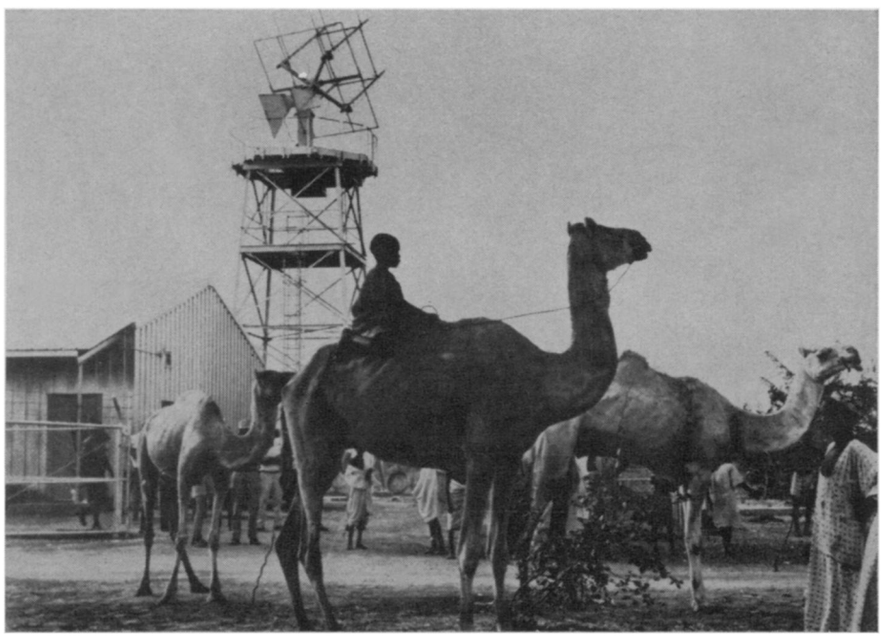
SPACE COOPERATION



NASA

At Kano, Nigeria, blase camels stand before a NASA tracking station.

NASA International—

Dozens of countries are joining the space agency in its hands-across-the-heavens program.

by Jonathan Eberhart

The little Nike-Cajun sounding rocket that blasted off from the rocky island of Sardinia in the first month of 1961 did nothing but spew forth a yellow cloud of sodium vapor into the atmosphere for the benefit of some wind-mapping Italian scientists. The size of the event belied its significance, however, for it was the first spaceward flight produced by cooperation between the U.S. and another country.

That summer Sweden tried a similar experiment, this time using an Arcas rocket from the U.S. Navy. The National Aeronautics and Space Administration launched four sounding experiments from Australia the same year, and Norway and Denmark joined to provide experiments for a U.S. launch from Wallops Island, Va.

By now some 400 sounding rockets have been launched under cooperative agreements between NASA and 19 other countries. Since that first U.S.-Italian shot, the space agency's international activities have expanded into many other areas such as satellite launches and information exchange, altogether involving some six dozen nations.

The cost to NASA of all these programs is small—less than $10 million in the fiscal year just ending covers satellite plans and launches with Canada, England, France, Germany, Italy and the 10-nation European Space Research Organization—but both cost and scope will undoubtedly grow as the newer spacefaring nations expand their horizons and additional countries join the club.

Some of the biggest gains from international space projects, in fact, turn out to be the cheapest. A few months after it had launched its second Tiros weather satellite, NASA got the weather organizations of 40 foreign countries to begin conducting ground observations synchronized with satellite photography and to exchange the results. This enabled improved weather data to be made available for much of the world, at relatively low cost to the participating countries.

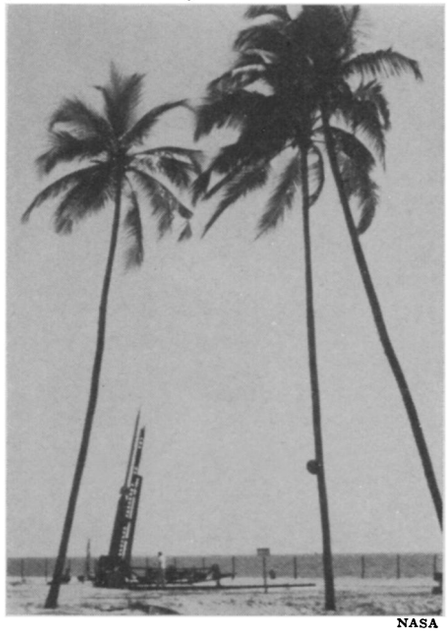
The cost came down even further in 1963, when Tiros VIII was launched, equipped with an Automatic Picture Transmission (APT) system that would let any country receive cloud cover photos directly from the satellite. APT ground stations are remarkably simple, and have been built for less than $100.

Eight foreign countries have joined the U.S. in trying to determine more accurately the shape of the earth, by measuring the precise orbits of the GEOS (Geodetic Explorer Satellite) and PAGEOS (Passive GEOS) satel-

lites. Various kinds of tracking and data-collection stations used for orbital satellites, deep space probes such as the Mariner Mars and manned flights involve 23 nations as sites; and Project Moonwatch, which utilizes both amateur and professional observers at times of interest such as eclipses, has now amassed the help of 32 countries besides the United States.

To keep things from getting completely out of hand in trying to organize such complicated multinational programs, NASA has a set of guidelines that must be agreed upon in advance by each participating country:

- Each government must designate a central civilian agency to handle all negotiations and subsequent joint efforts.
- Specific projects, rather than generalized programs, must be indicated for any operation.
- Each country must accept financial responsibility for its own contributions. NASA would not relish having to come up with some last-minute funds to salvage its investment in a supposedly joint undertaking.



NASA

A Nike rocket is poised in India.

Joint rocket and spacecraft launches make up only part of the space agency's international activity. An agreement with Russia for a joint compilation of space biological and medical data will be concluded next year, and a similar U.S.-Soviet plan calls for the exchange of weather data from satellites, sounding rockets and other sources.

Computer tapes and microfilmed technical information are passed back and forth by NASA, ESRO and the European Launcher Development Organization. In addition, NASA informally exchanges space data with 277 institutions in 42 countries.

NASA also has several different kinds of fellowship, associateship and technical training programs. These have brought more than 700 foreign scientists, engineers and technicians to the U.S. from almost 36 countries.

Still, the satellites are the most prominent examples of cooperative space research. In the summer of 1963, an Italian crew of launch technicians was trained at Wallops Island during a suborbital test preceding the San Marco satellite series. The first satellite was orbited from Wallops Island by a joint team late in 1964. San Marco 2 was launched April 26, 1967, from a floating launch pad off the coast of Kenya in the Indian Ocean. The rocket was a U.S.-made Scout; the crew was all-Italian.

Last month, England's third satellite, UK-3, was fired into orbit from Vandenberg Air Force Base, a site in California shared by NASA and the Air Force. Also in May, ESRO attempted unsuccessfully to launch its first satellite, which failed to orbit when a booster stage misfired (SN: 6/10).

In the future, NASA will find itself launching more and more complicated satellites for other countries, until the satellite-builders begin developing their own launch capabilities. Coming are:

- ESRO I (September 1967)—ESRO's second satellite, which will examine auroral phenomena from a polar orbit during the long Arctic night.
- ISIS 1, 2, and 3 (1968, 1969 and 1971)—a series of International Satellites for Ionospheric Studies, with both U.S. and Canadian experiments aboard.
- Project 625A (1968)—a German electron and proton probe which will do its looking from a highly-elliptical, 1,500-by-150-mile orbit.
- Eole (1969)—French meteorological satellite which will be used to collect data from hundreds of instrumented weather balloons floating around the Southern Hemisphere at different fixed altitudes.

In addition, many foreign-designed experiments are scheduled to go on what is NASA's most complex satellite series—the orbiting observatories. France, Italy, England and the Netherlands will be variously represented on the next three Orbiting Geophysical Observatories, three of the next four Orbiting Solar Observatories, and, in 1970, the third Orbiting Astronomical Observatory and the huge Nimbus-D weather satellite.

Even with other governments pushing hard towards space, however, the budget and technological level required for independent space research are still all but prohibitive. Many years will pass before NASA finds, if it ever does, that foreign space advances have made its international programs unnecessary.