Blimps to the Rescue

BY TIM FOLGER

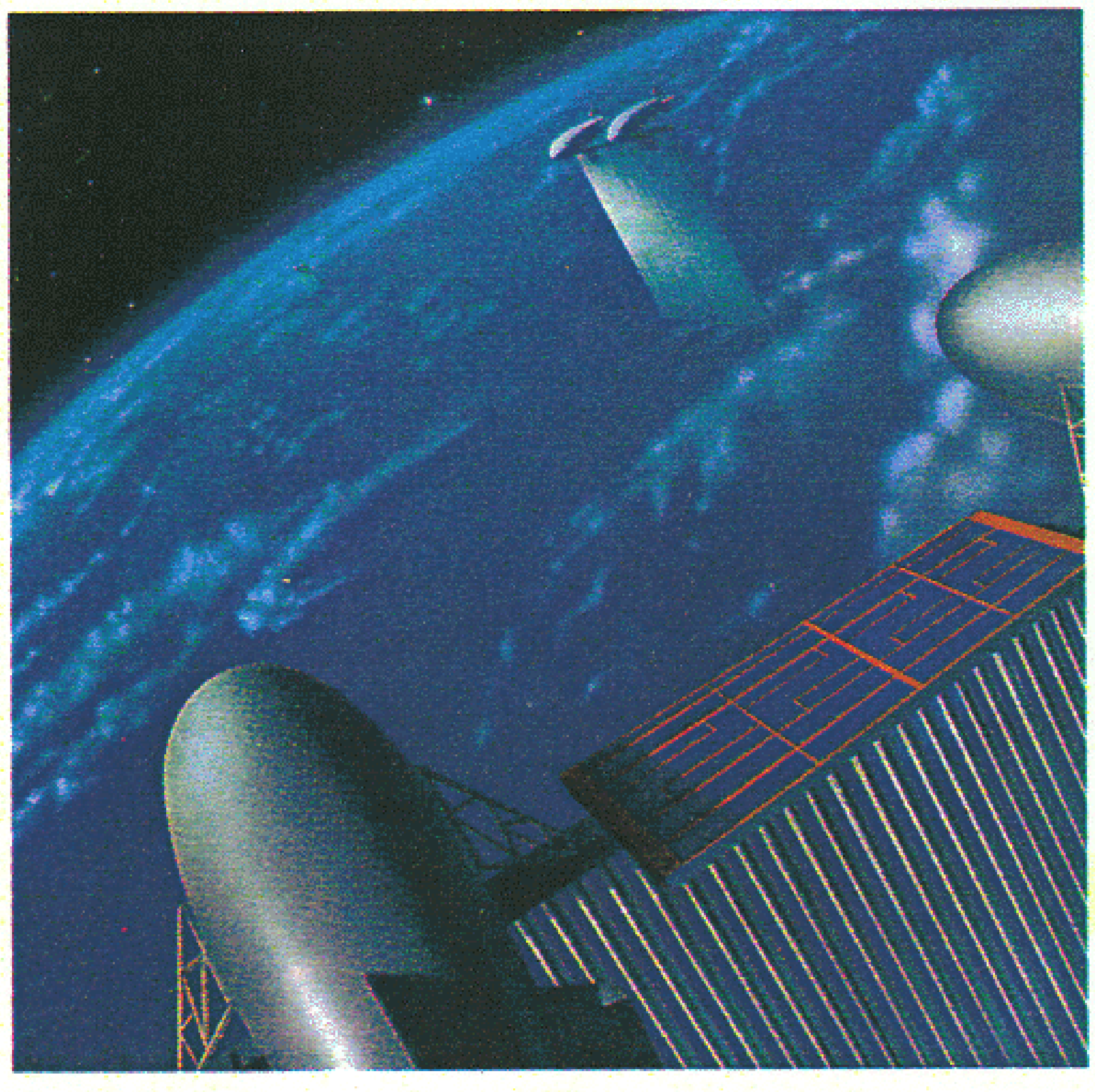
Floating in the stratosphere and spitting electrons, they could mop up chlorine and patch the ozone hole—or so says Alfred Wong.

TWENTY TO THIRTY miles above us, a tenuous envelope of ozone blocks the sun's lethal ultraviolet radiation. For some 20 years now scientists have known that man-made chemicals are eating away at that protective layer. As ozone levels continue to fall, more ultraviolet light will penetrate the atmosphere, increasing the incidence of skin cancer, harming microscopic marine life, and damaging crops. Recognizing the seriousness of the threat, the international community has agreed to phase out the production of ozone-destroying chlorofluorocarbons, or CFCs, by 1996. But even then the problem will be far from over.

"We have 40 to 100 years' worth of CFCs already released into the atmosphere," says Alfred Wong, a physicist at UCLA. "No matter what we do now, we still have that reservoir of CFCs."

Wong doesn't believe in waiting for the atmosphere to heal itself—especially since the problem may well continue to worsen for decades to come. Based on the results of four years of laboratory experiments, he has proposed a bold scheme that he believes will halt the destruction of ozone. His plan is to launch a fleet of 20 or so blimps into the stratosphere above the South Pole, where the ozone depletion is most severe. Hanging from each blimp would be a football-field-size curtain made of electrical wires—live electrical wires. Wong hopes this lighter-than-air armada will achieve on a global scale what he has already managed to accomplish in his laboratory—namely, the neutralizing of ozone-eating chemicals.

The jump from lab to stratosphere is a big one, but Wong believes the basic elements of his experiment will hold true no matter what the scale. In the atmosphere, CFCs—which used to be found in aerosol sprays and are still present in refrigerator coolants, among other things—remain stable and relatively harmless until they float up to the stratosphere. There energy from the sun breaks CFC molecules apart. One of the breakdown products is chlorine, a highly reactive, electron-hungry atom. When chlorine comes into contact with ozone—which consists of three oxygen atoms—the chlorine destroys the ozone by tearing away one of its oxygen atoms. It satisfies its lust for electrons by sharing one with the stolen oxygen atom, forming a molecule of chlorine oxide.



THE SOLAR-powered blimps would spray electrons from hanging wires.

Wong's idea is to redirect chlorine's hunger for electrons. In his lab at UCLA he simulates the stratosphere inside a telephone-booth-size test chamber containing a mix of stratospheric gases. A 140-watt mercury lamp serves as a miniature sun. When Wong injects a few hundredths of a pint of CFC vapor into his chamber, UV light from the lamp breaks up the CFCs, forming chlorine. In about six minutes the chlorine destroys nearly 60 percent of the ozone in the chamber. Then Wong steps in to repair the damage.

His method is straightforward: He pumps negative charges into the chamber, supplying the chlorine atoms with the electrons they would otherwise take from ozone. Once the chlorine picks up an electron, it won't react with ozone. The ozone it has already destroyed reforms naturally from oxygen molecules that have been split apart by UV light. In his test chamber Wong has reversed the destruction of ozone, and he is confident that he can repeat that success in the real world.

That's where the blimps come in. Each 300-foot-long unmanned blimp would float in the stratosphere 20 miles up like some giant airborne Portuguese man-of-war, trailing wire curtains. The blimps would also carry solar panels to generate electricity in the wire curtains. With a high enough voltage, says Wong—about 3,000 volts—electrons will pop off the wires and into the atmosphere. Radiation from the sun would also knock electrons off the wires, he says.

When chlorine atoms drifted by the blimps, they would pick up these free electrons and become inert as far as ozone is concerned. They would also become negatively charged. If the blimps carried a second sheet of positively charged wires, these sheets could sweep up the

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chlorine. After sweeping up two to three tons each, the solar-powered blimps would be steered back to the ground by remote radio control so the chlorine-laden wires could be replaced. Wong estimates that his fleet of 20 blimps could mop up between 300 and 1,000 tons of chlorine in a year—between 10 and 30 percent of the amount that is in the stratosphere—at a cost of around $400 million.

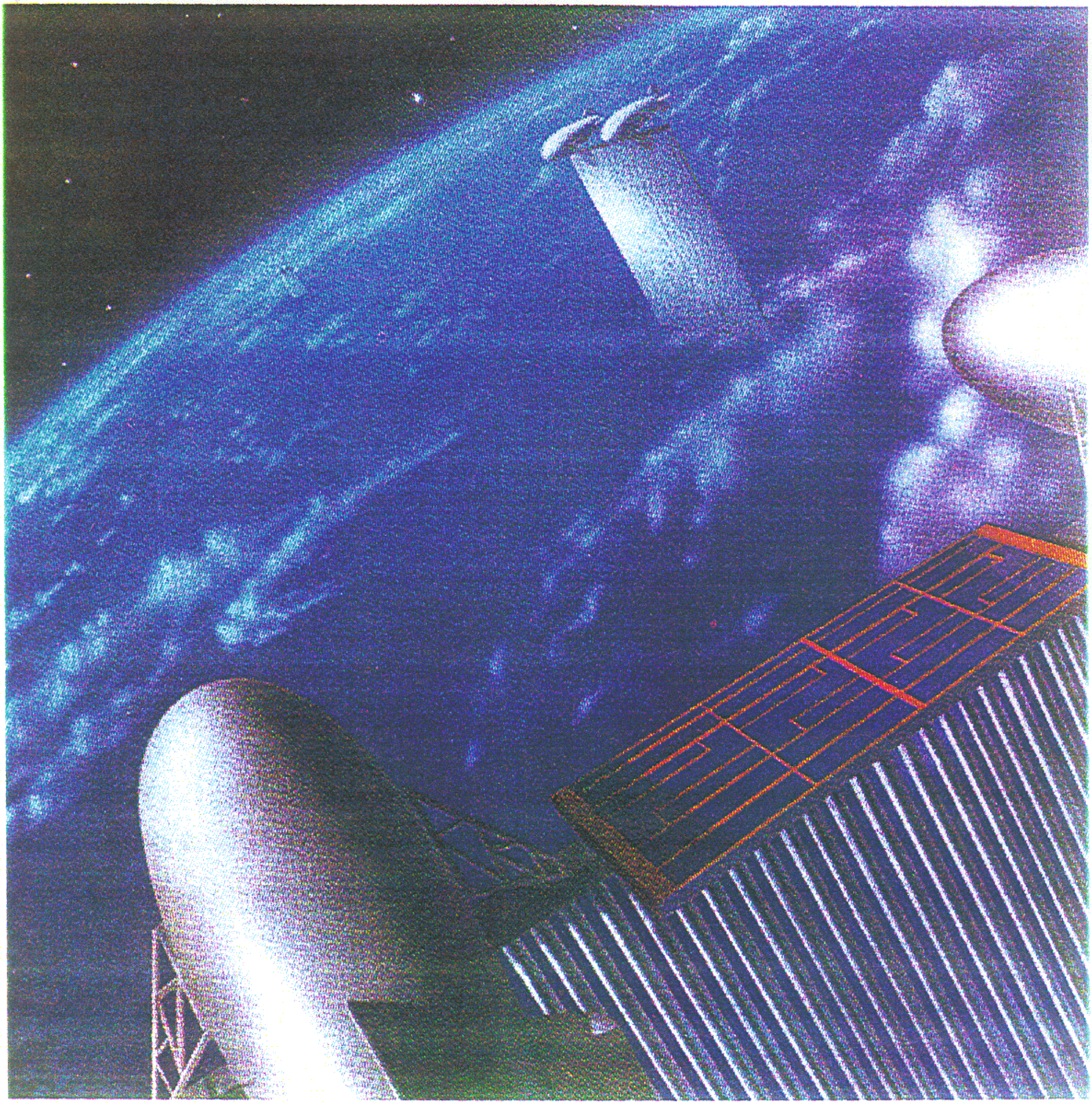
Will his plan work? "The basic idea is quite a brilliant one—namely, to put electrons onto chlorine and convert it into an inert species," says Earle Williams, an atmospheric physicist at MIT. "The practical next step is a very difficult one, but when you've got a simple concept that in principle should work, it's worth pursuing."

> "The basic idea is quite a brilliant one, but the practical next step is very difficult."

Other researchers are more skeptical. "I think what he's trying to do could probably be done on a small scale," says Ralph Cicerone, an atmospheric chemist at the University of California at Irvine, "but the complications in the real atmosphere look really insurmountable to me." Cicerone has had close experience with such complications. He proposed a scheme for patching the ozone hole in 1991—his idea involved injecting propane into the hole—only to find last year that two chemical reactions that in 1991 had not been known to occur in the stratosphere completely scuttled the scheme. In fact, Cicerone has now realized, injecting propane into the ozone hole would do no good and might even make it worse.

He thinks a similar surprise is in store for Wong. One problem with Wong's plan, says Cicerone, is that other gases in the atmosphere, nitrates and sulfates in particular, snatch electrons even more readily than does chlorine. So the electrons meant for the destructive chlorine atoms might never reach their targets. Wong says that just means he'll need to free enough electrons into the atmosphere to satisfy the needs of a wider variety of molecules. But he hasn't attempted to figure out what side effects that might have on atmospheric chemistry.

Wong thinks people like Cicerone are caviling when they warn of unexpected complications. "That's true of any experiment," he says. In any event, he isn't ready yet for a full-scale test. But he does want to try a small experiment in the atmosphere. Rocket exhaust, he says, punches small, temporary holes in the ozone layer. "If I can demonstrate that I can cure a small hole like that, it would be a good first step," he says. "We've already done the lab experiments. Now we're ready to do some field experiments, but a step at a time." D



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