations all show that it has been getting wetter.

Still farther south, however, is the great band of drought, and the moisture that used to come with the monsoons is yet below that. Where the

Spectrum

Seeking water in dry Indian riverbed.

mighty rains used to fall, the death toll from drought has been estimated in the millions, and the Sahara Desert is reportedly advancing southward in places as much as 30 miles a year. Rainfall from Mauritania to India in 1970 was barely half what it was in 1957. An experimental cloud-seeding project in Niger this month, the first in the country's history, has showed some promise, but the future still looks bleak.

For four years running, the monsoon's deluge has simply failed to occur. The spreading drought, according to H. H. Lamb, director of the Climatic Research Unit at the University of East Anglia, is part of a pattern of changes shaping the biggest shift in the world's climate in almost 300 years.

Whatever the explanation, the symptoms extend all the way to the north polar cap, where the southward movement of the ice border is paralleling the shifts of the circulatory wind patterns and climatic zones, and temperatures are setting new record lows. It appears, all in all, that while the world's total rainfall varies little from year to year, more of it is now falling in the Southern Hemisphere, away from the major areas of the continents of man. □