ROTOR

JUNE 2021 THE MAGAZINE OF HELICOPTER ASSOCIATION INTERNATIONAL

Helicopter Association International

Native Support

MD Helicopters Helps Navajo Tribe Weather the Pandemic

HELIFUELER®

ROTARY WING FUEL CART

This Is Hardly The Place To Be Worried About Maintenance Capabilities!

Specifically Engineered For Rotary-Wing Servicing!

Refuel • Defuel • Maintain

- Equipped to fit most helicopters (or UAVs)
- Refuel/Defuel safely and easily
- 400 and 600 gallon double-walled tank
- 2-stage filtration, fueling and defueling
- Easily transportable
- SPR refuel capability
- Operates via onboard deep cycle batteries
- Defuel for maintenance or deployment
- Self-contained operation for remote use

SPOKANE INDUSTRIES®

GSA
GS-07F-0257U

www.SpokaneIndustries.com
1-509-921-8861

Do Your Starter Generator Brushes & Armature Look Like This After 1,281 Hours?

PERSONAL TOUCH – PROVEN RELIABILITY

NAASCO

Mercury Mod Phase II

ETR-20™ & ETR-25™ STARTER GENERATOR IMPROVEMENT PROGRAMS

1,000 HOUR BRUSH LIFE GUARANTEE

Outright Purchase & Exchange | Repair & Overhaul | Manufacturing & Engineering

NAASCO.com | 631.399.2244 | 631-399-2275 Fax | FAA Repair Station No. FD1R135K | EASA. 145.4687

CONTACTORS, RELAYS, TERMINAL BLOCKS | AC/DC MOTORS | ELECTROMECHANICAL | LIGHTING

CONTENTS

FRASCA PHOTO

FEATURES

WHERE'S MY ROTOR?

Subscribe or Renew at rotor.org/subscribe
Your two-year subscription to ROTOR is FREE.

Update My Mailing Address
Log into your rotor.org web account to update your mailing address, OR send updates to subscribe@rotor.org.

ROTOR

JUNE 2021 | VOL. 34 NO. 1

PUBLISHER
James A. Viola

EDITOR
Gina Kvitkovich

DEPUTY EDITOR
Christine A. DeJoy

GRAPHIC DESIGN
Phyllis J. Utter

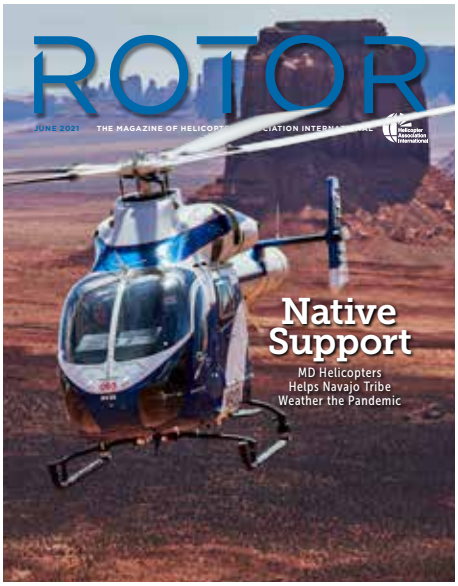
ADVERTISING
sales@rotor.org
703-683-4646

ROTOR (ISSN) 0897-831X is published quarterly by Helicopter Association International, 1920 Ballenger Ave., 4th Flr., Alexandria, VA 22314-2898.

Subscriptions: Visit rotor.org/subscribe to sign up for your FREE subscription.

Postmaster: Please send all address changes and correspondence to:

ROTOR®
1920 Ballenger Ave., 4th Flr.
Alexandria, VA 22314-2898
703-683-4646 | letters@rotor.org
www.rotor.org



ON THE COVER: For more than a year, MD Helicopters made weekly flights to bring equipment, PPE, and cleaning supplies to residents of the Navajo Nation, including trips to Monument Valley along the Arizona/Utah border, which is where aviation photographer Mark Bennett shot this image. Read more about how these missions helped isolated communities get through the coronavirus pandemic in Mark's photo essay on p. 46.

DEPARTMENTS/COLUMNS

WRITE FOR ROTOR

Got something to say to the international helicopter industry?
We're listening. Email story ideas, manuscripts, or questions to letters@rotor.org. Visit rotor.org/write for more information.

CONTRIBUTORS

QUESTIONS • REPRINTS • FEEDBACK • SEND TO LETTERS@ROTOR.ORG OR CALL 703-683-4646

Mark Bennett
Mark Bennett worked for McDonnell Douglas Helicopter/ Boeing for a decade, then in 1999 cofounded an aerospace-only marketing agency. With 30 years of photography and design experience serving the aerospace and defense industries, he founded AeroMark Images to shoot and write for both industry and media.

Jen Boyer
Jen Boyer is a 20-year journalism and public relations professional in the aviation industry, having worked for flight schools, OEMs, and operators. She holds a rotorcraft commercial instrument license with CFI and CFII ratings. Jen now runs her own public relations and communications firm.

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.

Jaasmin Foote
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 Jack Kenny
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.

Paul Koscak
Paul Koscak is a freelance writer and an aviator. He holds CFI, CFII, and MEI (multi-engine instructor) ratings and has 2,500 total flight hours. A former newspaper reporter and editor, broadcast journalist, and retired US Air Force Reserve officer, Paul recently retired from the US Customs and Border Protection's Office of Public Affairs.

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.

Thomas McKenzie
Thomas McKenzie is a retired US Coast Guard chief public affairs specialist with experience in Alaska; Washington, D.C.; New York City; the San Francisco Bay Area; and 42 other US locations. His final assignment was on the Coast Guard's National Strike Force Public Information Assist Team, a four-person crisis, emergency, and risk communications disaster-response unit.

Zac Noble
Zac Noble, HAI's director of 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.

Terry Palmer
With more than 25 years of experience in aviation safety and training, Terry Palmer has received many awards, including the 2010 HAI Salute to Excellence Safety Award. She serves on the HAI Training and Safety Working Groups and is working with SAFE Structure Designs and Southern Utah University on helicopter maintenance training initiatives.

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. Driven by her passion for public policy and advocacy, Emma is thrilled to start her career at HAI and has since developed a deeper appreciation for the vertical lift industry.

Congratulations
to the 2021 HAI Scholarship Winners

Bill Sanderson AMT Scholarship
Jeffrey Davis, John Doherty, Beth Elliott, Laura Fisher, Lillianna Sorensen, Teeratouch Triemasanchai

Commercial Helicopter Pilot Rating Scholarship
Hanna Santamaria

Maintenance Technician Certificate Scholarship
William Teigen

Michelle North Scholarship for Safety
Jessica Meiris

HAI offers up to 22 scholarships to support future helicopter pilots, maintenance technicians, and safety professionals:

- **Bill Sanderson Aviation Maintenance Technician (AMT) Scholarships** are awarded to up to eight AMT students, each of whom will attend a training course offered by select helicopter and engine manufacturers.
- **Commercial Helicopter Pilot Rating Scholarships** are awarded to up to four pilots who have their private licenses and are in the process of attaining their commercial rating.
- **Maintenance Technician Certificate Scholarships** are awarded to up to six students studying to become AMTs.
- **The Michelle North Scholarship for Safety** is awarded to a pilot who has already attained his or her commercial rating and who demonstrates an outstanding aptitude for safe flying and aviation best practices.
- **Southern Utah University (SUU) Rotor Aviation Scholarships** provide $20,000 toward the SUU Aviation commercial/instrument flight lab for up to three pilots who intend to complete their ratings up to CFI and to enroll in an SUU degree program.
- The **Women in Aviation International (WAI) Maintenance Technician Certificate Scholarship** is awarded to a student in training to be an AMT.

Helicopter Association International

2022 Applications Accepted Aug. 30 – Dec. 3 at rotor.org/scholarships

By Stacy Sheard

Telling Our Story

HAI is the voice for the global VTOL industry.

Stacy Sheard's aviation career began as a US Army Huey and Black Hawk pilot. After leaving the military to pursue a commercial flying career, Stacy flew in the charter, tour, news-gathering, air ambulance, and corporate aviation sectors; she was also a production test pilot for Sikorsky, a Lockheed Martin Company. Stacy is currently an AW139 corporate captain with Executive Jet Management/Fanatics. She was first elected to the HAI Board of Directors in 2016 and is the 2020–21 chair.

WATCH Stacy Sheard on RETAIN Act

IN THIS EDITION OF ROTOR, YOU'LL SEE A LOT OF DISCUSSION about an issue that HAI is taking very seriously: the decision by the US Federal Communications Commission (FCC) to allow telecommunications company Ligado Networks to operate on spectrum adjacent to the frequencies used by GPS and air-to-ground communications, causing interference that would make GPS and those comms channels unreliable.

If the paragraph above made your eyes glaze over, I completely understand. But put simply: the interference caused by Ligado Networks will endanger aviation safety.

On Wednesday, Jun. 23, HAI President and CEO James Viola and I participated in a press briefing organized by Sen. James Inhofe's office. There are plenty of others who oppose the Ligado plan, but Jim and I were there to share the perspective of the vertical lift industry. Our industry will be particularly hard-hit, as pilots conducting low-altitude missions will be closer to the Ligado towers and handsets that will be the sources of the interference.

The fight against the Ligado plan isn't over. But I have never been prouder to lead this organization than I was on that day.

As pilots, we are trained to focus on planning for the next flight and then on executing that plan to the best of our ability. And then we focus on planning for the flight after that and executing that one, and so on. In the day-to-day scrum of work and family, it's easy to lose sight of what we gain from our membership in HAI.

Some issues confronting our industry can seem remote or unlikely. After all, the FCC wouldn't really endanger the reliability of GPS, would it? But yes, it did. Is insurance for operators becoming prohibitively expensive, effectively limiting their ability to conduct business? Yes, it is.

This is why HAI is so necessary and why it's important to be an HAI member. It is the only organization that speaks for us and the international VTOL industry, that is dedicated to relieving our pain points.

I belong to several other aviation organizations, and I enjoy their particular emphasis. The Army Aviation Association of America does a great job of supporting the US Army aviation soldier and their families, and I try to do my part through my work in helping fellow veterans make a successful transition to the civil VTOL industry. Founded in 1955 by 13 female pilots who overcame great obstacles to pursue their love of flying helicopters, the Whirly-Girls is a historic organization that speaks to the determination of women to take our place in the right seat.

But there is only one organization that advocates for the global VTOL industry, that works to protect us from the fallout from overly burdensome regulations or uninformed policy decisions—and that's HAI. The important, lifesaving, essential services provided by our industry are put at risk when there is no one at the table speaking for us. And as HAI grows in membership, our voice with regulators and legislators will grow stronger.

By the time you read this, Randy Rowles will be the chair of this association, although I will continue to serve on the HAI Board of Directors. Thank you for giving me this chance to represent you as your 2020–21 board chair. I'm proud to be part of this industry and proud to be part of HAI.

2022

HAI HELI-EXPO

BY HELICOPTER ASSOCIATION INTERNATIONAL

March 7–10 • Dallas
Exhibits Open March 8–10

FIND THE FUTURE

EXHIBIT NOW

APPLICATION FOR SPACE IS NOW OPEN

LOTTERY 2

Open to all companies

APPLY BY **Aug. 20, 2021** WITH 50% PAYMENT

For information on how to upgrade within the Lottery, contact sales@rotor.org.

WATCH
Why Exhibit?

HELIEXPO.COM

By James A. Viola

Being in the Thick of It Creates Additional Risk

HAI is here to help.

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.

I HAVE SAID BEFORE AND IT BEARS REPEATING: HAI has a duty to protect the future of our industry by ensuring its safety. It's a duty we take seriously. We have faced threats to our safety and economic security before, but right now there is one that we are working hard to mitigate.

What would our modern VTOL industry be without satellites? Currently, the airspace where we operate is made safer by this industry's use of airwaves—the radio frequency spectrum in which GPS and satellite communications with the ground operate.

But a flawed decision by the US Federal Communications Commission (FCC) to accept a single company's plan could put all of that at risk. The Ligado Networks proposal seeks to establish a cellular network that uses the same block of airwaves used by GPS and satellites that support air-to-ground communications. Repeated testing demonstrates that the towers and handsets from this new network would interfere with GPS and satellite communications.

Interference in this case does not mean slower Wi-Fi or an occasional dropped cell phone call. It means less-safe rotorcraft operations, riskier airline travel, the disruption of critical weather monitoring and reporting systems, and the degradation of emergency communications. And it will be expensive.

HAI members operate right in the thick of it, at low altitudes, often in close proximity to flight obstructions and where there could be dense deployments of towers and potentially millions of Ligado handsets in operation. Aircraft could potentially experience repeated loss of GPS and air-to-ground communications, right when they need it most. This loss of navigational reliability caused by Ligado's plan would increase crew workload and significantly raise the risk of an air accident.

But beyond that, replacing GPS and satellite communications equipment will be expensive, driving up costs and erecting barriers to our industry's work in infrastructure, health care, agriculture, and public safety, to name

HAI President and CEO James Viola (second from left) and HAI Chair Stacy Sheard (second from right) listen as Sen. James Inhofe spearheads congressional opposition to the Ligado Order's negative impact on the reliability of GPS and satellite communications.

just a few of our missions. For the economically hard-hit industry sectors, this is an unacceptable additional burden.

For several years, HAI has worked with a large coalition of private companies and users of these systems, along with federal regulators and members of Congress, to preserve GPS and satellite communications. Yet the FCC ignored all of our concerns, instead prioritizing one company's commercial proposal.

Fortunately, HAI has found champions like Sen. Jim Inhofe, ranking member of the Senate Armed Services Committee (SASC), who agree with us. "When Ligado's effort to repurpose spectrum causes interference in the infrastructure of [critical] systems, as tests have shown it will, consumers and taxpayers can't afford the burden of updating countless systems," Mr. Inhofe has said. "That cost should only be borne by the responsible party: Ligado."

There is a bright spot to report. On Jun. 23, Sen. Inhofe introduced the Recognizing and Ensuring Taxpayer Access to Infrastructure Necessary for GPS and Satellite Communications (RETAIN) Act. This legislation would require Ligado to cover costs by all users who experience interference, including, but not limited to, costs for any engineering, construction, site acquisition, research, personnel or contracting staff, and labor associated with the replacement efforts.

The RETAIN Act is Sen. Inhofe's second legislative push against Ligado to emerge in the past week, following the SASC's version of the 2021 National Defense Authorization Act, which would slow the use of Department of Defense funds to support Ligado in any way and requests an independent technical assessment from the National Academies of Sciences and Engineering.

Given our concerns and advocacy on this issue, Sen. Inhofe's office invited HAI to participate in an event announcing the RETAIN bill's introduction. HAI Board Chair Stacy Sheard and I represented the industry and provided our perspective on how spectrum interference will impact vertical operations.

We will not let off the throttle and will continue to advocate for our industry on this and the myriad of other issues we face throughout the globe. In the meantime, keep in touch at president@rotor.org.

HAI/DAN SWEET

By Cade Clark, John Shea, and Emma Taylor

FCC Decisions Imperil Aviation Safety

HAI is working with industry partners to overturn, mitigate negative effects on GPS, radar altimeters.

CONGRESS HAS BEEN FOCUSED on passing pandemic aid packages and debating an infrastructure bill. However, we're less than 90 days out from a possible government shutdown. Congress doesn't seem too concerned; lawmakers seem already resigned to passing a continuing resolution (CR) to keep the government funded past September.

This is becoming a true talent. For over a decade, Congress has missed the Oct. 1 deadline and resorted to CRs to keep the government funded. Congress is particularly slow this year, so expect the CR punt to continue into December. Is it too soon to think about funding solutions as an early Christmas present?

HAI Members

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

While Congress tries to come to agreement on infrastructure, there are two important issues facing our industry: sustainability and spectrum. These issues can get highly technical, but bear with us. We hope by the end of this article, you'll have a better understanding of how these issues could directly affect you—and what you can do to influence the outcome.

Sustainability

The environment and climate change are top priorities for the Biden administration, and the aviation industry has made significant investments in technology to enable the reduction of its greenhouse gas (GHG) emissions. This type of proactive action by our industry is important, as we can then target workable solutions instead of waiting for regulators to develop possibly overly burdensome regulations.

Per the report of the Intergovernmental Panel on Climate Change, it's estimated that civil aviation contributes 2% of global CO_2 and 3% of GHG emissions. The single largest potential reduction in aviation's GHG emissions will come about through the broad adoption of sustainable aviation fuel (SAF). Produced from sustainable resources, SAF is a safe, approved substitute for Jet A or Jet A-1 and requires no changes to aircraft or fueling infrastructure. Compared with conventional jet fuel, SAF has the potential to reduce life-cycle GHG by up to 80%.

To help operators better understand SAF and its potential to reduce GHG emissions within the aviation sector, HAI is planning two HAI@Work webinars. The first, on Sep. 23, will provide operators with an understanding of the development, distribution, and usage of SAF. In the second webinar, scheduled for Sep. 30, representatives from the world's leading helicopter and engine manufacturers will talk about efforts to promote the development and use of SAF. (Webinar times and registration links are in the box at the top right.)

HAI is also a member of the Business Aviation Coalition for Sustainable Aviation Fuel (www.futureofsustainablefuel.com) and collaborates with other stakeholders in promoting SAF. HAI members themselves, such as Airbus, Bell, Bristow Group, Safran, and Pratt & Whitney, have recently released press statements on the work their company is doing to further promote SAF.

On Capitol Hill, a broad coalition of aviation interests has worked with Congress to introduce the Sustainable Skies Act, which proposes a blender tax credit for SAF to incentivize the production and use of low-carbon SAF. The legislation would establish a tax credit of $1.50 to $2.00 per gallon for SAF that achieves at least a 50% reduction in life-cycle GHG emissions compared with conventional jet fuel, with the precise amount of the credit linked to the SAF's GHG emissions performance.

Spectrum

HAI is also working on several issues related to the US government's management of the electromagnetic spectrum, or more specifically, interference with the L band, which is used by GPS units and satellite communications, and the C band, which is used by radar altimeters.

For a little background, the electromagnetic spectrum describes a range of radiation that surrounds us. Most of this radiation is invisible to our eyes, although it also includes visible light from any source. Parts of that spectrum were an untapped resource for most of human history. However, many essential modern technologies, including telecommunications, utilize the spectrum.

Have you heard that land is a good investment because they're not making any more of it? Well, that's also true for spectrum—there's a finite amount of it, and as we think of more and more ways to use it, including GPS, Wi-Fi, and cell phones, competition is fierce for room on that spectrum. In 2015, the Federal Communications Commission (FCC), which in the United States administers access to the spectrum, raised $44.9 billion by selling licenses for carriers to utilize the 1700 MHz and 2100 MHz blocks for mobile voice, data, and messaging services.

Recently, the FCC approved two controversial orders allowing cellular operations to expand in areas adjacent to spectrum vital to aviation. The first was granting a petition by Ligado Networks to build its cellular network next to GPS and satellite communications frequencies in the L band. The second, which we'll discuss below, was to auction spectrum to existing cellular companies in the frequencies used for radar altimeters in the C band.

GPS and Air-to-Ground Communications

When the Ligado cellular network becomes operational, GPS will face interference primarily from the thousands of Ligado base stations (towers), and air-to-ground communications through satellites will face interference from millions of Ligado user terminals (handsets), as shown in the graphic on p. 12.

Our industry is effectively getting hit twice by interference from Ligado: the towers could take out GPS, and the handsets could take out air-to-ground communications as pilots land and take off. Use of GPS is fundamental to the continued safe and effective operations of our industry, where false, missing, or delayed GPS data can result in a tragic accident. Disrupting communications during takeoffs and landings, which are critical phases of flight, could have similar consequences for flight safety.

Fourteen federal agencies—including the Department of Defense (DOD)—tried to intervene with the FCC to stop the approval of the Ligado plan. Disregarding all protests, the FCC proceeded with the plan, refusing to take full account of the diverse services in the L band that would be significantly impaired by interference, including those relied on by military, federal, and public safety users.

While the FCC is the lead agency for spectrum management, Congress is listening to arguments about ways to mitigate the risks imposed by the Ligado plan. In the National Defense Authorization Act for fiscal year 2021, Congress included language prohibiting the DOD from entering into contracts with companies whose operations would cause spectrum interference, unless the Secretary of Defense certified that such operations did not cause harmful interference. Furthermore, it required the operator of that network to pay for any damages to DOD GPS devices.

Sen. James Inhofe (R-Okla.) recently introduced the Recognizing and Ensuring Taxpayer Access to Infrastructure Necessary for GPS and Satellite Communications Act of 2021 (RETAIN Act) to address the cost impact of the Ligado Order on both the public and private sectors. The bill directs that the FCC Ligado Order shall not be effective until Ligado has reimbursed both the public and private sectors for the costs associated with the interference Ligado would cause.

You can read more about how HAI is working to highlight this threat to aviation safety in HAI Chair Stacy Sheard's From the Board article, on p. 6; James Viola's President's Message, on p. 8; and In the Spotlight, on p. 18, in which Ryan Terry of Lockheed Martin discusses the implications of the Ligado deal for operators and pilots.

Radar Altimeters

Impaired performance by radar altimeters is also a clear safety concern for our industry. Since 2017, the aviation

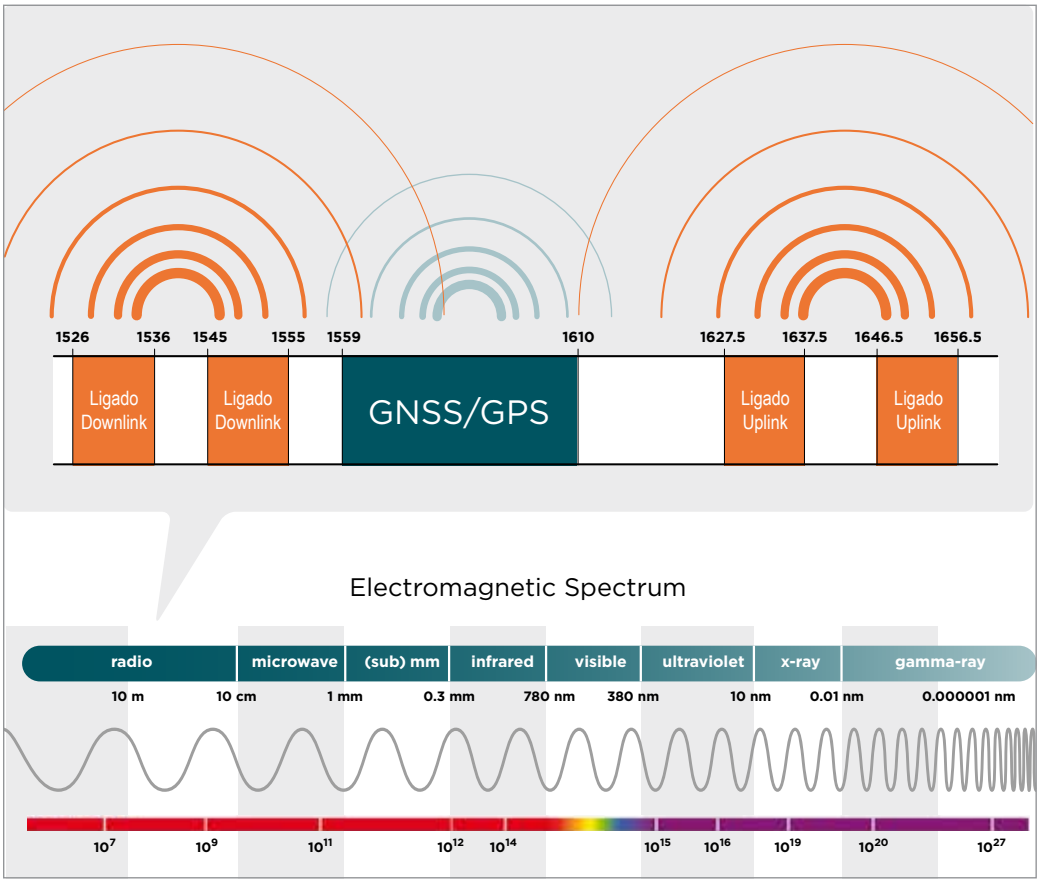
SAF: Learn More

- **Sustainable Aviation Fuel: On the Flightline**
  HAI@Work Webinar
  Sep. 23 | 4:00 PM eastern (UTC–4)
  Register at rotor.org/webinar
  beginning Sep. 17
- **Sustainable Aviation Fuel: CEO Roundtable**
  HAI@Work Webinar
  Sep. 30 | 4:00 PM eastern (UTC–4)
  Register at rotor.org/webinar
  beginning Sep. 24

WATCH
Sen. Inhofe on RETAIN Act

ADVOCATING FOR YOU

By Cade Clark, John Shea, and Emma Taylor



Ligado Networks Signals Will Interfere with GPS. The FCC approved Ligado Networks' request to operate in portions of the spectrum adjacent to that used by the US global navigation satellite system (GNSS), known as the Global Positioning System (GPS). Independent testing shows that the much-stronger Ligado signal will cause interference with the GPS signal. False, delayed, or missing GPS data could lead to helicopter accidents.

industry has consistently noted during the FCC rulemaking process that deployment of 5G networks in the C band may interfere with radar altimeters.

In April 2020, the Radio Technical Commission for Aeronautics (RTCA) formed a 5G task force to conduct a quantitative evaluation of radar altimeter performance regarding interference, as well as a detailed assessment of the risk of such interference occurring and impacting safety. This study used technical information supplied by the mobile wireless industry and radar altimeter manufacturers.

In a subsequent, October 2020 report, RTCA indicated that 5G networks operating in the C band pose a major risk for interference with radar altimeters on all types of civil aircraft. HAI, along with a large coalition of aviation organizations, petitioned the FCC to suspend allocation of C band spectrum to wireless companies, but this petition was denied.

The deployment of the 5G networks is expected to occur in December 2021. Without a reversal by the FCC, the aviation industry will bear the brunt of identifying—and paying for—the near- and long-term technical and operational solutions.

Helicopters are the category of aircraft most affected by 5G interference, and HAI is hard at work developing solutions and a path forward to blunt the effects of interference. John Shea, director of the Government Affairs team, is now the co-chair of the Technical Operations subgroup of the coalition, which is working to develop actionable mitigations to radar altimeter interference.

What You Can Do

As Congress gets more involved in the implications of FCC mismanagement of the spectrum, there is an important role you can play in advocating for our industry. This August, Congress will take its traditional month off for recess. Lawmakers will head home to visit with constituents—like you—and learn about issues important to those who voted them in.

The FCC actions that threaten dependable GPS and radar altimeter performance are a classic example of how decisions made by a government bureaucrat could turn your world upside down. It's our job—HAI's and yours—to explain that to our elected representatives. The more voices they hear from, the more they'll pay attention, particularly when those voices are from the people they have sworn to represent.

Commit now to reach out to your elected officials. During the August recess, invite them to your place of business, give them a tour, and show them all you do for the community. Discuss with them the real-world consequences of bad public policy.

Don't know where to start? Reach out to us at advocacy@rotor.org, and we'll gladly help you plan and connect with your lawmakers for a visit, including providing talking points that represent HAI's positions that will help our industry move forward.

FALCON CREST AVIATION SUPPLY

YOUR #1 CHOICE FOR SALES & SERVICE!

Falcon Crest Aviation Supply, Inc. exclusively distributes Concorde® starting and standby batteries recognizing them as the world leader in valve regulated lead acid battery technology. RG® Battery performance is dependable, with quantifiable time, service and cost savings over nickel cadmium and other lead acid batteries. Concorde's dependability is operationally proven by global militaries, fleets, and private owners.

Falcon Crest Aviation Supply holds Supplemental Type Certifications for installation of several Concorde Batteries on Sikorsky, Airbus Helicopters, MD Helicopters, Bell, and more. Our sales group will answer any technical questions to help protect your investment and keep you flying.

Contact us today! We are a stocking distributor and will specify the right battery for your rotorcraft.

Falcon Crest Aviation Supply, Inc.

8318 Braniff, Houston, TX 77061
713.644.2290 | 800.833.5422 | Fax 713.644.0356
www.falconcrestaviation.com

BRANCH LOCATIONS

San Antonio, TX 800-833-8229
Irvine, CA 888-304-8844
St. Charles, IL 800-481-1391
Lafayette, LA 800-327-6380
Englewood, CO 800-314-1185
Addison, TX 888-811-0012
Ft. Lauderdale, FL 877-404-8151
Atlanta, GA 888-451-7290

Visit HAI at
rotor.org/join

"HAI is our industry advocate; they need to hear from you so they know what to fight for and what is important to you as a pilot or organization."

– Grayson Barrows, repair station general manager

Helicopter Association International

JOIN HAI

FOR MORE THAN 70 YEARS, HAI HAS REPRESENTED ALL ASPECTS OF THE VERTICAL flight industry, promoting safety, professionalism, innovation, and economic viability.

Current HAI priorities include:

- Ensuring COVID relief for operators
- Advancing industry integration of unmanned aircraft systems and advanced air mobility aircraft
- Developing the global vertical flight workforce
- Strengthening safety collaboration within the international vertical flight industry

HAI BRIEFS

HAI Launches Virtual Event to Bring Together Vertical Aviation Buyers, Sellers

HAI IS PLEASED TO ANNOUNCE HAI Connect, an all-new, affordable way to help buyers in the rotorcraft industry efficiently evaluate new products and services—online.

At this virtual marketplace, which takes place Sep. 8–9, 2021, the vertical flight industry's leading manufacturers and suppliers will showcase and demonstrate their latest offerings and meet with potential buyers from around the globe in brief, prescheduled one-on-one appointments. In-depth panel discussions will round out the event.

"The concept is simple," says Charlotte Zilke, HAI's senior director of membership and conventions. "The easy-to-use platform connects operators and maintainers with manufacturers and suppliers, allowing them to schedule 20-minute online video appointments. We are also using this version of Connect to provide vendors the opportunity to conduct virtual product demonstrations both days."

Attendee Registration

Registration for HAI Connect attendees opens Jul. 12 and is free for HAI members and $95 for nonmembers. Look for more details in the coming weeks at rotor.org/events/2021-hai-connect. To become an HAI member or renew your current membership, contact HAI Membership at member@rotor.org. ➤

On Mother's Day this year, we told the tale of Kathryn Purwin and how she prevailed in raising her two children and stepping up as CEO of Helinet after the sudden death of Alan Purwin, her husband and the company's founder. Looks like she's not the only one who thinks she has "bad-ass mom skills"!

HAI ON SOCIAL

- YouTube /HelicopterAssoc
- /HelicopterAssoc
- /heliexpo @HELIEXPO #haiexpo22 /HeliAssoc @HeliAssoc
- /company/helicopter-association-international
- /HelicopterAssoc #haiexpo22

Vendor Opportunities

Interested companies can enjoy three ways to meet buyers from around the world at HAI Connect:

- As a **Connector**—use our portal to make prescheduled video appointments with potential customers.
- As an **Innovator**—in addition to using the portal for video appointments, take the opportunity to do a product demonstration or make a company announcement.
- As a **Sponsor**—optimize your brand's exposure at HAI Connect.

Limited space is available, so to learn more about our vendor opportunities, contact HAI Sales at kwhite@thewymancompany.com or 352-388-7031.

Schedule

HAI Connect will run from 9 am to 5 pm eastern (UTC-4) both days, Sep. 8 and 9. The full schedule is still being developed but will include appointments concurrent with product and service demonstrations in morning and afternoon sessions. A state-of-the-industry CEO panel discussion and a safety roundtable with rotorcraft industry professionals will be held midday Sep. 8 and 9, respectively.

More details about HAI Connect will be announced soon, so bookmark the event web page and check back regularly in the coming weeks to learn more.

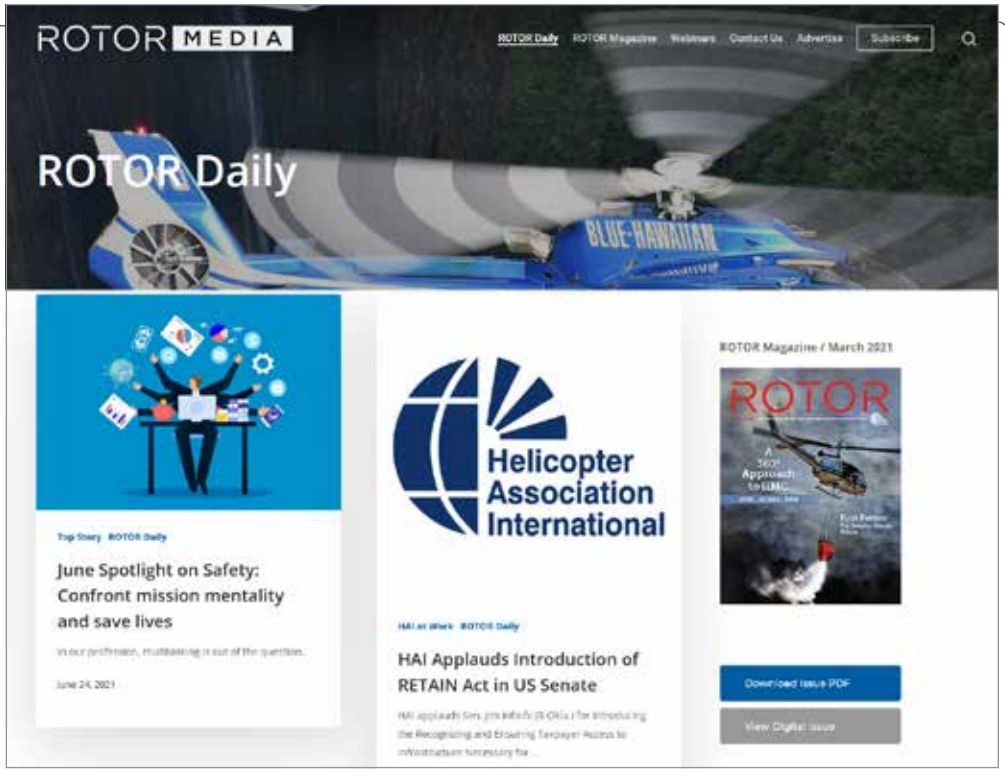
And be sure to save the date—Jul. 12, 2021—when registration to attend HAI Connect opens!

HAI BRIEFS

HAI Introduces ROTOR Media Website

WITH THE GOAL OF PROVIDING FASTER, MORE accessible news, features, and videos, HAI introduces the graphics-driven ROTOR Media website, rotormedia.com. HAI is also in the process of overhauling the organization's original, rotor.org website and offering new tools to prioritize content for HAI members.

First and foremost, the new ROTOR Media site



includes content from current and past editions of ROTOR magazine. It also serves as the story database for ROTOR Daily, HAI's daily news aggregator. Additionally, the new website features the weekly HAI@Work webinar series, where users can find the link to the next webinar and the archive of all past webinars, which are listed in chronological order.

"We wanted to make the site easy to use and provide robust content," says Dan Sweet, director of public relations and communications for HAI. "The new site provides all of our media content in one place and allows readers to enjoy the stories, images, and videos in the format they choose.

"While function was important, much of the credit for the design and appeal of the new site goes to Gina Kvitkovich, editor of ROTOR magazine and HAI's director of publications and media," adds Sweet. "She worked extensively with our web designer to make the site as graphically dynamic as ROTOR magazine, so the site is full of images and graphics, making it compelling and easily accessible to readers."

ROTOR magazine is available several different ways via ROTOR Media, providing readers with access to the content for consumption immediately or when they're offline. They can peruse the stories from the latest edition or skim through previous issues. Pilots and field crews who expect to be outside of mobile service or Wi-Fi range can download PDFs or a fully digital version of the magazine and read it at their convenience.

A redesigned ROTOR Daily also features prominently on the new website. Stories are available in chronological order, with the latest news posted toward the top of the page. Readers seeking articles on a specific subject can also click on various discrete story categories, accessing items published in that content area over the past two months. The ROTOR Daily eblast, available to subscribers each business day, also underwent a redesign, making the content more visually appealing and easier to view.

The HAI@Work webinar page is joining the ROTOR Media website and will be undergoing a redesign as well. Past webinars are currently provided in chronological order only. On the new site, users will also be able to search the webinars by subject.

"In the next few weeks, we'll introduce the new HAI (rotor.org) website, too," continues Sweet. "We're working through the process by 'chunking it.' We've already posted changes to the layout of the HAI HELI-EXPO® website and, now, we've unveiled the ROTOR Media site. The new rotor.org site will also feature revised menu structures for each HAI department, allowing visitors to locate the topics that are important to them more quickly."

Much of the two new websites will feature content accessible only to HAI members.

"Many other associations already limit access to their content to just their members," says Sweet. "We want our members to understand they have access to certain content that isn't available anywhere else. We'll continue to offer non-HAI members access to some restricted content without joining. Other sections will provide non-members a restricted view of the content and then offer them an opportunity to join HAI if they're interested in seeing more of the website."

HAI is also excited about our newest method of providing news and show services to everyone in the rotorcraft community: the ROTOR Now app, which is available for iPhones and Androids. The app serves as a hybrid of sorts, offering access to news and ROTOR magazine while also serving as the official show app for HAI HELI-EXPO. "Users can sign in to get the content of ROTOR Daily delivered as an RSS feed before the daily email is even distributed," says Sweet. "They can also access stories from ROTOR magazine or download the entire digital version if they prefer.

"Between the app and the new and revised websites, we're excited about these enhanced methods of communicating with everyone in the VTOL industry," adds Sweet. "Like all new launches, we might encounter a hiccup or two as we implement these new tools, but we're certain our members, readers, and visitors are going to enjoy these changes."

Ryan Terry, Director of Regulatory Licensing and Policy, Lockheed Martin Corp.

Unstable GPS and scrambled air-to-ground communications due to Ligado interference pose risks to aviation operations.

LIGADO NETWORKS, THE REBRANDED LIGHTSQUARED, ASKED THE FEDERAL GOVERNMENT FOR permission to repurpose its satellite spectrum licenses so they could be used for land-based mobile wireless broadband service. But users of the National Airspace System say Ligado's plan threatens to interfere with critical services, including GPS and satellite communications, that depend upon interference-free operations in the spectrum adjacent to the Ligado network.

As Ryan Terry, director of regulatory licensing and policy for Lockheed Martin Corp., explains, this issue is a threat to aviation safety, particularly to low-altitude operations.

Why does Lockheed Martin care about radio-frequency spectrum?

Terry: First and foremost, Lockheed Martin is committed to the safe, continued use of GPS and related infrastructure. We manufactured the most recent generation of advanced GPS satellites, GPS Block III. So we care about issues that impact users' access to GPS signals. That's why the Ligado issue is specifically relevant—testing has shown it's likely to interfere with that access.

GPS interference in low-altitude environments affects pilot workload, ADS-B, and other aviation functions used by aircrews for safety.

Lockheed Martin is also a leading manufacturer of fixed-wing aircraft and, of interest to your readers, a premier manufacturer of a variety of medium- and heavy-duty performance rotorcraft. We also manufacture and sell a host of unmanned aircraft systems (UASs).

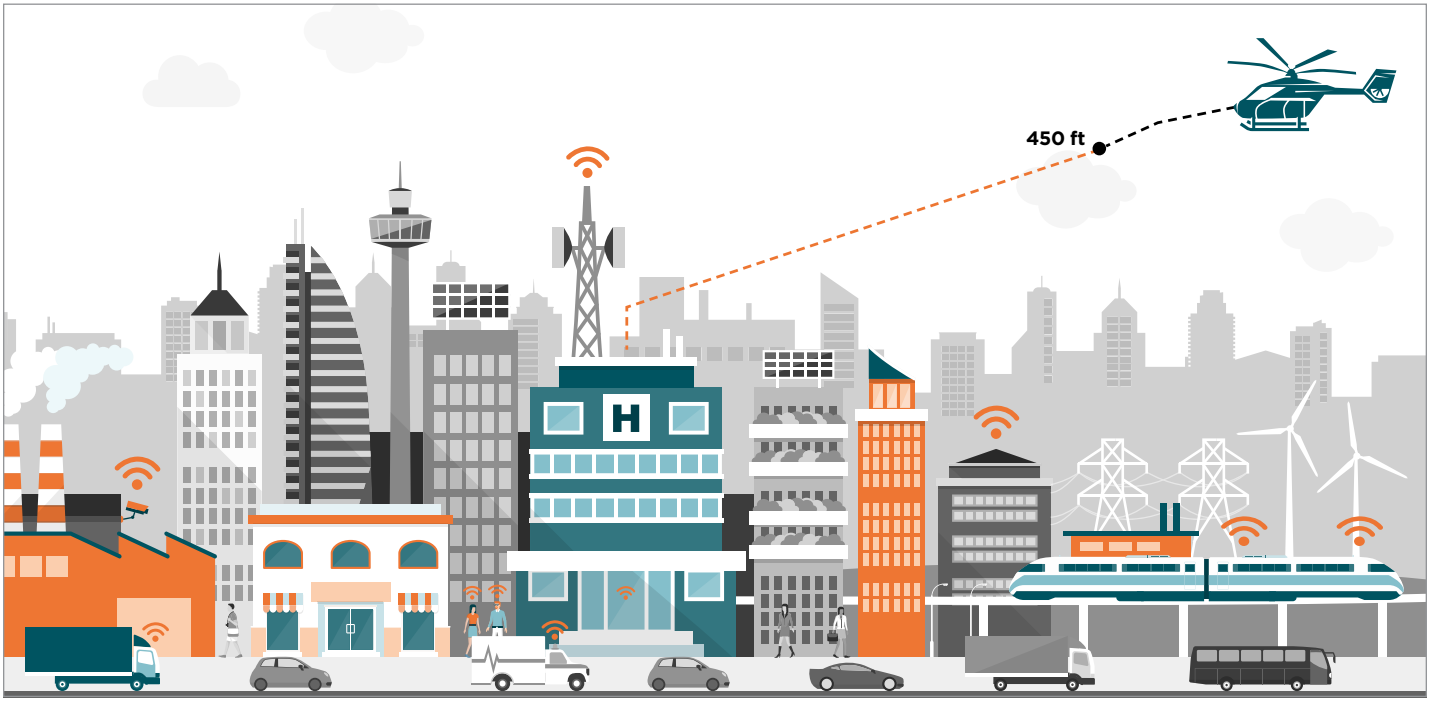
These aircraft all rely in some capacity on uninterrupted, predictable GPS signals for the safety of their operations, which routinely are conducted across some of the most challenging terrain and in fulfillment of critical missions. Predictable and uninterrupted GPS navigation is essential throughout all of these sectors.

We're also seeing the potential for the Ligado network to interfere with satellite communications between air-to-ground communications for these aircraft. Unstable GPS and scrambled air-to-ground communications: the combination isn't a good scenario.

What could be the impact if Ligado is allowed to proceed with its plans?

Ligado has said it will erect up to 20,000 cellular towers to build its network. Testing shows that cellular signals from those towers would interfere with aircraft operating FAA-certified GPS receivers. To mitigate this, the FCC is proposing a 250-ft. separation between Ligado towers and aircraft. But this isn't a workable solution, especially for low-altitude operators using helicopters and UASs. *[Editor's note: see the graphic above right for an example of how maintaining a 250-ft. distance from a Ligado tower isn't realistic for aircraft conducting low-altitude operations.]*

One major concern we have is the potential impact of this interference on helicopter terrain awareness and warning systems (HTAWSs), which are critical to determining location, particularly in harsh weather or low-visibility conditions. GPS interference in these low-altitude environments also affects pilot workload, ADS-B, and other aviation functions used by aircrews for safety while operating within 250 ft. of cell towers, which is often necessary in, for example, helicopter air ambulance operations.



Low-Altitude Aviation at Risk from Ligado Networks Interference. Many helicopter missions are performed at low altitudes or require pilots to land without airport navigation aids. Proximity to Ligado Networks towers and handsets dramatically increases interference with GPS and some air-to-ground communications, a particular concern during takeoff and landing phases of flight.

Beyond safety concerns, are there other costs to harmful spectrum interference?

GPS and satellite communications make up an expansive array of technologies and platforms that daily benefit users across the United States and, indeed, contribute to the US economy as a whole. In fact, the Department of Transportation (DOT)—and multiple users and industries—has noted that the types of GPS uses that would experience interference from the Ligado network include emergency response, commercial trucking, general navigation, high-precision instruments for surveying, machine control, scientific applications, precision agriculture, and timing signals.

Many GPS receivers have integrated antennas, and fitting them with new antennas could be extremely expensive. And because many receivers are integrated directly into the platforms without the ability to be accessed for replacement, retrofitting them is virtually impossible.

Why should rotorcraft owners and operators care about spectrum policy?

The Ligado issue is one use case that demonstrates a broader issue: spectrum policy is sometimes generated in a vacuum, and there's often not enough interagency coordination, particularly with the agencies and entities charged with public safety.

The FCC is an expert agency that deals primarily with communications—cellular towers and services, Internet access, wireline broadband equipment. As a result, the agency tends to treat all spectrum uses as just another communications tool. But issues like the interference caused by the Ligado network are actually about the compatibility between a communications network and a positioning, navigation, and timing (PNT) network, such as GPS.

The FCC doesn't historically have this in-house expertise; this expertise lives at the Department of Defense, DOT, and the FAA, among others—which is fine. But the FCC shouldn't treat spectrum use as solely a communications issue and not consult with other agencies, which is what happened in the Ligado Networks case. Fourteen other federal agencies went on record opposing this deal, but the FCC went ahead with it anyway.

What's next on this issue? What's next for spectrum policy generally?

On the Ligado issue, specifically, a bipartisan group of senators has introduced legislation that would address the costs to the private sector that would result from harmful interference with GPS and satellite communications. And the new FCC leadership will soon have the opportunity to address petitions to reconsider its decision.

Bottom line: spectrum is a resource that's taken for granted—until you no longer have access to it or it no longer works as it should. This is a lesson as to what we can expect when spectrum policy and aviation safety aren't aligned. And what we see here is that a well-informed spectrum management framework matters. Input from all the relevant stakeholders needs to be solicited and considered.

ROTORCRAFT EVENTS

2021

JUL. 20–22
15th Annual Electric Aircraft Symposium *(Virtual)*
CAFE Foundation and Vertical Flight Society
Learn more at vtol.org

JUL. 26–31
APSCON 2021
Airborne Public Safety Association
New Orleans, Louisiana, USA
Learn more at publicsafetyaviation.org
Visit HAI at Booth #807

JUL. 26–AUG. 1
EAA AirVenture Oshkosh 2021
Experimental Aircraft Association
Oshkosh, Wisconsin, USA
Learn more at eaa.org
Visit HAI at Booth #2023

AUG. 16–19
AUVSI Xponential
Association for Unmanned Vehicle Systems International
Atlanta, Georgia, USA
Learn more at xponential.org
Visit HAI at Booth #2608

SEP. 7–10
47th European Rotorcraft Forum *(Virtual)*
The Royal Aeronautical Society
Learn more at vtol.org

SEP. 8–9
HAI Connect *(Virtual)*
Helicopter Association International
Learn more at rotor.org/HAIConnect

SEP. 9–12
China Helicopter Exposition
Aviation Industry Corporation of China
Tianjin, China
Learn more at helicopter-china-expo.com

SEP. 14–15
FAA UAS Symposium *(Virtual)*
Federal Aviation Administration
Learn more at faauas.auvsi.net

SEP. 14–16
Business Aviation Virtual Exhibition & Conference
Asian Sky Group / Asian Sky Media
Learn more at asianskymedia.com

SEP. 17–19
Great Bend Airport Airfest 2021
Great Bend Municipal Airport (KGBD)
Great Bend, Kansas, USA
Learn more at greatbendairfest.com

SEP. 25
7th Annual Girls in Aviation Day
Women in Aviation International
Events hosted by local WAI chapters; online activities on Aviation for Girls app
Learn more at wai.org

OCT. 10–11
2021 Tax, Regulatory & Risk Management Conference
National Business Aviation Association
Las Vegas, Nevada, USA
Learn more at nbaa.org

OCT. 12–14
2021 NBAA Business Aviation Convention & Exhibition (NBAA-BACE)
National Business Aviation Association
Las Vegas, Nevada, USA
Learn more at nbaa.org

OCT. 26–27
41st Annual PA Aviation Conference
Aviation Council of Pennsylvania
Lancaster, Pennsylvania, USA
Learn more at acpfly.com

NOV. 3–5
9th Asian/Australian Rotorcraft Forum (ARF)
Vertical Flight Society and Nanjing University of Aeronautics and Astronautics
Location/format TBD
Learn more at vtol.org

2022

MAR. 7–10
EXHIBITS OPEN MAR. 8–10
HAI HELI-EXPO 2022

2022 HAI HELI-EXPO BY HELICOPTER ASSOCIATION INTERNATIONAL

Helicopter Association International
Dallas, Texas, USA
Learn more at heliexpo.com

HAI ONLINE
ACADEMY

Courses by industry experts for pilots, maintenance, and operators

BASIC BUSINESS MANAGEMENT AND LEADERSHIP COURSES

- The Foundations of Leadership
- The Leadership Journey
- Getting Back on Track
- The Mechanics of Effective Communication

rotor.org/academy

HAI Member Discounts on Online Courses!

AVIATION JOBS on ROTOR.ORG

In Partnership with JSfirm.com

Helicopter Association International | JSfirm.com

jobs@jsfirm.com | 724-547-6203


Alliance Bank

FlyOver

PHOENIX, ARIZONA | APR. 4, 2021
CHOPPERGUY ON YOUTUBE | ROBINSON R44
PILOT/REPORTER: BRUCE HAFFNER

PHOTO BY MARK BENNETT

WATCH MORE
Chopperguy

Helicopter Simulation Training: Should It Pay to Play?

Pilots benefit from flight simulation training, but lack of FAA flight credit inhibits its full potential.

By Jen Boyer

AS SIMULATED FLIGHT-TRAINING technology improves and becomes more affordable, the helicopter industry's training environment is evolving to embrace it. Insurance companies and helicopter operators increasingly require flight simulation in VFR and IFR training regimens. While the FAA does not provide credit for training in less sophisticated simulators, industry safety advocates strongly encourage every pilot to take advantage of any approved flight simulation technology for improved proficiency and safety.

Simulators Come Late to Helicopters

For decades, helicopter training was available only in the aircraft, limiting pilots' ability to maintain peak proficiency. Some maneuvers and procedures are simply too dangerous to simulate in flight, such as extreme unusual attitudes and full emergency procedures.

Pilots who only train in aircraft practice these maneuvers in theory. For instance, a pilot touches the handle, knob, or control that would be manipulated in the event of the emergency or talks through the procedure rather than actually making the flight input. However, in a true emergency, this type of training can leave pilots without the needed muscle memory or proficiency, as they never have actually practiced the maneuver.

Training in aircraft has other drawbacks. Hearing your pilot examiner announce that it's time to perform an autorotation is a very different experience than losing power in midflight, identifying the problem, and making the correct flight inputs, all in a matter of seconds. In a simulator, a scenario can be simulated, paused mid-action, and immediate feedback or correction given. A pilot can practice the same maneuver multiple times in rapid succession; there's no need to circle back to reposition the aircraft.

Airplane flight simulators became popular in the 1980s, with more than 300 in use by 1991. Yet, at the same time, helicopter simulators were available only in the military in the United States. While the technology was proving its value in Europe, it wasn't until the 1990s that the FAA began working on standards for helicopter simulators. Those that were approved were expensive full-flight simulators (FFSs) designed for large aircraft.

Editor's Note: In this article, we use "simulator" to describe any type of pilot training device that artificially re-creates various aspects of the flight environment. Please see "Simulator 101" on p. 26 for a comparison of the different types of simulators.

By the 2000s, little had changed. During the HAI Insurance Committee meeting at HELI-EXPO 2005, insurance underwriters cited the lack of simulator availability as the main reason for not requiring simulated flight training for helicopter pilots, despite requiring it for airplane pilots.

Simulator manufacturers at the time, however, were hesitant to make the costly research-and-development investment needed without helicopter OEM buy-in. Aircraft-specific data was needed to make accurate, realistic simulators. The industry focus turned toward developing strong relationships among simulation manufacturers and aircraft OEMs, with the goal of increasing access to flight simulator options. Simulated flight-instruction advocates encouraged OEMs and simulation technology manufacturers to share key manufacturing and flight data information that allowed simulators to accurately emulate cockpit layout and flight characteristics.

Meanwhile, the industry accident rate continued to be concerning. Safety advocates lobbied for more training, specifically in simulators, where full emergency procedures could be practiced.

Their voices were heard, to a point. In 2014, the US National Transportation Safety Board (NTSB) released Safety Alert SA-031, which recommended that helicopter pilots train in simulators. In the alert, the NTSB noted that in many of the accidents it investigated, "training in approved simulators could have provided pilots with additional knowledge and skills to handle in-flight emergencies and avoid maneuvering errors." The document emphasizes that "consistent, standardized simulator training will help prepare pilots for the unexpected and will decrease the risk of an accident." While the FAA didn't act on the alert, the insurance industry and many clients of helicopter operators—such as offshore oil companies—stipulated this training in contracts.

Industry flight-training consultant Terry Palmer, president of Pilot Landing LLC and chair of HAI's Training Working

HELISIM PHOTO

Simulator 101

There are three FAA-defined categories of simulation-based training devices currently used to provide flight simulation training. As simulators become more complex, they provide a more realistic training environment in terms of flight systems, visual displays, motion simulation, and cockpit environment.

Just as you look to buy the aircraft that most perfectly suits your mission requirements, you should invest in the simulated training environment that best suits your training needs. There is no one-size-fits-all solution.

Full Flight Simulators

The full flight simulator (FFS) is the most advanced type of flight simulation available to pilots and training institutions. An FFS has a motion base and includes a full replica of the cockpit of a specific make, model, and series of aircraft. All aerodynamics, flight controls, and systems must perform as the actual aircraft would in flight.

There are three levels of FFS available:

- FFS Level D: The highest level provides a motion platform capable of moving in all six directions, a visual system with a 180-degree view, and a number of motion, visual, and aural effects that enhance the realism of the cockpit environment.
- FFS Level C: This level has the same motion and visual capability as Level D but features fewer visual and aural effects.
- FFS Level B: This level has at least a three-axis motion platform and a visual system that responds to pilot input at a slower rate than the level C or D.

Flight Training Devices

A flight training device (FTD) is usually a nonmotion trainer that replicates a specific aircraft, including instruments, equipment, panels, and controls, in an open or closed flight deck. Some newer FTDs have a motion base. Research has shown that an FTD that provides even subtle motion or aural cues, such as vibration seats, can match the immersive experience offered by a more expensive FFS.

Aircraft-specific flight training devices are designated by numbers rather than the letters that correspond to full-flight simulators:

- FTD Level 7, the highest level, has an enclosed flight deck and a fully operational aerodynamic program with all helicopter systems operational. All controls and switches replicate the feel of the aircraft. The visual system must provide cross-deck viewing from both pilots' seats, and vibration cues enhance the realism of the training.
- FTD Level 6 is the same as Level 7 without the vibration cues.
- FTD Level 5 has at least one operating system, and the flight controls must be physical controls.
- FTD Level 4 has one operating system.

Aircraft Training Device

An aircraft training device (ATD) has a nonspecific cockpit. Significant developments in computer flight simulation and visual graphics capability have led to the increased use of ATDs in general aviation training. This evolving simulation technology provides effective training capabilities at reduced cost for flight schools.

Virtual Reality Simulation

The simulation industry is rapidly evolving, with manufacturers developing new technology that in some ways challenges current FAA-defined simulation levels, such as virtual reality. As these new devices come to market, more revolutionary and affordable options will help expand simulation training access.

Group, has been actively involved in promoting simulator training in the helicopter industry for more than two decades. One of the training industry's leading advocates, Palmer has an insider's view of the evolution of simulator training.

"Insurance companies respond to NTSB recommendations," Palmer says. "When the NTSB made the recommendation for training in simulators, the insurance companies finally put pressure on their customers, the helicopter operators, to use simulators. The operators then put pressure on the OEMs for better simulators, and it snowballed from there."

By this time, Level D full-motion full flight simulators (FFSs) were being used at several training locations. However, training time in these advanced simulators, which provide a high-fidelity experience in a full-size replica of a specific aircraft cockpit, has remained very expensive—sometimes twice the cost of training in the actual aircraft. Flight simulation was therefore rarely used beyond insurance or customer contract requirements.

Meanwhile, better computer flight simulation and graphics opened the door for less expensive flight training devices (FTDs): simulators that may or may not emulate a specific aircraft model and typically do not move, but that provide accurate instrument responses and flight controls to practice regular and emergency procedures. These less-sophisticated simulators, while not delivering the immersive experience of an FFS, provide all the advantages of simulation training—a way to accurately practice procedures and build correct muscle memory—at a lower cost. Helicopter OEMs and operators began working with simulator manufacturers to bring more FTDs to market and get them approved by the FAA.

Simulator Training Today

Today, most large helicopter operators, such as those supporting offshore energy production, government contracts, and helicopter air ambulance missions, provide annual or semi-annual simulator training for all pilots, some in FFSs and some in FTDs.

FRASCA PHOTO

Helicopter Association International

Salute to Excellence

Who Represents the BEST in Vertical Aviation?

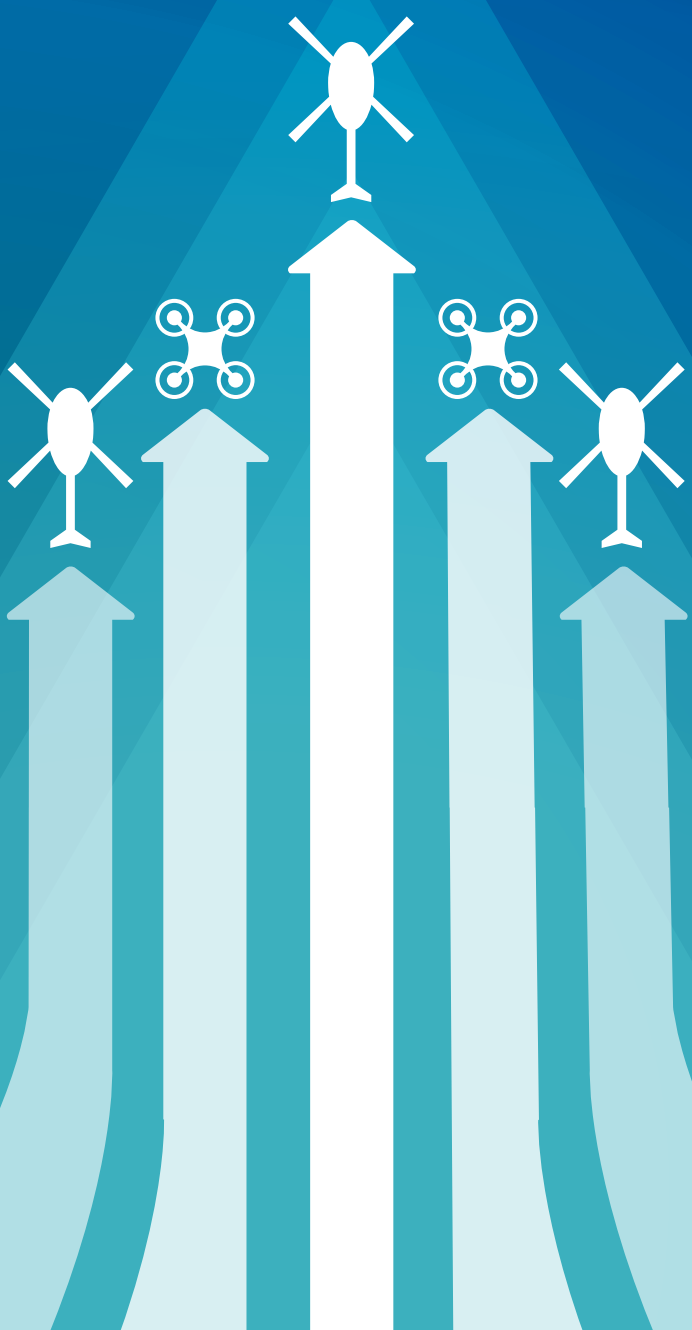
Nominate Him, Her, or Them for a Salute to Excellence Award

Nominate Today at rotor.org/salute

Nominations will close on Sep. 30, 2021.

The Salute to Excellence Awards recognize outstanding achievement in vertical aviation, and HAI has expanded them to include professionals in the helicopter, UAS, and VTOL industries.

Anyone may submit a nomination, and anyone may be nominated. Visit rotor.org/salute to see the award criteria, and nominate an exceptional individual or organization today!



2022 HAI HELI-EXPO
BY HELICOPTER ASSOCIATION INTERNATIONAL

The 2022 Salute to Excellence Awards will be presented at HAI HELI-EXPO 2022 in Dallas, March 7–10 (exhibits open March 8–10).

As a direct result of their customers' increased demand for simulator training, helicopter manufacturers have stepped in with their own simulator-equipped training centers. Offerings range from FFS-focused instruction to a variety of technologies that include FTDs.

Earlier this spring, Leonardo unveiled its new training center in Philadelphia, featuring three Level D FFSs, three virtual interactive procedural trainers (VIPTs) that simulate cockpit controls and avionics systems, and two FTDs. With the opening of the Leonardo training center, all helicopter OEMs in North America now offer simulator training.

Of all the OEMs, Bell operates the most FTDs in the United States. In addition to the Level D FFSs at its training academy in Fort Worth, Texas, Bell operates Level 6 and 7 FTDs to represent the company's light aircraft. Airbus Helicopters in Grand Prairie, Texas, built a new training center to house the first H145 and H175 Level D simulators in North America. This adds to Airbus's FTDs for its EC135 and H125 aircraft. (Please see "Simulation Training Resource Guide" on p. 29 for a list of simulation opportunities.)

"The OEMs realize their customers require simulator training for their pilots to safely operate the aircraft," Palmer says. "Access to an affordable simulator is now a part of the buying decision. If you don't have a simulator in-country, you could lose the sale to a competitor. At the same time, operators have not only accepted the value of simulator training for their own training regimen, but they also recognize the technology has improved to the point where they don't need the $20 million Level D simulators to achieve their training goals."

And the OEMs aren't the only game in town. Established flight simulation companies such as Frasca and Redbird have invested in developing more affordable FTDs with high-fidelity imagery and accurate aircraft responses, and many companies have begun purchasing their own FTDs.

Med-Trans Corporation of Denton, Texas, used to outsource simulator flight training by sending pilots to a third-party FSS. However, Level 7 FTDs provide high-value training at a fraction of the cost of sending pilots to a third-party FSS, prompting Med-Trans to purchase its own Frasca Bell 407GX Level 7 FTD, bringing its pilot simulator training in house. Each Med-Trans pilot trains three times a year, including one multiple-day training in the FTD.

"We are absolutely happy with the device," says Mike

Frasca has worked closely with OEMs and operators to deliver the next generation of flight training devices for the industry, offering very realistic experiences and training environments at a significant savings over Level D full flight simulators.

FRASCA PHOTO

Simulation Training Resource Guide

Below is a list of some training centers and flight schools that offer simulation training. Simulator manufacturers are also listed.

FRASCA PHOTO

TRAINING CENTERS

Coptersafety

Finland | coptersafety.com

Certifications
- EASA
- FAA – in process

Simulators
- AW139 Level D
- H125 Level D
- H145 Level D
- AW169 Level D
- Coming soon: AW189 Level D

Additional Services
- Full courses, including aircraft-specific, IFR, human factors, night-vision goggles
- Custom courses and dry leasing available

FlightSafety

UK, USA | flightsafety.com

Certifications
- EASA
- FAA

Simulators
- AS350 Level D
- AW139 Level D
- Bell 212 Level D
- Bell 407 GPX Level D
- Bell 412 Level D
- Bell 430 Level D
- EC130 Level D
- EC135 Level D
- EC145 Level D
- S-70 Level D
- S-76 Level D
- S-92 Level D

Flight Training Devices
- BH206
- BH407

Additional Services
- Full courses, including aircraft-specific, IFR, human factors, night-vision goggles
- Dry leasing available

HeliSim (Airbus, Thales)

France, USA | helisim.fr

Certifications
- EASA
- FAA

Simulators
- AS332 Level D
- AS350 B3 Level B
- H145 Level D
- H155 Level D
- H175 Level D
- H225 Level D
- NH90 Level D
- Coming soon: H160 Level D

Flight Training Devices
- AS332
- AS365
- EC135
- EC145
- H225

Additional Services
- Full courses, including aircraft-specific, IFR, human factors, night-vision goggles
- Custom courses and dry leasing available

Bell Training Academy

Spain, USA | bellflight.com/support-and-service/training

Certifications
- EASA
- FAA

Simulators
- Bell 407 Level B
- Bell 429 Level D
- Bell 525 Level D

Flight Training Devices
- Bell 206
- Bell 407
- Bell 412
- Bell 429
- Bell 505

Additional Services
- Full courses, including aircraft-specific, IFR, human factors, night-vision goggles

Leonardo

USA, Italy | leonardocompany.com/en/customer-support/elicotteri-helicopter/training-solutions/rotorsim

Certifications
- EASA
- FAA

Simulators
- AW109 Level B
- AW139 Level D
- AW169 Level D
- AW189 Level D
- Coming soon: AW609 Level D

Flight Training Devices
- AW109
- AW119
- AW139
- AW09 (formerly Kopter SH09)
- AW609

Additional Services
- Full courses, including aircraft-specific, IFR, human factors, night-vision goggles

FLIGHT SCHOOLS

Colorado Heli-Ops

Broomfield, CO, USA | coloradoheliops.com
- Elite advanced aircraft training device
- Full courses using aircraft and simulation
- Simulation supported pilot training

Hillsboro Aero Academy

Hillsboro, OR, USA | flyhaa.com
- Frasca advanced aircraft training device
- Full courses using aircraft and simulation
- Simulation-supported pilot training

SIMULATOR MANUFACTURERS

CAE

cae.com/civil-aviation
- Level D simulators

Elite

flyelite.com
- Advanced aircraft training devices

FlightSafety

flightsafety.com
- Level D simulators

Frasca

frasca.com
- Advanced aircraft training devices
- Flight training devices
- Level B simulators
- Level D simulators

Redbird Flight Simulations

simulators.redbirdflight.com
- Advanced aircraft training devices

Thales

thalesgroup.com/en/activities/market-specific-solutions/training-simulation
- Flight training devices
- Level D simulators

TRU

trusimulation.com
- Flight training devices
- Level D simulators

VRM Switzerland

vrm-switzerland.ch
- Virtual reality training devices

LaMee, Med-Trans director of operations. "You can't simulate an engine fire or get engine gauges to show oil temp high or loss of oil pressure in an aircraft. With a simulator, you can. It goes beyond learning emergencies academically. You can see the real indications you would experience in a situation.

LaMee goes on to say that offering in-house simulator training provides additional benefits. "We've gotten overwhelmingly positive feedback from our pilots, not just in the training and experience, but also in the connection our pilots make coming to the headquarters. This gives us the opportunity to engage with everyone in the 25 states where we operate."

Med-Trans Corp. is one of three global medical response (GMR) companies that own and operate Level 7 FTDs from Frasca. The other two are AirEvac Lifeteam of O'Fallon, Mo., and Guardian Flight in South Jordan, Utah. All three FTDs include cueing—some movement to give the pilot the sensation of change in direction in a 3D space—yet take up only a small portion of space compared to an FSS.

"We wanted to increase our training capabilities, so we looked at adding the FTD. I can say we are in a much better training situation now with it. These really are tremendous devices," says Tink Sullivan, AirEvac Lifeteam's chief aviation simulator operator and pilot trainer. "The visuals are spectacular. The movement is very realistic—it's given me the leans."

Newcomers to flight simulation manufacturing are also increasing opportunities with out-of-the-box thinking. VRM Switzerland received approval in April of this year from the

In response to customer demand, helicopter OEMs are offering increased simulator access as an incentive to purchase a helicopter. Leonardo's new AW139 FFS (pictured) is a part of the OEM's new US Training Academy.

LEONARDO PHOTO

European Union Aviation Safety Agency (EASA) for its Robinson R22 virtual-reality training device, the first approval by the agency for such a product. With its EASA flight and navigation procedures trainer (FNPT) II certification, the device can be used for credit toward European private and commercial helicopter licenses. The company plans to obtain FAA certification for this and several other model-specific devices in the works.

The Big Hurdle

VRM Switzerland's recent EASA certification highlights a major hurdle that continues to limit simulator training across the US helicopter industry: the lack of FAA credit for simulator use in VFR training and currency. IFR training and recurrency is already accepted by the FAA for multiple types of training devices, yet VFR credit remains out of reach.

"Safety advocates and simulator training providers have done a great job of educating the industry to understand the importance of simulators, with an emphasis on Level D simulators," Palmer says. "But you don't need the expensive full-motion simulators to practice and train for many emergency maneuvers and situations. The push now is for more FTDs and to make simulator training more affordable for all operators."

While individual operators may provide simulator training for their pilots, convincing the rest of the pilot population to pay out of pocket to access this technology for training and proficiency remains an uphill battle without FAA credit. "To ensure everyone is using them to increase their safety, we need the FAA to recognize their value and offer training and recurrency credit in FTDs," says Palmer.

Tim Tucker, former chief flight instructor at Robinson Helicopter Co., FAA designated pilot examiner, and industry safety advocate, agrees. "The only way simulator technology will take hold is if the FAA grants credit for simulator use, whether it be in initial training, recurrent training, or reviews," says Tim Tucker, "Otherwise, you're just relying on people's safety attitudes."

Today's simulator technology has become so advanced, Tucker says, that it provides very realistic opportunities for VFR pilots to practice maneuvers and emergency procedures that are just too dangerous to fully perform in an aircraft.

"When you can practice something properly that you can't do in the aircraft, there's considerable value there," Tucker says of simulators. "For helicopters, that's instrument training, because most training helicopters can't actually fly in instrument meteorological conditions or safely execute some high-risk emergency procedures such as low-G recovery, engine failure, or tail-rotor failure."

Although simulator training for inadvertent IMC (IIMC) is widely endorsed by some safety advocates, Tucker doesn't advocate this training for non–instrument-rated pilots who fly non–instrument-certificated aircraft.

"When it comes to IIMC, that's where my opinion differs," Tucker says. "For non–instrument-rated pilots, I'm against discussing and practicing what to do if you get into inadvertent IMC. For many pilots, that doesn't work. I'm more for teaching people how to stay away from getting anywhere near that situation. Certainly, you can teach avoidance in a simulator."

Tucker is excited by the EASA approval of the VRM Switzerland simulator. He sees it as being almost on par with a Level D FFS, which opens the door for new pilots to embrace realistic simulation training from the beginning of their schooling. This is the first device to closely resemble the world's most popular training aircraft, the R22.

"To have that for a Robinson is pretty incredible," Tucker says. "It shows that the quality of VFR simulation is getting better, better, and better. It truly can have a positive impact in training."

"Access to an affordable simulator is now a part of the buying decision. If you don't have a simulator in-country, you could lose the sale to a competitor."

—Terry Palmer, president, Pilot Landing

Without FAA credit for VFR simulator training, however, Tucker and Palmer believe this technology can't reach its full potential to save lives. Currently, the US training system incentivizes aircraft time over training value. Pilots' investment in simulator time does nothing to help them achieve the minimum aircraft hours needed to achieve a license or rating. Without the incentive of credit for simulator use, pilots scraping to afford their education can't or won't regularly choose sim training, Tucker emphasizes.

How much time a pilot chooses to train using simulated flight training technology after receiving a rating, license, or check out in a new aircraft really depends on the pilot's experience and skill, Tucker says. Practicing emergency procedures an hour or two in a top-level FTD twice a year would be very valuable for all pilots, as even the highest time aviators can get rusty. Tucker recommends using these devices more often, perhaps even quarterly, if you're a low-time pilot or fly only a few hours a month.

"The key is you're able to do things in a sim that you can't do in the aircraft," Tucker says. "Therefore, the simulator becomes valuable at every pilot skill level."

VERTICAL AVIATION SAFETY TEAM

By Gina Kvitkovich
and Thomas McKenzie

Refocused Industry Safety Program Includes All Vertical Aviation Aircraft

VAST provides global forum for sharing safety data, information, initiatives.

GLOBE COMPOSITE IMAGE: HAI/PHYLLIS UTTER; PHOTOS: LEFT, HAI/KEVIN CARTER; CENTER-TOP, WISK AERO; CENTER-MIDDLE, HAI/LAGNIAPPE STUDIOS; CENTER-BOTTOM, ISTOCK/PAKHNYUSHCHYY; RIGHT: HAI/GREGG DEACON

THERE'S A NEW FORCE IN AVIATION safety: the Vertical Aviation Safety Team (VAST; learn more at vast.aero). The International Helicopter Safety Foundation recently re-formed under a new charter, with a vision of achieving through cooperation and collaboration a global vertical aviation community with zero fatal accidents.

VAST will act as an essential hub for the vertical aviation community worldwide. By breaking down the artificial silos that exist between the helicopter, unmanned aircraft systems, and autonomous vertical lift aircraft and various mission sectors, such as offshore, air ambulance, and firefighting, VAST will enhance the exchange of safety data, information, and initiatives from the global vertical aviation community, collecting, harmonizing, and disseminating contributions from all of the many stakeholders in vertical aviation safety:

- Regional safety teams in Europe, the United States, Canada, Mexico, Brazil, India, and Japan, among others
- Industry associations such as HAI, the European Helicopter Association (EHA), and the New England Helicopter Council
- Mission-oriented groups, such as HeliOffshore, the Tour Operators Program of Safety, and the Airborne Public Safety Association
- Manufacturers and other vendors and suppliers to the industry
- Operators and the vertical aviation workforce.

VAST Improvement

To understand how VAST can address industry safety, it's necessary to see what preceded it. In 1997, the White House Commission on Aviation Safety and Security set a 10-year goal to reduce the US fatal aviation accident rate by 80%, while identifying the need for strong government–industry partnerships to support the aviation systems of the future.

The resulting Commercial Aviation Safety Team (CAST) focused its data-driven safety efforts on US Part 121 air carriers, with stunning success. From 1998 through 2008, the team's efforts reduced the fatality risk in this aviation sector by 83%.

In 2006, the international helicopter community created the International Helicopter Safety Team (IHST), with a goal of reducing the worldwide helicopter accident rate by 80% in 10 years. Three basic principles of the CAST model were retained to guide the new organization:

- Safety improvement recommendations should be based on accident data
- Safety improvement recommendations should be implemented so as to produce measurable results that can be evaluated for effectiveness
- Stakeholders from that region's helicopter community should lead the data analysis and resulting safety improvement efforts.

In other words, the IHST relied on regional helicopter safety teams to shape data-driven safety initiatives in their respective areas. The IHST was chartered as a foundation in 2019, becoming the International Helicopter Safety Foundation (IHSF).

The IHSF/IHST has accomplished many of its goals. Regional helicopter safety teams were begun, and many countries and regions in the world have seen a decline in helicopter accident rates.

However, the international rotorcraft industry is on the verge of a dramatic expansion. When the IHST was founded in 2006, advanced air mobility was just a futuristic concept and the FAA had only just begun issuing the first commercial drone permits. As of Jun. 15, 2021, the number of registered commercial drones was 358,137, many of them for vertical lift aircraft. And, as shown by the Leonardo AW609, Sikorsky S-97 Raider, and Bell V-280 Valor, technological innovation is occurring in more traditional rotorcraft as well.

The word "helicopter" is no longer large enough to hold all the types of rotorcraft. It was time to build a bigger tent. To expand its efforts to enhance worldwide safety in all areas of the vertical takeoff and landing (VTOL) industry, the IHSF organized under a new charter and in 2021 became VAST.

Regional Safety Teams

One thing that won't change with VAST is the importance of the regional safety teams. These teams of volunteers and other stakeholders in a particular country or region will continue to lead initiatives in their respective areas, with Brazilians in charge of creating safety programs for Brazil, Europeans working to address their local issues, and so on.

However, VAST was created in part to ensure that the regional teams can easily share safety data, information, and initiatives in a central location, an approach that makes more efficient use of safety resources. "The real work will continue to reside within the regional safety teams and global VTOL safety stakeholders," says Chris Hill, former manager of aviation safety for the US Coast Guard and currently HAI's director of safety and a member of the steering committee of the US Helicopter Safety Team (USHST). "If they're doing something to enhance safety in our industry, not only do we want them to keep doing it, but we want to provide them with the mechanism to propagate that information across the globe more efficiently."

VAST Advisors and Partners

Below are some of the organizations that will partner with VAST to improve global VTOL safety. If your organization would like to join them, please contact info@vast.aero.

VAST Advisors

VAST's two advisors are Regional Safety Team Representative Miguel Marin, ICAO, and Industry Representative James A. Viola, HAI.

Miguel Marin
Regional Safety Team Representative

James A. Viola
Industry Representative

Regional Safety Teams

These teams, which are composed of stakeholders from regional industry and civil aviation and safety authorities, work to improve the safety of civil VTOL operations in their respective regions.

Asia-Pacific
- Asia-Pacific Helicopter Safety Team (AHEST)

Brazil
- Brazilian Helicopter Safety Team (BHEST)

Canada
- Helicopter Association of Canada (HAC)

Chile
- Asociación Chilena de Helicópteros (ACHHEL)

Europe
- European Safety Promotion Network Rotorcraft (ESPN-R)

India
- Rotary Wing Society of India

Mexico
- HST México

Middle East and North Africa
- Global Humanitarian Aviation (GHAO)

New Zealand
- New Zealand Helicopter Association (NZHA)

United States
- US Helicopter Safety Team (USHST)

Other Global VTOL Stakeholders

In addition to regional safety teams, VAST works with other stakeholders that are working to improve global vertical flight safety, including various industry and regional associations.

Agricultural Application
- Canadian Aerial Applicators Association
- National Agricultural Aviation Association (US)

Air Tours / Sightseeing
- Tour Operators Program of Safety (US)

Business Aviation
- National Business Aviation Association (US)
- Southern California Rotorcraft Association (formerly the Professional Helicopter Pilots Association)

Emergency Medical Services
- National EMS Pilots Association (US)

Firefighting
- American Helicopter Services and Aerial Firefighting Association

General Aviation
- Association for Promotion of Helicopter Industry, Japan
- Australian Helicopter Industry Association
- Brazilian Helicopter Pilots Association
- British Helicopter Association
- Commercial Aviation Association of Southern Africa
- European Helicopter Association
- Helicopter Association International
- Helicopter Industry Association (Russia)

Instruction/Training
- National Association of Flight Instructors (US)
- Society of Aviation and Flight Educators (US)

Law Enforcement
- Airborne Public Safety Association (US)

This list is accurate as of Jun. 15, 2021.

Loreto Moraga, chair of the Chilean national helicopter association, Asociación Chilena de Helicópteros (ACHHEL), since 2018 and an attorney specializing in aviation and space law, has been working in the VTOL industry for 15 years as a legal counsel. In her ACHHEL role, Moraga coordinates statistical analysis of Chilean rotorcraft operations and collaborates with the Chilean civil aviation authority while serving as a local point of contact with VAST.

VAST will "allow us to move forward more efficiently by hosting a lot of the material generated by other teams that we can adopt and adapt directly to our environment," says Moraga. "This implies an enormous cost savings, a relevant issue in smaller markets like ours where financing safety activities is difficult. Likewise, VAST will allow us to avoid duplication with other stakeholders. We will be able to transmit a much more coherent and consistent safety message to the entire industry."

VAST has already changed ACHHEL's perspective. "We learned that we needed to redirect our safety efforts to the real risks and not intuitive ones, leaving behind several myths," Moraga says. Access to the VAST network of global safety stakeholders "will allow us to advance quickly to a stage of contribution, including the possibility of extending our safety advocacy within Latin America."

"In safety, cooperation among all stakeholders is key, and VAST is the future of vertical aviation cooperation."

Michel Masson, senior safety promotion officer for the European Union Aviation Safety Agency (EASA) and a European Safety Promotion Network Rotorcraft (ESPN-R) coordinator, sees VAST as a natural evolution in global safety. "We believe in the exchange of good practices and the benefits of sharing experience," Masson says. "This collaboration has taken different forms and has had different names since I started with EASA in 2006, but the spirit of working in partnership to improve safety has remained a constant."

The new organization will also further EASA's goals. "VAST builds on the IHSF and is fully compatible with the priorities set out in the EASA *Rotorcraft Safety Roadmap*, which aims to reduce accidents by 50% between 2019 and

The VTOL industry is experiencing a rapid expansion in aircraft types, with the Leonardo AW609 tiltrotor (top right) in production. Joby Aviation has entered into agreement with the FAA on the certification requirements for its eVTOL aircraft (bottom right). Other aircraft, such as compound helicopters, are also in development.

2029, and expands its scope to vertical aviation," Masson says. "In safety, cooperation among all stakeholders is key, and VAST is the future of vertical aviation cooperation."

Nick Mayhew is the USHST industry co-chair and a longtime safety advocate for the helicopter industry. He points to the successful 56 Seconds to Live program as an example of how VAST will enable the sharing of safety resources.

The 56 Seconds program launched with a short video illustrating how quickly a helicopter pilot can experience spatial disorientation after unintentionally entering instrument meteorological conditions (UIMC, also known as IIMC). Since premiering in February, the video has nearly 28,000 views on YouTube. The program also provides pilots with resources to help them avoid or recover from UIMC, including an online course showing how different choices by the pilot in the 56 Seconds video would have affected the outcome.

"We're eager to share this suite of safety products with the worldwide safety community, and we are already talking to VAST about that," says Mayhew. "The USHST volunteers worked hard to create these resources that raise pilots' awareness of the dangers of UIMC and then give them the tools to avoid, recover from, and train for it. Flying into degraded visual environments is a safety issue for pilots all over the world, so why shouldn't we make these research-based safety tools available to them?"

TOP: LEONARDO PHOTO; BOTTOM: JOBY AVIATION PHOTO

Helicopter Association International

HAI **CONNECT**

Bringing the Vertical Aviation Industry Together

Virtual Event | September 8–9, 2021

9:00 AM – 5:00 PM eastern (UTC-4)

Free to HAI member attendees
$95 nonmember attendees

HAI Connect is an all-new way to help buyers efficiently evaluate new products and services. Industry panel discussions and vendor demonstrations are combined with brief, prescheduled one-on-one appointments for an informative, economical experience for all participants.

Visit **rotor.org/HAIConnect** to learn more about reserving your company's portal for presentations and video appointments with buyers, or contact **kwhite@thewymancompany.com**.

Register NOW to reserve your HAI Connect meetings with manufacturers and suppliers at

rotor.org/HAIConnect

VAST provides a global approach to VTOL safety, which is needed in an industry performing diverse missions around the world. Above left, residents of Morutshe, Botswana, say goodbye after the monthly visit of a helicopter bringing pensions, mail, and news to their remote village. Above right, a French utility worker repairs cable with the help of an AS332.

VAST Organization

VAST has already begun to formalize its leadership positions and advisory roles for participating organizations and individuals. The foundation has been laid with the organization's charter, revealing another way in which VAST differs from the IHST/IHSF.

James A. Viola, HAI's president and CEO, and Miguel Marin, operational safety chief for the International Civil Aviation Organization, have stepped up to oversee the new organization—Viola as the industry representative and Marin as the representative of the regional safety team. The two played major roles in both drafting the VAST charter and deciding the initial direction the organization will take.

"As a practical matter, safety is operationalized as part of everyone's daily work. VAST will support the work of the regional safety teams and other stakeholders who concentrate their efforts to help those on the flight line, in the cockpit, and on the shop floor," says Viola. "At VAST, our role is to enable those teams and stakeholders to communicate and collaborate. I want VAST to become the trusted source for information about VTOL safety across the globe."

The drive for collaboration on safety is supported by data. "Aviation has always been a global enterprise, and analysis of vertical flight accidents demonstrates that they share the same causal factors, regardless of borders or language," says Marin. "Through VAST, we will share the modern, data-driven approach to safety with areas that currently lack a regional team. VAST volunteers are already in discussions to set up a regional team for South Africa, and I hope that more will follow."

The organizational structure of VAST is deliberately flat: Viola and Marin serve as advisors, not executives. A steering committee comprising liaisons to the regional safety teams and other global VTOL stakeholders will set priorities, and HAI staff will carry out some administrative and communications functions.

VAST Projects

In addition to its support for regional teams, VAST is looking at several areas where a consistent global approach would lead to improved results, with VAST serving as a collaborative platform for the industry. Presently, Marin and Viola, as the VAST co-advisors, lead three working groups: Safety Promotion, Technology, and Regulations.

For example, VAST could be a clearinghouse for recommended best practices. "There are those who routinely operate offshore, who've refined their own procedures, tactics, and techniques," Hill offers as an example. "But when they operate offshore, how much of that valuable knowledge is being shared across the industry, let alone across the globe? We want to reach out to and extend invitations to all the key players in the industry."

Another result of this cooperation, Hill says, lies in the development of draft documentation from recommended best practices, essentially turning "80% solutions" into actionable items. Once the FAA, EASA, or other regulatory authority makes the necessary adjustments and adds a new cover page, such proposals can become an advisory circular. These recommended best practices, developed by subject-matter experts, can influence accepted operational standards across the globe.

"We've certainly seen examples of this in the past," says Hill, "where a practice such as, for example, health and usage monitoring systems (HUMSs) and flight data monitoring or

LEFT: HAI/NOAH FALKLIND; RIGHT: HAI/JULIEN BOTELLA

flight operations quality assurance (FDM/FOQA) is introduced in one sector and then over time becomes standard across the entire industry."

Hill believes VAST will further this process. "When you introduce two different worlds in the hopes of extracting a common standard or consensus, you may not get the exact product you're looking for," he says. "We'd like to think that VAST can help common sense prevail by providing a source for trusted information and a forum for discussion. VAST can help people understand the reasons why standards differ, and then maybe, through that dialogue, we can arrive at harmonized standards."

Another VAST initiative could be the world's first international meeting on vertical aviation safety. Every two years, the FAA hosts the International Rotorcraft Safety Conference. The coronavirus pandemic shifted that event to a virtual format for 2020, but the conference may return as a live event in 2022.

"We think VAST would be the optimal organization to promote [the conference], as well as play a key part in the content development and delivery, which would focus on all aspects of vertical aviation," says Hill, adding that VAST would serve up a working group of international safety stakeholders to make that happen.

For those who want to support VAST in its efforts to improve safety in the global VTOL community, Hill advises them to "think globally and act locally" by joining their regional safety team or one of the many organizations that partner with VAST (see the list of VAST partners on p. 34, or visit vast.aero/the-team). Some of these groups are organized around a particular mission set, such as air tours or law enforcement; others represent the helicopter industry in a particular region or country.

"The local level is where volunteers can have the most impact," says Hill. "And after your local organization has developed a great safety resource that targets an identified safety issue, please send it to VAST so we can share it with the global industry. Through VAST, those resources can help pilots, operators, and maintenance technicians all over the world."

NASA/JPL-CALTECH IMAGE

WATCH
How NASA/
JPL Did It

Mars Helicopter Forges New Frontiers

Ingenuity more than lives up to its name, in accomplishments, design, and promise for the future of rotorcraft on Earth—and beyond.

By Paul Koscak

ON APR. 19, 2021, THE HELICOPTER Ingenuity completed the first powered controlled flight on a planet other than Earth when it lifted off the surface of Mars. The historic achievement proves what fearless engineering, inventive designs, and groundbreaking materials can achieve. But the feat is another example of how rotorcraft can be the right ship for the right mission, on Earth and in space, as well.

During its debut flight that April, Ingenuity, also known as the Mars Helicopter, smoothly rose 10 ft., hovered, and then gently lowered its four legs back on the planet's rust-hued soil. More-ambitious flights followed shortly after.

"Truly a milestone in the history of aviation" is how Jim Viola, HAI president and CEO, describes the event. "I look forward to seeing the kind of applications that industry can devise for a helicopter that's capable of flight at 100,000 ft. here on Earth."

Now that Ingenuity has provided proof of concept, future Mars rotorcraft will prove their worth by closing the gap between orbiters and rovers and exploiting the inherent advantages of aviation in the exploration of Mars.

"Orbiters can't resolve surface features less than 3 ft.," notes Ben Pipenberg, lead engineer for the Ingenuity project at AeroVironment, the NASA contractor that designed and built the Mars Helicopter's earlier prototypes and most of the major components of Ingenuity, including its blades and landing gear. "Rovers are good but slow," he says. "A helicopter can cover in a few minutes what a rover covers in a few years."

Birth of a Superstar

To really appreciate Ingenuity's accomplishments, one needs to look behind the scenes at its creation.

Since 2014, numerous prototype helicopters have been built and put through the wringer in punishing tests simulating a rocket's launch from Earth, the unforgiving environment of space, and the harsh conditions on Mars. The need to function in extreme environments drove Ingenuity's design, a project for which NASA budgeted $85 million.

"A rocket launch is a violent event, particularly for a helicopter," Pipenberg says. "There's lots of high- and low-frequency vibration. The helicopter is a pretty brittle piece of hardware compared to the 2,200-lb. rover [Perseverance]," about the size of a compact car.

A delicate aircraft, Ingenuity is just 19 in. tall and weighs about 4 lb. Its two 4-ft. counterrotating blades whisk the ship through a mostly carbon dioxide atmosphere that's only 1% as dense as Earth's. That's like taking off from a heliport sitting atop five Denalis, the highest mountain peak in North America at 20,310 ft., stacked atop each other, or about 100,000 ft. At that altitude, there's hardly any air for helicopter blades to push against.

AeroVironment, a California-based manufacturer of unmanned aircraft systems (UASs), solved that problem by making an advanced, light, super-strong blade for Ingenuity. The blade can withstand the tremendous rotational force needed to generate sufficient lift to fly in the thin Martian atmosphere.

Ingenuity's two counterrotating blades spin at nearly 2,500 rpm, compared with about 370 rpm to produce the same lift on Earth. The blades also feature molded carbon components, a foam interior, and a paper-thin skin of carbon

NASA/JPL-CALTECH PHOTO

Flying From the Right Seat 170 Million Miles Away

When Ingenuity flies, Håvard Grip is at the controls. A NASA research technologist, Grip is the agency's Mars pilot and has been with the program since it began in 2013.

Grip actually helped design and test Ingenuity's control system and points to the many parallels to flying conventional helicopters. Much of his work, for example, centers on aeronautical decision-making.

"We plan each flight," says Grip, who's also a private airplane pilot. "There's overlap to a standard flight plan. You have to know the aircraft and its performance and evaluate the environment."

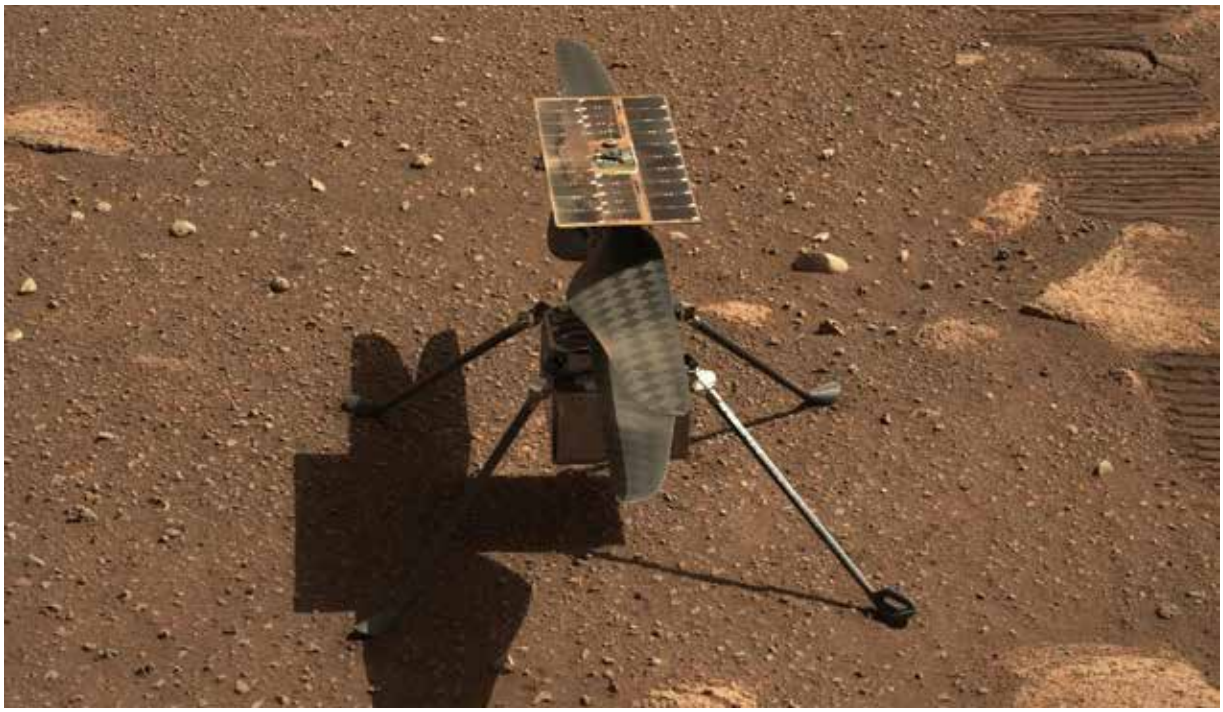
Håvard Grip records data of Ingenuity's first flight into the official pilot's logbook for the project.

Before each flight, Grip goes through a flight risk assessment, just like any other pilot flying on Earth would do. He checks weather, winds, and density altitude. He studies the terrain Ingenuity will be flying over and considers potential landing spots in case there's a problem. He then applies that information to Ingenuity's performance graphs. The graphs show the requirements to accomplish quality takeoffs and landings, how Ingenuity will perform in turns, and how the aircraft will perform at altitudes and distances. With that information, Grip is now able to create a flight profile. The scenario is entered into a computer and shown graphically, or the whole trip can be simulated before it's sent to the Perseverance rover, which then relays it to Ingenuity.

Grip also makes good use of checklists before and after a flight. "We focus on the things that matter, and we have extensive checklists," he says.

As Ingenuity is a technology demonstrator, Grip's role is more test pilot than pilot. Pressing the helicopter toward more-demanding flights is the only way to learn the ropes of flying on Mars. "This is an experimental aircraft, so we're not concerned with staying within the envelope," he explains. "Here [at NASA], we push it."

Because of the radio transmission lag time between Earth and Mars, Grip isn't flying in real time, but he is capturing flight data, such as rotor speed, altitude, the performance of the cyclic and collective, and all data captured by Ingenuity's camera. NASA plans to send additional rotorcraft to Mars, but until then, Grip is the first extraterrestrial, REALLY remote pilot. —P.K.



Ingenuity is designed to avoid obstacles that can spell disaster, like large rocks, when locating a place to land.

fibers placed 45 degrees to the blades' chords. The breakthrough design results in a stiffer blade that resists twisting. Additionally, a 16-degree twist built into the blades allows for easier hovering.

Ingenuity's swashplate is the same as that of a conventional helicopter. The cyclic and collective controls are sealed against dust and moved by servos that receive commands from the aircraft's computer. The whole shaft is driven by a brushless DC motor in which a ring of magnets revolves around fixed coils, just the opposite of how a standard electric motor runs. "The arrangement gives Ingenuity's motor higher torque and greater power with less draw on the battery," Pipenberg explains.

A six-cell lithium-ion battery powers the helicopter, and about 60% of the electricity is used to keep certain parts of the aircraft warm. A solar panel on top of Ingenuity keeps the battery charged. Some components, such as the servos, can be warmed on command depending on the expected weather, while the avionics box is automatically kept warm at night.

And it all worked better than expected. "Our helicopter is even more robust than we had hoped," says Joshua Ravich, Ingenuity's mechanical engineering lead at NASA's Jet Propulsion Laboratory (JPL). "The power system we fretted over for years is providing more than enough energy to keep our heaters going at night and to fly during the day."

Like a hand fitting the right glove, everything about Ingenuity centered on building the aircraft to fit into the underside of the Perseverance rover. "It's very tight, and we had to be sure it wouldn't interfere with the rover's mission," Pipenberg notes. The landing gear folds up, and a special deployment system developed by Lockheed Martin gently unfolds Ingenuity until it stands upright on the Martian soil. Deployment takes six days.

Anything but Conventional

Temperatures on Mars presented a special challenge to maintaining the helicopter. The planet can get brutally cold at night, with temperatures easily plunging to -130°F, making conventional oils useless. "They would just solidify," says Pipenberg.

Then there's the mostly carbon dioxide atmosphere. While CO_2 won't affect aircraft performance, it does change the performance of lubricants, which are crucial to unheated components, such as the landing gear's leg joints.

"Oxidation is slow, water vapor is low, so lubricants act differently [on Mars]," Pipenberg says. "Graphite [a dry lubricant] becomes extremely abrasive. Other dry lubricants such as molybdenum disulfide work really well on Mars."

Ingenuity's frame, along with its booms, yokes, trusses, and fittings, uses the latest unconventional materials to meet the high bar of space travel. "Advanced composites are absolutely required to do a mission like this," Pipenberg says.

These exotic and continually evolving materials are mostly carbon fibers packing up to three times the strength and stiffness of steel and held together with a variety of specially designed resins and tapes. They're rigid as well as inert, meaning they don't secrete even the most minuscule chemicals or gases, which are emitted more readily in a vacuumlike space.

NASA/JPL-CALTECH PHOTO

"Outgassing clouds camera lenses, creates corrosion, and clogs sensors," says Sean Johnson, thermoset product manager at Toray Advanced Composites, which provided advanced composites for Ingenuity. Astroquartz is another unusual material and is used on the rover. "These are fibers that are woven into a fabric to cover and protect antennas with minimal signal interference," he adds.

A variety of layered composite tapes is used to reinforce and strengthen the blades. "You can have a surface that's very thin but with a large number of plies to reduce stress," says Johnson.

Materials used to build the helicopter, Johnson adds, must be able to withstand extreme vibration and extreme temperatures and resist contamination, radiation, and microcracking. The constant cycle of extreme heat and cold in space can cause some materials to suffer very fine cracks that can lead to structural failure.

Materials from Toray Advanced Composites have been used in every Mars rover. "We have a nearly 30-year history in space programs," Johnson says. "Our products have even left the solar system on [NASA's] New Horizons spacecraft [launched in 2006, primarily to study Pluto]."

Ingenuity not only has set new benchmarks in rotorcraft aviation; it's pushed the envelope in space-vehicle manufacturing, as well. "There's an aversion to taking risks in manufacturing, especially in aerospace," Pipenberg points out. "NASA allowed for this to be a high-risk program. We needed to figure out what we didn't know. Ingenuity is really an appropriate name."

The AeroVironment team also traded convention for increased efficiency. "We had our engineers building the hardware, [eliminating] a layer of manufacturing," says Pipenberg. "This allowed us to move quickly, reduce errors, and improve communication."

There's an upside to high-risk missions like Ingenuity that rely on "space-qualified" off-the-shelf components, parts that have already met certain standards and have a proven performance record. Using those materials saves time and money and minimizes loss in case the mission fails, explains JPL's Ravich.

"This avoids all the testing you need for a part to be space qualified," Ravich says. "The screening is already done." Ravich says almost everything except Ingenuity's framework and structural connections are off the shelf.

A few distributors for the Ingenuity project are household names; others are better known in aerospace circles. Among the major components and vendors: battery, Sony Group; radio, LS Research; servos, Maxon; inclinometer, Murata Manufacturing; inertia measurement units (accelerometers and gyroscopes), Bosch; navigation processor, Qualcomm; cameras, Sunny Optical Technology; and altimeter, Garmin.

"The off-the-shelf components for our guidance and navigation systems are doing great, as is our rotor system," Ravich adds. "You name it, and it's doing just fine or better."

"Nerve-Wracking" Flight Tests

Constructing Ingenuity was only half the battle. The helicopter needed to survive a battery of several hundred grueling flight tests, as well.

In one test that simulated the vibrations of a rocket launch, the helicopter was secured to a platform on which it shuddered into a blur, sustaining up to a crushing 60 G of force for a split second. In another experiment, Ingenuity was placed in a liquid nitrogen chamber and cooled to below -200°F to see if its components continued to work. An oven test recorded the same observations at temperatures exceeding 200°. Wind-tunnel tests revealed the aircraft could withstand winds up to 20 kt.

Ingenuity's ability to automatically avoid obstacles using its camera was also evaluated in a large, circular room where dozens of X-shaped strips of tape were stuck to the floor to simulate rocks. The helicopter was required to identify and navigate away from these "barriers" in locating a safe landing spot.

Contamination control played an important role during testing, and that meant keeping everything squeaky clean. "We don't want anything hitching a ride," says Pipenberg about why a sterile environment is critical. Bringing microbes or other particulate Earth life to the Red Planet would jeopardize NASA's search for Martian life.

"The Ingenuity team did everything to test the helicopter on Earth," adds MiMi Aung, engineer and Ingenuity's project manager at JPL. "It will be another way to explore other worlds."

"Nerve-wracking," is how Pipenberg describes the tests. "There was less than a 5% margin for error and there are thousands of ways to fail. The flight looks uneventful, but when it's 173 million to 211 million miles away, depending on the elliptical orbits of the two planets, every second was very stressful for the whole operations team. Everything must work perfectly."

And it did. The tests were so complete that nothing was overlooked, giving the team confidence the hardware would work as expected. "There were no surprises on the Mars flights," Pipenberg says.

A Journey Two Decades in the Making

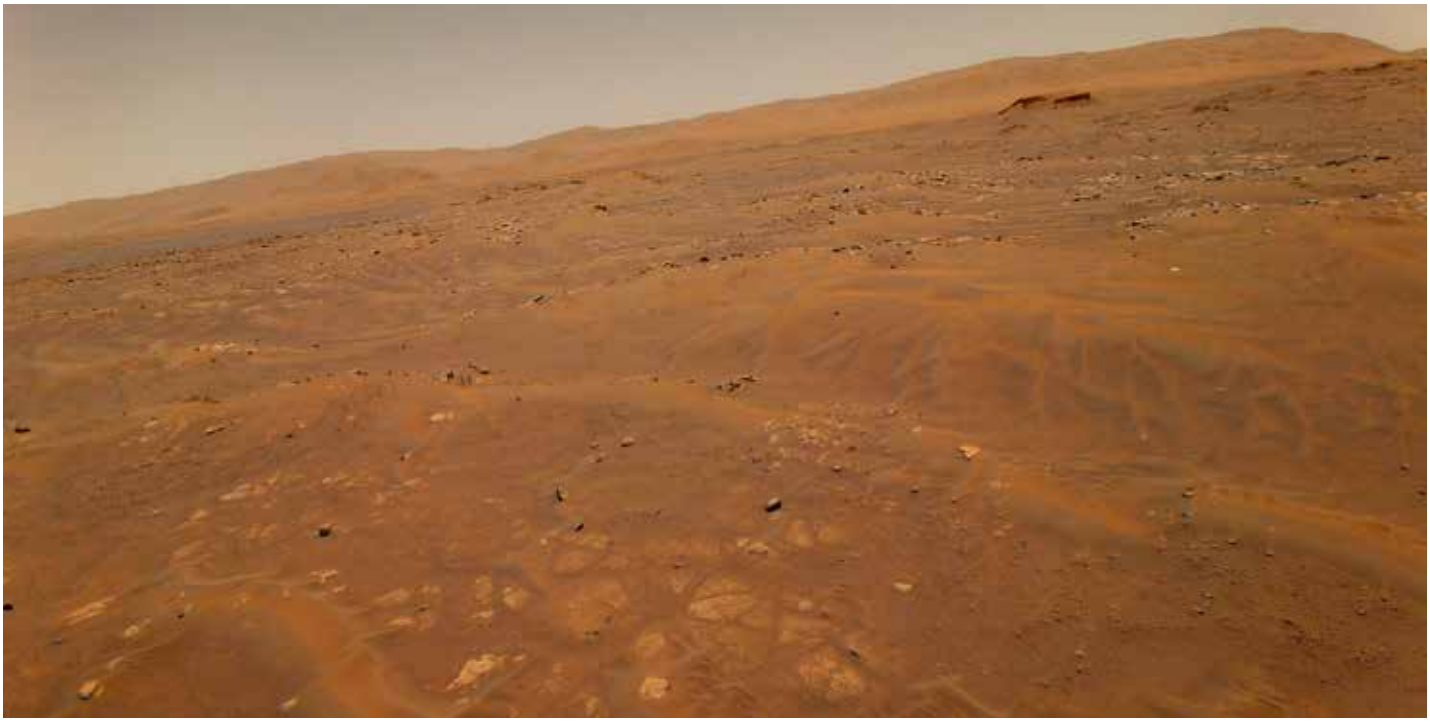
Ingenuity's first flight on Mars concluded a long journey that began in 2003 when a team at the University of Maryland produced a design for flying a helicopter on the planet for NASA, recalls Anubhav Datta, associate professor of aerospace engineering at the school. "The Mars Helicopter is similar [to that first one]—two rotors with two blades," he says.

But then progress stalled. "Nothing happened," Datta says. "It was entirely and singularly a JPL effort to procure the funding and convince management that this was a project of national aspiration and impact."

The project didn't move ahead until 2015, when NASA asked Datta to work with AeroVironment to help design and stress-test the blades.

"Since [NASA's] Viking [Project, the first US mission to land a spacecraft safely on Mars and return images of the surface to Earth, in the late 1970s], we've been spending less and less on Mars missions and science and technology," Datta says. "Big Science requires the right timing, the right money, the right politics, the right people, and the right technology. Most of today's challenges revolve around the first three. The US has been and remains inherently strong on the last two."

Ingenuity's success inspired NASA to draw



NASA/JPL-CALTECH PHOTO

This image of Mars was taken from a height of 33 ft. (10 m) by Ingenuity during its sixth flight, on May 22, 2021. One goal of the Mars Helicopter technology demonstration project was to enable future missions to leverage the greater situational awareness provided by an aerial perspective.

Taking commands from the rover on the ground, Ingenuity lifts off amid a barren red vista in this artist's depiction.

NASA/JPL-CALTECH IMAGE

parallels to the Wright brothers' first flight, in 1903.

"We've been thinking for so long about having our Wright brothers moment on Mars, and here it is," says Aung. "We'll celebrate our success and then take a cue from Orville and Wilbur regarding what to do next. History shows they got back to work, and so will we."

To immortalize that moment when the first successful powered flight occurred, NASA removed a small piece of fabric from the wing of the Wright Flyer and glued it to Ingenuity's solar panel before its trip to Mars. In another fitting tribute, the agency officially named the spot on Mars where the helicopter lifted off Wright Brothers Field. The 33-by-33-ft. plot is now recognized by the International Civil Aviation Organization.

Ingenuity Is Just the Beginning

As Ingenuity performs more-ambitious flights on Mars, its success represents just the first step in exploring the planet by helicopter. NASA is planning a second generation of larger, more capable rotorcraft down the road that will lead the way in further space exploration.

The agency will use nontraditional blades (for greater tip speeds), advanced batteries, and more-powerful motors. Eventually, the most advanced class of helicopters may exceed 50 lb., according to engineers at JPL.

These rotorcraft will operate independently from a rover and will likely have their own ground stations. Utilizing the inherent advantages of flight, they'll cover more ground and explore areas rovers can't reach, fetching rock, soil, and ice samples for study. Three more helicopters are on the drawing board, two of them coaxial and the third a hexacopter—which, as its name implies, sports six rotors—to mostly support rovers and landers, according to the NASA report "An Advanced Mars Helicopter Design."

The next helicopter will weigh 10 lb. and have the same blade diameter as the 4-lb. Ingenuity. After that, NASA will take an even bigger leap, with a 44 pounder sporting a 5½-ft. blade diameter. A hexacopter, also weighing 44 lb., will finally fly on Mars. Each of its blades will measure 3 ft. long. Unlike Ingenuity, which has no payload capacity, the advanced helicopters are expected to have payloads of at least 3 lb. each.

After Mars, NASA is scheduled to send Dragonfly, a 10-ft., 990-lb., nuclear-powered rotorcraft the size of a car, to Saturn's largest moon, Titan. The launch is scheduled for 2027, and it will take about nine years for the aircraft to reach Titan, which has an atmosphere four times thicker than Earth's.

Whereas Ingenuity had to be designed with care in order to fly in the thin Martian atmosphere, Titan's dense atmosphere and low gravity will make for easier flying than on Mars. Titan's diameter is 3,200 miles compared with the Earth's moon, at 2,100 miles.

"It's remarkable to think of this rotorcraft flying miles and miles across the organic sand dunes of Saturn's largest moon," said Thomas Zurbuchen, NASA's associate administrator for the agency's Science Mission Directorate, in a statement. "Dragonfly will visit a world filled with a wide variety of organic compounds, which are the building blocks of life."

NATIVE SUPPORT

"How can we help?"

Four little words that pack a lot of power.

In 2020, with communities around the world reeling from the economic and social disruptions resulting from the COVID-19 pandemic, folks at MD Helicopters wondered how they could help. The result: a yearlong airlift resupplying remote Native American communities while reducing their risk of contracting the disease.

A PHOTO ESSAY BY MARK BENNETT

The flight will lift off just after sunrise. It's cold in Mesa, Arizona, this late December morning, and it will be much colder where we're headed, 223 miles north and 4,126 ft. higher in elevation. Our destination: the town of Chinle, Arizona.

In addition to being manufactured by MD Helicopters (MDHI), this aircraft is owned and operated by it too. The company has been flying this MD 902, or another of its aircraft, from MDHI's main facility in Mesa to the far northeast corner of Arizona every week since May 2020. Each flight carries critical cargo to volunteers who distribute the cleaning supplies, personal protective equipment (PPE), and more to people spread across the largest expanse of reserved lands in the United States—the Navajo Nation.

MAP BY ALEX MCPHEE ON WIKIMEDIA COMMONS

WATCH
MD Airlift Flight

Left: MD 902 serial number 095 is topped off with fuel before departing for the Navajo Nation laden with supplies and equipment for blunting the impact of the COVID-19 virus.

Above: The landscape of the Navajo Nation is often breathtaking, but that rugged beauty comes at the cost of both access and arability.

The Challenges

COVID-19 infections began sweeping the United States in early 2020, leading to concerns about the impact of the disease on vulnerable Native American populations. These communities are often isolated and poor, with high rates of diabetes, obesity, and other health conditions that make residents high risk for COVID.

The Navajo Nation occupies 27,000 sq. mi., although with a population about the size of Eugene, Oregon's. Thirty percent of homes on the reservation lack electricity or running water. Poverty is endemic, and health care is as scarce as grocery stores. Within the reservation's borders, in an area larger than the five smallest US states combined, are a mere 5 hospitals, 7 full-time health-care centers, and 13 grocery stores.

Rugged topography, coupled with low population density, makes access difficult. Much of the land is ill-suited for roads, and after winter snowfalls, most smaller roads are impassable.


"I'm just honored to have been able to help." —Bob Rappoport, MDHI pilot
all clear
320
Sanitizing Wipes
Kids FACE MASKS
Face Mask
CLOROX
Kills 99.9% of Germs
32428
3 PACK

The Questions

In the early months of the pandemic, people around the world considered how they could help. It was a question also being asked at MD Helicopters.

Could they make ventilators? It turned out they were not really equipped to do that. How about making face masks? No, that wasn't possible either.

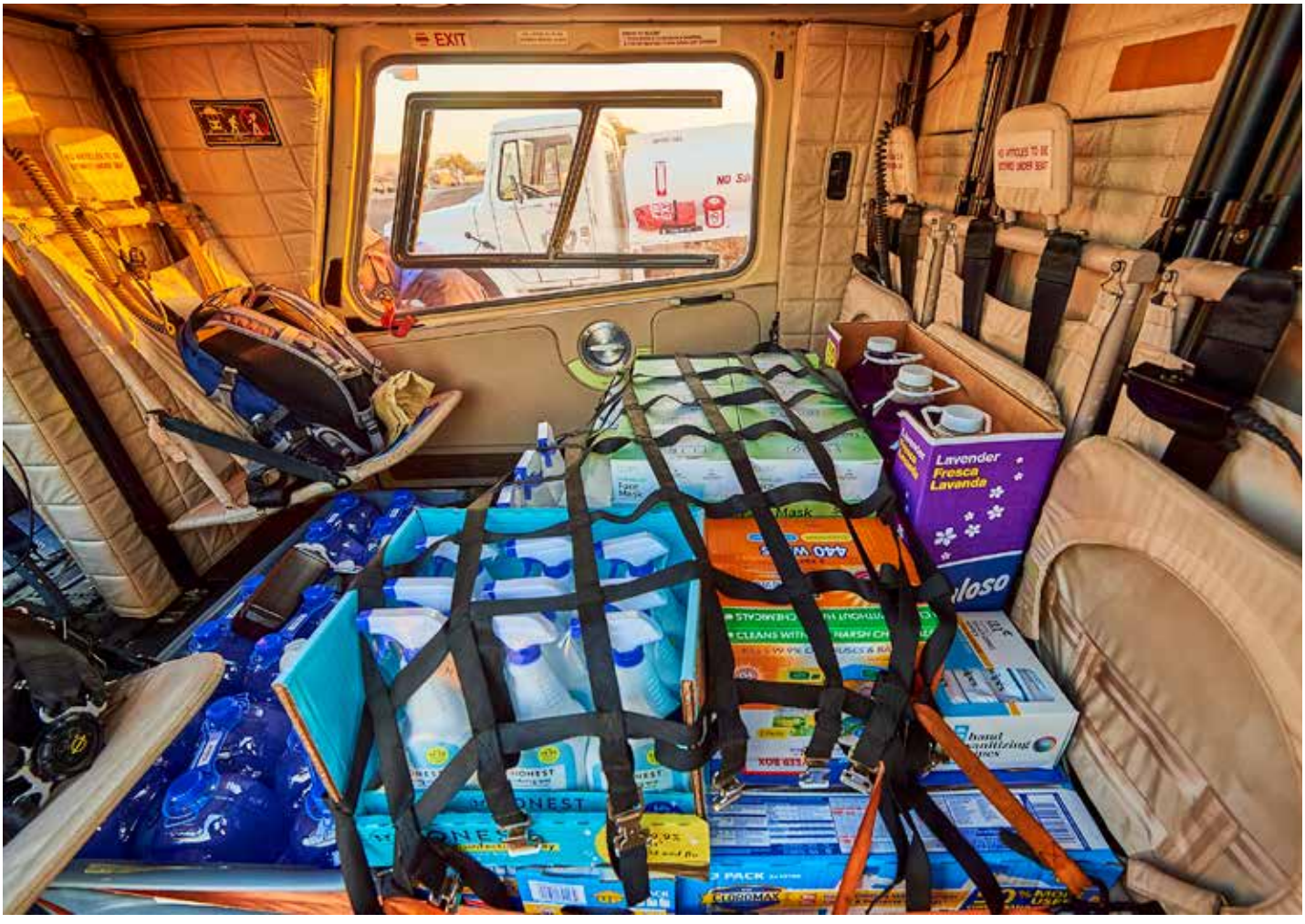
Elsewhere in the Phoenix area, a Native American military veterans group, Native American Sustainability for Veterans and Those in Uniform (NASVU), was already collecting monies and supplies to help those on the reservation. But when the tribal government closed off travel to and from the Navajo Nation, their question became: How can we get the stuff to the people who need it?

Meanwhile, an MDHI pilot saw news reports of the challenges facing the Navajo Nation and wondered, "Why don't we help them out? We have helicopters."

As it happened, both NASVU and MDHI had discussed pandemic relief with the Mesa Chamber of Commerce, which put the organizations in touch with each other. Chris Jaran, MDHI chief operating officer, then formed a plan to use company aircraft and crews to deliver the matériel provided by the veterans group. When he checked with the other MDHI executives about the plan, their answer was an immediate, unqualified yes.

Left: A thousand dollars' worth of bleach, face masks, and other matériel delivered to the MD Helicopters loading dock by NASVU volunteer Bob Dalpe, shown in the red shirt chatting with MDHI pilot Robert Rappoport, await transfer to the aircraft for the following morning's delivery.

Below: In colder months, the MD 902 carries about 750 lb. of supplies on the three-hour trip to the reservation; the payload is less when summer temperatures raise the density altitude.



"Every time we go, we're always greeted by many people, and everyone is grateful.

The Navajo Nation stretches across three states: northeastern Arizona, northwestern New Mexico, and, as seen here, southeastern Utah. The stark beauty of the land is undeniable, but the difficult terrain and widely scattered population form a logistics challenge, one uniquely suited to being solved by MD Helicopters and its fleet of aircraft.

They share their stories." *—Dave Salem, MDHI pilot*

"If not for MDHI's perseverance, we'd have been in one heck of a situation.

Delivering the Goods, and Goodwill

MDHI committed to weekly supply flights, assuming aircraft and flight crew availability, beginning May 14, 2020. The first three flights carried chainsaws and related items, important to the 15,000 Navajo homes without electricity for heating and cooking, followed by load after load of personal protective equipment, hand sanitizer, face masks, bleach, and anything else that was needed.

Nearly everything they carried was donated or purchased with donated funds, courtesy of NASVU, chaired by Tom Eisiminger, with Bob Dalpe coordinating operations with MDHI and Pete Tsinnijinnie as the Native American veterans advisor.

During the winter, as a new wave of infections moved across the area, even incoming road travel was forbidden by the tribal government, essentially closing off the Navajo Nation to outsiders.

Fortunately, MD Helicopters was allowed to continue its flights, becoming one of the only sources of supplies and equipment from the outside. To further reduce the risk of virus transmission, even intra-reservation road travel was discouraged, so MDHI flights were directed to additional locations, bringing supplies closer to those in need.

Above: MDHI pilots CJ Schneider, left, and Dave Salem coordinate the next leg of the journey during a refueling stop at Flagstaff Pulliam Airport (KFLG).

Below: On a different flight, MDHI pilot Bob Rappoport heads for the FBO office at Arizona's Winslow-Lindbergh Regional Airport (KINW).

Words alone can't express our gratitude." *—Pete Tsinnijinnie, commander, Chinle Agency Veterans*

Above: Navajo Nation volunteers pose with the MDHI flight crew and the supplies they had just unloaded at Monument Valley Airport (UT25).

Below: Some toys await MDHI's final flight to the Nation and their chance to meet some girls and boys.

Wrapping Up

The past 18 months have been disastrous for millions throughout the world, many of whom have then turned to others and asked, "How can I help?"

MDHI's commitment to help made a meaningful difference to thousands of Native Americans. Through 50-plus trips, the OEM delivered approximately 28,500 lb. of supplies and gear to remote Navajo communities. All costs for the six-hour round-trip flights, from fuel to crews to maintenance, were covered by the company.

As public health conditions on the reservation improved, MD Helicopters and NASVU concurred that these flights had served their purpose and could be suspended. But they had one last, special delivery to make.

Waiting in the warehouse since December of 2020 were 500 lb. of toys for Navajo children. They had been scheduled for delivery before Christmas, but out of an abundance of COVID caution, the toys stayed put. That is, until the very last flight, on Jun. 25, 2021, when, as a surprise to the children and a fond farewell to the adults, an MD Explorer loaded with goodies and piloted by Santa Claus landed in Chinle for a summertime Christmas.

QUICK FACTS

Amber Malin

RSG Aviation
Fort Worth, Texas

CURRENT JOB

As a quality assurance inspector, I'm responsible for ensuring that the quality of work completed meets the highest standards. Whether it be by verifying references in sign-offs, performing records research, or visually inspecting maintenance performed, my job is helping ensure the safety of our customers and my team to the best of my ability.

FIRST AVIATION JOB

My first job in helicopter aviation was with Air Evac Lifeteam as a completion mechanic. I got to learn the aircraft from the ground up while performing overhauls, repairs, upgrades, and modifications to the fleet.

FAVORITE HELICOPTER

AH-1 Cobra

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

Helicopters captured my imagination by their method of flight. The idea of flight through the use of various concepts always seemed so fascinating. Being able to better understand the ins and outs of various systems definitely helped guide me toward being a helicopter mechanic over other career choices.

Tell us about your most memorable helicopter ride.

My most memorable helicopter ride was having my first actual stick time, which happened to be in a Vietnam-era Huey. At the time, I thought the PIC was just letting me think I was actually flying, until about the time he told me to turn left and, naturally, I turned right. That's when I realized I was in control of the Huey.

How did you get to where you are now?

I got to where I am now because I *specifically knew* I wanted to be a helicopter mechanic. The moment I decided I wanted to, I began saving money to help get me through A&P school; I began searching for potential job opportunities for newly licensed mechanics. Basically, I became as proactive as I could.

After becoming licensed, I accepted a position at Air Evac, where I worked for a few years. I then took another job working on corporate aircraft for Bombardier, but after awhile I realized I missed helicopters, and I took another position with Air Evac as a base mechanic and never looked back.

What are your career goals?

Short term, my main goals are to keep being the best inspector I can be and continue getting good grades in my classes. Currently, I'm enrolled at Tarrant County College with hopes of transferring to the University of Texas at Arlington next fall. There, I plan to acquire a bachelor's degree in engineering and would like to either move into a management position or transition into an experimental program somewhere. I think it would be amazing to be part of a team that develops a new breakthrough for aviation.

What advice would you give someone pursuing your path?

The two pieces of advice I'd give someone pursuing this path are:

- **Network.** You can never have too many contacts. There have been several times when a fellow mechanic or manager has been able to help discover the cause of an obscure problem.
- **Get started!** While the road to getting your license may seem long, the hard work and perseverance are well worth it in the end.

What still excites you about helicopter aviation?
One of the most exciting things about helicopter aviation is how it's constantly changing. Not only do new engines and airframes come out, but there are also constant upgrades and modifications as well as improved diagnostic tools and system components.

If you couldn't pursue your current career, what other field would you choose?
If I couldn't pursue my job, I'd probably want to get a degree in business management. I might not be able to get hands-on with helicopters, but I'd still be a part of it all.

What do you think is the biggest threat to the helicopter industry?
The biggest threat to the helicopter industry is misinformation. When I was in A&P school, we were told that unless we were military, there'd be no chance at ever even touching a helicopter. We were also told that an A&P license wouldn't cover helicopters. Being told this (by more than a few people) was extremely discouraging, but, fortunately, it simply wasn't true—if you want to work in helicopter aviation, the opportunities are out there.

"When I was in A&P school, we were told that unless we were military, there'd be no chance at ever even touching a helicopter. It simply wasn't true."

Complete this sentence: "I love my job, but I'd rather work for a paper company in Scranton when ...
… it's 110° [Fahrenheit] out, and my helicopter gets stuck in a field because a bat got sucked up into the air intake." True story!

 By Jaasmin Foote

HAI Commercial Helicopter Pilot Rating Scholarship Winner Jordan Nieters

Student becomes tour pilot with goal of flying in utility sector.

GROWING UP IN BOZEMAN, MONTANA, Jordan Nieters had no aviation professionals in his family. His closest contact with helicopters was when he saw one hovering overhead one day. From that point on, whenever he saw a helicopter, he was so captivated that he dropped whatever he was doing just to watch it in action.

Jordan had always assumed military service was the only route to becoming a helicopter pilot, but four years ago he learned that wasn't true. One day, Jordan raved to his then-fiancée (now wife) about a helicopter he'd seen, and she asked him if he could fly one locally. He found a local flight school and took an introductory flight.

By the next day, he was hooked on aviation and decided he wanted to fly professionally. Jordan worked six to seven days a week to save enough money to enroll at Silverhawk Aviation Academy in Caldwell, Idaho, in April 2019 and pursue his dream of becoming a pilot.

On Mar. 25, 2020, just one week before he was scheduled to take his commercial checkride, Jordan's school received orders to shut down due to COVID-19. But he used the disappointment to his advantage.

"Flying is a 'use it or lose it' kind of skill," says Jordan. "You can never study too much, so the time off has helped me dial in the ground knowledge and prepare for whatever the DPE [designated pilot examiner] throws at me."

Although Jordan had to acclimate to learning online, he acknowledges that others had it worse than he did—at least he was still able to pursue his training. Once Silverhawk reopened in May 2020, Jordan successfully completed his commercial checkride.

Jordan says the tools that benefited him most during his training are collaboration and mentorship. He urges student pilots to form study groups to gain other perspectives.

ALL PHOTOS COURTESY JORDAN NIETERS

"I found two other classmates who were motivated, and we dedicated a couple days a week to get together and study," says Jordan. "Everyone interprets information differently, so working as a team helps you learn and comprehend the material a lot better."

He also appreciated working with pilots who were willing to share their insights with newcomers like him. Without that, he says, it would be difficult to follow this career path. But potential mentors aren't mind readers. "You've just got to ask!" Jordan says.

Jordan also realizes the value of networking and often chats with seasoned pilots to hear their success stories. (Read more about this effective career-building tool in "Stacy Sheard: All in for HAI," p. 28, Q3 2020 ROTOR.)

Like many other aviation students, Jordan says the biggest hurdle he encountered as a student was financing his education. Not only did he have to come up with the money to fund his training, but he also struggled to support himself and his fiancée while completing his studies.

Winning an HAI scholarship was "a tremendous opportunity for me," says Jordan, who used the money to help fund his CFI and CFII training. "I was one of the few students in my class who paid privately. Most of my classmates had GI benefits, so this scholarship helped me make payments on my Sallie Mae loan."

In addition to his HAI scholarship, Jordan received four other aviation scholarships. His hard work over the years and the time spent filling out scholarship applications definitely paid off, Jordan says. He wishes every student knew about these resources.

"I don't think many aviation students understand how many scholarship opportunities are out there," says Jordan. "It's great that organizations like HAI are willing to help the younger generation of pilots succeed."

Jordan continues to fulfill his personal and professional goals. He graduated from Silverhawk in August 2020 and soon after obtained his commercial license, CFI, and CFII. He got married in September 2020, and from September 2020 to March 2021 he taught helicopter flight and ground instruction to private, instrument, and commercial students at the academy.

"The most rewarding part about teaching is seeing your students achieve their goals and evolve from timid to confident pilots," says Jordan. "It really helped me gain confidence inside the helicopter as well. I still have a lot to learn in my aviation career, but my time as a flight instructor really helped me hone my skills and become a more confident pilot."

"The most rewarding part about teaching is seeing your students achieve their goals and evolve from timid to confident pilots. It really helped me gain confidence inside the helicopter as well."

Jordan recently moved to Myrtle Beach, South Carolina, after accepting a job as a tour pilot at Oceanfront Helicopters, where he flies a Robinson R44.

His ultimate career goal is to become a utility pilot. "It takes all your focus, and you must be on your toes at all times," he says. "From what I've learned about the utility sector, it seems like the right fit."

"I don't think many aviation students understand how many scholarship opportunities are out there," says Jordan Nieters, seen here in an R44 while training to be a helicopter pilot at Silverhawk Aviation Academy in Caldwell, Idaho.

RECENT ACCIDENTS & INCIDENTS

THE ROTORCRAFT ACCIDENTS AND INCIDENTS LISTED BELOW OCCURRED FROM JAN. 1, 2021, TO MAR. 31, 2021. The accident details shown are preliminary information, subject to change, and may contain errors. All information was obtained through the official websites included below, where you can learn more details about each event.

Australia—Australian Transport Safety Bureau (ATSB): bit.ly/2P3ZF1S

Canada—Transportation Safety Board of Canada (TSBC): bit.ly/3c6evf2

United States—National Transportation Safety Board (NTSB): bit.ly/2IueqZa

January 2021

Bell 47D
Marana, AZ, USA
Jan. 1, 2021 | NTSB WPR21LA077
1 injury, 0 fatalities | Instructional flight

No description available.

Robinson R44 II
Near Eaglesham, Alberta, Canada
Jan. 1, 2021 | TSB A21W0001
0 injuries, 4 fatalities | N/A

Helicopter impacted terrain and was destroyed for undetermined reasons.

Hughes 369D
Winthrop, WA, USA
Jan. 9, 2021 | NTSB WPR21LA084
0 injuries, 0 fatalities | Positioning flight

No description available.

Robinson R44
Albany, TX, USA
Jan. 9, 2021 | NTSB CEN21LA109
0 injuries, 0 fatalities | Hog hunting flight

Helicopter substantially damaged during autorotative landing following loss of engine power.

Hiller UH-12C
Lafayette, IN, USA
Jan. 12, 2021 | NTSB CEN21LA124
0 injuries, 0 fatalities | Personal flight

No description available.

Hughes 269C
Spanish Fork, UT, USA
Jan. 13, 2021 | NTSB WPR21LA086
0 injuries, 0 fatalities | Instructional flight

During autorotation training and attempted power recovery, aircraft impacted terrain and was substantially damaged.

McDonnell Douglas 369E
Queen Creek, AZ, USA
Jan. 22, 2021 | NTSB WPR21LA093
0 injuries, 0 fatalities | Personal flight

No description available.

McDonnell Douglas 600N
Mankato, MN, USA
Jan. 22, 2021 | NTSB CEN21LA116
0 injuries, 0 fatalities | External-load flight

No description available.

Robinson R22
West Palm Beach, FL, USA
Jan. 26, 2021 | NTSB ERA21LA117
0 injuries, 0 fatalities | Instructional flight

No description available.

Robinson R66
Knoxville, TN, USA
Jan. 30, 2021 | NTSB ERA21LA121
0 injuries, 0 fatalities | Personal flight

No description available.

February 2021

Bell 206B
Pahokee, FL, USA
Feb. 4, 2021 | NTSB ERA21LA126
0 injuries, 0 fatalities | Agricultural flight

During hover over a sugarcane field, pilot responded to rotor rpm decay and attempted an autorotation. The helicopter was destroyed after ground impact and rollover.

Hughes OH-6A
Horseshoe Bend, ID, USA
Feb. 5, 2021 | NTSB WPR21LA107
2 injuries, 0 fatalities | Wildlife damage-management flight

Helicopter substantially damaged after reported power loss and impact with terrain.

MD Helicopters 369E
Mesa, AZ, USA
Feb. 8, 2021 | NTSB WPR21LA109
0 injuries, 0 fatalities | Instructional flight

No description available.

Robinson R22
Far North Queensland, Australia
Feb. 11, 2021 | ATSB AO-2021-006
0 injuries, 1 fatality | Positioning flight

Helicopter impacted terrain for unknown reasons.

Leonardo AW119 MkII
Alexandria, MN, USA
Feb. 13, 2021 | NTSB CEN21LA128
0 injuries, 0 fatalities | Air medical flight

No description available.

Bell 206
Saint Thomas, US Virgin Islands
Feb. 15, 2021 | NTSB ERA21FA130
0 injuries, 4 fatalities | Aerial observation flight

Helicopter impacted steep terrain and was destroyed in postcrash fire. Video showed smoke from engine area before descent and impact.

Bell OH-58
Greensburg, LA, USA
Feb. 22, 2021 | NTSB CEN21LA135
3 injuries, 0 fatalities | Public aircraft

No description available.

Eurocopter EC130 B4
Tulsa, OK, USA
Feb. 24, 2021 | NTSB CEN21LA153
0 injuries, 0 fatalities | Air medical flight

No description available.

Hughes 369
Kaufman, TX, USA
Feb. 26, 2021 | NTSB CEN21LA139
0 injuries, 0 fatalities | Aerial observation flight

No description available.

March 2021

Airbus AS355
Buckingham, England
Mar. 2, 2021 | NTSB G-BOSN
0 injuries, 0 fatalities | N/A

No description available.

Robinson R22
Kodiak, AK, USA
Mar. 2, 2021 | NTSB ANC21LA020
0 injuries, 1 fatality | Personal flight

Helicopter was lost at sea and presumed destroyed after water impact 70 mi. north of Kodiak, Alaska. The pilot and sole occupant is missing and presumed fatally injured.

Leonardo AW139
Victoria, Australia
Mar. 4, 2021 | ATSB AO-2021-010
0 injuries, 0 fatalities | Aerial work

The flight crew climbed and safely recovered the helicopter after encountering IMC at low altitude and responding to a ground-proximity warning system.

Bell 212
Bowen Island, British Columbia, Canada
Mar. 5, 2021 | TSB A21P0018
2 injuries, 0 fatalities | Hydrological support flight

After indications of system failure, flight crew attempted emergency landing and lost control of helicopter, resulting in terrain impact.

Robinson R66
Duson, LA, USA
Mar. 9, 2021 | NTSB CEN21LA154
0 injuries, 0 fatalities | Personal flight

No description available.

Bell 206B
Laton, CA, USA
Mar. 13, 2021 | NTSB WPR21LA130
1 injury, 0 fatalities | Agricultural flight

No description available.

Robinson R44
Rosh Pinna, Israel
Mar. 13, 2021 | NTSB N97KC
Minor injuries reported | Flight type unknown

No description available.

Robinson R44
Pretoria, South Africa
Mar. 15, 2021 | NTSB ZS-OVV
0 injuries, 0 fatalities | Flight type unknown

No description available.

Bell 206L-3
Lucerne Valley, CA, USA
Mar. 16, 2021 | NTSB WPR21LA133
2 injuries, 0 fatalities | Personal flight

No description available.

Robinson R44
Leksand, Sweden
Mar. 17, 2021 | NTSB SE-JVF
Fatality reported | Flight type unknown

No description available.

Bell 206
Xiamen, China
Mar. 19, 2021 | NTSB B-7720
Fatality reported | Flight type unknown

No description available.

Hughes 369D
Lake City, KS, USA
Mar. 25, 2021 | NTSB CEN21LA165
0 injuries, 0 fatalities | External-load flight

No description available.

Leonardo AW139
Katoomba, New South Wales, Australia
Mar. 26, 2021 | ATSB AO-2021-018
0 injuries, 0 fatalities | Air medical flight

Helicopter sustained overtorque during night-vision goggles (NVG) winch operations after near impact with terrain.

Robinson R44
Dustin, OK, USA
Mar. 26, 2021 | NTSB CEN21LA173
4 injuries, 0 fatalities | Aerial observation flight

Helicopter substantially damaged following a loss of power and forced landing.

Airbus AS350 B3
Palmer, AK, USA
Mar. 27, 2021 | NTSB WPR21FA143
1 injury, 5 fatalities | Air taxi and commuter flight

During heli-ski flight, helicopter impacted mountainous terrain and was destroyed.

Bell OH-58
Pottsboro, TX, USA
Mar. 27, 2021 | NTSB CEN21LA169
1 injury, 0 fatalities | Personal flight

No description available.

Helicopter Association International

SAFETY

Your Most Important Mission

Supporting the global vertical lift industry with a 360-degree view of safety

HAI PRODUCES
Programs, tools, and resources to improve operational safety

HAI PROMOTES
Safety as an essential part in building a sustainable, viable industry

HAI PROVIDES
Safety education and recognition opportunities for vertical aviation pilots, operators, and maintenance technicians

HAI SUPPORTS
The work of volunteers to address safety issues by collaborating with global industry stakeholders

*Learn more about HAI safety programs, tools, and resources at **rotor.org/safety**.*

Please watch HAI's latest Spotlight on Safety videos here:

 By David Jack Kenny

Slipping Standards

Preflight complacency proves deadly.

"DEFINING DEVIANCY DOWN" WAS THE late US Sen. Daniel Patrick Moynihan's phrase for the gradual erosion of standards that results from tolerating previously unacceptable behavior. Overlooking minor transgressions makes more serious offenses seem less significant, progressively expanding the boundaries of what's considered permissible.

While Moynihan's focus was on crime and social standards, the same argument applies to aviation. If seemingly trivial lapses—say, a perfunctory preflight—pass without consequences, it becomes easier to contemplate cutting additional corners. Commercial aircraft operators have been known to succumb to this temptation despite being subject to more rigorous reporting and inspection requirements than private owners. But private owners who let their standards slide aren't likely to escape the consequences indefinitely.

The Flight

On Jul. 8, 2019, the pilot of a Robinson R44 and one passenger flew from the former's home in Sainte-Sophie, Québec, Canada, to a fishing camp the pilot owned on Lac-De La Bidière, where they were met by friends who arrived by seaplane. The party stayed for two nights.

The seaplane departed first, at around 12:25 pm on Jul. 10. Weather was good, with calm winds under high scattered clouds. The time of the helicopter's departure is unknown but was later estimated at around 12:56 pm. The pilot didn't request a weather briefing or file a flight plan or flight itinerary; family members expected him to return that day but weren't advised of a specific schedule, and no one was asked to track the flight.

It was just before noon the next day before the Trenton base of the Joint Rescue Coordination Centre (JRCC) was notified that the helicopter was missing. No emergency locator transmitter (ELT) signal had been detected, and the aircraft's flight path was unknown.

The Search

The JRCC initially dispatched a CC-130 Hercules four-engine turboprop and a CH-146 Griffon helicopter to search for the R44. They were unsuccessful, so on Jul. 12 the JRCC raised the search level to "major," increasing the commitment of resources by the Canadian Armed Forces (CAF) and establishing an independent incident command post. In addition to the CAF, the operation grew to involve the Canadian Coast Guard,

ISTOCK/ALKANE

volunteer aerial search organizations from Ontario (the Civil Air Search and Rescue Association, or CASARA) and Québec (Sauvetage et recherche aériens du Québec, SERABEC), and the Sûreté du Québec (Québec's provincial police service).

The Transportation Safety Board of Canada (TSB) determined that the search efforts all told came to involve 12 fixed-wing aircraft and 6 helicopters, 44 airborne personnel, and at least 77 administrative, logistics, and public relations staff on the ground. Those figures don't include some 21 aircraft flown by private citizens who volunteered to survey terrain on the periphery of the JRCC's search zones.

Because the pilot owned other properties to the north and northwest of Lac-De La Bidière, the initial search area was more than double that of the plausible envelope around feasible routes to Sainte-Sophie. The JRCC ruled out the northern portion on Jul. 13, three days after the helicopter disappeared, reducing the search area from 26,750 to 11,320 sq km (10,328 to 4,371 sq. mi.). Triangulation from the last towers to ping the pilot's and passenger's cell phones allowed the JRCC to concentrate on the swath surrounding a flight to Saint-Sophie, further narrowing the search area to 3,600 sq km (1,390 sq. mi.) on Jul. 16 and eventually to 2,058 sq km (795 sq. mi.).

By Jul. 21, the search teams had overflown the entire area multiple times without success. In the absence of new information, the JRCC terminated the operation that same day, transferring responsibility to the Sûreté du Québec.

"More precise data" informed a fresh round of triangulation calculations on Jul. 24, pinpointing a specific location. The following day, ground-based searchers found the helicopter in dense forest 193 m (633 ft.) from that point. The pilot's body was still strapped into his seat, but the passenger was found 66 m (217 ft.) away.

Damage to trees at the crash site indicated the accident aircraft experienced a near-vertical descent.

The Investigation

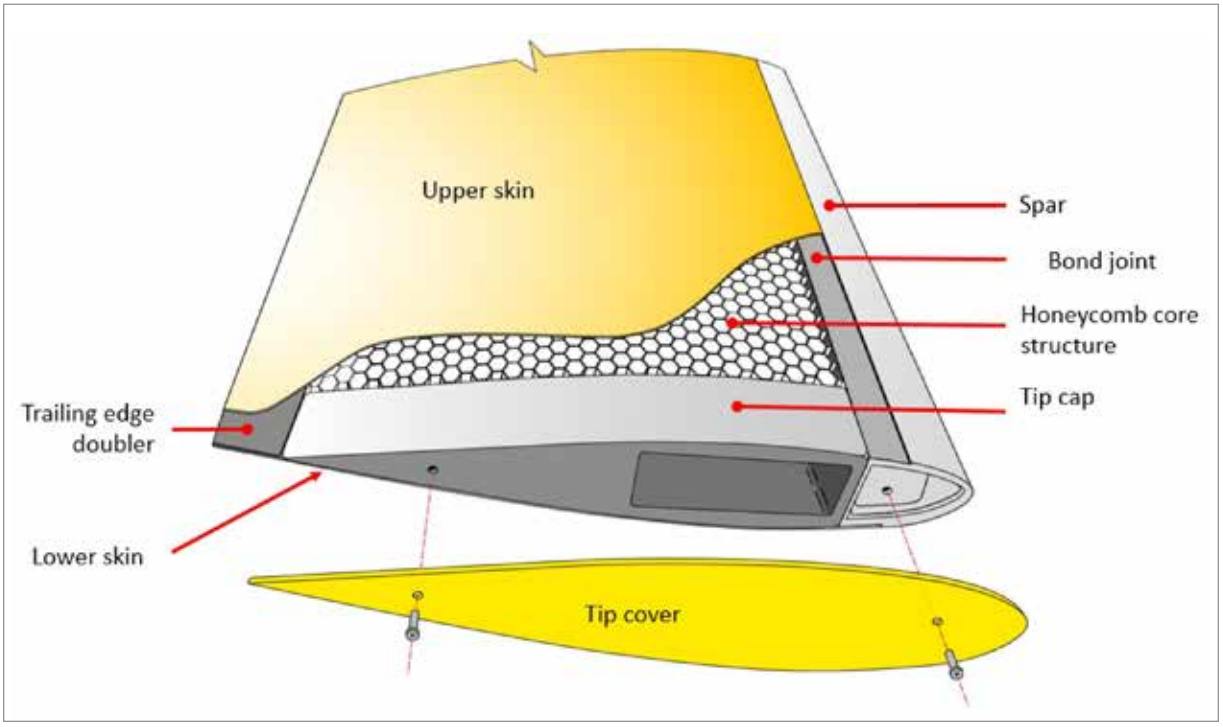
The helicopter was found upright on a rocky outcropping. Both tanks contained uncontaminated 100LL gasoline, and the engine showed no evidence of any pre-impact mechanical failure. Both drive belts were in good condition and correctly tensioned. The main rotor mast and head were still attached to the main gearbox, but the tail rotor and stabilizers had separated from the tail boom. The tail rotor blades were largely undamaged. Damage to the surrounding trees suggested a near-vertical descent.

One of the two main rotor blades, arbitrarily designated blade A, was bent in several places. The other blade, blade B, was straight but fractured at its tip. Neither showed the kind of leading-edge damage that would typically result from striking a tree while turning. Numerous deformations in their upper and lower skins suggested the blades had been subject to bending both upward and downward as they began to flap due to loss of centrifugal force at low rpm. Blade B also showed evidence of torsional (twisting) stress that apparently preceded the flapping.

The main rotor blades, part number C016-2, were original to the aircraft, which had been imported to Canada new in 2009. This blade's design fills the space between the stainless steel leading-edge spar and the trailing-edge doubler with an aluminum alloy honeycomb core covered by stainless steel skins on its upper and lower surfaces and terminated by an aluminum tip cover (see illustration, opposite). A spray adhesive is used to bond the honeycomb to the spar and doubler and the skins to all three of those components.

After multiple other instances of the spar–skin joint debonding near the blade tip on this blade model, the design was made subject to FAA Airworthiness Directive (AD) 2014-23-16, which requires a visual inspection for exposed metal at the spar–lower skin joint before the first flight of the day; repetitive 100-hour inspections by a

SÛRETÉ DU QUÉBEC PHOTO



The accident investigation revealed that evidence of blade skin debonding likely was detectable before takeoff but went unchecked despite a 2015 airworthiness directive that required preflight inspection of the specific main rotor blades installed in the accident helicopter and other R22s and R44s of similar vintage.

certified technician; and replacement of the blades with those possessing an improved design (in this case, part number C016-7) no later than Jan. 1, 2020. Compliance was also mandatory under Canadian regulations.

Closer examination of blade B found exposed metal along the spar–lower skin joint near the point the blade fractured, about 38 in. from its tip, with "signs of debonding and gaps in the skin at the spar bonding joint." The TSB noted that it was "highly likely that the metal surfaces in these areas were visible and detectable before takeoff." Destructive inspection also found a total of about 20 in. in which the adhesive on the spar and honeycomb didn't show the usual imprints left by contact between them, evidence of a manufacturing defect.

The TSB concluded that progressive debonding during the accident flight, compounded by the gap between a length of the spar and the honeycomb, led the blade to lose its stiffness and deform, causing progressively intensifying vibrations. Because the engine showed no sign of having been on at the moment of impact, the pilot is believed to have shut it down in an attempt to control the vibrations, then stalled the main rotor attempting an autorotation.

The helicopter's maintenance logs recorded the 100-hour blade inspections but didn't document the daily visual checks required by the AD, leaving doubt they were ever performed. This wasn't the only shortcut revealed by the investigation.

The private pilot held a helicopter rating, but his medical certificate had expired the previous October. Further, the lack of a flight plan or flight itinerary delayed initiation of search-and-rescue efforts by a full day and vastly expanded the search area, perhaps preventing help from reaching the passenger in time to save the individual. The arming switch on the body of the ELT was found in the "off" position. The safety lock to prevent its inadvertent movement from "arm" to "off" had snapped off long enough ago that the broken edge had worn smooth.

The Takeaway

While aerodynamics is a science, operating a flying machine requires a degree of faith. Without confidence that a rapidly moving collection of parts will continue moving together in flight, climbing into the cockpit would feel suicidal. But without self-discipline, confidence can breed complacency that slips into carelessness. No one takes off expecting to crash, but thoughtful action to prevent that contingency—such as careful fuel planning, informed weather evaluation, and a meticulous preflight inspection—is essential to preventing accidents.

Efforts to mitigate the risk of an accident are best backed up by measures to mitigate an emergency if one occurs. When flying over remote terrain, facilitating potential search-and-rescue efforts should never be far from mind.

Filing (and opening!) a flight plan, verifying ELT operation, and carrying a satellite-based tracking device can prove to be lifesaving precautions.

TSB IMAGE

 By Zac Noble

Protecting the Heart of Your Aircraft

Routine inspections and familiarity with your helicopter can spot engine problems before they lead to big-ticket repairs.

ENGINES ARE THE HEART OF ANY POWERED aircraft. As with human hearts, they require regular checkups and some attention from the user to maintain their health.

Like many of you, I've read countless articles by field experts, engine manufacturers, and makers of components, lubricants, and additives, searching for the magic formula to make my aircraft engines last longer. But, in reality, the secret to longer engine life comes down to some basic TLC.

Conduct Routine Inspections

As with most mechanical devices, much of an engine's durability depends on how you use and maintain the machine. Following a thorough inspection routine is a key aspect of maintenance that can identify a problem before it leads to a big-ticket repair or replacement.

Engine inspections typically involve several steps. On a piston engine, a compression check is required at annual inspection or as detailed in the OEM's maintenance manual. A differential compression check will reveal the health of your pistons, rings, valves, and cylinder walls.

These checks often yield different results between inspections, with numbers that may go up or down from cylinder to cylinder. Don't focus so much on the findings of a particular check; what's important are the long-term trends you uncover between inspections.

Logically, a differential compression check should be followed by a borescope inspection, to validate what the compression numbers showed. If your compression numbers are high, your borescope will probably show a good-looking cylinder, piston, rings, and valves.

Here's where the borescope is especially handy, though: it will help you identify an imminent problem, especially when a valve is burning. That valve could be sealing fine now, but a borescope inspection will show you whether the valve is burning and, hence, whether it

A couple of years ago, I was planning some long-range flights, but my confidence in the engine wasn't high, so I removed it for overhaul. What I found still bothers me today.

HAI/ZAC NOBLE

will fail if maintenance isn't performed.

Compression checks and borescope inspections cover our cylinders, but what about the crankcase and all the components inside it, such as the crankshaft, cam, lifters (tappets), piston rods, bearings, and a slew of gears? Here's where an oil analysis can identify a potential problem inside your engine case.

An oil-analysis program is much like the blood work conducted as part of your annual medical checkup. Some of the elements that can be identified and counted in an oil analysis are aluminum, chromium, iron, copper, lead, tin, calcium, magnesium, phosphorus, and zinc. Oil analyses also check the oil sample for viscosity, flash point, fuel content mixed in the oil, and any insolubles. If you haven't seen the results of an oil-analysis report, take a look. It's fascinating.

As with a compression check, the value of an oil analysis lies in the long-term trends it reveals. You don't have to be a chemical engineer to understand the report, because the oil-analysis lab technician will tell you in plain language in the report's comments section how your engine is functioning and any recommendations they might have for you, just like your doctor.

The Right Diet for Your Engine

All the inspections outlined in those countless articles won't matter if you don't manage what's taking place inside your engine. What you put into your power plant is as important as how you operate it.

The leaded aviation fuel that provides the higher octane our engines need compared with automotive engines produces more contaminants than unleaded fuel. That's why it's recommended that aviation engine oil be changed at intervals no greater than 50 hours if using a full-flow (spin-on) oil filter, or every four to six months, whichever occurs first. It isn't because the oil wears out—modern oils can go hundreds of hours and retain their lubricating quality. Rather, it's because aviation engines produce very dirty conditions because of their internal combustion process coupled with their use of leaded fuel.

The oil circulating through the engine must be clean in order to keep the machine clean, cool, lubricated, and sealed, so regular oil changes are a must.

Know Your Aircraft's Normal

Beyond routine inspections and oil changes, proper engine care also requires engine monitoring and pilot knowledge.

First, your aircraft should be performing within the limits specified by its manufacturer, meaning the oil pressure, oil temperature, cylinder-head temperatures, fuel flow, and so on should be within the design specs. Once it's been established that the aircraft meets OEM specifications, you should become familiar with what's normal for the aircraft you're flying that day.

An engine analyzer is a great tool, but the instrument between your ears is also essential in recognizing changes in engine behavior as they occur. If you don't pay attention to what your aircraft is trying to tell you, you might be surprised when the engine doesn't perform as you expect.

What You Don't See Can Hurt You

A couple of years ago, I elected to overhaul the engine in my own aircraft. It had been performing very well, but it was 350 hours over the recommended time before overhaul. I had relied on doing a repair or replacement based on condition, not time. As Part 91 operators, we have that prerogative. (Part 135 operators will have different guidance.)

I was planning some long-range flights, some that would put me over water for long periods of time. My confidence in the engine wasn't as high as I wanted it to be, so I removed the engine for overhaul. What I found still bothers me today.

The oil filter had never shown even a sliver of metal in the filter element, with oil temperature and pressure always in the green. I expected to see a clean, unharmed engine upon disassembly.

Instead I found enough solid metal in the oil sump to melt down and make new parts, and the crankshaft bearings looked like the Grand Canyon (take a look at the photos on the opposite page to see what I mean).

The metal I found in the sump was too large to be picked up by the oil system. Therefore, the metal never made its way to the oil filter, and because I used a quick-drain valve for easy oil draining, it didn't get through the small hole in the valve. All this meant I was oblivious to what was going on inside my engine.

That experience convinced me that all the measures I list above should be employed to assist in determining the health of your power plant. None of them alone will tell you the full story of what's happening within your engine, but if you conduct routine inspections and pay attention to what the aircraft is telling you, your engine will thank you—hopefully by continuing to move you and your aircraft forward.

By the way, since my overhaul experience, at each oil change I now also sweep the bottom of the oil pan with a magnet.

Fugere tutum!

By Terry Palmer

Components of Workplace Safety

Key measures can mitigate maintenance safety risks.

ISTOCK/RICARDOIMAGEN

ROTORCRAFT OPERATIONS MUST MEET regulatory and occupational health requirements, but other factors also affect operational safety and efficiency, including work environment and location, tools and equipment, human factors, and technician training.

Work Environment and Location

Safety in the hangar or maintenance facility is critical to the overall success of any rotorcraft operation. The location and environment in which helicopter maintenance is performed can vary significantly depending on the work required and whether it occurs inside a hangar or outside on a helipad. For this reason, technicians need to consider their personal safety no matter the setting. Extensive maintenance or repairs typically take place in a hangar or sheltered environment, but in some operations, line maintenance may be required in remote locations in perilous weather with limited facilities.

The hazards involved in helicopter maintenance differ from those affecting other types of aircraft because of the various nonlinear shapes and heights of many rotorcraft components. Because helicopters require frequent servicing to maintain optimal operating conditions, technician exposure to safety risks, such as work at height, is far greater than in fixed-wing maintenance work.

Although helicopters tend to be smaller than many fixed-wing aircraft, the height of their rotor assemblies and mechanical parts still poses a significant risk of injury from a fall. The removal and replacement of a

helicopter's major components or assemblies can be precarious work, and the presence of rotating blades presents additional danger in terms of both access and maintenance.

To reach many helicopter parts, techs have to climb ladders or scaffolding—while carrying tools. After accessing the aircraft, the tech might still have to stretch to reach the component requiring attention. If part removal or exchange is necessary, the worker might have to handle heavy parts at awkward angles, further complicating the task and posing additional personal safety risks.

This brings up several safety challenges. Injury from falls is the most obvious and has been more prevalent in recent years, perhaps due to the ever-rising number of aircraft. Another outcome, dropping components or tools, not only can injure the worker but damage the aircraft or serviceable component, as well.

Because helicopters require frequent servicing, technician exposure to safety risks is far greater than in fixed-wing maintenance work.

There's also the possibility the tech might become distracted during the repair and leave a tool or component behind, creating additional risk to the aircraft and others who'll be working on the helicopter or flying in it.

Fortunately, all of these safety risks can be mitigated with a few careful considerations.

Tools and Equipment

Using an appropriate ladder or maintenance stand improves both safety and efficiency. Maintenance stands that include a place for tools and trash make maintenance significantly safer and easier. If there's less chance of falls and components are easily accessible, there's lower risk of injury, damage, and distraction.

There are even ladders and stands that conform to the shape of a variety of aircraft, some of which move easily both indoors and out. Some are portable, and some fit in tight spaces. Maintenance stands and tools are also available that take technician comfort and efficiency into consideration, with padded platforms and handles.

Tool control is another issue that's plagued aviation. It's easy to forget or misplace a tool when working in an awkward or distracted environment. If the work is rushed or fatigue is a factor, the risk of error or injury increases. Misplaced tools can cause maintenance delays, and tools left in the aircraft can be dangerous.

There are several tool-control options out there, including high-tech toolboxes that electronically tag each tool and alert the tech when one is missing. Perhaps the simplest and most cost-effective form of tool control is shadowing the toolbox. With this practice, the tech returns the tools to the same location and outlines their shape in the toolbox, allowing him or her to see quickly whether anything is missing.

Human Factors

Human-factor issues such as fatigue and distraction can easily compromise maintenance quality and worker safety. Mechanics working long hours to meet deadlines sometimes have little time for rest. Interruptions by coworkers and others asking questions or looking for updates can further complicate matters. Fatigue and distraction can lead to mistakes, forgotten items, and poor decisions.

Major inspections can usually be planned with adequate time and staffing, but routine maintenance and out-of-service pressures often occur under less-flexible conditions. Safety policies that consider consecutive hours worked and scheduled update briefings can effectively mitigate such risks.

Technician Training

Work on helicopters can involve heavy maintenance and major inspections or regular, minor checks and repairs between flights. Whether the work is heavy or entails routine line maintenance, it's important that techs are suitably equipped for all tasks.

Equally important is a thorough understanding of the helicopter being worked on and proficiency in the required tasks. New technology incorporated into the aircraft can make maintenance efficient only if the technician has a strong knowledge of these systems, so initial and recurrent aircraft-specific training is highly recommended. In some countries, including most in Europe, type ratings are required for technicians.

Most aircraft-specific courses are available through manufacturers; others are offered at HAI HELI-EXPO®. Tech training in human factors, safety management, and troubleshooting has also proven to be effective in mitigating operational safety risks.

Each helicopter operation is different, but a goal common to all is safe, efficient maintenance to keep the rotors turning.

Jack Harter

Hawaii helicopter tour pioneer dies at 89.

JACK HARTER, WHO IN THE 1960S ESTABLISHED the first helicopter tour operators on Kauai, Hawaii, died Apr. 1, 2021, from complications following hip surgery. He was 89.

An industry pioneer, Harter parlayed his love for adventure into a lifelong aviation career. Born in Rapid City, South Dakota, on Dec. 26, 1931, Harter earned his airplane rating during his teen years. In addition to flying, Harter enjoyed parachuting, and he combined the two skills to work as a Hollywood stuntman and a smokejumper in California. In 1950, he left college to join the US Army and served as an infantry officer during the Korean War. Upon leaving the Army, he took up sailing to explore the Pacific before learning to fly helicopters in California.

By the 1960s, Harter had set his sights on pairing two of his passions—the "Garden Island," also known as Kauai, and helicopters—and began developing relationships and agreements with government entities in Hawaii that still benefit helicopter operators and environmentalists alike.

"Jack was a legend," says Paul Morris, director of operations at Sunshine Helicopters in Kealakekua, Hawaii, who had known Harter since 1984. "He would book flights by word of mouth. People sought him out. His skill and reputation set the bar high for our industry."

In 1975, with his wife, Bev, Harter opened Lihue-based Jack Harter Helicopters, which today operates five helicopters and employs six pilots and 32 other staff.

Harter had more than 35,000 flight hours, piloting tours, charter operations, and utility work and even volunteering his time and aircraft for rescue work before a formal rescue network was established on Kauai.

"He set the standard for the tourist industry that he hoped others would follow," Bev Harter says. "It didn't always work that way, but he really worked at it. He wanted to do what was best for the industry, not for himself."

In addition to his wife, who continues to run the 46-year-old company, Harter is survived by his two daughters, three stepdaughters, six grandchildren, and three great-grandchildren.

COURTESY JACK HARTER HELICOPTERS

INDEX OF ADVERTISERS

LAST LOOK

By Mark Bennett

ROTAK Helicopter Services
Kaman K-Max

ROTAK Helicopter Services is based in Alaska, but the operator brings its precision heavy-lift capabilities to locations across the United States, including helping rebuild Puerto Rico's infrastructure in the wake of Hurricane Maria.

Whether power-line construction, energy and mining development, aerial wildfire suppression, or less common projects like fishing a snowmobile from a glacial crevasse, ROTAK puts as much effort into planning and safety as it does flying. The company holds both BARS and, possibly unique among utility helicopter operators, IS-BAO Stage 2 certificates.

This K-Max, one of three in ROTAK's fleet (which also includes a pair of MD 500 helicopters), is resting during nearly a month of heli-logging in central Idaho, the type of operation for which the aircraft was designed.

PSI

Pacific Southwest Instruments

Complete Instrument & Avionics Service

OVERHAUL • REPAIR • EXCHANGE

PACIFIC SOUTHWEST INSTRUMENTS
PSI CERTIFIED
Home of Gold Medallion Instruments
Est. 1982
SEAL OF QUALITY

- Over 55,000 MRO Capabilities
- AOG Exchange Inventory
- Proactive Quality Control Program
- Legacy Equipment Specialist
- 37,000 sq. ft. Repair Center
- Inventory Asset Management

See our complete overhaul and repair capabilities at

www.psilabs.com

1721 Railroad Street • Corona, CA 92878 USA • (951) 737-0790

FAACRS#KD3R627L • EASA.145.4723 • Instrument 1,2,3,4 • Radio 1,2,3 • Accessory 3

2022

HAI HELI-EXPO

BY HELICOPTER ASSOCIATION INTERNATIONAL

FIND THE

FUTURE

SAVE THE DATE

REGISTRATION OPENS OCT. 25

MARCH 7–10 | DALLAS

KAY BAILEY HUTCHISON
CONVENTION CENTER DALLAS

EXHIBITS OPEN MARCH 8–10

HELIEXPO.COM