

# Weather Report: NASA GOES Astray

NASA missed a chance to save up to \$334 million on the GOES-NEXT weather satellites — more than one-third of the estimated \$934 million cost of building the five problem-plagued craft. The agency also failed to make contractors involved in the program perform engineering tests that NASA usually requires before developing large projects. So concludes an investigative report by the Government Accounting Office (GAO), released last week at a sometimes stormy congressional hearing.

Both the report and testimony at the hearing cast further doubt on the space agency's ability to launch the first of the scheduled GOES-NEXT satellites before the only other similar U.S. satellite now aloft begins wobbling out of orbit sometime in 1993. Without a replacement satellite, the report notes, U.S. meteorologists will lack many of the data they need to reliably forecast hurricanes, tornadoes and floods (SN: 7/6/91, p.5).

At the hearing, jointly sponsored by two House Science, Space and Technology subcommittees, NASA officials continued to assert that the agency can launch the first of the new craft — known as GOES-I — by December 1992. But several members of Congress urged the National Oceanic and Atmospheric Administration (NOAA), which owns and operates the weather satellites, to strongly consider alternatives such as buying or leasing a foreign satellite.

"NASA cannot retroactively fix a fundamentally flawed product produced by a flawed system," Rep. Howard Wolpe (D-Mich.) charged. Moreover, both Wolpe and a GAO investigator pointed out that GOES-I will likely only match the performance of the now-orbiting GOES-7, while costing five times as much.

Mismanagement by the space agency, poor performance by contractors and an unexpectedly complex design all contributed to the weather satellites' woes, the GAO report states. It notes that NASA's actions at the start of the program in 1984 set the stage for the current problems — which include satellites three years behind schedule and bearing a price tag nearly triple the 1986 estimates for their construction and launch.

For instance, unlike the current U.S. weather satellite, which spins in space, the new GOES is designed to stare fixedly at Earth. But the complexity entailed by that requirement, notes the GAO report, "led to additional analyses, redesign and remanufacture of parts, which resulted in increased costs and delays."

Making a challenging situation even tougher, the agency admitted to the GAO that it provided contractors with little guidance and technical expertise. In addition, NASA decided to forgo preliminary tests before getting the project fully underway — an apparent attempt to meet a tight launch schedule.

At the hearing, Louis J. Giuliano, president of ITT Defense, Inc., in Arlington, Va., which is building key infrared sensors for GOES, summarized the consequences of that decision. "Problems which ordinarily would be identified earlier in the program, when solutions are more easily accommodated, were not surfaced until later...when they had greater cost and schedule impacts."

Despite the delays and equipment problems, NASA until recently gave its main GOES-NEXT contractor — formerly known as Ford Aerospace Corp. and now part of Loral Corp. — quarterly performance ratings usually ranging from "successful" to "highly successful." From 1985 through early this year, the agency awarded the company 69 percent of the available money in its contract — considerably more than a company with this track record should have received, Wolpe contended.

Letters gathered by the GAO reveal that in 1988, NOAA asked NASA to cap the contract, and that Ford Aerospace agreed to consider fixing the cost of building the satellites at \$600 million. But the space agency declined to act. This year, the estimated price of building the satellites rose to \$934 million. "NASA missed an opportunity," testified Loral Corp. President Frank C. Lanza.

Documents presented at the hearing also reveal new information about five infrared detectors that for unknown reasons suffer impaired sensitivity. One of these detectors, designed to image cloud cover, had resided inside an instrument

intended for GOES-I up until a year ago. Only last month, NASA had reported that none of the defective sensors were in the imaging devices intended for the GOES craft, suggesting the sensors were spares damaged in storage.

ITT memos indicate that the sensitivity of the detectors — one of which was inadvertently lost during retesting — was not properly measured at the outset, making it hard to gauge exactly how much sensitivity the devices have lost. Other documents show that ITT lacks up-to-date blueprints of design changes made to GOES-I.

Congress may wish to withhold 1992 funds for GOES-NEXT until NOAA and NASA solve current technical and scheduling problems, the GAO report said. Congressional staff say they believe NOAA's most likely option will be to borrow or purchase a GOES-7 duplicate — now destined for Japan — that is under construction at Hughes Aircraft Corp.

— R. Cowen

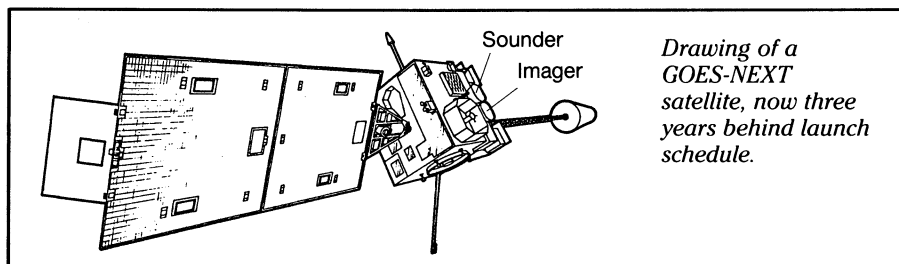
## Ancient ax helps date early Greeks

In the sediment of an ancient lake bed, Boston University archaeologists have found a flint hand-ax that provides new clues to the prehistoric settling of Europe. The ax, assigned a preliminary age of between 200,000 and 400,000 years, confirms that early Stone Age human ancestors lived in Greece.

"This is the most significant discovery for the early prehistory of Greece in some 30 years," asserts James R. Wiseman, director of the expedition known as the Nikopolis Project. He and his colleagues announced the find last week at a press conference in Boston.

In May, the scientific team began fieldwork in the region of Nikopolis, a site on the western peninsula of Greece founded by the Roman emperor Augustus in commemoration of a 31 B.C. war victory. On June 3, expedition member Curtis Runnels noticed the ax sticking out of undisturbed sediment in an eroded gully running through the lake bed, about 20 miles north of Nikopolis.

The researchers say the 9-inch-long specimen is an Acheulean hand-ax, named for a French site where similar implements turned up in the early 1800s. In western Europe and Africa, archaeologists have found numerous Acheulean hand-axes at sites spanning the period from 1.6 million to 200,000 years ago. Scientists do not know exactly how human ancestors used these pieces of flaked



*Drawing of a GOES-NEXT satellite, now three years behind launch schedule.*

NASA

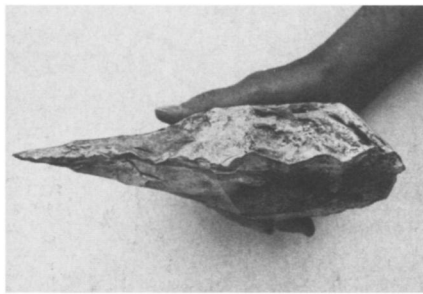
stone, which feature two sharp edges converging to a point at one end. Studies suggest the hand-axes may have served as cutting tools for tasks such as butchering large animals and digging up tubers.

Investigators generally agree that direct ancestors of modern humans — principally *Homo erectus*, but also a more recent group known as archaic *Homo sapiens* — fashioned Acheulean artifacts. Runnels suspects that archaic *H. sapiens* produced the Greek hand-ax, since it dates to around the time when *H. erectus* disappears from the fossil record.

If additional Acheulean finds emerge during fieldwork at several nearby lake beds of a similar age, Runnels says, the archaeological evidence will support the theory that archaic *H. sapiens* — rather than *H. erectus* — first settled Europe.

Researchers have found several skulls of human ancestors at central European sites dating to about the time of the Greek hand-ax, but the classification of the fossils remains controversial, Runnels says. Moreover, the skulls came from sediment lacking any stone tools or other distinctive artifacts.

Although the new find helps to close a gaping hole in knowledge about human ancestors in central Europe during the early Stone Age, scientists cannot conclusively peg the flaked stone to either *H.*



Boston Univ.

*Stone Age hand-ax, discovered in Greece, measures 9 inches long.*

*erectus* or archaic *H. sapiens*, contends archaeologist Ofer Bar-Yosef of Harvard University. "We need skeletal material from the Greek site to confirm who made the hand-ax," he argues.

Bar-Yosef supports a theory that several waves of *H. erectus* first entered Europe sometime between 1 million and 500,000 years ago, migrating from Africa through the Middle East and then westward along the Mediterranean coast.

Next year, the Boston team plans to excavate the Greek site more thoroughly. Runnels points out that the soil contains clay that hinders the preservation of fossilized bones. "But before this year," he adds, "I wouldn't have given myself much of a chance of finding an Acheulean hand-ax at the site either." — *B. Bower*

## Cancer treatment uses 'suicide' gene

An unforeseen marriage between gene-transfer experiments and chemotherapy may offer safer human gene therapy and a potent anticancer weapon, researchers say.

On July 29, the National Institutes of Health Human Gene Therapy Subcommittee provisionally approved the experimental injection of 16 ovarian cancer patients with drug-sensitive tumor cells. Scott M. Freeman and his colleagues at the University of Rochester (N.Y.) Medical Center expect final approval for this anticancer trial within eight months.

Freeman's group plans to incorporate the thymidine kinase (tk) gene, isolated from the herpes simplex virus, into cultured human tumor cells. The enzyme this gene codes for plays an integral role in DNA synthesis and cell reproduction. Because the tk gene is sensitive to the antiviral drug ganciclovir, injecting patients with cells incorporating this gene should render their tumors susceptible to ganciclovir.

Freeman's team was surprised to find that when tumor cells carrying the tk gene were injected into mice, ganciclovir killed not only the newly added cells but also existing cancer cells. The exact mechanism remains unclear, but tk-negative cells might become tk-positive by absorbing fragments of the killed cells, Freeman says. There might also be a tumor-attacking immune response from ganciclovir's actions, he adds.

In the July issue of *NEW BIOLOGIST*, Elizabeth Nabel and her colleagues at the University of Michigan Medical Center in Ann Arbor propose a different use for the tk gene: including this "suicide" gene along with any other therapeutic gene to be incorporated by the body.

Any new genes added to the body carry with them some chance of triggering uncontrolled cell growth, although such tumors have not yet been seen in treated animals. Growth factor genes, which one day may fight cardiovascular disease by spurring blood vessel growth, cause particular concern, says Nabel.

Inserting the tk gene along with the new gene could provide an off-switch to the experimental therapy. "If you saw a tumor was growing, you might give the patient ganciclovir" and selectively kill the newly added cells and their progeny, Nabel says. In mice, ganciclovir eliminated most tumors spawned by injected tk-positive cancer cells, she reports.

The tk gene could serve as a safety feature, much like the brakes in a car, says Nabel. Human gene therapy has not yet needed such a measure. However, she argues, "the ability to regulate recombinant gene expression will become increasingly important." — *J. Travis*

## Drug proves ace at fighting heart failure

A blood-vessel-dilating drug can prolong the survival of persons suffering from congestive heart failure, a chronic condition in which the heart's ability to pump is impaired, according to two independent groups of researchers. Their findings, announced this week, suggest such drug therapy may be able to prevent up to 20,000 deaths and 100,000 hospitalizations in the United States each year.

The new data confirm and extend earlier reports that angiotensin-converting-enzyme (ACE) inhibitors reduce the risk of early death for people with severe congestive heart failure. (ACE inhibitors belong to a group of drugs commonly used to treat hypertension by relaxing blood vessels.) The two new studies, detailed in the Aug. 1 *NEW ENGLAND JOURNAL OF MEDICINE*, also demonstrate these drugs can benefit persons with mild to moderate heart failure.

Neither study applies to treatment of heart attack, in which the heart stops suddenly.

In one study, Salim Yusuf of the National Heart, Lung, and Blood Institute in Bethesda, Md., and investigators at 83 medical centers in the United States, Canada and Belgium randomly assigned 2,569 men and women with mild to moderate heart failure to daily treatment with either an ACE inhibitor (enalapril) or a placebo. Neither the patients nor the investigators knew which participants

received enalapril. All volunteers continued to receive standard therapy for heart failure, such as the heart-strengthening drug digoxin.

Over a roughly 41-month treatment period, the researchers identified an 18 percent reduction in the risk of heart-related death for people taking the ACE inhibitor: Only 399 patients receiving enalapril died from heart failure, compared with 461 in the placebo group. The ACE inhibitor helped prevent the need for hospital visits as well. The team tallied 971 hospitalizations for heart failure in the placebo group—42 percent more than among patients receiving enalapril.

In the second report, Jay N. Cohn of the University of Minnesota Medical School in Minneapolis and his colleagues present data suggesting that enalapril provides better protection for people with mild to moderate heart failure than a combination of hydralazine and isosorbide dinitrate, two other blood-vessel dilators.

Treating existing illness may offer only a partial victory in the battle against heart failure, these two groups of researchers agree. That's why Yusuf's team is now testing enalapril's ability to prevent chronic heart failure in people with some damage to the heart but no symptoms of long-term heart failure. Results of that trial are expected next year.

— *K.A. Fackelmann*