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GODDARD NEWS

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Message from the Director: E.E.O.

Center Director A. Thomas Young

During the past several years Goddard has made significant progress in the implementation of its Equal Opportunity Program. We have consistently achieved hiring goals, led all centers in awards to women and minority-owned firms, and exceeded NASA's prescribed goals in this area. We have conducted a viable outreach program with colleges, universities, high schools and junior high schools towards expanding the pool of candidates with requisite skills for Center employment.

Our primary equal opportunity objective continues to be to perform our mission with a fully integrated work force. Positive efforts in recruitment have reduced the degree of underrepresentation of minorities and women in several of our mainstream occupations.

The next few years will require a more aggressive effort and a higher degree of sensitivity to our equal opportunity responsibilities due to budget restrictions and reduced personnel ceiling levels. Added focus during this period must be placed on our current employees and their development for movement into more responsible positions.

I am committed to achieving a work force in which minorities, women and the handicapped are represented at all levels and in all occupations. I urge your cooperation and support.

A. Thomas Young
Director

Marine biologists use Nimbus-6 to track dolphins at sea

Scientists studying the population and migration characteristics of dolphins have demonstrated a novel way of tracking their often invisible subjects: the dolphins wear backpack radio transmitters which, when the mammals surface, are located by Goddard's Nimbus 6 satellite.

The new technique for keeping tabs on the world's second most intelligent mammal was developed by NOAA's Fish and Wildlife Service and National Marine Fisheries and carried out last June in cooperation with Goddard's Nimbus Control Center and the Applications Directorate User Terminal and Location Systems Branch.

The NOAA scientists adapted the space technology to extend their observations and understanding of dolphin behavior, a study in animal psychology made urgent by the continuing capture and suffocation of thousands of dolphins each year in tuna nets. The dolphins often swim with tuna for reasons unclear, though scientists suspect some form of symbiotic relationship. As a result, tuna fishermen often make their catch by spotting the dolphins first, and in the process net both fish and mammals. The U.S. government hopes to reduce these losses and currently places a ceiling of 20,000 on the number of mammals that annually may be destroyed by American boats.

The Nimbus-6 satellite tracked two dolphins swimming off Hawaii, one for a day, another for a week. To "tag" the

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Dr. Mark addresses Scientific Colloquium

Dr. Hans Mark, NASA Deputy Administrator, visited Goddard October 6 to present a special Scientific Colloquium on "NASA in the Shuttle Era: NASA, DOD, and Space Science Relations.

C.F.C.: keep up the good work

As the annual Goddard Combined Federal Campaign for the National Capital Area swings into its fifth week, progress looks good. The campaign got off to a vigorous start September 25, and by October 15 had met 55.8 percent of its total goal of $205,000. However, we are not at our goal yet. So, please, keep the contributions for this worthy cause coming in. Remember, in the current year of tightened federal budgets, the needy will rely on private contributions more than ever.

Crustal Dynamics Project to apply space technology to understanding earthquakes

Six Goddard experimenters are among 56 scientific investigators chosen by NASA to be among the first members of the scientific community to apply data collected from space to the difficult science of measuring the large-scale motions of the Earth's crust and using these measurements to further our understanding of the basic causes of earthquakes.

The Goddard investigators, Ronald Kolenkiewicz (921), David Smith (921), James Marsh (921), Francis Lerch (921), James Ryan (974), Thomas Clark (974), and their colleagues will be using data obtained by the Goddard-managed Crustal Dynamics Project, which for the past three years has been developing two powerful yardsticks for determining Earth motion: laser ranging from ground stations to satellites, and radio interferometry of signals from distant quasars.

According to Crustal Dynamics Project Manager Dr. Robert Coates (904), the operational use of space techniques will mark a significant new development in making accurate geodetic measurements over long baselines. Such measurements are of great interest to scientists studying the relationship between the strain accumulating along shifting tectonic plates and the occurrence of earthquakes. According to current theories of earthquake mechanisms, when the accumulated stress exceeds the strength of underlying materials, the stress is released in the form of an earthquake or slow creep.

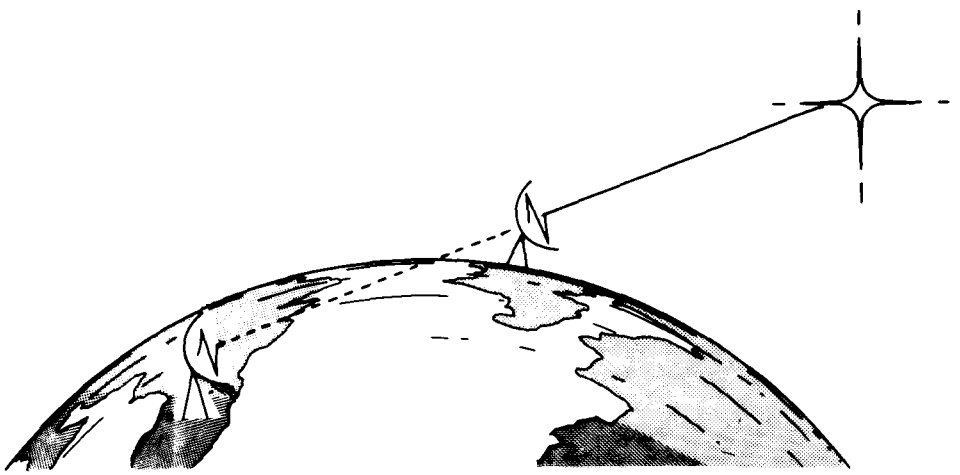
A laser tracking station atop Otay Mountain in Southern California prepares for ranging to a reflecting satellite in a measure of crustal movement.

In the past, baseline measurements over long distances have depended upon ground survey teams, a technique subject to errors. Dr. David Smith, Crustal Dynamics Project Scientist and one of the six Goddard investigators, explains. "Ground surveys traditionally have been unable to produce highly accurate long distance measurements over inhospitable terrain." The reason has been the necessity of making the measurements in a series of small steps, which inevitably accumulates errors. Additionally, says Smith, large scale pictures of strain have had to be extrapolated from clusters of local measurements, though local conditions might not always accurately reflect overall trends.

The new space techniques have demonstrated an order-of-magnitude improvement in accuracy over distances of 200 to 10,000 km. The measurements can be made over oceans and all types of land terrain and thus are capable of directly determining the movements of the planet's enormous and slowly shifting tectonic plates.

Laser ranging, the first of the two techniques being used, employs laser tracking stations to bounce light pulses off a satellite such as LAGEOS, a small sphere covered with optical retroreflectors launched by NASA in 1976. By timing the return of the pulse to the ground station, the distance of the station to the known orbit of the satellite can be detected and the position of the tracking station can be precisely determined.

Such laser ranging has been employed since 1972 in the San Andreas Fault Experiment to measure the changing distance between a pair of laser stations riding each of the tectonic plates that grind past one another along the earthquake-prone San Andreas Fault. Precise to about 5 cm. (2 in.) over thousands of kilometers, the technique was developed by a group of scientists and engineers at Goddard.



To measure the precise distance between two radio telescopes, the difference in the arrival times of noise signals from a distant quasar is determined. As tectonic plates move over the years, the distance between the telescopes changes accordingly.

Laser ranging employs laser tracking stations to bounce light pulses off a satellite. . .

The second technique, called Very Long Baseline Interferometry (VLBI), employs a pair of radio telescopes which can be separated by as much as several thousand miles. By noting the difference in receive times of a random noise signal from a distant quasar and how this difference changes as the Earth rotates, the distance between the radio receivers can be determined. Repeated measurements over years can reveal changes in the

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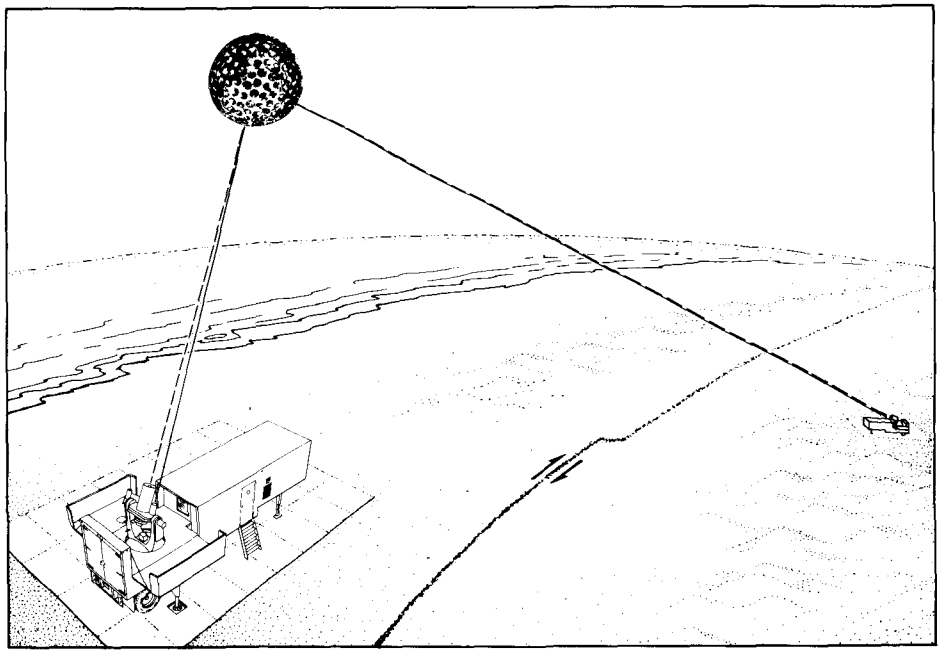


Laser ranging is being employed along the San Andreas Fault to measure the changing distances between a pair of laser stations riding opposing tectonic plates.

distance between stations as the plates below the telescopes shift relative to each other. Currently the precision of this technique is on the order of 3 cm. (1.4 in.) and the technique has been proven in continental and intercontinental measurements. The technique was originally developed by radio astronomers for measuring astronomical positions but was adapted for geophysical uses by a group of astronomers at Goddard, MIT and the Haystack Observatory in Massachusetts.

"By making repeated measurements over a period of years using both techniques, we can determine crustal motions as small as 1 cm. per year," says the Project's Investigations Manager, Dr. Gilbert Mead (904). That prospect excites the new scientific investigators, who met for the first time at Goddard September 1-3, to discuss their proposed research and hear reports on the current status of the Project.

The tasks to which the investigators plan to apply measurements made by the space techniques vary as widely as the disciplines and institutions of the investigators themselves, 42 of whom represent U.S. universities, governmental agencies, or private concerns, and 14 of whom are from Europe, Australia, New Zealand, Venezuela, and Canada. Among individual targets to be studied are crustal deformation in California, Alaska and other regions of high earthquake activity, motions of the Earth's tectonic plates, and variations in the Earth's rotation rate and the position of its polar axis.

Because measuring crustal strain buildup in California and other active regions will require repeated measurements at many sites, the Project has developed highly mobile systems using both laser ranging and VLBI technology. These units have already proved their usefulness. A mobile VLBI system developed by the Jet Propulsion Laboratory in Pasadena visited seven sites in California during 1981, while a mobile laser system developed by the University of Texas at Austin has taken data at six sites in Utah, Arizona, and California during the past year. By 1983, NASA expects to have four highly mobile units making repeated measurements at about 40 sites in the western United States.

The Crustal Dynamics Project Working Group - including many of the 56 scientific investigators recently chosen by NASA from the U.S. and abroad—met at Goddard September 1-3 to discuss proposed research and the current status of the project.

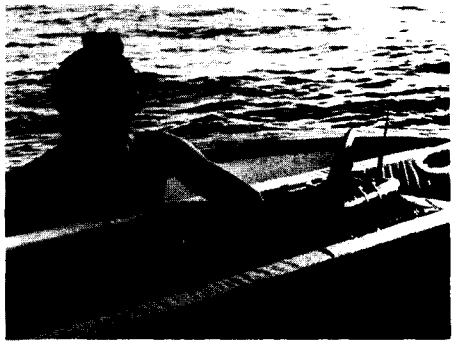
Nimbus-6

Continued from page one

dolphins, marine biologists first netted their subjects, then strapped transmitters astride their dorsal fins. Each time the dolphins surfaced for air thereafter, their signals could be located by the Nimbus-6 RAMS, (Random Access Measurement System), relayed in real time to a tracking station in Hawaii, and forwarded to Goddard for data processing and distribution back to the scientists.

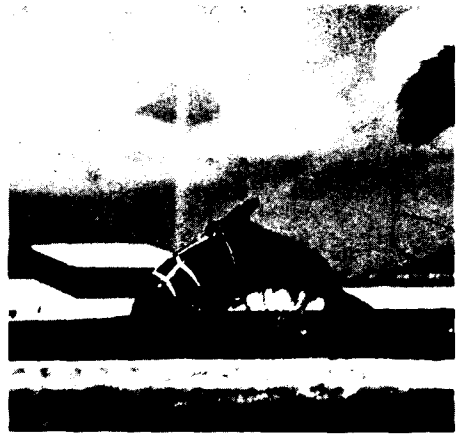
Goddard's Carl Westman and John Shawhan of the Nimbus Control Center managed reception of the data at Goddard, while Bill Seechuk, Garry Edem, and Bob Norton (all General Electric) arranged spacecraft scheduling. Keith Long, a contractor in the User Terminal and Location Systems Branch carried out the data processing, and Gene Gilbert of the same branch maintained user interface as the Nimbus 6 RAMS user coordinator.

It is not known what became of the first dolphin to be tracked; its signal was lost and the subject never found. The second was tracked successfully by satellite and aircraft until its signal also diminished. When experimenters found the dolphin, its transmitting antenna was broken, perhaps by another animal.



Jacqueline Jennings, marine biologist for the National Marine Fisheries Service, completes attachment of a transmitter to one of two dolphins tracked by Goddards Nimbus-6 satellite.

The dolphin experiment is the latest in a series of successful tracking demonstrations by Nimbus-6 designed to prove that the environmental monitoring satellite's capabilities also could extend to wildlife monitoring and search and rescue supporting mariners and other travellers.



A tame dolphin tries out the radio transmitter attachment before scientists take the gear to the field.

To date, subjects followed by the satellite include a polar explorer, a trans-Atlantic balloonist, and an aspiring trans-Pacific oarsman. Among the most successful of the wildlife trackings, says Gilbert, the RAMS user coordinator, have been sea turtles. "Compared to dolphins," he notes, "the turtles moved very slowly and surfaced for long transmission times." Dolphins, on the other hand, he says, "could be tracked only when they were running and emerging every few minutes for a couple of seconds in air."

In spite of the difficulties of dolphin tracking, the Nimbus-6 experiment proved so successful that the marine biologists are now considering extending their tracking work to pilot whales. Such an experiment, however, says Gilbert, could be more demanding. Last month, he notes, NASA discontinued funding for the Nimbus-6, whose last backup tape recorder for global coverage and playback failed in March. Future Nimbus-6 users will have to access the satellite through their own inexpensive ($50,000) ground stations, one example of which is located in Goddard's building 22.

The data collection and tracking system proved by Nimbus, in the meantime, has evolved into an operational system aboard NOAA's Tiros-N. Known as the Argos Data Collection System. The system is available on a cost reimbursable basis for tracking tasks of environmental significance.

Abrahamson to head STS Office

Maj. Gen. James A. Abrahamson, Deputy Chief of Staff for Systems, Headquarters Air Force Systems Command at Andrews Air Force Base, Md., has been named Associate Administrator for NASA's Office of Space Transportation Systems, on assignment from the Air Force. He is expected to report to NASA in November.

Abrahamson succeeds John F. Yardley who left NASA in May 1981 to become President of McDonnell Douglas Astronautics Co., Division of McDonnell Douglas Corp., St. Louis, Mo. L. Michael Weeks, Deputy Associate Administrator for the Office of Space Transportation Systems, has been Acting Associate Administrator in the interim.

William E. Lilly retires

William E. Lilly, NASA Associate Administrator/Comptroller, has announced his intention to retire in early October after over 37 years of service with the Federal Government, the last 21 years with NASA.

During his career with NASA, he has been instrumental in the development of the vast institutional capabilities of the Agency, including the facilities key to our research and development, and to the development of NASA's management systems and procedures.

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GODDARD NEWS

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