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ON THE COVER: An MD Helicopters MD 530F operated by the Tennessee Valley Authority sports high-visibility markings on its five main rotor blades, products of original equipment manufacturer Helicopter Technology Co. of Los Angeles, California, USA. Mark Bennett made this photo on a flight out of the aircraft manufacturer's headquarters in Mesa, Arizona.

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CORRECTION: In the June 2022 issue of ROTOR, we failed to identify everyone in the photo at left. The caption should have read as follows: While in France attending L'Hélico 2022 in May, Jeff Smith (with hat) and Jim Viola (in black shirt) met with (from left) EASA's David Solar, EHA's Christian Müller and Thierry Couderc, and Thierry Basset, president of the French Helicopter Group (GFH). ROTOR regrets the error.

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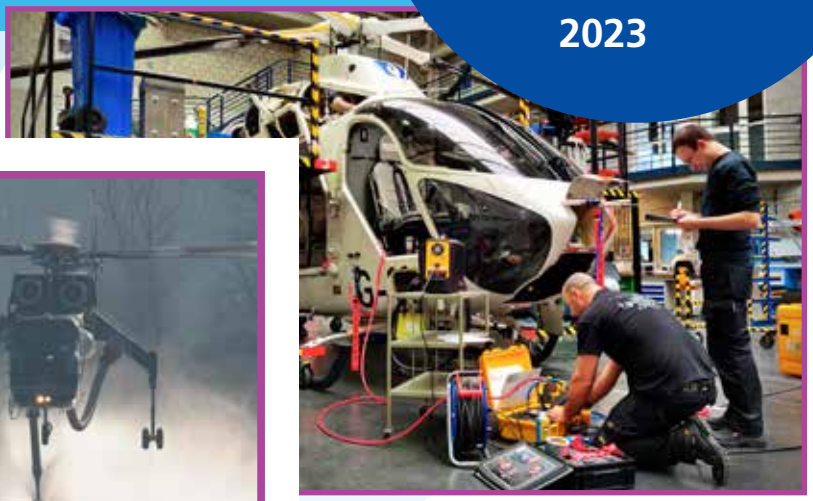
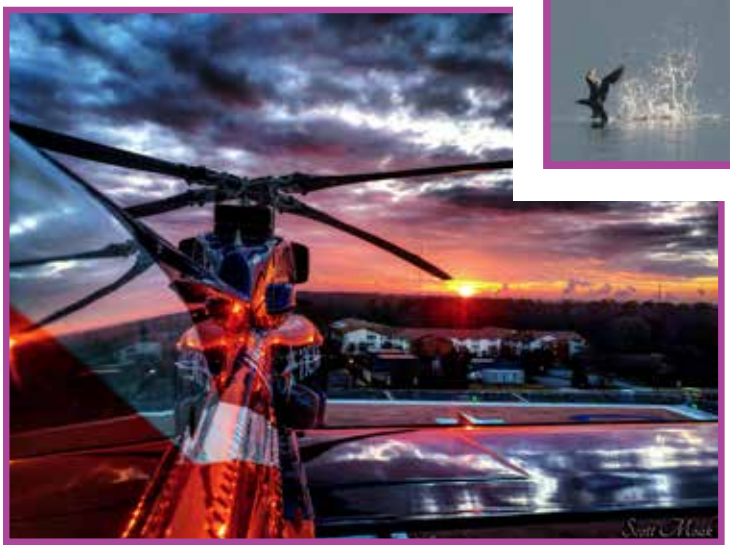
Winning photos will be published in the Mar. 2023 issue of ROTOR and displayed at HAI HELI-EXPO 2023





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Cade Clark
HAI's VP of government affairs, Cade Clark has directed association advocacy programs for more than 20 years. Growing up, Cade worked at an FBO where he learned to fly, washed planes, got in the mechanics' way, idolized the old-timers and their stories, and deepened his love for all things general aviation.

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Jaasmin Foote joined HAI as the association's social media manager in March 2020, just a week before the COVID-19 pandemic lockdown. She holds a bachelor's degree in English and is currently pursuing her master's in marketing. Jaasmin is responsible for all the cool posts on HAI's social media platforms. Follow us, drop by, and say hi!

David Hughes
David Hughes has been writing about aviation for 40 years. As a US Air Force Reserve pilot, he flew the C-5 and C-141, and he has logged 20 years writing and editing at *Aviation Week & Space Technology* magazine. He then joined the FAA to write about NextGen and today is a freelance writer.

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David Jack Kenny is a fixed-wing ATP with commercial privileges for helicopter. He also holds degrees in statistics. From 2008 through 2017, he worked for AOPA's Air Safety Institute, where he authored eight editions of its *Joseph T. Nall Report* and nearly 500 articles. He'd rather be flying.

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Gina Kvitkovich
Gina Kvitkovich joined HAI as director of publications and media in 2011 after decades of honing her skills in writing, editing, and publishing. As editor of ROTOR, she is responsible for every error in the magazine that you're reading—and for some of the good stuff, as well.

Zac Noble
Zac Noble, HAI director of flight operations and maintenance, has over 37 years of experience as a pilot and mechanic. He spent 11 years flying in the air medical sector before coming to HAI and is a veteran of the US Army, where he flew helicopters and multiengine airplanes. Zac is a dual-rated ATP, a dual-rated CFII, and an A&P mechanic with IA privileges.

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Ned Parks, founder of Aegis 360 Consulting, provides training and facilitation in team building, leadership development, and aviation strategy. Before beginning his company in 2000, Ned was an air ambulance helicopter pilot and manager for Keystone Helicopter and a division manager for Mid-Ohio Aviation. A 10-year military veteran, Ned served as a helicopter pilot and instructor pilot in the US Army before beginning his civilian career. Ned currently holds AGI, ATP, CFI-H, CFII ASEL, and IGI certifications.

John Shea
John Shea joined HAI as director of government affairs in 2019. He came to HAI from the National Association of State Aviation Officials (NASAO), where he was interim president in 2018 and lead government affairs representative since 2017. Previously, as a legislative staffer, John advised multiple members of Congress on transportation policy.

Dan Sweet
Dan Sweet joined HAI as director of communications and public relations in 2017. He previously served in the US Navy as a photojournalist. After leaving the Navy, he worked for Oregon-based Columbia Helicopters, performing public relations, communications, and trade show management work for more than 22 years.

Emma Taylor
Emma Taylor joined HAI as a policy analyst in 2020. She graduated *cum laude* from Villanova University in December 2019 with a major in political science. She left the association in August of this year to pursue a law degree.

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By Jeff Smith

Bridging the Identity Gap

Are we really that different?

Jeff Smith is the chief pilot for R.O.P. Aviation in Teterboro, New Jersey, and the 2022–23 chair of the HAI Board of Directors. A former US Army aviator, he is a dual-rated pilot with more than 11,500 flight hours. Jeff is an active industry volunteer and advocate who has worked on noise, safety, and airspace issues in the New York City area as a member of the Eastern Region Helicopter Council.

LISTEN TO the Founder of India's ePlane Discuss the Company's e200 VTOL Flying Taxi

LEONARDO DA VINCI DESIGNED THE FIRST HELICOPTER CONCEPT, the aerial screw. The first practical helicopter flew in 1939, with Igor Sikorsky at the helm. Today, we have glass cockpits, composite airframes and rotor blades, as well as more efficient, cleaner-burning turbine engines. We've expanded the capabilities of our aircraft in nearly every way, including remotely piloted and autonomous flights.

Evolution in vertical lift has been going on for a long time. And now, thanks to advances in computer programming, materials science, and other disciplines, the world of vertical lift is once again expanding. The Vertical Flight Society lists more than 600 designs for electric vertical takeoff and landing (eVTOL) aircraft in development by nearly 350 companies around the world. It's a given that not all of these will make it to certification, but I have a hard time believing that none of them will. Advanced air mobility (AAM) is on its way.

The substantial differences between the conventional aircraft of today and the ones of tomorrow embolden some to claim that AAM is an entirely new industry. Their machines will be quieter, cleaner, they promise. The idea that AAM will replace helicopters, however, is nothing more than a marketing scheme, useful until Day 1 after certification—which is when the similarities between AAM and helicopters will become apparent.

We will need pilots and mechanics to fly and fix these eVTOL machines, drawing from an already tight labor pool for skilled aviation workers. Pilots will need training on these new aircraft, requiring simulators to be built and certificated. Standards for maintenance on electric vehicles must be developed. You can't run an aviation business without insurance, so those folks will have to get involved. Airspace will have to be developed in an already saturated system, especially around urban areas. Safety, especially when your business model involves carrying paying passengers, must be paramount. In short, AAM operators will face the same issues and be looking for the same answers as helicopter operators.

There are no new missions. The helicopter industry has been doing urban air mobility for well over half a century; we just call it "on demand." Many of our global members are already using AAM in their operations, so we can see the practical results of AAM integration. The economics are clear: for the right mission, eVTOL aircraft are the right choice.

Yes, change is coming, but it will happen over the course of years. AAM can't immediately meet the performance margins that current technology provides. Did you know that when there's a wildfire, the first thing to be shut down is the power grid? It's a good thing Black Hawks and Chinooks are powered by a different fuel as they carry thousands of gallons of water to save homes and communities. Just as some missions will fit the profile for AAM aircraft, some won't.

For all to survive and prosper, we must collaborate with each other on lessons learned since Sikorsky's first flight in 1939. HAI has started making the adjustments that will help our members keep their rotors turning—whether that's on their VTOL or eVTOL aircraft. The HAI Board of Directors has appointed Jonathan Daniels, CEO of Praxis Aerospace Concepts International, our special advisor for emerging technology to advise on issues related to our industry's expansion. We're assessing our strategy to keep HAI relevant and focused on helping all our members succeed. We're evolving, just as you are, but our mission remains the same.


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By James A. Viola

Filling Our Workforce Pipeline

Our woeful numbers insist that we change tactics.

James A. Viola is HAI's president and CEO. After a career as a US Army aviator, he joined the FAA, where he served as director of the Office of General Aviation Safety Assurance before joining HAI. A dual-rated pilot, Jim holds ATP ratings in both airplanes and helicopters and is a CFII. Jim can be contacted at president@rotor.org.

WE ARE AT AN UNPRECEDENTED POINT in the vertical takeoff and landing (VTOL) industry: the shortage of pilots and maintenance personnel, forecast for years, is finally here. I am hearing reports from the field of operators not being able to vie for new contracts or support current ones because they lack the staff to support the work.

How did we get here, and more importantly, what are we going to do about it?

As to how we got here, well, at the most fundamental level, we have failed to recruit and retain talent in sufficient numbers. Examining the reasons why may provide us with some strategies for addressing the problem.

Conduct an informal survey of your colleagues. Why did most of them end up in VTOL aviation? For me, my childhood dream was to fly. Being able to live that dream has given me a meaningful career and a great deal of satisfaction. Many in our industry were also "bitten by the aviation bug" a long time ago, likely before they graduated high school. We cannot imagine doing anything else.

That bug continues to bite a certain number of young people, infecting them with the desire to do what it takes to be around helicopters all day. But those numbers are simply not enough to fill our pipeline. We cannot wait for our future pilots and maintenance technicians to seek us out; we have to go find them and make a convincing argument about why they should join us.

Our industry is not alone in being challenged to find qualified workers. In the United States, the unemployment rate is 3.5%, matching the lowest rate in 50 years and creating a competition for talent.

So what is our value proposition? For many pilots, it is that they should take out sizable loans, only to work for relatively low wages until they reach the 1,500 hours that enable them to be insurable, and therefore employable, in many sectors. Many pilots now in the industry made those sacrifices. While they built their hours, they delivered pizza as a side gig so they could support their families. Some may even feel that the next generation should struggle as they did. But is that a winning workforce-development strategy?

Even within aviation, the VTOL industry has trouble competing with the airlines. Those large corporations with deep pockets have developed entire recruiting programs for pilots and maintenance technicians, complete with career progression ladders and signing bonuses. For military aviators, they provide customized training plans that offer ex-military personnel what they are accustomed to hearing: "Just sign up and show up. We will take care of the rest."

We must also look at the issue of retention. Yes, we need to raise awareness among young people about the great opportunities we offer. But we should also take a hard look at why some experienced personnel leave VTOL aviation. As someone told me, "It is not just about who walks in the front door; we also have to look at who is walking out the back one."

This problem is larger than any one operator or manufacturer, which is why we need to address it as an industry. The HAI Board of Directors has created the HAI Workforce Development Working Group to examine the issue and create strategies to ensure a sustainable VTOL workforce. If you are interested in moving our industry forward on this issue that is critical to our future, please contact me at president@rotor.org.

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By Cade Clark, John Shea, and Emma Taylor

Some Wins for Our Industry

HAI initiatives on sustainable fuel, workforce development, and noise move forward.

THE PRE-AUGUST RECESS RUSH, A US congressional tradition, was especially eventful this year. In the United States, we're getting close to the November midterms, the elections that occur between the four-year cycle of presidential contests, so politicians were eager to return home for the traditional monthlong August recess and tout their legislative accomplishments.

Sustainable Fuel Tax Credits Available

Democrats in Congress delivered President Biden's signature legislative achievement, the Inflation Reduction Act of 2022. While the $737 billion package of climate, health care, and tax measures is a scaled-back version of the $2 trillion reconciliation legislation the House originally sent to the Senate late last year, key HAI-endorsed sustainable aviation fuel (SAF) tax provisions made the final cut.

HAI President and CEO James Viola prepares to testify before the US House Subcommittee on Aviation at the Jul. 13 hearing "The State of General Aviation."

The SAF blenders tax credits, valued at $1.25–$1.75 per gallon depending on percentage of life-cycle greenhouse gas emissions compared with fossil-based jet fuel, will be in place for 2023–2024. Beginning in 2025, the legislation creates three years of a Clean Fuel Production Tax Credit with an enhanced value for SAF of up to $1.75 per gallon.

These tax credits will be important tools for increasing the availability of SAF and encouraging its use. HAI, along with other general aviation associations and coalitions, has long advocated for these measures as a critical component in our industry's effort to reduce CO_2 emissions. These credits will help spur increased SAF production, thereby making the alternative fuel more available while reducing its cost to end users.

Federal Funding Still Up in the Air

Federal funding expires on Sep. 30. Neither chamber was able to complete the appropriation process before leaving the District of Columbia for August recess, which left lawmakers with a massive undertaking when they went back in session in early September, after the Labor Day holiday.

The House managed to pass 6 of the 12 appropriations bills but were unable to bring any of the remaining ones to the floor before leaving for recess. The Senate's 12 appropriations bills were introduced just before recess, but no plans to hold committee markups were ever provided.

As has been common in recent budget cycles, continuing resolutions that provide temporary, short-term funding are likely to keep the government funded while party leaders work to resolve disagreements on the

numbers. Given that neither party can afford a government shutdown right before the midterms, there is optimism an agreement can be reached before the deadline.

With Election Day looming on Nov. 8, lawmakers won't stay in Washington for long before heading back out on the campaign trail. The House is scheduled to have its last day in session on Sep. 30, while the Senate is tentatively set to be in session for two weeks in October, though that could change.

With both the Senate and House majorities on the line in the midterm elections, the passage of the Inflation Reduction Act is an exceptionally well-timed legislative success for Democrats in tough races. The conventional wisdom is that Democrats still face an uphill battle in retaining control, but recent events such as the Supreme Court rulings on guns and abortion are thought to have energized the Democratic base and drastically shifted the landscape.

FAA Reauthorization Coming in 2023

Members of the House Transportation and Infrastructure Committee are already preparing for the next FAA reauthorization bill; the 2018 legislation will expire in October 2023. To better understand the needs and priorities of the general aviation sector, the House Subcommittee on Aviation held a hearing, titled "The State of General Aviation," on Jul. 13. The hearing provided an excellent opportunity for HAI to present the committee with the priorities of our membership and to introduce legislative topics to be included in next year's reauthorization bill.

HAI President and CEO James Viola testified and addressed several issues critical for the vertical lift industry, such as the safe integration of new aviation technology into the airspace, sustainability, workforce development, and much-needed efficiencies within the FAA. (View his entire testimony at https://bit.ly/August2022VFR.) He also described a program recently launched by HAI and partners to address noise complaints in the Washington, D.C., area. (See "HAI, ERHC Debut Washington, D.C., Noise Initiative," at right.)

Looking ahead to the final months of this congressional session, the HAI Government Affairs team will continue laying the groundwork for the FAA bill, working with Congress to ensure that our priorities are reflected in the final language.

HAI, ERHC Debut Washington, D.C., Noise Initiative

During the Jul. 13 hearing on general aviation, Del. Eleanor Holmes Norton (D-D.C.) asked HAI President and CEO James Viola what steps the FAA and helicopter operators should take to reduce helicopter noise. Norton explained that as a co-chair of the congressional Quiet Skies Caucus, she was "particularly concerned with the effects of helicopter noise on the lives of my constituents here in the District of Columbia." She went on to say that helicopter noise is a major concern throughout the Washington, D.C., metropolitan area.

Viola expressed HAI's commitment to work with Norton and her constituents on the issue. He briefed her and other committee members about HAI's Fly Neighborly program, which focuses on implementing noise mitigation techniques and helping local operators communicate more effectively with their communities.

He also cited the initiative launched in June by HAI and the Eastern Region Helicopter Council (ERHC), in cooperation with the FAA, to collect aircraft noise complaints from D.C.-area residents through an online form, a mobile app, or a noise complaint hotline. After a 60-day trial, the system may be adopted permanently.

Data from the complaint system will be shared with the public and reviewed by industry and government stakeholders to determine where and how improvements can be made. Similar approaches to helicopter noise complaints have been used effectively in other regions to identify specific pain points and appropriately tailored solutions.

HAI supports community compatibility and data-driven efforts to measure and mitigate noise complaints. Operators are encouraged to visit rotor.org/fly-neighborly and take a proactive approach to fostering acceptance of helicopters within their local communities.

Learn more: rotor.org/fly-neighborly

Fly Neighborly
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continued

Building on Success

During the August recess, your legislator was most likely back in their state or district, seeking your support in the upcoming election. That's why the annual August recess provides an excellent opportunity for HAI members to interact with their elected officials and explain what issues are important to our industry and how their assistance will support small businesses and create jobs for their constituents.

To that end, HAI members involved with the Utah Rotor Pathway Program (URPP) contacted their elected representative, Rep. Burgess Owens (R-Utah-04), to highlight the labor shortage in aviation. They explained how the URPP exemplifies how industry and government can work together to solve a complex problem.

At the end of August, HAI staff and HAI members were invited to participate in the Aviation Workforce Development Roundtable in Salt Lake City, Utah, hosted by Owens. Government and industry leaders discussed opportunities to build on the success of the URPP, an HAI initiative that has just received its second national award.

HAI Members

HAI is here for you! Contact advocacy@rotor.org with your legislative challenges.

Owens led the discussion on how federal resources for URPP and similar high school and post-secondary programs could help close the skills gap and meet the labor demands of the aviation industry.

Employers and educators provided feedback on the ability to expand the program and how it can be replicated across the country. Cade Clark, HAI VP of government affairs, informed the roundtable of HAI's ongoing discussions with stakeholders in other states that are eager to set up pathway programs using the URPP model. Clark explained that establishing funding is the biggest barrier to getting the buy-in necessary to launch such programs.

Through the URPP, students are exposed to a pathway to technical careers, while the state benefits by building a skilled workforce. The program serves as a first-in-the-nation model for education and training programs that prepare high school students for science, technology, engineering, and math careers in rotary-wing aviation. Students can participate in technical classes and hands-on learning at the secondary-school level while earning college credits and learning skills specific to rotary-wing aviation careers.

URPP industry partners work with high schools, flight schools, and universities to offer benefits such as mentoring, internships, and job interviews. The Utah program has expanded to 32 schools in the state and has been awarded a perpetual Strategic Workforce Investment grant by the state legislature.

Farewell to One of the Team

Finally, in a bittersweet farewell, the HAI Government Affairs team said goodbye recently to one of our own. Emma Taylor, a policy analyst and outstanding team member of almost two years, headed off to law school in mid-August. Emma, we wish you the very best and know that you'll achieve your dreams.

HAI BRIEFS

HAI Creates Workforce Development Working Group

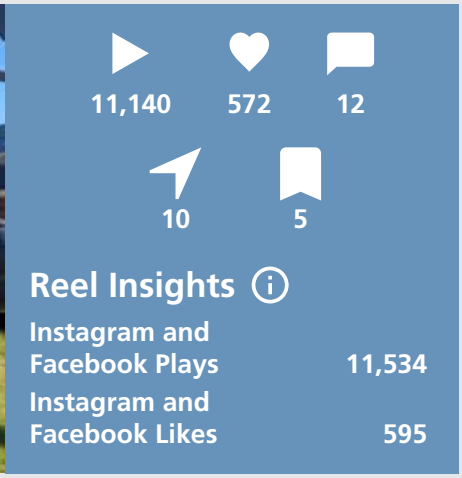
IN RESPONSE TO THE VERTICAL LIFT industry's growing pilot and maintenance technician shortage, HAI has launched the HAI Workforce Development Working Group (WDWG). The newest of HAI's many working and sub-working groups addressing issues important to our members, the WDWG is tasked with creating and reviewing programs to support a long-term pipeline of skilled workers for the industry.

Formed under the direction of the HAI Board of Directors, the new working group will help expand the international VTOL industry workforce by developing a comprehensive recruitment plan that addresses educational outreach, Mil2Civ transitions, job fairs, and marketing. The group will also collaborate with industry organizations to cultivate partnerships that boost recruiting and retain talent within the industry.

"If you've ever considered giving back to the industry, this is a great opportunity to share your knowledge and expertise."

—Greg Brown, HAI Director of Education and Training Services

The Workforce Development Working Group is now accepting applications from HAI members around the world who are willing to lend their diverse skills, expertise, and insight to the cause. "We're seeking anyone who has had strong success recruiting people to their company or to the industry to join this diverse working group," says Greg Brown, HAI director of education and training services and staff liaison to the WDWG. "We welcome heads of companies, human resources staff, directors of maintenance, chief pilots, and anyone else with experience in attracting and hiring talent. If you've ever considered giving back to the industry, this is a great opportunity to share your knowledge and expertise." ➤



AN OLD FRIEND: At this year's EAA AirVenture show, we asked our followers to guess which aircraft HAI President and CEO James Viola had flown in the past. The post received over 11,000 views and almost 600 engagements, with many correctly guessing that Viola had piloted the MH-47 Chinook, such as the one pictured with him above.

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EUROPEAN ROTORS returns this year to Cologne, Germany, site of the inaugural, 2021 show. More than 160 exhibitors will be participating, including Bell, whose 505 (foreground) and 429 models are pictured above in the exhibit hall at last year's event.

➤ HAI is also seeking at least one applicant who is affiliated with a school to join the working group, whether it be a middle school, high school, university, or aviation trade school.

The Workforce Development Working Group is one of 13 working groups and subgroups that advise HAI leadership on key sectors of the VTOL industry. Each HAI working group is led by a chair, vice chair, and secretary who are elected from the working group's members. A member of the HAI Board of Directors and an HAI staff liaison also participate in each group. HAI working groups typically meet virtually at least quarterly and in person at least once a year, at HAI HELI-EXPO®.

If you're interested in learning more about or joining the Workforce Development Working Group, contact Greg Brown at gregory.brown@rotor.org.

HAI BRIEFS

VAST to Host 1st Annual Global Conference

THE VERTICAL AVIATION SAFETY TEAM (VAST) will host the VAST 2022 Global Conference Oct. 4–6, 2022, in Hurst, Texas. The goal of the event's organizers, VAST, the FAA, HAI, and the US Helicopter Safety Team, is to elevate and inspire a thriving safety culture throughout the VTOL industry. Through informative lectures, panel discussions, Q&A sessions, and ample networking breaks, the conference will focus on safety and expanding participants' safety skills and tools.

The event will bring together experts from around the world to share best practices, lessons learned, safety and accident data, and proven risk-reduction strategies for VTOL aircraft operators and maintainers.

Day 1, Oct. 4, will include an overview of VAST, a panel discussion on global VTOL safety improvements, a first-person account of surviving a catastrophic crash, US and European helicopter accident statistics and trends, and more.

Day 2, Oct. 5, will be divided into three sessions, one each addressing operations, maintenance, and VTOL technology.

Day 3, Oct. 6, will focus on safety management systems (SMSs) for small operators, as well as heliports, regional vertical flight challenges and successes, and more.

The VAST 2022 Global Conference can be attended in person or virtually. The cost for in-person participation is $120 per person and includes breakfast and lunch each day. Virtual attendance is $50. Group registration discounts are available. For more information, including speaker and session details, and to register, visit conference.vast.aero.

HAI BRIEFS

EUROPEAN ROTORS Returns for 2022

THE EUROPEAN ROTORS VTOL Show and Safety Conference is returning this year, Nov. 8–10, 2022, in Cologne, Germany, following its debut in the same host city last year. Exhibitor registration for the event had, by early September, already outpaced that of 2021, with more than 160 companies and organizations registered as of press time.

EUROPEAN ROTORS, jointly organized by the European Helicopter Association (EHA) and the European Union Aviation Safety Agency (EASA), enables operators, regulators, and other industry professionals to exhibit their services and products, discuss safety issues, explore business opportunities, and consider the VTOL industry's future.

The exhibition floor will feature a static display of helicopters, a drone pavilion, a dedicated exhibit space for small and emerging companies in the rotorcraft market, and the Rotor Safety Zone, jointly organized by EASA and Heli-Flight and providing lessons from various flight instructors. Dedicated to all aspects of VTOL operations, the show includes participants from various industry sectors, including air ambulance, firefighting, public safety, offshore operations, logging, corporate transport, eVTOL aircraft, UASs, and more.

EUROPEAN ROTORS will also offer courses. Additionally, the event now

incorporates the successful EASA Rotorcraft and VTOL Symposium. In its 15th iteration this year, the symposium is the primary platform for the European helicopter industry to jointly discuss current and future challenges with EASA representatives.

Back this year at EUROPEAN ROTORS 2022 is the 365 Digital Event Platform, a portal that allows attendees to interact with in-person and virtual exhibitors and other aspects of the trade show. Additionally, attendees enjoy year-round online access to exhibitor information and other important industry communications.

HAI is a service provider to EUROPEAN ROTORS 2022, helping to produce the show. Through this arrangement, HAI provides marketing, scheduling, and logistics support for EUROPEAN ROTORS.

To learn more about the show, visit europeanrotors.eu/en.

HAI BRIEFS

HAI Firefighting Event Now the Aerial Work Safety Conference

IN RECOGNITION OF THE MANY operations entailed in aerial work, HAI has renamed its Aerial Firefighting Safety Conference the HAI Aerial Work Safety Conference, which will be held Nov. 16–17, 2022, in Boise, Idaho. The event's focus changes as well. All the firefighting sessions remain, but this year, the program will expand to include utility and restricted-category aircraft operations, too.

"Last year's firefighting safety conference was very well attended and represented the largest of its kind to date," says Zac Noble, HAI's director of flight operations and maintenance. "But because so much of the event's safety information is valuable to far more than just firefighting operations, we saw an opportunity to make this important conference better by combining our Utilities, Patrol, and Construction Working Group's safety event and the firefighting safety conference."

The conference will take place at Boise Centre West, Boise's large and modern convention center, conveniently located downtown within walking distance of hotels and restaurants.

Day 1, Nov. 16, of the conference will feature safety and informational sessions as well as breakout sessions for the utilities, restricted-category aircraft, and aerial firefighting sectors.

Day 2, Nov. 17, will include safety sessions, including agency updates from the US Department of the Interior, the FAA, and the US Forest Service. The afternoon will also offer courses in which attendees can earn FAA WINGS credit.

Registration for the HAI Aerial Work Safety Conference is $50 for HAI members and $150 for nonmembers registering by Oct. 3. After Oct. 3, the rates increase to $100 for members and $200 for nonmembers. Registration includes breakfast, lunch, and break refreshments both days of the conference.

To register, see a list of hotels with special rates, and review the full conference agenda, visit rotor.org/aerialworksafetyconf.

A Columbia Helicopters CH-47D lifts away from a fire retardant batch plant, preparing to deploy the long-term retardant on the Dixie Fire outside of Chester, California, on Aug. 5, 2021.

HAI/MICHAEL PIPER

A1: Jim Viola, HAI president and CEO, and Cade Clark, HAI VP of government affairs, visited HAI member Jack Harter Helicopters (JHH) in Lihue, Hawaii, in January. From left: Casey Riemer, JHH special projects manager; Jim; Jason Darr, JHH general manager and director of operations; Cade; and Chris "Kalena" Kim, JHH pilot. **A2:** Chris Hill, HAI senior director of safety, gets ready to talk shop with *Flight Suit Friday* podcasters Kenny Ingram (left) and Sam Hafensteiner (not shown). **A3:** Zac Noble (left), HAI director of flight operations and maintenance, and landing zone coordinator at HAI HELI-EXPO 2022 in Dallas, takes a break from his duties to help HAI Social Media Manager Jaasmin Foote (in yellow jacket) welcome Owen Watkins of SureFlight to the show. **A4:** Members of the HAI Board of Directors prepare to celebrate at the Flight Safety Foundation Networking and Awards Dinner in June in Washington, D.C. From left, Jeff Smith, Nicole Battjes, Rick Kenin, Stacy Sheard, and Robert Miller Stallings. **A5:** Cade Clark (left) and John Shea, HAI director of government affairs, visit with Carolyn Hicks Mayle, VP of government affairs for Air Methods Corp. in August in Denver.

ALL PHOTOS BY HAI STAFF EXCEPT FOR A3: HAI/F-STOP PHOTOGRAPHY

B1

B2

B3

B5

B4

B1: HAI Board of Director members Stacy Sheard (left) and Nicole Battjes bookend HAI President and CEO Jim Viola at the March 2022 Women in Aviation International Conference in Nashville, Tennessee. **B2:** From left: Miguel Marin, chief of operational safety at the International Civil Aviation Organization (ICAO); Mauricio Ramirez Koppel, Colombian representative to ICAO; and Jim Viola enjoy the annual celebration of flight that is EAA AirVenture Oshkosh. **B3:** Greg Brown (center), HAI director of education and training services, and Jim Viola (second from right) met some rotorheads from Spain at EAA AirVenture Oshkosh, including, from left, Hernan [no last name provided], Marc Delgado, and Carmen Martinez. **B4:** Jim Viola connects with Danny Kato, 505 sales manager at Bell Flight, in April at Sun 'n Fun in Lakeland, Florida. **B5:** Cade Clark, HAI VP of government affairs, and other stakeholders participated in an August roundtable on aviation workforce development sponsored by Utah Rep. Burgess Owens in Salt Lake City. From left: Robbie Paul, Southern Utah University (SUU); Rich Cannon, SUU; Crystal Maguire, Aviation Technician Education Council; Lorri Hansen, Utah Helicopter; Courtland Hansen (behind Lorri), SUU; Nicholas Johnson (next to Lorri), Intermountain Healthcare; Rep. Owens (next to Nicholas); Jared Esselman (in front), Utah Department of Transportation (UDOT) Division of Aeronautics; Courtney Johnson (in white blazer), Cedar Valley High School; Mandy Nelson (behind Courtney), Bristow Group; Rachelle Ackley (in black shirt), Utah System of Higher Education; Cade (behind Rachelle); Scott Romney (in front next to Rachelle), UDOT Division of Aeronautics; Mike Mower (behind Scott), SUU; Chris Cox, SUU; and Sandy Hemmert, Granite School District.

ALL PHOTOS BY HAI STAFF

By Jen Boyer

Robert Feerst, President, Utilities / Aviation Specialists

Wire-strike avoidance expert sees much to like in today's helicopter safety culture.

ROBERT "BOB" FEERST and his company, Utilities / Aviation Specialists, are synonymous in the helicopter industry for courses about safe flying around wires and obstructions. A former lineman and utility helicopter pilot, Feerst developed his first course for flying around wires for the utility sector in the 1980s and later expanded it to cover the full helicopter industry. His courses and refreshers have been credited with saving countless lives over the years.

ROTOR sat down with Feerst to learn more about how he became involved in wire-strike avoidance, the changes he's seen in the industry's safety record during the past 40 years, and how he's contributed to helicopter safety through not only training but auditing, consulting, and more.

ROTOR: You started courses in flying-in-the-wire environment at the request of former HAI President Frank Jensen. How did that happen?

Feerst: I've been a member of HAI since 1982 and was the manager of the flight department for a fairly large power company in the Midwest at the time. We operated nine helicopters and three airplanes because we patrolled not only for our power company, but also for four other power companies in the area.

What got me started in supporting other companies' safety was when another utility company just to the south of ours had a fatal accident. They came to me to ask if I could investigate and tell them what went wrong and how they could do better.

One of the things I came away with from that experience was the thought of starting a consulting firm to help power companies increase their safety. I realized there wasn't any meaningful training in flying for a power company. All we knew was what we had learned in the military, which was basically "watch out for power lines."

I developed a training course on how to fly in the wire-and-obstruction environment that covered numerous factors, such as visibility science, reading line hardware, and understanding how lighting, shadows, and background changes affect wire visibility. I knew what it was like to be looking at a wire one moment, look away for just a second, then look back and find the wire had completely "disappeared."

I put the training course together in the mid to late '80s to train the employees in the power companies I worked with. At about the same time, I became one of the founders of HAI's Utility, Patrol, and Construction Committee [now the Utilities, Patrol, and Construction Working Group]. Fast forward about a year and a half. The air ambulance business was really booming, and at that time, about half of air ambulance accidents were caused by wire strikes of some sort.

The FAA went to Frank Jensen and said HAI should do something about the wire-strike problem or the agency would do something itself. Frank came to me and asked how we could get meaningful training in wire strikes that would stop these accidents.

I shared my training course with Frank and offered to broaden it to address operations outside the utility sector. Wire strikes were prevalent across the whole

ISTOCK/BENDC

industry—they weren't only occurring among utility and air ambulance operators, but also law enforcement, general aviation, agricultural, and personal operators. We debuted the course at HAI HELI-EXPO 1989.

We had over 100 people from all over the industry at that first course. We still offer the course today, specifically for utility companies because we do a lot more work around wires in the utility sector than in other sectors. We also have courses for other operations, including air ambulance, military, and law enforcement, all of which fly in the wire environment at night.

Have you seen safety around wires change since you began this work?

Absolutely. Wire-strike accidents have declined substantially. I get testimonials from people all over the world that say the course saved their lives.

We had an email not long ago from a pilot who was flying between two barns. He said he remembered us teaching him that when you see a building out in the open like that, ask yourself the all-important situational-awareness question, "How does it get its power?" He asked himself that, and as a safety precaution, he realized he needed to fly above the buildings, not between them, because he didn't know if there was wire there or not.

While he was in the process of ascending, he flew right over two wires that he couldn't see when he was lower because they weren't visible. He ended the email to us by saying, "Thank you, Utilities / Aviation Specialists, for saving my life yesterday."

By popular demand, we created an online refresher course to make it easier for people to remain current. Then the pandemic hit. We started getting demands from everybody pleading with us for a full one-day online course. So, we decided to create one, completely restructuring the online refresher course and reformatting it to a full "Flying in the Wire and Obstruction Environment" (FIWOE) course.

The online FIWOE course went live in May 2021. Since then, thousands have taken it with the same material as in the in-person course. We bet the company on the online course and invested heavily to make it truly high quality. That's paid off in safety. We hear testimonials from people who took the online course saying it, too, saved their lives. The course is also becoming popular in Europe. More people are getting the information and increasing their safety in the wire environment.

You have a unique philosophy about auditing. Tell us about that.

Back when I was a flight department manager, I spent a lot of money having so-called professional auditors audit our company. They came in and were looking for trouble—something to nail you on.

While it's important for auditors to find things wrong with the company, it's equally important to find good things. We started our own audit business in the mid-1980s with that mentality. First, all our auditors have spent their careers in the industry. Second, we always send two auditors on an audit because it's important that two people confirm they're seeing the same thing. Third, we match the auditors and their experience with the operator. For example, we don't send people with experience in the Gulf of Mexico to audit power companies.

We also developed a philosophy that the company we're auditing is a good company and our job is to help them be the best they can be by finding things they can improve upon.

We've seen some terrible companies and we've seen some good ones. When we get audit jobs now, 99% of the time people are happy to see us. The exceptions are the operations that have something to hide. But we truly believe the vast majority of people in this industry want to do it right and safely, and we're there to help.

How has helicopter safety changed during your career?

I've seen tremendous leaps in safety over the past 40 years. In the early '80s, safety was a kind of necessary evil; a safety officer was someone who couldn't do anything else in the company. That's not true today. Now, it's a science that's embraced.

Safety officers are some of the most highly qualified people in these companies. They're very well educated, very well respected, and very disciplined.

How have you seen safety culture, in particular, change?

What I'm really impressed with is some of the younger people coming up. They're really on fire; they really want to learn—in some cases, much more than the older generation. When it comes to safety and wanting to do it right, and assimilating as much information as they possibly can, I see a much-improved attitude than when my generation was in the pilot seat.

Also, the top leaders used to set the company attitude. While that level is still very important, when it comes to safety, I don't see that as much today. A lot of the factors driving an organization's safety culture come from the bottom, not the top.

We still have individuals out there who are contributing to accidents, sure. We're starting to see wire-strike accidents start to come up again. But not anything like it was. I think a lot of that has to do with the fact that we need to increase awareness, and a growing safety culture plays into that.

CASA [Civil Aviation Safety Authority] in Australia was talking about making the wire-strike course mandatory to get one's license. Turns out, they didn't have to because Australian companies started making it mandatory on their own. Most of the power companies in the US and Canada require this training too.

This growing safety culture and desire to do what's right is really helping increase safety in the industry.

ROTORCRAFT EVENTS

2022

SEP. 20–22
6th Workshop on AAM Infrastructure
Vertical Flight Society
Dayton, Ohio, USA
Learn more at vtol.org

SEP. 24
8th Annual International Girls in Aviation Day
Women in Aviation International
Celebratory events worldwide
Learn more at wai.org

OCT. 4–6
VAST 2022 Global Conference
Vertical Aviation Safety Team, FAA, HAI, and the US Helicopter Safety Team
Hurst, Texas, USA
Learn more at conference.vast.aero

OCT. 11–13
2022 CHC Safety & Quality Summit
CHC Helicopter
Irving, Texas, USA
Learn more at web.cvent.com

OCT. 18–20
2022 NBAA Business Aviation Convention & Exhibition (NBAA-BACE)
National Business Aviation Association
Orlando, Florida, USA
Learn more at nbaa.org
Visit HAI at Booth #3626

OCT. 24–26
Elevate 2022 (formerly the Air Medical Transport Conference)
Association of Air Medical Services
Tampa, Florida, USA
Learn more at aams.org
Visit HAI at Booth #734

OCT. 26–28
Airtec 2022
Vertical Flight Society
Munich, Germany
Learn more at vtol.org

NOV. 2–4
HAC 2022
Helicopter Association of Canada
Calgary, Alberta, Canada
Learn more at h-a-c.ca

NOV. 8–10
EUROPEAN ROTORS
European Helicopter Association, European Union Safety Agency, and HAI
Cologne, Germany
Learn more at europeanrotors.eu

NOV. 12
American Heroes Air Show
Los Angeles, California, USA
Learn more at heroes-airshow.com

NOV. 16–17
HAI Aerial Work Safety Conference
HAI
Boise, Idaho, USA
Learn more at rotor.org/aerialworksafetyconf

2023

FEB. 23–25
WAI 2023
Women in Aviation International
Long Beach, California, USA
Learn more at vtol.org

MAR. 6–9
(EXHIBITS OPEN MAR. 7–9)
HAI HELI-EXPO 2023
Helicopter Association International
Atlanta, Georgia, USA
Learn more at heliexpo.com

APR. 26–28
AAAA Summit
Army Aviation Association of America
Nashville, Tennessee, USA
Learn more at quad-a.org

JUN. 19–25
Paris Air Show
Salon International de l'Aéronautique et de l'Espace (SIAE)
Paris, France
Learn more at siae.fr


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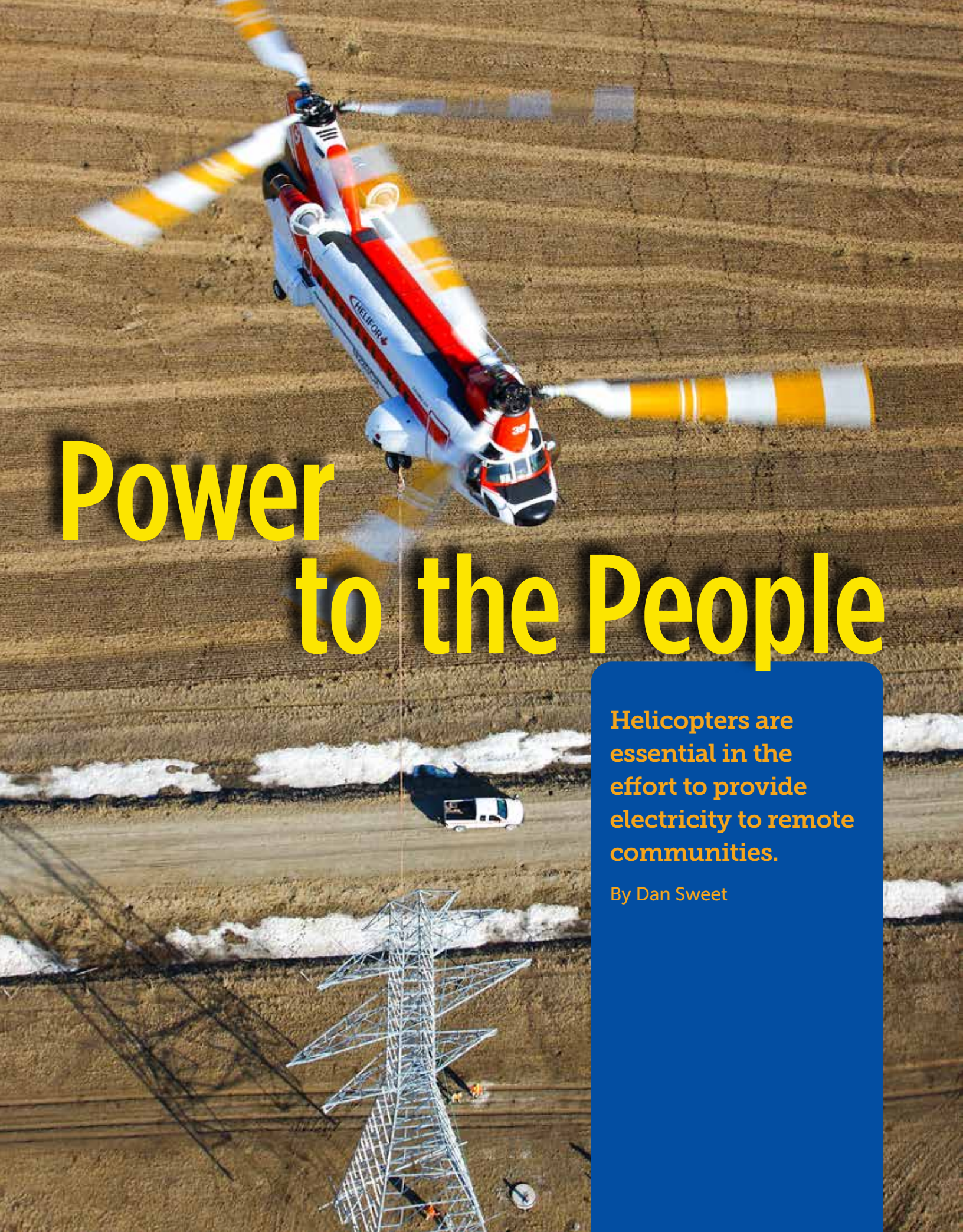
FlyOver

WASHINGTON, D.C. | JUL. 1, 2022
NATIONAL PARK SERVICE PARK POLICE | BELL 412EP
PILOT: OFFICER RYAN EVASICK
RESCUE TECHNICIAN: OFFICER DANIEL GLENDINNING
NOT SHOWN: RESCUE TECHNICIAN SERGEANT JAMES LASKA
NOT SHOWN: RESCUE TECHNICIAN OFFICER JOHN DEMYANOVICH

PHOTO BY MARK BENNETT



Power to the People

Helicopters are essential in the effort to provide electricity to remote communities.

By Dan Sweet

SEE the Impact the Watay Project Will Have on First Nations Communities

THE DAYS START EARLY and can end late on the Wataynikaneyap Transmission Project, or Watay Project, an effort to supply reliable electric power to 17 remote communities in Canada. These localities extend across a 500-mile arc located north of the town of Red Lake and stretching east over the remote forests and lakes of west-central Ontario. Many communities, especially the northernmost, lack utility corridors and all-season road access, instead relying fully on power from diesel generators. During the winter, diesel can only be trucked in on ice roads or flown in at twice the expense.

Many utility or construction projects cross stark, sparsely populated areas, but working in roadless areas means ground-based equipment may be limited to highways and staging areas. While the arc of the Watay Project is 500 miles long, the entire project requires the installation of more than 4,800 steel towers onto right-of-ways stretching about 1,100 miles. Installation of substations and distribution lines round out the project.

Mitch Brown is the director of helicopter operations for Valard Construction, a Canadian utility contractor based in Calgary, Alberta, and the primary contractor for the Watay Project. "We have 5 of our own helicopters working on this project, and we've had subcontractors providing up to 20 other helicopters at the same time. We've had at least 3 aircraft work through the winter as well," he says, describing the project's scope.

Houston-based Quanta Services is a parent company to some of the top names in the helicopter utility industry, including Valard Construction; PJ Helicopters of Red Bluff, California; Winco Powerline Services of Aurora, Oregon; Haverfield Aviation of Gettysburg, Pennsylvania; and Luma Utilities in Puerto Rico. "We offer a full range of helicopter services to the utility community," says Spencer Duke, VP of aviation services for Quanta.

Working to Scale

Utility and construction work with helicopters varies dramatically by project. In some cases, such as installing a communication tower, the job involves one helicopter setting a single load, or pick. There might be multiple picks from one staging area for other projects, such as setting heating, ventilating, and air-conditioning (HVAC) units or ski-lift towers. Utility helicopters are also used to set communication structures in remote areas, support petroleum exploration operations in roadless areas in South America and the South Pacific, and provide transportation and logistical support in the Arctic and Antarctic.

On a power-line tower project, rotorcraft might be used for planning, mapping, and surveying. The unique ability of vertical takeoff and landing (VTOL) aircraft to land in confined areas allows them to carry workers and hand tools to clear a landing site. Then, heavier helicopters can deliver the equipment and supplies needed to prepare tower sites. When concrete is necessary to establish bases for certain towers, helicopters carry buckets of concrete to the ground crews to direct into the ground or forms.

Utility helicopter companies can sometimes conduct smaller projects from parking lots or staging sites near roads. Pilots and maintenance crews might stay in commercially available accommodations. Larger projects often require significantly more planning to provide food and housing for

A Columbia Helicopters Model 234 Chinook (left) delivers a 16,000-lb. steel-lattice tower to a site in Alberta, Canada. Pilots on utility projects (right) often fly from the left seat, allowing them to maintain direct visual operational control of the load while piloting the helicopter.

OPPOSITE: COLUMBIA HELICOPTERS/DAN SWEET; RIGHT: VALARD CONSTRUCTION PHOTO

Type 3 helicopters, such as this AS350 B3, perform myriad jobs on utility projects, including carrying sling loads from staging areas.

the crews. With the scale of the Watay Project, working from multiple camps and staging sites is mandatory.

"We've split the project into three work fronts, with 22 substations and switching stations," says Brown. "We had about 800 people working on this project at the high point, and I think we've had 12 major camps. The camp size changes depending on the location, but we've had a range of 100 to 300 people per camp."

As with any development of this size, logistics is one of the biggest issues facing the crews. Many construction and utility projects have the benefit of roads wending their way through right-of-ways, but for the Watay Project, the only roads available are winter ice roads.

"You might have seen the *Ice Road Truckers* show on the History Channel on television. Those are the only kinds of roads we can use on this project," says Brown. "We're moving millions of pounds of steel into strategic positions, which requires advance planning. Even supplying fuel for the helicopters is an issue, and it's been hard to keep up with fuel demands throughout the project."

A Helicopter for Every Role

Large utility projects typically call for a variety of helicopters. From moving people to setting towers, using the appropriate aircraft saves time and money.

A veritable air show of vertical lift aircraft supports the Watay Project at different times of year. "We've used—or are using—the Airbus AS350 B3, Bell 206 LongRanger, Bell 407s, Bell 412s, Bell 214Bs, Bell 205s; and the heavy-lifter on this project is the Airbus H225 Super Puma," says Brown.

VALARD CONSTRUCTION PHOTO

Near Belen, New Mexico, an MD Helicopters MD 500E operated by Rotor Power pulls a sock line during construction of a line of transmission towers.

Like most large construction projects around the world, helicopters on the Watay Project fill a variety of roles. Type 1 helicopters, the largest, and carriers of the greatest payload, often assist by moving equipment and delivering and setting towers or tower sections. Aircraft in this category include Air Cranes, Skycranes, Chinooks, S-61s, Boeing-Vertol 107s, Black Hawks, and Super Pumas.

Type 2 helicopters—the mediums—carry and set tower sections, transport cement and other construction supplies, and move smaller pieces of equipment. Very common helicopters in this segment are the variants of the venerable Huey (UH-1), including restricted-category aircraft outfitted for construction use.

The lightest helicopters, the Type 3s, are often the most versatile aircraft on a construction project. These smaller aircraft regularly move workers from site to site and often directly onto a tower. They carry supplies on board, in skid baskets, or in sling loads below the helicopter.

Turbine-powered Type 3s are routinely used to carry and thread lines through transmission towers. These are typically "sock lines" or light but strong ropes that the pilots pull through guides on the towers. Ground crews then attach high-voltage transmission cables or lighter distribution cables to the sock line, winching the combined lines through the towers.

Precision Placement

Utility pilots often do significantly more than just deliver a load. Setting a load so that it doesn't require additional handling, or perhaps making minor adjustments to its position, means crews can quickly move on to the next lift. While not all utility work requires precision placement, it saves time for the flight and ground crews and uses less fuel.

HAI/MARK BENNETT

An Airbus H225 Super Puma begins to lift a steel-lattice tower from a staging area along the Watay Project right-of-way.

Precision placement of a load with a utility helicopter is a practice reportedly started by Wes Lematta of Columbia Helicopters in the late 1950s. Flying on a power-line project in Oregon's Columbia River Gorge, Lematta used the left-seat controls on a training helicopter so he could see the load he was placing. Termed direct visual operational control (DVOC), or "flying the load," placing the lead pilot in the left seat remains common in utility work today, although it depends on the load, the model of aircraft, and sometimes pilot preference.

Lematta and his younger brother Jim also claimed credit for developing the large plastic bubble windows that allow utility pilots to watch the load in inclement weather; Jim had nearly become hypothermic looking out an open window during a tower-setting project in Leadville, Colorado, in the 1960s.

Carrying a load isn't for every pilot. "I think one of the hardest things to learn about precision placement and external-load work in general is the mental side of it," says Andre Hutchings, an experienced utility pilot. After developing his skills with Columbia Helicopters for 26 years, Hutchings and his wife, Kimberly, opened Volo Mission, an external-load, longline, and aerial firefighting training company just northeast of Dallas, Texas.

"To remain calm, breathe, possess a lot of patience, and stay out of your own head while setting max gross loads with your crew being hands-on—there's a lot of pressure," says Hutchings. "Having a calm, relaxed demeanor not only helps you, the pilot, but keeps your crew calm as well. Often, this is easier said than done."

Columbia's crews typically use 200-ft. lines (plus rigging) for external loads, meaning the pilot has a unique perspective on the load and the placement site. "It's a long way down, and it looks and feels like it when you are setting a precision load with that length of line," Hutchings says. "The longer the line, the more difficult it is to see the visual cues and subtle signs from your ground crew or line person or the environment that you can pick up when using a shorter line."

He explains that when working with a 200-ft. line, there's a slight delay from the controls to the load. "You have to exercise patience and wait for the reaction to your input. You really have to trust your crew and their instructions, because from that height, it's going to be them that's talking you down and instructing you to 'hold' or 'come down 6 inches,' etc."

Longline work is a team effort, says Hutchings. "Always look after and out for your ground crew; they are typically in a precarious position, working under you. You need to look out for them, point out any hazards they may not be aware of, and keep them safe," he says. "Theirs is a high-pressure job as well. These guys and gals can make a pilot look good on a tough job!"

VALARD CONSTRUCTION PHOTO

A pilot's perspective of what a load and landing zone look like at the Volo Mission training site. A pilot's input on flight controls takes time to reach the load.

Ground and Air Operations

Depending on location and other variables, projects of the scale of the Watay Project require extensive planning, surveys, and permitting processes that can take months or years. Once the project is ready to begin, clearing the 130-ft. right-of-way starts. Workers using feller bunchers (harvesters used in logging) remove the sellable timber and use bulldozers to clear brush and smaller trees. Crews take additional care around riparian zones, minimizing disruption to lakes, ponds, streams, and wetlands.

Once sections of right-of-way are ready, construction can begin. This is when helicopter activity really starts to pick up. The helicopters on the Watay Project work in sections, often hopscotching each other. Rotorcraft will bring compressors, generators, and earth-moving equipment to help prepare the base for each tower.

Once the base is ready, a Super Puma carries to each site steel-lattice, guyed V towers at the end of a longline. With the pilot flying the load from above, ground crews move the tower into position, then attach the guy lines. While the Super Puma retrieves the next tower, the ground crews move to the next site.

Two ground crews often work together to set the towers, jumping past one another to keep the flight operations as efficient as possible. Other ground crews may follow, adjusting and tightening the guy wires to straighten the towers and prepare them for line stringing using the sock lines.

Working in Northwestern Ontario in the summer means a long day. That provides opportunities to accomplish more work but also means tired pilots and maintenance personnel. "Sunrise comes around 5 to 5:30 each morning," says Brown. "We hold our daily safety meeting, then try to get skids and wheels up around 6 am. We run 14-hour duty days, but we shut down for level checks and other maintenance inspections around noon. We have a fatigue management plan in place, so we want to make sure the crews are properly rested."

VOLO MISSION PHOTO

Once the flight day ends, the maintenance shift begins. Each aircraft on the Watay Project is required to have on-site at least one licensed aircraft maintenance engineer (AME) to oversee maintenance on that aircraft. Hangars are a rare luxury, and maintenance is typically conducted in the open, in all conditions: rain, wind, snow, and heat. Lights assist the maintenance crews with seeing their work but also tend to attract insects.

The maintenance crews work from large trailers or vans that carry tools, spare parts, maintenance manuals, maintenance record books, and consumables. Spare parts must be carried or ordered as necessary, with delivery times added into scheduling. Maintenance crews often help with refueling, with fuel another item that must be ordered.

Winter adds another challenge: cold weather. Pilots and maintenance crews must protect themselves, as well as the aircraft, from the harshest conditions. "Last winter, it got down to 44 degrees below zero centigrade [-47.2 Fahrenheit]," says Brown. "Most aircraft have limitations that prevent the aircraft from flying at minus 30 centigrade. It was so cold that some of the steel teeth on a loader trying to dig into the ground shattered."

Let There Be Light ... and Heat

When crews finish the Watay Project—which is currently scheduled for completion in mid-2024—residents of the 17 communities will be connected to the power grid, no longer relying on diesel-powered generators. Connection to the grid will help First Nations improve their communities' living conditions, infrastructure, health care, use of modern technology, and ability to pursue economic development opportunities.

For the helicopter crews on the project, it simply means moving on to the next camp, the next project. As populations expand and everything from cars to aircraft require more electricity, the work of a utility helicopter operation is seldom finished.

"I really enjoy all kinds of tower work," says Hutchings. "Once you start flying these types of jobs, it puts the hook into you, and then you're always looking for that new challenge, whether it's a new type of load, new environment or terrain, or new ways to use mechanical advantage to make a job safer or more efficient. It's a very satisfying feeling to have built and set something; it keeps you wanting more. I highly recommend it."

Type 3 helicopters like this MD 500D are routinely used on power-line tower projects due to their maneuverability, with pilots providing fast access to crews making adjustments at multiple towers along a right-of-way.

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Tackling the HIGH COST of Aviation Insurance

By Christine Knauer

AFTER A DECADE OF LOW INSURANCE RATES, rotorcraft operators are feeling the gut punch of soaring premiums. The painful truth is that rates aren't going down soon, if ever. While several factors have converged over the past few years to spur high insurance costs, understanding the aviation insurance ecosystem offers important clues for how operators can reduce the hurt.

Market Size Matters

One factor affecting costs is the small size of the aviation insurance market. Some 1,500 insurance companies in the United States serve automobile owners, but just 15 underwriters insure aviation operators.

Each insurer has its own appetite for liability limits, risk, and types of operations. Some handle helicopter operations better than others. Some won't insure them at all. Some only work with private operators. Others prefer the commercial sector.

Moreover, with today's higher liability and hull values, insurance companies sometimes spread the risk by requiring a quota share where two or three providers come together to insure one operator, further reducing the pool of insurers competing for your business.

"The market gets very small fast. The more specialized you are, the smaller it gets. So many times, helicopter operators have only one option, maybe two at the most," says Jim Gardner, who has 20 years of experience in the insurance industry, including as owner and president of the James A Gardner Co., an aviation insurance broker based in Marietta, Georgia.

"The general aviation industry is also not large. There may be $5 billion to $6 billion in total revenue worldwide, with about $2 billion to $3 billion in the United States. If you look at the rest of the property and casualty world, that's a very small fraction. There may be $3 billion worth of property and casualty premiums in Atlanta alone," he says.

In an industry built on acquiring a large group of customers whose premiums subsidize the payout for those with claims, the relatively small size of the helicopter industry works to keep premiums high.

"The insurance world works on the law of large numbers of homogeneous units putting money into a pool," says Gardner. "That money goes to pay the claims in aggregate of everybody. In aviation, the law of large numbers doesn't work. The industry just isn't large enough."

The Insurers' Perspective

Turns out, those gloriously lower insurance rates that began in the late aughts and lasted through 2018 were destined to climb. Operators today are feeling the impact of that unreasonably soft insurance market.

HAI/PHYLLIS UTTER ILLUSTRATION

Why does your insurance cost so much, and what can you do about it?

"The entire aviation insurance industry was losing money hand over fist—15 to 20 cents on every dollar they collected. That wasn't sustainable," says Gardner. "We started seeing insurance rates rise dramatically in 2019, 2020, and 2021. Even so, I would say that the losses are still unacceptable. Over the past five years, the losses may be as much as $600 million to $700 million from just general aviation."

When a new underwriter entered the aviation insurance market in the first quarter of 2022, many hoped the additional capacity and more competitive underwriting atmosphere might help lower rates. Gardner, however, doesn't believe it will have much impact on rotorcraft operators.

"I see the trend still moving toward higher rates. On top of inflation, the cost of claims is going up and accidents aren't going down appreciably, which puts pressure on the insurance companies. However, I don't think we'll see the 30% to 100% increases in premiums that we've seen over the last couple of years," he says. "My average client right now is staring at a 10% to 20% increase, depending on the quality of their operation."

To the bottom-line question that every helicopter operator asks their aviation insurance broker, "Will my rates ever go back down to the 2018 rate?" the answer is no. The insurance companies have returned to underwriting practices that emphasize risk management. In other words, they're vetting their customers a whole lot more closely.

How the Other Guy's Accident Affects You

Safety advocates often say one person's accident is everyone's accident—that we are all affected by the level of overall operational safety in our industry. And when it comes to insurance, that's certainly true: each accident payout affects the premiums for other operators.

"You can be the best, safest operator in the entire world and yet your insurance rates are going up 10%. It's because of all those other guys out there. If someone has one total loss, how many policies would the insurance company have to sell at the same premium to make up for that one total loss? It's humbling," says Gardner.

Insurance companies determine premiums based on "the ship you fly and what you do with it," says James Gardner, a 14,000-hour ATP-rated pilot who now owns and manages an insurance brokerage firm.

Aviation insurance companies don't share details about how they calculate premiums, but other organizations do track and report accident information. The US Helicopter Safety Team, the group of government and industry volunteers working to improve safety in US civil helicopter operations, examined 10 years of helicopter operations data from January 2009 through 2018.

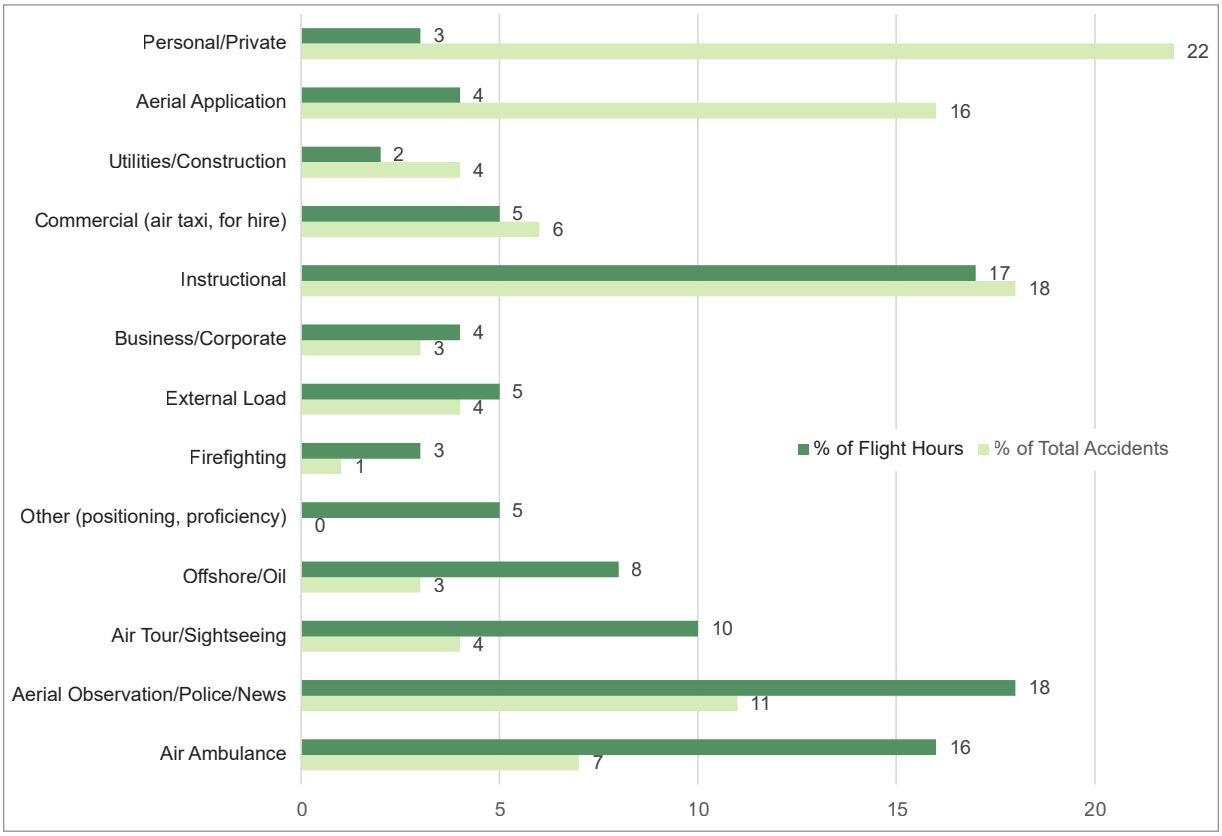
The team found that while air ambulance helicopters flew about 16% of the industry's more than 31 million flight hours during that period, they accounted for only 7% of all rotorcraft accidents. Also ranking in the top three sectors for fewest accidents per share of flight hours were police/news-gathering/aerial observation flights and air tour/sightseeing flights. (See "Industry Sector Flight Hours versus Accident Share, 2009–2018," on p. 36 for a complete breakdown by industry sector.)

On the other hand, private pilots operating personal helicopters accounted for a full 22% of accidents—a staggering number given they fly only 3% of all flight hours. However, these pilots typically face numerous challenges: they may be less experienced, and their operations often lack the safety infrastructure and layered decision-making of larger operations.

Helicopter operators working in aerial application as well as those supporting utility and construction operations also had higher rates of accidents than others because of the challenging environments they operate in, including flying in the obstacle-rich low-altitude airspace.

"Helicopter operators fly lower and slower. They put the helicopter in a lot more hazardous positions than most

Industry Sector Flight Hours versus Accident Share, 2009–2018 (%)



In terms of the percentage of hours flown versus accident share, private operators have the worst ratio by far of all industry sectors, while air ambulance services have the best.

Source: "US Helicopter Safety Team Provides an Accident Ranking for Different Areas within the Industry," USHST Nov. 13, 2018, press release. Online: https://bit.ly/3zpgZm7.

The wide diversity of helicopter missions—and their associated risks—means insurance costs for helicopter operators may vary widely as well.

fixed-wings. For helicopters, it's not just where they fly but where they *could* fly," says Gardner. "Plus, as the old saying goes, when it comes to helicopters, there's no such thing as a partial loss.

"Consider this: you do a successful autorotation and clip a tree on the way down. Everybody lives, nobody gets hurt, but you may have destroyed a rotor blade, rotor head, or maybe even a gearbox, and what you didn't destroy requires inspection," he says. "Insurance companies look at all of that and say that the cost of repairing helicopters is high. Whether it's a fixed-wing aircraft or rotorcraft, you're going to be rated on the ship you fly and what you do with it."

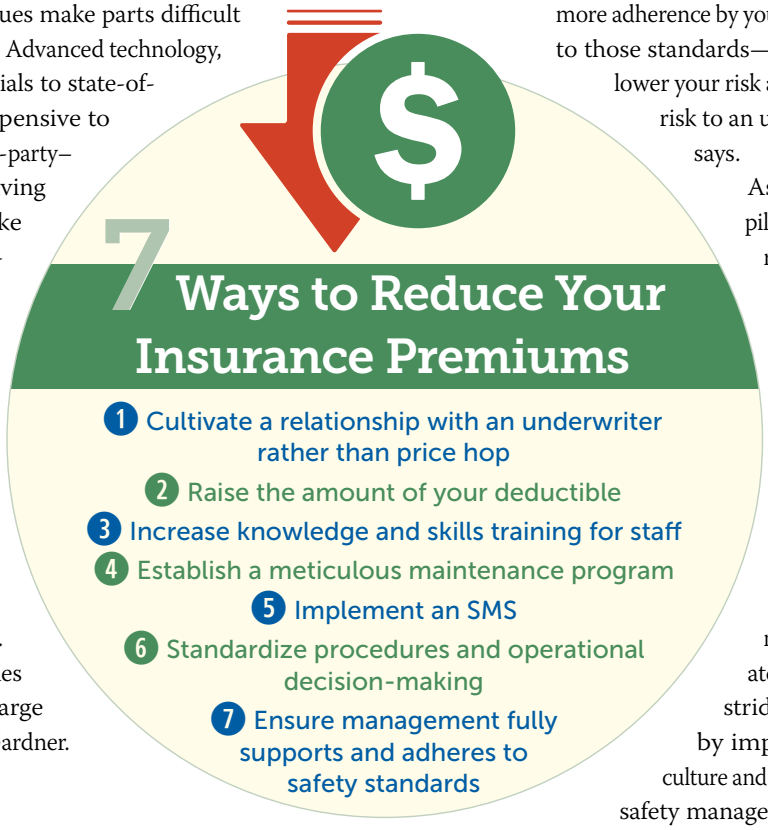
Surely, if they could, insurers would shout from the rooftops, "Want lower rates? Stop having accidents." Actually,

FROM LEFT: HAI/KRISTAL WHITLEY; HAI/KIMBERLY KOTHMAN; HAI/MICHAEL ADAM; HAI/JULIEN BOTELLA; HAI/MIKE REYNO

myriad factors feed into an underwriter's premium-setting equation, especially in today's market.

Even as premiums rise, the cost of a claim is rising too, from 30% to 150%, according to Gardner. Pandemic-fueled supply chain issues make parts difficult and expensive to obtain. Advanced technology, from composite materials to state-of-the-art avionics, is expensive to repair and replace. Third-party–backed litigation is driving up legal costs. And like other businesses, insurance companies are raising their premiums to offset inflationary pressures.

"We have several converging black swan events—the pandemic, the Ukraine war, and the fact that Russia has impounded several hundred airplanes. The insurance companies are looking at a very large potential payout," says Gardner.



Operators: How to Lower Your Insurance Costs

Given this increasingly difficult insurance landscape, can helicopter operators do anything to lower their individual premiums? Yes, to a degree, says Gardner, who recommends that operators take various steps to reduce their operational risk.

"The better your maintenance, the better your pilots, the better your training, the better you are at making operational decisions, the more command and control you have, the more standardization you have, and the more adherence by your senior management to those standards—all these factors can lower your risk and make you a better risk to an underwriter," Gardner says.

As an example, private pilots could dramatically reduce their helicopter accidents, and eventually their insurance premiums, by adding structure to their aeronautical decision-making through the use of a flight risk assessment tool.

Private and commercial rotorcraft operators could make major strides in mitigating risk by improving their safety culture and implementing a robust safety management system (SMS). HAI members should visit rotor.org/safety to access a variety of affordable SMS options and flight risk assessment tools.

Another path to reducing risk is to institute a more meticulous maintenance program. For example, Saleh et al. found that, from 2005 to 2015, flawed maintenance and inspections were causal factors in 14% to 21% of US civil helicopter

Looking for Answers

HAI launches the HAI Aviation Insurance Working Group.

DURING ITS JUNE MEETING, the HAI Board of Directors identified the need for an aviation insurance working group to address the issue of rising premiums for rotorcraft operators. Over the next several months, Chris Martino, HAI's senior director of operations and international affairs, will head the search for participants.

"The skyrocketing costs of insurance across the entire aviation industry have people concerned. The board believes that by providing industry with a way to work closely with insurance companies, we can address concerns and provide some relief to rotorcraft operators," says Martino.

The board intends for the working group to include a mix of insurers, brokers, and operators as well as representatives from every industry sector, including air ambulance, utility patrol, construction, aerial firefighting, and others. The diversity of rotorcraft operations poses challenges for insurers when it comes to assessing risk.

"Not all insurance providers are the same, and not all insurance issues are the same for all operators. For example, someone lifting timber out of the Pacific Northwest with a big helicopter may have completely different insurance needs than a tour operator with a smaller helicopter. We want and need a variety of perspectives," Martino says.

"By bringing the two groups together, there's an opportunity to bridge some knowledge gaps and help insurers feel more comfortable with the risk they're taking to provide insurance," he says. "Through the working group, we can identify key factors that tie directly to a culture of safety and allow an insurance company to say, 'We see you're operating at this level, and therefore you'll get this discount.'"

In addition, Martino hopes to get answers for rotorcraft operators, including the effect on the helicopter industry of big payouts on behalf of large, commercial fixed-wing operators, as in the Boeing 737 Max accidents. Underwriters typically hold that type of information closely, but the hope is that they'll share more details in the collaborative atmosphere of the working group, where everyone has the same goal: reducing the risk of incidents and accidents and providing affordable insurance solutions for helicopter operators.

Learn More

HAI members interested in learning more about the Aviation Insurance Working Group should contact Chris Martino at chris.martino@rotor.org.

accidents, according to their February 2019 article, "Maintenance and Inspection as Risk Factors in Helicopter Accidents: Analysis and Recommendations" (available online at https://bit.ly/3QgPDWh).

"Will all those things pay for themselves by reducing your insurance rate? No, but what they will do is help you avoid an accident," says Gardner. "Anyone who's ever had one knows that the cost of an accident goes far beyond what the insurance company pays for."

In addition to minimizing their operational risks, helicopter operators should develop a relationship with an underwriter rather than try to chase lower premiums, recommends Gardner.

"The best insurance rate is going to those who are not just the best risk but who are also cultivating a relationship with the underwriter. In the long run, you'll get the best results by staying with an insurance company that fits your operational style, understands your pressures as an operator and manages that, and writes it in accordingly," he says.

Another strategy is to increase your deductible. Insurance companies look at an operator's claims ratio, which is generally the number of claims over the past five years divided by the total amount of the premiums paid. If an insurance company pays out on hangar rash and other small claims, an operator can quickly become underwater in their claims ratio.

"Even the little stuff hurts. It's not unusual to see a deductible of 5% to 10% or even more," says Gardner. "For easy math, consider that if you have a $1 million helicopter and 10% deductible, you'll pay the first $100,000 of damage out

of your pocket. It tells the insurance company that they don't have to deal with the smaller claims, which can add up. Plus, the insurance companies know that's a lot of incentive for you to be extra careful."

In an effort to help its member operators better navigate the current insurance climate, the HAI Board of Directors recently initiated the formation of an insurance working group to address the issue of rising premiums. (For more on this, see "Looking for Answers," p. 38.)

"HAI can help insurance companies identify operators who are doing a really good job with their training and safety culture versus those just operating to minimum FAA standards," says Chris Martino, HAI's senior director of operations and international affairs. "For those implementing best practices and going the extra mile, insurance companies can then say a discount is in order."

HAI can help insurance companies identify operators who are doing a really good job with their training and safety culture versus those just operating to minimum FAA standards.

Creating a Sustainable Industry

Gardner cautions against operators comparing their premiums with those of other operators, because what might seem similar on the surface actually isn't. "Every risk is unique. Your operation is different. Your airframe is different with different equipment. Your pilot has different skills and experience.

"Ultimately, all of us who fly need a sound and solid insurance industry," Gardner continues. "If everyone did everything they could and accidents were just a bad day rather than self-induced, then insurance rates could potentially level off or even come down. But those years between 2008 and 2018, those were abnormally low rates. We're now getting back toward what is normal and sustainable."

Gardner encourages operators to look at how the insurance and rotorcraft industries are linked by their mutual interest in improving safety. "The bigger the bucket with less payout, the stronger the insurance industry and the less the likelihood of some catastrophic event upsetting the applecart. We're truly all in this together."

Piasecki
and the Hydrogen-Powered Helicopter

A well-known name in rotorcraft innovation prepares to do it again.

By David Hughes

TRAILBLAZER. PIONEER. INNOVATOR. Not one of these words exaggerates the impact the Piasecki family has had on the helicopter industry since its beginnings in the late 1930s.

The Essington, Pennsylvania–based company's history goes back to the development of the tandem helicopter—the foundation of today's CH-47 Chinook—and has progressed through more than 25 vertical lift aircraft initiatives, including high-speed compound helicopters, hybrid heavy-lift helicopters, flying cars, and the world's first fully autonomous man-rated helicopter.

Today, Piasecki Aircraft Corp. is pioneering an especially timely innovation: hydrogen-powered helicopters. With its multifaceted effort to bring the technology to market in the form of light helicopters and electric vertical takeoff and landing (eVTOL) vehicles, the company hopes to transform vertical flight once again by addressing some of its biggest constraints: high operating costs, noise, and growing public intolerance of transportation that carries a high carbon footprint.

The PA-890 eVTOL Compound Helicopter

Several high-profile start-ups have focused on battery-powered eVTOL aircraft, but the low energy density of batteries limits their application to small, short-range vehicles suitable for the urban air mobility market, with mission legs as short as 25 nm. Piasecki, meanwhile, has focused on developing a practical eVTOL aircraft to disrupt the turbine helicopter market: the PA-890 eVTOL hydrogen fuel cell–powered compound helicopter (pictured above).

The PA-890 features:

- A design mission capability exceeding 200 nm plus IFR reserve
- A 50% reduction in operating cost per flight hour
- A significantly reduced acoustic signature
- Zero direct emissions.

Certifiable under FAA Part 27 standards, the aircraft couples the hover efficiency of a low disk loaded rotor with the forward-flight efficiency of a winged aircraft. The helicopter's variable-incidence wing is designed to rotate up to 90 degrees to minimize download for efficient

PIASECKI IMAGE

hovering. As the aircraft transitions to forward flight, the wing rotates to a horizontal position, providing lift to offload the rotor.

The propulsive efficiency of the aircraft is enhanced by a swiveling tail rotor, which provides anti-torque and yaw control in hover and swivels 90 degrees for forward propulsion. With lift and thrust demands relieved, the rotor's rpm is slowed. The net effect is increased range and reduced noise and vibration.

Why Power with Hydrogen?

The key design challenge in conceptualizing the PA-890 was how to power the aircraft electrically at an acceptable weight, volume, and cost. As part of the helicopter's development, Piasecki evaluated three options: battery only, hybrid diesel–battery, and hydrogen fuel cell.

While the simplicity of the battery-only approach was attractive initially, detailed research into battery chemistries revealed that the projected energy density improvements of batteries aren't being realized. Moreover, the high discharge and recharge rates required for VTOL operations significantly degraded battery life to the point that the operational cost was only marginally better than that of a turbine helicopter.

The hybrid diesel–battery alternative met performance requirements and delivered a 25% reduction in cost relative to turbines but still retained a carbon footprint, albeit reduced. This led Piasecki to explore the potential of the third possibility, the hydrogen fuel cell.

While low-temperature proton-exchange membrane (LTPEM) hydrogen fuel cells have been in use for many years and are increasingly found in automotive applications, the powerplants suffer from weight, water-management, and cooling-system constraints that limit their specific power.

To achieve the energy density and specific power levels required for flight, Piasecki turned to HyPoint, a small start-up company developing turbo air-cooled high-temperature proton-exchange membrane (HTPEM) fuel cells specifically designed for aviation applications. The cells' higher operating temperature yields water vapor, via the reaction of hydrogen and oxygen, that is exhausted without the need for LTPEM's heavy, complex water-management and cooling systems.

In 2020, after initial feasibility studies were conducted, Piasecki signed a collaborative agreement with HyPoint to develop aviation-grade HTPEM hydrogen fuel cell technology for the PA-890 and other applications. The US Air Force is now co-investing with Piasecki in the development of this technology.

Piasecki and HyPoint's shared vision is a fuel cell with the following key attributes:

- A fivefold increase in energy density over today's lithium-ion batteries
- A threefold increase in specific power over traditional LTPEM fuel cells
- A 50% reduction in operating cost compared with turbine-powered helicopters.

"While hybrid solutions were lower risk, we decided to go with the hydrogen fuel cell because there's a huge payoff for our customers," says John Piasecki, president and CEO of Piasecki Aircraft. "The fuel cell is less expensive to operate, it's quieter, and it features zero carbon emissions.

"If you look at the commercial market and certain parts of the military market—like logistics and utility—you have the opportunity to provide the needed performance at 50% lower cost because the hydrogen fuel cell doesn't have very many moving parts while providing zero emissions and a low acoustic signature," he says. "In addition, coupling hydrogen fuel cells with the winged compound's variable-speed rotor design will enable the PA-890 to operate very quietly."

With space to seat eight people and a large baggage compartment, the PA-890 will be able to fulfill various missions, including emergency medical services, high-value on-demand logistics, on-demand mobility, personnel air transport, and other applications.

"We're working closely with launch customers to make sure the PA-890 addresses today's helicopter operator's needs for more affordable mission performance with a safe, reliable, supportable system," says John. "I think, too, it's fair to say that in the next 10 years the regulatory pressure to lower carbon emissions will only intensify. We plan to answer those demands."

The family legacy of rotorcraft innovation is being carried on by two of Frank Piasecki's sons. John (top photo) is president and CEO of Piasecki Aircraft, while Fred is the company's chairman and chief technology officer.

The Fuel of the Future?

Introducing a new aviation fuel is another challenge facing the PA-890 team. Universal Hydrogen is one company that's working on producing and shipping hydrogen to airports. The start-up firm is led by former United Technologies senior VP and chief technology officer Paul Eremenko.

Eremenko thinks hydrogen is the ideal propellant for aviation. "Or expressed another way, aviation is the killer app for hydrogen," he says. "It's the most energetic propellant

The Piasecki family has been driving innovation since the dawn of rotorcraft flight. The prototype PV-3 "Dogship" (top right) was developed in 1945 for the US Navy and produced as the HRP-1, popularly called the "Flying Banana." The first US military aircraft with significant transport capabilities, it could carry up to 12 people. While the German-produced CoAX 2D (bottom right) is not a Piasecki design, the company plans to use the aircraft to complete, in 2023, the first crewed helicopter flight powered by a hydrogen fuel cell.

outside of nuclear fuels."

John Piasecki agrees. "Hydrogen is well on its way to becoming another major player in the fuel arena. I don't know if it's going to replace fossil fuels, but it's going to be a big player."

Universal Hydrogen has developed lightweight, aviation-grade modular hydrogen capsules that can be used to ship hydrogen to airports. The company formed a partnership in March with fuel-cell power-train developer H3 Dynamics to develop zero-emission propulsion systems for uncrewed aircraft, air taxis, and regional aircraft.

The Piasecki team believes hydrogen-powered eVTOL aircraft can add the most value initially in the existing light-helicopter market. Helicopter operators are always looking for ways to reduce operating costs, including maintenance, and this is one area where electric vehicles are

PIASECKI PHOTOS

expected to deliver benefits.

Maintenance schedules haven't been established for electric motors and hydrogen fuel cells. But most of the systems' inspection and refurbishment will be "more than an order of magnitude less demanding than with a turbine engine," John Piasecki says. Some analysts predict that inspection intervals with hydrogen propulsion will rise from 2,500 hours in the beginning to as long as 20,000 hours when the technology is fully mature and tested.

> ***"Aviation is the killer app for hydrogen. It's the most energetic propellant outside of nuclear fuels."***
>
> – Paul Eremenko, CEO, Universal Hydrogen

The CoAX 2D Coaxial Ultralight

As the company develops the PA-890, Piasecki is also working with the FAA on defining airworthiness certification criteria for hydrogen fuel cells. HyPoint will deliver five full-scale, 650 KWh hydrogen fuel cell systems for ground tests, flight testing, and for use in certification efforts. Piasecki Aircraft says it's working on FAA certification criteria for the hydrogen fuel cell–powered PA-890 by 2023.

"Our main challenge will be in maturing the hydrogen fuel cell through a rigorous development program to educate ourselves and the FAA, using lessons learned to inform certification criteria, and developing a conforming design to take into production," John says.

The firm plans to use the CoAX 2D coaxial ultralight helicopter from German developer edm aerotec GmbH as a test bed for a proof-of-concept demonstration of a scaled HTPEM hydrogen fuel cell. Piasecki aims to complete the first crewed helicopter flight powered by a hydrogen fuel cell with the CoAX 2D in 2023.

The CoAX 2D sports two counter-rotating rotors on a common shaft that counteract each other's torque, providing highly efficient hover performance and eliminating the need for a tail rotor. The two-passenger helicopter weighs 1,320 lb., is powered by a 125 hp engine, and is certified by German airworthiness authorities as a light sport aircraft.

The HTPEM hydrogen fuel cell demonstrated on the CoAX 2D will reduce the risk for scaling up the technology

LEARN
More about Helicopter History with a Look at a Vintage Bristol Sycamore

Founding Father

Frank Piasecki left his mark on the helicopter industry.

JOHN AND FRED PIASECKI, the current leaders of Piasecki Aircraft Corp., like to say that Piasecki is an ideas company, with a legacy of more than 25 vertical flight aircraft developments. That tradition was begun by their father and company founder, Frank Piasecki, an engineer who pioneered helicopters during the industry's infancy, developing innovations such as the tandem rotor that are in wide use today.

In 1943, Frank Piasecki developed the second helicopter to fly in the United States, the PV-2 single-seat, single-rotor helicopter, four years after Igor Sikorsky's first flight in the VS-300. He was also the first to obtain a US helicopter pilot's license without already having an airplane rating.

To promote the PV-2, Frank appeared in a short film, landing the helicopter on a golf course, at a gas station, and in other locations, displaying its novel ability to land practically anywhere. Developed as a technology demonstrator and never produced commercially, the PV-2 now resides at the Smithsonian Institution.

Frank's accomplishments attracted the interest of the US Navy, and in 1945, the service awarded him a contract to design a large tandem-rotor, heavy-load helicopter. The result was the HRP-1, the "Flying Banana," the first tandem-rotor helicopter and the first helicopter designed for the Navy. This aircraft and its derivatives were instrumental in pioneering vertical lift applications in the US military, including anti-submarine warfare, mine clearance, vertical envelopment with the Marine Corps, air assault and air ambulance for the US Army, and combat search and rescue for the US Air Force.

Piasecki's tandem-rotor design formed the foundation of many present-day rotorcraft, including the CH-47 Chinook, cementing his helicopter legacy. A durable workhorse for both military and civilian missions, the CH-47 has a payload of approximately 14 tons.

In 1955, Frank left what was then called Piasecki Helicopter Corp. to form Piasecki Aircraft Corp. and concentrate on developing advanced VTOL systems. Piasecki Helicopter Corp., renamed Vertol, was then sold to Boeing.

Meanwhile, at Piasecki Aircraft Corp., Frank continued to advance vertical flight and, in 1958, developed the Airgeep flying car. At the same time, he flew the world's first quadcopter drone, called the Sea Bat.

From 1961 to 1966, Frank developed the first shaft-driven, high-speed compound helicopter, the 16H-1 Pathfinder and 16H-1A Pathfinder II. In the 1970s and 1980s, he developed and flew the world's largest VTOL aircraft, the PA-97 Helistat, a hybrid aircraft that incorporated a blimp and four helicopter rotors for super-heavy lift applications.

In his later years, Frank oversaw the resurgence of compound-helicopter technology with the successful test flight of the X-49A SpeedHawk compound aircraft, ushering in a period of VTOL innovation with the US Department of Defense's Future Vertical Lift (FVL) program.

Before his death in 2008 at the age of 88, Frank received numerous awards, including the National Medal of Technology and Innovation and the Smithsonian National Air and Space Museum Lifetime Achievement Award.

Above: Frank Piasecki accepts the 1986 National Medal of Technology and Innovation from President Reagan for his numerous contributions to vertical lift aircraft. Below: the Piasecki Airgeep II, a prototype of a flying jeep developed for the US Army, takes its first flight in 1962. At right: the US Army CH-21C Shawnee utilized Piasecki's tandem-rotor design.

TOP LEFT: PIASECKI PHOTO; BOTTOM LEFT: SAN DIEGO AIR & SPACE MUSEUM PHOTO; RIGHT: US ARMY PHOTO

for the PA-890. Modifications for the CoAX 2D will include removing the piston engine and replacing it with an electrical propulsion system while finding room for all the fuel cells and tanks.

While retrofitting an existing aircraft with hydrogen fuel cells will always present integration constraints, Piasecki will have more flexibility to optimize the results when designing the PA-890 to use hydrogen from the outset. Key design issues to be addressed are fuel cell integration, thermal management, tankage, and carriage and storage of hydrogen on board.

Meeting Market Demands

John Piasecki and his brother Fred, the company's chairman and chief technology officer, are following in the footsteps of their father, Frank, who founded Piasecki Helicopter Corp. in the 1940s (see "Founding Father," p. 44). In 1960, Boeing bought Piasecki Helicopter, which at that point went by the name Vertol Corp. Frank Piasecki continued on an independent path to research and develop advanced rotorcraft technology, founding Piasecki Aircraft Corp.

Today, John manages Piasecki Aircraft's strategy, programs, and business aspects while Fred heads engineering development, fabrication, ground and flight testing, and airworthiness certification.

"[Our father] was always a forward-looking man, and he let the customer, or the need, drive the solution," says John, who notes that the evolution of the hydrogen-powered helicopter is similar to that of the piston-powered helicopter.

"The development of the tandem helicopter was critical because it took what little power was available for the weight of a piston engine and made the most of it," he says. "The efficiency of tandem rotors then opened the door for broader helicopter operations.

"Single-rotor helicopters were, in many respects, saved by the turbine engine, which provides ample power in a small weight budget. The problem is, turbine engines are expensive to operate, [which] has limited vertical lift to [more expensive] niche markets that can afford them," John adds.

"Frank Piasecki would say that electrification and hydrogen fuel cell propulsion can address the fundamental issue of cost—that is, getting the cost of vertical flight down so more people can use it."

Makin' the Blade

Rotor blades are designed for performance. But they are also designed to be manufactured, and *how* they are manufactured is probably more involved than you think.

A PHOTO ESSAY BY MARK BENNETT

Rotorcraft blades are some of the most complex purely mechanical items on a helicopter. They might appear as a seamless piece, but their construction comprises myriad components, shaped and joined, inspected and tested. The end result must be able to endure a range of environments and abuse, survive being flung around a hub hundreds of times per minute, twisted up, then down at that same rate, while supporting its share of an aircraft ranging from less than 900 to over 120,000 lb.

WATCH a Maintenance Team Install Blades on a Bell 407

Pencils to PCs, Spruce to Carbon Fiber

Long before you start hammering together a rotor blade, much design work is required across manifold disciplines.

At the dawn of rotary-wing flight, it made sense that existing fixed-wing airfoils, developed with pencils and slide rules, guided the design of helicopter rotor blades. Likewise, wood-and-fabric construction was the logical choice.

Those airfoil designs and construction techniques were found wanting, however. For instance, air pressure changes in hollow, fabric-covered trailing edges would change performance during flight, and moisture from rain, or even just humidity, could alter the weight of blades disproportionately on a single helicopter. Moreover, the inherent difficulty of making every blade for a specific aircraft model the same size, shape, and weight was so severe that blades had to be installed and, when needed, replaced in complete sets.

Soon, legacy designs yielded to the results of intensive (and ongoing) research into not just the shape of airfoils—the 2D cross section—but also a full 3D optimization of the blade from root to tip, calculated with computers and verified in wind tunnels. Construction materials and manufacturing processes progressed similarly. (See sidebar, p. 57, for more on airfoils.)

Above: What is possibly the only extant set of Sikorsky S-51 main-rotor blades not mounted on a helicopter currently rests on a hangar wall at Vertical Aviation Technologies in Sanford, Florida. The blades were manufactured in 1952.

Right: A Sikorsky HO3S-1, the US Navy designation for the Sikorsky S-51, hovers above the battleship *USS New Jersey* while off the coast of Korea in 1953.

Previous spread: Van Horn Aviation design engineer Chris Gatley brought with him 13 years of experience when he joined the company in 2019, including work on main-rotor blades for the AH-64D/E Apache, foreground.

US NAVY PHOTO

VERTICAL AVIATION TECHNOLOGIES S-52L MAIN ROTOR BLADE

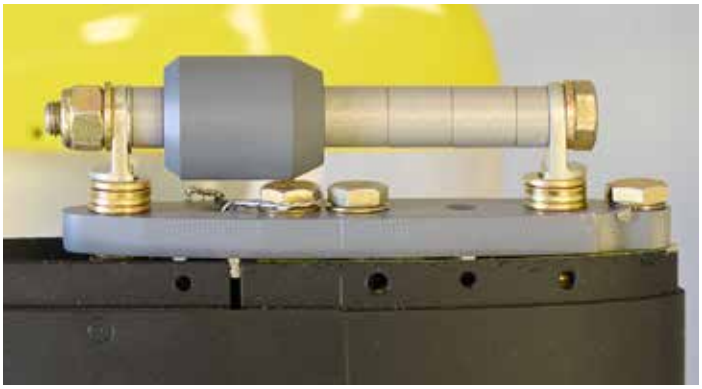
AIRFOIL
NACA 0014

LENGTH
15′7″ (4.75 m)

WEIGHT
40 lb. (18.1 kg)

NUMBER OF COMPONENTS
≈138

MANUFACTURING TIME
79 hours over 18 days



The result? The designs, materials, and manufacturing processes for helicopter rotor blades, main and tail, followed the same path forged by makers of airplanes: better-performing, longer-lasting, more-consistent wings.

As It Ever Was

Vertical Aviation Technologies has been building kit versions of the Sikorsky S-52 helicopter, including the main-rotor blades, for 30 years in their Sanford, Florida, facility.

The aircraft sported the first all-metal blades on an American helicopter, a design later revised for more consistent manufacturing, better performance, and longer life. The blades now comprise about 138 components, most of them manufactured on-site by Vertical Aviation, and all of them assembled, painted, and balanced per the company's FAA-approved process specifications.

Those components include an extruded aluminum spar, which also functions as the leading edge; trailing-edge pockets of aluminum sheet (15 per blade in three different configurations); phenolic spacers; custom blade-balancing hardware; and a steel cuff with a unique threaded collar for attaching the blade to the rotor head.

There have been other improvements over the decades, mostly in adhesives and paint, but the basic design remains safe and effective.

Opposite page: The S-52 blade assembly and balancing room at Vertical Aviation Technologies.

Top left: Beneath the end cap on each blade is this blade balance weight system.

Top right: The root end of two S-52L main-rotor blades, the lower one with just the pocket attached, the upper one complete with its unique threaded cuff nut for attaching the blade to the rotor head.

Bottom right: Trailing-edge pockets awaiting incorporation into blades.

Everything Old Is New Again

When Van Horn Aviation decided to design replacement main-rotor blades for Bell 206 helicopters, they opted for a NASA airfoil and modern materials. The result is performance that matches or surpasses that of the factory blade, with a service life four times the original's.

The Van Horn Aviation blade is seriously more complex than its sleek exterior might suggest. Beneath the paint and behind that full-length abrasion strip are layers of precisely laid carbon-fiber fabric of varying formulations, dimensions, and locations. And beneath the carbon fiber is a core of structural foam cut by computer-controlled machinery.

Designing a composite blade to replace an aluminum one also requires engineering and manufacturing the components used to attach the composites to the metal root, creating and bonding the abrasion strip, incorporating track-and-balance adjustment features, etc.—every item and process different from the original.

Even after the composites are laid up, the titanium machined and coated, and all the components bonded and cured in an autoclave, ahead are still final machining, painting, and quality control. No wonder it takes so long (nearly seven weeks, start to finish) to make a blade!

VAN HORN AVIATION
BELL 206L MAIN ROTOR BLADE

AIRFOIL
NASA RC(4)-10

LENGTH
17'6" (5.28 m)

WEIGHT
96.9 lb. (43.95 kg)

NUMBER OF COMPONENTS
316

MANUFACTURING TIME
240 hours over 40 days

Above: Technicians at Van Horn Aviation, on the left, piece together plies of carbon fiber and other materials for Bell 206 tail-rotor blades, and on the right, lay up a main-rotor blade for the same aircraft model.

Right: While some carbon-fiber panels are the length of the blade, others are mere inches across, and all must be placed with precision.

Below right: One of the autoclaves, where a blade will spend six hours curing, is secured.

Below left: Titanium root fittings are machined in-house, as are all custom metal components.

ERICKSON INCORPORATED
S-64E/F MAIN ROTOR BLADE

AIRFOIL
NASA RC(4)-12

LENGTH
31'11.7" (9.75 m)

WEIGHT
395.6 lb. (179.44 kg)

NUMBER OF COMPONENTS
524

MANUFACTURING TIME
968 hours over 24 days

When You Have to Lift a Lot, You Need a Lot of Lift

The CH-54 entered the world of heavy lift as a military helicopter in the early 1960s. The civilian version, the S-64, capable of carrying 17,636 lb. (8,000 kg), came not long after and is now manufactured and supported by Erickson.

In addition to the hundreds of changes Erickson has made to the aircraft over the years, it has recently designed new S-64 main-rotor blades, which are manufactured in the same facility used to support the legacy blades still in service around the world.

When you design a new blade for an existing airframe, you consider every available, practical improvement. Thus, the new blade is of composite construction, with a longer service life and a more efficient airfoil design—lifting capacity is now 20,000 or 25,000 lb., depending on the aircraft model—but is a bolt-on replacement for the original, mostly aluminum, blades (in sets of six, of course).

To make each new 32-ft.-long blade, an aluminum mandrel is meticulously wrapped by hand with over 300 layers of carbon- and glass-fiber mats, with more than 100 leading-edge weights encased between layers of composites, which are then cured for 19 hours in an infrared oven. Next, the honeycomb trailing edge, the skins, and trim tabs are added. Then, all are bonded and cured together for 10 *more* hours.

Opposite page: More than 300 individual plies, a mix of unidirectional and woven carbon and glass fibers, are hand laid to form the spar for the composite version of the S-64 main-rotor blade.

Below: Plies are positioned and aligned with the help of lasers, but it still takes sharp eyes and steady hands.

Above: Once components are in place, the uncured S-64 blade is sandwiched between two 33-ft.-long, 16,000-lb. tools, wheeled into the infrared oven, and after 10 hours the blade is ready … to continue its 24-day production process.

Below left: A technician applies adhesive laminate to 1 of the 100-plus leading-edge weights destined for a single blade.

Below right: Beneath the skin of the trailing edge, wedges of polyamide honeycomb provide structural stiffness without undue weight.

Then, as with most rotor blades, no matter the materials or manufacturing, there are many more steps before the blade is ready to hang on an Air Crane—machining, adding hardware, painting, balancing—and, at every step, quality control.

What Binds Us Together

The industry has come a long way in the decades since practical helicopters joined the still-young age of heavier-than-air flight. Across that span, blade designs have yielded sleek shapes and smooth skins.

But those svelte exteriors hide surprising complexities of materials and joinery. Actually, here's a fact that isn't widely appreciated: except for root attachment hardware (if the design includes it) and minor hardware (such as, perhaps, a screw securing a weight pocket), almost every component of a main-rotor blade, whether predominantly metal or composite, is attached to other components with adhesives.

That's right—helicopters stay in the air mostly thanks to glue.

Airfoil Design

Off the shelf or made to order?

Deciding what you want from a rotor system is the critical first step in designing main- and tail-rotor blades. Overall performance values for the aircraft flow into questions such as, how many blades and how long can or should they be? Even at an early stage of design, many compromises must be accommodated.

With those decisions come the next tranche of questions. How much lift under what conditions? And how can we achieve that?

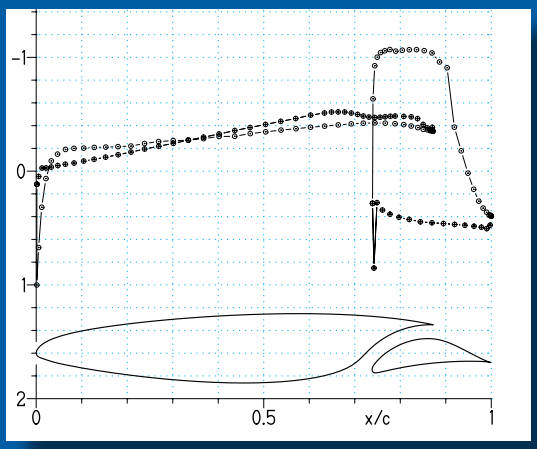
One possible solution is to select an airfoil design from among those developed over the history of rotary-wing flight, including those from NASA. Incorporating one of these designs requires skill, but because its performance is known, it can be a solid solution.

What's becoming more common is creating custom airfoils that provide optimal performance for specific aircraft. Computer codes exist to facilitate the task, but if designing an airfoil were as simple as pressing a button, everyone would be doing it.

That's where someone such as Dan Somers comes in. He worked for 15 years at NASA Langley Research Center and in 1980 launched Airfoils, Incorporated, advising aircraft manufacturers and designing airfoils for them.

Somers's enthusiasm for his work was clear as he told me more (and more!) about how these precisely formed shapes keep hundreds or thousands of pounds airborne.

Yet, despite his decades of experience—or because of it—he says design is part science and part art. The truth comes out only when air flows over the wing.



Above: A pressure distribution graph that aligns an airfoil with the measurements obtained in a wind tunnel.

Below: Dan Somers explains elements of airfoil performance and design while seated next to one of his airfoils in the Penn State wind tunnel.

Left: An airfoil test article mounted in the wind tunnel at Penn State University in University Park, Pennsylvania.

QUICK FACTS

Loreto Moraga

Chilean Helicopter Association, Santiago, Chile

CURRENT JOB

I'm a lawyer specializing in aviation and space law. I've also been president of the Chilean Helicopter Association since 2017 and of the Chilean Space Association since 2021.

FIRST AVIATION JOB

My first job was advising on the legal setup of a helicopter operating company, which today is the largest operator in the Chilean market. It was a good experience because, unlike the airlines, it involved working in a small, highly innovative company, carrying out very interesting flights for large local industries (such as mining and forestry) that needed very specialized services.

FAVORITE HELICOPTER

I really like the Airbus H130 because it mixes the efficiency of the H125 with a higher level of design that not only makes it more beautiful but also allows a panoramic view for its passengers, among whom I count myself because I'm not a pilot (yet!).

How did you decide helicopter aviation was the career for you?

In my law practice, for many years I worked in aviation insurance and in forming operating companies. The versatile, technological aviation industry immediately charmed me. But in the helicopter subsector, I saw a kind of contradiction between its public relevance and its almost null visibility before the sectoral authorities and the public. That limited the industry's development in a country like Chile, where our geography and natural catastrophes cry out for air services of this type. That scenario was a challenge.

How did you get to your present position?

When I was a member of the Chilean Helicopter Association, before I became president I got to know the world of operators and stakeholders more in depth and grew to share many of their convictions. I think that's why they entrusted me with the presidency. I think they needed a leader who was more political than technical because, although the association was doing a lot of good work, the organization was very self-absorbed and needed to be open to new issues and take a longer-term view. The group also needed to define its strategies, gain stature and visibility before the authorities, and connect with other national and international organizations. It needed to be publicly recognized and to earn its place in the aviation sector.

What are your career goals?

As a lawyer, my goal is to assist my clients by understanding their business and empathizing with their needs. As an association president, I want to develop plans that strengthen the aerospace industry in Chile, where it faces great challenges, including the arrival of a new generation of aircraft and business models associated with eVTOL; sustainability; and the biggest challenge currently affecting Chile—safety. We need to achieve cultural changes at a personal and organizational level because we have unacceptable accident rates.

What advice would you give someone pursuing your career path?

Lawyers in general work very quietly at their desks and often see the industries they work for from a theoretical perspective alone. Well, in aviation, that doesn't work.

You have to go out and get involved, learn what the operation is really like, the processes, the risks, and all the factors surrounding the activity. After doing all that, then you can really contribute as a legal advisor and pretend to lead.

Who inspires you?

For many years, our executive secretary in the Chilean Helicopter Association was José Miguel Infante, a naval pilot and a pioneering Chilean helicopter operator who passed away five years ago.

José worked tirelessly for this industry and was a very committed, simple, authentic person. His death really affected this organization, but we moved forward inspired by his example.

Tell us about your first helicopter ride.

I was invited to the inaugural flight of a new helicopter being delivered to a client in the Los Andes mountains surrounding Santiago.

The skies were very clear and the snowy mountains unforgettable. The helicopter had several technical innovations that were tested on the flight, which made the experience especially entertaining. It wasn't just a ride but also a display of the potential of a great machine.

What still excites you about helicopter aviation?

That it is vital to society. Helicopters help save lives and take care of people on a daily basis by carrying out aerial work in places that have very limited access and that are characterized by difficult climates. So it's very important to take care of the organizations, the people, and the aircraft behind such operations.

I also think the way aviation is evolving is very exciting. In the future, eVTOL technology will be massively integrated into daily life in terms of transporting cargo and people within cities. Preparing for this eventuality is very stimulating.

What challenges you about helicopter aviation?

Preparing Chile to be part of the eVTOL revolution, not only as operators but also in developing a local chain of suppliers of goods and services, and building up Chile as a market that can provide technology developers worldwide.

What do you think poses the biggest threat to the helicopter industry?

Helicopter aviation is an activity with implicit risks, but we're not doomed to have fatal accidents. We must be convinced about this once and for all.

How did you know you chose the right career?

As an aviation lawyer, I feel a lot of satisfaction when I'm able to broker agreements that enable the acquisition of helicopter fleets that are used for important aerial work for my country. And as president of the Chilean Helicopter Association, I know I chose the right career every time we contribute to society, like two years ago when, during the pandemic, our members donated flight hours to distribute vaccines.

Complete this sentence: I love my job, except when ...

… bureaucracy hinders the progress of projects or when I'm trying to execute a project alone or a member asks me to do something that's in their personal interest or requests something in exchange for their support. In Chile, association executives are financially uncompensated, so collaboration is essential.

 By Jaasmin Foote

Blake Olson, Recipient, HAI Maintenance Technician Certificate Scholarship

Career path combines reservist's twin passions for aviation and community service.

IMAGINE IT'S A CLOUDY, breezy day but good weather for a solo flight as you train for your private pilot license. Halfway through your trip, the weather worsens. You're on the upwind climb and beginning your crosswind turn in the traffic pattern when a wind shear hits and starts to pull you into a roll. How do you recover?

Not easily, Blake Olson can tell you. The aspiring Black Hawk crew chief experienced the harrowing flight while seeking his private pilot's license in 2020. Olson, a mechanic for the Idaho Army National Guard and now a fixed-wing private pilot, avoided a possible fatal accident that day by reacting quickly, moving the aileron in the opposite direction and pulling out of the roll.

Safety Mentality

Some pilots aren't comfortable talking about a close call. But Olson wants to share his story, because he believes doing so can help others avoid accidents and understand the importance of prioritizing safety in their operations and training.

"It shook me up, because I knew if I hadn't reacted the way I did, I probably wouldn't have recovered and I'd be the next news story," says Olson. "After that, I instantly turned back and landed. I didn't fly for a little while [afterward].

"The main takeaway from my story is that weather is intense and unpredictable and can change at any point. It deserves respect, as does flying any kind of aircraft in any scenario," Olson adds.

"I've overcome my [aviation] fears by accepting that there are some major risks in my chosen career path as a pilot and mechanic," Olson says. "But if I make sure I'm doing my job correctly and learning everything I need to know to complete the job safely and efficiently, I'll be much better off. Accidents happen, but if I'm ever involved in one, it won't be from a lack of training or knowledge."

That mentality has had an extremely positive impact on his training, says Olson, who's currently enrolled in the fixed-wing pilot program at Treasure Valley Community College in Ontario, Oregon, working to obtain his commercial pilot ratings so he can eventually fly fixed-wing aircraft in the civilian sector.

Olson uses his military educational benefits to pay for his pilot training. He also uses his experience working with military and civilian aircraft to better himself as a mechanic. He's currently apprenticing under the mechanic at his flight school to gain experience and training to receive his A&P license. He hopes this approach will allow him to earn real-world experience in maintaining aircraft and set him up for success as a mechanic.

Ultimately, Olson hopes to use his career in aviation as a means to help others by working in sectors such as aerial application, air ambulance, fire support, and charitable work.

An Early Interest in Aviation

Like so many in aviation, Olson's interest in the field began in childhood. He fondly remembers his parents and grandparents taking him to an air show at a local airport in his hometown of Twin Falls, Idaho, when

he was seven or eight years old.

"I loved everything about the show, from the loud noises to all the airplanes and helicopters that were there," says Olson. "I thought to myself, 'Wow! People really fly these things as a career!'" From that day forward, he says, he was obsessed with finding out more about how airplanes and helicopters fly.

As he approached the end of his junior year in high school, Olson decided he wanted to find a job that combined two of his passions: community service and aviation. With the aim of pursuing dual career paths as an aircraft maintenance technician and a pilot, he joined the US Army National Guard as a UH-60M Black Hawk helicopter mechanic.

As with most students beginning a career in aviation, finances were one of the first obstacles Olson encountered. "I'm an aspiring pilot and mechanic, and those two fields are very expensive to fund to receive the proper training to become qualified," he says.

Olson learned about HAI and its scholarship program while attending Idaho State University, and he applied for the association's Maintenance Technician Certificate Scholarship in October 2021. After learning he had won the scholarship, he quickly made plans to use the monetary award to help pay for the remainder of his A&P training, which he plans to complete in the next two years.

"This scholarship means a lot to me because the aviation industry isn't cheap, by any means, and every little bit helps," says Olson. "Sometimes you just need that little bump to help make ends meet, and that's what this scholarship will do for me."

Always Bettering Himself

Olson says he's honored to be chosen for a scholarship by an organization such as HAI because he feels it shows that other aviation professionals recognize the hard work he's put into his career. His advice to newcomers in the industry? Stay focused and give your best at all times.

"As long as you always think about the end goal and all the things you can accomplish, there's no obstacle you can't overcome," Olson says. "It's this mindset that pushes you forward every day.

"We have to treat every day like there's no tomorrow," Olson adds. "That means you must get up and better yourself today because it's all you have. Nothing is guaranteed."

Olson can already see his hard work paying off and says his experience with HAI will benefit him for the rest of his life. In addition to the financial aid the scholarship provided, Olson will get a complimentary show-floor pass to HAI HELI-EXPO 2023.

"Going to Expo is so important, because it gives me the chance to meet new people in the industry, make connections, learn about aviation, and make myself better with the knowledge I receive," says Olson. "To me, that's priceless. If I hadn't won the scholarship, I wouldn't have gotten this opportunity that will help guide me in my career going forward."

A big fan of engineer, pilot, entrepreneur, and YouTuber Mike Patey, Olson says every pilot should learn as much as possible from seasoned aviators, even those they've never met. Everyone has a story and experiences that can help you along the way, he says.

"I haven't met Mike yet, but I've been watching his videos for years, and he's so incredibly knowledgeable," says Olson. "He uses his abilities, resources, and knowledge to help other people. Not only that, but he has a blast doing it. You can tell he has a sincere passion for what he does, and that's inspiring to me."

Olson gives a lot of credit to the pilots and mechanics in his unit, as well as his CFIs, because they've helped advance his career and have gotten him through some tough times.

"They've taken the time to teach me what they know to make me a better pilot, crew chief, and mechanic. I can never thank them enough."

HEAR from Blake Olson What Winning an HAI Scholarship Has Meant to Him

 By David Jack Kenny

Hurried Departure

Failure to prepare for a dark-night flight sends seven to their deaths.

This Canterbury West Coast Air Rescue helicopter departing Greymouth, New Zealand, illustrates the additional risk posed by taking off in dark-night conditions, with no external visual references, a causal factor in the 2019 Bahamas accident discussed in the article.

MOST OF US CAN PERFORM reasonably well in familiar situations. Recognizing previously observed patterns eases mental workload, freeing bandwidth and attention to devote to the larger picture.

Coping with strange circumstances has the opposite effect, particularly if they trigger discomfort or anxiety. In a high-stakes, high-stress flight operation, that combination can snowball, putting the pilot(s) further and further behind the aircraft. Given time and the altitude to maneuver, the results can be merely frightening; without those advantages, the outcome can be disastrous.

The Mission

Shortly before midnight on Jul. 3, 2019, a corporate pilot based at Florida's Palm Beach International Airport (KPBI) received an urgent phone call from his employer. The company's owner was hosting a gathering on Big Grand Cay, one of his private islands in the Bahamas. His daughter and one of her friends had taken ill—another attendee later described them as "groggy and unresponsive"—and he wanted to evacuate them to Fort Lauderdale for evaluation and treatment. The pilot then called a contract pilot who worked for the company and asked him to join the flight as second in command (SIC).

They departed Palm Beach at 12:55 am on Jul. 4 in the company's AgustaWestland AW139. There were only a few clouds below 25,000 ft. and winds were light, but it was very dark: both the sun and moon were more than 15 degrees below the horizon, providing no illumination.

The cockpit voice recorder (CVR) captured the pilots'

ISTOCK/LAKEVIEW_IMAGES

discussion of the conditions; the SIC assured his colleague that he "was night current," had "done a lot of night flying," and was accustomed to making off-airport landings after dark. They arrived at Big Grand Cay at 1:42 am and landed on the island's 40-by-40-ft. helipad. The pad was unlit, so floodlights mounted on golf carts had been positioned where they wouldn't interfere with the pilots' vision. They kept the engines running after landing to board the passengers without delay.

The Aircraft

The 2007-model helicopter had a five-bladed, fully articulated main rotor system and a four-bladed, fully articulated tail rotor powered by two Pratt & Whitney Canada PT6C-67C turboshaft engines, each rated for 1,531 shp. The aircraft was equipped with a Honeywell Primus Epic integrated avionics suite that included an automatic flight control system (AFCS) utilizing two four-axis autopilots, each capable of controlling the aircraft if the other failed.

Force trim release (FTR) switches on the cyclic and collective controls enabled either pilot to override the autopilot and hand-fly that control as long as the switch was depressed. The FTR switches could also be used to reset the autopilots' input parameters. Depending on which autopilot mode was in use, the AFCS captured the indicated airspeed, vertical speed, or altitude at the moment the FTR was released. A Penny & Giles multipurpose flight recorder combined the functions of the flight data and cockpit voice recorders.

The helicopter had flown 2,158 hours as of the day of the flight. An extensive series of 25-, 50-, 300-, and 600-hour repetitive inspections had been completed on Jun. 28, just 4 flight hours earlier, along with annual oil changes in the main, intermediate, and tail gearboxes. Track and balance of the main- and tail-rotor systems was also checked, and repairs made to the landing gear and rotating scissor assemblies.

The Pilots

The 56-year-old pilot in command (PIC) was a longtime close friend of the owner. He held a commercial certificate with ratings for single-engine seaplanes and single- and multi-engine airplanes as well as an instrument rating for helicopters. In the National Transportation Safety Board (NTSB) report, his total flight experience in all aircraft was given as 2,241 hours, but his pilot log was kept on an iPad from which no data could be recovered, so his make-and-model time, night currency, and instrument currency couldn't be determined. According to the operator's chief pilot, the PIC exercised operational control over the helicopter. His second-class medical certificate was issued in December 2018.

The 52-year-old SIC held an airline transport certificate for helicopters with commercial privileges for gyroplanes and a flight instructor's certificate for both classes of rotorcraft. He'd given the PIC, already a fixed-wing pilot, his initial helicopter instruction in 2004 and they'd been friends since, starting an aviation business together. The SIC had accumulated 12,200 hours of total flight time. Though the SIC held no US fixed-wing ratings, the chief pilot recalled hearing that he'd previously flown fighter jets for the Royal Air Force. His second-class medical certificate was issued in April 2019.

According to his girlfriend, the PIC didn't like to fly at night and rarely did so, characterizing it as "a whole different ballgame." She believed this was the first time he'd flown to the island after dark. The SIC's wife reported that he enjoyed night flying and had logged about 1,450 hours at night, most recently on May 25, six weeks before the accident.

The two pilots had been paired during their initial type-rating training in the AW139, which included instrument takeoffs and unusual attitude recoveries. The SIC's instructor commented that he showed "great understanding of instrument procedures and FMS [flight management systems], but not always using a checklist led to momentary loss of situational awareness." He also noted that the SIC "struggled with [crew resource management] … wanting to fly single-pilot, especially during emergency training."

Both pilots passed Part 61 checkrides and proficiency checks in November 2018, though the PIC was rated below average on airman's skill-decisiveness as well as overall. His instructor wrote that "progressive training/checking was halted and changed to traditional 61.58 training due to the applicant not reaching the required proficiency."

The Flight

The flight lasted less than 2 minutes and covered less than 2 miles.

At 1:45 am, the PIC used a ForeFlight integrated flight app to file an IFR flight plan requesting direct routing at a cruising altitude of 1,500 ft. and an airspeed of 140 kt. It was never activated. The CVR didn't record any preflight briefing or discussion of the division of crew responsibilities or procedures for making a dark-night departure over water. At 1:50 am, the PIC said he'd enter the flight plan information into the FMS. Five passengers were boarded, including the owner, the two ailing guests, and two more of their friends, one of whom had

just passed her nursing board exams and wanted to be available to help during the flight. The helicopter lifted off at 1:52:17.

Things began to fall apart almost at once. Both the cyclic and collective FTR switches were engaged immediately. The helicopter climbed vertically to 62 ft. above ground level at zero airspeed before the SIC advised "push that nose forward, get some airspeed."

The left side of the accident fuselage following recovery.

The collective FTR was released at 1:52:28. Nose-down cyclic inputs pushed the helicopter's pitch attitude below horizontal, and it gained speed while continuing to climb. At 184 ft. and 53 kt. airspeed, the SIC warned, "Watch your altitude." Pitch attitude was 12 degrees nose down. The helicopter reached 190 ft. at 68 kt., then began to descend while banking left. At 1:52:48, the CVR recorded automated warnings of "sink," "warning terrain," and "one hundred fifty feet" generated by the enhanced ground proximity warning system (EGPWS).

The helicopter was 110 ft. above the water and descending at 1,380 ft. per minute (fpm) when the autopilot was engaged in both the "altitude acquire" and "indicated airspeed" modes. Target altitude was set at 1,000 ft.

The collective FTR switch was briefly activated at the same time. Because the helicopter was below its target altitude and descending, this reset the autopilot's target rate of climb from 1,000 to 100 fpm, a design feature of the system. The ship pitched up and reached an altitude of just 52 ft. before beginning to climb again as its left turn continued. In the 14 seconds from 1:52:51 to 1:53:05, the EGPWS issued nine separate terrain warnings. The cyclic remained under manual control with the FTR engaged.

Climbing through 78 ft., the PIC asked, "How high are you?" but the SIC didn't reply. Three seconds later, passing through 116 ft., the PIC said, "Three hundred feet," apparently having mistaken vertical speed for altitude: the helicopter was then climbing at 300 fpm.

The SIC replied, "We're not," to which the PIC answered, "That's what it says here." At 1:53:05, the SIC observed that they'd been "diving." The EGPWS warnings ended once they reached 150 ft. Meanwhile, the autopilot began lowering collective in an attempt to reduce their rate of climb to its target of 100 fpm.

After 20 seconds of nose-up or nose-level flight, the helicopter pitched down again at 1:53:11. Two seconds later, it reached its maximum altitude of 212 ft. while banked 30 degrees left, then began descending again as the autopilot gradually raised the collective. EGPWS warnings resumed.

The SIC said, "There was a fatal accident in the United Kingdom, and this is exactly what happened there." Descending nose-low with airspeed building, the PIC asked the SIC for headings several times and for altitude once but got no reply. Impact occurred at 1:53:22 in a 12-degree left bank and a pitch of 7 degrees nose-down.

Two witnesses about 1.6 nm to the southwest heard the impact and set out to search in a spotlight-equipped boat but couldn't find the helicopter. The flight wasn't reported missing until the following afternoon, when another company pilot learned that it had never reached Fort Lauderdale. The FAA was notified and issued an alert notice.

The company pilot set out to search in a float-equipped Cessna Caravan but was unsuccessful. The

NTSB PHOTO

witness who'd heard the crash the night before also resumed searching and found the wreckage lying inverted in 16 ft. of water just 1.2 nm from the departure helipad. The retractable landing gear was still extended. Divers recovered the bodies of all seven occupants.

Bahamian authorities delegated the investigation to the NTSB. Having found no evidence of equipment failure, the board determined the probable cause of the accident to be "the pilots' decision to take off over water in dark-night conditions with no external visual reference, which resulted in spatial disorientation and subsequent collision with the water. Also causal was the pilots' failure to adequately monitor their instruments and respond to multiple EGPWS warnings to arrest the helicopter's descent."

External pressure to complete the flight, lack of night flying experience from the island, and inadequate crew resource management were all cited as contributory.

Unanswered Questions

Several aspects of the accident sequence remain difficult to explain. Especially puzzling is why the pilot who was both less experienced and, by his own admission, uncomfortable flying at night took the controls to lift off into utter blackness, with no ground lights or visible horizon. It's possible the PIC's uneventful departure from Palm Beach, where the lights of the airport environment and the Florida coastline provided visual references for their climb to the 2,500-ft. cruising altitude logged in the flight data recorder, led him to underestimate the challenge posed by this departure.

Before that, it's not clear why two pilots consistently described as careful, competent, and safety-conscious didn't perform any kind of departure briefing or formally assign responsibilities as pilot flying versus pilot monitoring. Perhaps concern for the ailing passengers led them to hurry their preparations, or perhaps their long-standing comfort flying together made a briefing seem redundant. Family members and colleagues interviewed by investigators agreed that they probably weren't seriously fatigued.

Most baffling, though, is why the SIC didn't take the controls once he realized his partner was struggling, especially after his comment about the nearly identical British accident (which also involved an AW139). At that point, the helicopter was less than 200 ft. above the ocean, descending at a rate accelerating through 1,000 fpm. Disaster might still have been averted in the nine seconds that remained. Given their prior relationship as instructor and student, a sharp callout of "My controls!" would almost surely have triggered an immediate transfer of command.

The Takeaway

Many accidents begin with flights that seem routine until they're not, but some flight operations aren't routine at any point and can't be treated that way. A medical evacuation requiring a black-night departure over the ocean is among the situations that combine an extremely narrow margin for error with the most severe consequences should anything go wrong.

Regardless of weather, this is a pure instrument flight and must be handled as such. With no established departure procedure from an off-airport site, the takeoff and climb to cruising altitude require detailed and specific planning.

A hard check on the pilot's current level of skill is also in order. Instrument flight requires regular recurrent training to maintain proficiency. Year after year, about one-third of all pilots killed attempting VFR flight in low-visibility conditions already held instrument ratings.

The two ailing passengers mightn't have been better off had they waited until morning, but they certainly wouldn't have fared any worse. Transporting patients to safety rests on safely transporting the patients.

 By Ned Parks

Caution: Helicopter Wake Turbulence

It's past time to educate the entire aviation community about this dangerous phenomenon.

WATCH an Investigator from France's BEA on Managing Wake Turbulence

SOMETHING SURPRISING ABOUT FLIGHT instruction is just how little is taught about helicopter downwash—and virtually nothing about helicopter wake turbulence.

There isn't a mock checkride, or a real checkride, covering private, commercial, instrument, or CFI instruction that doesn't include some conversation about wake turbulence from fixed-wing aircraft. Land beyond, take off before, wait 3 minutes. The reminder we're given goes something like this: "Cleared to land, caution: wake turbulence departing 737."

I can't tell you the number of times I've been told to "taxi to the pumps and we'll get you topped off" with a light fixed-wing sitting right there and a trash can with a lid on it 20 ft. away.

But how often have you heard, "Caution: helicopter wake turbulence," or, "Caution: wake turbulence departing/landing helicopter"? The occasion is rare or even nonexistent.

Notice I've used the term "wake turbulence," not "rotor downwash." That's because the two events are distinctly different and, other than the fact they're both produced by the rotor blade, have little in common.

Downwash is produced while at a hover or during a very slow hover taxi, whereas wake turbulence is produced with the helicopter in forward flight starting at approximately 20 kt. Downwash in ground effect hits the ground and moves out 360 degrees from the helicopter, with hazardous winds up to 3 diameters the size of the rotor disc. Wake turbulence from a helicopter is more like that of an airplane and moves behind the aircraft while the latter is in forward flight.

They Don't Know What They Don't Know

Helicopter pilots teach ad nauseam, for good reason, the damage we can do with our rotor downwash. I always teach that being mindful of our downwash is part of flying neighborly. Fixed-wing pilots, however, aren't taught about rotor downwash or wake turbulence produced by a helicopter.

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I can't tell you the number of times I've been told to "taxi to the pumps and we'll get you topped off" with a light fixed-wing sitting right there and a trash can with a lid on it 20 ft. away. They don't know what they don't know, and they haven't been taught.

In 1996, the FAA published a report, "Flight Test Investigation of Rotorcraft Wake Vortices in Forward Flight," based on tests performed to determine the need for rotorcraft separation standards based on the wake vortex (think "wake turbulence") hazards of following aircraft. The tests involved four helicopters: the S-76, UH-60, CH-53, and CH-47. The FAA team used a T-34 and a Decathlon for probe aircraft.

The testers learned that within 3 nm behind the helicopter, the probe aircraft experienced bank-angle upsets that exceeded 30 degrees and, in some cases, more, with some resulting in a spin.

More recently, a Cessna 172 pilot experienced helicopter wake turbulence flying behind a departing R-44, which resulted in full aileron deflection and rapid increase in vertical speed followed by a rapid decrease in vertical speed.

Similarly, a Cirrus SR20 landing behind a departing UH-60 ended up cartwheeling down the runway with substantial damage to the aircraft and injury to the pilot. And a PC-12 fixed-wing landing behind a departing UH-60 experienced more than 30-degree bank angles. Thanks to some fast maneuvering by the pilot, and powerful thrust, the aircraft avoided crashing.

In September 2021, an experimental Rans S-20 departed behind a landing S-76 air ambulance helicopter. The airplane reached approximately 50 to 60 ft., rolled left, then rolled right until inverted and impacted the runway, resulting in a post-crash fire and one fatality.

Taking the Lead

The 1996 FAA study recommends that to avoid "hazardous" helicopter wake vortices/wake turbulence, fixed-wing aircraft in trail should remain at no less than 3 nm behind the helicopter. The report further shows that vortex decay time can take up to 3 minutes depending on the size and speed of the helicopter. But even 3 nm might not be enough.

Earlier this year, I was teaching an instrument student in a Cessna 172. An EC135 was practicing the same ILS (instrument landing system) approach. We were 4 nm in trail with both of us at 90 kt., and we still felt a light wing rock from the helicopter wake turbulence.

The fly neighborly movement in the vertical flight industry has rightly emphasized the need to minimize the noise impact of helicopters on communities, but we must consider the effects of our rotor downwash and wake turbulence, as well. Let's take the lead to educate the entire aviation community about both phenomena.

 By Zac Noble

Fuel for Thought

A preflight fuel sample helps ensure the safety of the aircraft occupants. Don't skip it.

LET'S TALK ABOUT SOMETHING THAT'S important but sometimes dismissed by the pilot in command (PIC): fuel.

The PIC is responsible for making sure all aspects of the aircraft are airworthy before flight—including the fuel. Drawing a fuel sample (also referred to as sumping the tank) can be performed by someone other than the PIC, but he or she is ultimately the person responsible for ensuring the task is completed before takeoff.

Indeed, many Part 135 operations manuals say that if an aircraft is getting fuel from an unknown source, the fuel must be checked by the pilot before it's put in the aircraft.

I beat the drum of PIC responsibility when it comes to fuel because I've seen pilots who haven't performed or supervised the task in so long they need refresher training in it. No kidding.

How Much Is Enough?

Once you've decided to comply with the aircraft checklist and draw a fuel sample, how much fuel do you take from the aircraft tank or sump? You should draw enough fuel to have collected a sufficient amount from around the drain (the low point in the tank) to determine whether the fuel contains any contaminants.

Some aviators have shown me samples that wouldn't fill a thimble. My response to them is, "What can you determine from that amount?" Did they draw a sample? Yes. Does the sample satisfy the checklist requirement? Maybe. Will it tell them if the fuel contains any impurities, such as water, dirt, or eroded fuel-bladder particles? Probably not.

You need to collect enough fuel to be able to ensure it's clean. There are fuel-sumping containers available that will let you draw a respectable sample and then return it to the tank in a clean condition.

Fuel tanks made of bladder material can deteriorate over the life of the bladder, leaving very small, dark-colored particles in the fuel. Similarly, solid tanks can collect condensation over time if the aircraft is parked in a humid location. Water can even penetrate the tank during aircraft washing or heavy rainfall, or through vents or poorly sealing fuel caps.

And don't overlook the tanks the aircraft is fueled

HAI/ZAC NOBLE

from. It doesn't matter if the tanks are permanently mounted above or below ground or if they're housed in a fuel truck: the fueling tanks should be sumped periodically to ensure they, too, are clean.

The photo opposite shows four fuel samples I drew myself to illustrate the significant visual differences between pure and impure fuel. The two jars on the left contain Jet A fuel; the one on the far left holds very old fuel sumped from a helicopter at an airport. The two jars on the right contain avgas.

The sample on the far right is clean; the sample next to it shows the water I added to illustrate what a contaminated sample can look like. Note the blue top half of the sample, indicating the gas, and the clear bottom half, indicating the water. (Water weighs more than gas and therefore settles to the bottom of the receptacle.)

New Doesn't Guarantee Clean

Believe me, what you put in your aircraft's fuel tank is important. One time, I was ferrying a brand-new EC130 from a completion center where it had received new paint, interior, and avionics. The helicopter's engine and airframe had a whopping seven hours of use.

After getting the ship to the destination airport and refueling after the trip, I showed a rated student pilot the next day how to sump the tanks, because he was new to the aircraft and needed training. The fuel sample yielded about a gallon of fuel that looked like I had taken it from a mud puddle!

That, ladies and gentlemen, is why you draw a fuel sample. It doesn't matter how new or old the aircraft is. It doesn't matter how much you trust the truck or tank it came from at the airport. It's the pilot's responsibility to ensure the aircraft is airworthy prior to flight.

Do the sample. It's too easy, and it's one thing you have control over to protect your safety and that of your passengers and crew. Take advantage of it!

Fugere tutum!

Lorenz "Lorry" Land

Longtime EAA AirVenture announcer delighted crowds at Oshkosh.

LONGTIME EAA AIRVENTURE OSHKOSH ANNOUNCER Lorenz "Lorry" Land died unexpectedly Aug. 1, 2022, immediately after spending the week doing what he loved—announcing at this year's AirVenture air show. He was 69.

For the past 15 years, Lorry, who hailed from Waukesha, Wisconsin, entertained the crowds during the rotorcraft flight demonstrations at AirVenture, where he was sometimes joined onstage by HAI President and CEO James Viola.

Lorry's cheerful smile and unending humor made him a fan favorite, as did his passion and enthusiasm for rotary flight, which he shared with the audience through his stories and fun facts about the history of helicopters. He famously closed each AirVenture show by telling attendees, "The sky is not the limit; it's just the beginning!"

Survivors include his wife, Christine; sons Christopher and Michael Land; and stepchildren Michael, Adam, Caitlin, Holly, and Lindsay Cosgrove; as well as five grandchildren and eight siblings.

Thomas "Tom" Poberezny

Aerobatic pilot, retired executive served as president of EAA from 1989–2010.

TOM POBEREZNY, RETIRED PRESIDENT AND CHAIRMAN of the Experimental Aircraft Association (EAA), died on Jul. 25, 2022, following a brief illness. He was 75.

Tom, who served as EAA president from 1989 to 2010 and chairman of the board from 2009 to 2011, leaves an impressive aviation legacy. He was a member of the US National Unlimited Aerobatic Team, winner of the World Aerobatic Championships in 1972, and won the US National Unlimited Aerobatic Championship the following year. Afterward, he flew 25 years on the Eagles Aerobatic Team (originally called the Red Devils).

During his time at the helm of EAA, which was founded by his father, Paul Poberezny, in 1953, Tom led the creation of the association's popular youth program, Young Eagles, and spearheaded for a decade EAA's role in urging the FAA to create the sport pilot/light-sport aircraft categories, which the agency did in 2004. He was inducted into the National Aviation Hall of Fame in 2016.

Survivors include his wife, Sharon (pictured); daughter, Lesley; two step-grandchildren, Lily and Kayden; and a sister, Bonnie.

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LAST LOOK

By Mark Bennett

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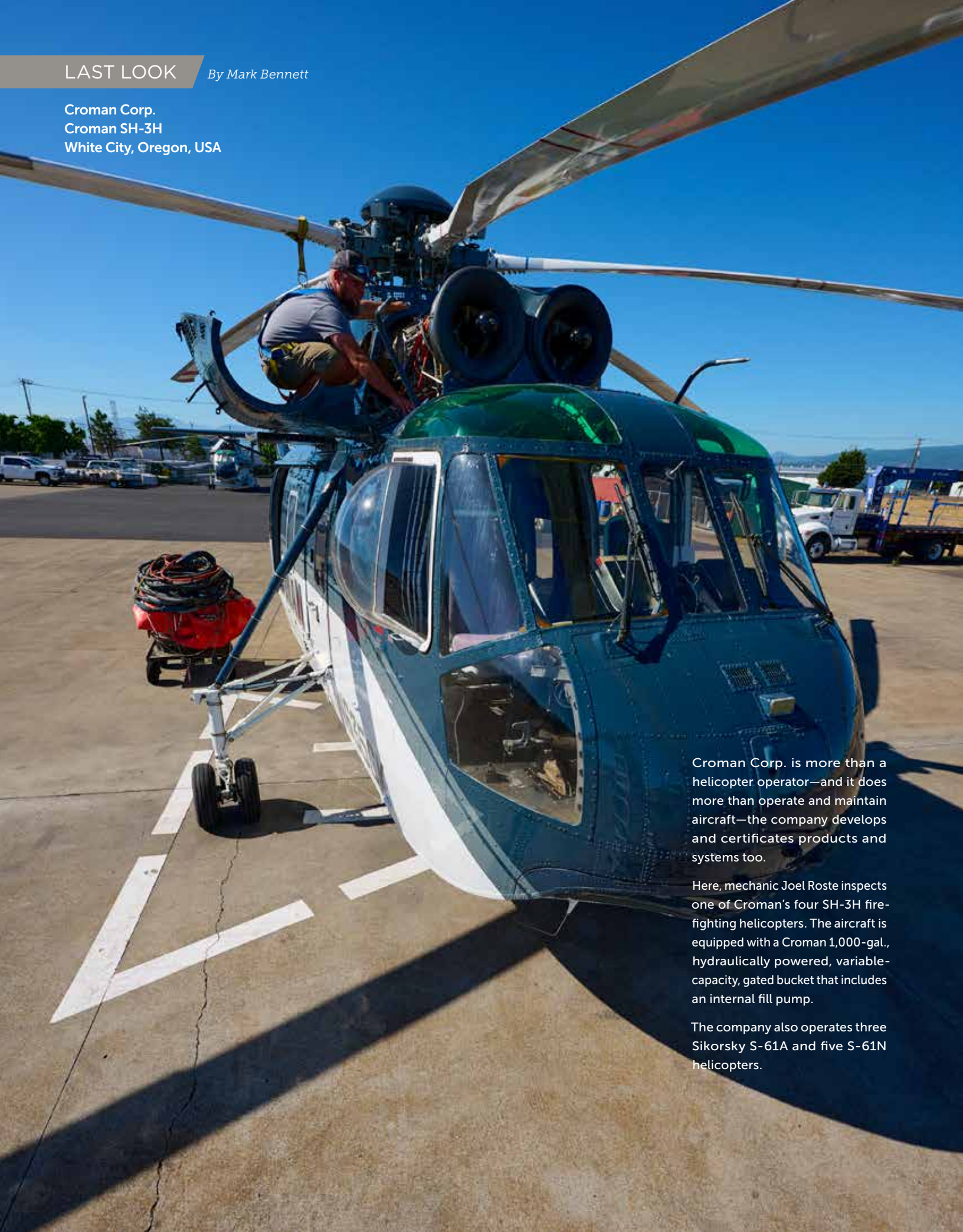

Croman Corp. is more than a helicopter operator—and it does more than operate and maintain aircraft—the company develops and certificates products and systems too.

Here, mechanic Joel Roste inspects one of Croman's four SH-3H fire-fighting helicopters. The aircraft is equipped with a Croman 1,000-gal., hydraulically powered, variable-capacity, gated bucket that includes an internal fill pump.

The company also operates three Sikorsky S-61A and five S-61N helicopters.

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