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GODDARD NEWS

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Landsat data used to help chart shipping lanes

By Bob Ames

One million tons of shipping is lost at sea each year. Some of this is due to collisions, but much is due to poor charts of reefs, off-shore banks and shallows. The reason for these losses is that until recently, revising maps of ocean depths has been a slow process.

New hope for speeding preparation of maps and reducing the amount of shipping loss has come from the space program and a novel application of a series of satellites originally intended for surveying land. Landsat satellites are helping the Defense Mapping Agency (DMA) to revise its estimates of the time required to update charts of the top priority shipping lanes.

Captain Jacques Yves Cousteau (left) and Goddard's Charles G. Bohn (right), Manager of the 1975-1976 NASA/Cousteau Society Ocean Bathymetry Project, are shown inspecting a Goddard exhibit describing the project for the third annual Harborfest in Norfolk, Virginia this year. For more on Harborfest, see page three.

According to old estimates, using the traditional method of on-site surveys and soundings, revisions would take over 50 years. Dollar saving could be in the millions.

Landsat satellites detect and measure light reflected from the earth's surface in the ultraviolet, visible and microwave portions of the electromagnetic spectrum. Since various objects reflect light at different wavelengths, the satellites measurements can be used easily to distinguish such features as different types of rock, several crops, and water bodies.

In August and September of 1975, the Cousteau Society and NASA performed a set of experiments to determine if Landsat sensors might also be used to distinguish differing sea depths and ocean bottom features in shallow seas.

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Comet Bradfield wags tail

Comet Bradfield surprised astronomers with a violent wag of its tail one week after it passed the Earth in late January. It was a phenomenon rarely observed for comets and never before seen to occur with such intensity.

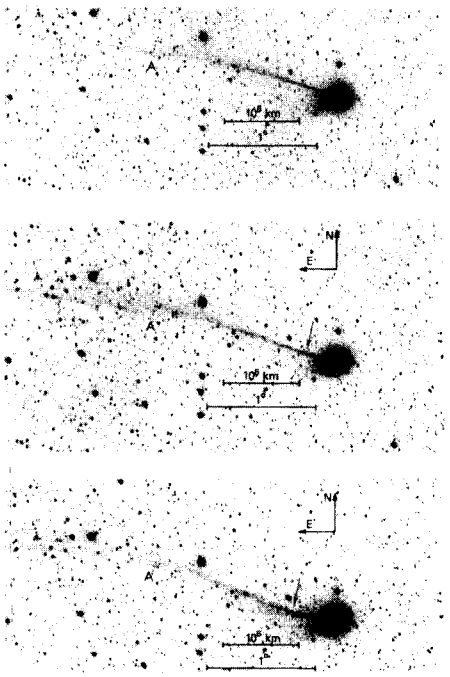
According to Goddard investigators who photographed the comet's passage from a mountaintop observatory in New Mexico, the innermost section of the comet's ordinarily straight tail suddenly bent 10° in less than 30 minutes, an "extraordinary shift" that also propogated down the tail at a velocity of about 300 kms per second.

"The speed of this tail turning exceeds that of any other known cometary event," say investigators Dr. John Brandt and Dr. Malcolm Niedner, Jr., both of Goddard's Laboratory for Astronomy and Solar Physics, who observed the event with John Hawley of the New Mexico Institute of Mining and Technology.

Usually, the tail of a comet seems to flutter and wave in the solar wind like a windsock in a mild breeze. The sudden bending of the tail, they think, could be the result of a sudden reversal in the north-south direction of the wind flow near the comet.

The most probable cause, say the researchers, is that the comet encountered a velocity shear in the solar wind. The shear could have occurred either on a leading edge of a high speed stream in the wind, or near the shock front of a disturbance due to a solar flare.

The phenomenon is particularly intriguing to astronomers for it seems to afford a visible illustration of the dynamic interaction between comets and the solar wind. To determine if there is indeed a relationship between the tail wag and a solar wind disturbance, the investigators will compare the event with solar wind data gathered concurrently by satellites.



Astronomers obtained three pictures of an unprecedently large and rapid bending of a comet tail, while observing Comet Bradfield from the mountaintop Joint Observatory for Comet Research near Socorro, New Mexico. The observatory is a cooperative facility operated by the New Mexico Institute of Mining and Technology for Goddard. Top: The comet prior to tail bending. Middle: 15.5 minutes into the bend. Bottom: 27.5 minutes later the bend reaches its furthest observed displacement.

Space Shuttle's thermal protection system subject for NASA concern

By Bob Ames

Day and night more than 1,100 workers meticulously examine the thermal protection system on the space shuttle Columbia, looking for tiles that may be improperly glued to the aluminum body, and applying new tiles to unprotected areas.

The tiles which compose the thermal protection system are made of silica fibers with a ceramic surface designed to protect the ship against the searing frictional heat as it reenters the atmosphere at velocities 26 times greater than the speed of sound.

The major problem facing workers has been how to apply the tiles to the body of the shuttle. The gluing process has proved to be complicated and very time-consuming. And many of the tiles which were already glued on the shuttle were found to be defective and had to be taken off and reglued.

"We are very concerned about the structural performance of the shuttle thermal system," said NASA scientist Dr. Sidney Dixon. "Does it have the durability for a quick turn around time which is imperative? With the current ceramic tile system there is a question as to how much inspection will be necessary before the shuttle can take another flight, how to certify it if it is ready, and basically will it last for 100 voyages like we thought it would originally. The current system is very good thermally, but it is very fragile. And as it stands now, the shuttle will have to undergo a very exhaustive examination after each flight to make sure the thermal system is holding up."

These questions have led to consideration of possible alternate thermal protection systems for the space shuttle. According to Dixon, the alternate systems being considered are metallic, ablative, and reinforced carbon/carbon systems.

"The best system, most likely, is a mix of the three concepts," said Dixon. "The metallic system is complicated and heavy, but there are perhaps some areas on the shuttle where it should be used. The reinforced carbon/carbon system was previously unavailable in sheets thin enough to make it mass competitive, and there was also an oxidation problem. But current technology has now reduced the oxidation problem and made the sheets thinner. The ablative system is just a one shot application for intense localized heating. But perhaps it should be used on areas like the fins.

"What it boils down to is that we've got to stop and take a look again at what we've done in the last eight years. The ground rules have changed now that we have learned more about the present system, and we've got to start looking at some alternatives. In the past eight years technology has advanced to the point where some of these other systems are now feasible," Dixon said.

Search is over

Rockwell Intern'l selected to study the problem

NASA has selected Rockwell International Corp., Downey, California, to conduct a design study of alternate thermal protection systems for the Space Shuttle orbiter.

The nine-month study will begin in late June and is expected to cost approximately $900,000.

The major goal of the study will be to determine if a more durable system, requiring less maintenance and a lower life-cycle cost, is or can be made available, based on improvements in thermal protection system technology. Alternate systems to be studied will include, but are not limited to, metallic, ablative and reinforced carbon/carbon concepts.

The present orbiter thermal protection system uses ceramic reusable insulation over most of its exposed surface. The insulation has low mass and can withstand the extremely high heating that occurs during reentry into the Earth's atmosphere, but it has low strength and is brittle in nature.

The ceramic system was selected in the early 1970s as the best then available. No detailed assessment of alternate systems, however, has been conducted since that time.

The contract will be managed by NASA's Langley Research Center, Hampton, Virginia. Boeing Aerospace Co., Seattle, Washington, also bid on the project.

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Past to present: GS

Pictured above is a rare gathering of all f
who don't remember right away, take a m

Coming

Key Appointments

Sciences

Effective July 13, 1980, Mr. Joseph H. Bredekamp, Jr., is appointed Chief, Science and Applications Computing Center (Code 603, 344-8541), replacing Mr. William F. Cahill, who recently retired.

Applications

Effective August 24, 1980, employees of the Earth Resources Branch (Code 923) engaged in the support of the Nonrenewable Resources Program are reassigned to the Geophysics Branch (Code 922), Earth Survey Applications Division.

Dr. Charles C. Schnetzler, formerly Head, Earth Resources Branch, is appointed Head, Geophysics Branch (Code 922, 344-8364). Dr. Robert D. Price, Assistant Division Chief, in addition to his present duties,

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›FC Directors gather

›ur Center directors of the past and present. For those Goddard old-timers inute to guess their names . . . . Remember them?

(From left to right): Dr. Robert Cooper, A. Thomas Young, Dr. Henry Goett and Dr. John Clark.

New access road constructed

The new access road being constructed from road one to road four is scheduled for completion this fall. The road will go by the new Building 28 and Building 20.

The road will provide easier access to the Center and cut down on the traffic congestion on road one (the main on Center road off of Greenbelt Road) at the intersection by Building 8, project engineer Bill Stitz said.

Stitz said a special problem he had in designing the road was settling it in by the pond. He had to squeeze it in between the pond and Building 20 and allow for the normal drainage in that low lying area.

& Going

will lead the Earth Resources Branch in an acting capacity pending selection of a permanent branch head.

Effective July 27, 1980, Dr. Desiraju B. Rao is appointed Head, Oceans and Ice Branch, Laboratory for Atmospheric Sciences (Code 912, 344-4718).

New Employees

Alea, Pedro M., Aerospace Engineer (Code 754.1), 08-10-80

Chin, Herbert, Electronics Engineer (Code 728.4), 08-10-80

Hartline, Beverly R. Karplus, Physical Scientist (Code 924), 08-10-80

Moseley, Samuel Harvey, Jr., Astrophyscist (Code 693.2), 08-24-80

Rodriguez, Jose R., Electronics Engineer (Code 841.1), 08-24-80

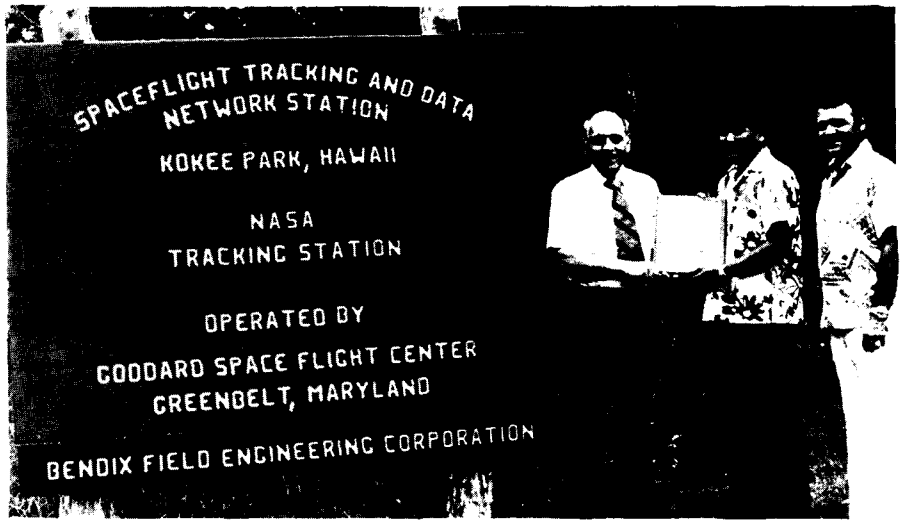
GSFC participates in Harborfest Week

Goddard Space Flight Center recently helped commemorate the opening of the Cousteau Society's new headquarters in Norfolk, VA. by participating in the third annual Harborfest Week.

GSFC carried an exhibit at the Harbor for the whole week. The exhibit, which was viewed by over 150,000 people, described the ocean bathymetry experiments that led to the operational use of Landsat imagery in charting ocean depths. A duplicate of the exhibit is now on display in the building three lobby.

Harborfest Week began on the 21st of May with an ocean parade. The parade was led by Jacques Cousteau and the *Calypso* (his vessel,) and included three tall ships and many navy vessels. Festivities continued until May 26th which was declared Ocean Science Day.

Captain Cousteau and Goddard's Charles G. Bohn, Manager of the 1975/76 NASA Cousteau Society Ocean Bathymetry Project view Harborfest display. The exhibit was prepared in conjunction with Goddard's Public Affairs Office and is now on display in the Goddard Visitors Center.



Employees at the NASA Spaceflight Tracking and Data Network (STDN) station at Kokee Park, Kauai, Hawaii, have been awarded the quarterly "Outstanding Performance Award" by the Bendix Field Engineering Corporation's STDN Program Management. The award was presented to the station at Hawaii by Lawrence A. Jochen, Bendix vice president and STDN program director.

Participating in the Hawaii station award presentation are (from left to right): Lawrence A. Jochen, Daniel M. Funamura, Hawaii senior manager; and Fidel R. Rul. Jr., NASA station director.

Cousteau

Continued from page 1

Goddard's Dr. Enrico Mercanti, a mechanical engineer who was experiment manager for the project said the assumption was that since Landsat imagery determined differences based on absorbance and reflection, differences in ocean depths could be seen by degree of reflectance of the bottom and absorbance by over-lying water.

Mercanti cooperated on the project with another Goddard experiment manager and technical monitor, Charles Bohn, as well as Apollo 9 astronaut Russell Schweikart, who coordinated the NASA effort with Jacques Cousteau.

The experiments took place in the Bahama Islands and involved a 12-day research cruise, thirteen satellites, and two research vessels. The vessels used were the Cousteau Society's *Calypso* and the *Beayondan*, from Johns Hopkins University.

Satellite data was handled on a priority basis at NASA's Goddard Space Flight Center and General Electric's Image 100 facility in Beltsville, MD. This data was transmitted to the research team abdard *Calypso* for near real-time experiment planning. The *Beayondan* recorded positioning data at selected sites.

While the data was coming in from the satellites, scuba divers from *Calypso* worked around the boats, collecting measurements of ocean floor reflectivity and water transparency using sophisticated underwater instruments. These measurements were taken in order to verify the accuracy of Landsat measurements of the same area.

When the Landsat measurements of ocean shallows using the green part of the visible light spectrum were analyzed and compared with the onsite data and existing maps, the Landsat data was found to be remarkably accurate. Any errors found were attributed to the existing maps and charts.

The experiments found that Landsat data can be used accurately to measure depths up to approximately 40 meters. This gives more than enough accuracy for shipping, with the largest supertankers only requiring clearances of about 30 meters.

As a result of the experiments the

Cousteau Society made the film "Troubles Waters," which described what occurred. The experiments also led to the DMA's appropriation of this technique for mapping out ship channels and revising hydrographic charts.

"There still remain some problems in implementing the use of Landsat data for shallow water Bathymetry," Bohn said. "Among these are cloud cover, water clarity, sea state and spectral band limitations.

"But even with these limitations," he said, "Landsat images are still the most promising new space technology for determining possible hazards to shipping in remote and poorly charted areas around the world."

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