

# To Stop Kuwait's Fires, First Clear the Mines

*Scientists and engineers have proposed new gadgets for removing explosives under the oil lake, but who's buying?*

INSIDE MANY A SCIENTIST THERE'S A TINKERER, and nothing stirs the problem-solving impulse like a technical disaster. The biggest crisis that might yield to an engineered solution today is the conflagration in Kuwait's oil fields, and proposals for snuffing it out more quickly are coming in from particle physicists, fusion reactor designers, astronomers, and electrical engineers.

Among the early volunteers in the assault were two well-known physicists—Henry Kendall, winner of the 1990 Nobel Prize in physics and a theoretician at the Massachusetts Institute of Technology, and Richard Garwin, a defense expert and IBM fellow at the Thomas Watson Laboratories. They organized a symposium this spring in Washington that turned up several novel proposals, and—as Kendall explained in hearings before the Senate environment committee on 11 June—some key insights.

The big challenge in Kuwait is not to snuff out the flames—that can often be done quickly with a well-placed explosive blast. The more demanding problem is get access to the wells, still surrounded by explosives laid down by Iraqi troops, and then to stop the flow of oil. Neither allied military forces nor anyone else is rushing in to clear away the mines now that combat is over. Which brings in the scientists: Kendall said that governments have invested little money in developing efficient methods of removing mines during peacetime. Yet buried mines present a growing threat to life and limb not just in Kuwait, but in the Falkland Islands, Cambodia, and Afghanistan.

Kendall's view matches a bleak assessment given by Red Adair, the famous Texas oil fire fighter, who appeared at the same hearing. The 150 (of roughly 600) ruptured Kuwaiti wells shut off so far, Adair said, were "the easy ones." "The real hard work hasn't started," Adair said, adding that unless fire fighters get more administrative support, it will take "4 to 5 years" to stifle all of them—not just a year, as some Kuwaiti officials are predicting.

Can the scientists do anything to speed things up? Clever optimists have proposed the following:

■ **Chain sledge.** Because modern mines are made of plastic, they cannot be detected by metal sensors and are often set to explode



**Saddam's Inferno.** To get access to the wells, crews must clear a path to them.

if only slightly disturbed. The only effective way to remove them is to dig them out—from a distance. William Wattenburg—inventor, former weapons engineer, consultant to the Lawrence Livermore National Laboratory, and radio talk show host—last February came up with a design for a mine-remover in the form of a chain matrix with digging knives pulled by a helicopter. Wattenburg sank \$45,000 of his own money into building prototypes and persuaded the director of Lawrence Livermore National Laboratory to invest \$50,000 in discretionary lab funds. Columbia Helicopter in Portland, Oregon, donated the use of a helicopter, and a big prototype has now been tested. Says Kendall, the device is "ingenious and effective," and the "only innovation" that can clear mines submerged in oil pools or under water. Some of the oil lakes in Kuwait

are 5 feet deep by 7 miles long, and growing. (As we went to press, Lawrence Livermore was filing for a patent.)

■ **Jet blaster.** Not so advanced in development, but promising, is Sterling A. Colgate's notion. A theoretical physicist at the Los Alamos National Laboratory, Colgate came up with a design for something that might be described as a giant leaf blower. He would harness the equivalent of a small jet engine (10,000 horsepower) to a steerable nozzle and a long boom, and use it to air blast mines out of the way. There are some big problems with the device—one, for example, is that the nozzle would have to sweep back and forth rapidly (tenths of a second) to avoid blasting a sizable hole in the ground. Colgate says the design would require "exhaustive technical development" before it could be used, but theoretically it should be able to move 1000 cubic feet of dirt per minute, clearing a safe roadway through a mine field in a matter of minutes. Dresser Industries is interested, according to Colgate, and if the cash is forthcoming, a prototype will soon be built. Says Kendall: "Feasibility studies suggest it is a promising technology."

■ **Infrared sweep.** Even more high-tech—and not yet endorsed by Kendall or Garwin—is an idea developed by scientists at the Lawrence Livermore lab: a remote mine detection system that senses faint differences in subsurface heat signatures and uses a computer to recognize distinctive shapes. Art Toor, a physicist at Livermore, says, "We are using the exact same algorithms" developed in the 1960s and 1970s to run computerized pattern recognition programs in an astronomy program designed to search for x-ray signals from supernovae. The remote sensor, which has been under development for 2 years, has been used successfully in locating archeological deposits, and Toor says it scored 100% in a mine-spotting test in Arizona this year.

All these systems may have technical hurdles before them, but that isn't the big question, according to an engineer who was deeply involved in this work. That question is: Will Kuwait invest in them?

So far, the signs have been discouraging. Kuwaiti military officials have signed an exclusive contract for mine clearing with a company called Royal Ordnance, an offshoot of a British aerospace firm. Kendall derisively refers to the company's "very primitive" approach. Workers walk along the sand, probing with hand-held rods for buried mines. This method is likely to become less and less effective as casualties mount, Kendall said. As for the alternatives suggested by Kendall and others, Royal Ordnance has "shown no interest."

■ **ELIOT MARSHALL**