Autorotate

Helicopter Test Pilots–The myth, the reality

COLUMNS

FEATURES

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Where Does PHPA Stand Today?

As PHPA approaches its first year of organization, I thought I would take this opportunity to explain what we have accomplished to date and PHPA's plans for the future.

PHPA was launched on 5 June 2002 after eighteen months of work by a handful of pilots from LSI at Ft. Rucker, Air Logistics and Petroleum Helicopters along with the much appreciated help of OPEIU. Since the launch last June PHPA has managed to increase our membership to nearly two thousand pilots with more joining our ranks each and every day. These pilots come from thirty-one nations and represent a remarkable cross section of our profession.

PHPA has made great inroads into many areas of the industry and we have done so in a very short time. We now hold the Vice Chairmanship of the International Federation of Airline Pilots Associations Helicopter Committee, a great honor. IFALPA represents over one hundred thousand pilots worldwide. The Helicopter Committee is readily accepted as a welcome participant on most committees working on important projects around the world. We also are working on ICAO committees and study groups on everything from single engine operations to Tiltrotor rules and regulations. PHPA is continuing to work for the inclusion of our staff on every committee and study group working in areas of importance to our membership.

In January, PHPA sent two members to meet with ALPA (the Airline Pilot's Association) at their Washington offices, seeking to benefit from ALPA's 70 years of experience in this arena. The meeting was very productive. ALPA has agreed to provide us with help and guidance and we are excited at the possibilities this support will provide. ALPA already recognizes PHPA as the United States representative to the IFALPA helicopter committee, and is willing to help us gain access to standing committees in the U.S. as well. One of the more significant committees that ALPA mentioned is one we are very interested in, the Gulf of Mexico Work Group. Allan Duquette, a GOM S-76 Captain is currently pursuing our potential involvement there.

PHPA attended HAI for the first time and this too was a great success. I met with many pilots from around the world who already knew who we were. We also met with many pilots who were just learning we existed. I spoke with dozens of people and learned that PHPA is not only a recognized name in the industry but is also an organization which is stirring the curiosity of many around the world. HAI was a very positive experience for us; one which will pay dividends for years to come.

Where are we headed?

PHPA has more opportunities before us than we can currently handle. We are being offered seats on committees and being asked for expert input on a number of issues. The industry is fast learning that we have direct access to thousands of pilots with a tremendous variety of skill and expertise and they want to tap those resources. It is satisfying to know that helicopter pilots are finally being looked at as a valuable resource capable of contributing much to the growth of our profession and this industry.

We are also working with pilots around the world to build a salary/wage database so, for the first time, we can compare notes on salaries and benefits with the goal of assisting pilots everywhere to achieve fair and equitable compensation for a job well done. This database will give all members the information they need to see where they stand with regards to pay and benefits. This will be an invaluable tool for helping determine compensation across the profession. The first meeting concerning these efforts was held in New Orleans from 30 January through 2 February, 2003. I have included the news release from that meeting to give you some idea of just how far we have come in so short a time. We hope to have this project completed by year's end.

For Immediate Release

Helicopter pilots from around the world meet at PHPA

Labor leaders representing helicopter pilot associations in Europe and the U.S. recently met in New Orleans, LA. The meeting was hosted by the Professional Helicopter Pilots Association (PHPA), an affiliate of OPEIU, which represents nearly 2000 pilots in the US and abroad. Assistance was also provided by the International Federation of Airline Pilots Associations (IFALPA) representing more than 100,000 pilots worldwide. This was an important step towards bringing together helicopter pilots from around the world for cooperation and mutual assistance.

Issues on the agenda:

- Cooperation and solidarity between helicopter pilots worldwide
- Working conditions
- Safety; many improvements are needed to reach acceptable safety levels for passengers and pilots
- Wages and benefits

Dr. John McGurk of the British Airline Pilots Association, Head of Research and Communication, made several presentations on benchmarking of pay and conditions. Short seminars were held on the presentation of data in negotiations and negotiating techniques. Other topics included upcoming pilots contract negotiations at several companies. Among relevant matters discussed was the development of an international database of helicopter pilot wages and benefits, safety issues and the impact on the industry of the helicopter pilot shortage. Also

discussed was the formation of international helicopter pilot alliances that would mirror the structure of the multinational operators and build on the vast experience our airline colleagues have already acquired.

Others in attendance were:

Petter Førde -
President Norwegian ALPA

Sigurd O. Løkholm -
General Secretary Norwegian ALPA

Olav Bastiansen -
President CHC Helikopter Service Pilots Association of Norway

Butch Grafton -
President - PHPA

Ron Whitney -
Vice President PHPA

Jack Bower -
Secretary/Treasurer PHPA

Ken Bruner -
President PHPA Local 107 (Air Log)

Pete Catalano -
Negotiator PHPA Local 107 (Air Log)

Don Robson -
Negotiator PHPA Local 107 (Air Log)

Mick Brade -
Principle Negotiator BALPA

Dave Hogg -
Balpa IFALPA Director

Steve Ragin -
President PHPA Local 108 (PHI)

Jeff Rusich -
Organizer OPEIU

Paul Bohelski -
Negotiator OPEIU

END

As you can see, PHPA is working every minute for its members. The problem now is we have more work than volunteers and the volume of important work necessary to grow and to fulfill the mission of PHPA increases daily. We need your help. If you are willing to invest a portion of your time, working hard for something extremely worthwhile, please drop us a note explaining your skills and areas of interest. Our contact information can be found at www.autorotate.org. We will contact you as we match your particular skills with the tasks requiring attention.

We currently need a web master, also a volunteer position, to manage the PHPA web site and we need one soon. We are looking for a talented webmaster who has the vision and the skills to make the PHPA website a place our members can come for everything related to their job and profession. If you have the skills and vision to do this and would like to take this project on, please contact me directly at Butch@autorotate.org.

Finally, I would like to add a special thanks to Ron Whitney, PHPA's Vice President, for doing remarkable work on a number of projects. Ron is currently taking on the insurance project and making excellent progress. He has been very busy seeking opportunities to improve member benefits. Programs under development include; Term and Whole Life Insurance policies, Supplemental Disability Insurance, Loss of License (Own Occupation) coverage, as well as a comprehensive medical plan. Final negotiations are currently underway and we hope to announce a very impressive addition to our membership benefits package. If you would like further information please contact Ron Whitney at RonWhitney@autorotate.org.

Ron is also handling preparations for our first PHPA convention, to be held September 19-21, 2003, in New Orleans. He will be releasing all the pertinent information in a few weeks. The PHPA website will soon have a convention registration page online with all the relevant convention data available.

I would also like to thank all of you, our members, for your support of PHPA. It has been a remarkable first year for your organization and with your continued support, it will only get better.

Butch Grafton
President, PHPA

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Correction:
Photocredits for the January-February 03 issue should read - Cover photo, Dave Peregoy; Photo Page 3, Carol Chambers.

Cover:
Photo courtesy of The Boeing Company.

Helicopter Test Pilots –

By Tony Fonze

The words, 'test pilot', bring a vivid picture to mind—a picture tinted with awe, wonder and respect. But how much of that picture is reality and how much of that picture is 'Hollywood'? And, perhaps most importantly, how much of that picture is missing? *Autorotate* finds out, as we explore the common myths of helicopter test piloting.

MYTH 1

Test pilots aren't made, they're born

I'm pretty sure that the pilots and instructors at the National Test Pilot School in Mojave, California would take issue with this. Their mission is to create test pilots.

Mojave's best kept secret

The National Test Pilot School (NTPS) is the largest civilian test pilot educational institution in the world. Opened in 1981, the NTPS offers a range of courses covering every aspect of flight and system testing for both fixed wing and rotary wing aircraft. Courses include Performance Flight Testing, Flying Qualities Flight Testing, Flight Management Systems Flight Testing, Night Vision System Evaluation Techniques, Flight Test of Electronic Warfare Systems, and everything in between. Put them all together and you're looking at the 12 month, Professional Test Pilot course—an in-depth, comprehensive program that attracts students from all over the globe. This was something I had to see for myself.

Mojave, known primarily as a pit stop on the road between Los Angeles and Mammoth Mountain, a Sierra ski resort very popular with 'Angelinos', is home to NTPS. It is also the home away from home of my friend Shawn Coyle, Chief of the Rotary Wing Branch at NTPS. Shawn's impressive credentials include a degree in Civil Engineering from the Royal Military College of Canada, attendance at the Empire Test Pilot School, and the Canadian Forces Staff School. He has worked as a military test pilot for the Canadian Air Force and as a test pilot for Bell Helicopter Textron Canada and has taught test piloting at the International Test Pilot School in Cranfield, UK; the US Naval Test Pilot School; and now at NTPS. You may know Shawn as the author of ***The art and science of flying helicopters***, a wonderful guide to all things helicopter that

The myth, the reality

is a great read for anyone in the field. (See review page 12)

During my three days at the school I met course attendees from the air forces of Korea, Malaysia, Australia, Israel, South Africa, Canada, Italy, and Denmark. The school also provides test pilot training for multiple airframe and systems manufacturers including Sikorsky, MD, and Honeywell. FAA pilots, engaged in manufacturer verification testing, are also trained at NTPS.

Got a spare tape measure?

The first thing I learned at NTPS is that a large part of test piloting is about measuring. I could tell, because all of the helicopters in the hangar: the OH-58C (like a 206), the Hughes 500, the Bell 212 and the Sikorsky S-55, all had measuring devices hanging all over them. Some involved electronic quantification, measuring changes in capacitance as a control was moved one way or another. But, many, if not most, involved strange Rube Goldberg devices made out of tape measures, rulers, rubber bands and lots of duct tape.

"Test piloting is primarily about measuring conformance to requirements and validating the ability of an aircraft or aircraft system to perform a specific mission," says Shawn Coyle. "It is largely a quantitative process." Even the qualitative parts are quantitative, but, more on that later. Yes, it takes skill as a pilot, but, most test pilot activities involve a process and that process can be taught.

The rest of the team

Additional members of the NTPS rotary wing faculty include Tom Benson, Rotary Wing Instructor and Michael Hardy, Rotary Wing Test Pilot Instructor.

Tom is a very smart, funny man who soft pedals his own expertise and credentials which include degrees from multiple professional schools and universities like Cal-Poly and the University of Southern California. His extensive aircraft testing background includes work on GPS evaluations on the Bell UH-1H, instrument flight evaluations on the Hughes OH-6A, advanced attack helicopter evaluations of the Hughes AH-64, radar jamming on the Sikorsky CH-53D, and airworthiness evaluation on the Boeing Vertol. Tom was also assigned to the original military test team developing wire cutter technology for helicopters.

Do you know how they originally tested the wire cutters? They mounted them on trucks and drove through wires of ever increasing thickness. "We had some very exciting moments in the cabs of those trucks," Tom said with a smile. And, just to keep life interesting, Tom also has a degree in acupuncture and herbal medicine.

The newest member of the Rotary Wing instructor group is Michael Hardy. Michael was an officer in the Royal Australian Navy where he served in numerous capacities including Flight Commander on the HMAS Success, Resident Test Pilot for the SH-2G(A) Super Seasprite assigned to Kaman Aerospace and a line pilot off the HMAS Tobruk including duty in Mogadishu, Somalia. Mike's youthful appearance belies his 20 plus years of flight experience and extensive education that includes the U.S. Navy Test Pilot School. Mike explained, "We try to teach the test pilot thought process at NTPS." "We get people to observe and report, and then quantify, without jumping to conclusions. When our students arrive here, they already know how to fly helicopters. When they leave, they know how helicopters fly."

MYTH 2

Test pilots need, big brass 'ones' (of either sexual variety), many thousands of hours and a very cool swagger, which often takes years to develop

It was my last night in Mojave—not necessarily a bad thing. The wind was blowing at 50 mph outside and the hotel swimming pool, just a few feet from my door, now had 5 foot swells that threatened to crash into my window. They had already eaten and swallowed all of the lawn chairs on my side of the pool and they were thinking about coming to get me. I was awake and I found myself thinking about the nature of test piloting. Test piloting involves facing the unknown. And, anytime you face the unknown, an element of courage is required.

There's the unknown and there's the UNKNOWN

Unknowns are personal in nature. Something new, and consequently unknown, to me may be very familiar and comfortable to you. By definition, test piloting means confronting the unknown—both your own unknowns and, sometimes, the completely unknown. So yes, a certain amount of brass may be in order.

Thousands of hours—probably. Many thousands of hours—not necessarily. By definition, if you're going to make a living "measuring" a rotorcraft in one way or another, you need to be very familiar with rotorcraft in general and the specific aircraft being measured in particular. So, yes, a certain number of hours is a requirement. Entry level test pilots at MD Helicopters are required to have a minimum of 1500 hours including experience in MD aircraft, though in truth, most of the pilots there have hours well in excess of this minimum.

Photography (from top): Aaron Reyes, Studio 33; Judson Brohmer, NTPS; Boeing Experimental Test Pilot Rich Lee (l) and Chief Pilot Mark Metzger (r), The Boeing Company.

Nobody is going to say that test pilots don't have a good dose of ego, Type A personality, and testosterone (found in both sexes). But, if you were going to rank the attributes necessary to be a good test pilot, other faculties: curiosity, intelligence, and analytical skills would probably rank higher. The profound desire to understand how something works and, as importantly, why it doesn't work, will serve your purpose more than a desire to rush out and fire it up.

"Tests are carefully designed by the project test pilot and the engineering support team," Rich Lee, Boeing Experimental Test Pilot, told me. "Test pilots are problem solvers."

But, a cool walk never hurt anyone.

MYTH 3

Testing an aircraft means "strapping her on and seein' what she'll do."

No, not really. It all boils down to a good vocabulary.

If I want to analyze the flight characteristics of an aircraft (i.e. "strap her on and see what she'll do") I need to first identify those things that I want to ask her to do. For example, climb at max power for 5 minutes. Or, hold an OGE hover at max gross weight at 5,000 feet with no wind. In short, I need a plan.

I got your big vocabulary, right here…

The size and magnitude of your plan depends upon what exactly you're attempting to test. If you've got a brand new aircraft or new major component (engine, main rotors, tail rotors, etc.) a significant plan is required. That plan would almost certainly include evaluating the aircraft's handling qualities through a large range of tasks. In addition to handling, we'd also be examining the aircraft's dynamic stability (motion over time after an input) through the longitudinal, lateral, and vertical axis. And we'd be interested in both the short term response (STR) and long term response (LTR) to that input.

Once I've built my plan and I'm ready to execute it, I need to be able to accurately describe and report my observations. For this, I need a vocabulary. Yes, that's right—a vocabulary. Think about it. The principles of flight have been understood and documented for a long time and most of the flight characteristics we're analyzing have names: dynamic stability, static stability, Dutch roll, dihedral effect, cross coupling... Here's an example.

I climb into the cockpit of a new aircraft, establish an 80 knot climb at max power on a heading of 360°. I notice that the aircraft yaws several degrees to the right, followed by a roll to the left, after which we briefly resume our course. We almost immediately, however, begin a left yaw, somewhat less than the right yaw experienced earlier followed by a right roll and again a brief period of on course. This cycle continues to repeat itself in ever diminishing amounts as I continue my climb. In my report I can take two pages to describe this phenomena in painful detail. Or, I can take two words—Dutch roll. And, because my vocabulary is soooooo good, I augment those two words with, 'dynamically stable', to reflect the diminishing characteristics of my yaw, roll observations.

To be a good pilot problem solver, you need to have the knowledge to recognize and describe the conditions you perceive in testing and the vocabulary to let you do that accurately and succinctly. Dynamic and static stability, dihedral effect, and Dutch roll are terms most of us haven't used since…Ok, have never used. But they are well understood in the world of test piloting. And, test pilots have their own tools of the trade as well.

How bad was it?

Earlier, I said that even qualitative data are quantified. The tool used for that is the Cooper Harper Scale. The Cooper Harper Scale is a vehicle for turning descriptive language and perceptions: poor, light, sluggish, snappy, etc. into repeatable, precise data points that mean the same thing to everyone. It works like this. The very bottom line is that either an aircraft can perform a task or it can't. But, there are gradients of both can perform and can't perform that provide valuable input. By asking ourselves a series of specific questions about the aircraft's performance in the maneuvers and the pilot's efforts required to conduct the maneuver, we can, in essence, give the aircraft a "grade" in the performance of that maneuver.

Acceptable grades range from A1 (excellent performance) to A6 (Pilot had to work his or her butt off to make it happen) and unacceptable grades include U7 (Adequate performance not attainable) through U10 (Control will be lost). An acceptable score for a particular maneuver can be predetermined based upon the aircraft's mission requirements. In some categories, the aircraft may be required to receive a score of A1 or A2, for others an A3 or A4 may be acceptable.

MYTH 4

Test pilots are loners

Testing an aircraft is a team effort and the pilots are members of that team. The team works together to accomplish the project while protecting both the aircraft and the pilot. This requires good communication and people skills—characteristics not usually found in loners.

MD Helicopter's production test teams are comprised of manufacturing test pilots working closely with an A & P crew chief, permanently assigned to the new aircraft. Together they perform all of the checks and tests on the Production Flight Test Procedure and Check-off List (PFTP), a formal test plan used to evaluate each aircraft coming off the line.

Sing it with me,
"and you'll never walk alone…."

Boeing's test pilots work on project teams whose composition varies with the nature, complexity, and risk of the mission. The team may be comprised of pilots, engineers, A & Ps, managers—even medical experts and emergency rescue personnel. In fact, Boeing employs a documented risk management process that guides both team composition and actions according to the level of risk. Team members are required to engage in a scenario building process where they envision the test to be conducted and consider everything that could go wrong and the resulting hazards to the aircraft and the pilots.

Risk is a reflection of both the magnitude of the hazard and the probability level of that hazard occurring. The lowest level of hazard would be defined as "negligible—less than minor injury or system damage." The highest level of hazard severity is "catastrophic—no further definition required." Probabilities range from improbable to frequent. If you have a hazzard level of 'catastophic' and a likelihood of 'frequent'–better call in sick that day.

Once a measure of risk is assigned, a series of risk mitigating controls are identified and put in place. Unnecessary risk is eliminated. The level of management participation, supervision and sign-off required escalates in accordance with the level of risk.

Test pilots often act as a liaison and interpreter between the engineers and the customers. They are frequently in the field, with their products, clients and prospects helping to identify issues and provide training. They also serve as front line diagnosticians guiding the resolution process to complex problems. Rich Lee has made many dozens of foreign trips in his test pilot role, taking him to more than 40 different countries. This doesn't include his extensive domestic travel schedule. Be a test pilot—see the world. More truth than fiction.

MYTH 5

Test pilots laugh in the face of danger

Richard Lee is an experimental test pilot for Boeing. Aerobatics, flight strain surveys and height/velocity determination are some of the tasks performed by Rich and other experimental test pilots —they beg the question of risk and danger. When posed with the issue, Rich reflects, "We are in a business where mistakes are fatal. It's bad enough if your failure to do your homework results in a damaged aircraft. A fatal accident is unconscionable. Except in very extraordinary circumstances, the skills, procedures and equipment available today make accidents preventable."

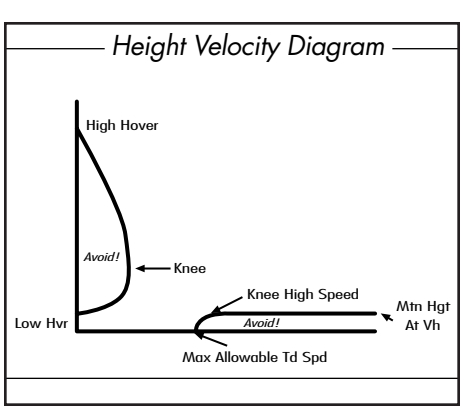
Coming to grips with risk

Boeing has developed a risk identification and management program that is applied to every flight test conducted by Boeing test pilots. It is an extremely functional, practical tool to detect and mitigate risk in all flight scenarios. It is based on the idea of employing all members of the project team to identify hazards, quantify the risks posed by those hazards, determine controls that may be affected to minimize the risk, and then implement and supervise the application of those controls. There is no doubt, it saves lives and money.

Rich concluded, "The art of experimental test piloting has come a long way over the years. Today's level of expertise, technology and risk management would have kept a lot of guys alive who didn't have the benefit of those tools in the early days."

Volunteers for the H/V testing, please step forward…anyone?

An example of a test procedure usually



Photography (from top): Judson Brohmer, NTPS; The Boeing Company; Illustration, NTPS.

relegated to those with the coveted title of experimental test pilot, is the height velocity diagram. While some of the limitation charts that appear in our respective POH's represent mathematical extrapolation of data (i.e. created by computer); the H/V diagram is done the hard way—literally. Determining the altitudes and speeds from which a safe autorotation can be performed is done through a process of trial and error. The errors can be both costly and painful.

Conduct of the test is tightly regulated by FAA specifications. The objective is to determine the height/airspeed conditions from which it would be difficult or impossible for a pilot of average ability to land safely following a sudden engine failure. This is the area where most helicopter flight test accidents occur. As we all know, every autorotation and simulated engine failure behaves a little bit differently due to the broad range of variables involved: airspeed on entry, RPM, density altitude, wind direction and velocity, aircraft weight, landing surface, etc. If the test is to have any validity whatsoever, the affects of these variables must be minimized.

The tests are always performed to a firm, level and smooth hard surface; usually a runway. Winds may not exceed 3 knots. The weight, according to 14 CFR 27.79, may not be less than the maximum weight or the highest weight allowing hovering out of ground effect whichever is lower. Rotor RPM in the autorotation should be at minimum power off N(R) with collective full down. The altitude upon entry must be precise. But wait, that's not all. Since it takes a pilot of any ability a little time to recognize that they've had an engine failure, the test pilot must wait 1 full second before entering the auto when entering above the 'knee' (see HV diagram pg. 7). Military delays must be 2 seconds.

When performing a test of this nature it is impossible to eliminate all of the risk to either the aircraft or the pilot. However, steps can be taken to minimize the danger. Needless to say, the pilot will be dressed appropriately including nomex flight suit, gloves, boots and helmet. And, it never hurts to have emergency crews already on hand, in the event of a worse case situation. But, steps can also be taken so that these measures are not put to the test.

"There is a minimum airspeed below which a flare is not effective in stopping the rate of descent. Know this airspeed in advance and know what you'll do if you don't have it prior to entry into the flare," cautions NTPS's Coyle. He continues, "the test is usually started at the safer regions of height and or airspeed and then progresses towards the marginal areas. Also, only one variable is changed at a time, either height or airspeed, while the other remains constant."

The purpose of the test is to determine what is safe for pilots of 'average' skill. Consequently, the test pilot's additional expertise and superior skill levels should create a buffer region that allows them to make a safe recovery even though it may end up in the shaded area for the PoH and the rest of us. Most of the time.

MYTH 6

Test pilots can do it all.

We've already established that test pilots have Big Ones…vocabularies, that is. But even so, there are different test pilot roles suitable for different skill levels, personalities and life styles. While the responsibilities between the different job descriptions are frequently blurred, different titles accommodate different levels of experience and aptitudes.

Test piloting, a range of options

Maintenance test pilots perform testing on aircraft and equipment after repairs and new equipment installations, provided the new equipment has already been certified and tested in the aircraft. Pilots in these functions usually are very mechanically oriented and they are frequently A&Ps as well. The best of both worlds.

If the organization is a manufacturer, then the next, and frequently the highest level of position available is manufacturing or production test pilot. These men and women usually provide a broad range of services. (See MD Helicopters pg.10.) These include comprehensive testing of each aircraft as it comes off the line, testing aircraft parameters and determining limitations for new equipment and configurations (i.e. pop up floats, weapons pods, etc.). They also act as the company's primary interface with the client; providing transition and recurrency training. They often customize the training regimen with the client's unique mission requirements. In the case of MD Helicopters this can include flight with a set of SWAT team members standing on your skids.

Straddling the line between production and experimental are engineering test pilots. These are the folks whose primary function is to do the testing associated with new or modified equipment installations. Their roles border those of experimental test pilots because they are often testing the aircraft in various stages of flight after it has sprouted additional appendages, grown new equipment or suffered significant changes in weight and balance. Some "interesting" examples taken from the resume of Rich Lee provide some insight into the range of tasks expected:

- FAA certification testing of main rotor elastomeric lead-lag dampers
- Flight test of a belly mounted air conditioning unity to obtain handling qualities evaluation and to determine speed/power curves

- Test firing of a chain gun installation to verify compatibility with airframe and sub-systems
- Evaluation and flight test of an automatically arming auto re-ignition system
- Airspeed calibration and pitot/static system error calibration in a highly modified aircraft
- Flight test and evaluation of anti-ice equipment performance

Why it's called 'EXPERIMENTAL'

Experimental test piloting is the pinnacle of the job. By definition, experimental test piloting enters the scene when you are capturing data in envelopes for which no data yet exist. You are doing something that hasn't been done before. You are probing boundaries and limits. Height velocity diagrams and flight strain data are just two areas visited by experimental test pilots. More "mundane" roles (also borrowed from Rich's resume) include:

- Flight test to determine the characteristics of no collective pitch pull autorotations and high speed ground slides at various weights
- Flight testing to determine flight strain data with a new tail rotor assembly
- Evaluation and hard landing tests at various gross weights of new landing gear dampers during power on and power off landings at high sink rates
- Flight testing to evaluate the possibility of in-flight main rotor and tail boom contact during extreme cyclic input maneuvers within the normal flight envelope. (My personal favorite).

MYTH 7

It takes a special person to be a test pilot

That's no myth!

Photography: The Boeing Company

EXPERIMENTAL TEST PILOT—RICHARD A. LEE

Military trained, a Vietnam veteran with 860 combat flight hours as an OH-6A scout pilot; over 18,000 flight hours in more than 30 different aircraft; and nearly 25 years of test pilot experience. Richard, "Rich", Lee is Boeing's Chief Pilot, Engineering Flight Test and Experimental Test Pilot assigned to the Apache, AH-64D, program. Rich personifies experimental test pilot.

Expert in every facet of the Apache: flight characteristics, aerodynamics, systems, munitions, weapons, tactics and electronic warfare, Rich is a 'generalist' in the aircraft—able to lead a project in any facet of the helicopter. Of Boeing's twenty-two test pilots, some are generalists and some specialists. "Attack aircraft are uniquely complicated," explains Rich. "Navigation, communications, flight control systems, weapons systems—sometimes specific, in depth knowledge of a particular system is required. You may have to be an engineer or scientist to adequately perform the specialist function. Skills, interest levels, education and experience also help determine a test pilot's role and areas of expertise."

Rich reflects, "in experimental flight testing, those with the best hands do flight strain surveys, handling quality analysis and height/velocity chart determination. Great precision is required when doing these tests so that replicable and reliable data points can be captured." He smiles, "These are the choice projects for all experimental test pilots." Rich continues, "flight strain surveys are very expensive to conduct. They require the support of technical and engineering team members and make extensive use of real time telemetry, so you want to complete them as quickly as possible."

Rich put his extensive experience in flight strain testing to good use as he led the development of Boeing's aerobatic demonstration routine for the Apache (See *autorotate* archives, June 2001, Aerobatics in the Apache Longbow). Boeing Chief Pilot, Mark Metzger and Rich comprise Boeing's lead aerobatic team and have performed loops, rolls, hammerheads and show stopping bows to the delight of audiences and prospective buyers all over the world. These shows served a purpose. "We are the only aircraft I know, helicopter or fixed wing, that perform aerobatic maneuvers in a mission weight aircraft with a combat configuration," states Rich. "The additional weight and drag resulting from the attack mission configuration reduce tolerances to the minimums, but, our demonstration was designed to show the capability, integrity and reliability of the AH-64D in situations well beyond those

found in a standard combat mission." Rich, who started doing helicopter air shows in 1980 was the first recipient of an FAA aerobatic competency card, for helicopters.

One comment made by Rich during our interview has made a particular impression on me. "As an experimental test pilot, you never arrive." This statement required some elaboration. "The level of expertise and knowledge that must be maintained to master a complex aircraft is staggering," Rich relayed. "In order to maintain that level of proficiency you have to study and test, constantly." All Boeing test pilots are regularly and rigorously tested on all aspects of the aircraft: systems, limitations, emergency procedures (which must be memorized verbatim), etc. A typical pilot may have to memorize about a dozen emergency procedures in order to satisfy their regular check ride requirements. But, an Apache test pilot has to commit over 50 emergency procedures to memory.

So, if for some reason this all sounds good to you. What can you do to move your career in this direction? "Pursue every opportunity to be involved in testing, no matter how small," Rich recommends. "Most manufacturers offer a maintenance test pilot course—even if they don't promote it. Try to take one of those courses. You'll learn a lot about the aircraft's mechanics and what it takes to fly properly."

You can also look for a job with a company that is involved in changing or modifying aircraft design or equipment, as a way of getting your foot in the door. And, of course, there's always the FAA." "The FAA," I ask? "The FAA does flight test verification for all manufacturers. Get a job with the FAA and then seek promotion from within," says Rich. "Finally," he concludes, "determine what you want out of your career and make a plan to go after it. Things are much more likely to happen if you make them happen then if you wait for them to happen by accident or divine intervention."

For those of us who fly in Arizona, there's another facet of Rich Lee that has reached near legendary proportions—his role as a designated examiner. While all practical tests are cause for elevated blood pressure, a Rich Lee practical is, well, just a little bit more. It could be the standard uniform of the day, Boeing's distinctive blue flight suit. Or, maybe it's the ever-present shopping bag that accompanies Rich to all practicals. It is filled with Advisory Circulars, Notams, charts, pamphlets, manuals and who knows what (no one, not even Rich is entirely sure what's in there). But, perhaps it's that you are about to be questioned, and maybe even taught something, by a master. When one of my students takes their practical with Rich, we may spend just a little more time going over those small points that sometimes get lost in the depth of information we're expected to retain. Because in aviation, there really aren't any small points. I usually leave my students with one final, comforting, admonition. "Don't worry, you're ready and you'll do fine. But, whatever you do, don't embarrass me in there."

PRODUCTION TEST PILOTING AT MD HELICOPTERS

Flight Instructor and Production Test Pilot Mark Friskel, hopped the MD600N from the ramp, over the fence, to the grass area, at Falcon Field, AZ; home to MD Helicopters. "Go ahead and pick it up," Mark said. "I have all the controls," I confirmed in response. But, in truth, my mind was thinking something a little different.

The 600N is a powerful aircraft and, with no hydraulics, I could feel that through the cyclic in a way I had never quite experienced before. The Rolls Royce 250-C47 engine, puts out 800 shp, derated to 600, and uses that to drive 6 rotor blades just overhead. You can use this power to lift a Max Gross Weight of 4,100 pounds. Or, you use it to fly 5 guys over the Salt River valley.

When I took that cyclic in my hand I had the strong sense that I had a rhino by the horn here. With the famous MD NOTAR® on one end, Mark and I on the other, and 3 passengers in the middle, I began to raise the collective. As we got light on the skids I had a vision of the rhino deciding on its own, to drift left, towards the watering hole, and me unable to influence it otherwise. But, as we slowly broke free of the ground I found I was, indeed, in control of a very stable,

Photography: (top) Aaron Reyes, Studio 33; (bottom) The Boeing Company

solid feeling platform. In fact, I've found myself "missing" that feeling, in the weeks since.

The NOTAR® in a hover is a little different. Very light pressure on the pedals was all that was required to rotate the tail thruster, and I found myself doing a little dance as I tried to fix our heading. However, a few minutes of practice and a 360° left pedal turn later, things settled down and we were ready to take off.

MD's patented NOTAR® consists of four key components. A shaft driven, enclosed, articulated internal fan is used to create a positive air pressure in the tail boom. Two elongated slots along the boom allow a portion of the air to vent along the empennage. This flow of air results in a large amount of the directional control in a hover as it causes induced flow from the main rotors to hug the airframe. The famous directional jet thruster at the tail, works in conjunction with the dual vertical stabilizers to complete this unique heading control system.

The left vertical stabilizer is controlled by the pilot's pedal inputs, acting much like an airplane's rudder. In both the 520N and the 900 (MD Explorer) the right vertical stabilizer is driven by MD's YSAS (Yaw Stability Augmentation System). The stability augmentation system is a gyro-controlled actuator that assists the pilot by automatically providing enhanced trim stability. YSAS is an option on the 600N.

Two trips around the 'Yankee Pattern', making right traffic over Boeing's Apache Longbows lined up on the ramp; an extended flight at 500 AGL following the path of the Salt River as it descends from the mountains surrounding Phoenix; helped reveal the aircraft's handling characteristics. Landing on a hilltop, Mark took the controls and demonstrated that we were able to easily climb straight up at 1,200 fpm with a total of 5 passengers, most of them pretty good sized boys.

We landed at the pad, Mark rolled down the throttle, and I heard a gentle female voice in my headset proclaim, "Low RPM, Low RPM." Both the 600N and the 900 are equipped with a FADEC system that not only starts the engine, monitors all vital system parameters, but also triggers a voice warning box to let you know about low rpm, fire and other important distractions.

Experiencing flight at the controls of the 600N was a treat and helped fill out my experience with MD's unique product line. But, it's a long path from the beginning of the production line to the customer's hangar and I was anxious to find out the role played by the manufacturing test pilots in that process. MD's Chief Pilot, Don Smith helped clarify things.

"All production aircraft are built under the auspices of a type certificate, issued by the FAA for that model aircraft when it first goes into production," explained Don. The primary purpose of production test is to make sure that each aircraft coming off the line meets the requirements of the type certificate with regards to system and equipment function, limitations, and specifications." A quick review of 14 CFR, Part 21 which describes the rules governing the issuance of a type certificate and a supplemental type certificate (STC) makes it very understandable why manufacturers aren't rolling off new aircraft models every year. The time and expense associated with satisfactorily acquiring a new type certificate are huge. Part 27 goes on to describe, in extreme detail, the standards that must be met by a normal category rotorcraft, under 6,000 pounds, in order to qualify for a type certificate. It covers EVERYTHING and I mean EVERYTHING. Included are pitch limits, seat belts, static longitudinal stability requirements, pilot force limits (not more than 130 pounds on the pedals), ground resonance prevention and the rotorcraft flight manual—just to scratch the surface.

Photography (from top): MD Helicopter's Chief Pilot, Don Smith; Mark Friskel discusses YSAS and the vertical stabilizer; Somebody's new 600N rolls off the line; MD Helicopter test pilot Mark Friskel next to experimental 600N. Aaron Reyes, Studio 33

Production test is performed on the basic aircraft as it rolls off the line and is governed by a detailed Production Flight Test Procedure and Checkoff List (PFTP). At this point, the aircraft is considered 'Experimental' by the FAA. These aircraft are basic. They lack the high gloss, custom paint jobs and the high tech avionics packages as a production test pilot and a crew chief are assigned to conduct the PFTP. The PFTP begins on the ground and includes checks of everything from safety harnesses to main rotor track and balance. In fact, hover tests don't begin until you're more than half way through the 30 plus page specification. The entire test involves well over 500 individual checks, tests and parameters and may take 5 days to perform. When the ship has completed this milestone, it is now considered a normal category aircraft and it's on to finishing, where, in all likelihood, it will be largely disassembled again.

In finishing, the aircraft is painted and kitted. Kitting involves the final installation and application of the aircraft's customization package: radios, navigation equipment, paint, etc. But, sometimes it means more—supplemental fuel tanks, extensive avionics modifications and more. When all is done, the aircraft is re-tested. The degree of re-testing required is commensurate with the level of kitting involved. After an extensive final build, the aircraft may have to go through most of the original PFTP again and pass a customized test program designed by the engineering team—reflecting the equipment installed in the kit.

MD has a total of 6 test pilots to perform these functions and I was fortunate enough to meet with four of them: Don Smith, Chief Pilot; Mark Friskel, Flight Instructor; Jim Fowler, Senior Production Test Pilot; and Gene Nuqui, Production Test Pilot. Each of these experienced pilots has a notable background. Gene has the added distinction of having been "Stormin' Norman's" pilot during the first Gulf War. In addition to their role in the production and final test areas, MD's pilots also have a great deal of customer interface. These same pilots conduct transition and recurrency training for MD clients. They frequently go to the client's site to conduct onsite training using the client's new helicopter under the client's unique conditions. Not infrequently, they fly with the client on the initial delivery—an opportunity for additional training, in a real world setting.

My final question for the elite MD pilot team—why does the pilot sit on the left side in the 600 and 500 series aircraft? The answer, the original aircraft was designed to accommodate three in the front seat. For that configuration to work, the collective would have to be located on the far left and if the pilot was going to be able to reach it, he or she also had to be on the far left. And, since that is in the original type certificate—let's just stick with it.

To obtain more information on the National Test Pilot School, go to the web at www.ntps.edu or call 661-824-2977. Shawn Coyle may be reached at scoyle@ntps.edu.

BOOK REVIEW

Cyclic & Collective, More Art and Science of flying Helicopters

By Shawn Coyle

Rotorcraft flight is a fascinating subject, full of mysteries to solve, skills to develop, complexities to unravel, challenges and fun. Shawn Coyle's latest book, *Cyclic & Collective*, helps guide us down this fascinating road with wit and charm. Probably the most comprehensive book on helicopters to date, it covers material of interest to student pilots and long term professionals alike. Still have difficulty explaining transverse flow effect, Shawn can help. Looking for more complexity—try reading the sections on AFCS, the Koanda effect, underslung loads and FADEC. It's all there in simple, easy to understand language with lots of diagrams and illustrations. This recently released, one of a kind text, is available for $44.95 from Mojave Books Limited. To buy or get more information go to www.helobooks.com, on the web, send an e-mail to info@mojavebooks.com or call 661-823-8068.

I recommend the book to all past, present and future helicopter pilots who possess a passion for their craft and a thirst for knowledge about this fascinating aircraft and career.

Tony Fonze,
Managing editor, *autorotate*.

Photo: The single engine production line at MD Helicopters, Aaron Reyes, Studio 33.

ERRWOLF'S OFFSHORE WEATHER WISDOM

A review for some, a primer for others, and part of a continuing education process for all. Not necessarily in priority order.

- "Everyone talks about the weather, but nobody ever does anything about it." – Mark Twain
- An instrument rating indicates that the holder has enough sense to know when they shouldn't be flying.
- Read the accident reports. Rarely does anyone find any new ways to crash a Bell 206.
- Frontal passage, squall lines, and waterspouts will all blow an aircraft with tie-downs right over the side. Even more so if the tie-downs are still stowed in the baggage compartment.
- The three stages of decaying enroute weather:
  Skosh – weather is approaching minimums.
  Silly – weather is obviously below minimums.
  Stupid – weather is way below minimums, and you know it, and you take off anyway.
  Don't be stupid.
- The "Other Fool Supposition" states that it is relatively safe to fly VFR in bad weather because no other fool would be flying on a day like this. Actually, all the other fools are thinking the same thing, are at the same altitude, and they can't see you either.
- By the time you decide to turn around, it may already be too late.
- Wait it out. Rarely is a pilot drowned or killed while sitting on a couch drinking a cup of coffee.
- It is better to be on the pad wishing you were flying than in a rubber raft waiting on the Coast Guard.
- Six eyes (Two pilot IFR crew plus weather radar plus TCAD) are preferable to two on most low visibility days.
- You can choose to point your aircraft into the wind, or you can let the wind and the aircraft decide for you.
- Oil and gas deposits that have been under the surface for thousands of years will probably be there when you come back tomorrow.
- Wait it out. If you kill yourself in bad weather, your funeral will be held on a sunny day.
- Every summer, you learn more about how to fly in the gulf. Every winter, you learn more about when not to fly in the gulf.
- Consider—at your cruise altitude under a low ceiling, would you have time to enter autorotation, turn into the wind, get the floats out, and flare before you hit the water? Extra credit is given for mayday calls and emergency procedures.
- Don't leave home without a toothbrush and overnight kit. Plan on getting stuck somewhere due to weather at least every 6 months.
- Every day in the gulf, hundreds of offshore pilots work a delicate balance between keeping the customer happy and killing them by pushing weather.
- The next guy to go down in adverse weather is walking around somewhere out there right now. If you see him, please let him know.
- There were lots of good pilots who knew all of this, and their aircraft are still on the bottom of the gulf today.
- There but for the grace of God go I.

Riding the aluminum cocoon

By Troy Hayes

"Rotor brake, Frank," I yelled. "Rotor brake!" Strangely, there was little sound except for my voice. The rotor blades on the Bell 206L3 had been intact and turning at full RPM only seconds before. Now fractured and drooping, they still rotated lazily, using up the last bit of their legendary inertia. I briefly and gratefully reflected on the passenger briefing that I had given so many times, "If we have a hard landing, don't get out until the blades stop moving. The skids might have spread and the blades will be closer to the ground. You would hate to survive the crash and get decapitated by the spinning blades." Now it was my turn to heed the warning. From my forward-facing seat on the right side of the rear cabin I saw Frank's left hand, framed by shattered Plexiglas, move slowly but purposely up to the rotor brake handle and pull it down. Thank God, I thought, he heard me. He must be OK. Susan, the other aft cabin passenger, and I had already shot each other silent glances, speaking volumes. We had made it!

The flight had started out routine enough, if there is such a thing as "routine" in EMS flying. We had been dispatched to transport a patient from a rural hospital in the western United States to a large, metropolitan medical center. Along the way Susan and I, the medical crew, had discovered a glitch in a piece of necessary medical equipment that we couldn't fix. After delivering the patient and refueling at the airport, we headed east toward one of our other satellite bases, two mountain ranges away, to pick up a spare device. It was a beautiful, clear day and I would have to admit that we were all a little "fat, dumb and happy." That would change soon enough.

Fifteen miles from our destination and 500 feet agl, I looked down out the right side of the ship and spotted a large herd of antelope. Not extremely unusual in those parts, but it was nonetheless a fairly remarkably sized herd. For no reason other than mere curiosity, I said, "Hey, Frank, there's a herd of antelope off the right side. Can you come around right so we can get another look?" Ever agreeable, "Sure," was his reply. He started a level turn to the right. We had come around almost 180 degrees, coincidentally now into the wind, and I had just started to point out the antelope to Susan when everything got quiet. But not for long. The audible alarms started screeching and I heard Frank's incredulous voice ask, "What the (deleted expletive) is going on ?"

It should be mentioned that after many years of being the GIB (Guy In Back) in the helicopter, I had gone over to the "dark side" and learned to fly the dang things. At the time, I was a recently minted commercial pilot with a CFI checkride coming up in a couple of weeks. Scarcely qualifying as an aviation neophyte, I nonetheless had enough knowledge to know that, whatever the (deleted expletive) was going on, it wasn't good.

"Hang on guys, this is for real" were Frank's very fitting next words. In fact, nobody would speak again until my shout about the rotor brake. I shot a quick glance out the window and was somewhat reassured that we were over relatively flat terrain, but there were sure a lot of scrub trees and high brush that I hadn't noticed earlier! Our rate of descent didn't seem too bad and the rotor blades were still a blurry disk, so I knew Frank had entered an autorotation. Not that I ever worried he would do the right thing. The pilots I've flown with in three EMS programs around the country have all been, with rare exception, consummate professionals.

Without a conscious decision that I can remember, I chose the chest-to-knees crash position and was grateful Susan, in the aft-facing seat in front of me, didn't choose the same, else our heads would have crashed together. Time seems to expand and contract simultaneously in situations like these. It took forever to get to the ground, and yet it took only a moment.

Frank had the ship aimed for a clearing in the trees and brush, but he only got to play with the hand he was dealt. During the flare, the tail boom crashed through the top of a tree and completely separated from the aircraft. The remaining fuselage whipped around and slammed violently but mercifully upright into the clearing, with the nose now facing 180 degrees from the original flight path. The rearward impact force threw my upper body back upright against the aft bulkhead, just in time to get a face full of topo maps and sectional charts that had been tossed back through the tunnel from the floor area at the foot of the stretcher.

Photography: A different Long Ranger on a better day. Bell Helicopter.

Thankfully, the heavy medical gear in the back was well secured and didn't budge.

There was a faint odor of jet fuel, but we weren't on fire. Nonetheless, I wanted OUT OF THERE ! After Frank applied the rotor brake and the shattered blades coasted to a stop, I gave the stuck cabin door a shove to get it open. To say that the skids were spread is a monumental understatement. My seat cushion was nearly at ground level, and I had to stand up to get out. I moved quickly up to Frank's door, with a bit of lingering dread because his windscreen was shattered and I hadn't actually seen his face yet nor heard his voice.

It was strange to be standing on the ground, yet looking down into the cockpit. Frank was still strapped in, busily checking and double-checking that he had shut everything down. Save for a tiny rivulet of blood running down his forehead from a small laceration, he was unhurt! My first remarkably poetic words to him, face to face, were, "Holy (deleted expletive) man, autorotations WORK !!!" For some bizarre reason, doubtless due to my recent flight training, my predominant initial emotion was a strange, detached fascination with the aeronautical experience we had just had. "Yeah, I guess so," Frank said quietly. "Do me a favor and check to make sure I turned everything off."

I don't think Frank ever quite got over that fact that the aircraft was destroyed, but the wrecked airframe pales in comparison to the three lives he saved that day. As one of Frank's fellow company pilots told him later that day, after congratulating him on a job well done, "Hey, when the engine quits, your love affair with the aircraft is over. You're just riding that aluminum cocoon down to the ground, and if it ends up in one piece, it's just a bonus." In my mind, this accident clearly illustrates that emergency procedures training is invaluable and should be taken seriously by operators and pilots alike. I owe my life to a well-trained pilot. Yeah, autorotations work.

LESSONS LEARNED (or relearned!)

If you fly with passengers, brief them thoroughly. Yes, the regulations say we have to, but it's something that's easy to get complacent about. If you fly with any type of crew, make absolutely certain they know their roles in an emergency situation. If you don't already do it, train your crew to fully shut the aircraft down.

As a medical crewmember, I had always, ALWAYS, taken along a little ditty bag with personal survival equipment, sometimes to the good-natured consternation of the pilots ("It's not 'just' five pounds, it's another five pounds!") On the way to work that morning, just a few blocks from my house, I realized that I'd forgotten my bag. Running a bit late, I thought I wouldn't need it and didn't turn back for it. Hey, Murphy was an optimist, right?

None of us got out a "Mayday" on our company frequency, and I'm not sure why. Frank has an excuse because he had his hands full, but the crew had been trained for that as well.

The aircraft radios and GPS were fubar after the crash. I had always given Susan grief about being a techno-gadget geek, but I was immensely grateful for her personal handheld GPS and mobile phone. Using these, we plotted our position on the topo map, then coordinated with our company dispatch center to have someone meet us on a dirt road about a mile away.

When shutting things down after a hard landing, don't forget about turning off the ELT if you're OK and don't require someone to search for you. Later that day, the county search and rescue folks got sent out on an ELT signal that a satellite had picked up. Guess whose it was?

Autorotate

Live and Learn—More than just entertaining reading

We can all learn from the experiences of each other. It is something we can give back to our pilot community. Your story may even save a life. With that in mind, do something for your fellow pilots and yourself by submitting your flight experiences to Live and Learn. They can be brief or long (no books please); rough drafts or well crafted; as long as you have something to share. Don't worry about your English or writing skills—that's why we're here. Submit your Live and Learn stories to Tony Fonze, editor at TonyFonze@autorotate.org.

You'll be glad you did, and so will we!

PHPA and ALPA meet in Washington

By Jeff Smith

On January 13th 2003, representatives from the Professional Helicopter Pilots Association (PHPA) sat down with representatives of the Airline Pilots Association (ALPA) at ALPA's headquarters outside Washington, D.C. The purpose of this meeting, arranged by the Office and Professional Employees International Union (OPEIU), was to provide PHPA committee leaders with a first hand look at how ALPA performs many of the same functions that PHPA is seeking to develop. The meeting, though short and preliminary, was informative and productive on several fronts.

ALPA

For those unfamiliar with ALPA, the organization was founded in 1931 to give airline pilots a voice in matters involving air safety, operational procedures, equipment design, working conditions and, of course, compensation levels. It was and is fundamentally a labor union, currently organized as an arm of the AFL-CIO. But, ALPA has always been much more than the stereotypical labor union.

From the very beginning, ALPA has focused much of its efforts on improving the safety of air transportation. After all, the argument goes, what good is a great salary if you don't live long enough to enjoy it? In the 30's and 40's, as the airline industry was developing, that was a genuine concern for pilots. The events of 9-11 alone show that there is still room for safety improvements, 70 years later.

Today, ALPA technical experts participate in accident and incident investigations alongside the federal agencies responsible to oversee such matters. ALPA experts work with cutting edge technology to help discover the causes of accidents, and then work with manufacturers, regulators and operators to help prevent similar incidents.

Numerous ALPA committees, consisting primarily of active pilots, are constantly looking at issues that could improve or hinder the safety of air travel. Through ALPA's legislative representatives, pilots have the political muscle to be heard at the levels where federal policy and rule making originate.

These are capabilities PHPA is seeking to develop.

21ST century cowboys

The helicopter industry at the beginning of the 21st century has some remarkable similarities to the airline industry pre-World War II. Today's helicopter industry is characterized by numerous, small companies, providing a host of services. They employ aircraft that normally carry less than a dozen passengers, operated primarily under VFR, by pilots who were frequently military trained, and often see themselves as the rugged, cowboy of the air, type.

Note: Read, "Flying the Line," by George E Hopkins, a history of the first 50 years of ALPA, for a good description of the early airline industry.

Pilots don't need to be told that helicopter flying is not the most glamorous type of aviating. Helicopters are noisy, slow and often underpowered. The work is tiring, with 14 hour, 7 day work shifts the norm in many places. It has more than its share of risks: operating to and from small oil rig platforms miles off-shore, or landing to a city street at night amongst wires and other obstacles. Helicopter pilot salaries are perhaps a third of that enjoyed by the average airline pilot, yet the training, certification and experience requirements are comparable to their fixed wing brethren. Still, most helicopter pilots wouldn't do anything else.

Vietnam hangover

Until recently, pilots have had no opportunity to voice their concerns over matters affecting their careers due to the chronic oversupply of pilots produced by the military for the Vietnam conflict. According to the Vietnam Helicopter Pilots Association, the US military trained approximately 40,000 helicopter pilots during the 60's and early 70's. Most of them were released into a very small and struggling civil helicopter industry, and the number of pilots vastly exceeded the number of available jobs. Management's solution to a pilot who raised too much of a fuss was to simply replace him with one of the hundreds of unemployed pilots willing to keep quiet about unsafe practices or lousy working conditions.

But, the Vietnam conflict ended 30 years ago. The bubble of former military pilots is gone, and in many places industry is experiencing a shortage of experienced pilots. Around the country, pilots are beginning to organize to take advantage of the change in the supply/demand equation. Salaries are going up, if slowly. But, management is still the only voice being heard by legislators, regulators and

Photography: (l to r) Jeff Smith - PHPA, Kevin Kistler - OPEIU and Allan Duquette - PHPA. PHPA Staff

equipment manufacturers when decisions are made affecting the daily work environment of pilots.

PHPA-ALPA meeting

Like ALPA, PHPA is a labor organization. It is organized under OPEIU, an arm of the AFL–CIO. The goals of PHPA are essentially identical to those of ALPA. That's where the idea for a meeting between ALPA and PHPA was born. It was an easy decision to go and see what could be learned from an organization that has over 70 years of experience with the types of issues helicopter pilots are interested in.

The meeting was a good first start. ALPA representatives offered to provide advice and assistance to PHPA representatives wherever needed. During the discussions, it was discovered that there are several issues of joint importance to both organizations. Working together on issues such as communications, weather, radar coverage and military warning areas, PHPA and ALPA can help each other attain common goals. A classic win/win.

CAUTION – work ahead

Now the real work begins. And anyone who believes that it is all down hill from here ignores history. It took ALPA many years to rise to its position as a respected voice listened to by all segments of our industry. Along the way there was much criticism and resistance from within the very pilot community that ALPA sought to represent. Pilots are by nature a very independent lot, used to having their fate in their own hands.

PHPA will have to prove to pilots and industry alike that the voice they seek will be used to improve the industry, for the good of pilots, customers and operators equally. The success of our efforts will not only affect the career satisfaction of pilots, but will have a large impact on the fortunes of this entire industry.

The following information was extracted from the NTSB files. It has been edited for available space and is subject to change as investigations continue. Reports were selected based on the importance of the information to the broader helicopter industry.

Agusta A-109-K2; Salt Lake City, UT
January 10; 1 Fatal, 1 Serious Injury

On January 10, 2003, approximately 2050 MST, an Agusta A-109-K2 air ambulance helicopter was destroyed when it impacted the terrain while attempting to maneuver in dense fog near Salt Lake City, Utah. The instrument rated commercial pilot and a flight paramedic were fatally injured, and flight nurse was seriously injured. The flight originated from the LDS Hospital, Salt Lake City, at 2031, and was enroute to Wendover, Utah, to pick up a patient who had been injured in an auto accident.

According to data received from air traffic control, after crossing the Salt Lake City International Airport (SLC) on a westerly heading, the pilot encountered deteriorating visibilities and elected to return to the LDS Hospital. The pilot was unable to obtain a clearance to cross the airport on an easterly heading and was asked to hold west of the airport until SLC air traffic control allowed him to cross, due to arriving SLC traffic. While holding, the pilot encountered instrument meteorological conditions (IMC) and declared an emergency. The controller issued a heading of 340 degrees to vector the helicopter to SLC. No reply was received from the helicopter and a search was initiated.

Approximately 2130, the helicopter wreckage was located by rescue personnel one half mile southwest of the approach end of SLC runway 34L. The aircraft initially impacted a soft field, became airborne, then came to rest in the upright position approximately 1/4 mile from the initial impact. There was no post-impact fire.

At 2056 local, the SLC Airport was reporting winds from 350 degrees at 6 knots, visibility of a 1/8 mile in fog, with a vertical visibility (VV) of 200 feet. The temperature and dew point were both reported at 01 degree centigrade.

Sikorsky S-61A; Glady, WV
January 12; 2 Serious Injuries

On January 12, 2003, about 1220 EST, a Sikorsky S-61A, was substantially damaged when it impacted terrain during a forced landing near Glady, West Virginia. Both certificated commercial pilots sustained serious injuries. According to the crew, after the helicopter came out of maintenance, the captain and first officer conducted a test flight, and then ferried the helicopter to the area of operation. On the day of the accident, the first officer flew flights one and three, and the captain flew flights two and four. Each flight lasted about 1 hour 20 minutes, the helicopter was hot refueled between flights, and the flying pilot would occupy the left seat. During the previous flights, no flight control anomalies were identified, and on the accident flight, the captain was in the left seat and flying the helicopter.

After completing approximately the seventh load of the flight, the captain maneuvered the helicopter over the ground tenders, and entered a 155-foot out of ground effect hover. The tenders connected the chokers to the cargo hook, and called "clear." About the same time, the helicopter started a slow uncommanded yaw to the right. The captain applied full left pedal, released the load, and the ground tenders called "kick out." With full left pedal applied, the helicopter continued to yaw right. During the first revolutions, the captain identified a small clear area to the north. The area was approximately level with the helicopter, and approximately 150 feet away on a ridgeline. The captain tried to maneuver the helicopter to the clear area, but by the fourth revolutions, the yaw rate had increased drastically, and helicopter controllability became a major issue. The first officer placed his left hand on the throttles, and the captained called for engines to idle. The captain entered an autorotation, and applied full collective before entering the trees. The helicopter impacted the ground, came to rest up right, and both pilots exited with the assistance of one of the ground tenders. Examination of the anti-torque flight control system revealed that the left anti-torque control cable was broken. The break was in the aft part of the cabin and associated with a pulley assembly.

Robinson R22; Ft. Lauderdale, FL
February 01; No Injuries

On February 1, 2003, at 0945 EST, a Robinson R22 helicopter crashed during a run on landing at Fort Lauderdale Executive Airport, Fort Lauderdale, Florida. The helicopter rolled over on its left side and sustained substantial structural damage to the cabin and tailboom assembly. The private pilot and airline transport rated check pilot reported no injuries. The private pilot stated he was demonstrating a run on landing to the check pilot. The helicopter touched down on the sod area. The left front skid contacted something on the ground and the nose of the helicopter pitched downward. The pilot stated he went forward in his seat and inadvertently moved the cyclic forward and to the left. The helicopter rolled over on it's left side before he or the check pilot could take any corrective action.

Robinson R44; Russelville, KY
February 06; No Injuries

On February 6, 2003, at 1645 EST, a Robinson R-44 helicopter, was substantially damaged during a forced landing to Lake Malone, near Russellville, Kentucky. Instrument meteorological conditions prevailed. According to the pilot, he was flying at an altitude of 1,000 feet, and the cloud bases were at an altitude of 1,100-1,200 feet. When he was approximately 30 miles from his destination, he decided to land the helicopter, due to deteriorating weather conditions and rising terrain. After landing, the pilot reassessed his route of flight, then prepared for another takeoff to continue the flight.

As the pilot initiated a hover, he applied full carburetor heat, and as he raised the collective for takeoff, the carburetor heat automatically dropped. He then lowered the collective, but "failed to get the carb heat needed to maintain power." The engine began to sputter, then lost power completely. The pilot then performed a full autorotation into the lake. Upon impact, the canopy burst, and the helicopter sank 10-15 feet underwater. All three occupants were able to unfasten their seatbelts and swim to the surface.

The pilot reported that the weather in the area included a visibility of 1-2 miles and light rain. He also reported 950 hours of total flight experience, 27 hours of which were in the R-44.

Weather reported at Campbell Army Airfield (HOP) miles to the southeast, at 1655, included 1 mile visibility with light snow and mist, overcast clouds at 500 feet, temperature 32 degrees Fahrenheit and point 32 degrees Fahrenheit.

Hughes 369E; Paxson, AK
February 10; No Injuries

On February 10, 2003, about 1115 AST, a Hughes 369E helicopter sustained substantial damage when it collided with terrain after encountering flat light conditions while maneuvering, about 15 miles north-northwest of Paxson, Alaska. During a telephone conversation with the NTSB investigator, the director of operations for the operator said the pilot told him that he was dropping aerial stakes along a property line when the accident occurred. The pilot said he would hover at a low altitude and a passenger would drop a stake about every 800 feet. The pilot related that the sky conditions were variable from clear to overcast throughout the morning, and he became disoriented when the snow-covered ground blended into the overcast sky. The director of operations said the pilot indicated he lost sight of a discernible horizon while at a low altitude, and the helicopter inadvertently impacted terrain.

Rotorway Exec 162F; Westford, MA
February 15; 1 Serious Injury

On February 15, 2003, about 1610 EST, a home-built Rotorway Exec 162F helicopter was substantially damaged when it collided with trees, then terrain while executing a steep approach to a confined area, in Westford, Massachusetts. The certificated commercial pilot sustained serious injuries. The pilot stated that he had made a steep approach, and planned to land in his friend's driveway, a confined area. According to the pilot, when the helicopter was just about in a full hover (about 8 feet above the ground), it began to rotate to the left. The pilot applied full left pedal, but could not stop the rotation. He elected to not perform an autorotation from a hover because he was concerned of landing hard, rolling over, and shedding parts that could have possibly hurt his friend who was standing in the driveway about 50 feet away. Instead, he lifted the helicopter back up and tried to fly to a vacant area. During the ascent, the pilot was able to slow the rotation by reducing power, but was never able to completely stop the rotation. He was not able to perform an autorotation because he had no forward airspeed, so he elected to put the helicopter down into trees. An FAA inspector performed an examination of the helicopter. According to the inspector, one of the tail rotor pitch change links was fractured. The fractured end had accrued 192 hours of operation since new.

Bell 407; MI 700 GM
February 16; 2 Fatal, 3 Serious Injuries

On February 16, 2003, approximately 1225 CST, a Bell 407 single-engine helicopter, landed offshore in the Gulf of Mexico following a loss of engine power. The pilot and one passenger received fatal injuries, and three passengers received serious injuries. The helicopter has not been recovered and is presumed destroyed.

The pilot transmitted a Mayday call, engine failure, and that he was going to land the helicopter on the water. The Coast Guard at Aransas Pass, Texas, and Corpus Christi, Texas, were notified. Search and rescue was initiated by the operator, Coast Guard, water vessels, and other helicopter operators.

Two of the passengers reported that the helicopter rolled inverted within a few seconds after the landing. The pilot and passengers exited the helicopter, inflated their life vest, and awaited their rescue. Approximately 1425, the pilot and passengers were recovered by the Coast Guard. The operator, the dispatcher, Coast Guard helicopter pilots, pilot's of other search helicopters, and two of the passengers reported the winds were from the north at 25-40 mph with 5 to 9-foot seas.

Bell 407; High Island 44, GM
February 22; 1 Fatal Injury

On February 22, 2003, approximately 0945 CST, a Bell 407 single-engine helicopter, was not damaged when the main rotor blades contacted a passenger during hot refueling operation on offshore platform High Island 443 (HI 443), in the Gulf of Mexico. The pilot, in an interview conducted by an FAA inspector, reported that he landed the helicopter on HI 443 to refuel prior to proceeding to WC 407. After the helicopter landed, the pilot asked the passengers if they were trained to refuel the helicopter with the engine and rotors operating. The passengers reported that they had completed that type of operation before. During the refueling operation, a wind gust started to push the helicopter on the platform. The pilot immediately began to shutdown the helicopter engine and applied the main rotor blade brake. The helicopter continued to slide and came to rest approximately 1 foot from the edge of the platform. After the helicopter came to rest, the pilot noticed that the main rotor blades contacted a passenger.

Sikorsky S-61A; Kimble, TN
March 23; 1 Fatal, 1 Serious Injury

On March 23, 2003, at 0800 CST, a Sikorsky S-61A, collided with terrain and burst into flames during a logging operation in remote area near the city of Kimble, Tennessee. The commercial pilot was fatally injured and the second commercial rated crewmember received serious injuries. The helicopter was destroyed. According to the witness on the ground, the helicopter was preparing to release a group of logs. After the helicopter released the logs, the witness heard the pilot yell and observed the lower pick-up hook hit the ground and start coiling up on the ground. The witness observed the helicopter spinning in a spiral motion. The witness ran away from the helicopter and heard it collide with trees. Seconds later a loud explosion was heard. The witness returned to the accident site to assist the pilots escape the burning wreckage.

Examination of the wreckage site revealed, the helicopter came to rest 75 feet down a ravine on its left side. There were freshly broken trees approximately 50 feet above the wreckage site. The lower pick up hook of the long-line rested on a dirt path with approximately a 50 foot section of long-line extending down towards the helicopter. The long-line displayed heavy fire damage. The cockpit and the main fuselage of the helicopter were consumed by fire. The tail boom was partially consumed by fire, and tail rotor blades were bent and connected to the tail rotor transmission. The tail rotor drive shaft was intact and connected to the main rotor transmission. The five main rotor blades were connected to the main rotor head and displayed buckling and deformation damage. Evidence of the long-line electrical cable was found wrapped around the swash plate. A 38 foot section of the long-line was found on one of the main rotor blades. The engines sustained heavy fire and deformation damage.

Rotorway 162F; Greensboro, NC
March 27; No Injuries

On March 27, 2003, at 1800 EST, a experimental Rotorway 162F lost engine power and collided with terrain during an autorotation. According to the pilot, after the preflight examination of the helicopter was completed, he departed and flew around the airstrip. After several passes over the airstrip, the pilot received an electronic control unit failure indication light. When the engine lost power, the pilot entered an autorotation. During the touchdown phase of the autorotation, the helicopter rolled over on the left side.

Enstrom 280FX; San Carlos, CA
March 28; No Injuries

On March, 28, 2003, about 1650 PST, an Enstrom 280FX, lost engine power on short final approach to touchdown and made a hard landing at San Carlos, California. The commercial pilot and passenger were not injured. The pilot stated that the helicopter performed normally throughout the entire flight. As he made a long approach towards the departure end of runway 30, he executed a 20-foot flare for landing. The low fuel pressure light illuminated, he verified that the fuel boost pump was on, and as he "rolled the throttle on," the engine "sputtered and went dead." In an attempt to safely land the helicopter the pilot made a hard landing. A Federal Aviation Administration inspector observed that both fuel tanks had less than 1 inch of fuel.

Robinson R44 II; Willcox, AZ
April 02; No Injuries

On April 2, 2003, about 0800 MST, a Robinson R-44 II, executed an emergency landing after experiencing a drive belt failure near Willcox, Arizona. The helicopter sustained substantial damage. The cross-country ferry flight departed Tucson, Arizona, about 0700, en route to St. Louis, Missouri.

In a telephone interview with the Safety Board investigator, the pilot reported that the purpose of the flight was to ferry the newly purchased helicopter to St. Louis. The new owner accompanied the pilot. During cruise flight, the alternator light illuminated and the ammeter showed a drop. About 15 seconds later, the clutch light illuminated and the pilot heard a "thud." The pilot lowered the collective and both lights continued to illuminate. The pilot then entered an autorotation. As the helicopter settled from the flare, it contacted a "clump" of dirt. The helicopter tipped forward, which bent the forward portion of the skids, and resulted in the main rotor striking the tail boom.

Bell OH-58A; Calipatria, CA
April 04; No Injuries

On April 4, 2003, about 0555 PST, a Bell OH-58A, collided with terrain after an in-flight loss of control during the initial takeoff climb near Calipatria, California. The local aerial application flight departed about 0555 from a dirt road 8 miles west of Calipatria. Day visual meteorological conditions prevailed, and no flight plan had been filed. The primary wreckage was at 33 degrees 07 minutes north latitude and 115 degrees 40 minutes west longitude.

The local aerial application flight was the first flight of the day for accident pilot. The pilot was onboard the helicopter preparing to depart. He observed the loader walking away from the helicopter, but he failed to notice the 50-foot loading hose was still attached. When the hose became taunt, the helicopter was pulled down until the main rotor blades collided with the ground. The helicopter rolled over and came to rest on the right side, 180 degrees from the departure path.

Enstrom F-28F; Monroe, LA
April 05; No Injuries

On April 5, 2003, approximately 1113 CST, an Enstrom F-28F helicopter, was substantially damaged when it impacted the ground following a loss of aircraft control while hovering at the Monroe Regional Airport near Monroe, Louisiana. The private pilot rated student, sole occupant of the helicopter, was not injured.

According to preliminary information, the pilot rated student was on his second helicopter solo flight and had completed several touch-and-go landings. While practicing hovering over taxiway Hotel, with the helicopter facing into the wind, the pilot initiated a left hovering turn. As the helicopter was turning to face downwind, it became unstable, and the pilot turned the helicopter back to facing the wind. During a second left hovering turn, and as the nose of the helicopter was 90-110 degrees from the wind, the pilot lost control of the helicopter. The right skid hit the ground, and the helicopter came to rest on its left side. At 1117, the weather facility at the airport, reported that the wind was from 050 degrees at 7 knots.

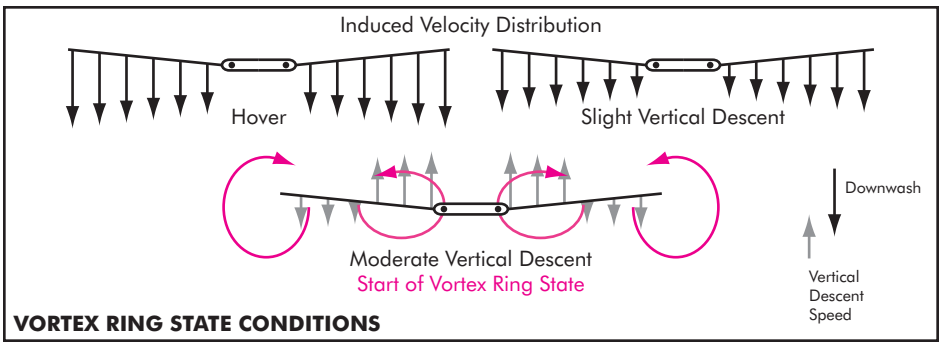
SETTLING-WITH-POWER

In July of 2002, at approximately 1515 Alaska daylight time, an MBB BO-105S sustained substantial damage after colliding with terrain. According to the NTSB preliminary report, the helicopter contacted the ground after developing a high rate of descent during the landing flare. According to the pilot, the helicopter was flying at about 70 feet AGL and at 50 knots over the landing area. During a descending 180 degree left turn to the open flat tundra landing area, the pilot began decreasing the airspeed. The helicopter began shuddering and developed a high rate of descent. As the pilot applied collective pitch and power, the rate of descent increased. Subsequently, the helicopter's right skid contacted the ground and the helicopter rolled over onto its right side. Neither the pilot nor the passenger was injured in the accident. The pilot reported the wind conditions at approximately 8 knots from the northeast, however, the accident brief doesn't state in which direction the pilot was landing.

Although the NTSB has not yet released the official accident cause, the limited information provided by the accident brief points to the signs and symptoms of settling-with-power.

Vortex Ring State

Renowned helicopter aerodynamicist Raymond Prouty describes the vortex ring state as the state resulting from the upflow through the rotor system caused by the descent rate of the helicopter at approximately the same flow rate as the rotor-induced downwash. Prouty further states that in this condition, tip vortices cannot move away from the rotor disc and some of the air becomes trapped in a smoke-ring-shaped body enclosing the outer rim of the rotor. He recommends approach angles shallower than about 50° and corresponding forward speeds of 15 to 30 knots to introduce enough fresh air into the rotor system to blow the tip vortices away from the rotor and free it from the clutches of the vortex-ring state.



VORTEX RING STATE CONDITIONS

The terms vortex ring state and settling-with-power are often used interchangeably. It should be noted, however, that settling-with-power is the end result of the vortex ring state if insufficient power is available to slow or stop the resultant descent. The tail rotor is also prone to vortex ring state under the right environmental or flight conditions.

According to the FAA's Rotorcraft Flying Handbook, three conditions are required to cause settling in a vortex ring state: 1. A vertical or nearly vertical descent of at least 300 fpm. (Actual critical rate depends on the aircraft GW, RPM, DA, and various other factors). Although the 'various' other factors are not listed, the rotor disc loading is a key factor in determining the actual critical rate. Disc loading is determined by dividing the aircraft gross weight by the area of the rotor disc. 2. The rotor system must be using some of the available engine power (from 20 to 100 percent). 3. The horizontal velocity must be slower than effective translational lift.

We do not know in the accident described above how steep the approach angle was or whether or not the pilot was landing downwind, crosswind, or into the wind. The described signs of aircraft shudder and increasing descent rate with increased collective pitch and power are two telltale signs of vortex ring state. At the altitude the pilot was at (approximately 70 feet AGL), there was likely not enough altitude to recover. Prouty states that power settling has been experienced during the downwind flare. Perhaps this is what occurred during the BO-105 accident?

Depending on the reference, approach angles of less than 50° (Prouty), or 30° (U.S. Army Fundamentals of Flight Manual), forward speed greater than 15 to 30 knots (Prouty), or 10 knots (Army), and rates of descent less than 300 fpm are recommended to remain clear of the vortex ring state. Remember, settling with power is also possible with downwind approaches. Unfortunately, as was the case with the described accident, seldom in helicopter flying is there enough altitude to recover from this situation if and when it does occur. That is why it is so important to evaluate your situation during your reconnaissance of the landing area. A very steep approach angle may be fine if the winds are strong enough and the approach direction is made taking advantage of the wind. The key is to have a specific plan, evaluate each situation, and have knowledge of the potential hazardous flight conditions. If you're like me, I would rather learn the lesson from others than by demonstrating it myself!

Kent Sapp holds Helicopter CFI, CFII and ATP ratings as well as Airplane Commercial/Instrument/Multi-engine, CFI and CFII ratings. He is an active duty Army Instructor Pilot, Instrument Flight Examiner and Aviation Safety Officer currently stationed in Japan.

Illustration: From Cyclic & Collective by Shawn Coyle

EXEMPT OR NON-EXEMPT, THAT IS THE QUESTION

Many U.S. helicopter pilots, for years, have been categorized by their employers as exempt employees. Exempt employees are typically paid straight salaries rather than hourly, and are not paid for overtime. Nine past and present Corporate Jets pilots, assigned to a UC Davis EMS contract in California have taken exception to this practice.

A total of nine pilots, six of whom are still employed at UC Davis, have filed grievances with the State of California Labor Board asking the state to rule on whether or not they are entitled to back pay for an accumulation of "overtime." The company, to date, has rejected the pilot's claims on the basis that the pilots are employed on an exempt basis.

One of the pilots, Jack Pulley, recently laid off by Corporate Jets, is a PHPA member and is receiving legal assistance from PHPA in the support of his claim. The State of California, the pilots, and Corporate Jets met in an initial hearing, where Marsha Rarick, the Deputy Commissioner of the California Department of Labor presented the State's opinion to Corporate Jets. The California Labor Board supports the pilot's position that they are, in fact, non-exempt employees. Corporate Jets chose to pursue the matter in court, rather than accept the Labor Board's recommendations.

Each employee's claim is pursued individually by the State of California and the first claim has a trial date set for May 8th. The outcome of this case has the potential to impact pilots both in and out of California working for a number of operators. Autorotate will follow the progress of these cases and keep our members informed.

PHPA STORMS HELI-EXPO

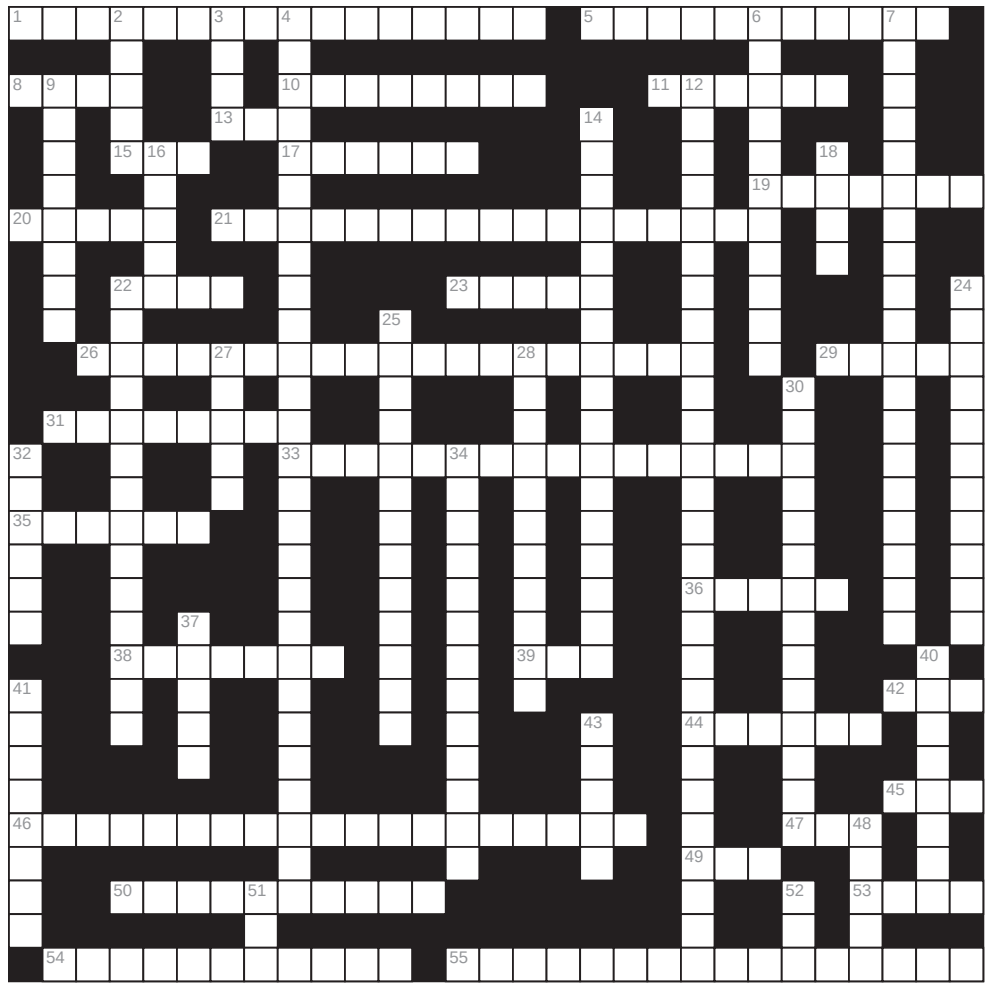
PHPA descended upon Heli-Expo and Dallas this February to help spread the word that helicopter pilots have a group and a voice of their own. Heli-Expo, organized by HAI, is the predominant helicopter industry show and exposition in the world and is held annually. This year, more than 12,000 attendees gathered in Dallas to share ideas, sell products, meet friends, get educated, and to experience the awe derived from standing in the midst of 30 or so helicopters—indoors.

Representatives from PHPA were Bill Blume, John Bosch, Tony Fonze, Butch Grafton, Carl Neubig and wife Gail, Steve Ragin, and Ron Whitney. We were all kept busy, Saturday through Tuesday, talking to both passersby and those who made a point of coming by for a visit. I particularly enjoyed seeing old friends and sharing with them autorotate's new life and mission, as a part of PHPA. We handed out over 3,000 copies of our magazine and PHPA introductory packages and shook literally thousands of hands. It was a great experience and we expect many good things to come from it. Special thanks to Ron Whitney for helping set up the arrangements for the show and to Carl Neubig for single handedly wrestling several thousand people into the booth.

Photography: (clockwise from top right) PHPA member Ginger de Villa Rose (r) and friend; DTC's Jim Metze, Kim Sparks and Doug Priestly; There were little helicopters at HAI; And Really big helicopters too; FLY IT Simulators was besieged with test drivers; PHPA members Rikke and James Carmichael in front of PHPA booth. Autorotate Staff.

Cross Word

By Ron Abshirer



ACROSS

1 Tell me what you plan to do. (2 words)

5 A departure time restriction issued to a pilot by ATC. (2 words)

8 My transmission is ended, I expect a response.

10 The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL).

11 Straight line flight between two navigational aids, fixes,points or any combination thereof.

13 When repeated three times, indicates uncertainty or alert.

15 The barometric pressure used for the standard altimeter setting.

17 Activate specific modes/codes/functions on the aircraft transponder.

19 Used in radio transmissions to indicate that the controller or pilot must pause for a few seconds, usually to attend to other duties of higher prio.

20 The time between the end of evening civil twilight and the beginning of morning civil twilight.

21 ATC (3 words)

22 Pilot to metro services, abbreviation.

23 Military Authority Assumes Responsibility For Seperation Of Aircraft

26 ATC authorization for an aircraft to make a touch and go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. (4 words)

29 Terminate a preplanned aircraft manuever.

31 A route designed to serve aircraft operations from 18,000 feet MSL up to and including flight level 450. (2 words)

33 An airport at which an aircraft may land if a landing at the intended airport becomes inadvisable. (2 words)

35 A nongovernment communication facility which may provide airport info at certain airports.

36 When a fix, point, or object is approximately 90 degrees to the left or right of the aircraft track.

38 An area on land or water that is used or intended to be used for the landing and takeoff of aircraft.

39 The conversation is ended and no response is expected.

42 Abbreviation for a service which seeks missing aircraft and assists those found to be in need of assistance.

44 Used to instruct pilots to advise ATC of specified information.

45 Abbreviation for the estimated flying time from departure point to destination.

46 Minimum altitude specified for various aircraft operations. Altitudes depicted on approach charts which provide at least 1,000 feet obstacle clearance. (3 words)

47 Height of DECISION Height or Minimum Descent Altitude above the highest runway elevation in the first 3,000 feet of the runway. Abbreviation

49 Equipment (airborne and ground) used to measure, in slant range distance of an aircraft from the navigational aid. Abbreviation

50 Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an FSS or ATC facility. (2 words)

53 Area of airspace over land or water, extending upward from the surface, within which the ready identification, the location and the control of aircraft are required in the interest of natl. security.

54 Let me know you have received my message.

55 A condition of air piracy or other hostile act by person(s) aboard an aircraft which threatens the safety of the aircraft or its passengers. (2 words)

DOWN

2 Abbreviation for Information Request.

3 Initial approach Waypoint, Abbreviation.

4 A continuous recording of meteorological and aeronautical information that is broadcast on L/MF and VOR facilities for pilots. (3 words)

6 A request to reduce speech rate. (2 words)

7 A point prescribed in each instrument approach procedure at which a missed approach procedure shall be executed if the required visual reference does not exist. (3 words)

9 Circular patterns of air created by the movement of an airfoil through the air when generating lift.

12 A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions to a point from which a landing may be made visually. (3 words)

14 A map used in air navigation containing all or part of the following: navigation aids, navigation routes, designated airspace, and airports. (2 words)

16 Notice to Airmen. Abbreviation.

18 The movement of an airplane under its own power on the surface of an airport.

22 Person responsible for the operation and safety of an aircraft during flight. (3 words)

24 Device normally located on uncontrolled airports and used as a landing indicator.

25 The manuever prescribed when it is necessary to reverse direction to establish an aircraft on the intermediate or final approach course. (2 words)

27 A defined path, of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth.

28 Any object/obstacle exceeding the obstruction standards specified by FAR Part 77, Subpart C.

30 An approach requested and conducted by a pilot which will result in either a touch-and-go, missed approach, low approach, stop-and-go, or full stop landing. (2 words)

32 Authorizes the pilot to fly at any altitude from the minimum IFR altitude up to and including the altitude specified in the clearance.

34 A flight path over which the pilot is performing his own navigation. (2 words)

37 The actual flight path of an aircraft over the surface of the earth.

40 Used by ATC to taxi an aircraft on the runway opposite to the flow of traffic. (2 words)

41 Weather condition requirements established for a particular operation or type of operation; e.g., IFR takeoff or landing

43 Loss of the ability to communicate by radio. Aircraft are sometimes referred to as this.

48 In respect to icing, the rate of accumulation is slightly greater than the rate of sublimation.

51 Abbreviation Height Above Landing

52 Primary radar equipment is used to determine the position of an aircraft during final approach, and communicate guidance instructions to the pilot.

ANSWERS - next issue

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