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ON THE COVER

Two Billings Flying Service (BFS) Boeing CH-47 Chinooks fly near the operator's home base in Billings, Montana. **SKIP ROBINSON PHOTO**

CANADIAN VERSION // One of four new Airbus H125 AStars belonging to Nova Scotia's Department of Lands and Forestry, Aviation Services, flies near Cape Split in the Bay of Fundy. **MIKE REYNO PHOTO**

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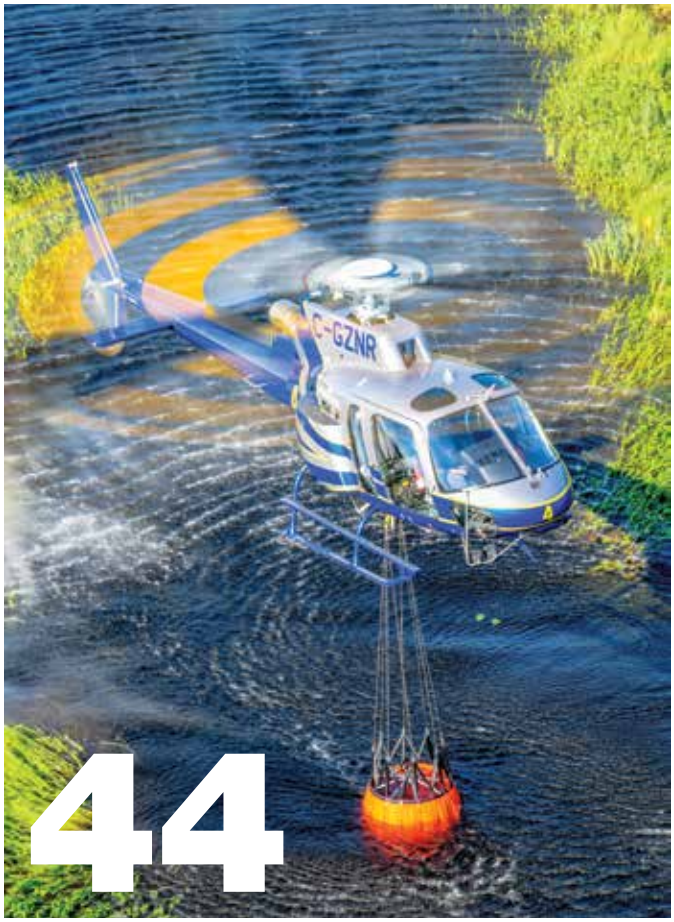

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A NOVA SCOTIAN SERVICE

A new fleet of four H125 AStars takes flight at Nova Scotia's Department of Lands and Forestry, Aviation Services. **BY OLIVER JOHNSON**

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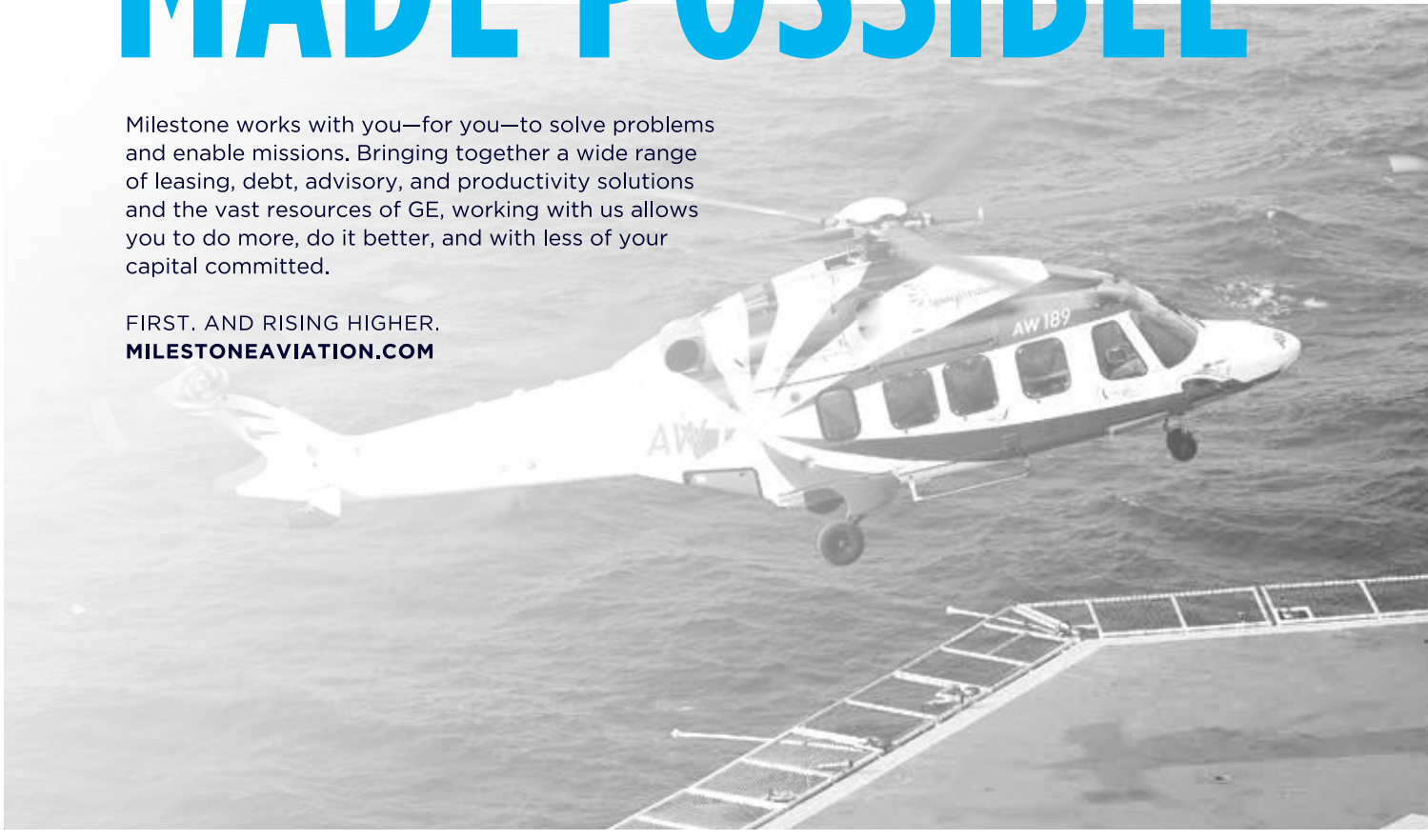

Column

Focus on Safety // **Geoff Goodyear**

Examinations are pure humbug!

As a character in Oscar Wilde's *The Picture of Dorian Gray* once noted, "Examinations, sir, are pure humbug from beginning to end." Anyone who gets into aviation will sympathize with this sentiment, having endured ground school and that most anticipated end game of the aviation education process — the written exam!

I have a checkered past with academic processes, with grade two having been the most challenging four years of my life. The most traumatizing exam event I encountered after this was when I wrote a pilot exam.

This was back in the day, before such conveniences as online access, when exam papers were physically gathered up by Transport Canada (TC) staff in Moncton, New Brunswick, and secreted off to locations throughout Atlantic Canada to unsuspecting junior pilots. I had to pre-register with TC to be put on their list and was then advised when and where to show up to write my exam. As Transport did not have an office in Gander, Newfoundland and Labrador, the exam was to be administered at the airport in some secret room, with the RCMP passing out the exams and casting a watchful eye over the student pilots.

Now, most of us experience some stress when writing an exam, but having exam monitors who wore sidearms put the stress level at an epic height. God help anyone who was caught cheating.

Coming into the exam room, I had every reason to be confident. Indeed, cocky would probably be a better description. You see, I had already been a commercial helicopter pilot for some years when my dad acquired a Cessna 172 on floats. It wasn't the most overpowered aircraft in the world (the only way it got off the water was due to the curvature of the earth), but my brother and I decided that with a plane in the family it was imperative that we learn to fly it — and borrow it as required. After all, that is what sons do.

So, I was registered to write the Alternate Category Commercial Helicopter to Private Fixed Wing. I swaggered into the exam room, gazing incredulously at these poor saps preparing to write voluminous exams that will determine the rest of their career paths. I, on the other hand, was here to write a one-pager of material I knew in my sleep. Confidence was high.

We all sat down and as a group we were all very well behaved. I think that had something to do with the heavily-armed exam monitor. We were each given our labeled envelopes with our individually prepared exams and told to open them. All hands in the room, save two people, were sweating bullets. The guy wearing the sidearm feared not, and showed no signs of stress. And I was cool as a cucumber anticipating an academic romp through the exam.

The first thing I saw when I opened the envelope was the exam title. My heart sank along with my knees, which was compounded by that choking feeling that accompanies high stress. "Commercial Multi Engine Pressurized Aircraft" was the exam they sent from Moncton! As smiles began to form on the faces of the other students as they realized they knew the answers to their questions, I began to loosen the top button on my shirt and could barely understand the questions, let alone provide answers to my exam.

I raised my hand and motioned to the attendant. "They sent me the wrong exam!" He looked as perplexed as I did. There was nothing he could do. No fax machines or email in those days. He called Moncton and they quickly acknowledged their error and he returned with details of his exchange with Transport. "They said to write it anyway. If you pass, you are on your way. If you fail, they will waive the normal waiting period and send you another exam next week."

Well, this was cold comfort, but what the heck. I scanned all the questions and any that had "d: All of the above" got an automatic check. Questions on braking indexes, pressurization and anything to do with variable pitch propellers caused me significant angst, but I pressed on. I got a call from Transport in a week or so. I PASSED! It wasn't pretty, but I stumbled across the pass line and I seem to recall them telling me that as long as I promised not to apply for a job with an airline, they would let me go. Very thoughtful of them.

Exams come in many formats these days, as attempts are made to simplify the education process and enable those of us with marginal capacity to retain knowledge. Some might argue it is an outdated process with doubtful outcomes, but we soldiered on with them in the hope that some tidbits of information might cling to us after having gone through it. Having considered exams inconveniences in the past, I now appreciate their value, as most of us can make good use of annual information reminders.

Have a safe summer everybody.

Having considered exams inconveniences in the past, I now appreciate their value, as most of us can make good use of annual information reminders.

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Column

Focus on Training // **Andy Roe**

Getting your bearings

A comprehensive pre-flight inspection before every training flight ensures that the helicopter is airworthy and safe to fly. Not all students look forward to this procedure, but it is important nonetheless. Your instructor will show you what to look for around the helicopter, while the flight manual/pilot's operating handbook has the inspection procedure spelled out in detail. Interestingly, the majority of the many parts and pieces to be looked at are bearings.

A helicopter is a mechanically complex assembly of major components supported by frames, brackets, hoses, fittings, tubes, castings, panels, plates, cables and bearings, all held together by an assortment of nuts, bolts and fasteners. Bearings comprise the largest group of items found throughout the airframe, and learning how all of the different bearings function and wear could be a ground school topic on its own. Bearings and bushings allow free and uninhibited movement of driveshafts, pitch links and other types of slide or rotational devices.

If you limited your pre-flight to checking just the accessible bearings around the airframe for proper condition and wear tolerance, you would be more than halfway through the inspection. Learning the function of bearings, understanding why they are there and how they work, might even make the pre-flight more interesting.

Bearings of all types and sizes keep the myriad parts and components moving and rotating freely. Most of them are visible and can be inspected "hands on" for acceptable condition before flight. Bearings are also installed inside the engine, main rotor transmission and tail rotor gearbox. These, obviously, cannot be inspected, but engineers make sure these components are properly assembled and airworthy when they are overhauled. Good instruction encourages student pilots to learn how these hidden bearings can fail, how to recognize an in-flight bearing malfunction, and what to do as an emergency procedure.

Piston engine bearings are steel shells that have soft metal bonded to their inside surfaces. They are cupped around the crankshaft, connecting rods and camshaft journals. When the engine is running, a thin film of pressurized oil injected between the bearings and the journals prevents friction and wear. When the engine is shut down, the full weight of the crankshaft, connecting rods and the camshaft rests on the bearing shells.

An aggressive overspeed when starting the engine could damage the bearing shells or cause them to rotate and dislodge in their housings before oil pressure is established. Left unreported, the next pilot flying that helicopter could face a sudden drop in oil pressure, or even a sudden stoppage of the engine altogether. Good instruction encourages a culture of pilot honesty and integrity at all times when mistakes are made. The truth is always easier to remember. Even though helicopter engines are extremely reliable, pilots must always be vigilant and ready to respond to a powerplant malfunction.

Turbine engines and transmissions contain ball, needle, and roller type bearings to support shafts and gear clusters. They are lubricated by the oil inside the component. These types of bearings are also used in certain airframe components such as the swash plate, main rotor grips and some tail rotor driveshaft installations. These are lubricated with grease.

In-flight indications of excessive wear or imminent failure of any of the engine or transmission bearings are irregular sounds or vibrations, and these require immediate pilot recognition and response. An engine failure has a workable emergency procedure we call autorotation. A complete tail rotor gearbox failure is more difficult to manage to the ground. A complete seizure of the main rotor transmission is a grave situation. The best place for any ailing helicopter is on the ground tout de suite.

Control tubes and pitch links transfer motion between components. For example, flanges on the movable upper section of the swash plate are connected to the main rotor grips through long pitch links with spherical bearings at each end to allow the links to move freely. The lower or non-rotating section of the swash plate has multiple pitch links as well. For just this one component, there are at least 10 spherical bearings that need to be checked on the pre-flight for acceptable wear tolerance.

With use, rod end bearings and spherical joints begin to develop radial (vertical) play and axial (side) play. Some flight control bearings must not have any radial or axial play at all. Others have an allowable wear tolerance expressed in thousandths of an inch or millimeters. Student pilots should learn to recognize the loose feel of a bearing with a radial or axial play of ten-thousandths of an inch (0.254 milimeters) as a standard. Older technology bearings need frequent grease lubrication. Many of today's bearings are Teflon-lined or of elastomeric technology not requiring lubrication, but are still subject to wear.

Pitch links, flanges, hinges, drive shafts, input and output quills and cables are good examples of helicopter parts that incorporate bearings — all of which need to be checked regularly. Finding a bearing somewhere beyond acceptable wear tolerance makes the whole inspection procedure seem worthwhile and confirms that a thorough pre-flight inspection is essential to maximize flight safety. When you hear about an unfortunate crash due to the failure of a $50 part, the chances are good that it was a bearing of some sort. Make sure that all of your bearings are in airworthy condition before flight to avoid becoming a news item yourself.

> Learning the function of bearings, understanding why they are there and how they work, might even make the pre-flight more interesting.

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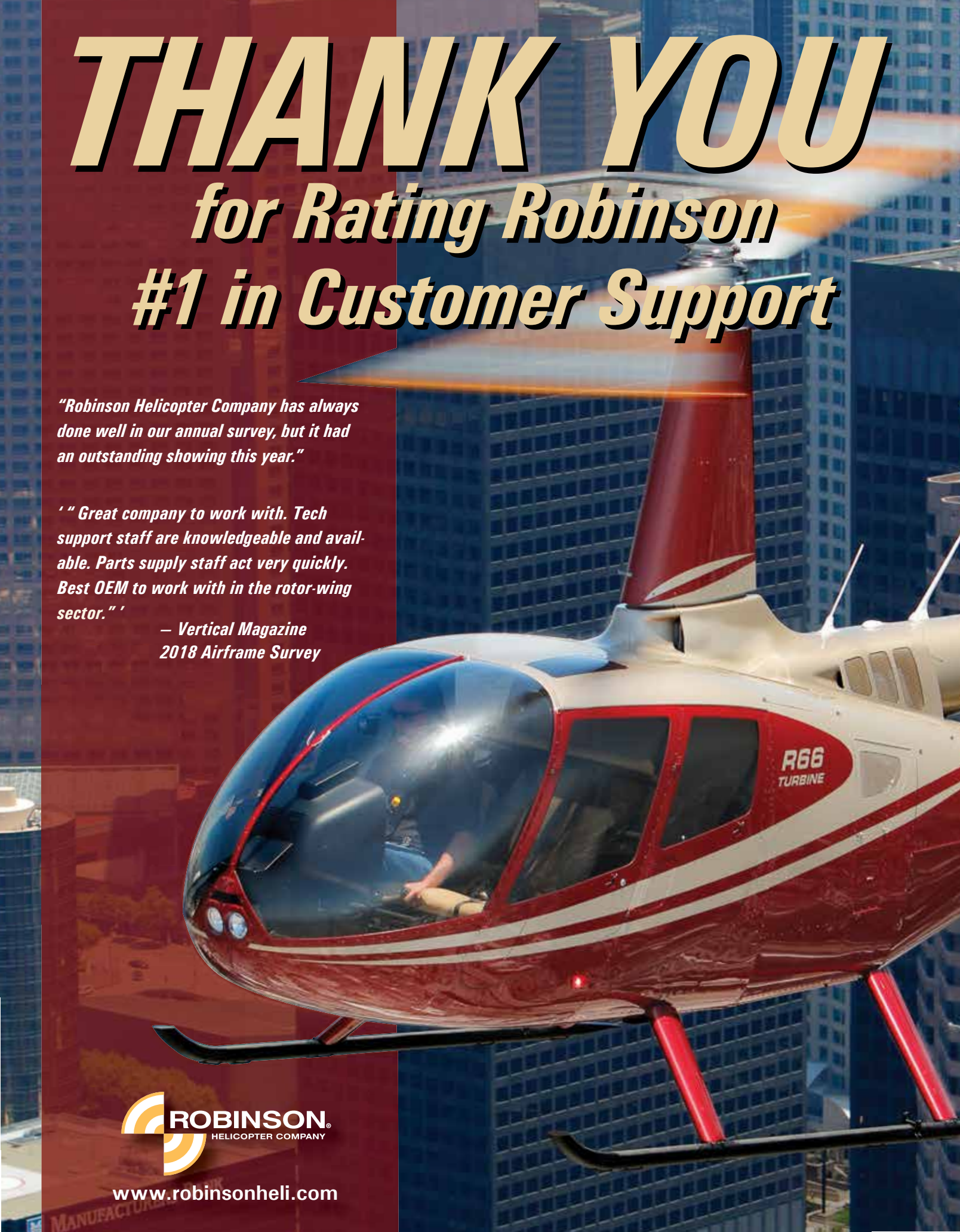

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Column

Focus on Maintenance // **John Carinha**

A question of bonding

For many people, bonding refers to the process of attachment that develops between romantic or platonic partners, close friends, or parents and children. It's a relational attribute that is characterized by emotions such as affection and trust.

But this is not a *Chatelaine* magazine article.

The kind of bonding I'm going to talk about is electrical bonding in regards to airframes and airframe systems.

Electrical bonding involves joining together all conductive surfaces, metal structures, and components so that they are all at the same electrical potential. This is achieved through hardware, bonding straps or wires, and metal-to-metal (non-painted) surface contact.

There are a couple of major reasons why electrical bonding is so relevant in an aircraft environment: it protects the aircraft and people inside it against lightning discharge; and also serves to minimize or eliminate static charge accumulation on the aircraft that could impede the quality of radio transmissions and communication systems.

However, a recent fly-in to our facility in Pitt Meadows, British Columbia, challenged this knowledge. The aircraft — an Airbus AS355 — had been conducting powerline inspections, and had experienced severe static noise on both VHF communication systems, rendering them inoperative. But once clear of the powerlines, the radios were operational.

My first instinct was to check for any radio software updates and check the configuration menus for any squelch adjustments. With the latest software loaded and the audio configuration settings set to levels deemed adequate, we conducted a flight test. No sooner were we staring 500,000 kV in the face than the radio's squelch broke wide open. Our ears were filled with static noise and any communication was unreadable. Resolve would not find us on this day.

A couple of weeks later, I was summoned to the client's base of operations. The problem aircraft had been pulled offline again, and was now sitting ready and willing to be diagnosed and repaired. I felt helpless, as I thought there were already no stones left unturned. We swapped antennas, checked the bonding from the radio tray to the instrument panel to the airframe — and all the checks proved successful. If this aircraft was a chess board, we were clearly at "check."

As the day wrapped up, I loaded my tools into my truck feeling defeated. As I drove away, I had a steep gravel road to climb, and as I negotiated it carefully, steering to one side, the helicopter came into view below me, in my side view mirror. I hit the brakes and stared. I carefully combed over its mirrored reflection and wondered. I flashed back to that initial flight test and could hear the sound of the static pulsating in my ears. And then it hit me. It pulsed. It had tempo. It had rhythm. It was in tune… with the NR (rotor RPM).

I quickly got myself back to the helicopter and took out my electrical meter and checked for bonding between the rotor blades and the airframe ground. Each rotor blade has a metallic leading edge which has a lap joint about mid-span. Of the three blades, two had outboard leading edge sections that were reading open (no bonding). Considering the amount of turning metal, bonding on a helicopter's drivetrain and rotor system is critical. I was not equipped, nor licensed, to start digging into the mechanical aspects to gain access to further investigate the issue, but I knew I was on the threshold of that elusive resolve.

I reported my findings back to my client. A follow-up was conducted two weeks later and they reported that besides the main rotor blades, a bonding wire was found damaged and another missing on the rotor system. Simply replacing and repairing these brought on a 90 percent improvement in radio transmission capability and quality. Checkmate.

No matter the time invested or how long one spends on troubleshooting a problem, a resolution is not found until the aircraft says it is. When a problem persists no matter what you try, ask, or do, it can become a mental game to outwit the issue. There have been many times I've stepped back and walked away from a problem, only to return at a later time with a different set of eyes and a revised attitude. Sometimes, rather than using anything you might find in a toolbox, the power of simple thought and wonder can be the best tool you have to solve a problem.

> There have been many times I've stepped back and walked away from a problem, only to return at a later time with a different set of eyes and a revised attitude.

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Column

Focus on Leadership // **Kim Hutchings**

Stop the madness

One of my favorite shows to watch on TV is *Shark Tank*. It's entertaining viewing, but I really watch it to learn from the sharks.

For those that don't watch the show, Kevin O'Leary (one of my least favorite sharks) has a couple of common sayings, one of which is, "Stop the madness!" He says it condescendingly when people are pitching their products, talking about how great they are, how much they are going to sell, and how it's going to be an obvious success. Of course, there is always a "but" at the end of their pitch — otherwise they wouldn't be on the show for help — and this is when O'Leary tells them to "stop the madness!"

I don't know if others feel the same, but to me it feels like the last 12 to 24 months has been an especially difficult time in the helicopter industry with the number of accidents and fatalities.

It goes without saying that safety is the most important issue for everyone connected to the rotary-wing world, yet we continue to have accidents. As someone dedicated to increasing safety and decreasing the accident rate, it makes me wonder what is going on. We have no shortage of articles, research, reports, experts, training, and opinions when it comes to the topic of safety, but the accidents still happen. This spawns a new cycle of research, articles, and expert opinions… and on we go.

Have we become a little too much like O'Leary when the reports and the articles and the experts talk about the importance of safety? Have we become so used to the articles and people talking about safety that we have become a little condescending? "Yeah, yeah, another safety report. We know, we know — we need crew resource management, safety management systems, risk analysis, briefings, a just culture…. We've heard it all before."

I actually don't think as an industry we have become like a condescending O'Leary at all. I think people truly believe in safety and making sure everyone goes home to their family at the end of the day. So what are we doing wrong? How do we "stop the madness?"

There are two things that stand out.

First, we have a loop that we repeat nearly every time there is an accident. When an accident happens, the response starts with a lot of finger pointing. It generally begins with the pilot taking the brunt of it, and then the company, and sometimes the manufacturer. Not until a country's accident investigation agency does a full accident review and investigation do we know what happened (and even then, we don't know everything that happened). We try to learn from our mistakes and new rules and regulations get put in place. In the meantime, it can take months or years for the final report to come out, and by that time, another accident has likely occurred and we have moved on from the previous one. And so the cycle continues. Accident. Finger-point. Investigate. Learn. Forget.

Maybe if there was a lot less finger-pointing, a lot more learning, and not as much forgetting, we might move closer to decreasing accidents.

The second thing I see going wrong is leadership style — or lack of leadership altogether. There is a lot of talk about safety culture and the importance of implementing it throughout the whole operation. Yet, how many times do you hear stories of a crewmember with an attitude, maintenance issues not being reported or addressed, or management putting pressure on the crew to meet production or budget limits. Again and again, I hear the same stories.

Having the right people in leadership positions is key, but even more important is that the leader uses the right style of leadership for the right reason.

For example, when it comes to creating a safety culture, transformational leadership is essential. A transformational leader builds trust, recognizes accomplishments, and inspires a collective vision (such as safety first). Unfortunately, the leaders I sometimes hear about are more aligned with a transactional leader style. The transactional leader places emphasis on the exchange that occurs between himself and his followers. That means, you get the job done no matter what, and the leader will reward you (through such things as an increased paycheck, promotion, or an upgrade to a better helicopter).

> A transformational leader builds trust, recognizes accomplishments, and inspires a collective vision.

The aviation industry is not like most organizations, because people's lives are on the line. Therefore, having a leader that builds trust and inspires a collective vision of making sure everyone comes home at the end of the day — even if it means not completing the mission — is so important.

How many times have we heard of helicopter emergency medical service (HEMS) accidents happening when pilots take off to fly visual flight rules (VFR) in instrument meteorological conditions (IMC)? We have seen these accidents year after year, sometimes a few times in a single year. HEMS pilots know the risks and likelihood of these types of accidents, they know the dangers associated with the decision to fly VFR in IMC, but every year the decision is made to do it anyways, with catastrophic results.

This is not meant to be a finger-pointing exercise. HEMS is not the only sector of the helicopter industry that repeatedly has the same types of accidents. Unfortunately, we all seem equally capable of repeating the same mistakes that have been made many times before. And it's going to need all of us to work together to break the cycle and stop the madness.

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Column

Focus on Operations // **Corey Taylor**

Do audits improve safety?

I think few would disagree that complying solely with the bare minimum of regulation is not likely to result in the safest operation imaginable. Allowing pilots to fly as many hours over as many days as regulation allows would probably lead to fatigue — if you could find anyone to work like that for more than a tour or two. Completing only the minimum amount of required training has undoubtedly led to accidents in the past, and likely will again.

A prudent operator establishes standards that fit the work environment, consider what has gone wrong in the past, and seek to prevent anything bad from happening again. There are obstacles to this pursuit, including the clientele who want the best possible service at the lowest price conceivable (and please throw in a picnic basket). We are ground like grains between the stones of what the client demands and what is achievable with the price they're willing to pay. Something must give and often does, sometimes tragically.

Enter the other kind of client. The one with the book of standards and policies so large as to pose a threat to shipping were it left floating on the same route as the Titanic. Most operators are more than willing to delve into and comply with the dictums of these massive books — as long as a contract is involved, and one that has good margins to boot. The bane of many an operator's existence are those clients that hand over that massive tome for us to comply with, making no promises of any work at all. It is a brave company that would invest the capital to fully comply based on little more than hope. With even a medium-sized fleet, the spend could be so far into six figures that a seventh is in sight, so it's little wonder we chew our nails right past the end and down to the first knuckle on contract award day.

All these thousands of pages, produced by well-meaning people who care about safety, begs the question: Do operators that abide by standards far beyond regulation have better safety records than those that don't? This is difficult to answer, but if we take the focus off the operator, and instead examine the clients' role in the application of these standards, I think the answer is yes. The caveat I would apply, is that by producing and insisting on rules that cover everything from the pilots' schedules to how much noise can be present in the sleeping quarters, the client has advanced safety for flight crews, but they have done this chiefly by shifting their position in the equation.

By removing themselves from the side of economic pressure — where the pilots who can always get the job done are rewarded and pushing weather and darkness become hallmarks to be desired instead of discouraged — clients are saying they value safety and compliance over price. When those clients reward compliance, usually with further work, and punish non-compliance by non-acceptance, the safety record can only get better. This is complicated for clients and operators alike, because pilots push weather, darkness and allowable weights to please the client. The "can do" attitude has been recognized as a cause of accidents for more decades than I've been alive, but if the clients reward it, it's here to stay.

Clients that produce those books of biblical proportion tend to want to confirm an operator is living up to what they say, and is complying with the standards they've invested so heavily in. This is difficult for the operator to achieve, not from a lack of desire, but due to the plethora of audit standards circulating the globe. Even deep-pocketed companies have trouble pleasing every client, especially when some of the standards contradict each other, or are simply unachievable due to logistics, or aircraft performance, or any number of other reasons. Larger companies may undergo dozens of audits yearly, usually paid for by clients. Logic would seem to dictate that a prudent client would accept an audit from another client (and some do), but whether it's prestige or liability, very few have that level of trust. I once went through two audits, a week apart. The audits had the same auditor and the same audit protocol. Only the client was different. Aside from a few laughs at the clients' intransigence, it's just the cost of doing business sometimes.

There does seem to be a desire to establish common audit standards among large groups of clients, with at least two competing for business. Most of the oil companies are endorsing one standard, and most of the big miners are endorsing another. While this ought to benefit lots of operators, the usefulness of some of the requirements still needs to be examined.

It's common to have findings on an audit, corrected by creation of policy, perhaps specific to a single client, followed by client acceptance. A few new policies written, a couple of memos sent, and all is good. Are we certain it has increased safety? Policy needs to become action, and that action needs to be examined to see if it had a positive benefit. Words in books don't make us safer unless they are wise to begin with and we actually follow them. Safety doesn't live on a shelf.

Policy needs to become action, and that action needs to be examined to see if it had a positive benefit. Words in books don't make us safer unless they are wise to begin with and we actually follow them.

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FieldOpsPhotos

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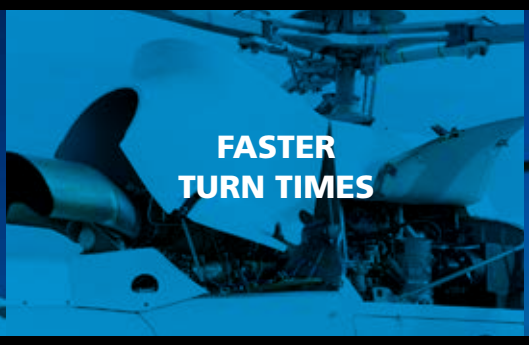
The Apple Valley helitack crew works hard alongside a HeliQwest Bell 205 in record-breaking heat to combat the valley fire in the San Bernardino mountain range in California. **Bryan Jeffrey Photo**

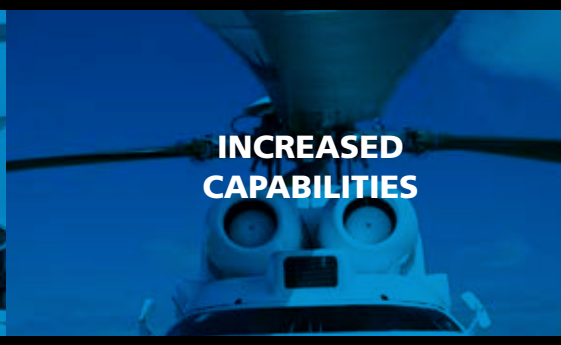
A Dutch landscape provides a very green (and flat) backdrop to this air-to-air photoshoot with an Aérospatiale SA 341G Gazelle and Airbus EC130. **Jimmy van Drunen Photo**

A unique lighting effect puts a rainbow on the rotor disc of this Airbus AStar in Miami, Florida. **David Alan Arnold Photo**

"Bubba," an Erickson S-64F Aircrane, works on a power line job on the British Columbia-Alaska border. **Shawn Evans Photo**

A HeliQwest AStar rests during a Colorado sunset. **Steve Nelson Photo**





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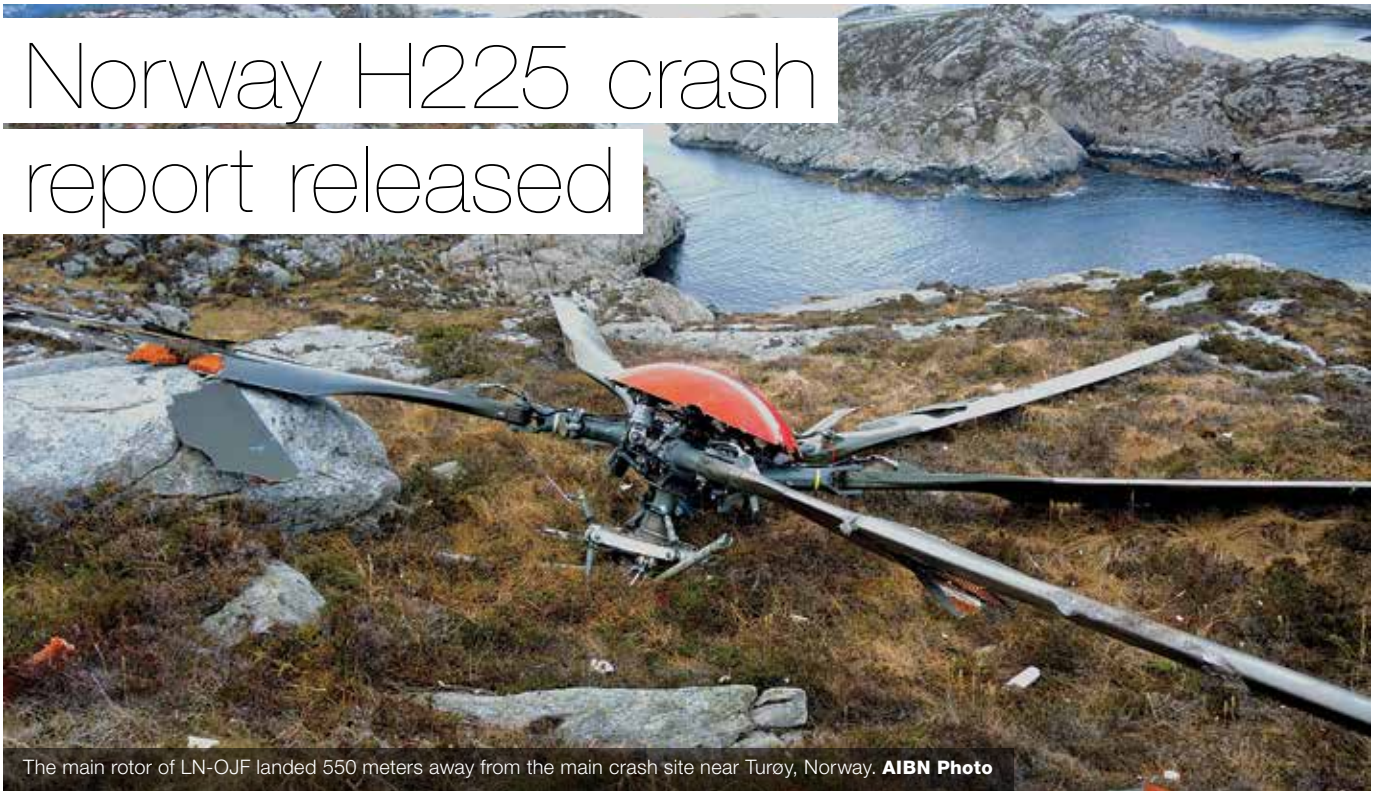
Norway H225 crash report released



The main rotor of LN-OJF landed 550 meters away from the main crash site near Turøy, Norway. **AIBN Photo**

AIBN recommends changes to Super Puma type design following crash near Turøy, Norway, in April 2016.

BY OLIVER JOHNSON & THIERRY DUBOIS

The Accident Investigation Board of Norway (AIBN) has called on Airbus Helicopters to revise the type design of the AS332 L2 and H225/EC225 LP, as part of its far-reaching final report into a fatal crash of a Super Puma near Turøy, Norway, in April 2016.

The recommendation to "improve the robustness, reliability and safety of the main gearbox" in the two Super Puma variants was one of 12 safety recommendations in the report. It also targets the European Aviation Safety Agency (EASA), calling on the regulator to revise certification standards for large rotorcraft, commission research into crack development in certain aircraft bearings, and make sure manufacturers' continuing airworthiness programs cover the examination of critical components found to be beyond serviceable limits.

The cause of the accident, which killed all 13 people on board, was a fatigue fracture in one of eight second stage planet gears in the epicyclic module of the main rotor gearbox, the AIBN report found. This ultimately caused the aircraft's gearbox to seize and rupture, leading to the detachment of the main rotor.

The aircraft — LN-OJF — was a CHC-operated H225, and was returning to Bergen Airport Flesland from Gullfaks B platform in the North Sea. It had just descended to 2,000 feet and was in cruise at 140 knots at the time of the failure. The AIBN said cockpit recordings showed the crew had received "no warnings" before the main rotor detached. The cockpit recording ended almost immediately, but data from health and usage monitoring systems showed the aircraft yawing and rolling to the right, impacting a small island about 13 seconds after the main rotor detached. It ultimately landed about 550 meters away from the main crash site.

The AIBN's analysis found the fatigue fracture began at the surface of the upper outer race of the planet gear bearing, initiating from a surface micro-pit and propagating below the surface.

"The combination of material properties, surface treatment, design, operational loading environment and debris gave rise to a failure mode which was not previously anticipated or assessed," the report stated. "The failure developed in a manner which was unlikely to be detected by the maintenance procedures and the monitoring systems fitted to LN-OJF at the time of the accident."

Indeed, the report notes that the gearbox had just 1,080 flight hours when it was installed in LN-OJF, and 1,340 flight hours at the time of the accident. During that time CHC had completed six visual inspections of the gearbox chip detectors without finding any chips.

The unanticipated nature of the failure was an area of particular focus for investigators, given the clear parallels they drew to the fatal crash of an AS332 L2 off the coast of Scotland in 2009 that killed 16 people. In that aircraft (G-REDL), the main rotor also detached following what was later discovered to be a fatigue fracture in a second stage planet gear.

"However, the post-investigation actions were not sufficient to prevent another main rotor loss," the Norwegian report noted, adding that "the [G-REDL] accident was not fully understood at that time due to the lack of some essential wreckage parts."

DESIGN CONCERNS

The report noted that the design of the second stage planet gears in the AS332 L2 and H225/EC225 LP was based on earlier AS332 L/L1 and SA330 Puma gearboxes. The architecture of the L2's epicyclic module was based on the L1, but it was fitted with eight larger diameter planet gears rather than the nine in the L1.

Bearing manufacturers FAG and NTN-SNR supplied planet gear bearings for the L2's epicyclic module, and, during the design of the H225/EC225 LP, Airbus asked them to re-evaluate the epicyclic module planet gears for use in the more powerful new aircraft. According to the AIBN report, Airbus concluded that the epicyclic module was capable of withstanding the H225/EC225 LP's higher operational loads without change in design, but it gave different operational time limits (OTL) for the two variants: 4,400 flight hours in the H225/EC225 LP, and 6,600 flight hours in the L2.

During the AIBN's investigation, it found that no FAG-supplied second stage planet gears reached their intended OTL of 4,400 hours before being scrapped during inspection, and only about 10 percent of NTN-SNR planet gears did. The report notes that between the dates of the G-REDL accident in 2009 and the LN-OJF accident, Airbus Helicopters did not section and inspect any of these second stage planet gears.

The investigators also noted dimensional differences between internal bearing parts manufactured by the two suppliers. Airbus Helicopters told the AIBN it had "no reason to regard the potential differences in performance of the planet gears as a contributing factor at the time" of the G-REDL crash, the AIBN report stated, and it wasn't noted in the report of that accident.

"Airbus Helicopters considered the [G-REDL] accident as mainly a result of maintenance error and additional safety measures were introduced to improve the chip detection system," the report stated. "Hence, they did not regard the performance of the planet gear bearings as a significant safety factor at the time. In contrast, during the LN-OJF investigation the performance difference between FAG and NTN-SNR has been a significant issue."

Following the crash of LN-OJF, the H225/EC225 LP and AS332 L2 fleets were grounded by regulatory agencies around the world, and as part of the types' return to service following the grounding, Airbus implemented a variety of safety measures. Among these were the removal of FAG planet gears from service, and the reduction of the service life limit of the planet gears to 1,100 flight hours for the H225/EC225 LP and 1,650 flight hours for the AS332 L2.

"The introduction of service life limit for the second stage planet gears and the latest reduction to 1,100 flight hours, indicate that the design initially did not possess sufficient robustness for the EC225 LP application," the report states.

"Two catastrophic events and the service experience of few second stage planet gears reaching their operating time limit, may suggest that the operational loading environment, on both AS332 L2 and EC225 LP, is close to the limit of endurance for the design.

"New continuing airworthiness requirements and ADs reacting to service experience should be temporary safety measures only. To address the permanent solution changes to the type design should be considered."

A RAFT OF RECOMMENDATIONS

The investigators said they still don't fully understand the failure mode — a failure that was not previously anticipated or assessed — and as such, have recommended to EASA to commission research into crack development in certain aircraft bearings.

And, as the chip detection system in the accident aircraft didn't find any warning of the impending failure, the AIBN recommended EASA revise the certification specifications for large rotorcraft to introduce requirements for chip detection performance.

Following that, given that it might not be possible to assess the fatigue reliability of internal gearbox components, it recommended EASA require a fail-safe main gearbox, in which no failure of an internal component leads to a catastrophic failure.

In response to the AIBN report, Airbus Helicopters said it expressed "deep regret" for the accident and welcomed the conclusion of the investigation.

"Neither aviation authorities nor industry had ever seen the type of crack in the main gear box that led to the LN-OJF accident," the company said in a statement. "Extensive analysis of the accident has led to the development of a set of safety measures, approved by global aviation authorities, which have allowed the H225 fleet to resume flight operations worldwide."

In addition to the changes impacting the second stage planet gears, the safety measures implemented by Airbus included the installation of a full flow magnetic plug to collect main gearbox particles upstream of the oil cooler, intensified maintenance inspections, and the removal of epicyclic modules from service that had been subject to unusual events.

"Today, as a result of the measures introduced by Airbus Helicopters and approved by global and national aviation authorities, including the U.K. and Norwegian CAAs, the H225 meets the most stringent, global airworthiness standards," said Airbus.

"The company continues to work on incremental improvements to the H225 as part of its ongoing, continuous improvement process."

Responding to the Norwegian investigators' criticisms of its actions, EASA said the AIBN's report contained "a number of opinions and hypotheses."

The European regulator said the decisions it made after the G-REDL accident "were based on the knowledge available at the time, and the actions put in place were justified and commonly agreed."

It said the micro-pitting that initiated the crack in the gear on LN-OJF "had not been identified with respect to the G-REDL accident investigation or analysis." Indeed, several parts were not recovered.

EASA concluded that the investigation "did not reveal any facts or evidence available at the time that would invalidate the basis" for the return-to-service process after the G-REDL accident.

LN-OJF was a CHC-operated Airbus H225, and was returning to Bergen Airport Flesland from Gullfaks B platform in the North Sea. **Mihai Crisan Photo**

Airbus & Era settle H225 lawsuit

BY OLIVER JOHNSON

Era Group has received $42 million from Airbus Helicopters as part of a settlement of an ongoing lawsuit related to Era's purchase of 11 H225 Super Pumas.

Era was one of several companies seeking remuneration from Airbus for aircraft they claimed were no longer airworthy, as well as damages and costs. Among a range of allegations in the lawsuits, it was alleged that Airbus sold the helicopters in a defective state due to an inherent problem in the H225's main gearbox.

The allegations stem from the grounding of the global H225 fleet following the fatal crash of a CHC-operated H225 near Turøy, Norway, on April 29, 2016, which claimed the lives of all 11 passengers and two pilots on board after the main rotor separated from the fuselage.

In its final report on the accident, released July 5, 2018, the Accident Investigation Board of Norway said the cause of the accident was a fatigue fracture in one of eight second stage planet gears in the epicyclic module of the main rotor gearbox. The seizure of this caused the main rotor to detach *(see p.26)*.

In the weeks and months following the crash, regulatory agencies around the world lifted the grounding as Airbus Helicopters implemented a variety of measures designed to ensure the safe return to operation of the H225 fleet, including creating a "full-flow" magnetic plug to improve the detection of metal particles, excluding one of two types of planet gear from operation, and enhanced packaging for the main gearbox.

But in its lawsuit, filed in November 2016, Era alleged the representations made by Airbus regarding the safety, reliability, and design of the 225 and, in particular, the design and reliability of the main gear box, "were (and remain) demonstrably false in light of recent revelations by Airbus Helicopters that at least the second stage planet gears inside of the main gearbox are irreparably defective, rendering the 225 unfit for flight."

Airbus refuted the charge.

And in a third-quarter earnings call in November 2017, Era Group CEO Chris Bradshaw said the operator had reappraised its H225s at just $4 million per helicopter.

The settlement between the operator and the manufacturer covers "all claims made by Era against Airbus related to Airbus' marketing and sale, and Era's purchase, of 11 H225 model helicopters," a stock exchange filing from Era stated.

As part of the settlement, Airbus will also provide Era with "trade account credits" that can be used for up to five years. Neither party has admitted fault.

Era had alleged that Airbus sold the H225s in a defective state due to an inherent problem in the aircraft's main gearbox. **Airbus Helicopters Photo**

RotorBits

Bell Photo

Fourth Bell 525 joins flight test program

The fourth Bell 525 flight test vehicle (FTV) has completed its first flight, the manufacturer has announced.

"This is another significant milestone for the Bell 525 program and a testament to the hard work being completed at our flight research center," said Byron Ward, vice president of the Bell 525 program. "We are focused on certification and delivering the most technologically advanced helicopter to market."

When certified, the 20,000-pound (9,070-kilogram) gross weight 525 Relentless will become the first commercial fly-by-wire helicopter, competing against the likes of the Airbus H175 and Leonardo AW189 in the super medium category. Bell is currently aiming for certification in 2019.

DART firefighting bucket impresses in tests

DART Aerospace's new 320-US gallon (1,210-liter) bucket has "exceeded expectations" during testing with Guardian Helicopters, the company's engineers have reported.

The tests have included functionality checks in damaged conditions, in-flight stability assessments, simulated bucket maneuvers and a large number of drops in forward flight and banked turns. As the bucket flew at speed, the accuracy of the drops was also assessed.

"Our test pilot was impressed that even with the removal of parts to try and disable the bucket, it continued to be stable in flight — had no issues picking up and dumping water as before," noted Phillip DiFiore, president of Guardian Helicopters.

Safran tests hybrid electric propulsion system

BY THIERRY DUBOIS

Safran Helicopter Engines has passed a major milestone in its hybrid electric propulsion roadmap, following the first ground test of a distributed propulsion system — the type of system it is partnering with Bell to develop for the airframer's urban air taxi program.

The engine manufacturer's recently announced partnership with Bell involves powering a vertical takeoff and landing (VTOL) flight demonstrator, a Safran spokesperson told *Vertical,* and the first ground test of the hybrid system, in mid-July, is an important step in getting ready for that demonstrator.

Jean-Baptiste Jarin, Safran's vice president of the hybrid propulsion system program, said his company is on track to support an entry into service in 2025. Given the predictable development cycle, he sees a demonstrator flying six or seven years before – therefore in 2018 or 2019.

In a distributed hybrid electric propulsion system for aircraft, a turbo-generator (a gas turbine driving an electrical generator) is coupled to a bank of batteries. This system powers multiple electric motors turning propellers to provide propulsion. The power is efficiently distributed by a new-generation power management system, and the motors are controlled by a fully-integrated smart power electronics assembly.

The 100 kW (130 shp) hybrid propulsion system Safran has ground-tested is based on the e-APU, an auxiliary power unit in service with the Leonardo AW189 super medium twin.

"This test marks a major step forward in demonstrating our ability to offer hybrid propulsive solutions for tomorrow's aircraft," said Jarin. "We are on track to meet our goal of testing a more powerful system in the near future."

The manufacturer plans to evaluate that 500 kW system over the next few months, and Jarin said such a system would be compatible with a four-passenger VTOL vehicle. It could also be fitted on a 10- to 12-seat fixed-wing aircraft, like the one Zunum is developing in the U.S.

Several operating modes were tested and validated during the first series of tests, held at a Safran Helicopter Engines test facility near Pau-Pyrenees Airport in France.

Safran's hybrid electric propulsion system features the possibility to feed the motors with electric current from the batteries and, for peak demand, directly from the generator. During the first ground test, the electric motors were powered only by batteries or by a combination of batteries and turbo-generator.

The demonstration was conducted by Safran Helicopter Engines, Safran Electrical and Power and Safran Power Units, in conjunction with Safran Tech, the group's research and technology center.

"Following the recent announcement of our partnership with Bell concerning 'mobility on demand,' this latest milestone clearly reflects Safran's determination to invest in the development of hybrid electric propulsion systems, which will be the foundation of future propulsion solutions," said Stéphane Cueille, senior executive vice president for R&T and innovation at Safran.

Safran believes hybrid propulsion systems will contribute to the emergence of new VTOL and STOL (short takeoff and landing) aircraft, by enhancing their flight capabilities and expanding their range of missions.

Under the "shared vision" unveiled last month, Bell said Safran will "bring its technical expertise to bear in the development of a disruptive propulsion system."

Hybrid propulsion systems are expected to contribute to the emergence of new VTOL aircraft. **Remy Bertrand Photo**

Bell said that feedback received through *Vertical*'s 2018 Helicopter Manufacturers Survey influenced its decision to change its parts distribution policy.
Mike Reyno Photo

Bell changes parts distribution policy

BY ELAN HEAD

Bell has responded to customer complaints by reversing an unpopular parts distribution policy that had limited sales to owners and authorized customer service facilities only.

Under a new policy that became effective July 2, the company is once again selling parts to Federal Aviation Administration-approved part 145 repair facilities and their international equivalents, giving Bell's civil helicopter customers more options for maintaining their aircraft.

Bell's previous restrictions on parts sales had been a significant concern for respondents in *Vertical*'s 2018 Helicopter Manufacturers Survey, conducted earlier this year *(see p.78, Vertical, June-July 2018)*. For the first time in the annual survey, Bell saw its overall customer support ranking fall to second among the major helicopter original equipment manufacturers, behind Robinson Helicopter Company.

At the time, Bell told *Vertical* readers, "based on the survey feedback and other customer input, we are evaluating our policies to address areas of concern in parts distribution and better ways to provide customer service."

Now, the company has moved swiftly to resolve this customer pain point, in what Javier "Jay" Ortiz — Bell's senior vice president for the Americas, commercial business — described as a "first step" in a comprehensive effort to re-evaluate its customer support practices.

"We continue to take a look at our policies to make sure that what we put in place improves the level of service to our customers, while maintaining the high quality of service and support and safety that we expect from Bell," he told *Vertical.*

Ortiz explained that this effort is part of a broader company reorganization that coincided with Bell's rebranding earlier this year. What was previously a standalone customer support and services unit now falls under a commercial business organization led by Susan Griffin, who previously served as Bell's executive vice president of commercial programs and vice president of the Bell 525 program.

Ortiz, who most recently served as Bell's managing director for Latin American sales, now reports directly to Griffin, as does Patrick Moulay, who has been named senior vice president for the commercial business – international.

"Where there was the individual sales and marketing of aircraft, and the support element, [these] have been completely absorbed, so that now from a sales perspective, and a customer-facing perspective, we are one unit basically taking care of the aircraft from cradle to grave," Ortiz said.

Going forward, customers can expect one primary point of contact for all of their Bell needs. Ortiz added, however, that the company is also putting systems in place to better communicate internally, so that, for example, "if a customer decides to address his issue with a customer support engineer, the person responsible for the account knows that a) the customer had an issue, and b) the customer support engineer resolved it. And if he hasn't resolved it, he can follow up with the customer and the customer support engineer to help drive a resolution to that problem."

Meanwhile, Ortiz said, Bell continues to gather information on other ways to improve customer support.

"We're still in the discovery phase," he said. "There's a recognition that because we were kind of stovepiped, we just don't know what we don't know and we're going through the policies and procedures one step at a time. . . .

"As we go through this process of taking a look at our policies and procedures, we continue to tweak those policies and procedures with our end customer in mind."

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Offshore oil-and-gas on cusp of recovery

Bristow recorded an increase in annual flight hours for the first time in three years last year, indicating the start of a gradual recovery of the offshore sector. **Bristow Photo**

BY THIERRY DUBOIS

The downturn in the offshore oil-and-gas industry has bottomed out and the sector is beginning its recovery, the major operators are reporting. Citing rotorcraft utilization numbers, they believe they are not of the woods yet, but are expressing optimism.

It has been one of the worst ever downturns in the oil-and-gas sector, caused by plummeting oil prices in 2014. The impact forced operators to implement restructuring plans – including job cuts – and manufacturers to ramp down production abruptly. Overcapacity is still keeping flight hour pricing at low levels.

But now operators and airframers agree that a favorable trend has appeared. "There are signs of recovery," said Mark Abbey, CHC's regional director for Europe, Middle East and Africa.

Jamie John, NHV's base manager in Aberdeen, Scotland, agreed. "The market has not returned to where it was five years ago, but [it] has been steadily improving," he told *Vertical.* "Compared to a year ago, a lot more exploration campaigns are taking place."

This has recently translated into a 30- to 40-percent increase in NHV's monthly flight hours, or an extra 100 hours per month. "A lot of new players are coming to Aberdeen, purchasing assets in the field sold by legacy players," John added. NHV is operating 15 helicopters in the North Sea.

Over at Bristow, the offshore giant has seen an increase in annual flight hours for the first time in three years. In its 2018 fiscal year, which ended on March 31, 2018, it recorded 165,000 flight hours — a 13,000-hour improvement over fiscal year 2017. "We are in a gradual recovery," said Bristow president and CEO Jonathan Baliff. "Now offshore oil-and-gas is becoming cost-competitive again and our clients realize they need to run a portfolio."

Sikorsky is similarly positive. "We have seen an increase in the percentage of flight hours for the S-92 helicopter fleet operating in the offshore oil-and-gas segment," David Martin, Sikorsky's VP for oil-and-gas and leasing, told *Vertical.* Also, the number of S-92s not flying is decreasing to the point of "nearing single digits," he added.

"We have seen a nearly 10-percent increase in flight hours for the S-76D fleet in the first quarter of 2018, as compared to the first quarter of 2017," said Martin, noting that the medium segment (to which the S-76 belongs) is where most of the offshore flying happens.

Airbus's head of oil-and-gas market, Alexis Vidal, is somewhat more cautious. "While

it is too early to talk about a recovery, we have seen a double-digit increase in spending for exploration and development in 2017 compared to 2016, and this has continued rising since January 2018," he said.

Both Vidal and Martin emphasized the market remains "difficult." There remains "a significant excess capacity" of offshore helicopters in the market today, Vidal pointed out. Martin agreed the market is still "oversupplied."

"We are beginning to hear conversations about what the future holds," CHC's Abbey said, describing himself as "cautiously optimistic."

He has hope in renewable energies as a growth relay. The construction of a wind farm, for example, needs a lot of helicopters. Then, multiple maintenance checks are required every year for a wind turbine.

"For helicopters, the sweet spot is when wind turbines are built 40 nautical miles from the shore," Abbey said. CHC already has contracts in the wind industry.

Consulting service provider Westwood Global Energy Group sees "a significant opportunity" in the offshore wind market. Almost 6,000 turbines are to be installed globally between 2018 and 2022, bringing the global total to 10,000, according to Westwood. It expects $119 million of offshore wind-related helicopter expenditure over the forecast – a growth rate of 39 percent.

Back to oil-and-gas, Bristow's Baliff said he expects the gradual recovery to continue over the next 12 months. Will all this translate into employee recruitment and aircraft orders? "We have started hiring pilots — we let one third of our workforce go since the downturn began," Baliff said.

But airframers are not expecting a rebound in sales anytime soon. "While there are some encouraging signs, we anticipate flat demand for commercial helicopters in 2018," said Sikorsky's Martin.

Baliff estimates the industry does not need more helicopters. "Let's sweat the assets, we want to use the existing fleet more because it is young," he said.

The only short-term hope, for manufacturers, is new models replacing older ones. "We have seen a shift from the use of heavies to super-mediums," said Airbus's Vidal.

Building Safety at Every Level

CHC explores key themes ahead of 2018 CHC Safety & Quality Summit.

The CHC Safety and Quality Summit has grown to become one of the foremost global aviation safety events in the industry. Ahead of this year's event — to be held in Dallas, Texas, Oct. 2 to 4 — Karl Fessenden, president and CEO of CHC Helicopter, has previewed the focus of the 2018 Summit.

"The quest to improve safety and reliability can never end if we are to get everyone home safely after every flight," he said. "The roots of a strong safety culture are not found in posters or statistics, but in the actions and attitudes of employees at all levels of an organization."

Events like the summit are part of the aviation ecosystem that builds and sustains safety best practices for both rotary- and fixed-wing operations. Over the past 14 years, it has become an essential opportunity to refuel commitment and share new ideas toward the shared goal of eliminating injuries and accidents.

"The summit provides a forum for professionals from aviation, energy, training, insurance, universities, OEMs and regulatory sectors to learn from one another," said Fessenden. "Time to focus exclusively on safety allows us to raise the bar across our industries in a way that would just not be possible without the summit. Everyone returns to their own organization with not only a renewed focus, but the latest tools and practices to make their organizations safer."

An extremely high caliber of speakers will be attending the summit, including professionals from the highest levels of regulatory agencies such as Australia's Civil Aviation Safety Authority, to frontline safety employees from aviation operators. This year's gala dinner speaker is Alison Levine, the team captain of the first American Women's Everest Expedition.

"Alison has climbed to the summit of the highest peaks on each of the seven continents," said Fessenden. "She has taken part in many other adventures and we look forward to learning from her experience as a leader."

THE HUMAN FACTOR

Human error remains a contributing factor in many aviation accidents and incidents, and extensive research has been conducted into why accidents happen — from the analysis and subsequent identification of errors and gaps in existing safety management systems, to better understanding their influence on human behavior.

That research led to the creation of the Human Factors Analysis and Classification System (HFACS). Developed by Doug Wiegmann and Scott Shappell, a returning speaker to this year's Safety & Quality Summit, HFACS is now widely deployed across the aviation industry.

"We use this information to rethink how we stay safe on the ground, in the air, and across the whole of our operation," explained Fessenden.

In the air, CHC said it continues its investment in flight safety through the adoption of line operations safety audits (LOSA) and ongoing work to enhance flight data monitoring (FDM). These changes help identify improvements in both human and procedural performance. On the ground, maintenance tasks have also been standardized, greatly aiding compliance and monitoring.

"While LOSA looks at the behaviors of aircrew during normal flights, we are also strengthening the way we manage similar checks on the ground," said Fessenden. "This helps us zero in on challenging areas where we have opportunities to improve. We're also introducing revamped training programs for ground operations, with an increased focus on reducing loss time injuries through personal safety.

"A lot of the technology we see in fixed-wing aviation, like FDM and HUMS [health and usage monitoring system], is still relatively new to rotary operations," Fessenden continued. "We are working hard to customize this technology for our aircraft and operations."

In partnership with Skytrac and Leonardo, CHC is testing a new capability on the AW139 that will automate the transmission of HUMS and FDM. "The ultimate goal is to have real-time HUMS monitoring while the aircraft is flying, so we can be notified about issues as they arise," said Fessenden.

"As we work through our own key initiatives, we've been defining central standards and expectations around safety. However, our local teams know their regions and operations better than anyone else, so their feedback is essential. We are making sure the local teams share their perspectives and best practices, while also giving them the support needed to make sure these efforts comply with their operational needs and local regulations."

RotorBits

MD announces flight training academy

MD Helicopters, Inc. (MDHI) has revealed the formation of the MDHI Flight Training Academy.

The academy will provide maintenance and pilot training, with MDHI expanding its current training offerings to include a more comprehensive portfolio focused on mission execution, effectiveness and safety.

All classes incorporate safety, crew resource management and other aircrew considerations, and include classroom instruction as well as flight time.

Developed to create proficient aircrew and maintenance personnel that will enhance an operator's aviation capability, readiness, and safety, courses can be conducted at the MDHI Training Center in Mesa, Arizona, using MDHI-owned aircraft, or on-location at a customer's site using customer-owned aircraft.

Vertical contributors win Aerospace Media Awards


Anthony Pecchi Photo

Contributors to *Vertical* and *Vertical 911* magazines were recognized with Aerospace Media Awards at a dinner at the Royal Aeronautical Society in London in July.

Anthony Pecchi took home the prize for Best Aviation Image for his Airbus family flight photo, which appeared in the December 2017-January 2018 issue of Vertical.

Meanwhile, Dan Megna was recognized for Best Rotorcraft Submission for his compelling account of the Ventura County Aviation Unit's early response to the Thomas Fire, the largest of the devastating wildfires that swept through Southern California in December last year. That story appeared in the Winter 2018 issue of *Vertical 911*.

This year, there were more than 250 nominations for awards in 12 categories.

Maximum Pilot View Kit approved for AStars in Canada

BY DAYNA FEDY

The Maximum Pilot View Kit (MPVK) for the Airbus AS350 B2/B3 models, developed by Swiss Rotor Solutions, has recently received Transport Canada approval, following European Aviation Safety Agency (EASA) and Federal Aviation Administration (FAA) approvals.

The kit offers pilots a wider perspective from the cockpit by enlarging the cabin floor window to 350 percent the size of the existing window — improving pilot visibility, safety, and the efficiency of long line operations.

Flight tests for the AStar MPVK were conducted by two EASA-designated test pilots in Europe, who — in cooperation with the Design Organization Approval — determined the never-exceed speed (Vne) while flying with the MPVK to be 145 knots power on, and 110 knots power off.

Following Transport Canada approval, Avialta Helicopter Maintenance Ltd., based at Villeneuve Airport outside of Edmonton, Alberta, has been approved to distribute and install the MPVK in Canada.

Installation of the MPVK is a complex task that requires modifications to the helicopter doors and airframe. Some of the original equipment is modified and refitted back into the airframe, and according to Avialta's general manager Paul Horvatis, it is a requirement that installation is completed by a certified installer. The company's now-certified MPVK installer, Jonathan Wood, travelled to Europe to receive the required training allowing the new modifications to be completed at Avialta's facility.

"[The MPVK] is the first product of its kind, of this magnitude, for the AStar," said Horvatis. "Everybody has a large window, but this is going to take it one step further. It will create ease of operation, improve safety, and relieve pilot workload while long lining."

With the MPVK requiring large-scale modifications to the aircraft, Avialta anticipates the install will take roughly 100 hours — not including paint.

Swiss Rotor Solutions had the MPVK on display at this year's HAI Heli-Expo in Las Vegas, Nevada, and received numerous inquiries from well-known Canadian aircraft operators, many of which are now working with Avialta since it became a distributor and certified installer.

Horvatis said the MPVK can help make long line missions such as search-and-rescue, drill moves or water bucketing less challenging for pilots.

"[The MPVK] takes long lining to a different level," he said. "It's not an easy task to long line from an AStar; it takes exceptional pilot skills in order to be very efficient. I think the MPVK will broaden the scope of people who can long line — and, on the other hand, will support inexperienced long line pilots for a fast and safe learning process by providing them a huge vertical view.

"You can see the ground; you have a bigger area to work with. It's almost like taking the door off and sticking your head right outside the aircraft."

Avialta Helicopter Maintenance is planning to install the MPVK on one of its AS350 B3s with hopes of demonstrating it at this year's Helicopter Association of Canada (HAC) tradeshow in Vancouver, British Columbia.

The Maximum Pilot View Kit, developed by Swiss Rotor Solutions, enlarges the AStar cabin floor window by 350 percent. **Swiss Rotor Solutions Photo**

The Airbus RACER builds off technologies developed in the X3 demonstrator, featuring a main rotor and two pusher propellers mounted on box-wings. **Airbus Image**

Airbus testing RACER in sim

BY JON DUKE

Airbus Helicopters has revealed new details of the progression of its high-speed RACER program — the compound helicopter developed under the Clean Sky 2 program and direct descendent of the record-breaking X³ technology demonstrator.

Like the X³, RACER — which stands for "Rapid And Cost-Effective Rotorcraft" — features a main rotor, along with two lateral pusher propellers mounted on short "box-wings" that provide lift and thrust in forward flight. The aircraft is still in development, but is already being flown by test pilots at Airbus in a fixed-base simulator.

"The configuration is surprisingly easy to fly, much easier than a tilt-rotor because you are basically flying a helicopter, but with one additional thrust control," said Hervé Jammayrac, a former H175 project pilot and Airbus Helicopters' chief test pilot, who also flew the X³ extensively. "If you want to accelerate, you have a switch on the collective to increase or decrease speed. In this configuration, you put the nose where you want to go, and you decelerate using that switch, and you can do this without any automation or autopilot at all."

Following the success of the X³ program, which saw the aircraft reach a level flight speed of 255 knots and record more than 155 flight hours, Airbus was confident that the twin-propeller compound concept was sound, Jammayrac told *Vertical*. "We were not sure about the application of the specific design of the concept, but from the beginning we were confident of future development. We were not designing a one-shot project just to break records."

Getting maximum performance from the X³ involved matching component limits closely to minimize performance bottlenecks. To reduce associated risks and development time, the team used an

AS365 Dauphin as a donor airframe, mated with components that were already available but modern enough to confer a degree of future-proofing. While this means that a few critical components of the X³ now find themselves part of the RACER, including a modified variant of the H175 gearbox, others were replaced with recently available products such as Safran's Aneto engine.

"While there is commonality [with X³] in RACER, there are differences because the aircraft has a different aim," said Jammayrac. "With X³, we focused closely on safety issues but, as a prototype, [we weren't] being held back by certification requirements. However, we are developing RACER with the aim of minimizing the time between certification and a production aircraft."

The X³ was only flown under tightly controlled test conditions by highly qualified and experienced test pilots like Jammayrac. If successful, RACER's direct derivatives will very quickly be operated "in the wild" by pilots of all experience and skill levels, so the safety factor is intrinsic to the system design. Something that Jammayrac says Airbus Helicopters is very focused on.

The most obvious impact of this has been on the placement of the propellers; the X³'s were mounted on the front of the aircraft's wings, but on the RACER, they're found behind a biplane-style wing.

"Doing this creates a barrier in front of the propellers, and access to the cabin is in front of this barrier," Jammayrac explained. "Also, the [box-wing] allows a large wing area beneath the rotor span so the aircraft remains compact, and the downwash effect on the wing area is minimized." However, he did admit that it is too early to tell what penalties or compromises these changes will incur.

These compromises are currently being explored in Airbus Helicopters' developmental fixed-base simulator, which Jammayrac is already using to assess the aircraft, although all he would say about this is that "it flies well."

RACER is being developed under the Clean Sky 2 program, which aims to reduce the environmental impact of aviation, and while a target first flight date has been set, Airbus says safety and simplicity are at the heart of the project, and that the highest priority is to get the design right.

RACER has been developed under the European Clean Sky 2 program. **Airbus Image**

Bell & Subaru collaborate on 412 upgrade

The Subaru Bell 412EPX commercial variant will be available to customers globally through Subaru and Bell in the future. **Bell Photo**

Bell and Subaru Corporation are collaborating on a commercial enhancement of the Bell 412EPI, which was type-certified this month as the 412EPX, in support of the Japan UH-X program.

The Subaru Bell 412EPX has a more robust main rotor gearbox dry run capability, increased internal maximum gross weight to 12,200 pounds (5,535 kilograms), and mast torque output of +11 percent at speeds below 60 knots.

This gives operators the ability to transport more supplies and achieve better operational efficiency, said Bell.

In 2015, Bell's long-term partner, Subaru (formerly known as Fuji Heavy Industries), was awarded the contract for the Japan UH-X program to replace Japan Ground Self Defence Force's (JGSDF) current fleet of UH-1J aircraft with a militarized derivative of the Subaru Bell 412EPX, which will enable the JGSDF to protect and save lives across its challenging topography, while addressing Japan's unique requirements.

With improved performance and safety features, Bell said the Subaru Bell 412EPX will also provide more capability while maintaining a reputation for utility and reliability for commercial customers.

"Our relationship with Subaru extends over six decades," said Bell president and CEO Mitch Snyder. "Together, we were the first to deliver military helicopters to Japan's defense force. We look forward to continuing our successful collaboration on the UH-X and the 412EPX programs."

Shoichiro Tozuka, corporate executive vice president and president of Aerospace Company, Subaru, said the Subaru Bell 412EPX will provide a great opportunity to expand the company's commercial business.

"Further, the UH-X, which will replace the current UH-1J aircraft, will start delivery to JGSDF in 2022 and will be deployed for island defense and disaster relief efforts," he said.

The Subaru Bell 412EPX commercial variant will be available to customers globally through Subaru and Bell "in the future," the companies said in a press release. A commercial prototype has undergone testing at Bell's facility in Mirabel, Quebec, and Federal Aviation Administration (FAA) certification was achieved on July 5, 2018.

Helitech to focus on innovation

Rotorcraft professionals attend a briefing at Leonardo's booth at Helitech International. This year's edition will return to Amsterdam, the Netherlands. **Helitech International Photo**

Innovation and enterprise in the rotorcraft industry will be at the heart of this year's Helitech International when it returns to the RAI Amsterdam Exhibition and Convention Center from Oct. 16 to 18, 2018.

This year's edition will include 10 percent more floor space and has 13 new exhibitors joining the event for the first time.

The event will provide the European rotorcraft industry with a chance to see the latest developments in flight safety and maintenance, repair and overhaul (MRO), as well as virtual reality and augmented reality training opportunities.

Taking its own stand for the first time, SWITLIK Survival Products will showcase its ETSO approved life vest and ETSO pilot and passenger suits. The company, a manufacturer and supplier of safety and survival products, has recently gained CAP1034 approval on its life vest, dry suit & CA EBS combination – the Civil Aviation Authority's technical standard for helicopter emergency breathing systems. The accreditation will enable the company to expand its reach into new territories.

It will also launch its X-Back MOLLE+ (Modular Lightweight Load-Carrying Equipment) air crew vest – a newly configured lightweight crew vest that offers comfort and durability, designed for constant wear in the seated position within a helicopter or fixed wing aircraft.

Visitors can also discover how the Internet of Things is aiding MRO operations with Librestream Technologies. The company will be on hand to offer insights into its Onsight Connect software, used to rapidly respond to MRO situations and aircraft manufacturing processes. The software enables rotorcraft operators to receive faster turn-around by using live video collaboration to engage remote experts.

Equally as important to the continued growth of the rotorcraft industry is pilot training. Merlin Simulation, a designer and manufacturer of high fidelity simulators replicating any type of aircraft across the military and commercial sectors, will showcase its range of simulators including its Pro Series product line for flight schools.

Other new exhibitors joining the Helitech International line-up this year include Luminator, suppliers of a broad range of lighting products, from search lights and interior signs to interior or exterior lighting; SCOTTY Group Austria GmbH, a solutions provider and manufacturer of systems for beyond line-of-sight audio, video, and data connectivity for communications and surveillance purposes; and TracPlus Global Ltd, a real-time tracking service provider using the latest satellite, web and mobile technology.

RotorBits

FAA approves MD 530F all-glass cockpit

MD Helicopters, Inc. (MDHI) has announced Federal Aviation Administration (FAA) approval of its advanced, all-glass cockpit for the MD 530F (type certificate 369FF). Approved for production and as a type design option, this is the third glass cockpit certification MDHI has received in the last year.

"My commitment to delivering next-generation technologies that are both design and function-forward is unwavering," said Lynn Tilton, MDHI chief executive officer.

MDHI completed all FAA certification requirements for the updated MD 530F glass-cockpit in early June 2018.

Efforts to obtain type design certification for this cockpit configuration for remaining MDHI single-engine models is ongoing.

Bell Training Academy opens Floyd Carlson Airfield

On July 9, the Bell Training Academy (BTA) opened the Floyd Carlson Airfield on the corner of Trinity Boulevard and Greenbelt Road to give BTA pilots and customers quick and easy access to training fields.

The airfield offers a raised landing platform and runways for training critical normal and emergency procedures, including full touchdown autorotations. The field is dedicated to Bell's very first training pilot.

Floyd Carlson took his first flight in Bell aircraft on June 2, 1942, in a Bell P-39D Airacobra. Since then, he performed the first flight of every Bell helicopter designed and built, up to his retirement.

Equatorial Guinea orders cancellation of CHC contracts

Equatorial Guinea has ordered all oil companies operating within its territory to cancel any contracts with CHC Helicopter, after accusing the helicopter operator of failing to comply with the country's national content regulations.

Issued by the central African country's Ministry of Mines and Hydrocarbons, the edict gave producers including Noble Energy, Exxon Mobil, Kosmos Energy, Trident, and Marathon Oil Corporation 60 days to unwind contracts with CHC and find new suppliers. Only helicopter operators in compliance with the National Content Regulation of 2014 may be allowed to bid for these contracts, the ministry said.

Under the National Content Regulation of 2014, all agreements related to the exploration of oil-and-gas must have local content clauses, with preference given to local companies when awarding service contracts. Local shareholders must be part of every contract and producers have an obligation to ensure the compliance of their subcontractors.

"These laws are in place to protect and promote local industry, create jobs for citizens, promote the sustainable development of our country, and we are aggressively monitoring and enforcing the compliance of these requirements," said Gabriel Mbaga Obiang Lima, the Minister of Mines and Hydrocarbons.

When reached for comment by *Vertical* on July 17, CHC said it was "confident" it was in compliance with the regulations.

"We have operated in Equatorial Guinea for nearly 20 years and have built one of the most comprehensive training programs of any oil-and-gas contractor in [the] country," the company said in an emailed statement. "We have provided successful training for pilots, engineers, and administrative staff, and implemented a cadet training program. We are also invested in local social projects with our teams dedicated to providing physical and financial support to local charities and causes.

"Our operations have been regularly audited and any minor findings have been addressed in our ongoing dialogue with the Minister of Mines and Hydrocarbons. We look forward to continuing the conversation with local authorities beginning with already planned discussions for this week and look forward to continuing to support our customers and the greater Equatorial Guinean community."

The action from the ministry is part of a broad ongoing compliance review of the entire sector, led by Equatorial Guinea's director of national content and legal advisors of the ministry. The ministry warned that similar measures will be taken with other companies who are deemed non-compliant as the review continues.

"We are eager to work with international companies who partner with Equatorial Guinea in the development of our industry," said Mbaga Obiang Lima. "But we expect all companies operating in Equatorial Guinea to follow the laws of the Republic of Equatorial Guinea. As minister, I will not hesitate to enforce the law to ensure compliance."

'Aviation Futures' launched

Aero Tech is an industry partner in the Aviation Futures program. The company has previously donated flight time to worthy pilot candidates in aircraft including this Bell 407.
Colorado Heli-Ops Photo

A new program aims to provide helicopter pilots at the early stages of their careers with a defined path for achieving their professional goals.

Called Aviation Futures, the program was created by the Broomfield, Colorado-based flight school Colorado Heli-Ops in cooperation with Black Hills Aerial Adventures, a helicopter tour company based in Custer, South Dakota. Other helicopter operators who have agreed to take part in Aviation Futures include Papillon Airways, Air Evac Lifeteam, PJ Helicopters, Aero Tech Inc., and T&M Aviation.

Under the program, certified flight instructors at Colorado Heli-Ops will be eligible for seasonal flying positions at Black Hill Aerial Adventures upon reaching 500 hours of flight time. That will allow them to build real-world commercial flying experience while retaining their instructing jobs at Colorado Heli-Ops.

As they achieve additional flight experience milestones, these pilots will have the opportunity to interview for positions with other participating operators, and will receive priority hiring preference if their interviews are successful.

According to Colorado Heli-Ops founder Dennis Pierce, Aviation Futures was conceived with two complementary goals. First, it will benefit promising lower-time helicopter pilots, who often struggle to establish the experience and connections needed to advance to the next stage of their careers. While structured career development programs are common in fixed-wing aviation, such opportunities have been generally lacking for helicopter pilots.

"We knew the industry needed a career path," he said.

Additionally, the program will provide participating operators with a stream of vetted, high-quality pilot candidates — an increasingly valuable resource as airlines step up their recruiting efforts for skilled helicopter pilots.

"The search for quality pilot applicants is an ongoing challenge and a program such as this can only help to streamline recruitment of suitable candidates," stated Simon Whiteley, assistant director of operations for Papillon. "We look forward to working closely with Colorado Heli-Ops, Black Hills Aerial Adventures, and other partners within the Aviation Futures program to help nurture the next generation of professional helicopter pilots."

Most of Colorado Heli-Ops' flight instructors were hired after completing their professional pilot training at the school. According to Pierce, pilots who train at Colorado Heli-Ops have a head start on commercial operations in that they are exposed to important industry concepts — such as flight risk assessment tools and safety management systems — from day one of their training. As he described it, "We make really skilled and professional pilots that have higher-order thinking skills and do all of their training at high altitude."

They also receive early exposure to Colorado Heli-Ops' commercial helicopter operations, with some of them having the opportunity to build flight time during ferry flights associated with the company's pipeline inspections. In fact, the Aviation Futures program builds on an established initiative by Colorado Heli-Ops to connect lower-time pilots with empty co-pilot seats on cross-country ferry flights, giving these pilots the opportunity to build valuable flight experience in different models of aircraft.

According to Pierce, last year the company facilitated over 100 hours of free flight time, most of it in turbine-powered helicopters. In some cases, the experienced pilot in the other seat was the owner of an Aviation Futures partner operator.

As pilots progress through the Aviation Futures program, it is envisioned that the program will maintain a verified record of their flight experience that can be shared with future employers. "We'll have a chain of references that will reduce employers' risks," explained Dave Dziura, Colorado Heli-Ops' chief pilot and chief flight instructor.

That's appealing to operators at all tiers of the program, including Air Evac Lifeteam, which requires its operational pilots to have a minimum of 2,000 hours of flight time to meet Commission on Accreditation of Medical Transport Systems (CAMTS) standards.

"Air Evac Lifeteam is pleased to be an industry partner in support of the Aviation Futures career path program developed by Colorado Heli-Ops," stated Tony Bonham, senior director of flight operations for Air Evac Lifeteam. "As the pilot shortage increases, we view this program as a resourceful method to develop a pool of qualified helicopter pilots for both the near and long term."

Pierce said the first and second tiers of the Aviation Futures program are already active, as Colorado Heli-Ops has placed two of its flight instructors with Black Hills Aerial Adventures for the summer season. These pilots are working a rotating schedule of two weeks at Black Hills Aerial Adventures followed by two weeks at Colorado Heli-Ops, and will be able to return to flight instructing full-time at the end of the tour season.

Pierce said he hopes to see more helicopter operators from a variety of sectors join the program as industry partners in the future.

"We'd like to cover as much of the industry as we can," Pierce said. "It works for us and it works for them."

If you would like to submit a press release or if you have a new product or service that you believe is newsworthy, please email our news editor at news@verticalmag.com.

Vertical PHOTO CONTEST 2018

GRAND PRIZE SPONSORED BY: BELL

Do you wrap up a long day in the field by breaking out your camera to get photos of your helicopter? Do you find yourself taking pictures of your rotary-wing "office" at every opportunity? Does your Instagram have more photos of aircraft than your significant other? If this sounds like you, it's time to look through your archives for your finest shots for the 2018 *Vertical* Photo Contest. Submit your best work in these three categories:

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FIRST // $750 cash award // 3 Winners, one in each of the three categories
SECOND // $500 cash award // 3 Winners, one in each of the three categories
THIRD // $250 cash award // 3 Winners, one in each of the three categories
READERS' CHOICE // $500 cash award for the photo with the most online votes. // Submit photos early for more chances to win!

All winning photos will be featured on our social media channels and in the Dec.'18/Jan.'19 print issue of Vertical *Magazine.*

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An Airbus H125 AStar, operated by Nova Scotia's Department of Lands and Forestry, Aviation Services, flies alongside the popular fishing village of Peggy's Cove in Nova Scotia.

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A *Nova Scotian* SERVICE

With a new fleet of four Airbus H125 AStars, Nova Scotia's Department of Lands and Forestry, Aviation Services, has a multimission workhorse to match its vast range of utility operations in "Canada's Ocean Playground."

STORY BY OLIVER JOHNSON // PHOTOS BY MIKE REYNO


C-GYNR
NOVA SCOTIA
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From the rolling rocks of the fishing village of Peggy's Cove, to the natural wonder of the tides of the Bay of Fundy, to the rugged beauty of the highlands of Cape Breton, the province of Nova Scotia is a sight to behold at any level. But from several hundred feet in the air, it's particularly breathtaking. And for the pilots working at Nova Scotia's Department of Lands and Forestry, Aviation Services — all proud Nova Scotians — this is the view from their office.

That office recently received a notable upgrade, with the last of four new Airbus H125s joining the fleet earlier this year. *Vertical* paid the operator a visit in mid-July to find out how the new aircraft were performing.

A day, visual flight rules program, operating under Canadian Aviation Regulations 702 (aerial work operations) and 703 (air taxi operations), Aviation Services operates as a branch of the provincial government. While it technically falls under the provincial Department of Lands and Forestry, it offers its services to all government departments and agencies — which means its crews can be working alongside geologists, foresters, biologists, search-and-rescue volunteers, law enforcement officers or fire-fighting personnel on any given day.

"What's nice here is the diversity of work," Ian Moore, the department's chief pilot and acting operations manager told *Vertical*. "Every day, it's something different. Whether you're looking at mines, you're looking at forests, you're looking at shorelines, you're doing a wildlife job, a search, forest fires — it's always something different."

The department is located in Shubenacadie, in the center of the province. Geographically, Nova Scotia is small compared to other Canadian provinces, which means that the unit's crews can reach any part of it in about an hour and a half.

And it's perhaps due to Nova Scotia's unique characteristics — small size, yet with areas that are relatively inaccessible by land — that it is one of just two provincial governments to have its own rotary-wing fleet.

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1 // The pilots at Aviation Services praised the visibility, comfort, endurance, and lifting performance of their new AStars. **2 //** The department's work takes it right across the province. Here, one of the unit's AStars holds a hover off the tip of Cape Split in the Bay of Fundy. **3 //** Aviation Services maintenance staff and pilots pose for a picture outside the department's hangar in central Nova Scotia. It has four full-time maintenance staff and six pilots. **4 //** The maintenance team said they were very happy with the product support they have received from Airbus and Safran. **5 //** The department has established 28 helipads and 14 refueling stations throughout Nova Scotia. **6 //** The hangar at Aviation Serivces' headquarters in Shubenacadie is able to accommodate all four AStars.

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The unit's roots reach back to 1945, when the Nova Scotia Department of Lands and Forests contracted two de Havilland Tiger Moth biplanes for forest fire detection. After almost 30 years of working exclusively with fixed-wing aircraft, Aviation Services purchased its first helicopter — a Bell 47 — in 1974.

The Bell 47 was soon replaced by a Bell 206, and another was added to the fleet in 1975. Aviation Services made the move to Shubenacadie in 1977, having built a new hangar that offered ample storage for both rotary- and fixed-wing aircraft. Over the years, the fleet continued to evolve, with the JetRangers ultimately replaced by four Hughes/MD 500s (beginning with C models, and then transitioning to D and E models) and a Bell 212.

By 2005, the fixed-wing component of Aviation Services' fleet had been sold off, and a Eurocopter (now Airbus) EC120 B joined the fleet to replace one of the MD 500s.

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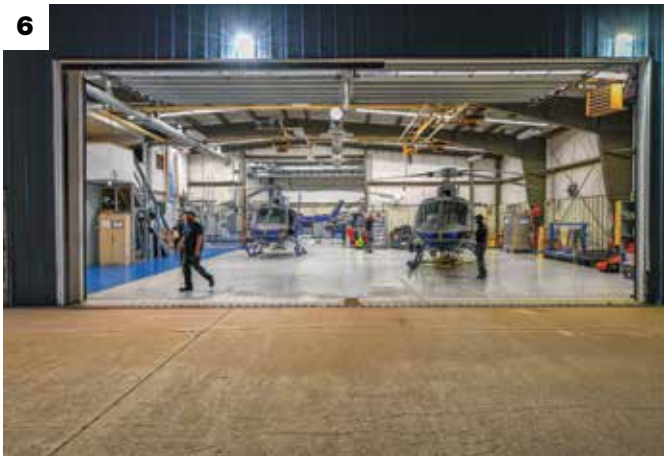

"We were struggling a little bit with product support, so we ended up going with the EC120, which was quite new at that time," said Moore. "It was a fantastic aircraft; you could stay in the air for three hours. It had great visibility, was very comfortable — very different than what we'd been operating. But it was a heavy aircraft, and at the end of the day, it wasn't lifting like our 500s could lift."

This experience helped inform Aviation Services' requirements when it began looking at options for a fleet renewal in 2012. It ultimately decided it could operate with a reduced fleet of just four aircraft, but it wanted those four to be of the same type. At the time, its pilots and maintenance personnel were working across three types: the Bell 212, MD 500E, and Airbus EC120B.

It put out a request for proposals, specifying a turbine light single-engine aircraft. The choice was eventually between the Bell 407 and the Airbus H125, with the latter ultimately winning the tender.

Once the process started, the transition to the new fleet was lightning fast. The first of the AStars was delivered in January 2017, and the last arrived in March 2018. Aviation Services sold its Bell 212 to a private operator, and then traded in the MD 500s as each new AStar joined the fleet.

A MULTIMISSION ROLE

Aviation Services is a true multimission utility operator, performing work across the province for various government entities.

"It's really just based on need," said Moore of the fleet's assignments. "Most of our work is tied to the province's natural resources. In addition to the Department of Lands and Forestry, there are other departments, such as the Department of Agriculture and Department of Environment, that make good use of the aircraft as well."

Having historically fallen within the Department of Lands and Forestry, work associated with that department — overseeing the harvest of timber and infrastructure development within crown lands — has been one of the larger areas of responsibility. This also involves working closely with the government's forestry experts and biologists, who work on a wide variety of wildlife initiatives.

One of the more unusual — and successful — recent operations Aviation Services worked on was reducing the acidity of a river to restore it to original levels, and make it more likely to attract wild salmon. Years of acid rain had reduced the number of salmon reproducing in the river, so working through the province's Department of Fisheries and Aquaculture, the unit dropped 625 tonnes of lime over the

1 // Before the fleet renewal, the department was working with three different types. Going with an all-AStar fleet has made life simpler for both the pilots and maintenance team. **2 //** The H125 has brought a new generation of avionics with it, in the form of the Garmin G500H. **3 //** The department is aiming to fly 1,400 flight hours in 2018.

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surrounding area, in the hope that it would seep through the soil and bedrock and neutralize the acidity of the water. Over two campaigns a year apart, the project proved a major success, with salmon returning to the river in promising numbers.

"The first year, we did it with the MD 500s and it was about 21 days of work," said Moore. "When the AStar came in, we narrowed it down to eight days."

Moore said another area of growth has been in geological work. "There was a gold rush in Nova Scotia in the late 1800s, and they're now revisiting a lot of those sites with newer technology," he said. "Our government geologists spend a lot of time flying — whether they're doing site audits, assessments, or just keeping an eye on the process."

The Emergency Management Office (EMO) is another entity that makes good use of the aircraft, typically calling for assistance for local law enforcement agencies in the search for lost people. The fleet is the designated air support for the provincial Ground Search and Rescue program. Last year, Aviation Services spent 41 days working on 36 different such searches.

The digital TMR2 network— a trunked radio system — makes communicating with other departments and agencies in the province a breeze. The system was established

WATCH VIDEO


C-GYNR
NOVA SCOTIA
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after the crash of Swiss Air 101 off the coast of Nova Scotia in 1998, when agencies and departments found difficulty communicating with each other during the response to the incident. Today, the system spans 100 towers across Nova Scotia, with over 9,000 radios operating on the 700 MHz public safety bandwidth in the province. Over the years, the system has expanded to New Brunswick and Prince Edward Island.

"It's an interoperable system, and what's really neat about it is that everyone on the system can talk to each other," said Moore. "We can talk to the RCMP [Royal Canadian Mounted Police], first responders, sheriff's departments, snow plow operators, Coast Guard, Border Patrol, major forestry companies, or even the Michelin Tire plant." As the aircraft travel throughout the province, the system seamlessly hands each radio off to the next tower without the pilot having to make physical adjustments.

In the summer, as with most utility operators, Aviation Services is kept busy fighting wildfires.

According to Moore, the 10-year average in Nova Scotia is about 330 fires a year.

"Our fires tend to be a little bit smaller, but we do get some big fires," he said. "We follow the [wildfire] hazard based on the indices. So if the hazard is high here in central Nova Scotia, we keep the machines here. Otherwise, we start moving them around the province."

Typically, Aviation Services' fleet is able to handle wildfires on its own, but occasionally the province has had to call for fixed-wing assistance from its neighbors in Newfoundland, New Brunswick and/or Quebec. Nova Scotia is a member of both the Canadian Interagency Forest Fire Centre (CIFFC) and the Northeastern Forest Fire Protection Compact (NFFPC).

With the new fleet of AStars, the department also bought seven new Bambi Buckets — four 820-liter (216-US gallon) standard buckets, and three 910-liter (240-US gallon) Bambi Maxs (which allow for multiple drops of various sizes) — that present a leap forward in firefighting capability.

"With the newer fleet we have more firepower," said Moore. "We have a water bucket that's two and a half times the size of what we used to carry, so we can throw more resources at a fire than we could with the MD 500s."

1 // The department has seven Bambi Buckets, including three 910-liter Bambi Maxs, which offer the capability to perform multiple drops of different sizes. **2** // The aircraft's paint scheme incorporates the colors of the Nova-Scotian flag, with large yellow aircraft numbers on the side and belly to help those on the ground quickly identify the aircraft during firefighting operations. **3** // New pilot hires in the department are expected to have at least 2,500 hours, and the right attitude to fit into a continuously evolving environment. **4** // The new fleet provides the department with more fire-power through the ability to carry larger buckets.

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CUSTOMIZING THE AIRCRAFT

Aviation Services worked closely with Airbus to complete the AStars to the department's requirements, and Moore was deeply impressed with the experience.

"We had never built an aircraft from scratch before, and I thought going in to it that it'd be like buying a car — you're haggling and bargaining, and not a particularly pleasant experience," said Moore. "But it was very enjoyable. Airbus made it easy. There were no surprises — the aircraft were delivered exactly as we had ordered."

The experience of the department's six pilots, which spans working with a number of different operators across Canada, helped inform the modifications they wanted.

"We put a lot of thought into the aircraft," said Moore. "There's products that we'd seen over the years — some we wanted to avoid, and some that we really thought we'd like to have."

Among the latter was a cargo basket from Aero Design, with the department's pilots praising the simplicity of mounting it to the aircraft, as well as its durability. "They make a nice product and the support has just been phenomenal from those guys," said Moore.

Due to the amount of work the unit does around urban environments, wire cutters were a must-have, and high visibility doors were necessary to make life easier during aerial wildlife surveys and searches. And, given the amount of work over water that is required, the unit has

After noticing that not all K9s it works with were entirely comfortable around the aircraft, the unit built a training program for them to ensure they would all be relaxed and ready to perform in future operations.

It's a short flight from the department's headquarters in Shubenacadie to Halifax, the province's capital. Here, an AStar flies above Citadel Hill in downtown Halifax.

A conservation officer joins Aviation Services for a flight. The officers perform regular patrols of crown lands to ensure no illegal activities — such as prohibited fishing, hunting, or the construction of structures on crown land — are taking place.

a set of floats that can be used on two of the aircraft.

Each machine has its own litter kit, which is taken on every flight in case of an emergency. "Whether we're dispatched to a search or a forest fire or any other event, we always have that capability [to carry an injured person]," said Moore.

All the aircraft have "squirrel cheeks" to increase the size of the cargo compartments, and Moore said the amount of storage space available in the AStar was a major step up from the MD 500s. "We carry more gear than we ever did before," he said. "We carry survival kits that can accommodate six passengers, along with a first aid kid, an axe, and the stretcher. We carry a kit in the back with all our oils and fluids and cleaners. There's just much more room, and that's been a real plus for us."

Inside the aircraft, the department's pilots have appreciated the benefits of a glass cockpit with the Garmin G500H.

"Having that glass cockpit, having everything centralized right at your fingertips, is really a joy," said Reuben Solomon, who has been flying for Aviation Services for the last three years. "And it's great for our users as well to be able to see [the displays] in front of them, and understand what they're seeing and get a feel for the aircraft."

In terms of its performance in the field, Moore said the AStars had been "fantastic" thus far, praising the aircraft's visibility, comfort, endurance, and lifting performance — up to 2,425 pounds (1,100 kilograms) externally.

Solomon agreed. "The H125, at sea level, gives us actually a fairly large margin of safety for power on demand," he said. "With a lot of the older military-designed aircraft, such as the 500s, you used full power every takeoff, but with this machine, we're continually maintaining about a five- or 10-percent power reserve on all of our operations. It's rare to use full power on these aircraft."

The unit's four maintenance engineers have been equally impressed.

"If anyone's spent any time around an AStar, they know how easy they are to work on because everything is so easily accessible," said Jay Parrott, chief aircraft maintenance engineer. The fleet availability has been "really good," he added, praising the support the unit has received from both Airbus and Safran, with quick turnaround times on requested parts.

"Not only that, these engines are bulletproof," he said. "The TBO [time between overhaul] has moved up to 5,000 hours — that's almost unheard of for an engine to go that long."

The standardization of the fleet has not only simplified the maintenance work — from working on three types to just one — but it has slashed the inventory required to keep the fleet in the air, freeing space in the hangar, said Parrott.

HOMEGROWN TALENT

All of the pilots within Aviation Services are originally from Nova Scotia, and all have spent time and gained experience with operators across Canada before returning home.

Solomon started his career in British Columbia, and subsequently worked in every province and territory in the country, except for New Brunswick and Prince Edward Island.

The operator regularly works with inland search-and-rescue personnel to find missing people. There are 23 SAR teams across Nova Scotia, consisting of 1,400 volunteers.

"I'd come home to Nova Scotia to visit my family and I'd come visit these guys [Aviation Services]," he told *Vertical*. "I got to know them and learned the type of work that they did, and I started tailoring my career specifically to the work we do here. The wildlife work, the aerial surveys, the forest firefighting, the search-and-rescue — all of the jobs that I would take year-to-year were specific for trying to build a resume for this position."

Today, Solomon has around 4,500 flight hours. "The bush experience is really the core of our work; the unprepared landing areas and the offsite work that we do," he said. "So having guys with that experience already is really beneficial."

According to Solomon, the major challenges faced by pilots in Nova Scotia are presented by the weather. "Geographically, it's only a small province, but you can have completely different weather systems, and it can change at the drop of a hat," he said. "You leave in the morning and it's raining, and then you have to contend with fog, and then the thunderstorms roll in the afternoon."

Ardel Smith has been a pilot with Aviation Services for seven years. "This is the bush here, and you saw the terrain we've been flying over," he said. "At any given time, when we're up there, flying around, doing our regular daily work, we're landing in river beds, bogs, stumps — off-level areas."

Aside from the weather, he said this was one of the major challenges the pilots face.

"You've really got to be mindful of how far back your tail rotor is when you're landing in confined areas and with the rotorwash, too. That's the big challenge, really."

In addition to annual factory training from Airbus, the pilots spend many hours in the classroom reviewing regulatory requirements, and

in the air honing their operational skills. The aircraft maintenance engineers also receive training from Airbus and Safran.

For half the year, the pilots work a five-day week, from 8:30 a.m. to 4:30 pm, with the weekends off. A pilot and an engineer are kept on standby for any emergency calls. Then, during the busier summer months, from April to October, pilots are typically working one week on/one week off.

With all the pilots having previously worked long rotations in remote camps elsewhere in Canada, they appreciate that Aviation Services gives them the ability to return home most evenings after work.

"We've lived in canvas prospector tents and ATCO trailers, and to come back here to this has just been phenomenal," said Moore. "I have a very normal life. There's certainly a commitment in the summer with fire season, but it's very predictable, whereas generally in the industry you just don't know where you're going to be and for how long."

New hires are expected to have at least 2,500 hours. Moore said the interview process is tough, with the focus more on behavioral and situational elements rather than technical questions on aviation.

"We're looking for good people and we need people who, when they're not flying, are eager to take on other projects," said Moore. "We're continually evolving, we've always got our eye on emerging technologies and we need to put our resources on it to do that. What we're looking for are those other talents and skill sets a pilot may possess."

Solomon said the work the department does is exciting, but considers the aircraft to be just another tool in a lot of department's toolboxes.

"As a government-run service, it's important that we're there serving the people as a public servant," he said. "We do that so effectively with our unique ability to access sites, our centralized base, and the expertise of our folks. With the versatility of this new aircraft, we're really able to help our partners do their job quicker, easier, and more efficiently than ever before."

Oliver Johnson | Editor-in-Chief of *Vertical* Magazine, Oliver has been covering the helicopter industry since joining MHM Publishing in 2012. He can be reached at at oliver@mhmpub.com
Follow him on Twitter @orjohnson_

Aviation Services is always looking to raise awareness of its unique services among other departments and agencies to create efficiencies for the government.

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Robinson's new external cargo hook kit for the R66 can be ordered with optional bubble windows for either side of the aircraft. The large windows provide plenty of room for the pilot to look out and down, even with a helmet on.

NEW TRICKS FOR THE R66

We visited the Robinson factory to try out the latest upgrades for the R66, including a 1,200-pound cargo hook kit and new touchscreen avionics.

BY ELAN HEAD
PHOTOS BY SKIP ROBINSON

Since certifying the R66 Turbine helicopter in 2010, Robinson Helicopter Co. has been steadily expanding the aircraft's capabilities and mission sets. It certified an R66 Police Helicopter in 2012, the R66 Turbine Marine with pop-out floats in 2014, and an electronic news gathering model last year. Along the way, it has also certified a range of avionics and equipment for the aircraft, including glass cockpits from Garmin and Aspen Avionics, and the Genesys HeliSAS stability augmentation system and autopilot.

At HAI Heli-Expo 2018 in Las Vegas, Nevada, earlier this year, Robinson showed off its latest upgrades for the R66: new touchscreen Garmin avionics and, for utility operators, a long-awaited cargo hook kit.

Robinson has been promising a cargo hook kit for quite some time now, but as company president Kurt Robinson explained, it kept getting sidelined by other projects. While an Onboard Systems cargo hook kit has been available for the R66 since 2015, the factory kit comes with a slightly higher weight limit and some premium features, notably provisions to enable solo flight from the left seat.

At press time, the company expected Federal Aviation Administration certification of the cargo hook kit by the end of July. In advance of certification, Kurt Robinson invited me to the factory in Torrance, California, to give it a try.

FLYING THE LINE

It had been over a decade since I had been to the Robinson factory as a certified flight instructor in training, getting ready to launch my career in helicopters by instructing in R22s. Not surprisingly, plenty had changed. Kurt Robinson gave me a tour of the now much larger factory floor, pointing out sophisticated new machines and procedures aimed at improving the quality and efficiency of manufacturing.

I had never flown the R66 before, although I had studied up on the flight manual in anticipation of my visit. To get me comfortable with the aircraft, Robinson chief test pilot Doug Tompkins talked me through a pre-flight, then took me up for a 1.5-hour familiarization flight in the local area. It didn't take me long to appreciate why the R66 is such a popular option for private owners upgrading to turbine helicopters from R44s. In flying, primacy is everything, and as someone who logged her first thousand flight hours in Robbies, I felt right at home.

After warming up with some pick-ups and set-downs in Torrance, we departed west to the Pacific coast, where Tompkins had me enter a maximum performance climb at 60 knots, yielding a very sporty climb rate of over 2,000 feet per minute. We headed to the Long Beach Harbor to practice recovering from vortex ring state, then to the Compton/Woodley airport for some straight-in and 180-degree autos with power recoveries. (I was already a fan of the R44 for autorotations, but I think I liked the glide of the R66 even better.)

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We wrapped things up in Torrance with some full-down autos — which were fun and easy with a 15-knot headwind — plus a hydraulics-off approach and some hovering autorotations. By the end of the flight, it was apparent to me that the R66 has the performance and smooth control to serve as a capable light utility helicopter, particularly for R44 operators looking for next-level performance, or legacy Bell JetRanger operators seeking an affordable modern replacement.

The day was still young, but the Torrance airport was mobbed with students from Robinson's factory safety course, plus a variety of warbirds practicing low passes over the runways. Rather than fight the crowds, we postponed my cargo hook evaluation until early the next morning, when coastal fog meant we had the airport all to ourselves.

Robinson has clearly put a lot of thought and effort into designing its cargo hook kit. This is a product optimized for serious utility operators, not someone who has to sling a load once or twice a year. The kit includes an Onboard Systems cargo hook rated to a maximum load of 1,200 pounds (545 kilograms), which is a nice bump over the 1,015 lb. (460 kg) to which Onboard Systems' own kit is certified. The Robinson kit includes electrical and mechanical releases for both pilots, as well as remote external control.

However, the real differentiators for the factory kit are the left-side pilot-in-command provisions. In the standard R66, solo flight is permitted from the right seat only, but the cargo hook kit includes an upgraded left-side cyclic with hydraulic and radio switches, plus a left-side start button, which together enable solo flight from the left seat.

The enhancements don't stop there. A panel at the left door sill contains supplemental engine torque and gas temperature gauges and a load cell display so that the pilot can track essential parameters during vertical reference work. This panel also includes an

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emergency manual hook release, in the form of a knob rather than a conventional T-handle (a similar manual release is located between the seats, accessible to the co-pilot).

The kit includes some additional smart touches, such as a fuel status light to indicate approximately 12 gallons of usable fuel remaining — a welcome reminder before the standard five-gallon low fuel caution light. There are also interior hard points at the forward door posts for attaching safety tethers or harnesses during doors-off operation.

The standard kit adds approximately 9.5 lb. (4.3 kg) to the R66 at a cost of US$28,000. Optional equipment includes forward doors with oversized bubble windows (12.5 lb./7.5 kg and $4,900 each) and six-inch-diameter cargo mirrors mounted at the front of the skid tubes (1 lb./0.45 kg and $340 each). The aircraft I flew was equipped with a left-side bubble door and cargo mirrors for both skids; we removed the right-side door for the demonstration.

Even though we had the Torrance airport to ourselves that morning, we were fairly limited in what we could practice due to the surrounding built environment. Tompkins, in the right seat, lifted off the ramp with a 400-lb. (180-kg) load on a 50-foot (15-meter) line, then transitioned to the grassy field on the northwest side of the field. We weren't able to do pattern work, but I was able to fly the load back and forth along the length of the runway, and practice some abbreviated approaches.

Visibility out the bubble window was terrific, and although I didn't need it that morning, the window was also equipped with a small fan to keep it from fogging up. The sizing of the window is generous; even with a helmet on, I didn't knock my head against the window

once. The bubble windows limit never-exceed speed (Vne) to 100 knots indicated airspeed (Vne with a load on the hook is 80 knots). When we later did a photo shoot with both bubble doors but no line on the hook, the aircraft reached 100 knots easily, with no adverse vibrations.

During my cargo hook demonstration at sea level — with two pilots and around 50 gallons (190 liters) of fuel on board, plus the 400-lb. load — we were hovering at between 60 and 70 percent torque (maximum continuous torque is 83 percent). With the factory cargo hook kit installed, the maximum gross weight of the R66 will increase

1 // New Garmin Txi touchscreen avionics are installed on this R66, which was the demo aircraft for *Vertical*'s avionics evaluation. **2 //** On the ramp at the Robinson factory in Torrance, preparing to lift with a 400-lb. load. **3 (all photos) //** Features of the Robinson cargo hook kit include, clockwise from top left, a small fan to prevent the optional bubble window from fogging; supplemental gauges and a load cell display in the left door sill; an Onboard Systems cargo hook rated to a maximum load of 1,200 lb.; and a manual hook release for the right-seat as well as the left-seat pilot.

from a standard 2,700 lb. (1,225 kg) to 2,900 lb. (1,315 kg) with an external load.

Once I was satisfied with flying from the left side of the aircraft, we landed and Tompkins and I swapped seats. What a difference! From the right seat, with my hand on the collective, I struggled to lean out far enough to see the load. Since I'm not a high-time long line pilot to begin with, I made the conservative call to forgo the 400-lb. load for this round and practice with just the remote hook. That was fine, but certainly less comfortable than flying from the left seat.

Granted, having Tompkins in the left seat of the aircraft shifted our lateral center of gravity left by about an inch, so the difference would probably be less pronounced for a solo pilot. But I'm not alone in my preference. Robinson initially planned on offering a less expensive "basic" cargo hook kit for right-side-only operations, but scrapped that idea after flight testing. Instead, R66 operators who only want to long-line from the right side will need to order their kit from Onboard Systems.

Utility helicopter operators are not famous for prioritizing the comfort of their pilots, so the more economical Onboard Systems kit (which retails for around $13,000) will no doubt continue to sell. Moreover, the factory cargo hook kit is currently only available for new helicopters, not for retrofit, which will further limit its market share. But for full-time utility operators who are investing in a new aircraft, the Robinson cargo hook kit should quickly pay for itself through its advantages in performance, comfort, and safety.

ENHANCED GLASS

While I was in Torrance, I also took the opportunity to check out the new Garmin touchscreen avionics for the R66 in a customer aircraft that was about to be delivered. My guide for this demo flight was flight test engineer Dale Taft, Robinson's resident avionics guru.

The Garmin Display Unit (GDU) 1060 Txi is a high-resolution, 10.6-inch touchscreen display that upgrades Garmin's popular G500H flight deck. In the R66 I flew, it was paired with a Garmin GTN 750 GPS/nav/comm unit, plus a Genesys HeliSAS.

Also available is a smaller, seven-inch GDU 700L Txi display that pairs with any Garmin GTN 6xx model in a compact console. This landscape-oriented display was designed specifically for Robinson with the R44 in mind, but it can also be ordered for the R66. (The prices for the 1060 Txi and 700 Txi are $35,700 and $24,000 respectively, not including the cost of a requisite GTN 6xx/7xx.)

Taft and I started our flight over a grassy area adjacent to Robinson's ramp, where I spent some time getting comfortable with the HeliSAS. We then departed west to intercept the coast, and headed south to give me some practice with the autopilot's upper levels — all fairly straightforward.

West of Long Beach, we took a brief detour to fly toward a mountainside to demonstrate the terrain alerting feature, which provided clear visual and aural warnings as we got closer to the terrain. The sensitivity of this feature can be adjusted, and it can also be turned

The bubble windows for the R66 limit airspeed to a maximum of 100 knots (never-exceed speed with a load on the hook is 80 knots).

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1 // At left, an R66 panel featuring the 10.6-inch Garmin Display Unit 1060 Txi. A smaller seven-inch GDU 700L Txi is also available, shown here at right, installed in an R44. **2 //** While the 1060 Txi panel takes up more space than it strictly needs to, pilots who learned on steam gauges will likely feel comfortable with the analog redundancy.

off for continuous low-level operations. However, doing so is not exactly simple or intuitive, so this would probably be a good checklist item for the ground.

I didn't have any trouble with the touchscreen functionality of the system, although admittedly we were flying in smooth air. One thing I really loved about the display was the vertical speed indicator (VSI), which was custom-developed with Robinson's input. Presented as a partial semicircle, it has a moving needle that quickly conveys trend — just like on a conventional analog gauge, only more compact.

We wrapped up our short demo flight with a practice ILS approach to runway 29R in Torrance. Taft showed me how to pull up the appropriate instrument approach chart on the 1060 Txi display, a fantastic functionality that is probably overkill for a visual flight rules helicopter, but which would make for a terrific instrument trainer.

With the approach programmed and altitude and heading modes engaged, we flew toward our final approach course; once we were close, selecting the NAV button on the autopilot intercepted the localizer. Likewise, pressing VRT at the appropriate point intercepted the glideslope, leaving me with nothing to do but set the power with collective. Watching the HeliSAS "stir the cyclic" as we descended on the approach made me a little uneasy, but Taft explained that it was normal. As he put it, the HeliSAS flies a great approach, "you just have to get used to the fact that it flies differently than you do."

Although I didn't find the size of the instrument console to be problematic on this short flight, there's no denying that it occupies a lot of real estate. And much of that real estate is taken up by

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redundant analog gauges that have been eliminated on more elegant glass cockpit installations.

I don't disagree with Robinson's approach, however. Like I mentioned, primacy is everything. Many of Robinson's customers were, like me, trained on analog gauges and default to those displays under stress; particularly for the private market, it makes sense to give pilots what they know and feel comfortable with, even while providing them with new functionalities.

I doubt you'll be seeing the GDU 1060 Txi and cargo hook kit on the same ship, but both are great examples of how Robinson continues to develop its products with customers' needs front of mind.

Elan Head | An award-winning journalist, Elan is also an FAA Gold Seal flight instructor with helicopter and instrument helicopter ratings, and has held commercial helicopter licenses in Canada and Australia as well as the U.S. She is on Twitter @elanhead and can be reached at elan@mhmpub.com.

With the Chinook's quick transit time and the ability to fill the Kawak/Billings internal firefighting tank system in under 30 seconds, Billings is able to put more water on a fire at a greater rate than ever before.

BLAZING A TRAIL

With eight Boeing CH-47 Chinooks and a cutting-edge 2,500-US gallon internal tank, Billings Flying Service is bringing a new level of capability to aerial firefighting from its home in the heart of Montana's "Big Sky Country."

STORY & PHOTOS BY SKIP ROBINSON

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Billings Flying Service (BFS) has never been afraid of trying something new when it comes to aircraft types. The Billings, Montana-based utility operator also has a history of success when taking former military machines and putting them to work in the commercial sector. So in early 2014, when two U.S. Army Boeing CH-47D Chinooks appeared for auction on a U.S. government General Services Administration (GSA) website, Al and Gary Blain — the founders and owners of BFS — were quick to pounce on the opportunity they saw in front of them.

The pair purchased the aircraft, which were the first two former military CH-47Ds to be auctioned to civilians, and began transforming them for their new life as heavy-lifters in the commercial world.

Today, the BFS fleet has eight Chinooks, and they are joined by one Sikorsky UH-60, five Bell 206s, five Airbus AS350 B3s, one MD 500, and one Hiller 12B. The range of operations is fairly typical of a utility operator, spanning aerial construction, firefighting, and support of oil-and-gas and mineral exploration work. But the relatively unique fleet also allows for more niche operations, such as government contracting, disaster relief, and movie work. And while it's very much a family company, BFS has a substantial staff of about 85 employees, including 20 pilots. All the pilots are qualified on the Chinook and some are dual qualified on the Black Hawk.

Al and Gary describe BFS as a second-generation company, having inherited their passion for aviation from their father. Gerhart Blain founded Blain's Spray Service — a fixed-wing crop-dusting business — in the early 1950s, and he joined the rotary-wing

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community a couple of decades later, when he learned to fly a helicopter in the 1970s.

Gerhart's sons were actively involved in the family business from a young age, both as ground support and as pilots. The pair ultimately left to pursue careers as commercial airline pilots with Continental Airlines, but still flew for the family ranch in their time off. Continental went through bankruptcy in the early 1990s, and though the Blain brothers didn't lose their jobs, the instability of the career led them to look for other opportunities.

In 1995, they bought a surplus Bell UH1-E Huey and set it up for spraying. By 1997, they had their first call-when-needed (CWN) contract with the U.S. Forest Service (USFS). That first Huey was the start of a number of helicopters the company purchased and refurbished, put to work, or sold, with the business really taking off with a busy wildfire season in 1998. Gary and Al flew over 1,000 helicopter hours that year — spraying weeds and managing the buying, selling, and overhauling of Hueys, all while still flying for Continental Airlines. "We were the good type of busy!" Al told *Vertical*.

A HEAVY MOVE

Horse traders at heart, Al and Gary saw the possibilities in an Aérospatiale SA330 Puma they discovered for sale in Japan in 2001. After shipping it to the U.S., they began the certification process, and shortly after that, learned to fly it. With the Puma, BFS was able to expand into the Type 1 (heavy helicopter) firefighting market, bidding on contracts that would have never been possible with the Huey. The Puma won its first firefighting contract with the USFS in 2002, and due to BFS's success with the aircraft, Al and Gary decided to purchase another two Japanese Pumas.

BFS operated its Puma fleet for a few years, eventually selling the aircraft to a company for use on a Navy VERTREP (vertical replenishment) contract. The Pumas were replaced in the Billings fleet with two Sikorsky S-61 As. "[It was] like I bought a spaceship — they were built like a truck, lifted like crazy, and were super reliable," recalled Al. "I am not nostalgic about helicopters, but I loved the S-61. We operated them for many years on construction jobs, firefighting, and training."

In July of 2013, tragedy struck the family. Al's oldest son, AJ, was killed in an accident while doing seismic work in a UH-1 Huey in Colorado. The loss was so devastating, Al and Gary considered leaving the aviation business behind. But with aviation being a major part of their DNA, they ultimately decided to continue.

It was shortly after this that the CH-47Ds appeared for auction. "We were bidding against larger and more well-funded companies, but we were determined to move on these machines," said Al. BFS ended up getting both airframes, and began building its Chinook program. Requiring spare parts, hangar space, pilots, and maintenance infrastructure, the effort took every nickel the company could scrape together.

BFS also set to work writing a type certificate for the aircraft, working closely with the Federal Aviation Administration's (FAA's)

1 // A key component of Billings' firefighting work is the Bambi Bucket, which the operator has had modified with faster pumps. **2 //** Bubble pilot-side windows allow flight crews in the Chinook to have a clearer view over their loads, making it easier to precisely place water where it's needed. **3 //** During *Vertical's* visit, BFS was called to lift a tractor that had become stuck near its facility during some local flooding. **4 //** BFS operates a Sikorsky UH-60A Black Hawk for utility and firefighting work.

aircraft certification to ensure its success. BFS believes the certificate was a world-first for the CH-47D.

The Chinooks were initially operated out of the BFS hangars on its private airstrip outside Billings, but the company quickly realized that it was outgrowing these facilities. After a search for a suitable location that would allow it to comfortably expand, it found the perfect spot adjacent to the Billings International Airport.

In 2015, BFS broke ground on a 25,000-square-foot hangar and maintenance facility, designed to house six Chinooks with blades on, eight Chinooks without blades. The company is also building a new office facility, which is due to be finshed in September 2018.

Of the eight Chinook airframes in the BFS fleet, six are flying, and it began operating the type on CWN contracts with the USFS in 2015.

For operators and customers, the Chinook certainly presents impressive numbers, with 140+ knots cross-country, a maximum range of about 350 nautical miles (650 kilometers), up to 25,000 pounds (11,340 kilograms) on the cargo hook, and exceptional "hot and high" performance. As the aircraft is still in production, spare parts are readily available, but to ensure BFS has sustainability for decades to come, the company is adding MRO capabilities for the CH-47D.

BUILDING THE CHINOOK'S TANK

Up until this summer, BFS operated the Chinooks solely with 2,600-US gallon (9,840-liter) variable drop buckets for firefighting work. The idea to develop an internal tank for the Chinook had its roots in a contract BFS had with Kawak Aviation to design a bottom-filling refill pump for the buckets. Kawak was able to produce a retrofit kit that consisted of a single 1,600-gallons-per-minute (6,050-liters-per-minute) pump. The new system reduced overall bucket weight by 425 pounds (190 kilograms), and proved to be reliable and maintenance-free for an entire fire season.

At the moment, BFS operates two versions of the CH-47D Chinook — the new Kawak-tanked version, and the standard version that uses the Bambi Bucket system.

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Given the success of the bucket retrofit program, Kawak and BFS formed a partnership in 2016 to develop a new internal firefighting tank for the CH-47D. In May 2018, after many months of design, development, and manufacturing, Kawak received a supplemental type certificate (STC) from the FAA for the new "aerial liquid delivery system" and the auxiliary hydraulic system that powers it.

The system consists of a 2,500-US gallon (9,465-liter) internal water tank, a 128-US gallon (485-liter) foam tank, a fully independent 50-horsepower hydraulic system, a 4,000-US gallons-per-minute (15,140-liters-per-minute) refill pump, a unique sliding belly door water drop design, and cockpit controls for the system. The tank can release 90 percent of a full 2,500-US gallon load of water in just three seconds.

Kawak subcontracted Trotter Controls of Fort Worth, Texas, to develop the door controls for the tank, and, in opting for a sliding door instead of a clamshell-style door system, Kawak was able to create a more effective drop pattern while still utilizing the existing hook well. The aircraft's hydraulic system produces more than enough power for the firefighting system, which does not interfere with the aircraft functions necessary for flight. BFS said this type of tank system provides high performance, safety, and ease of maintenance.

One key aspect of the system is a live telemetry functionality, which automatically records how much water is taken on, how much is dropped, and where it was dropped. This information is then transmitted to the agency managing the fire for analysis.

"We are proud of this tank design," Kawak's Andrew Sawyer told *Vertical*. "The pumps are powerful and able to fill the tank in under 30 seconds, giving the aircraft more time on target during its flight cycle."

He said the tank was proving itself so far, but that Kawak would continue to watch its performance and offer support when necessary. "We will refine the system and incorporate what we find into the next evolution of the tank system for the next BFS Chinook to come online," said Sawyer.

Al Blain said BFS was happy with the system's development to date. "We will watch its durability and hope to do some weight reduction and refinements in the future," he said. "We will keep the Bambi Buckets along with the Kawak pumps; we are very happy with their performance and they still have a place in aerial firefighting."

PUTTING THE TANK INTO SERVICE

BFS pilot Mike Strasser told *Vertical* that all the company's pilots enjoy flying with the bucket on the end of a long line — which allows for great precision for load placement — but that there were increasingly restrictive requirements affecting where buckets could be flown, particularly around urban interfaces. Because of this, he said the tank will prove particularly popular in more densely-populated areas such as Northern California.

Strasser said the plan with the Kawak-designed tank was to increase the advantages of using an internal tank over existing

1 // Al (left) and Gary Blain's vision and hard work brought BFS to where it is today — a premier heavy-lift helicopter operator with a focus on the firefighting sector. **2 //** The new hangar is fully equipped and gives crews crews plenty of room to do their work. **3 //** BFS's new hangar and maintenance facility is located next to Billings Logan International Airport. Its headquarters will be located next door. **4 //** The new Kawak tank system has been tested in the field and is proving reliable and very capable. **5 //** The BFS crews said they were particularly impressed with the tank's flow rates and patterns.

products. “I have seen in these first weeks of the fire season the Kawak pump is capable of filling [the tank] at 100 gallons per second,” he said. “This reduces the time spent snorkeling at the water source during a very critical time of the flight.

“My main worry was the drop pattern of the water, which proved to be unfounded. With water having to come out from the cargo hook well of the Chinook, which seemed small compared to a S-64 Skycrane tank door, I was afraid the water would not come out fast enough. Within one day of flying the [Chinook with the] new Kawak tank, it showed that water comes out as a solid beam that I can steer around the fire’s edge.”

The Kawak tank system also gives BFS pilots the option to split the water drop and use different coverage levels for each drop.

“This is our first season with the internal tank, and I only expect the system to get better,” said Strasser.

Brian Jensen, another BFS pilot, spoke to *Vertical* about the differences operating with a bucket and the internal tank. “The long line bucket is more popular in the Northwest and areas with heavy timber,” he said. “It can reach into smaller dip sites, like ponds or rivers that are surrounded by trees. In these areas, a bucketed aircraft can generally find a dip site closer to the fire, because it does not need as much room as a tanked aircraft.

“It also has the benefit that it can make drops at a lower airspeed than the tanked CH-47D, which helps the water penetrate the dense timber canopy and get to the source of the fire.

“The new pump and actuator in the bucket are awesome,” Jensen continued. “They’re much more reliable, and reduce the time spent at the water source. The pump itself is extremely fast and being as it’s a single pump, we save a lot of weight.”

Jeff Cook, BFS’s director of operations, told *Vertical* that the tank and bucket each have their own place. “The modified bucket is working great, and the tank, although new, has a great design that we have been impressed with,” he said. However, he added that the operator plans to increase the number of its Chinooks that are flying with the tank.

Along with the Chinooks, BFS has bolstered its fleet with another military stalwart — the UH-60A Black Hawk. Over the past couple of years, the operator has acquired three, selling two to other operators. “The Huey, which we dealt with for years, is still a great machine and has many years of life in it, but we see the Black Hawk as a part of the future in the utility and firefighting market,” said Gary.

“The Sikorsky S-61 is aging and parts are

becoming hard to come by, so its logical replacement is the UH-60 series."

Al's son Bridger, who has an engineering degree from Montana Tech, wrote BFS's UH-60 type certificate. He is part of the next generation of Blains to be actively involved in BFS. Bridger works in sales and acquisition of aircraft, and is certified to fly the CH-47D, UH-60, and Cessna CJ series, among others.

"IT IS ONE OF OUR MISSIONS TO CREATE AN ENVIRONMENT WHERE PEOPLE CAN RAISE THEIR FAMILIES AND WORK FOR A LIFETIME."

- AL BLAIN, FOUNDER OF BILLINGS FLYING SERVICE

Even with the addition of the tank, long line bucket work will remain an integral part of BFS's firefighting offering.

BFS is now in the process of "finishing up" its UH-60A and plans to use it in the utility and firefighting market. "Although the UH-60 is a bit more expensive to operate than a Huey, it simply does twice the work on its worst day and better than that on its best day," said Gary.

BFS plans to keep an eye on the military surplus UH-60 market, anticipating the release of the more capable L models, which will provide even more lift and performance at high altitude.

In addition to its rotary fleet, BFS operates three fixed-wing aircraft to support its firefighting operations, mostly around the Western U.S.

"We want our firefighting aircraft operating with as little, if any, downtime as possible, so we have a Cessna Citation, Cessna Caravan, and a Pilatus PC-12 to move replacement parts into airports where the Chinooks are operating from," said Gary. "Both the Caravan and the Pilatus can carry a Chinook engine and any transmission used by the CH-47."

The Chinooks carry a pickup truck inside their cabin when flying out to fires, and this can meet the fixed-wing supply aircraft to collect parts, said Gary. The aircraft are also used to move flight crews and mechanics to jobsites.

The Blains proudly describe their life's work as safely providing a quality service. With the Chinooks and their newly-developed firefighting tank now part of the BFS offering, it has taken the breadth of that service to another level. The secret behind the operator's success, Al said, is its employees.

"It is one of our missions to create an environment where people can raise their families and work for a lifetime," he said. "We have very high expectations of them and they have very high expectations of us."

For them, and in the memory of his son, AJ, Al said the company continues to strive for excellence each and every day.

"We wake up in the morning thinking about helicopters and how to do [our work] better, and we go to sleep at night thinking about helicopters and how to do [our work] better," he said. "I want AJ to be proud of what we are doing and how we are doing it."

Skip Robinson | Skip has covered helicopter operations through photography for 25 years and has worked with *Vertical* Magazine for over a decade. His main interests are rescue, parapublic and military operations. Skip is based in Los Angeles, California.

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INTO THE ICE

Airlift helicopter pilot Tom Andreas Østrem tells us about a special operation he was part of earlier this year, which took him to the West Ice in the Greenland Sea.

BY TOM ANDREAS ØSTREM

Variation is a big part of any utility pilot's everyday routine. However, once in a while a mission comes along that provides a completely different experience to any you've had before. I was fortunate enough to be slated for one such assignment earlier this year, when I flew researchers conducting seal counts in the Arctic.

The expedition was run by the Institute of Marine Research (IMR), based in Norway. They count seals about every five years to track the general population from a sustainability aspect.

Using an Airbus AS350 operated by Airlift, the company I work for, our mission would be to fly reconnaissance flights in the West Ice in the Greenland Sea to locate patches of baby harp and hooded seals. Once we'd located the patch or patches, we'd set GPS beacons for aerial fixed-wing assets to take photos that would enable later counting of the pups. The third objective would be to fly staging flights to determine the age of the pups in the patch. So: find the seals, mark the area, then staging.

Preparing for takeoff from the Norwegian Coast Guard icebreaker KV Svalbard, which provided the base of operations for the expedition. **Tom Østrem Photo**

East of Greenland and north of Iceland, the West Ice is covered in pack ice in winter. But given that we would be flying there in mid-March, there was a lot of uncertainty as to how close to Greenland we would have to get to find the ice. We decided to aim for an area along the 72°30N parallel and follow that into the ice a little bit to escape some of the swells from the Greenland Sea that could make operating from a ship impossible. A dedicated research vessel was not available this time around, but luckily the Norwegian Coast Guard icebreaker KV Svalbard stepped in and filled that role.

The Norwegian Coast Guard is a branch of the Royal Norwegian Navy, so before we set out, I needed to brush up on naval ops procedures. I then planned our more-than 600-nautical-mile transit from our base in Førde to the rendezvous with the vessel in Tromsø, and completed some general and mission-specific risk analyses.

After joining the vessel in Tromsø, we removed the helicopter's blades and wheeled it into the hangar. We were forecast rough conditions for our transit, so we lashed down the helicopter and ensured it was securely fastened.

The transit took three days each way, which meant we only got six days in the mission area. That is a pretty small window in the best of conditions, so we were really at the mercy of the weather. The three main parties onboard — the Coast Guard, the expedition, and us as the air asset — held daily briefings to thoroughly plan and prepare to ensure we made the most of our time in the West Ice.

Our greatest concern was having to land on ice and wait for the vessel to reach us, either due to a technical issue or a sudden change in weather. We identified the latter as more likely, so much of our effort went into preparing for that eventuality. We can't affect the weather, but we can adapt to it. We decided the weather and weather trends would be the main limiting factors as to how far away from the vessel we would dare venture.

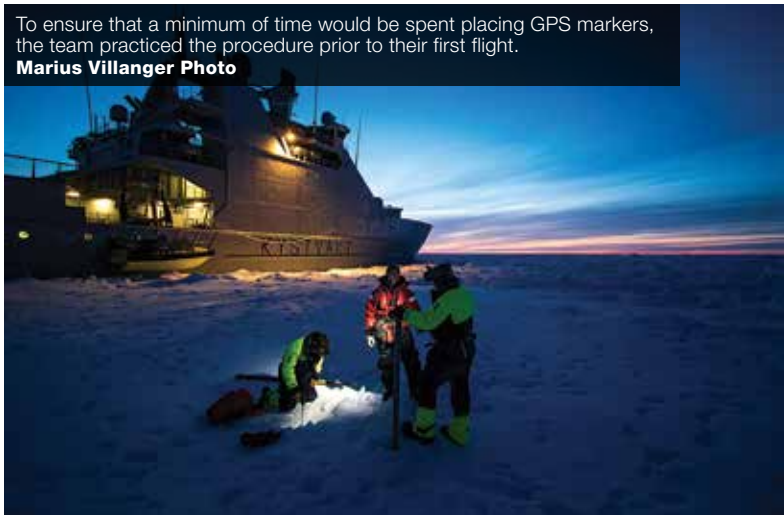
I figured if we had to do a landing due to poor weather, the lighting conditions would be conducive to a whiteout and possible rollover on landing (not all ice floes are flat). That would make an already bad scenario potentially deadly. I was able to get my hands on some canisters of orange smoke that we could toss out for a reference if I needed one.

In case a rescue was necessary, close flight following with the vessel was essential. Satellite tracking on our aircraft was to be an incredibly valuable resource that gave us all peace of mind. The vessel could track us via a webpage as long as they had VSAT coverage. If they lost coverage, they would call air traffic control (ATC) in Longyearbyen. This way, we had a robust flight following system even when we were beyond the vessel's radar coverage. Considering we were operating at about 400 feet, that coverage was lost fairly quickly.

Safety briefings touched on emergency and survival equipment, as well as covering basic helicopter safety issues. We placed our special arctic survival kit and standard survival kits in different side holds, so we would have access to at least one burner — even if the helicopter were to roll to one side in a crash. We briefed using the dinghy, and discussed how that could be used as shelter on the ice if need be.

Here, the helicopter waits on the deck for a window of favorable weather. The ladders on the deck indicate that the crew was not optimistic that the weather would clear, and in fact the aircraft didn't fly that day. **Tom Østrem Photo**

When the aircraft was flying, the vessel would stay in the same position most of the time. **Lasse Thomasgård Photo**



To ensure that a minimum of time would be spent placing GPS markers, the team practiced the procedure prior to their first flight.
Marius Villanger Photo

An avid photographer, the author missed out on shots of the aurora borealis in order to be rested and ready for long days of flying.
Marius Villanger Photo

TAKING FLIGHT

We reached the close drift-ice late in the afternoon on the third day. To be able to begin operations as early as possible the following day, we needed to get far enough into the ice to escape the swells before nightfall. Running in ice is very noisy, so to ensure we all got the rest we needed, we decided not to run in ice at night during the expedition.

Walking onto the bridge the next morning, we saw clear skies. We had two sorties planned for the first day, and the first of these was an exercise with the vessel to ensure all procedures were established.

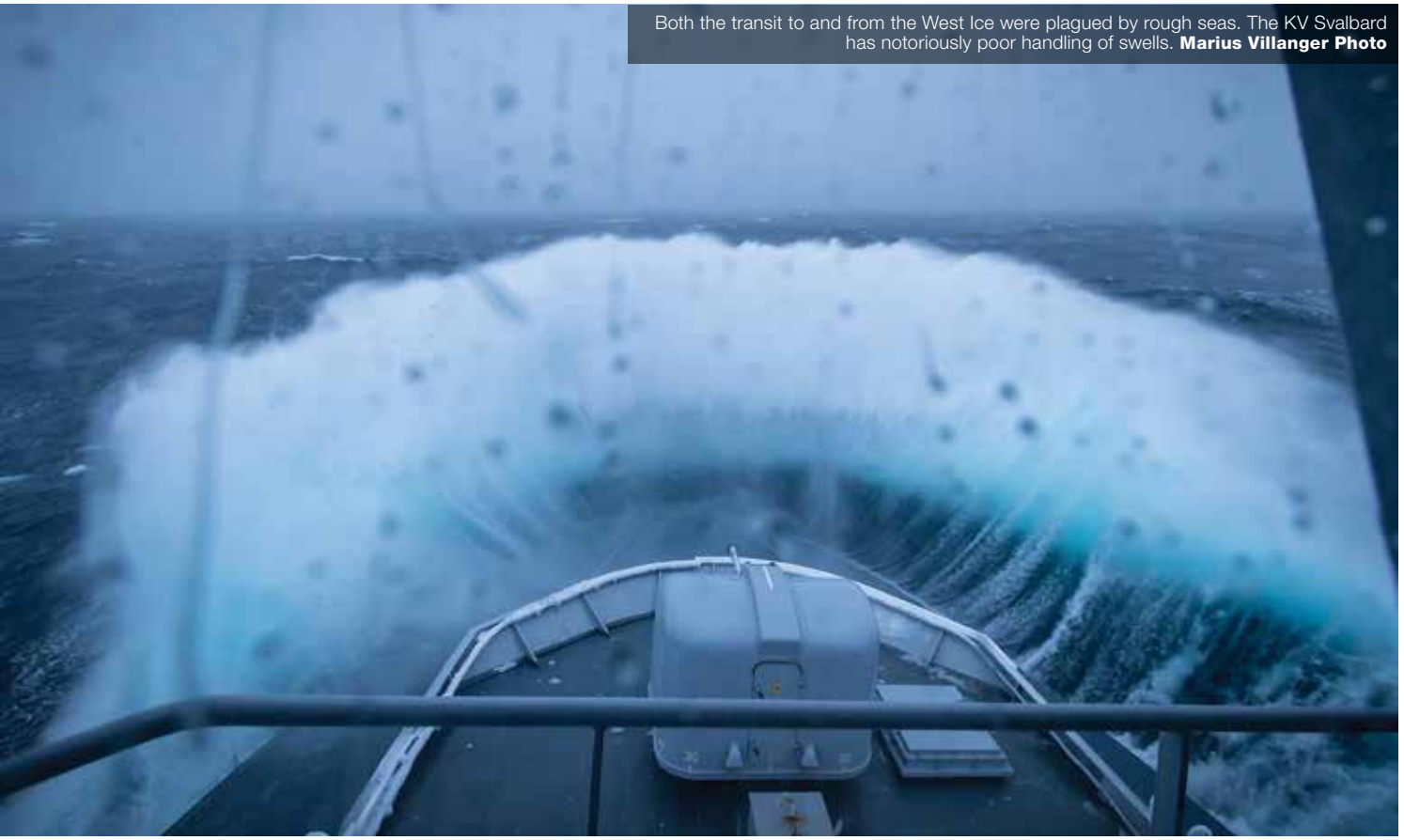
Naval ops are quite different to how we normally operate. Radio procedures and hand signals need to be adhered to, as well as the "Ship-Helicopter Operating Limits" (SHOLs). SHOLs are specific envelopes for the various operations on the flight deck. They cover everything from traversing the helicopter to the different takeoff and landing procedures. Each operation has pitch, roll, heave, and wind velocity limits. The wind velocity differs a lot for the various flight procedures.

We had fore-and-aft port side takeoff/landings as our preferred procedure. This required the wind to be in the sector primarily just left of midship for us to be given a green deck. This procedure had us lifting up facing forward, then moving sideward to the left until we were clear of the deck, then turning away from the vessel and accelerating. Landings followed the same pattern.

We did some deck landing practice (DLP) and performed a "crash on deck" exercise, and took a break for lunch before returning for the afternoon flights.

Arriving back at the vessel after a productive day of flying. **Lasse Thomasgård Photo**

WATCH VIDEO



Both the transit to and from the West Ice were plagued by rough seas. The KV Svalbard has notoriously poor handling of swells. **Marius Villanger Photo**

Here, the main patch of harp seals, as well as a mother harp seal and her pups. **Oda Linnea Iden Photos**

We took three researchers on each flight, rotating them between sorties. This load gave us maximum range — a play-time of about two and a half hours, with a 30-minute reserve.

For the recon part of the mission, the researchers acted as spotters, trying to find what proved to be increasingly elusive patches of seals. We flew east-west transects spaced five nautical miles apart. They stretched from the edge of the drift ice and westwards, sometimes as long as 50 nautical miles. Due to the large magnetic variation in the area, we used the GPS and flew true tracks along each five-minute parallel, as long as we were flying over suitable ice for the seals.

We reported "pps normal" to the vessel every 20 minutes. When we lost radio coverage, which wasn't unusual, we called them using the satcom. As long as they had our GPS tracking working we omitted position reports, and instead just reported endurance and any intentions to deviate from our predictable pattern.

Day one left us having seen five polar bears, but very few seals.

On the second and third day, a low ceiling in our southern-most search area made us unable to reach the easternmost areas, but we were still able to cover a lot of ground. It was in this overcast area we found our first patch of hoods. This find was deemed important enough to part ways with one of our five GPS markers. As I had anticipated in our risk assessment, landing on an ice floe in flat light would prove to be challenging. We notified the vessel, tossed out a canister of orange smoke, and landed using that as a reference.

As much as the photographer in me would have liked to shut down on an ice floe to take some pictures, the risk versus reward didn't justify it. The researchers only required about five minutes to place the marker, and not being able to start again on an ice floe 50 nautical miles away from the vessel was not something I wanted to risk. Instead we kept an eye out for polar bears as the researchers worked their magic.

The weather for day four looked great, but with the forecast for the following days being much worse, I suggested we use the day effectively. This meant changing our habit of taking breaks when the vessel's crew had their meals. So began a most magical day!

Running out of time to find the big harp seal patch we were looking for, we decided to focus our attention on an area a bit to the north of our search area that had been highlighted by the fixed-wing.

At the conclusion of our first sortie, we started hearing a rapid increase in seal reports from our spotters. And not just any seals — but finally the harp seals that we had seen so little of until that moment. A few minutes later there were seals as far as the eye could see, and the density was such that I realized I was witnessing a very special event first-hand. The only thing missing was a commentary by David Attenborough.

After a quick refuel and bite to eat back at the vessel, we returned to the area. We flew transects to get a grasp of the extent of the patch, and then placed a few GPS markers. Our third and final sortie of the day was a staging flight. This was done flying transects spaced roughly two nautical miles apart at about 150 feet at between 40 and 60 knots, depending on density. A researcher on each side would call out any observation of pups. Pups have different names depending on age, so they would call out things like, "thin-white (harp), fat-white, four thin-whites, thin-blue (hood)," and the researcher up front would

The author carried his helmet out of the freezing helicopter in between flights. **Oda Linnea Iden Photo**

Here, the author turns the aircraft in order to ensure a clear view of the flight deck officer. **Martin Kristiansen Photo**

The author was given training in order to sign off on the procedure of taking the blades on and off. **Marius Villanger Photo**

The hangar on the ship had plenty of room for an AS350. **Tom Østrem Photo**

The flight deck officer front and center used voice and hand signals to guide the helicopter in the immediate vicinity of the helideck. **Tom Østrem Photo**

Although seal counting was the primary mission of the expedition, other teams came along to conduct their own research, thus maximizing use of the vessel. **Oda Linnea Iden Photo**

take notes. As we reached nine hours of flying that day, it was time to head back in.

I think we all slept well that night. Unfortunately the forecast from the day before was right, and we had a lot more clouds with a cloud base between 500 and 1,000 feet. We only placed one more GPS locator and did a general recon in the nearby area that day.

As expected, day six was worse. A lot worse. Visibility was down to between 500 to 2,000 meters, and the vertical visibility was 500 feet at best. We waited patiently, but by early afternoon I realized I had already had my last flight over the ice.

The vessel endured some tough conditions escaping the ice on the way home, but managed to do so with no hull damage. As we entered the Norwegian fjords, we readied the helicopter and said our goodbyes. Though an extremely short expedition, it was a lot of fun. I would like to thank all the people who participated and contributed to it being an amazing experience that I will remember for a long time.

Tom Andreas Østrem | is a helicopter pilot in scenic Norway, where he lives his childhood dream and shares it with the rest of the world through social media. As well as being a pilot, he works on another passion — flight safety. "The most important thing after all is getting safely home to my beautiful little family every time," he said.

2020 VISION

There are less than 18 months to go until the U.S. Federal Aviation Administration's Jan. 1, 2020, deadline for installation of ADS-B Out capabilities — but with time running out, the majority of operators are still to make the change.

BY NORM MATHEIS

Midnight on Tuesday, Dec. 31, 2019, is a time and date that has been hammered home to any user of U.S. airspace on a frequent basis over the past few years. But, for those unaware of its significance, it's the deadline for compliance with the Federal Aviation Administration's (FAA's) Automatic Dependent Surveillance – Broadcast Out, or ADS-B Out, mandate. This calls for all aircraft — including part 27 and part 29 rotorcraft — currently required to have a transponder to be equipped with DO-260B ADS-B Out-compliant extended-squitter Mode S transponders and associated GPS receivers. This means those required to comply now have less than 18 months to do so — and at current install rates, not all aircraft will make the deadline.

ADS-B Out is an avionics technology that transmits GPS-based position and other data via extended squitter Mode S transponders to a ground station network that is linked to air traffic control. Information "squits" like identification, GPS position, altitude, velocity, and quality and integrity data are made available for an air traffic controller's situational awareness.

The FAA's successor to tracking aircraft and separating them by radar, ADS-B Out is just one part of the regulator's multi-faceted NextGen effort to modernize the U.S. air transportation system. The aim with ADS-B Out is to increase the efficiency, capacity and safety of air traffic management.

According to Federal Aviation Regulations (91.227) published in August 2010, ADS-B Out equipment must be approved to either TSO-C154c (universal access transceivers, or UAT) or TSO-C166b (1090 MHz extended-squitter transponder). Somewhat confusingly, even though the former is called a universal access transceiver, the 978 MHz UAT is actually less universal than the 1090 MHz ES transponder in terms of where it can fly and what airspace it can use. Extended-squitter Mode S transponder equipment compliant with TSO-C166b will be required in order to operate In Class A airspace (above 18,000 feet) in accordance with Federal Aviation Regulation 91.225. Rotorcraft that never fly in Class A airspace can be upgraded to a 1090 extended-squitter transponder, or can be equipped to comply by installing a 978 MHz UAT, which is meant for the lower altitude operations of most rotorcraft.

The avionics modifications for required for medium and heavy helicopters can be comprehensive. Typically, this can include replacing a flight management system with a wide area augmentation system (WAAS)-capable unit, replacing both legacy transponders with Mode S extended-squitter versions, adding wiring and a failure annunciation somewhere, testing, and, of course, gaining the all-important approved data. Some operators in this class will opt for cheap and cheerful "bolt-on" solutions, meeting the mandate but not doing anything for the navigation solution presented to the crew.

Some avionics mod shops and integrators still have capacity to do the mandatory avionics equipment installations prior to the deadline, but operators who haven't begun the process of booking slots may be setting the

Aircraft operating in U.S. airspace must be equipped with ADS-B Out capabilities by Jan. 1, 2020. **Mike Reyno Photo**

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ADS-B surveillance has significantly improved safety and efficiency for all operations in airspace where radar was never possible. Westwind Helicopters has installed the L3 Lynx NGT-9000 systems so that the company is not only compliant with the 2020 ADS-B mandate, but also provides pilots another level of safety. **Dan Megna Photo**

stage for a crisis in demand, with long wait times and "overs" as the deadline approaches. But, there is capacity if you can commit now.

WHY IS IT HAPPENING?

Let's digress for a moment. We're hearing a lot about ADS-B Out, but what is ADS-B In? This refers to reception of ADS-B Out broadcasts by aircraft equipped with ADS-B In avionics, but there isn't any mandate for this, yet. Further to that, there is ADS-C (Contract). This is an element of Future Air Navigation Systems, replacing HF position reporting with tracking using a datalink and SATCOM. Mandates are in place for ADS-C in remote and oceanic operations.

Air navigation service providers like the FAA were motivated to make the change to ADS-B as it allowed them to decommission expensive aging secondary surveillance radars (SSRs). And, as it was never possible to deploy SSR in remote regions like Alaska and Canada's North, those areas don't get radar surveillance, period. Comparatively, ADS-B sites are much less expensive to install.

Another benefit offered by ADS-B Out is a much faster update rate (once per second), better position accuracy, aircraft state and intent information, and it should ultimately allow more helicopters to use existing airspace with equivalent or better safety and efficiency. Finally, there is the "green" movement to be taken into account. Nav Canada estimates that in the Hudson Bay/Minto airspace sectors, ADS-B Out will save airline customers an estimated $374 million in fuel by 2020, and reduce greenhouse gas emissions by about 982,000 metric tons.

While there are definite benefits to the technology, uptake among owners and operators has been slow. According to the FAA's figures, only 2,411 of the 13,195 active civil rotorcraft registered in the U.S. had been equipped with rule-compliant ADS-B Out technology as of mid-July. Of course, we don't know how many of these helicopters will ultimately operate in the airspace affected by the rule, but still, one of the reasons for that small percentage seems to be that the end of 2019 is still too far in the future to be considered an urgent matter to owners and operators. One of the most common reasons avionics shops hear operators give for delaying the modification is that they may sell the aircraft before the 2020 mandate kicks in. The flip side is that selling a helicopter that isn't equipped with ADS-B Out in this market against similar models that are equipped will not be easy.

Pro Star Aviation, based in Londonderry, New

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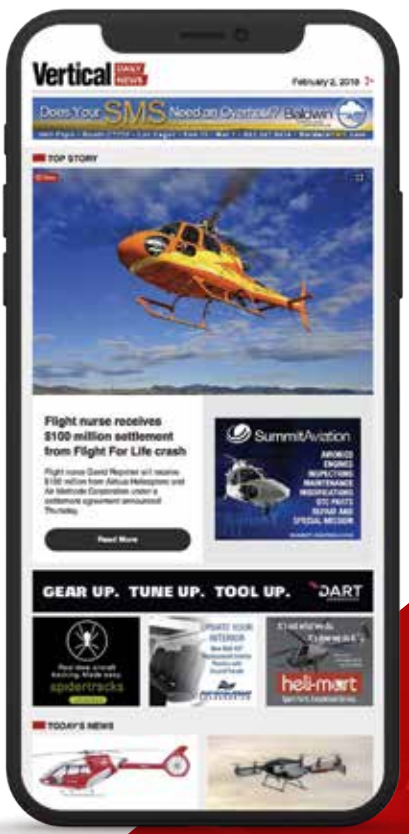

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Hampshire, is a major player in the U.S helicopter avionics mod business. Jeffrey Shaw, the company's director of business development, told *Vertical* that it is currently doing the back-to-back modification of four Sikorsky S-76s to comply with the mandate.

"Rockwell Collins has an STC [supplemental type certificate] for three of these machines, and an existing fixed-wing equipment pairing will be used as a basis for the other Honeywell-equipped S-76," he said.

However, such preemptive work seems to be the exception to the rule.

"Our normal clientele are heavy VIP-style rotorcraft — S-76 and [Leonardo] AW139," said Shaw. "The entire business aviation sector of the market is pretty slow to adopt ADS-B Out, and the helicopter segment is even slower than fixed-wing. . . . One reason it's been slow is there haven't been solutions out there until recently. And one thing helicopter operators are not very tolerant of is downtime."

Shaw said his main concern for an operator would be that the mod shops who can reliably take on an ADS-B Out install can also afford to be choosy about the type of work they take on in the current environment. For example, a standalone ADS-B Out install would not be at the top of their list if there was a cabin connectivity job on a G550 on offer. Even for a long-time loyal client, Shaw said Pro Star Aviation is probably at least four months out from taking in any aircraft to do an ADS-B Out install.

With concerns about whether operators will meet the 2020 deadline, the U.S. Congress has requested that the Department of Transportation Office of the Inspector General explore equipage rates for ADS-B and other NextGen technologies on aircraft, as well as the reasons operators decide to equip their aircraft. It has also requested an assessment of the plans in place for meeting the 2020 ADS-B Out deadline. This audit was due to begin in June, but the FAA emphatically says it will not postpone the compliance date.

THE BENEFITS OF MAKING THE CHANGE

Besides getting ahead of the crunch, there are other benefits to getting ADS-B Out sooner rather than later. The infrastructure is complete and ADS-B Out is available, and there may be some low-altitude special treatment available from air traffic control. On top of this, at least one avionics manufacturer offers a trade-in credit incentive for the removed transponders for early adopters.

Life is also getting easier for those looking to install the technology. Guidance material for ADS-B Out on-aircraft installations on N-registered machines, which those in the avionics business live by, continues to evolve. Installers can now reference data from previous STCs and install new equipment on a different aircraft.

The FAA's ADS-B AFS-360 Focus Team released a technical paper (AFS-360-2017-1) in September of last year to provide additional clarity for ADS-B Out policy. The agency has streamlined the type design approval of ADS-B Out installations, and some field approvals are now being allowed, but the rotorcraft flight manual supplement still needs to be signed off by the FAA.

In August 2017, the FAA released a legal interpretation that clarifies that the aircraft Flight ID (aircraft registration or call sign) must

synchronize to the aircraft's flight plan. If the aircraft operates, or is likely to operate, with a changeable call sign, the ADS-B Out installation must be able to support pilot-entered Flight ID in order to be rule-compliant. This can affect emergency medical services (EMS) rotorcraft operators, who will need support in their modified avionics fit for flight crews to be able to change their ADS-B Out Flight ID to align with their flight plan call sign.

The FAA has set up an *Equip ADS-B* website to be the core information source for operators to get the list of FAA-reviewed ADS-B equipment pairings, and to find answers to frequently asked questions regarding policy and ADS-B Out compliance.

Avionics OEMs continue to release new ADS-B hardware, and the competition is increasing the number of options available to operators of part 27 and 29 helicopters. Just one example is Becker Avionics with the BXT6500 Mode S Transponder series, which is designed specifically for single antenna applications across all fixed- and rotary-wing applications. With a FreeFlight 1203C SBAS/GNSS sensor, these remote-mounted transponders provide another solution for the mandate. In addition to providing ADS-B compliance, the system features enhanced privacy settings that can disable both ADS-B and Mode S transmissions — a feature Becker says is unique to the BXT6500 family.

WIDER ADOPTION

There are interesting discussions going on between the military, the FAA, and other "three-letter agencies" on the feasibility of "cloaking" ADS-B Out transmissions to ensure the privacy of sensitive missions. ADS-B Out is easy to receive, even by hobbyists, making state aircraft potentially more vulnerable to tracking. This emerging concern may be a reason why ADS-B Out adoption rates for the armed forces is relatively low. The U.S. Army says it is still aiming for fleet-wide installation of the necessary ADS-B Out avionics, but it will request exemptions for an unspecified number of aircraft that will not be in compliance by the 2020 drop-dead date.

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Another interesting consideration is for those rotorcraft working in the offshore industry. The operators and lessors of these aircraft, which are often on the move to a different operating region, must keep track of worldwide ADS-B Out rules and plans. Brazil, with its large Campos Basin, was the first to mandate ADS-B Out, but north of the 49th parallel, there is cautious and methodical progress towards a proposal for such a move in Canada. That said, Nav Canada has already been providing tactical surveillance separation in certain airspace using ADS-B Out technology for the best part of a decade.

Daryl MacIntosh, president and general manager of Maxcraft Avionics, based in Pitt Meadows, British Columbia, said the company often performs ADS-B Out installations while doing other avionics work on aircraft.

"It's a form of insurance, say for a local client with an AW139, who may have to do a charter to Seattle from the B.C. lower mainland," he told *Vertical*. "We came up with a Garmin UAT-based solution for them . . . . And what is also interesting are the Canadian wildfire attack contractors sending helicopters and crews to the U.S. to fight fires — they're not thinking about ADS-B Out yet, [but] I wonder if the U.S. Forest Service has updated their requirements to have ADS-B Out equipment."

If and when Canadian ADS-B Out rulemaking launches, Aireon satellite-based ADS-B Out will very likely be part of the eventual mix. Nav Canada is a founding partner in the Aireon joint venture that has ADS-B receivers carried on the Iridium NEXT satellites. Aireon claims that space-based ADS-B surveillance will bypass the limitations of ground-based SSR radar, Wide Area Multilateration (WAM) and ground-based ADS-B surveillance systems.

The Edmonton Flight Information Region will go live utilizing space-based ADS-B Out in late 2018, and it will be the first to operationally use space-based ADS-B Out in its airspace. Aireon is expected to be central to any expansion of Canadian coverage, with the possibility of additional ground-based coverage following consultation with users.

The satellite payloads receive ADS-B Out signals broadcast from aircraft equipped with 1090 MHz extended-squitter ADS-B transponders, which operate on the same frequency as traditional Mode A/C/S transponders. UAT operates at a different frequency, and won't be supported by Aireon.

Northern and remote operators could benefit in other ways when they equip with ADS-B Out. In uncontrolled airspace, there is a certain reliance on monitoring TCAS traffic, but there will be more visibility now. Aireon says it will provide the location and track of ADS-B-equipped aircraft to assist in search-and-rescue, at no additional cost to registered users.

What does the future hold? A good guess might be a change to Canada airspace to require DO-260B 1090ES ADS-B Out after the U.S. date. C-reg operators needing to run schedule, charters, corporate flights and special ops, such as medevac into the United States, will have already equipped for the U.S. mandate. As will those needing to pass through U.S. airspace to approach close-to-border Canadian airports, such as Victoria and Abbotsford.

The U.S. ADS-B Out rule date will not change. Seeing it approach is like looking through a viewfinder and seeing an image become increasingly clear. And for those required to operate in U.S. airspace, there are many benefits to getting ahead of the mandate. The risks of not doing so, and missing the deadline altogether, could be severe.

Norm Matheis | Norm Matheis is a senior avionics sales and marketing professional and an AME E.

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FUTURE-PROOF?

Predictive maintenance is rapidly evolving, allowing operators and manufacturers to predict — and avoid — potential problems before they appear. What does the future hold for this burgeoning technology?

BY THIERRY DUBOIS

We all wish we could foresee misfortune on the road ahead of us, allowing us the opportunity to avoid it. In many aspects of life, this ability remains firmly in the world of science fiction, but for those who work in helicopter maintenance, it's fast becoming a reality. This is world of predictive maintenance, in which usage and condition monitoring data is used to predict potential issues before they happen. The rapid evolution of predictive maintenance is not only enabling measurable improvements in its effectiveness, but is democratizing its use among the global fleet, with even some smaller helicopters now able to benefit from it.

Most of the advancements stem from ever-increasing computing power, but a new, more science-based approach may allow manufacturers and operators to have an even earlier and deeper understanding of potential problems. Airbus Helicopters, Sikorsky and Sentient Science are among those investing to enhance the capabilities of prognostic tools.

Matt Tarascio, director for data analytics, prognostic health management and artificial intelligence (AI) for rotary and mission systems at Lockheed Martin (Sikorsky's parent company), told *Vertical* that the manufacturer is using the extensive data collected from health and usage monitoring systems (HUMS) on the S-92 to predict negative events. "We have over 15 years of data on a 300-strong [S-92] fleet," he said. The company uses

Maintenance engineers inspect the main rotor hub of a Sikorsky S-92. The manufacturer has used HUMS data to extend the part's service life in the past, and is now using that data to predict negative events. **Heath Moffatt Photo**

Last year, in collaboration with Outerlink Global Solutions, a Metro Aviation company, and offshore operator PHI, Sikorsky launched in-flight real-time HUMS data transmission. **Ted Carlson Photo**

machine learning-based tools to predict failures using data analysis, and the result is helping customers operate their fleet "safely and more affordably," said Tarascio.

Such tools have been developed over many years, but that progression accelerated four or five years ago, he said. It "picked up in pace with big advancements in machine learning, when neural networks became popular again, when Google beat the world's best Go player," Tarascio said.

This has translated into an estimated five to 10 percent better fleet availability over the last 10 years. "We are now talking about extracting the last bit of availability; you will never get to 100 percent because there will always be something you cannot predict, but we are trying to get as close as possible," said Tarascio.

Image recognition is one of the areas in which machine-learning tools have been leveraged for sustainment. It starts with photos of failed components of the same type. "Imagine numerous images of the same component in the fleet," said Tarascio. "We can apply machine learning to looking at pictures, and detect a failure before it happens. The downside is you need a lot of data to train your algorithm well."

Airbus Helicopters has also exploited recent progress in data analytics. "Last year, we launched Flyscan, a new data monitoring tool on dynamic systems," Matthieu Louvot, Airbus Helicopters' executive VP for customer support and services, told *Vertical*.

Sikorsky believes its data analysis has already improved fleet availability by five to 10 percent over the last 10 years. **Sikorsky Photo**

"Before, such data analysis was used in a reactive mode; after a given threshold seen on HUMS data, you could not fly any longer and had to perform maintenance," he said. "Now, in a proactive mode, weak signal analysis can indicate that a threshold will be crossed soon." The warning comes several dozen hours early. "Therefore, the operator can plan a maintenance operation and thus avoid unscheduled works or even a mission failure," he said.

As of late April, Airbus had found six customers for Flyscan, for a combined 26 rotorcraft. Those customers using HUMS have historically been offshore operators. "But Flyscan is suitable for every type of operation, such as EMS [emergency medical services]," Louvot emphasized.

It is available for all of Airbus's twins, as the smaller H135 now has HUMS as an option — since the Helionix suite became the H135's avionics standard last year. Louvot's target for an offshore operator is one last-minute aircraft-on-ground situation avoided per year. Using Flyscan may also translate into a seven percent cost saving in unscheduled maintenance, he added.

In Airbus's Flyscan, HUMS data is uploaded after each flight, instead of after a threshold is crossed.

REAL-TIME HUMS

Sikorsky has gone one step further. Last year, in collaboration with Outerlink Global Solutions, a Metro Aviation company, it launched in-flight, real-time HUMS data transmission to an operations control center via satellite. "We now have the ability to predict events by analyzing historical data in real-time," Metro Aviation president Mike Stanberry said at the system's launch. "That innovation helps operators more efficiently run their fleet and could very well be lifesaving."

Engineers at launch customer PHI can view, assess, and track aircraft health data, and provide additional information to aircraft crew and ground support teams. PHI can thus improve operational and maintenance decisions, according to Sikorsky.

"We leverage maintenance, weather and other state data; this is an extra layer of safety," Tarascio said. "A customer, such as PHI, can access this information throughout a mission and assess component health indicators."

During flight, HUMS data is transmitted to PHI's fleet management center. This includes flight manual exceedances, mechanical diagnostic health indicators, maintenance data collection alerts and avionics bus parameters. After the flight, the data is uploaded to the maintainer or operations center for further analysis and trending.

"HUMS data is owned by the customer," Tarascio said. "The customer can choose not to share it, but there is an advantage — such as prognostics — for them to allow Sikorsky to apply advanced analytic models to their data."

However, Louvot said he believed in-flight data transmission had limited relevance to rotary-wing operations. "In commercial [fixed-wing] aircraft, that could be interesting, but helicopters fly shorter legs, their utilization rate is lower than that of an A320, and satellite communications are expensive," he said.

Increasing the amount of data available is key, according to Simon Gharibian, director of fleet management at Sikorsky. "The more data is available on the aircraft, the more Sikorsky is able to focus on parts that drive down availability," he said.

Airframers monitor the removal rates of different parts that contribute to grounded aircraft. They track when the parts need to be replaced, how old they were, the reason they needed to be replaced, and how long they took to be replaced. Analytics tools are set to target parts that need to be replaced most often, or took the most time.

"In one case, we noticed that operators needed to replace their landing gear more often than we expected, so we took a look at the data and found that the issue was actually related to leakage and corrosion on the landing gear piston," Gharibian said. "At this point, our engineering and manufacturing teams came in and developed on-aircraft repairs to address the corrosion and resulting leakage, thus reducing the number of times the landing gear needed to be replaced."

BROADENING THE SCOPE

Helicopter manufacturers are now working to extend the reach of predictive maintenance. What about adding further sensors? "The addition of sensors to various critical components of the aircraft has proven to be a crucial part in understanding the aircraft's performance and potential maintenance needs," a spokesperson with maintenance giant StandardAero said. Such components are relatively cheap.

Sikorsky's Tarascio and Airbus's Louvot agree, however, that installation can be expensive and impractical for existing aircraft.

A more relevant approach is to infer information from existing sensors, Tarascio said. It is the equivalent of creating virtual sensors around the aircraft. "We look at fully instrumented flight-test aircraft and compare [them] with production aircraft," he said. On the latter, Sikorsky engineers try to predict loads and compare the predictions to measurements on instrumented aircraft. Once the load prediction is validated, component usage estimates can be improved.

Airbus launched FlyScan to help customers analyze their helicopters' HUMS data for insights related to the safety, maintenance, and operation of their fleet. **Airbus Helicopters Photo**

Flyscan, a new data monitoring tool on dynamic systems, was launched by Airbus last year. It is now available for all the manufacturer's twin-engine aircraft, including the H135 with Helionix. **Lloyd Horgan Photo**

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Manufacturers hope new regulatory rules will allow for a 10- to 15-percent reduction in maintenance costs for commercial operators.
Heath Moffatt Photo

Over the last four years, Sentient Science's software has been adopted by 10 percent of the world's wind turbines.

Another way to expand the use of predictive maintenance is to look at those aircraft that were built without a HUMS. That was the purpose of the letter of intent Airbus and Safran Electronic and Defense signed earlier this year for the distribution of helicopter data monitoring systems.

Safran Electronic and Defense had developed Helicom, a system for the collection of usage and health data, certified through a supplemental type certificate. It is now part of Airbus Helicopters' HCare Connected Services offering. "Safran had already sold the system to a great number of operators," Louvot said. Helicom is believed to have become more attractive thanks to the services Airbus can provide.

The pair hope civil aviation authorities will approve the new methods and tools and eventually update regulations. "To extend a maintenance interval, you have to trust sensors and analyses, which involves work on aircraft certification," Louvot said. Airbus has experimented with complementing scheduled checks with vibration monitoring. The company is aiming to receive certification of longer intervals in the coming years.

According to Sikorsky, the next step to implementing more advanced data analytics is regulation. Company executives hope the Federal Aviation Administration will be persuaded by the level of trust the airframer puts in its recommendations for repairs and replacements. Ultimately, new rules could lead to a 10- to 15-percent reduction in maintenance costs for commercial helicopter operators, Sikorsky estimates.

Another level where data analytics can be used is in part ordering. Sikorsky provides its customers with an Amazon-type environment to order parts: "Someone who ordered that component also ordered this one." Why should the customer trust the recommendation? "The old style was very transactional, the spare parts department was incentivized to

sell parts and not customer fleet availability," Tarascio said. "But this is changing thanks to pay-by-the-hour fleet management models."

Meanwhile, Sentient Science is claiming to have found a more science-based approach to predictive maintenance. "When you look at a system relying on sensors, it looks at deviation from the norm," Jason Rios, vice president of Aerospace at Sentient Science, told *Vertical*. "It can figure that something is beginning to go wrong. The failure mode — such as a pit — has started to occur. So, your ability to react is already reduced."

Sentient looks at the ability of materials to withstand operating conditions. Its software predicts "when these pits, cracks and other defects may start to occur before failure." It takes into account the materials themselves, as well as heat treatment, surface finish and lubricant. It can tell whether a critical bearing will begin developing spall.

"It is a more science-based answer to questions, rather than interpolation of previous data," said Rios. It can find the root cause of an issue. It thus "offers our customers the possibility to reduce stresses and extend life."

Sentient's software has been adopted by 10 percent of the world's wind turbines in four years, said Rios. The first application in helicopters has been in the military, thanks to U.S. government-funded research and development. The 10- to 15-percent reduction seen in the operating costs of wind turbines is hoped to be surpassed in civil helicopters. "There are better records, a lot of data is available," said Rios.

He deems Sentient's work complementary to existing systems. "Our software programs would be continuously fed with HUMS data to keep refining our models," he said.

Predictive maintenance is already proving itself in the field, reducing downtime and likely preventing more serious mechanical issues. But with an increasing amount of data at their fingertips, and evermore intelligent systems and software to analyze that data, a growing number of manufacturers, maintainers, and third party providers are making those predictions smarter, more accurate, and more accessible than ever before.

Thierry Dubois | A freelance writer specializing in aerospace technology, helicopters and business aviation, Thierry also moderates international conferences on aviation technology topics.

a LEADING SOUTHERN light

The sales team at New Zealand-based Oceania Aviation takes a personal approach to helicopter transactions, with integrity at the forefront.

BY DAYNA FEDY

While Oceania Aviation's origins were in the aircraft parts business, it later branched off into fixed- and rotary-wing aircraft sales, and then started MRO work throughout New Zealand. Aircraft sales are a large part of the company today, and what it's known for globally. **Tony Steer Photo**

When a pilot or a company makes a commitment to purchase an aircraft, they must put a significant amount of trust in the seller. And it's in meeting this need for integrity and authenticity that Oceania Aviation, an aircraft and parts sales, and maintenance, repair and overhaul (MRO) provider in Auckland, New Zealand, has built a hugely successful business.

Despite being thousands of miles away from the giant helicopter fleets of North America and Europe, Oceania Aviation has forged a reputation as a reliable sales agent for customers around the globe, thanks to its prioritization of integrity in its operations.

"In spite of the fact that we are a small nation geographically located at the bottom of the world, we work really hard to ensure that there is a lot of client/customer satisfaction," said Stephen Boyce, aircraft sales manager at Oceania Aviation. "One hundred percent of what sales are all about at the end of the day is integrity; we're very cognizant of that."

The company was established in 1992 by two pilots, Josh Camp and Jonathan Bowen. Over the following years, they worked diligently to build Oceania Aviation into the company it is today, with more than 180 employees spread across 10 locations throughout New Zealand. Oceania Aviation was acquired by Salus Aviation Limited in November 2017, helping it become the largest general aviation MRO company Down Under.

The company's origins were in the aircraft parts business. It later branched off into fixed- and rotary-wing aircraft sales, and then started MRO work throughout New Zealand.

"I think, out of everything, the big difference between Oceania Aviation and any company in North America is that because of our location in the world, physically, we have to do a little bit of everything," explained Boyce. "We repair rotor blades; we overhaul gearboxes; we repair turbine engines and piston engines; we fix airplanes — it's everything."

A WELL-OILED MACHINE

While aircraft sales are a key part of Oceania Aviation's international reputation, its MRO capabilities add huge value to its business. "The MRO gives us the capability and the reputational integrity across the industry," Boyce said.

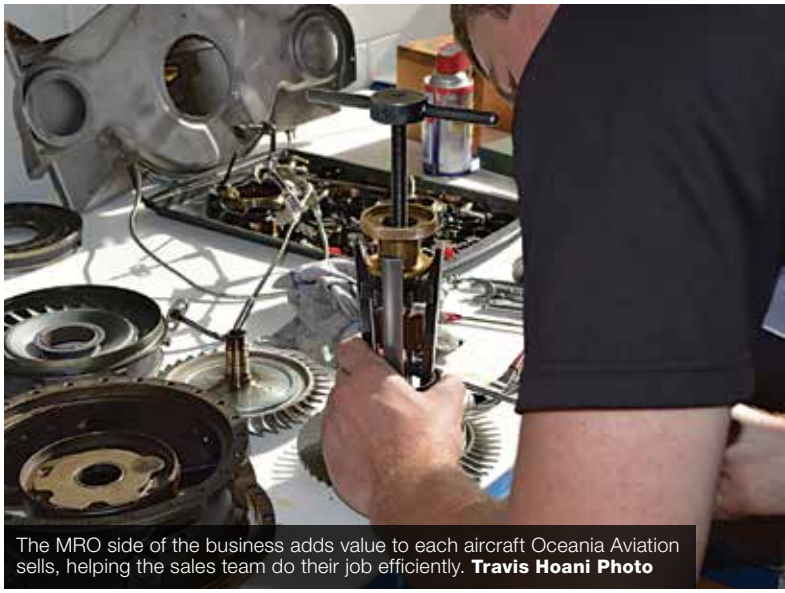
Any maintenance or repair that an aircraft may need before it takes flight with a new owner is completed by Oceania Aviation's MRO team, helping the sales staff to do their job of selling dependable aircraft. And the breadth of the company's MRO capabilities are all-encompassing, said Boyce. "If it's on an aircraft, we have someone to fix it."

The company operates like a well-oiled machine; all moving parts work in unison with one another. The sales team can be just as hands-on as the MRO team when needed, and will help dismantle and pack the aircraft for shipping to clients across the globe.

"Where most sales teams farm out the 'dirty work,' we offer the service to ensure the aircraft arrives and leaves in the most efficient time possible," said Boyce.

For years, Oceania Aviation has focused on converting aircraft from one sector to another to meet market demand. With the oil-and-gas industry going through a prolonged downturn, Boyce said the company has felt pressure from other aircraft re-sellers who are looking to move their aircraft into the utility sector. As a result, Oceania Aviation has developed a specialty in repurposing machines for utility work, ensuring customers have the solutions they require.

One example of this was the conversion of a VIP-configured



The MRO side of the business adds value to each aircraft Oceania Aviation sells, helping the sales team do their job efficiently. **Travis Hoani Photo**

A 1999 MD 520N is packed and loaded on 40-foot roll-on-roll-off, bound for Australia. **Tony Steer Photo**

The sales team at Oceania Aviation often helps dismantle and pack the aircraft for shipping to clients across the globe. **Jessica Peckett Photo**

This 1987 MD 500E, formerly ZK-IRD, was exported from New Zealand to fly missions in Russia, and is still doing so today. **Stephen Boyce Photo**

Airbus AS322L Super Puma into a utility aircraft. Oceania Aviation currently has two of them in New Zealand, with a goal of refurbishing both aircraft for work in the utility market in 2019.

But a project of this magnitude is no easy feat. It can take anywhere from six to 12 months to complete the conversion, and it involves some third-party providers for certain tasks, along with plenty of expenditure with the original equipment manufacturer (OEM). The helicopter paint job alone can take eight to 10 weeks to complete.

Converting a medium or light helicopter, such as the Bell 412 or Airbus AS350, into a utility aircraft is a much quicker process. "Registering an aircraft into the NZCAA [New Zealand Civil Aviation Authority] or FAA [Federal Aviation Administration] system is straightforward, and auditing and preparation of log books takes a little longer — generally from two to four weeks," explained Boyce. "Depending on depth of the required inspections and client expectations around role equipment, we can typically deliver in less than two months."

With decades of experience in the industry, the Oceania Aviation team has learned how to manage the complexity of preparing and certifying helicopters and fixed-wing aircraft, equipping them for the aircraft sales market.

EXPERIENCED OPERATIONS

Part of the expert knowledge at Oceania Aviation comes from experience gained in handling and selling such a wide variety of aircraft.

The list of aircraft Oceania has sold over the years is lengthy, consisting of rotorcraft from the Bell 412HP to every make of Robinson, as well as a fixed-wing fleet of King Air B200s. **Jessica Peckett Photo**

"The last eight years have seen us sell every model of Robinson, everything Bell from the 206 to the 412HP, a lone Gazelle, a SA315 Lama, BK117s, S-76s, AS365 Dauphins, more MD 500s than I can remember, half a dozen Bo.105s, a flight line of Cessna pistons, a fleet of King Air B200s, and even a Pilatus PC-12 NG," Boyce said.

Oceania Aviation's real-world experience allows the sales team to offer meaningful advice to customers who aren't certain about which type of aircraft is right for their operations. Boyce said he and his team provide honest opinions to clients as to whether the aircraft they want to buy is a good fit for a certain role or not; he believes integrity and honesty are fundamental to providing this guidance.

The aircraft sales team consists of a dedicated group of people committed to helicopter and fixed-wing sales. To cover the major markets, the team members are spread out between New Zealand, Australia and the United States, but they also travel globally to support the needs of clients.

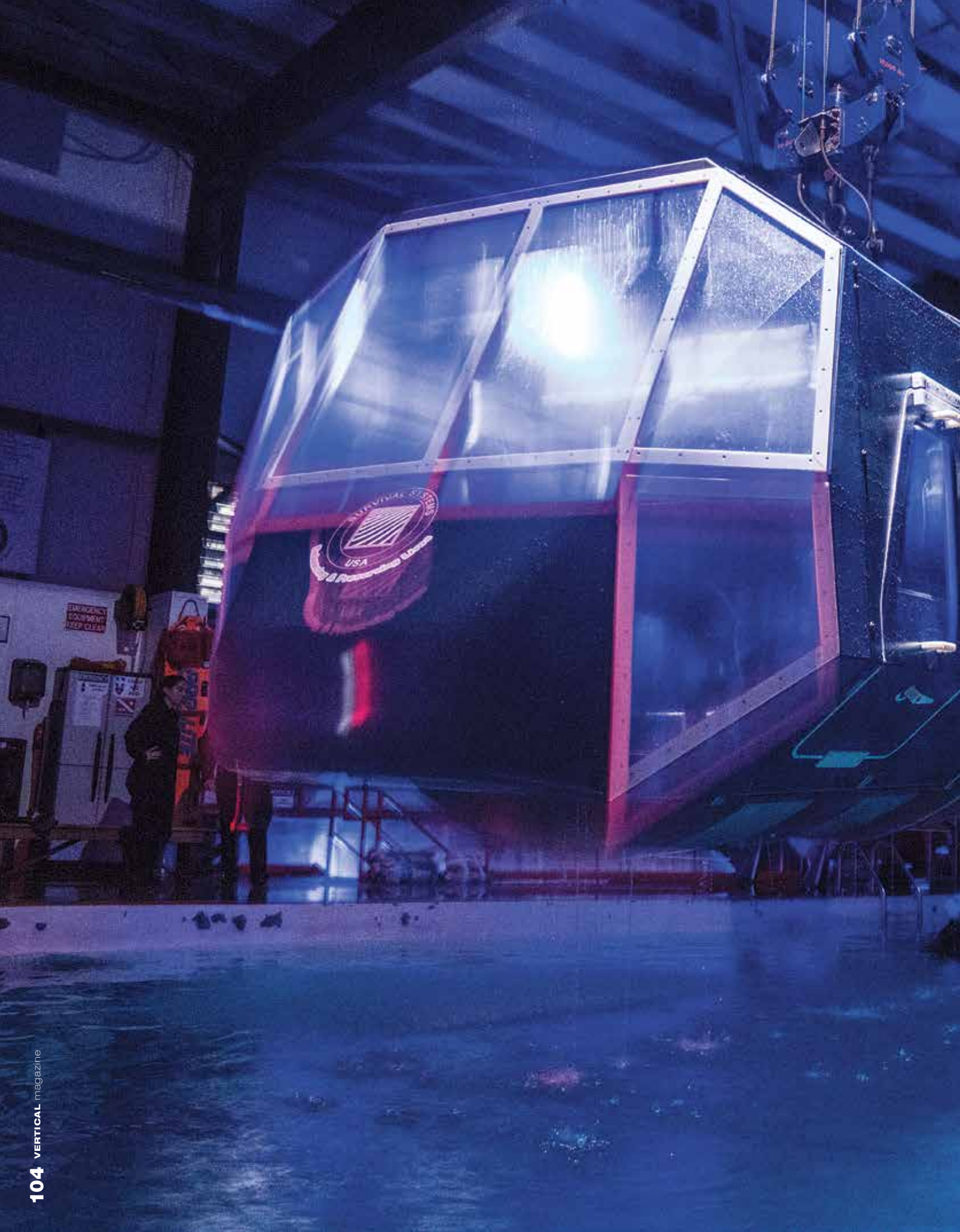
With a hands-on approach, the aircraft sales team likes to stay intimately involved from beginning to end — the sales process doesn't end once a deal is closed and a check is written. Where possible, the team will fly aircraft to any destination for delivery, will assist with disassembly for shipping purposes, and, if needed, will reassemble aircraft once they have reached the customer.

This dedication has been provided to customers such as Wisk Air Helicopters in Thunder Bay, Ontario; Blackcomb Helicopters based in Whistler, British Columbia (which purchased one aircraft from Oceania Aviation this year); and numerous individual clients who have purchased aircraft from the company over the years.

The Oceania Aviation sales team has significant experience flying many types of fixed- and rotary-wing aircraft, and that knowledge helps them enhance customer satisfaction. And each team member offers the benefits of that knowledge to Oceania Aviation's customers.

Boyce said, "Integrity is the lifeblood of aircraft sales, and we covet a reputation of decency and fair trading that has evolved since we started trading helicopters in 1992."

Dayna Fedy | Dayna is junior editor of *Vertical* magazine. She completed her undergraduate degree in communication studies in June 2017, joining MHM Publishing later in the year to pursue a career as a writer and editor.


USA

DUNKING PRACTICE

Everyone who spends time in a helicopter should complete underwater egress training, but many of us in the civil world never get around to it. If you've been putting it off, too, here's what to expect.

BY ELAN HEAD

Earlier this year, I helped ferry an Airbus AS350 helicopter from Fort Worth, Texas, to Anchorage, Alaska. We intercepted the coast of British Columbia near Prince Rupert and followed in into southeast Alaska; because it was springtime, the weather was sometimes not flyable and the rest of the time, only barely so.

Low ceilings and almost constant rain meant that it was rarely possible to climb to more than 600 or 700 feet above ground level. We knew from our charts that we were flying past spectacular mountains and glaciers, but for hours at a time our view was limited to a mile or two of the coastline in front of us, shrouded in mist.

We were wearing life jackets for this part of the ferry, but out aircraft didn't have floats. And, although we stayed as much as possible within power-off gliding distance of shore, that shoreline was often rocky or covered in dense forest, hardly ideal for an emergency landing.

Fortunately, the flight was uneventful. But I spent a lot of time contemplating the cold, dark water beneath me, wondering whether and how I would be able to get out of the helicopter if our single engine were to suddenly take the day off. Like many civilian pilots, I had never gotten around to underwater egress training, and I felt as vulnerable as I had as a brand-new private pilot, flying a Robinson R22 over the Superstition Mountains in Arizona and realizing that I didn't know the first thing about how to land in them.

That Alaska flight was one of two things that moved egress training to the top of my priority list. The other was the March 11 helicopter accident in New York City, in which five tightly harnessed FlyNYON passengers drowned when the Liberty Helicopters AS350 they were riding in made an emergency landing to the East River, then overturned in the water. I wrote extensively about the accident, and imagining the passengers' terrifying last moments disturbed me profoundly.

The Modular Egress Training Simulator (METS) at SSUSA's headquarters in Groton, Connecticut, is a 6,500-lb. device that can be configured to represent a range of different aircraft types, both fixed- and rotary-wing. SSUSA also has a separate simulator to represent aircraft with tandem seating, such as the AH-64 Apache. **Eric Adams Photo**

Shortly after the accident, I interviewed Jon Ehm, training coordinator for Survival Systems USA (SSUSA), a longstanding provider of underwater escape training. A few months later, when I had an opening in my schedule, I contacted SSUSA again to sign up for a two-day Aviation Survival and Egress Training (ASET) course at the company's headquarters in Groton, Connecticut.

Having never completed underwater egress training before, I wasn't entirely sure what to expect. I enjoy swimming and am comfortable in the water; even so, I doubted that the experience would be pleasant. However, I went into it confident of one thing — that for someone who spends so much of her time in helicopters, undergoing egress training would be far preferable to *not* undergoing it.

I wasn't wrong about that.

PULLING OUT ALL THE STOPS

Because any underwater escape training is preferable to no training at all, SSUSA offers a range of courses to accommodate all schedules and budgets. In fact, the day after my own course wrapped up, I headed to APSCON 2018 in Louisville, Kentucky, where some of the SSUSA team were putting on a one-day course in the pool of the Galt House Hotel. The company plans to offer something similar at HAI Heli-Expo 2019 in Atlanta, Georgia, next year, which should be a great opportunity for crewmembers of all experience levels to check this item off their to-do lists.

Having put off my own egress training for so long, however, I wanted to go all out. And "all out" is what's on offer at SSUSA's headquarters, home to a million-dollar Modular Egress Training Simulator (METS) that convincingly simulates flying an aircraft into the drink. The simulator can be configured to represent a range of different fixed- and rotary-wing models; for my class of eight, which included six U.S. Army flight crewmembers, the METS was nominally a UH-60 Black Hawk.

The METS would be impressive enough on its own, but it's supplemented at the Groton facility with some gnarly environmental effects — wind, thunder, and driving rain. By the end of the course, the lights would be off and the environmental effects would be full on as we rolled upside-down into the deep end, simulating a nighttime crash in weather that even the Coast Guard would have a tough time flying in.

Naturally, we would need to work our way up to that. And because it can be difficult to retain new information when you're strapped into a chair with your sinuses full of water, we started our training with three hours of ground school in a bright, dry, climate-controlled classroom.

SSUSA's ground instruction is thorough but engaging and to the point; at least in my class, no one was zoning out or checking their phones. Our instructor for the day, Andrew Kelly, talked us through the basic steps of an underwater egress, explaining the principles and some potential pitfalls behind each. Brace. Wait for the violent motion to stop. Sit up and find a reference point. Locate the exit. Jettison the door or window. Release your seat belt while keeping one hand on the exit, then pull yourself out.

We talked about disorientation, and about the importance of keeping your eyes closed to protect them from contaminants like fuel and hydraulic fluid. Because we would be using emergency breathing devices (EBDs, sometimes called helicopter emergency egress devices, or HEEDS) we also spent considerable time reviewing the fundamentals of compressed air. We learned how to pre-flight our devices, which held two cubic feet of air compressed to approximately 3,000 psi when full — enough for around 21 breaths, which can make all the difference under water.

After a brief exam, we broke for lunch. The real fun was about to begin.

WATCH VIDEO

SSUSA's Groton facility can simulate wind and driving rain during METS runs and other exercises. Here, a student is hoisted out of the pool in a rescue basket to practice being on the receiving end of a helicopter rescue. **SSUSA Photo**

PRACTICE MAKES PERFECT

"Ditching, ditching, ditching."

That's something you hear over and over again at SSUSA; it's your cue to brace yourself, take a deep breath, and close your eyes. If I ever hear those words in a real ditching scenario, my first thought may be, as it was in the pool, "Oh God, here we go again." Of course, that's the point — to build proficiency through repetition.

Wearing helmets and flight suits over our swim clothes, we started off easily enough, in the Shallow Water Egress Trainer (SWET). SSUSA's SWET is a seat suspended within a hollow metal frame; on either side of the seat, clear plastic panels simulate push-out window exits. Floats attached to the frame keep your butt at the surface of the water when seated. As the name implies, the SWET is used at the shallow end of the pool, supported by two instructors who stand in front of and behind the student.

As I strapped into the SWET's four-point harness for the first time, the instructor facing me carefully reviewed the egress procedures I had learned in the classroom. Then I crossed my arms over my chest, grabbed my harness high on my shoulders, tucked my head down in the brace position, and took a deep breath. "Ditching, ditching, ditching." Over I went.

I WOULDN'T SAY THAT THESE METS RUNS WERE FUN, BUT I FOUND THEM INCREDIBLY EMPOWERING.

I've never been a fan of getting water in my nose, but I quickly realized there are more important things to worry about when you're strapped into a seat under water. Happily, the egress procedures I was taught worked like a charm. Reference. Locate exit. Jettison. Hold the exit with one hand. Undo the seatbelt with the other, taking an extra moment to ensure it releases. Egress. Before I knew it, I was standing up in the water, free and clear. That wasn't so bad!

We each did another run in the SWET, this time wearing blackout goggles and egressing through the other side. Then it was on to the deep end of the pool and the METS — which was considerably more intimidating.

Our class divided into groups of four for the METS runs, and as the only pilot in my group, I headed straight for the cockpit. I won't deny feeling some trepidation as we lifted out of the water and I strapped into my harness, a five-point one this time. We would be taking this introductory run in stages, first descending to just above the surface of the water to pre-jettison our exits. (Having never actually jettisoned an aircraft door before, I found the experience surprisingly satisfying.)

Then came the "Ditching, ditching, ditching." As the massive, 6,500-pound (2,950-kilogram) METS descended and rolled over in the water, I finally understood what our instructors had meant by the "violent motion" of water rushing into a submerging aircraft. I gripped the cyclic and collective tightly and waited for the motion to stop. Then it was the same basic steps I had followed in the SWET, minus jettisoning the exit. Long before I had to worry about running out of air, I was sputtering on the surface, paddling my way to the side of the pool. That wasn't so bad, either!

We did a couple more runs in the METS, in darkness and with full environmental effects. We did an egress that required us to

Students begin their dunker training in the Shallow Water Egress Trainer (SWET, shown at right in this photo) before moving on to the more realistic METS. **Eric Adams Photo**

jettison our emergency exit under water, and one that required us to move to the opposite side of the cabin (or in my case the cockpit, using the glare shield on the instrument panel as a reference). I learned that it really is possible to become completely disoriented under water, and that, just as I had been taught, having reference points will get you right again.

I wouldn't say that these METS runs were fun, but I found them incredibly empowering. Yes, it is possible to escape from a submerged aircraft, and yes, I had actually done it! I was so enthusiastic, in fact, that when one of my classmates had to repeat some METS runs for proficiency I asked if I could do them again, too (I could not, due to liability reasons). As it turned out, I needn't have worried — I would be getting my own repeat runs soon enough.

LET'S TRY THAT AGAIN

Once our initial METS runs were complete, it was on to the EBDs. We took a crawl, walk, run approach to these, too. First we learned how to use the regulators on the surface of the water. Then we practiced clearing and using them under water, but with our heads upright — no problem.

Then, as one instructor held our feet at the edge of the pool, we leaned back against the wall of the pool until we were upside down. Now we had to clear the regulator and begin breathing from it with our sinuses full of water, which wasn't fun at all. It took me a few full-body sit-ups to get the hang of this.

From there, we took our EBDs into the SWET chair. Now, when we turned upside-down, we first had to extract the regulator from a dust cover on our vests, fully extend the hose, clear the regulator, and begin breathing from the EBD under water before we completed the egress procedure.

My first run at this went fine. My second, with the blackout goggles on, not so much.

1

2

Although I managed to deploy the EBD, I didn't fully release the four-point harness, and I got hung up in it when I tried to egress. I repeated the process; I got hung up again.

Back in the SWET chair. This time, I got so frustrated that I released my hold on the exit frame and used both hands to undo the harness. That did the trick, but I realized immediately that I had made a serious error — letting go of a reference point could be a fatal mistake in a real-life scenario. Back in the SWET chair.

I eventually completed a successful egress, but it took me the rest of the night to get the water out of my ears. I had learned an important lesson: even a conventional quick-release harness can be extremely difficult to get out of under water.

We would see the EBDs again on the second day of the course, but not until the end of the program. Day 2, led by instructor Dan McInnis, was largely focused on overwater survival: how to use life vests and life rafts, how to move through the water as a group, and what to expect during a hoist rescue.

Once again, we started with a few hours of ground school, had a break for lunch, then moved into the pool. We jumped off a high dive to practice exiting a helicopter from the hover, then deployed our emergency life vests (another first for me). We practiced curling into individual trash bags to preserve body heat, and then linking up with our classmates into a "carpet" formation. In a chain formation, the eight of us awkwardly paddled around the pool.

We took turns individually righting a capsized life raft and hoisting ourselves into it, then helping each other into the life raft as a group. With the environmental effects full on, we battened down the hatches and gained some appreciation for what it might be like to spend hours adrift at sea with seven close friends or strangers. Finally, once again with the wind and rain going full blast, each of us swam to a lowered strop and was hoisted a short distance out of the water, simulating a helicopter rescue.

1 // SSUSA instructors proceed methodically in introducing students to the METS. Initial runs are straightforward and conducted in bright lighting. The exercises gradually increase in difficulty, and by the end of the course students are using compressed air to complete cross-cabin egresses in darkness and driving "rain." **Eric Adams Photos** **2** // Overwater survival exercises include group practice in helping each other into a life raft. Activities like these might seem straightforward, but in a real-life survival situation, they could become exhausting challenges without prior instruction in proper techniques. **SSUSA Photo**

BRINGING IT ALL TOGETHER

For the most part, this overwater survival training was uncomplicated and fun. And thanks to our life vests, our heads stayed above water the entire time! Of course, this was too good to last — it was soon time for more egress practice with the EBDs.

We started by repeating two EBD-aided egresses in the SWET chairs. Then it was on to the METS, where we would complete three egresses: one requiring us to jettison and escape through the exit next to us, followed by two cross-cabin egresses, in darkness and with full environmental effects.

I have no previous diving experience, and despite my repeated dunkings the night before, I still wasn't entirely comfortable with the EBDs. So my anxiety was high as I heard "Ditching, ditching, ditching" and we rolled into the water. I waited for the violent motion to stop. I pulled out the regulator and hose and inserted the mouthpiece. And then the thing I feared most happened: as I attempted to clear the regulator, I inhaled water.

That was it for me — I wasn't going to keep messing around with the EBD. I jettisoned the door. The instructor who was watching me said that I only released one strap of my harness, yet I still managed to wriggle out of it and through the exit, faster than they could come to my assistance. As I broke the surface of the water, a diver was by my side immediately to make sure I was safe.

The experience was frightening, but also liberating. My worst-case scenario had happened, and I was still OK. Once I had coughed my way to normal breathing, I stayed in the shallow end and practiced clearing the regulator until the bottle was exhausted. Then I grabbed a fresh bottle, pre-flighted it obsessively, and prepared for round 2.

This time, everything happened the way it was supposed to. I cleared my regulator and began breathing under water without difficulty — a miraculous feeling. I heard my breathing become fast and shallow as I began to fumble with the buckle on my harness; I forced myself to slow down and release the harness completely. I found the glare shield on the instrument panel and used it to walk my way across the cockpit. Using the edge of the panel as a reference point, I found the exit and pulled myself out.

Everything went just as smoothly on the third and final METS run, when I had the added step of jettisoning the opposite-side door. I broke the surface of the water marveling at everything I had just accomplished.

I was justified in feeling proud of myself. But the remarkable thing about SSUSA's training is that it will bring almost anyone to the same level — even if you start out claustrophobic, apprehensive of the water or, like me, overly protective of your sinuses.

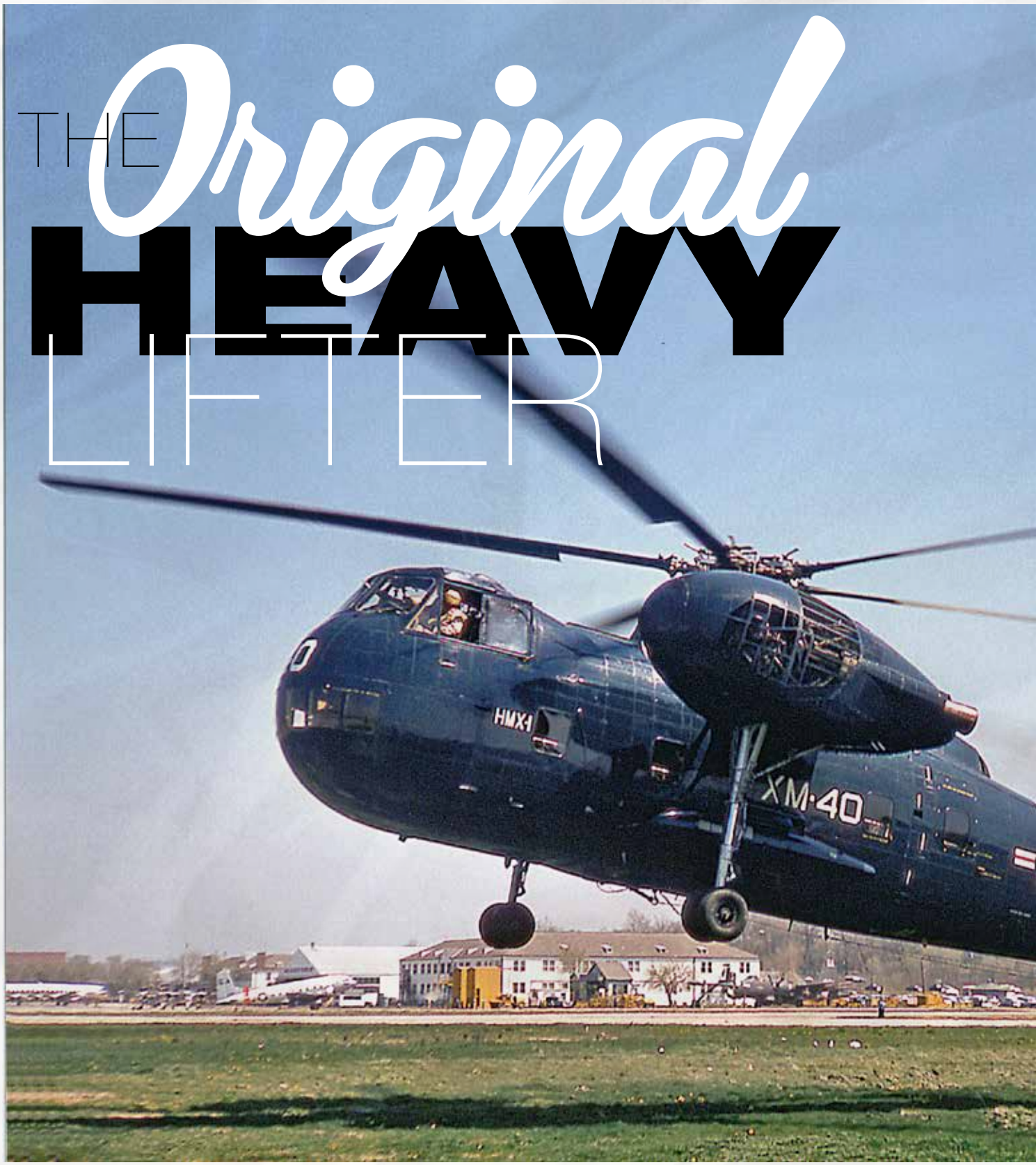
Having finally completed this training, now I can't believe I put it off for so long. If you've also been delaying egress training, do yourself a favor and move it to the top of your priority list, too.

SSUSA's overwater survival training emphasizes techniques for group as well as individual survival.
SSUSA Photo

Sikorsky S-56

written by Bob Petite // photos courtesy of the Jeff Evans Collection

THE Original HEAVY LIFTER



The Sikorsky S-56 was the Western world's first heavy-lift and transport helicopter — and the company's first twin-engined aircraft.

A U.S. Marine Corps HR2S-1 at the Marine Helicopter Squadron One HMX-1 in Quantico, Virginia, where it was first evaluated and tested by Marine pilots.

WATCH VIDEO

On Dec. 18, 1953, what was then the largest and most powerful helicopter in the Western world first took to the air at the Sikorsky Plant in Stratford, Connecticut. That aircraft — the Sikorsky S-56 — was enormous in pretty much every aspect: 88 feet (27 meters) long, with five 72-foot (22-meter) all-metal main rotor blades, and a tail rotor with four 15-foot (4.5-meter) blades. Inside, the massive 1,250-cubic-foot (35-cubic-meter) cabin provided enough space for 26 fully-equipped troops. It was also the first twin-engine helicopter from Sikorsky to serve in the United States military, was notable for having retractable landing gear and an early automatic stabilization system, and was the first helicopter to have main rotor and tail rotor de-icing.

The S-56 was designed in 1950 in response to the U.S. Navy's request for an assault helicopter. Sikorsky submitted a proposal called the XHRS-A (later given the military designation XHR2S-1). The "X" indicated the helicopter was an experimental prototype; "H" stood for helicopter; "R" for transport; the "2" was for it being the second transport helicopter (the S-55 was the first); and "S" was for Sikorsky.

The aircraft was powered by two 2,100-shaft-horsepower Pratt and Whitney R-2800 Double Wasp radial piston engines, which were mounted on nacelles at the tip of a short high wing. The wings were to help provide lift in forward flight.

The all-metal helicopter had large clamshell doors in the nose to allow jeeps and trucks to be driven straight into the cavernous cabin, which measured seven feet, eight inches (two meters) wide; six feet, eight inches (two meters) high; and 30 foot, 4 inches (9.2 meters) long.

The cockpit for the two pilots was located in the nose of the helicopter above the cargo compartment. There were two sets of throttles for the pilots — one overhead and the other a twist grip that allowed the pilots to make power adjustments.

A cargo hatch in the center of the cabin floor had a sling capable of lifting 10,000 pounds (4,535 kilograms). It had an additional electric cargo hoist mounted on the ceiling along a monorail that could lift 2,000 lb. (905 kg). The helicopter was thirsty, and had two 400-US gallon (1,515 liter) fuel tanks.

Sikorsky had considered a proposal for a compound variant of the type that had stub wings and pusher propellers, and even offered the Navy a turbine-powered version. However, the Navy chose the basic S-56 model, as it had the least technical risk. On May 9, 1951, it gave Sikorsky an order for four experimental XHR2S-1s. These aircraft were extensively evaluated by the U.S. Marine Corps.

AN ADVANCED DESIGN

The S-56 experimental program represented a major advancement in helicopter design for Igor Sikorsky. The aircraft was four times larger than the S-55/H-19 — the company's first transport helicopter. When introduced, the S-56 was not only the largest piston helicopter ever constructed in North America, but also the biggest and fastest rotary-wing aircraft.

It was the first Sikorsky helicopter with automatic main rotor blade folding and a folding pylon, enabling the helicopter to fit on aircraft carrier elevators. Additionally, it had an auxiliary power unit that enabled electricity to power the cargo winch, but development of these systems ended up taking Sikorsky additional time to perfect.


A front view of the U.S. Army Mojave, showing the open clamshell doors and the large cabin.

The U.S. Marine Corps was the initial customer for the HR2S-1/S-56 utility helicopter, which was nicknamed "The Deuce."

Operated by a crew of three, the S-56 had an empty weight of 20,831 lb. (9,470 kg) and a maximum takeoff weight of 31,000 lb. (14,090 kg). In terms of its performance, it had a maximum speed of 130 mph (209 km/h) with a cruise speed of 115 mph (185 km/h). It had a range of 145 miles (233 kilometers), a service ceiling of 8,700 feet (2,650 meters), with a rate of climb of 1,732 feet a minute (8.66 meters a second).

The aircraft would also set three world records: a speed record without payload (162.7 miles per hour/261.8 kilometers per hour); a record altitude (12,100 feet/3,688 meters); and a load carrying record of 13,227 lb. (6,000 kg) to 6,561 feet (2,000 meters).

But while 180 HR2S-1 helicopters were ordered for the Marines, only 60 were finally delivered. The first arrived for evaluation at Marine Helicopter Squadron One (HMX-1) in Quantico, Virginia, in July 1956. The first operational S-56 Marine Corps squadron was formed at New River, North Carolina, in January 1957. A second was set up at the Marine Corps Air Station in Santa Ana, California. All S-56s ordered by the Marines were delivered by the early 1960s, but the Marine Deuce would only deploy on ships in squadron strength on one occasion.

Unique to the Marine version of the HR2S-1 Marine helicopter production version was a dorsal fin on the back of the helicopter. A few of the Marines' helicopters were modified with a large search radome under the nose. These were designated as the HR2S-1W as a patrol aircraft. This aircraft required additional crewmembers for radar duties, helping to spot-low flying enemy aircraft. However, this program wasn't deemed a great success.

Sikorsky tested a Marine XHRS2-1 with a V-shaped twin tail rotor system, designed to improve the center of gravity range and increase the forward speed of the helicopter. Both four blade and five blade tail rotors were used in the evaluation, but the results indicated little improvement to the helicopter, and the program was dropped.

A further design trial took place in 1959, when Sikorsky experimented with a six-bladed main rotor, wanting to understand the impact of the extra blade on the aircraft's flight characteristics. That was as far as the development went, though, and the six-bladed rotor was never used operationally on the S-56.

JOINING THE ARMY

In 1954, the U.S. Army tested a Sikorsky S-56/Navy XHR2S-1 helicopter, designated the YH-37, as a potential troop and cargo carrier. The test program resulted in an immediate order for nine of the type, but this eventually grew to 94 H-37As, which the Army called the "Mojave."

The Army version featured a manually folding main rotor, and hydraulically folding tail rotor pylon. The first Mojaves went to Fort Rucker in Alabama in the summer of 1956, and the last was delivered in June 1960.

The first operational Mojave unit in the Army was established at

The Navy HR2S-1W helicopter, modified with a large search radome under the nose, was used for radar duties in spotting low flying enemy aircraft.

The U.S. Marine Corps HR2S-1 helicopter was one of the first rotary-wing aircraft capable of lifting heavy equipment that supported the Marines.

The U.S. Army was the second U.S. military service to purchase the S-56 as a transport helicopter, which it designated the H-37 Mojave. The first aircraft was delivered to the Army at Fort Rucker, Alabama, in 1956.

Fort Benning, Georgia, in February 1958. The following year, Army Mojaves were shipped to West Germany to support the U.S. forces in Europe. The Army reportedly found the Mojave very reliable and quite easy to maintain.

Ninety of the helicopters were returned to Sikorsky for upgrading to the H-37B configuration, completed in 1961. This moved the stabilizer to the top of the tail rotor pylon, added larger 30-US gallon (115-liter) oil tanks, and automatic stabilization equipment — thus allowing an instrument flight system for the aircraft, and hands off flying capabilities. The rear split cargo door was also replaced with a sliding cargo door.

The Army also evaluated the Navy HR2S-1W radar patrol helicopter with the chin radome, operating it in an Army Arctic two-tone paint scheme. However, no sales materialized for this version.

During 1962, an Army Mojave helicopter was fitted with special recovery gear that was used to catch parachutes carrying missile cones and data capsules during space experiments. It was known as MARS (Mid-Air Recovery System). The Mojave flew in above the parachutes and snagged them with a recovery hook. This became a routine successful operation.

Four CH-37Bs were shipped to Vietnam in 1963 to help in the recovery of downed U.S. aircraft. By December that year, the CH-37Bs had recovered $7.5 million of equipment, sling-loading the damaged aircraft from inaccessible terrain. It appears at least one CH-37B was lost to enemy fire. Despite the success of the operation, the Mojaves returned to the U.S. shortly afterwards.

During the mid-1960s, Army CH-37s were deployed to Korea, where they were used for evacuation duties during major floods, for logistical support in the mountainous areas, and in support of the president when he visited in 1966.

By the late 1960s, the Mojaves were withdrawn from the Army and transferred to Army National Guard units throughout the U.S. They were used by the National Guard until 1974, before going into storage.

Eight Marine Deuce HR2S-1 helicopters were sent to Vietnam in September 1965 to support the Marine Air Group. They carried out over 1,500 missions, moving equipment and 31,000 personnel without one air accident. This was a real testament of faith for the type, which had pioneered heavy-lift operations in Vietnam.

But, with the arrival of the turbine CH-53 helicopter in 1967, the Marine Corp HR2S-1's days were also numbered. After a successful 10 years in service and 5,300 hours of flight in Vietnam, the Deuce helicopters were all shipped back to the U.S. for storage at the Davis-Monthan Air Force Base in Arizona. Some S-56 helicopters were believed to have been abandoned overseas.

Sikorsky manufactured a total of 154 S-56s. Vibrations in the cockpit caused some issues for the aircraft in service, but, overall, it turned out to be a great performer for the military.

THE S-56 IN RETIREMENT

Sikorsky briefly considered selling the S-56 for use in commercial operations in 1958, but the market never materialized, largely due to the aircraft's exorbitant fuel consumption and very high operating costs. And with half an eye on new advanced turbine helicopter designs, Sikorsky also dropped plans to modify the S-56 to turbine engines.

However, some of the former military airframes still found their way into the civilian world. Peter Wright, president of Keystone Helicopters in Philadelphia, Pennsylvania, purchased 45 CH-37B and C helicopters, along with spare parts, following the airframes' retirement from the military in the early 1970s.

Keystone applied for, and received, a restricted type certificate from the Federal Aviation Administration to commercially operate the S-56. The certificate allowed it to sling 10,000-lb. (4,535-kg) external loads, but Keystone was restricted to carrying only the amount of crewmembers required for flight operations.

Keystone's modified S-56 saw the military version stripped of all unnecessary cowlings, heating systems, main landing gear hydraulics, and the hydraulic system to open and close the nose doors and ramp. The automatic stabilization equipment system was also disabled, any systems not required for external lift missions were removed, and Keystone also locked the aircraft's main landing gear down.

For a few years, Keystone used several of the S-56s commercially in heavy lift work — primarily firefighting and crop fertilizing — through its company Aircrane Inc. in West Chester, Pennsylvania. The model was also used for transporting wooden powerline poles and in external load construction projects.

A U.S. Marine HR2S-1 Deuce helicopter slinging a tank over the desert. The helicopter was capable of lifting up to 10,000 pounds.

Sadly, Keystone's commercial venture with the S-56 only functioned for a few years before shutting down — the aircraft's operating costs, estimated to be around $420 per hour, were likely to blame. Keystone sold five S-56s to a Philippines logging company, the rest spent their final years sitting across several acres of Arizona desert, before most disappeared without a trace.

In 1980, Keystone overhauled one of the stored H-37s and made it airworthy. Painted in U.S. Marine Corps colors, the aircraft made its last ferry flight on Feb. 25, 1981, from Tucson, Arizona, to the Naval Aviation Museum in Pensacola, Florida.

Other S-56s have survived in museums across the U.S. The U.S. Army Aviation Museum at Fort Rucker, Alabama, has an H-37 on display, as does the Army Transportation Museum in Fort Eustis, Virginia; the Pima Air and Space Museum in Tucson, Arizona; the Classic Rotors Museum in Ramona, California; and the Evergreen Aviation and Space Museum in McMinnville, Oregon. The Helicopter Museum in Weston-Super-Mare, U.K., has an S-56 stored in the U.S., but has not, as yet, been able to find a way to have it shipped across the Atlantic.

Those who flew the the S-56/HR2S-1 Deuce/Mojave over the years often spoke glowingly about the aircraft, praising its performance and reliability, if noting quite how loud it was to fly.

Despite its brief service life, the S-56 helped blaze a trail for heavy-lift aircraft in the U.S. military, ultimately maturing into a successful, dependable, and proven helicopter at a time when the rotary-wing industry was still relatively new.

Bob Petite | Bob is a member of the Twirly Birds, AHS International, the Canadian Aviation Historical Society, the American Aviation Historical Society and the Bell 47 Helicopter Association, Inc. He is the author of *The Bell 47 Helicopter Story.*

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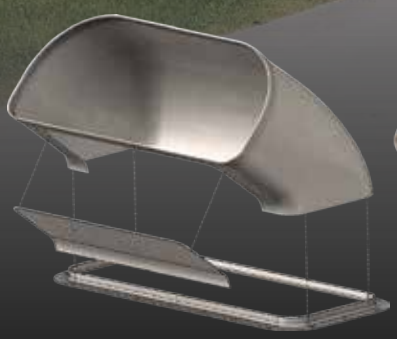

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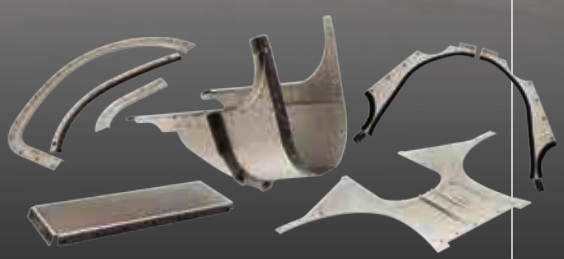

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There I Was...

By Mike Muench | Mid-Life Crisis

When an ag pilot straps on a helicopter, it's a whole 'nother ballgame to the type of flying you learn to do when you're ferrying people around all day. It's the difference between an off-road racer and a limo ride.

I'd been spraying with helicopters for 18 years. It had been my only flying job. It was a nice run, but I wanted to do some professional flying that didn't involve insecticides. You know — flying something that doesn't get all over you.

Of the thousands of hours in my logbook, almost all were solo. A prospective employer might like to know that you've either flown with passengers or can be trusted to do so safely. I was hoping that the "Airline" part of the ATP acronym was what would show that, yes, this pilot can safely fly a helicopter full of passengers. Well, maybe safely, but as I found out, not necessarily comfortably. With that being said, I attempted a mid-life change of careers.

My resume went out to many more operators than the number of responses I received. Some of the offers were for instructor openings, offshore, electronic newsgathering and helicopter emergency medical services (HEMS). The first response was from a HEMS company out of Denver that had bases all over the country. After an interview, the check airman and I boarded the company's new Bell 407 on the rooftop pad of a hospital that could wind up being my first assignment.

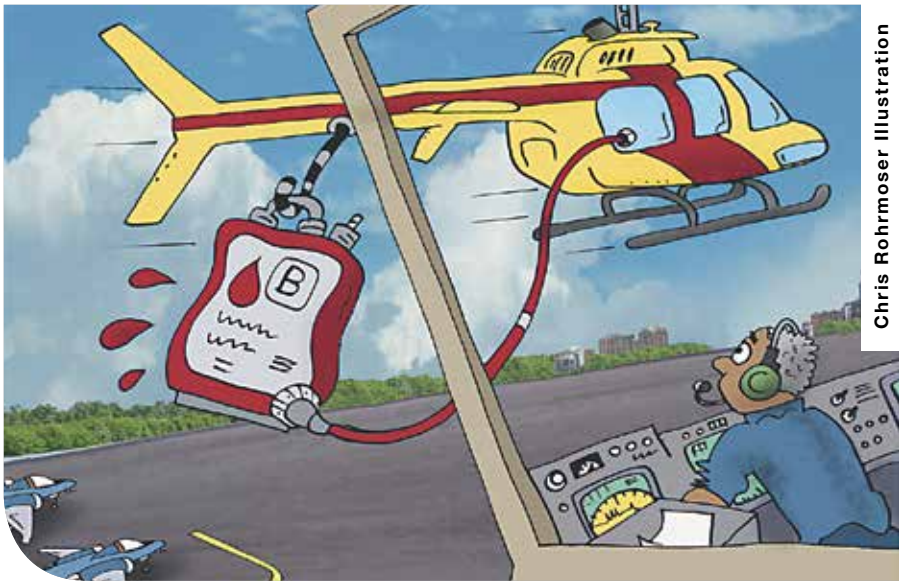
Since almost all of my flying had been solo, it wasn't long before the sideways glances started. I could almost feel them. "You know," the check airman said, fully aware of my spray background, "flight nurses rarely appreciate a pilot making their already sick patients throw up." Hmm... That makes sense.

"Now, the pilot wouldn't have to clean that up, would he?" I thought about asking.

"Finesse the controls. Nice and easy," he said. "As if you were trying not to spill a cup of coffee."

After a couple hours of learning HEMS procedures and practicing autorotations, I heard, "Very nice. I think that you'll be a good fit here."

I wasn't quite sure though that this was going to be the career change for me.



Chris Rohrmoser Illustration

As the saying goes, "It's tough to make predictions, especially about the future." But I thought I'd give HEMS flying a try.

One day, while on assignment at Darlington Raceway for a Winston Cup stock car race, the crew and I were enjoying the action from the pits, staying close to the helicopter in case we were needed. Luckily, we weren't.

While flying back to our base in Columbia, a call from our dispatcher diverted us to an accident scene along the way. It took us 15 minutes to get there. The med crew packaged up the teenage girl for transport and as the flight paramedic secured her in the helicopter, the flight nurse came over to my door.

"Mikey..." she said. (She always called me Mikey when she wanted something.) "Let's not drag our feet on this one, OK?" Got it. I set the torque for max cruise and we were on our way, heading right towards Shaw Air Force Base. I could hear from the conversation in the back that the patient was not doing too good.

"Shaw tower, Lifeguard November four zero seven Lima Romeo, eight miles northeast requesting direct Columbia."

"Seven Lima Romeo turn left, circumnavigate the base to the south," came the reply. "I have a flight of two fighters ready to take off to the north."

I glanced over my shoulder at the flight nurse. She was shaking her head. Her wide eyes told me that she heard the response from the tower. We'd already consumed 47 minutes of that "Golden Hour" you hear so much about. I quickly computed the extra time required to fly around the airbase. At least another seven minutes.

"Seven Lima Romeo, turn left now," the tower said.

"Shaw tower, Lifeguard seven Lima Romeo, I have an urgent medical emergency on board. I need priority; direct Columbia; no delay."

After a short pause, "Lifeguard seven Lima Romeo, Shaw tower. Proceed as requested."

"No pulse," I heard the flight paramedic say. We arrived at the trauma center with CPR underway. The crew didn't wait for shutdown. The helicopter doors flew open as the stretcher rolled up under the turning blades. As the patient was hurriedly rolled into the trauma center, the golden hour expired. I shut the ship down and waited at the helicopter for the med crew to finish up their paperwork so we could head back to our base across town. The flight nurse finally came out and walked over to me.

"One of the surgeons on the team just told me that if we had arrived five minutes later, they wouldn't have been able to bring her back."

I guess Yogi Berra was right. It ain't over till it's over.

I flew HEMS for another seven years, and loved every minute of it.

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