Carter originally aimed to produce 2.5 million barrels a day by 1990—an objective judged by half a dozen expert reviews this summer to be unachievable.

Although agreement seems near on the level of funding for the project, confusion persists on the degree of authority to be given to an associated proposal, the Energy Mobilization Board (EMB). This new agency would be given the power to remove legal barriers standing in the way of high-priority energy projects, including any that might hinder the synfuels plants. According to Bowman Cutter, the panel would be composed of three members appointed by the President and confirmed by the Senate; it would be able to designate up to 75 projects for "fast-track" regulatory consideration; it would draw up a "project decision schedule" for each of these, setting deadlines by which federal, state, and local agencies would have to accept or reject each project; and it would be able to enforce these schedules by stepping in and making a ruling itself whenever an agency failed to meet a deadline.

The central point of dispute has to do with the EMB's power to override "substantive" laws when they are seen as causing delays in licensing or construction schedules. Before the August recess, Carter said he did not want to give the EMB broad authority: He simply wanted it to have the power to waive procedural delays after a project has received all the necessary approvals and construction has begun. This "grandfathering" approach, as it is called, would guarantee that once contracts have been let on a project, work will not be halted by a new law or a revision of existing law. Waivers would be given, the President said, only if they were needed to help get a project on the EMB's fast-track approval list finished on time, and only if they would not "unduly endanger public health and safety." The language used to describe these waivers remains vague.

When it came time to write the legislation, however, Administration lobbyists seemed to take a different tack. Coleman and Eizenstat, for example, gave their support to a sweeping waiver provision drafted for the House commerce committee by Representative John Dingell (D-Mich.), giving the EMB power to override any law standing in the way of energy projets on the EMB's fast track. Representative Tim Wirth (D-Colo.) attempted twice to have the provision amended so that the EMB would only override procedural actions, not matters involving substantive law. Wirth's amendments, his staff says, were opposed both times by Administration lobbyists.

The distinction between substantive and nonsubstantive waivers is not a clear one; even several Cabinet officers seem unsure of the official line on this issue. The heads of the Environmental Protection Agency, the Interior Department, and the Council on Environmental Quality have written to the President expressing concern about the powers being given to the EMB and asking for a clearer definition of its role.

One clarification was given by the director of the Office of Management and Budget, James McIntyre, Jr., in a letter to Senator Abraham Ribicoff (D-Conn.). Ribicoff, who chairs the Governmental Affairs Committee, wanted to know which federal laws would be affected by the EMB's override authority. McIntyre's reply contained what one Ribicoff staffer called a "hit list" of major environmental legislation, including the Clean Air Act, the Clean Water Act, the National Environmental Policy Act, the Endangered Species Act, the Toxic Substances Control Act, and about 20 others. McIntyre wrote: "The Administration's proposal does not provide for changes in the substantive requirements of any law that we have mentioned. . . . Our concern rests primarily with the time frames within which these substantive requirements are considered."

There is no clash between this assurance and the decision to support the Dingell bill, Eizenstat says, because the latter was adopted for purely tactical reasons. White House tacticians decided they should support a stronger bill than they wanted in order to offset weakening amendments expected on the House floor. The conservationists take this explanation with a grain of salt, for they have been burned by unexpected policy shifts before.

Among the important committee chairmen who have registered doubts about the power being given the EMB are Senators Ribicoff, Edward Kennedy, and Jennings Randolph, and Representative Morris Udall. The stage is set for another energy battle in Congress.

—ELIOT MARSHALL

Egyptian Geologist Champions Desert Research

From his base at the Smithsonian, Farouk El-Baz looks to space technology for more knowledge of the earth

The man who is perhaps the Arab world's best-known scientist is right here in the United States, working at the Smithsonian Institution's Air and Space Museum. He is Farouk El-Baz, Egyptian-born geologist and personal science adviser to Egyptian president Anwar Sadat.

El-Baz, who first came to this country in 1960, gained renown as a scientific planner for the Apollo moon flights. He was one of the people who advised astronaut-geologist Harrison Schmitt what to look for when he got to the moon. But El-Baz, a humanist at heart, has discovered in recent years that his real concerns have to do with the planet Earth, namely its deserts. The deserts occupy one-fifth of the earth's land surface, yet they are the least understood of the world's ecosystems, he says. A comprehensive understanding of deserts and their ways is crucial if man is going to learn to live with them and make intelligent decisions in attempting to reclaim desert areas for agriculture.

As director of the Air and Space Museum's research core, the Center for Earth and Planetary Sciences, El-Baz finds that he is in an ideal position to pursue his interests. Yet he would not be there were it not for the shortsightedness of Gamal Abdel Nasser.

El-Baz was born in 1938 in the Nile delta town of Zagazig, one of nine children, the son of a language and religion teacher. The family eventually moved to Cairo. El-Baz's father used to say that he would be happy if one of his children

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achieved a high school degree. But the Egyptian revolution of 1952, which decreed that all Egyptians could get a free higher education, permitted his dreams to be more than realized. From the El-Baz family emerged two lawyers, one of whom is deputy foreign minister of Egypt, a home economist, a medical doctor, a chemistry teacher, an aerospace engineer, and a son with a degree in business administration. El-Baz studied geology in Cairo and, as one of the five top geology graduates of 1958, was given the chance to study abroad. The other four went to the Soviet Union to get higher degrees, but young Farouk, warned by an older brother who had been to Russia, held out for training in the United States. He got his doctorate after studies at the Missouri School of Mines and the Massachusetts Institute of Technology, after which he taught for a year in Heidelberg, Germany. He collected tons of samples along the way and was determined to return to Egypt and build a school of economic geology (geology related to valuable minerals and petroleum). But when he returned to Egypt the Nasser government wanted him to teach chemistry to oil drillers. When appeals extending up to the president himself were turned down, El-Baz emigrated to the United States in 1966. He was hired for his first job in this country—interpreting moon photographs for NASA—by President Nixon's brother Ed, who was than at Bellcomm.

During his years working on the Apollo and Apollo-Soyuz missions, El-Baz became something of a folk hero in the Arab world ("hometown boy makes good," he says), particularly after being sent on a goodwill tour by the State Department to explain the U.S. space program to Arab nations. Such was his reputation that when the Egyptian foreign minister visited Washington in 1974, he extended a personal invitation from President Sadat (who took office in 1971) to come back and meet him. Thus began a close friendship with the Egyptian president and his family, which found expression in 1978 with Sadat's asking El-Baz to be his personal (unpaid) scientific adviser. Sadat also gave El-Baz carte blanche for any scientific projects he wanted to conduct in Egypt—an agreement that led to, among other things, an unprecedented Egyptian-American expedition last year into the western desert of Egypt.

El-Baz has unbounded admiration for Sadat, whom he describes as "an unbelievably good person, a lovely, lovely man. A man of vision and high intelligence . . . he can see very easily through fog." Sadat, for his part, was attracted to the "space connection"—he is "hip on space technology," says El-Baz—and found it advantageous to have as his adviser someone with no vested interest, outside the intrigues of Egyptian politics.

Sadat has turned to El-Baz for counsel on such matters as oil exploration, use of U.S. AID money, and new agricultural projects. Says El-Baz, "The biggest thing for Egypt will be to cut the war effort and put attention back into the economy, particularly agriculture. A war-minded economy emphasizes industry, as the Egyptian economy has done for the past 30 years at the expense of agriculture." El-Baz says of Sadat, who was formerly high up in the Nasser government, "This man grew in my mind a hundredfold when he admitted that excess industrialization was a mistake."

El-Baz supports Sadat's decision to dig a tunnel under the Suez Canal from Ismailia in order to supply water to the Sinai desert. This, he says, will enable the area, which now has about 100,000 inhabitants, eventually to support a population of 2 million. (On a recent trip to Israel, Sadat held out the possibility that some of this water could also be used to irrigate the Negev desert.)

At the end of September El-Baz plans to make a trip to Egypt to promote another grand scheme: utlizing the abundant waters of Lake Nasser, formed by the Aswan dam in the south of Egypt, to irrigate vast new tracts for agriculture. Satellite photography has revealed the existence of old valley floors near the lake, indicating the presence of good clayey soil, which could make a significant contribution toward what El-Baz thinks may be a feasible goal: food self-sufficiency for Egypt, which now spends $1 billion a year on food imports. El-Baz is also seeking ways to arrange for determining the oil potential of the western desert, adjacent to oil-rich Libya. "Sadat wants to know if there is any scientific reason why there should be no oil on the Egyptian side of the border," says El-Baz.

But in conversation El-Baz always returns to his core interest, his "mission": the development of a comprehensive understanding of deserts. Although policymakers have not yet caught on to the idea, El-Baz believes the time is ripe for in-depth studies of deserts, studies that have in large part been made possible by developments in satellite and space photography. Without the development of such knowledge, he maintains, international agencies and underdeveloped countries are going to continue to sink untold sums of money into ill-conceived and often fruitless programs to combat desertification.

El-Baz contends that one of the reasons for our backwardness about deserts is that although geology has numerous subdisciplines, such as glaciology, there is no subdiscipline on the geomorphology of the desert. One reason, he believes, is that geology evolved in Europe, the only continent on the earth that has no deserts. "When I studied geology in Egypt, I studied everything but the desert," he says. When Americans took over leadership in geology they brought to it an emphasis on the action of water—there was a particular fascination with the formation of the Grand Canyon through erosion by the Colorado River—but still no focus on deserts. Also, he says, geologists have been hampered by the image of themselves as studiers of

Farouk El-Baz with satellite photograph of Egypt.

Photo by C. Holden

solid rock, and the deserts are mostly just soil and sand.

Not many people know anything about how deserts are formed or what they are made of, says El-Baz, despite the romantic attraction the desert has held for foreigners. Actually, he says, "had it not been for those romanticists of the desert we would have known absolutely nothing." He refers specifically to Ralph Bagnold, an English Army officer who was stationed in Cairo in the 1930's, whose fascination with sand led him to write a book, *The Physics of Blown Sand and Desert Dunes*, which remains a classic for geologists. Bagnold, who had no scientific training, was responsible for the first and only classification of dune shapes: barchan (crescent-shaped), longitudinal, parabolic, dome, and whaleback. When Bagnold, who is still living, returned to England, he put sand in a wind tunnel and photographed it: from the results he derived a mathematical formula describing sand movement. "We are still using that formula for describing the transport of grains on Mars," says El-Baz.

El-Baz is fascinated by the similarities between the Viking photos of Mars and photos of deserts on Earth and says much can be learned about Mars by comparing the two. To illustrate this, he brought out two almost identical photographs of pitted rocks, one from Mars and one from the Egyptian desert. The Mars rocks were assumed to be vesicular—that is, having holes formed by gases trapped in lava. The Egyptian rocks had only external pocks, which were formed by the wind which, in combination with grains of sand, acted as an air drill. Now scientists think that the same may be true of the Mars rocks.

El-Baz says that what little money is now available for studying deserts is a result of the Viking program. "Almost all of Mars turned out to be a desert—we came in through the back door." He believes that vast amounts of money are being squandered in trying to stem desertification. "The thing that gets me about these UN people," he says, is that "none have experience with the real desert." They are only interested in the potentially reclaimable fringe areas. "Generally you find almost no geologists in on the discussions," he says, and we are "left with a bunch of biologists, chemists, and maybe some weather people talking with no real understanding of the terrain itself or how it got to be the way it is." He says there is still a persistent bias in favor of the idea that desertification is a result of human activities. Weight was lent to this prejudice when a Landsat photograph of northern Africa revealed a little dark patch that turned out to be a ranch some Frenchmen had fenced off in the desert. This led some experts to the conclusion that where overgrazing can be eliminated, desertification can be stemmed. But, says El-Baz, although the Frenchmen's land had more vegetation than the surroundings, "if you look at the soil, it's still desert."

The United Nations has estimated that in recent decades some 20 million square kilometers of land have reverted to desert or desertlike conditions—a staggering figure considering that the Sahara, by far the largest desert on the earth, is 9 million square kilometers. El-Baz believes the 20 million figure is complete nonsense and is tenable only if you believe that desertification is basically a man-induced phenomenon. He says most desertification is part of a drying trend which, according to historical records from ancient China and Egypt, has probably been going on for about 6000 years. "We really don't know why," he says, but his "gut feeling is that all of that is due to natural changes that are basically fueled by the sun." Thus it is extremely important not to throw money into trying to reverse an inevitable natural process.

Satellite photographs, El-Baz says, will be of enormous value in locating the areas of desert peripheries that would be most amenable to efforts to make arable land. He says that Egypt sank hundreds of millions of pounds into an area west of the Nile valley—to no avail because the soil was already too poor to respond. Another project, west of the Nile delta, met with much greater success because the soil contained much more clay, which holds water. He says that if Egyptians had had the benefit of satellite photographs, they could have told from slight differences in the color of the terrain which area was more suitable for reclamation.

El-Baz, who recently returned from a trip to China to look at its deserts, has visited most of the world's great deserts, in the United States, the Middle East, Australia, and India. Last September he was part of an expedition of Americans and Egyptians who traveled by jeep from the Kharga oasis west of the Nile down into the formidable southwestern desert of Egypt. The group of archeologists, botanists, geologists, and geographers brought back 3 tons of archeological artifacts, plant material, and rocks. Early next year he plans to take a team to do detailed studies of the Rajasthan desert in India.

These trips are part of a long-term global project funded by a multitude of different agencies. El-Baz has been coordinating the activities of an international "desert team" composed of space scientists, archeologists, botanists, geologists, geographers, and climatologists, which he hopes in the next 5 years or so will gain "the first real understanding of the desert environment" and the natural forces that act on it. Space technology is crucial for such an understanding. The desert has often been compared to the sea; its shifting dunes, like waves, make it impossible to establish landmarks. And some areas, such as the Great Sand Sea of western Egypt, are impossible to penetrate except by camel, "the ship of the desert."

A great deal of geological history being made on the great deserts of the earth is not being recorded by anyone. Says El-Baz, "There is not a single weather station in the open desert." Now, with the help of satellite technology, a remote monitoring station is being built that will be tested in the Arizona desert. It will measure cumulative precipitation, wind speed and direction, temperature, humidity, barometric pressure, and dust particles. The information will be relayed by solar-powered batteries to orbiting satellites, which will beam it back to receiving stations on the earth. El-Baz says that an ideal location for such a monitoring station would be Egypt's western desert, where, as Bagnold wrote, "The free interplay of sand and wind has been allowed to continue for a vast period of time, and here, if anywhere, it should be possible in the future to discover the laws of sand movement, and the growth of dunes."

Asked if his presence in this country is symptomatic of an Egyptian brain drain problem, El-Baz says he doesn't think so. He says that Egypt has many highly educated people; the problem there is not lack of talent but lack of motivation. With the government assuming responsibility for seeing that everyone gets an education and a job, complacency is flourishing. El-Baz says it flourishes no less in the scientific community than everywhere else, and believes Egypt could benefit from a little U.S.-style academic elitism.

El-Baz believes he can contribute at least as much to his native country from his base in the United States as he could if he went back to Egypt. It's a long way from Zagazig to Washington, and it may seem paradoxical that a son of the Nile delta should have to travel so far in order to study the deserts of his native land.

—CONSTANCE HOLDEN