

In 1954, archeologists discovered two subterranean chambers carved in the bedrock near the Great Pyramid of Khufu in Giza, Egypt. Excavation of one of them uncovered an exciting find: the disassembled pieces of a wooden funerary boat apparently intended for Pharaoh Khufu's use in the afterlife. Incredibly, the boat's timbers were in a near-perfect state of preservation after 4,600 years. The boat was painstakingly assembled and put on display (right) in a museum built on the site.

Egyptologists wondered for years whether the second chamber, roofed by a five-foot thickness of limestone, contained another royal boat—and whether the air sealed in the chamber for 46 centuries had some property that helped preserve the wood of the boat, because the original boat was showing signs of deterioration and information on the chamber's environment might lead to a way of preserving it longer.

In 1985, the Egyptian Antiquities Organization (EAO) asked Dr. Farouk El-Baz whether it would be possible to examine and sample the second chamber without admitting people, air or contaminants. El-Baz, an Egyptian-born geologist, felt it could by applying space technology to the task; he was thoroughly familiar with a number of space technologies as a one-time lunar science planner on the Apollo program and, more recently, as director of the Boston University Center for Remote Sensing, Boston, Massachusetts.

The initial contact led to a two-year project in which El-Baz organized and headed a team, co-sponsored by EAO and the National Geographic Society, to apply space technology in an effort to examine and photograph the Giza chamber. National Geographic had for a number of years been investigating means of photographing unopened tombs without entering or contaminating them. In Washington, D.C., the Geographic's photographic division modified and tested a remotely controlled video system and a 35-millimeter camera, and developed a lighting system that would not elevate the chamber temperature; the team established that all this equipment would work if it could successfully be inserted into

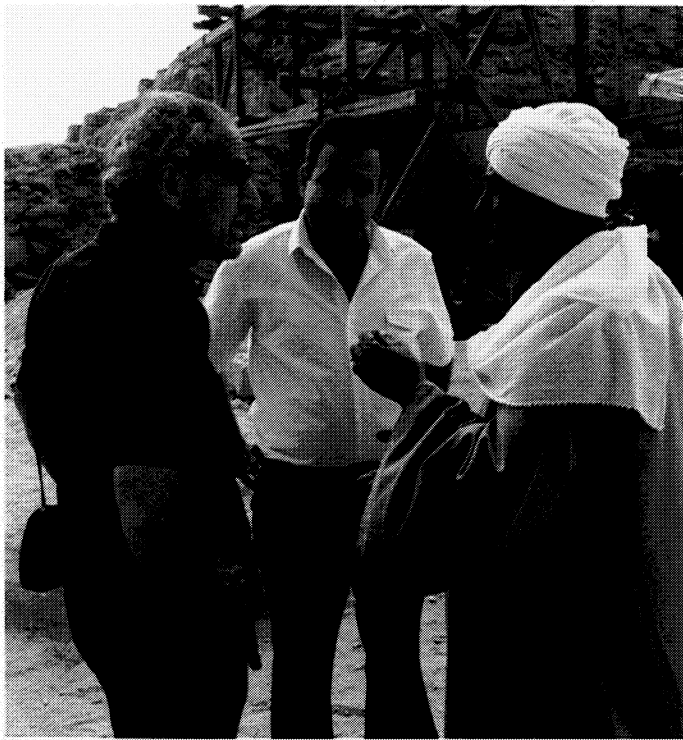


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the chamber.

That left two big requirements: a drill to cut through the limestone cap without using lubricants or cooling fluids that might contaminate the chamber, and an airlock that would admit the drill shaft and photo equipment but not air. For this job, El-Baz brought to the team Bob Moores, a drilling technology engineer with Black & Decker Corporation, Towson, Maryland, which had developed for NASA in the 1960s a drill capable of boring 10 feet into the moon's surface and extracting soil samples without contamination. Moores used much of this knowledge to select a new drill tailored to the Giza exploration.

In October 1987, work began at the site, shown at upper right. In the foreground, from left are Farouk El-Baz, EAO's Dr. Kamal Barakat, and work crew foreman Touhamy Mahmoud Ali. The drill pit, evidenced by the scaffolding, is in center background; the tent at right housed the electronic equipment for operating the cameras and viewing their findings.



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For 48 hours off and on, Moores drilled through the limestone until, at a depth of 63 inches, the drill bit broke through into the chamber. At lower left, El-Baz, holding the drill shaft, grins triumphantly after the breakthrough; in red is engineer Bob Moores. At right, the science and support teams assemble in the drill pit for a victory photo.

A stainless steel tube was lowered through the airlock to take samples of the chamber air at several levels. But there was disappointment—even before the samples were scientifically analyzed at laboratories, there were indications that the chamber was no longer airtight if ever it had been.

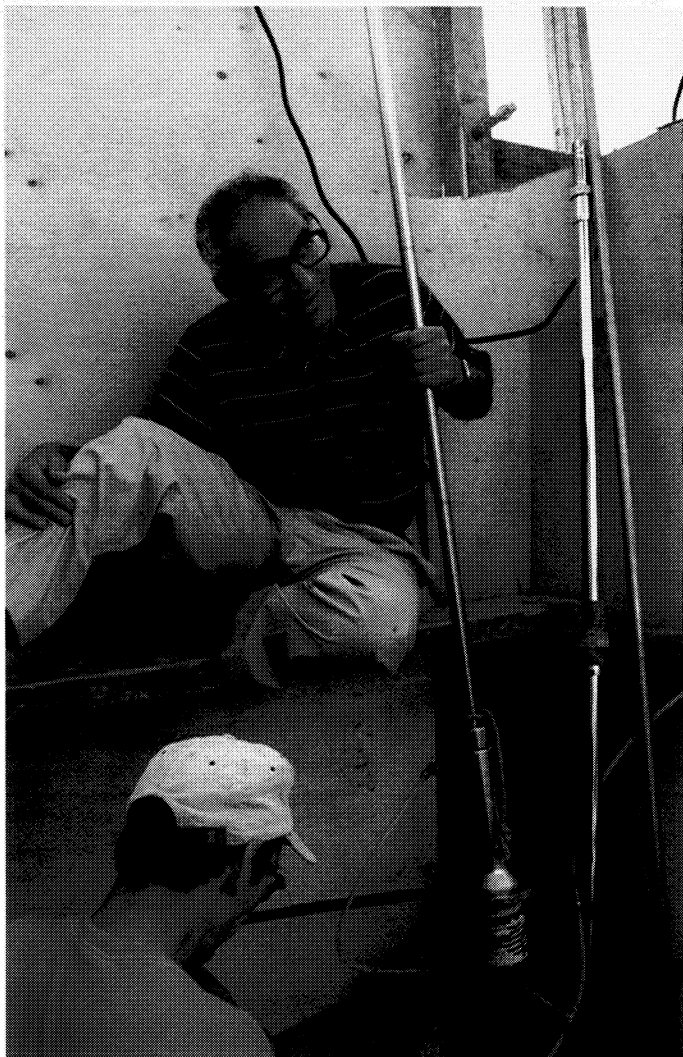
But on the morning of October 20 there came a compensating discovery when the video camera started sending images from the chamber: there was indeed a second royal boat, disassembled like the first in stacks of wooden panels, planks and oars.

The watching team members were the first to view the boat since the 26th century B.C. And the last, for a while. It had been decided to leave the chamber intact. So, after six days of recording the chamber's contents on film and tape, the team removed the airlock and replaced it with a seal fitted with sensors that would peri-

odically monitor chamber temperature and humidity indefinitely.

The space technology that made possible unviolated inspection of the Giza chamber has wide applicability in other archeological investigations and Dr. Farouk El-Baz is looking into additional space technologies that might be used in archeological applications.

"In the past," he says, "some archeological work was blind. Where to dig and how to approach a site was pretty much left to chance. From now on, any archeological excavation can be based on a tremendous amount of information by using our technology and methodology." ▲



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