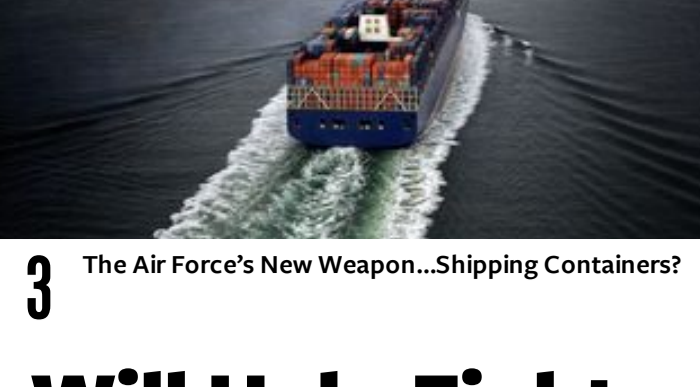


1 Why Did This Particle Mysteriously Disintegrate?



2 Can You Solve Our Riddle of the Week?

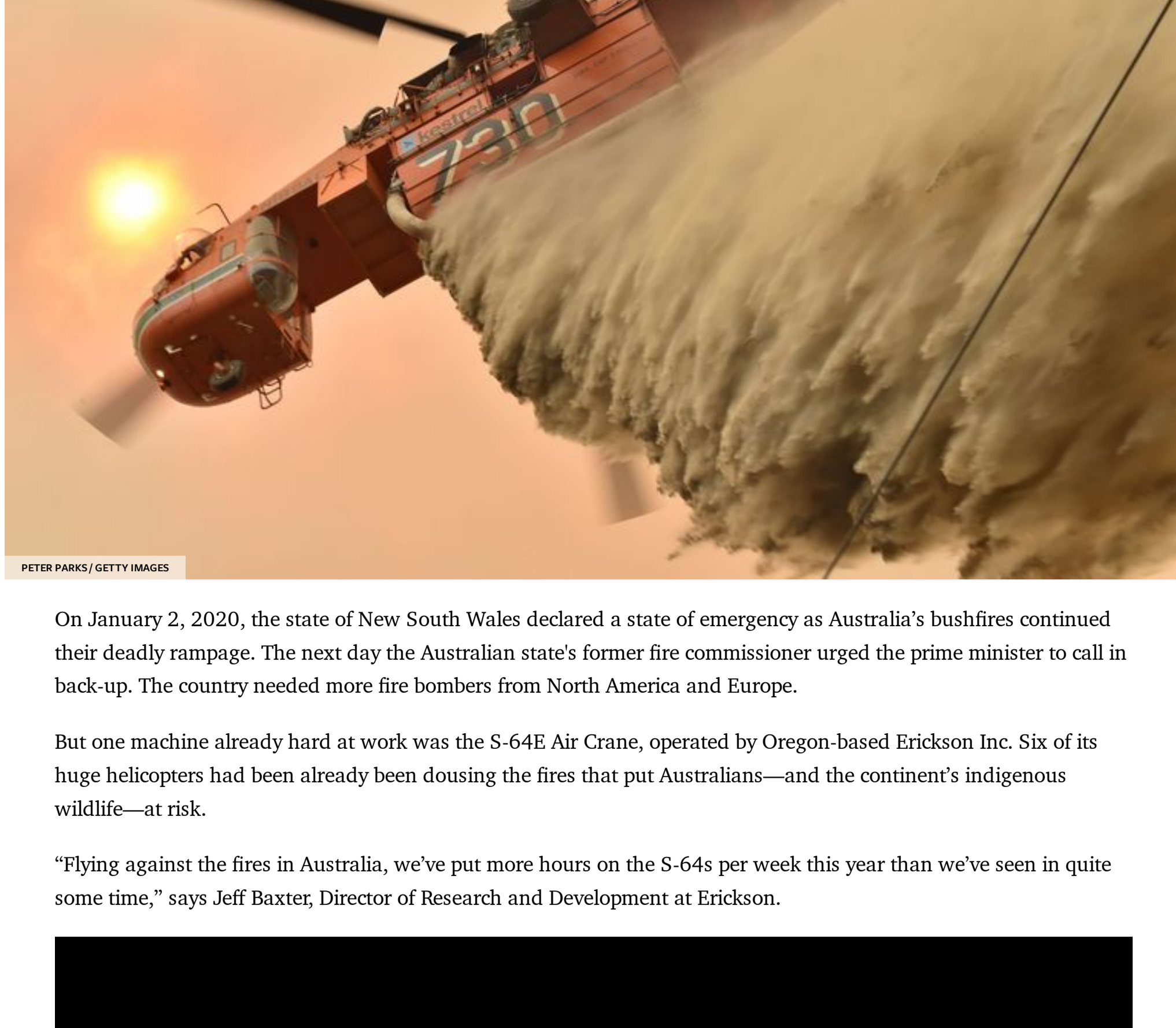


3 The Air Force's New Weapon...Shipping Containers?

A Vietnam Helo's New Robot Brain Will Help Fight a Different Kind of Enemy

The CH-54 did lots of heavy-lifting during the Vietnam War, but wildfires could be its biggest battle yet.

By Eric Lipton, Mar 9, 2020



PETER PARKS/GETTY IMAGES

On January 2, 2020, the state of New South Wales declared a state of emergency as Australia's bushfires continued their deadly rampage. The next day the Australian state's former fire commissioner urged the prime minister to call in back-up. The country needed more fire bombers from North America and Europe.

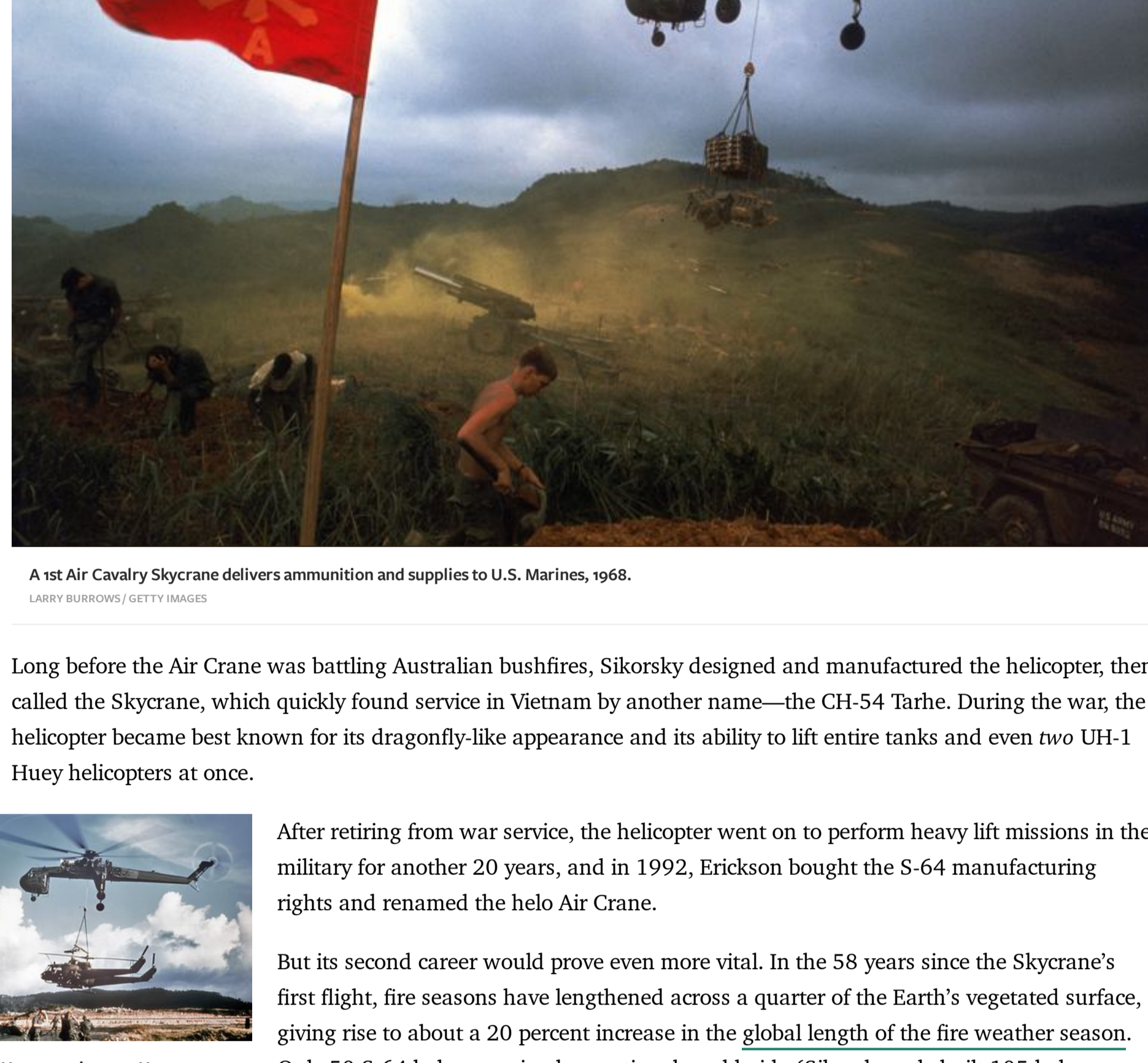
But one machine already hard at work was the S-64E Air Crane, operated by Oregon-based Erickson Inc. Six of its huge helicopters had been already been dousing the fires that put Australians—and the continent's indigenous wildlife—at risk.

"Flying against the fires in Australia, we've put more hours on the S-64s per week this year than we've seen in quite some time," says Jeff Baxter, Director of Research and Development at Erickson.

With the help of these six Air Cranes, C-130s, 737 large air tankers, and some much-needed rain, Australia officially declared on February 28 that all fires had been extinguished in New South Wales—after 240 days of fighting. But from the ashes came a harsh reality: As wildfires grow in frequency and intensity, aircrews face increasing danger, a fact sadly confirmed when a C-130 crashed in New South Wales killing three U.S. firefighters in late January.

That's why Erickson is transforming its water-bombing helo into a robotic firefighter in an effort to fight fires both day and night and save the lives of future firefighting pilots.

Bringing a Robot to a Firefight



A 1st Air Cavalry Skycrane delivers ammunition and supplies to U.S. Marines, 1968.

LARRY BUSBROOK/GETTY IMAGES

Long before the Air Crane was battling Australian bushfires, Sikorsky designed and manufactured the helicopter, then called the Skycrane, which quickly found service in Vietnam by another name—the CH-54 Tarhe. During the war, the helicopter became best known for its dragonfly-like appearance and its ability to lift entire tanks and even two UH-1 Huey helicopters at once.



A CH-54 carrying two Huey helicopters.

WIKIMEDIA COMMONS

After retiring from war service, the helicopter went on to perform heavy lift missions in the military for another 20 years, and in 1992, Erickson bought the S-64 manufacturing rights and renamed the helo Air Crane.

But its second career would prove even more vital. In the 58 years since the Skycrane's first flight, fire seasons have lengthened across a quarter of the Earth's vegetated surface, giving rise to about a 20 percent increase in the global length of the fire weather season.

Only 50 S-64 helos remained operational worldwide (Sikorsky only built 105 helos during the war), but wildfires continued flaring up with worrying regularity.



PHOTOGRAPHY/GETTY IMAGES

"When you fly over and put 2,000 gallons of water on a fire it's going to go out," says Baxter.

And that kind of fire-fighting capability means the Air Crane is in incredibly high demand around the world. In fact, Erickson CEO Doug Kitani told a crowd at the Heli Expo trade show in January that "there are not enough aircraft to go around." To meet this uptick in demand, Erickson is looking to robots to become more efficient at fighting fires—day or night. After all, fires don't sleep.

But one big problem is that nighttime water bombing is "a very dangerous thing to do on a forest fire," Baxter says. Usually, firefighting pilots have to fly with night vision goggles, which often degrades depth perception, and aircrews also need additional help from a dedicated guide helicopter. While these night missions are technically possible, Erickson doesn't want to take the risk—that's where the Matrix comes in.

Developed by Sikorsky, Matrix is an autonomous technology designed to take control of helicopters—no pilots required. While Matrix's development began more than a decade ago, it wasn't until 2013 that a Sikorsky S-76 commercial helicopter flew with an early version of the system. During the test flight, the helicopter flew at full speed, avoided obstacles, and even selected landing zones without pilot input.

Fast-forward to May 2019, Sikorsky adapted a more advanced version of Matrix to a UH-60A Black Hawk, the Army's workhorse tactical helicopter. Earlier this year, Sikorsky and Erickson agreed to bake the tech into a new version of the Air Crane—the S-64F+.

"The S-64 is obviously a much larger vehicle but similar [to the UH-60] in terms of their [design] vintage and mechanical controls so the Matrix kit is very similar for both aircraft," says Igor Cherepinsky, Sikorsky's director of autonomy. Integrating Matrix with the Air Crane involves adding a digital fly-by-wire system, control actuators, and Sikorsky's perception software and sensor suite.

But the tech isn't quite ready for service as Erickson and Sikorsky won't demonstrate the S-64F+ with Matrix until 2021. This first demo flight will likely see the helicopter autonomously fly a pre-programmed mission, including take off, transit to a water pick up, proceed to a target, fire bomb it, and then return to base.

Observer pilots onboard will monitor the aircraft/mission via a tablet with custom-designed software and user interface. If the test is a success, Baxter says subsequent test flights will fly without pilots while controllers oversee them with a Matrix ground control station, redundant satellite communication, and line-of-sight data links.

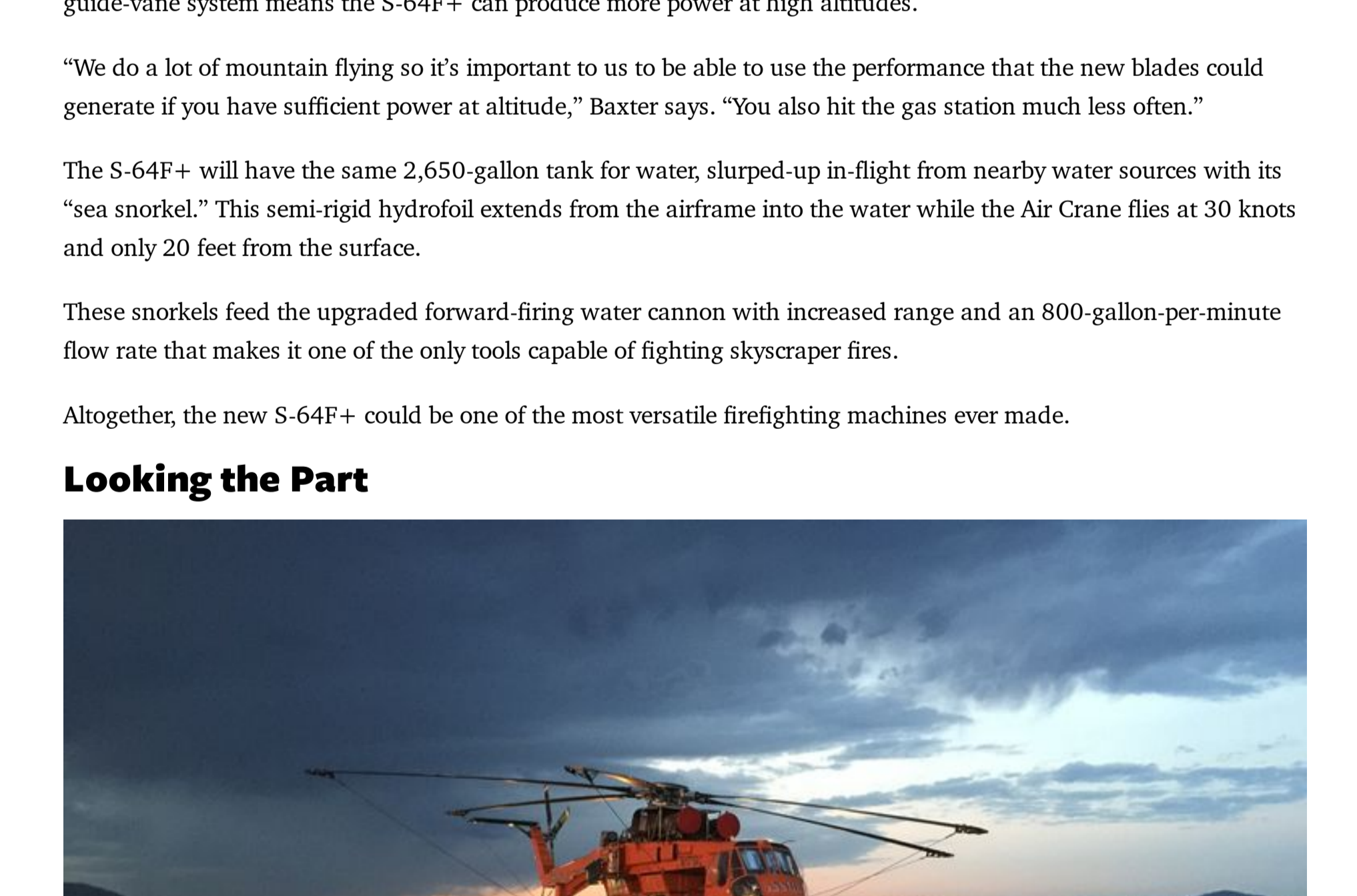
ERICKSON'S OWN AIR CRANE PILOTS HAVEN'T COMPLETELY COME AROUND TO THE IDEA OF LEAVING THE COCKPIT JUST YET.

"Night flying around smoke and other particles is an interesting problem which we believe our [Matrix] perception system was designed to manage," Cherepinsky says. "We're looking forward to doing that testing to understand what the limits might be."

These ongoing tests mean unmanned missions are likely several years away, understandable considering the variability of firefighting environments and the need to coordinate closely with firefighting teams on the ground. But in the near-term, Matrix-equipped helos can reduce pilot workload, enabling single-pilot operations, and aircrews also need additional help from a dedicated guide helicopter. Even Erickson's own Air Crane pilots haven't completely come around to the idea of leaving the cockpit just yet.

"We have two pilot camps," Baxter says. "One camp says we don't need any of this modern automated stuff. That's a very strong camp. Then there's the camp that thinks this will be better than what we've got. I've got the naysayers to convince still."

A Firefighting Juggernaut

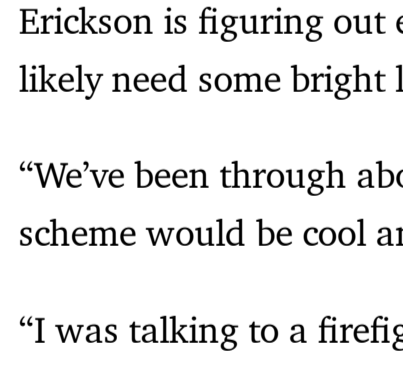


ERICKSON

While a robot brain can increase pilot safety, the S-64 has two big challenges to overcome—it's old and its fuel hungry. That's why the company isn't just refurbishing the S-64. Instead, it'll manufacture a brand new aircraft, possibly up to 100 if the global firefighting effort demands it.

Apart from the Matrix control system, the S-64F+ will feature new in-house designed main rotor, new digitally-controlled turboshaft engines, a fly-by-wire flight control system, digital avionics, and an upgraded forward water cannon.

MORE GREAT HELOS



The 15 Most Important Helicopters of All Time



This Is the Air Force's New Rescue Chopper



Air Force's New Helicopter Is Called 'Grey Wolf'

Despite all these upgrades, the Air Crane will look like its predecessors because Erickson designed its components to work with the existing S-64E architecture. The main rotor remains a 72-foot diameter, six-blade disc, but the blades are made from a carbon-fiber composite construction, each comprised of four discreet airfoils blended together. Erickson engineers based this design partly on a late 1990s rotor-airfoil NASA study.

Here's how it works: each blade bends slightly before the tip, creating an aerodynamic vortex in addition to the vortex generated at the tip itself. These vortices alter airflow to make following

blades more efficient as they chop through that disturbed air. The result is a main rotor that adds 3,000 pounds to the S-64's already impressive 20,000-pound lift capacity.

The new engines that replace the 4,500-hp Pratt & Whitney JFTD-12 turboshafts of the current helicopter are sourced from an as yet unnamed manufacturer. They're projected to be 30 to 40 percent more fuel efficient and a variable guide-vane system means the S-64F+ can produce more power at high altitudes.

"We do a lot of mountain flying so it's important to us to be able to use the gas station that the new blades could generate if you have sufficient power at altitude," Baxter says. "You also hit the performance much less often."

The S-64F+ will have the same 2,650-gallon tank for water, slurped-up in-flight from nearby water sources with its "sea snorkel." This semi-rigid hydrofoil extends from the airframe into the water while the Air Crane flies at 30 knots and only 20 feet from the surface.

These snorkels make the upgrade of forward-firing water cannon with increased range and an 800-gallon-per-minute flow rate that makes it one of the only tools capable of fighting skyscraper fires.

Altogether, the new S-64F+ could be one of the most versatile firefighting machines ever made.

Looking the Part



ERICKSON

In an interesting twist on human psychology Erickson has found that just the sight of an Air Crane coming to a fire has a profound effect. "These aircraft actually help people stay calm in a hectic disaster environment," Baxter says.

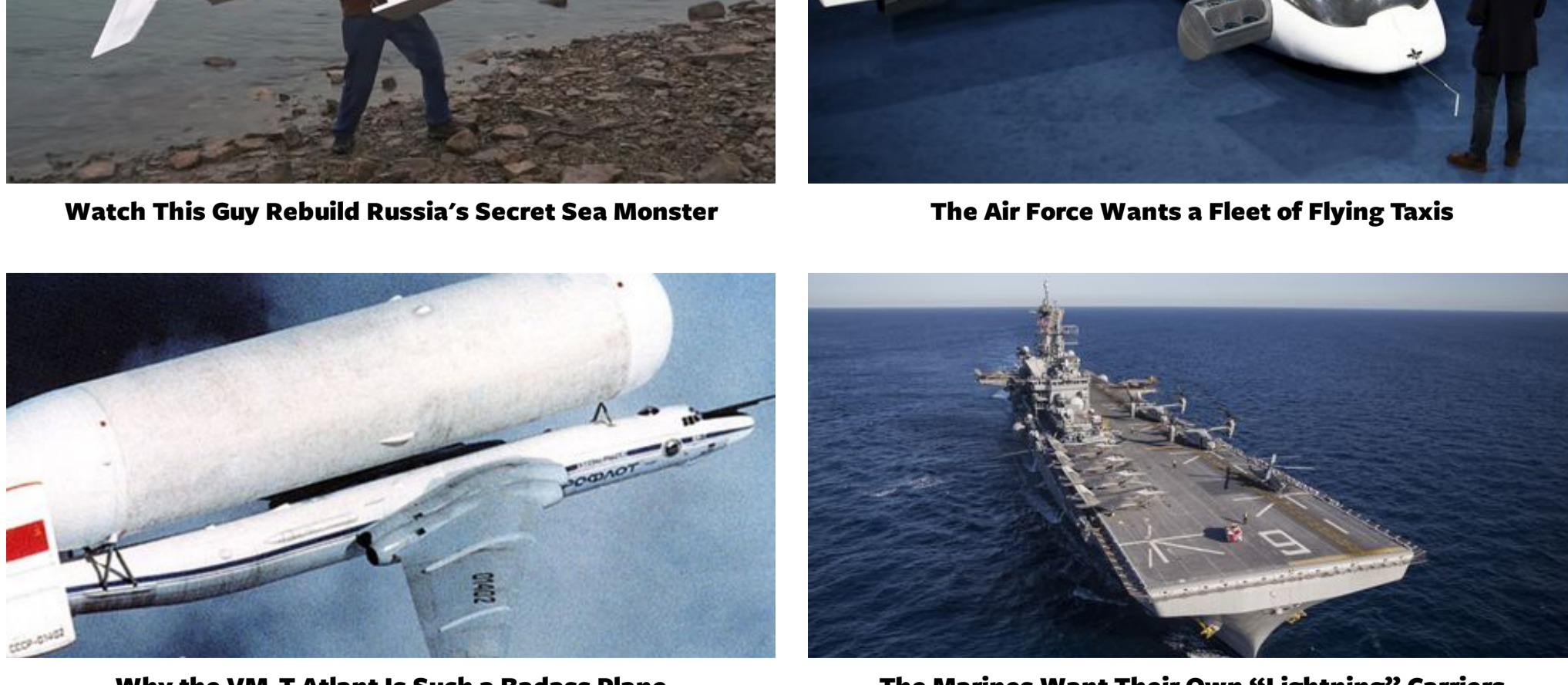
Erickson is figuring out exactly how it'll look the part. Because of its additional, night-flying capability, the helo will likely need some bright lighting. A whole different look could accompany any helicopters during day operations.

"We've been through about 30 or 40 paint schemes," Baxter says. He thinks an orange digital camouflage paint scheme would be cool and could help boost morale for weary firefighting crews.

"I was talking to a firefighter two weeks ago," Baxter says. "He knows the fire's going to go out when we put this big aircraft on it."

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