TWIN & TURBINE

FOR THE PILOTS OF OWNER-FLOWN, CABIN-CLASS AIRCRAFT

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Howard 500

Vintage Cabin-Class Twin Embodies Artistry & Power

Delivering Hope: Owner-Pilots Play Critical Role Following Hurricanes

Wake Turbulence: It Can Happen At Any Altitude

Seeing the Future with Vertical Profile Radar

Miller: Do You Know Your Limitations?

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N500LN, the 13th Howard 500.
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by Dianne White

A Passion That's Not Aviation

If you are like 99 percent of aviation families I know, not everyone in your family embraces aviation the way you do. You may eat, sleep and breathe flying and if you're lucky, some in your clan may join in your obsession. I feel incredibly fortunate to be surrounded by family members who are pilots: my mother (THE aviation matriarch of our familial tree), father, husband, father-in-law and eldest daughter.

The one exception to this lovefest is the youngest of our two daughters, Erin. This sweet, talented young woman has many interests and passions, but aviation isn't one of them. Certainly, she loves to travel and has been flying in GA airplanes since she can remember. Spring break trips to the Caribbean, vacations in the mountains, visits to Grandma's, transportation to camp…most of these voyages were made possible thanks to general aviation. So, while she prefers taking one of our airplanes versus suffering through the TSA/airline gauntlet, she has no desire to assume the left seat. During the holidays (and countless other times, too), she suffers through long, boring discussions about airplanes, avionics and "there I was" flying stories. And she does it mostly without complaint.

There is one type of flying with which Erin has an anomalous obsession. Since she was seven, she has wanted to skydive. It was the thing she begged for at every birthday and Christmas. Much to her father Tim's relief, the law states you must be the age of consent – 18 years – to skydive in the United States. The countdown began 11 years ago to her 18th birthday. Her sister and I readily agreed that we would go with her when the time came. Quite adamantly, Tim saw absolutely no reason to jump out of a perfectly good airplane, unless it was on fire. He said, "I will happily stay on the ground and cheer you on."

Finally, Erin turned 18, and the day of her long-awaited jump arrived. It would be tandem, with experienced skydiving instructors strapped to our backs. As we signed the waivers and prepared to begin the ground training, I noticed Tim pacing back and forth. Thinking he was nervous about our impending jump, I stepped over to reassure him.

"That's not it at all – okay maybe a little bit – but I can't be the wimp who's sitting on the ground while all three of his girls leap out of an airplane." With that, he threw down his credit card and began furiously filling out forms.

Soon, we were piling into a beat-up King Air and barreling down the tiny airstrip. Erin was beaming, high-fiving everyone and mugging for the GoPro. On our way up to 13,000 feet I looked back at Tim, his face ashen but doing his best to be a team player. Once at altitude, we lined up for our exit: Abby followed by Erin, then me and lastly Tim. Pair by pair, we launched. Tim stood helplessly watching his entire family fling themselves out of the doorway, hurtling toward the ground at a terminal velocity of over a 100 kts. He later admitted he felt a bit queasy.

The experience was everything that Erin dreamed it would be, from the freefall, the chute pull, the serene ride under canopy and finally the soft landing back on terra firma. She was immediately ready to go again. Tim said once was enough for him.

I am glad we could share in this magical experience with Erin, something that she had long dreamed and patiently waited to do. Flying will never stir her soul the way it does for the rest of us, and that's perfectly fine. Just as my mother fed my passion for flight, we will continue to support and encourage Erin's passions, even if it means feeling a bit queasy at times.

Over Thanksgiving dinner, Erin commented that she can't wait to skydive again. "Who's with me?" she asked. After an uncomfortable moment of silence, my mother – Erin's grandmother who turns 75 next year – thoughtfully said, "That's something I've always wanted to try – I'll go!"

Happy holidays and best wishes for a prosperous 2018!

Diane


Jay Selman Photo (www.jaybirdaviationphotos.com)

Howard

For the first time since it had arrived at Oshkosh AirVenture 2017, the big blue-and-silver beauty was not surround by throngs of gawkers. Only curious stragglers, captivated by the machine, wondered aloud what it was. Upon learning it was a Howard 500, most assumed that Howard Hughes, Hughes Aircraft, or the Howard Aircraft Company (builders of the single-engine Howard DGA) were involved. None were, though its elegance easily conjures up such romanticized imagery.

Mechanical Artistry

The Art Deco period ended as WWII began, but Dee Howard seems to have been a fan of the era's unmistakable panache. The decommissioned military aircraft he and his famed mechanic Ed Swearingen built ushered in upscale executive transportation. Their ever-evolving series of conversions, focusing mainly on the Lockheed Lodestar and Ventura models, seemed to ooze art deco styling. Howard Aero Corporation's swan song was a design Howard hoped could compete while retaining unparalleled luxury.

Through obsessive persistence, it became the first pressurized, cabin-class, bizliner with transcontinental range. Sadly, even Mr. Howard admitted, it came a decade too late. The design was finalized in 1958 and conversions of PV-1/B-34 Ventura airframes began in 1959, concurrent with the process to certify the Howard 500 as an independent type. The HW-500 was not a conversion in the truest sense. Design and engineering changes imposed upon donor airframes were so extensive that the final product was a whole new aircraft, including unique flight characteristics, systems, performance and operational parameters.

Fuselages were built new, incorporating a 48-inch stretch and major structural changes necessary for pressurization. Huge double-pane windows, a three-panel windshield, a vault-like cabin door, and a fully enclosed aft lavatory were designed in. Under the floor, two massive baggage areas resided where the Ventura's bomb bays had been. The typical 12-passenger corporate configuration included

500

by **Matthew McDaniel**

folding tables, divans (couches), galley and numerous stowage areas. Although, in a high-density configuration, it could carry 19 passengers.

The all-new wing center-section incorporated additional tanks for fuel, oil, deice and engine anti-detonation fluids. This wider and stronger wing spaced the engines further apart, lowered cabin noise, incorporated redesigned fowler flaps, and provided a wider gear stance. Pratt & Whitney R-2800 engines (the same 18-cylinder radials used on the DC-6 airliner) produced a total of 5,000 hp (20 percent more than the PV-1). Two-speed superchargers boosted manifold pressure to 62 inches for takeoff and kept it well above sea-level power through the entire altitude envelope. Power was converted to thrust with 11-foot, Hamilton Standard props made up of Lockheed Constellation blades, modified Corsair hubs and DC-7 spinners.

The extra weight was carried using strengthened gear from the heavier PV-2 Harpoon with massive brakes adapted from the DC-7 (including an analog anti-lock system). Every flight control, mechanical, electrical, pneumatic, and hydraulic system was redesigned for increased reliability and redundancy. In the end, the only commonality between a WWII production PV-1/B-34 and the Howard 500 were the outer wing panels and the tail feathers.

Certification Purgatory

Howard's team worked and waited from 1959 to 1963 to achieve type certification of the HW-500. Meanwhile, large competitors (propelled by massive budgets and infrastructures earned as the spoils of

Front office of the Howard 500: One of the busiest throttle quadrants to be found on any twin.

The elegant lines of the Howard 500 are apparent from nearly any angle. The distance between the aft belly and the ground is not nearly as close as the grass parking spot makes it appear.

wartime contracts) sailed their new turbine business aircraft designs through certification with relative ease. Concurrently, 17 Howard 500's were produced. Yet, even among those, Howard and Swearingen were still tweaking the design, essentially building highly individualized, handcrafted aircraft. Thus, no two HW-500's were exactly alike (further complicating certification).

Even before certification, the HW-500 found itself competing against new turbine aircraft designs already dominating the marketplace. It wasn't the performance of those aircraft that sealed the fate of the HW-500. In fact, the Howard's performance could best that of the early cabin-class turboprops. However, the comparative ease of maintenance offset any minor performance deficiencies and the smaller, less-opulent cabins of the turboprops. While the Howards required many hours of maintenance per flight hour, the competing turbine aircraft

The distinctive twin tails of the Ventura did not need to be enlarged to deal with the higher weight and horsepower of the Howard 500, thanks to extra 4 feet of length designed into the 500's fuselage. The 13th Howard 500, N500LN, in its natural element.

operated routinely using the opposite equation. Time had run out to bring a truly standardized production version of the HW-500 to market. The process did provide the HW-500 one distinction it is likely to retain forever: it was the last radial-engine, passenger aircraft to be FAA-certified in the Transport Category. In future ventures, Dee Howard and Ed Swearingen would both continue to leave indelible impressions in the aircraft design, modification, and manufacturing fields for decades to come.

Some purchasers wouldn't accept their plane until the design was officially certified as an HW-500, which didn't happen until February 1963. Buyers who'd taken delivery upon completion, received a "Pressurized PV-1 Ventura" conversion. The assumption being that once certification of the Howard 500 was complete, re-certification as HW-500's would be a simple paperwork exercise. In most cases this happened in 1963-64, but in at least one case, it never happened.

N500LN (Howard 500 Serial #500-113)

Most of Howard Aero's PV-1 donor aircraft were ex-South African Air Force (SAAF) aircraft (some with actual combat histories). The 13th PV-1 to morph into an HW-500 was Lockheed serial No. 5560, which began its military life in September 1943 as SAAF ship #6417. It accumulated only 827 total airframe hours before acquired by Howard Aero in late 1959. Its transformation was completed in Nov. 1962. Five owners and registration numbers later, it was exported to England in 1978, where it remained under the U.S. registration N500LN for 30 years. Today, it is one of only two Howard 500's still airworthy, both owned by Tony Phillippi of TP Aero in Minnesota. Both are still actively flown as corporate aircraft, supporting Phillippi's equipment and export businesses.

The first operator accepted delivery before Howard Aero officially achieved certification of the HW-500 type. So, it was delivered as a "Howard Super Ventura" (in Howard Aero's marketing lingo). Apparently, the original buyer (nor any subsequent owner) felt the need to complete the paperwork after the HW-500 type certification was completed. Thus, when it returned to American soil in 2012, it did so still officially designated a Pressurized PV-1 (L-B34) in the FAA records. TP Aero has owned and actively flown the only other flyable Howard 500 (N500HP, the fifth of the 17 HW-500's) for the past 15 years and employs the only active, type-rated, HW-500 pilots in the world. In order to fly both aircraft using their existing HW-500 type ratings, they successfully convinced the FAA to allow N500LN to be operated as a HW-500, based upon the fact that (official certification notwithstanding), the aircraft conforms to the HW-500, rather than the PV-1/B-34 it was derived from.

Since its purchase in 2009, N500LN has been thoroughly restored. While still in Europe, it received new engines and extensive mechanical work before touring parts of Europe and crossing the North Atlantic. The restoration was completed in the United States, concluding with new paint and a brand-new interior (that exactly matches the original and retains that Art Deco style). Attention to detail is apparent everywhere you look and stepping aboard is like walking into a time warp. N500LN personifies the belief that the journey is more important than the destination.

The Howard 500 was unique from its Ventura lineage right down to the rudder pedals.

High Pilot Workload: The Cost of Going Retro

After walking through the long, stand-up cabin and stepping over each of the three beefy wing spars, I climbed into the cockpit and sat for a long time. Taking in the placement of controls and instruments, I tried to imagine workload flows for various phases of flight. Buttons, knobs, levers, and switches blossom like wildflowers on a prairie. The workload in the ergonomically-designed, glass-cockpits of today is laughably simple in comparison.

Ryan Mohr was instrumental in the acquisition of N500LN. While he currently flies Boeing 737's for an international airline, he is also still a current HW-500 captain. Mohr soon arrived to help me better decipher the checklists and preflight items. At times, the uniqueness of each Howard 500 would present itself as we'd reach an item on the checklist that caused a pause. Mohr commented that some items only applied to

The new center section of the Howard 500 allowed the huge fowler flaps to be redesigned and enlarged when compared to the stock Ventura flaps.

Phillippi's other HW-500 (N500HP) or vice-verse, based on minor differences between the two machines. Afterward, he deftly started the massive radials as only an experienced round-engine master can. With virtuosity, his hands moved between throttles and mixtures, while his fingers danced between starter, primer and magneto switches, as blue and white smoke belched from the stacks and low-pitched snorts announced the R-2800's reawakening.

I was warned that the brakes were quite sensitive. Maneuvering out of AirVenture parking, I was humbled immediately as I curled three toes of one foot to apply some differential brake pressure and the 500 lurched abruptly in protest. But, by the time we'd reached the runway, I'd adjusted and found her surprisingly nimble to taxi (careful attention to its size notwithstanding), if kept slow to reduce the directional instability inherent to all taildraggers.

For takeoff, one cannot simply firewall the throttles and go. At low speed, the P-factor of the 5,000 HP cannot be overcome with rudder pressure. Throttles must be advanced slowly, leading with the left by 15 inches MAP or more, to allow the Howard to accelerate and get enough airflow across the twin tails to compensate for left turning tendencies. Only after the tail is flying can matching power be applied to the right engine without fear of a runway excursion.

While the Howard is about the same weight as a DC-3, it has over 40 percent less wing area and double the horsepower. Rotation (V_r) and takeoff decision (V_1) speeds are both 98 KIAS, while the single-engine takeoff safety (V_2) and liftoff speeds are 111 KIAS. However, 130 KIAS is consider a more practical initial climb speed to provide appropriate engine-failure safety margins.

Thanks to Mohr's coaching, the procedure was straightforward and the technique is similar to a soft-field takeoff in any small aircraft. It helps that the Howard's robust landing gear retract in under three seconds, which could be critical in reducing drag in an engine-failure scenario. While there is an auto-feather system, it takes about 10 seconds to fully feather the offending prop. So, the rudder-boost system is critical in single-engine situations, where it can reduce required rudder force by as much as 85 percent.

Kid Gloves

While the two remaining Howard 500's still fly whenever duty calls, they are no longer expected to perform like youngsters. Their pressurization system was state of the art for its time, with 6.75-psid that provided sea-level cabin

The aft end of the Howard's cabin features a large, fully-enclosed lavatory with a running-water sink.

The stand-up cabin of N500LN accommodates 12 passengers in executive-level comfort. Each set of club seats in an executive-configured Howard 500 cabin included a stowable work table and cup holders to complement the adjustable leather seats.

altitudes at 16,000 feet. Even though they are capable of cruising at FL250, typical cruise is kept in the low flight levels or below. This allows minimal pressurization to be used, putting far less strain on the fuselage, window and door structures. Similarly, the need to use engine "high blower" supercharging or alcohol-injection is rare, greatly prolonging cylinder life and reducing overall engine maintenance. Operating on 100LL fuel slightly reduces the max takeoff MAP permitted, as well. While all systems on Phillippi's two Howard 500's are fully operational, there is full recognition that these machines are pushing 60 years old and they are operated accordingly.

Under the close supervision of Mohr, I climbed at 150-160 KIAS to 14,500 feet. Using sedate power settings, we still achieved near 225 KTAS, while consuming just under 200 GPH (with two pilots, five passengers, and a week's worth of Oshkosh cargo aboard). Flying the Howard is pure joy. The aircraft is relatively quiet due to its slow-turning, geared props. Control harmony is near perfect. The hydraulically-assisted rudders are easily manageable throughout the speed envelope. Aileron and elevator servo tabs provide aerodynamic assistance to keep both controls light while retaining just enough required break-out force to keep them naturally neutralized. Each yoke is equipped with electric pitch trim, yet I found that fine-turning was far easier via the manual trim wheel. Monitoring the engine and fuel parameters is challenging due to the chaotic panel layout, but after a while your eyes begin to dart around as necessary to gather the desired information.

On descent, engine temps were the primary focus. Mohr coached me on power settings to use and did most of the other engine management tasks (mixtures, cowl flaps, oil cooler doors, carb heats, etc.). He schooled me on appropriate times for gear and flap extension to be stabilized on final. I then slowly decelerated to cross the threshold at 105-110 KIAS. Mohr advised that the combination of big tires and short/stout gear legs made "greaser" landings rare. Sure enough, my landing was no greaser, but the big beauty was not unruly by taildragger standards. I'm sure in more challenging conditions, it wouldn't hesitate to bite if provoked or neglected. Like any taildragger, it requires an engaged PIC all the way to the parking spot.

Passion and Reverence

The time of art-deco, radial-engine bizliners is long past. Therefore, operating a mini-fleet of them for modern-day corporate transport is far from practical. However, Tony Phillippi and his pilots and mechanics are positively reverent toward Dee Howard and the aircraft he created. The majesty and engineering brilliance of the Howard 500 fuel their passion to keep the last two flying for the foreseeable future. Alas, the practicality and passion of such lofty endeavors are mutually exclusive. T&T

Matthew McDaniel is a Master & Gold Seal CFII, ATP, MEI, AGI, & IGI and Platinum CSIP. In 25 years of flying, he has logged nearly 16,000 hours total, over 5,500 hours of instruction-given, and over 5,000 hours in all models of the Cirrus. As owner of Progressive Aviation Services, LLC (www.progaviation.com), he has specialized in Technically Advanced Aircraft and Glass Cockpit instruction since 2001. Currently, he also flies the Airbus A-320 series for an international airline, holds 8 turbine aircraft type ratings, and has flown over 80 aircraft types. Matt is one of only 25 instructors in the world to have earned the Master CFI designation for 7 consecutive two-year terms. He can be reached at: matt@progaviation.com or 414-339-4990.

Textron Aviation Unveils Turn-Key Maintenance Program

Ideal for owner-pilots or small operators.

Textron Aviation has introduced a new maintenance solution tailored for the owner-pilot of Cessna Citation, Beechcraft King Air and Cessna Caravan aircraft. Called ProMaintenance, the turnkey program covers the complete maintenance spectrum, including management of scheduled, unscheduled and aircraft on ground (AOG) maintenance events.

"Designed to alleviate any additional complexity that comes with managing aircraft maintenance, ProMaintenance is an ideal solution for an owner-operator or a larger operation that may not have a full flight department," said Kriya Shortt, senior vice president, Customer Service.

Customers enrolled in ProMaintenance receive a customized support program tailored to their needs that can include:

- Dedicated director of maintenance;
- Total management of scheduled, unscheduled and AOG maintenance events;
- Aircraft pickup to and from service center;
- Management of airworthy directives, service bulletins and inspections;
- Technical records administration;

- Maintenance tracking and reporting;
- Coordination of approved modifications and repairs.

ProMaintenance is complimentary for FAR Part 91 Citation customers who utilize Textron Aviation's company-owned service network for maintenance and support. While the program is currently limited to U.S.-based customers, Textron Aviation offers similar solutions for European customers through its CAMO program, which is available through all six Textron Aviation company-owned service centers across Europe.

Textron Aviation has a global network of 18 company-owned service centers, nearly 200 authorized turbine service facilities, more than 60 MSUs and three dedicated aircraft for complete, immediate 24/7 response. T&T

I See the Traffic And Its Wake

Wake turbulence can be dangerous at any altitude or phase of flight. Know how to visualize its location – and what to do if you find yourself in an upset.

by **Thomas P. Turner**

There's an Alert Area over my home airport on the northeast side of Wichita, Kansas. There are no restrictions to civilian IFR or VFR flight in an Alert Area; they exist, according to definition, "to inform nonparticipating pilots of areas that contain a high volume of pilot training operations, or an unusual type of aeronautical activity that they might not otherwise expect to encounter. Pilots are advised to be particularly alert when flying in these areas." Alert Area A-683 warns pilots about extensive visual traffic at McConnell Air Force Base, most notably, KC-135R heavy tankers at this, one of the U.S. Air Force's so-called "supertanker bases."

Every time I look up and see a tanker fly in McConnell's visual pattern that take it almost directly over the airport where I'm based, or I sight a KC-135 on upwind, downwind or base leg when I'm in the air, I think not only about traffic avoidance, but also about avoiding that airplane's very significant wake turbulence as well.

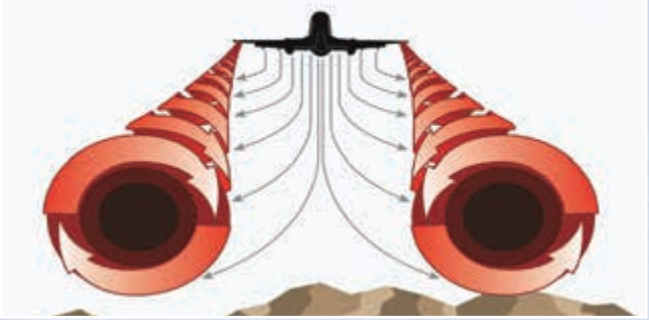
Some pilots might not realize that when you are in visual meteorological conditions you are responsible not only for avoiding a collision with other airplanes, you are also required to maneuver

to avoid encountering that airplane's wake. If you are IFR in instrument meteorological conditions controllers will provide separation from airplanes and the expected location of their wake turbulence. But even if you're IFR in VMC, or ATC advises you of traffic and you report it the traffic sight, *you* assume responsibility for avoiding the airplane and its wake turbulence, too.

Most instruction and guidance about wake turbulence avoidance focuses on avoiding wakes during takeoff and landing. Certainly, that's where you're most likely to have a wake turbulence encounter, because you are sharing a very small airspace with other airplanes (and the air they disturb). Comparatively little time is spent on training teaching and reviewing how to avoid wake turbulence encounters away from the runway. Yet as I said earlier, it's *our* responsibility to avoid wake turbulence anywhere it may exist in visual conditions.

Uncontrolled Roll

A Canadair Challenger 604 was cruising at FL340 over the Gulf of Oman in January 2017. An Emirates Airways Airbus A380, en route from Dubai to Sydney, Australia, passed overhead at FL350, 1,000 feet higher than the business jet. The crew of the Challenger was quoted by FlightServicesBureau.org as saying: "A short time later (one to two minutes) the aircraft encountered wake turbulence sending the aircraft into an uncontrolled roll, turning the aircraft around at least three times (possibly even five times). Both engines flamed out [and] the aircraft lost about 10,000 feet [before the crew] was able to recover the aircraft, restart the engines and divert to Muscat.



The wake behind an aircraft consists of two counter-rotating cylindrical vortices. The strength of the vortex is governed by the weight, speed, wing shape and wingspan of the generating aircraft.

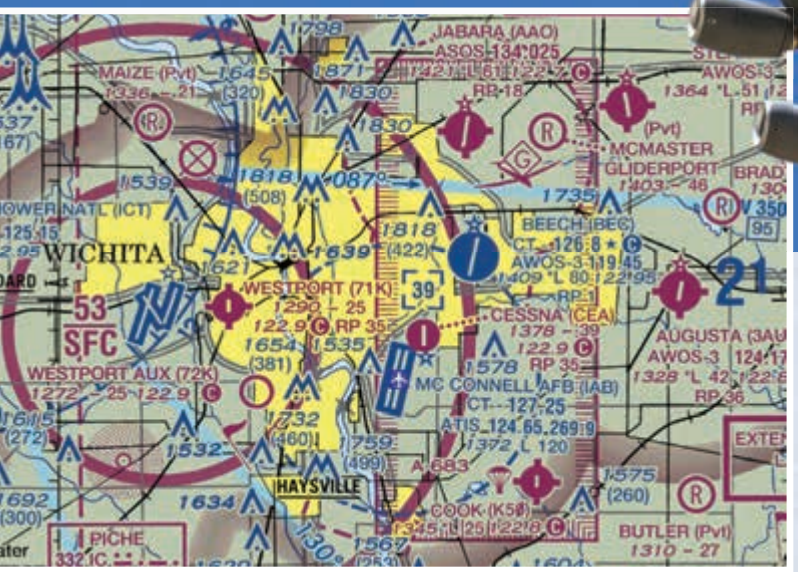
The aircraft received damage beyond repair due to the G-forces [encountered], and was written off."

Anyone who has ever flown a 360-degree, level steep turn and hit a bump at the end knows even airplanes as small as a Cessna 150 leave a wake of disturbed air behind them. When the airplane trailing a wake is bigger than the one you're flying, its wake turbulence may be strong enough to upset your airplane – or worse.

So how *do* wake vortices behave? What strategies can we use to avoid them, in climb, cruise and descent as well as during takeoff and landing?

PAUL BOWEN PHOTO

The airspace near Wichita, Kansas has an Alert Area that warns pilots about extensive visual traffic – including KC-135R heavy tankers – at McConnell Air Force Base.



Air Force KC-135's based at McConnell Air Force Base are a common sight in the airspace around Wichita, Kansas.

Wake Turbulence Advisory

FAA Advisory Circular (AC) 90-23G provides specific information about wake turbulence formation and behavior, as well as suggesting avoidance techniques. Let's summarize and comment on the highlights of this guidance.

Lift is generated by pressure differential above and below the wing surfaces…the lowest pressure over the upper wing surface and the highest pressure under the wing. This pressure differential results in swirling air masses trailing downstream of the wingtip. The wake consists of two counter-rotating cylindrical vortices (AC-90-23G figure 1). The strength of the vortex is governed by the weight, speed, wing shape and wingspan of the generating aircraft. The extension or retraction of flaps, slats or other wing configuring devices will change the vortex characteristics of an aircraft. However, most significantly the vortex strength increases with an increase in aircraft operating weight or decrease in aircraft speed. The greatest vortex strength occurs when the generating aircraft is heavy, slow and clean (flaps and slats retracted) since the turbulence from a "dirty" aircraft configuration hastens wake decay.

Flying around Wichita with a KC-135 in the McConnell pattern? Until it turns final, the tanker is fairly heavy, flying fairly slow, and has its flaps and other wing devices retracted, generating its greatest vortex strength, according to the FAA. AC 90-23G continues:

Air density is also a factor in wake strength. Even though the speeds are higher in cruise at high altitude, the reduced air density may result in wake strength comparable to that in the terminal area. In addition, for a given separation distance, the higher speeds in cruise result in less time for the wake to decay before being encountered by another aircraft.

Since both a traffic pattern encounter and an en route, high-altitude confrontation may result in significant vortex strength, we need to know how wake turbulence behaves after it leave the airplane's wingtips.

Where Does It Go?

The horizontal tornadoes that roll off an airplane's wingtips when lift is generated have been found to exhibit predictable behavior:

The vortex circulation is outward, upward, and around the wing tips when viewed from either ahead or behind the aircraft. The vortices remain spaced slightly less than the distance of the generating airplane's wingspan apart, drifting with the wind. Vortices sink at a rate of several hundred feet per minute (fpm), slowing their descent and diminishing in strength with time and distance behind the wake-generating aircraft. Atmospheric turbulence hastens decay.

The worst-case atmospheric conditions are light winds, low atmospheric turbulence and a stable atmosphere. En route in these conditions, vortices can descend more than 1,000 feet. In rare cases, wake turbulence can rise in an updraft or when it bounces off the top of a strong inversion layer.

If the air is indeed stable, the wake turbulence behind a heavy airplane will take as much as 5 miles to make the 1,000-foot descent. The vortices will then linger at that lower altitude, drifting downwind, until the turbulence eventually dissipates. AC-90-23G Figure 5 shows some of the behavior of wingtip vortices.

Caution: Wake Turbulence

Air traffic controllers will provide a "Caution: Wake turbulence" advisory call any time they feel wake turbulence will be an adverse factor for your airplane. This is normally a one-time advisory – the controller only tells you once, and you're expected to heed the warning thereafter.

We usually expect to hear the wake turbulence advisory when following a larger airplane for takeoff or landing; they're not commonly heard away from the immediate airport area. That's because, as stated at the beginning of this article, if a pilot is in visual conditions it's that pilot's responsibility to visually detect other aircraft and to then predict and avoid the location of its vortices as well.

A few notes from the FAA about wake turbulence avoidance:

Whether or not a warning or information has been given, ATC expects the pilot to adjust aircraft operations and flightpath as necessary to preclude wake encounters.

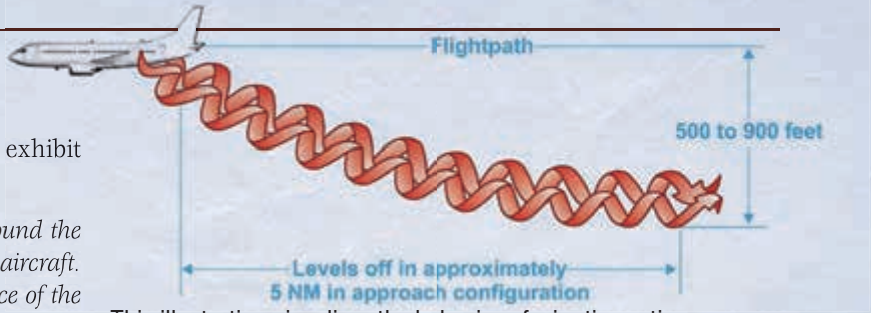
When any doubt exists about maintaining safe separation distances between aircraft to avoid wake turbulence, pilots should ask ATC for updates on separation distance and groundspeed.

If a larger aircraft is observed above on the same track (meeting or overtaking), adjust your position laterally, preferably upwind.

Fly at or above the preceding aircraft's flightpath, altering course as necessary, to avoid the area behind and below the generating aircraft.

Recovery

The proper technique for recovering from a strong wake turbulence encounter may seem counterintuitive. It also differs from what was taught about upset recovery for many years. For



This illustration visualizes the behavior of wingtip vortices.

some time, pilots were encouraged to learn to command a roll in the direction of turbulence-induced roll, to turn an upset into a full, 360-degree roll to recover upright, most sources now recommend against rolling recover because most airplane will lose a substantial amount of altitude in the process (consider the Canadair Challenger experience).

Instead, most experts recommend letting the airplane enter an unusual attitude during the encounter, and then recovering from that attitude. AC90-23G states:

It may be better to allow the aircraft to transition through the wake and then recover from any resultant unusual attitude, rather than aggressively trying to control the aircraft during the wake encounter. If an autopilot is engaged and remains engaged, it may be better to allow the autopilot to recover from the wake vortex encounter rather than disconnecting the autopilot and using manual control inputs. However, be prepared to assume manual control of the aircraft if the autopilot disengages.

Prior experience or training that emphasizes use of rudder input as a means to maneuver in roll may not apply to all aircraft operations. Using the rudder to counter roll rate during a roll upset may lead to an undesirable aircraft response. Large, aggressive control reversals can lead to loads that can exceed the structural design limits.

Specialized upset recovery training in aerobatic airplanes is still a superb idea for all pilots. If you attend training intended to give you the skills needed to best recover from a strong wake turbulence encounter, expect it to emphasis unusual attitude recovery, and not commanding a roll with the vortex until you are again upright, as your best response to an upset.

Back Under the Pattern

When I'm departing or inbound to my home airport and see a KC-135R in the McConnell Air Force Base pattern above me, or any time I am operating in the vicinity of a larger airplane away from the immediate runway environment, I consciously visualize a pair of wingtip-vortex tornadoes extending behind the airplane, gradually drifting down to about 1,000 feet below the airplane 2 to 5 miles behind it and hovering there, drifting with the prevailing wind. When I see the traffic, I also see its wake so I can see and avoid the entire turbulence complex, not just the airplane that generates it. T&T

Thomas P. Turner is an ATP CFII/MEI, holds a master's Degree in Aviation Safety, and was the 2010 National FAA Safety Team Representative of the Year. Subscribe to Tom's free FLYING LESSONS Weekly e-newsletter at www.mastery-flight-training.com.

General Aviation

Paul Weismann (third from left) volunteered to fly his Citation V on relief missions to areas hit by Hurricane Maria. Approximately 150 flights were completed to Puerto Rico, St. Thomas, St. Croix and Dominica.

by **Rebecca Groom Jacobs**
Photos courtesy of PALS Sky Hope

Earlier this year, in a matter of just four weeks, three record-breaking hurricanes pummeled the United States and Caribbean. Hundreds of thousands of people were displaced, cut from power sources and left with unrecognizable homes and neighborhoods. Conditions in some areas were referred to as "apocalyptic."

As the world watched these disasters unfold from afar, many looked for ways to help, pulling out their checkbooks or donating goods. But seeing as the hurricane damage made it near impossible to access areas affected, it was clear aviation must play a huge role in delivering those goods and providing vital relief efforts.

PALS Sky Hope Disaster Relief Program

Just weeks before Hurricane Harvey making landfall, two charitable aviation organizations, Patient Airlift Services (PALS) and Sky Hope Network, merged to form PALS Sky Hope Disaster Relief Program. Little did the group know they were about to be thrown into the midst of three full-blown hurricane response efforts.

Answers the Call

Warren Brown, a Houston native, and his wife Bethany on a relief mission following Hurricane Harvey. Brown flew as many as nine missions to deliver relief supplies to hard-hit areas around Houston.

Both formed in 2010, PALS and Sky Hope Network were founded upon similar missions: using business aviation for emergency aid. Whereas Sky Hope Network provides predominantly disaster relief, PALS typically focuses on medical and veteran transport.

"Our goal in merging with PALS was to connect with a charity flight organization that had full-time staff. This would enable us to create better infrastructure to respond to disasters in the future," said Robin Eissler, program director for PALS Sky Hope Disaster Relief Program and COO at jetAVIVA. "We barely had had time to begin strategic planning before Aug. 26 when Harvey hit. I called PALS executive director Eileen Minogue and said, "looks like we are going to be doing our planning live!"

In just over two days, Hurricane Harvey grew from a tropical storm over the Gulf of Mexico into a Category 4 hurricane as it made landfall near the Texas Gulf Coast late on Aug. 25. On initial impact, Harvey had a *diameter of 280 miles* and winds of 130 mph. But it was the slow movement that led to the catastrophic flooding in southeast Texas. Harvey broke the U.S. record for rainfall from a single storm, dumping over 50 inches of rain in some parts of Texas.

Residents were seen wading out of their homes, flagging rescuers from their rooftops or boating down streets. Help was needed and needed fast. Fortunately, in addition to the incredible first responders and guardsmen, hundreds of owner-pilots stepped up to the plate.

"In a two-week period, PALS registered more pilots than it normally does in a year," said Eissler. "We flew approximately 175 missions for Harvey. Many were life-saving."

Warren Brown, electrical contractor and PC-12 owner, was one of the pilots to answer the call.

Hurricane Harvey

The day after Hurricane Harvey made landfall, Warren Brown, a Houston native, saw his Facebook newsfeed filling with panicked friends being pounded by the rain and floodwaters south of his Austin home. It was not long until he decided he had to do something.

Having flown charitable missions before, Warren recognized his PC-12 could be particularly useful in a situation like this with its range/payload capability and cargo door. He jumped onto the Pilatus Owners Association (POPA) webpage and was soon connected with PALS and Robin Eissler. He was informed general aviation disaster-relief operations were going to be conducted out of Georgetown, Texas, just a short hop from his home base of Lakeway Airpark.

"My wife Bethany and I showed up that first morning not knowing exactly what we were getting in to," said Brown. "But after about a 20-minute pilot briefing, all of us just hit the ground running. There was a hangar full of pallets loaded with food and supplies, weighing at 500 pounds each. Half-dozen or so volunteers helped load up my airplane and off we went."

Over the next five days, this same process would occur as many as nine times as Warren either flew supplies to Beaumont or Orange, Texas. PALS had worked with several local area

The Georgetown, Texas airport was the staging ground for PALS Sky Hope relief flights. Here, supplies are organized on pallets ready to be loaded on volunteer aircraft. Once on the ground, those supplies were unloaded by volunteers on the ground at Beaumont's Jack Brooks Regional Airport.

Houston was inundated with floodwaters as the result of Hurricane Harvey, essentially making the region an island and cut off from critically needed medicines, drinking water and other relief supplies.

Austin nonprofits and aviation businesses to set up a supply chain mission that supported Houston and the Texas coast. At one point during the hurricane's peak, the coastal cities of Beaumont and Port Arthur received 26 inches of rain in 24 hours.

"The area was essentially an island. There was no way of getting food or supplies in except by aircraft or boat," said Brown. "You looked down and just saw miles and miles of roads and houses underwater."

The bulk of the supplies consisted of packaged food, water and sandwiches. But one flight in particular stuck with Warren – a critical mission to deliver Pedialyte and other infant supplies for a baby in Beaumont suffering dehydration.

"That flight felt the most urgent of them all," recalled Brown. "It was apparent those supplies were needed right away." Fortunately, the items were successfully delivered.

After each landing in Beaumont, Warren joined hundreds of helicopters and other aircraft on the ground. Some were owner-flown but the majority being military. Beaumont's Jack Brooks Regional Airport, a commercial airport, incredibly had little ramp space to spare.

"I don't think I will ever see an airport like that in my lifetime – from R-22s to Chinooks and even C130s," said Brown. "A couple of times, we had to hold outside the airspace 10 minutes before we could get on the radio."

Nearby, Orange County Airport, an uncontrolled airfield, presented Warren with challenges of its own due to TFR's and heavy helicopter traffic. Warren's strategy consisted of keeping his airplane 1,500 feet or higher until he was able to bring it into a short final then "dive-bomb" the runway. Once on the ground, people quickly appeared to help offload and distribute the supplies.

"It was a busy, exhausting week of flights. But everything was extremely organized considering the circumstances," said Brown. "PALS and the ground crew did an amazing job. I feel really good that I was able to help my home city."

But just as Hurricane Harvey diminished, another tropical storm was rapidly brewing in the Atlantic. A storm that would go on record as the strongest Atlantic basin hurricane outside the Gulf of Mexico and Caribbean Sea ever recorded by the National Hurricane Center.

Hurricane Irma

On Sept. 6, Category 5 Hurricane Irma plowed through portions of the Caribbean with incredible 175-plus mph winds, causing tremendous damage to Barbuda and parts of the United States and British Virgin Islands. The storm which stretched 650 miles from east to west, prompted massive evacuations amongst the islands and Florida, displacing millions of people.

As many continued to flee the affected areas, PALS founder and owner-pilot Joe Howley and his co-pilot Brian Lisoski prepared to fly critically needed communications equipment from White Plains, New York to St. Thomas. The hurricane had completely wiped out communications on the island.

"Irma was a really big challenge being an international flight. It was not a situation where you can just show up," said Howley, an experienced volunteer pilot. "I think I spent around 12 hours on conference calls with other groups and NGO's (non-governmental organizations) in preparation. Our office coordinators probably spent twice that much."

As the plans solidified, Brian prepared Howley's PC-12 for the mission by reconfiguring the seats and protecting the

PALS founder and owner-pilot Joe Howley and his co-pilot Brian Lisoski flew critically needed communications equipment from White Plains, New York to St. Thomas in the Caribbean following Hurricane Irma.

interior. The duo then loaded a batch of handheld satellite equipment before flying to Georgia (PDK) to pick up 10 satellite dishes and corresponding equipment. From there, it was off to meet Rescue Global (NGO) on the ground in San Juan, Puerto Rico.

"You cannot do these flights unless you have a contact in the specific place you are bringing your aircraft or it can get real uncomfortable," explained Howley. "But Rescue Global was a huge help in the logistics of the operation."

After spending the night in San Juan, Joe and Brian completed the flight to St. Thomas where they delivered the equipment to another NGO, Global DIRT. Upon landing, they were greeted by an awful sight.

"It looked as if a nuclear bomb went off," recalled Lisoski. "Irma absolutely decimated the area. There was just one controller working four frequencies from a damaged control tower."

As they dropped off the equipment, they became aware of an older gentleman in St. John who needed to go to San Juan to receive medical care. They successfully transported the man then quickly headed back to New York, well aware another hurricane was on its way.

"When these things happen, it is a short-term, needs-to-be-done-now event," said Howley. "In this case, you cannot save people if they cannot communicate. So, it was very satisfying trip where we were able to see the results of what we were doing right away."

Less than 24 hours after Joe and Brian departed San Juan, Hurricane Maria hit Puerto Rico.

Hurricane Maria

In just one day, on Sept. 18, Hurricane Maria rapidly intensified from a Category 1 to Category 5. Two days later, it was the strongest hurricane to make landfall in Puerto Rico since 1928. Maria devastated the country along with parts of the Virgin Islands and Dominica.

Through partnerships made during Irma with global relief agencies and clients, PALS Sky Hope jumped into action yet again. A supply warehouse was set up at Banyan Air Service in Fort Lauderdale and around 150 flights were completed to Puerto Rico, St. Thomas, St. Croix and Dominica. Each island's missions were coordinated through contacts focused on the particular area.

For Puerto Rico, United Airlines pilot Miguel Estremera helped coordinate most PALS' missions to the country. Miguel had a personal connection with the air traffic controllers and one of the first flights was to supply the ATC controllers themselves with much needed food, supplies and generators for their families and control center. To help with this mission, the PALS team reached out to owner-pilot Paul Weismann.

Paul, an investment portfolio manager and ATP pilot in Connecticut, had flown several medical transport missions for PALS the past two years; this would be his first disaster-relief flight. But all it took was the late-night phone call and Paul was in his Citation V the next morning departed for Puerto Rico. Miguel flew with him.

Citation V owner-pilot Paul Weismann (right) and United Airlines pilot Miguel Estremera en route to Puerto Rico bringing relief supplies following Hurricane Maria.

"We loaded the airplane as full as we could and then waited to get an oceanic clearance. That took a while; the airways were closed because Maria was still out there," said Weismann. "Once we were able to get a route, it was almost four hours direct to Puerto Rico."

At that time, no radar was available in San Juan and ATC had a slot system running. Paul recalled many general aviation airplanes having trouble getting in and being asked to hold. Any delays or holdings would have pushed the Citation's range, but fortunately, with their connection to ATC, Paul and Miguel were ushered in despite the heavy traffic.

As he taxied in, Paul processed the damage. The terminal was battered, piles of debris lay strewn, hangars had collapsed and trees were blown everywhere. Remarkably, he pulled up to an unscathed Jet Aviation FBO.

"It was very chaotic. The airport was crammed with airplanes and all kinds of people – federal agents, rangers, civilians, military," said Weismann. "Supplies were lying everywhere. It was evident a lot of aide was coming in and a large number of people were trying to leave at the same time."

After the supplies were unloaded, Paul and Miguel worked to figure out who they were going to take back to Florida. Cell service on the island was down and they had been unable to reach the people they had planned to transport. They ultimately ended up taking a mother and her young child, a frail older lady and U.S. Army sergeant back to Ft. Lauderdale.

Over the next couple of days Paul would fly two more missions, a second one to Puerto Rico and one to Dominica. He was challenged with more heavy traffic, poor weather conditions and lack of fueling stops.

"These were not flights just anyone could wake up and do. You really need to know the procedures, be comfortable flying IFR and dealing with international charts," said Weismann. "Thankfully, I had previously flown a number of flights in the area. I never felt in danger, it was just *a lot* of physical work and always a sense of urgency."

Upon returning to Connecticut, there was little time for rest. Paul received a flurry of media attention and surplus of folks wanting to also help and donate items. He avidly worked to use that support and round up the money to fund a cargo Gulfstream flight back to Puerto Rico.

"It feels really good to combine my true passion of flying with helping other people," said Weismann. "Once I started flying missions for PALS, I found it very addicting and rewarding. Truly an amazing organization."

Owners and pilots who are interested in learning about future disaster missions or interested in flying for PALS can register at PALSflight.org. **T&T**

Jacobs is a private pilot and general aviation enthusiast. In 2012, she earned her business degree in marketing from Oklahoma State University. Since then, she has specialized in aviation-specific marketing, working first for Piper Aircraft, and then as an aviation marketing specialist at Sullivan Higdon & Sink. Jacobs is now serving as the director of communications at the consulting firm Groom Aviation. You can contact Rebecca at rebecca@groomaviation.com

by **Kevin R. Dingman**

One Foggy Night

Managing low-visibility procedures like Santa.

Once upon a Christmas Eve flurry, RVR's were squat; reporting six, four and blurry. "Our Christmas hustle must go on without pause; we can't wait for the weather," exclaimed Mrs. Claus. Santa's retort, was precise and quite short: "I work like a dog, when there's snow or thick fog. Any bright lights, Christmas trees or red nose, will diffuse in the snow; it's best I don't go."

But the elves had worked hard to empty the shelves, all eight reindeer well fed, were attached to the sled. The children had been good, this was well understood; everyone knew, what Santa simply must do. But the TAF we all know, predicted more heavy snow; his all-nighter flight, would be no delight. With VOR and red nose, though high-tech for a sleigh, without an ILS, there was simply no way.

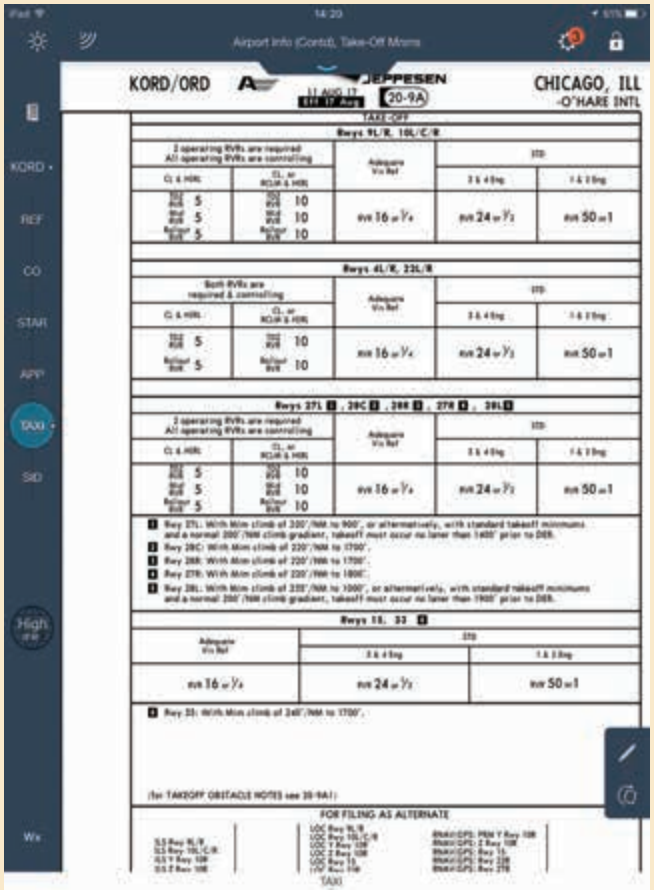
Not his flawless approach, nor that glowing red snout, helped Santa to land; or to even break out. The missed and divert showed Santa's pilot skills: dodging chimneys at first, then hill after hill.

Well, I'm sure Santa hated to disappoint all of the children Christmas morning, and he likely got an earful from Mrs. Claus when he called from his diversion hotel in Cabo…I'm just saying. But the mins are the mins, and without the right equipment on the ground and in the air, as well as proper training and proficiency, RVR's of six, four and blurry are a show-stopper. Especially for eight flying reindeer and a sleigh, with or without a glowing red nose.

In 1929, Jimmy Doolittle became the first pilot to land an aircraft solely by reference to instruments. Since then, we've made giant strides in "low visibility procedures," thereby minimizing the times we go missed or divert due to weather. It began with developing aircraft and ground systems, hardware and procedures, then qualification training and practice in order to fly non-precision approaches in the clouds. Eventually, inflight and ground systems were improved to the point we can now takeoff and land with visibilities measured in just a few hundred feet. Along this journey we found that once we land following a low-visibility approach, or try to leave after refueling, it could be difficult or impossible to find our way. Additional systems and procedures had to be developed to get us from the ramp or gate to the departure runway, or to our parking spot after landing.

Transmissometer

The primary ground equipment used in establishing which low-visibility procedures (LPV's) are in effect is the transmissometer. Transmissometers are used to measure the extinction coefficient of the atmosphere and to determine visual range. They operate by sending a narrow, collimated beam of energy, usually a laser, through the propagation medium. In Santa's case, snow and fog were the offending "propagation medium." The measurements are taken at either one, two, three



The takeoff minimums at Chicago O'Hare airport.

or sometimes four (KDEN), locations along the runway. These positions are classified as touchdown, mid (midfield), rollout and far-end.

The result is expressed as runway visual range, or RVR, in hundreds of feet or meters. Depending on which LVP is in use, we need a specified minimum number of transmissometers to report (that is, functioning), and the value reported must meet or exceed charted RVR minimums in order to use the desired LVP. Individual operators (through FAA ops specs), or the charted procedure itself, may allow substitution of certain transmissometers for another when one or more are inoperative. For example, the mid substituted for touchdown, or far-end for rollout. In order to review several types of LVP's, let's take a flight starting from the ramp, a taxi and takeoff, with a review of the decision to return or divert if we have an issue after takeoff, followed by descent and an approach.

Self-Imposed Restrictions

First, we need to determine if the visibility is adequate for taxi, takeoff and a return. While Part 91 operators may depart with no visibility constraints, self-imposing the published takeoff minimums found on the airport diagram pages is a good idea. These charts may specify how many, and which, transmissometers are available for each runway as well as RVR values required for takeoff. These visibilities, however, are normally well below Category I landing minimums. After takeoff, if we have the required equipment operating – two motors, electrical and hydraulic systems for example, as well as necessary ground equipment and lighting – a return for a Cat II or III approach may be possible. If we're not able to perform a Cat II or III landing at our departure airport, then a diversion to better weather, like Santa, rather than back to the six, four and blurry airport we just left, would be the plan.

Therefore, when the takeoff visibility is below Cat I mins, select a takeoff alternate within a prudent distance that would allow you, the airplane and your avionics to fly a single-engine, Cat I approach. A piston twin may not have the ability to fly single-engine to another airport with better weather. If not, then waiting for the takeoff weather to reach Cat I landing minimums would be another prudent, self-imposed restriction.

SMGCS, REL's, THL's, SMR and ASSC

Next, review the SMGCS (Surface Movement Guidance Control System) taxi procedure pages. There will be charts for several visibilities to and from the active runway (Less than RVR 1,200 to 600, or RVR 600 to 300, for example). Using in-ground, multi-color lights similar to the runway centerline lights, the charts will depict a unidirectional or bidirectional route, geographic position markings, holding "bars" as well as Runway Entrance Lights and Takeoff Hold Lights (REL's and THL's) to the takeoff runway.

Since we seldom use these charts, a slow and thorough review before engine start should be accomplished. While we taxi, ATC will normally monitor surface movement using both SMR (Surface Movement Radar) and the ASSC system (Airport Surface Surveillance Capability). These tools display aircraft and ground vehicles on the airport surface, as well

Approach Lighting Systems

MALSR: Medium-intensity Approach Lighting System with Runway Alignment Indicator Lights

MALSF: Medium-intensity Approach Lighting System with Sequenced Flashing lights

SALS: Short Approach Lighting System

SSALS: Simplified Short Approach Lighting System

SSALR: Simplified Short Approach Lighting System with Runway Alignment Indicator Lights

SSALF: Simplified Short Approach Lighting System with Sequenced Flashing Lights

ODALS: Omnidirectional Approach Lighting System

ALSF-1: Approach Lighting System with Sequenced Flashing Lights configuration 1

ALSF-2: Approach Lighting System with Sequenced Flashing Lights configuration 2

REIL: Runway End Identification Lights

RAIL: Runway Alignment Indicator Lights

as aircraft on approach and departure paths within a few miles of the airport. Some airports may also offer "follow me" services during SMGCS use. Make sure your transponder is turned on for taxi and don't forget to enable the "own-ship" display option on your avionics or tablet.

Ball Notes

When anticipating a precision approach when visibilities are squat, whether Cat I, II or III, an early review of the descend-via arrival, the approach chart and the arrival SMGCS should be accomplished before the top of descent. Like a puzzle where you try to find a list of hidden objects in a drawing, ball notes and conditional statements are scattered everywhere. In addition to speed and altitude restrictions over each fix, some descend-via procedures will hide a note that tells you to maintain 280 kts when transitioning from mach, for example.

On the approach chart, requirements for visibility, approach and runway lighting, radar, GPS or DME, minimums when the arrival field altimeter setting is not available and often times, a convoluted missed approach or obstacle avoidance procedures must all be reviewed and understood. Look for notes that say special aircrew (SA) training or onboard equipment is required (i.e., Flight Director, autopilot or HUD), changes to approach legality "with ships taller than 144 feet present; procedure not authorized" (KBOS, ILS 4R), or a note that may say the localizer is not accurate certain distances off the course centerline or unusable during landing rollout.

Check the NOTAM's and ATIS for inoperative approach-related ground equipment. Then, during the approach, aircraft systems as well as airport lighting and transmissometer functionality should be monitored. Depending on which airborne or ground equipment fails or drops below minimums, different operators may allow continuing after glide slope intercept, or may require a go-around (rejected landing).

Visibility Conversions

RVR (ft.)	Visibility (Sm)
400	1/16
800	1/8
1,200	3/16
1,600	1/4
2,400	1/2
3,200	5/8
4,000	3/4
4,500	7/8
5,000	1
6,000	1 1/4

And finally, after landing rollout we may be back to yet another SMGCS chart where there will undoubtedly be differences from the departure SMGCS, including another ball note search-puzzle. Like Santa said, with snow or thick fog, we will work like a dog.

Missing Christmas or an important commitment because of weather is something that we all face. But having the right equipment, procedures, knowledge and proficiency will increase the likelihood of landing at our planned destination. None of us want to disappoint family, friends or our passengers, nor get an earful from Mrs. Claus.

How do we prepare for our own "One Foggy Night?"

Talk to the weather man, your crew and the dispatcher, too. Hear all of their words, until they are through. Once in the fog we will work like a dog, so try not to hurry when the airport gets blurry. Learn ILS's, RVR's and airport SMGCS, too. Follow the charts, hidden ball notes all through. Study and practice, till our faces turn blue; and stay on the gauges, that's what we must do. Though whine and complain the passengers may chide, good judgment prevails and we must decide: do we fly the trip with caution astride, or cancel the flight and stay home inside.

Be diligent and careful out there my friends.

Merry Christmas. T&T

Kevin Dingman has been flying for more than 40 years. He's an ATP typed in the B737 and DC9 with 23,000 hours in his logbook. A retired Air Force major, he flew the F-16 and later performed as an USAF Civil Air Patrol Liaison Officer. He flies volunteer missions for the Christian organization Wings of Mercy, is employed by a major airline, and owns and operates a Beechcraft Duke. Contact Kevin at dinger10d@gmail.com.

FIVE on the FLY

Some of the volunteer members of the PALS Sky Hope disaster relief team assembled during the recent efforts following Hurricane Harvey.

by **Rebecca Groom Jacobs**

WHO:
Robin Eissler

WHERE:
Georgetown, Texas

POSITION:
COO of jetAVIVA

CAREER HIGHLIGHTS:
Founder and Program Director PALS Sky Hope Disaster Relief Program

Private Pilot

1. ***You've been in aircraft sales for more than 20 years. Can you describe your start in the industry?***

I grew up around the industry helping my dad with his aircraft sales business. At the age of 18, I had an opportunity to go to work for one of the largest preowned aircraft sales companies at the time. I jumped at the chance! After working there for two years, I then took at position at Banyan Air Service while I finished college. I loved the FBO business, but my heart was in aircraft sales. In 1999, my dad and I founded Jet Quest, Inc. And just this year, I sold the business to jetAVIVA, which is where I am today.

2. ***Aircraft sales is a predominantly male profession. What type of hurdles have you faced as a female? How did you overcome those hurdles?***

My dad and I actually started Jet Quest after I was told by another aircraft sales company that they would never hire any women salespeople. Being female and not having an ATP certificate, I have always had to work harder to establish my credibility. One way of doing so was in 2008 when I was one of the first women to take the NBAA Certified Aviation Manager exam and distinguish my skills.

3. ***jetAVIVA projects energy, urgency and innovation embodied in its branding and slogan "Life is short, fly a jet." Why do you take special pride in mentoring the younger members of the company's team, many of which are women?***

There is nothing more exciting than watching someone you have trained and mentored delight a customer through the sale or acquisition of their airplane. When I started in the business, "young professionals" meant you made the coffee! Now, it's a great feeling to be able to pass along the skills and techniques I've used for 20 years to help our young members of the team grow.

4. ***Disaster relief is nearly 24/7 work. What motivated you to put in long hours for PALS Sky Hope during the recent hurricane disasters?***

My kids are the motivation behind my disaster relief work. My twins were preemies born between two hurricanes in Boca Raton, Florida in 2004. We were forced to evacuate and leave them 1 mile from the coast during a Category 3 storm. After Hurricane Katrina occurred the next year, I saw a story very similar to ours and took action. The helpless feeling I experienced myself inspired me to help others.

5. ***There were many organizations involved in the recent disaster relief. What was uniquely impactful about PALS Sky Hope's efforts?***

The jetAVIVA team during EAA AirVenture Oshkosh 2017.

The key to effective disaster flying is recognizing the critical missions and finding the right aircraft assets to respond. Having a very solid understanding of aircraft performance enables us to do missions that others are unable to fill. During disasters, we can receive hundreds of requests a day. Filtering through those to determine the ones that will have the biggest impact is the most critical role of our team. We must also have the confidence of our aircraft donors. Almost every one of our airplanes flies more than one mission for us. T&T

Rebecca Groom Jacobs can be contacted at rebecca@groomaviation.com.

Seeing into the Future

Radar reveals only what a storm *is*. Vertical Profile *reveals what it will soon be.*

by **Archie Trammell**

Instantly after radar engineers discovered how to convert millevolts, ohms and dBs into digital code, they begin adding dozens of high-tech features to airborne radars. The digital revolution brought on such things as color displays, turbulence detection, auto tilt, extended STC, REACT, digitized signal generators, and on and on. None of these technologies add to the two basic things a pilot needs to know to conduct a safe, comfortable flight: "Where is it?" and "What's a safe path for avoiding its hazards?"

In truth, there have been only two advances in radar engineering of help to pilots in thunderstorm see-and-avoid since that first system designed by George Lucchi of RCA 60 years ago. First was the so-called "flat plate" antenna that came to airborne radars near 50 years ago. Before that, the radiation pattern from our small parabolic antennas was so scattered, half the echoes displayed were false side-lobe returns. The phased array antenna rounded them up into a much cleaner beam.

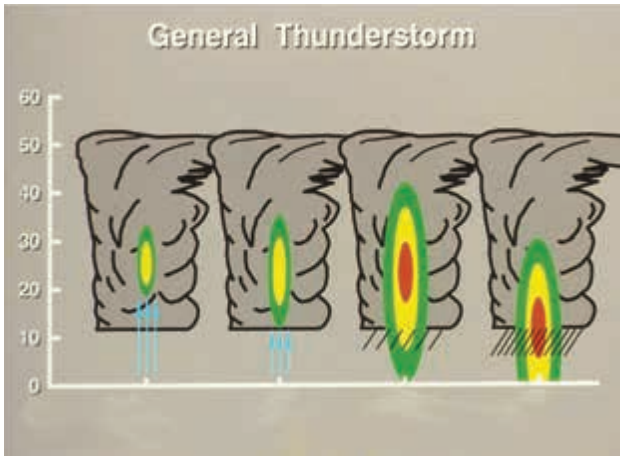


Illustration from the Dr. Kenneth Wilk study of 45 years ago on the growth of various storm types. He found that the echo of a general "Popcorn" storm begins as a weak echo at 20,000 to 30,000 feet. The first red appears at about 22,000 feet, after rain begins to fall.

Second of the only two meaningful advances in radar engineering was the addition of Vertical Profile 30 years ago. That was an innovation by engineers at King Radio just after it was acquired by AlliedSignal. A new general manager at the King Division floated the idea by engineering and, since it was simple to do, it quickly became an added feature to the Bendix RDS 81/82 systems.

VP: A Simple Add-On

Creating the feature required only a simple software addition. Antenna stabilization, which has been a common feature of airborne radar since the beginning, requires that the antenna be articulated to swing 30-degree up and down as the antenna sweeps back and forth horizontally to detect weather and terrain ahead from top to bottom. But to accommodate maneuvers of aircraft in both pitch and roll the TILT limits must be about 15 degrees.

Therefore, to create VP it was only necessary to create digital software to stop the side-to-side swing of the antenna at some position and direct it to commence running the antenna vertically through the natural up-and-down, 30-degree limits at that position. Voila! A Vertical Profile feature! A VP 30-degree up-and-down scan. (It was limited to 25 degrees on early systems and 30 degrees on later ones.) Also, later, more software was added to allow pilot selection of which azimuth position VP would scan up and

down. Of course, it wasn't quite that simple, but almost.

Amid that development, Bendix was acquired by AlliedSignal as was the Bendix/King line of avionics. When the Bendix/King RDR 2000 was next added to the Allied radar lineup, that radar also had the VP feature. Later Allied/Bendix/King was scooped up by Honeywell and the Bendix/King RDR 2000 then became a division of Honeywell, where it remains today.

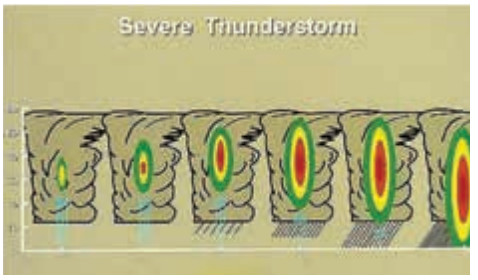
Next, when Garmin decided to expand into airborne radar products with the GWX 68, Vertical Profile was one of several features copied from those earlier Bendix/King radars. That was followed by the GWX 70, also with VP. Today only those three have it: RDR 2000, GWX 68 and 70. (The top-to-bottom scan of certain other "high-tech" radars isn't true VP, but a limited, mixed horizontal/vertical scan.)

Why VP is Important to Flying

Why hasn't it become a feature of other radars? Because radar engineers know so little about convective meteorology they don't know what it's good for. After inventing it, Bendix/King had no idea of what value it was except as another gadget for radar salesmen and ladies to brag on. Their early RDR 2000 POG reflects that lack of understanding.

Why VP is extremely useful for flight safety is not a deep mystery; it's been known for 45 years. A study by Dr. Kenneth Wilk at the NOAA National Severe Storms Laboratory published an illustrated report about it that long ago. Fact is, his report revealed, typically thunderstorms do not grow from the ground up, they grow from precipitation that forms aloft and then propagates downward. Furthermore – and this is a critical fact – common air mass "popcorn" thunderstorms tend to begin at 15,000 to 25,000 feet then grow down to the surface. But severe, extremely dangerous supercells tend to begin much higher, way up around 25,000 to 35,000 feet and then rapidly descend to the surface.

Properly educated pilots have known that for 40 years. That's the reason for the well-publicized "TUT" position of TILT, which is simply +10 degrees.



Echoes most likely to grow into hazardous Supercells tend to begin as a weak echo at a much higher 25,000 to 40,000 feet and develop a red core at about 35,000 feet.

When +10 degrees TILT is selected the height of storms is instantly revealed; the ratio is 1,000 feet per nautical mile. So, in operations below 20,000 feet, select TUT for several sweeps and any echoes detected at 10 nm are at minimum 10,000 feet above your current altitude; at 20 nm 20,000 feet above; at 30 nm 30,000 feet.

Thus, if a pilot climbing through 10,000 feet with TUT selected sees an echo at 10 nm he or she knows instantly that it's a thunderstorm at minimum

Bendix/King's RDR 2000 is one of the best-known examples of radar systems that provide vertical profile functionality.

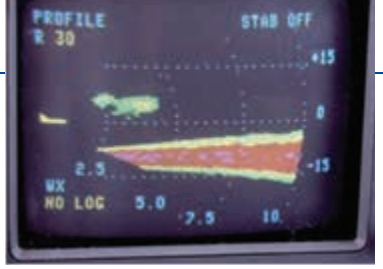
to 10,000 feet, plus the current aircraft altitude. So, it's a thunderstorm. If there's no red at +10 degrees, run TILT on up several more degrees. If that echo now contains any red it's most likely going to grow into a severe, hail-producing thunderstorm.

Wonderful! With TUT and TUT+altitude, a pilot can see into the future! Knowing that is a tremendous factor in conducting a safe, comfortable flight.

A problem arises, however, when the flight is down low, climbing through 3,000 or 4,000 feet and the growing, potentially severe, storm is only 5 or 6 nm distant. Max up TILT available without VP on other airborne radars is +15 degrees. At +15 degrees, the beam will not sweep high enough to detect any red that may exist at 25,000 to 35,000 feet when the aircraft is at lower altitudes. But with VP, the radar will see into the high aloft future, as it were, and the pilot will be alerted to echoes that will soon grow into very dangerous storms. That's a capability other radars have but only with intelligent use of TILT, and to a limited degree. With VP, it's only a button push away.

I flew one of the earliest VP radars from King extensively in my own aircraft while conducting thunderstorm research 30 years ago. One day I was climbing out of New Orleans, northbound, good visibility, no storms in sight, but under a high overcast. When I selected VP for several sweeps it revealed Level 1 and 2 echoes above me that had best be avoided. Otherwise, I was likely to have several tons of water drop on me. VP gave me a look into the future.

Another day I was doing thunderstorm research out of my home airport 50 nm south of DFW when my radar detected an echo ahead with



Climbing out of New Orleans, nothing at my level, but VP reveals yellow echo above me. In the near future that yellow may drop on me with most unpleasant results. I turned right to get out from under it. Note that the distance to the yellow is just 3.5 nm. Only a + 30 VP scan could detect it. The 15 degrees max of other radars will not reveal the impending danger above.

VP revealing a small cell 32 nm ahead. Behind it a little bump that doesn't appear to be anything, But look close and you'll see it has some kind of top knot above it. In this area of obviously unstable atmosphere that suggests an explosion is about to occur. It's another look into the future only with VP.

another little echo directly behind it. No question the echo in the rear was more intense than depicted, but I needed to know how much more intense, so I selected VP. It revealed that the little echo was literally blowing its top. It was short but it had developed a totally detached wad of detectable precip above its top. I figured that was a weather system to stay far away from. Again, I had a look, not in the now, but into the potential future.

On that same flight, I encountered a vicious-looking storm with a smaller cell next to it. VP revealed that the large cell was very tall, the small one barely out of 15,000 feet. A wise convective storms research pilot, Jim Cook, had earlier warned me about just this situation. Often the larger storm will begin to drop its load of moisture and the smaller one will suck up that energy and explode upward. As I orbited at a safe distance and watched, sure enough in the next 10 minutes the large storm dissipated and the smaller one grew into a monster.

Again, VP revealed the future to me.

Why Not More VP?

The question that must be asked is why haven't other radar development teams incorporated VP in their radars, only those three? Not even those automated radars manufactured by Collins and Honeywell have it, they scan only up to +15 degrees to create a top-to-bottom image of a storm. VP is to 30 degrees.

The answer to why other manufacturers haven't offered VP is because their radar engineers have little-to-no knowledge of convective meteorology. Perhaps it should be a prerequisite to a degree in electrical engineering. T&T

Considered a pioneer in onboard radar and convective weather training, Archie Trammell is a highly respected safety consultant whose lectures, video programs and instruction classes on the proper use of weather radar have been used to train thousands of pilots and more than 4,000 business flight departments.

Nextant Certifies the King Air G90XT

Nextant Aerospace recently announced that the Beechcraft King Air G90XT certification effort is now complete.

"When we launched the G90XT program, we had an opportunity to be the first company to deliver on the full potential of this great airframe by providing technology that operators have been waiting years for," stated Nextant executive Jay Heublein. "The King Air family is the most successful business aviation platform in the history of our industry, but it has long lacked the technology that the jet market has benefitted from over the last decade."

The G90XT is world's first business aviation turboprop to feature single-lever power control combined with electronic engine control system. In addition to the advanced Garmin G1000 integrated flight deck, the G90XT benefits from a 20-knot increase in speed at altitude and as importantly, features an all-new cabin designed by Nextant.

The interior provides a bespoke level of refinement not previously seen in the turboprop market that enhances the overall passenger experience. The G90XT also features an all new environmental system with the ability to significantly enhance both ground and in-flight cooling capability for added passenger comfort.

The G90XT is now on a demonstration tour in the United States. For more information about the aircraft or the demo tour, contact Nextant through the website at: *www.nextantaerospace.com.* T&T

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by **David Miller**

Limitations

In junior high, I used to walk to school every day. It was uphill both ways. At least so I thought. When I tell my grandkids this story they just look confused. "Didn't they have Uber back then Poppy?"

But the slope of the runway is much more important to airplanes. During the summer, Larry King and I planned a gross weight departure from Colorado Springs (KCOS) on a 25-degree C day in his Citation M2. We figured 11,022 feet of runway (35L) would be plenty. But after plugging in the parameters into Cessna's handy performance calculator, we were wrong. The software said we would have to offload 700 pounds of stuff in order to legally depart. And we would still need every foot of the runway to do so.

"What's wrong with this stupid calculator," I moaned. After much wrangling with the numbers, we realized that the runway slope for 35L at 1.2 percent was the culprit. Just a few hundred yards away was the 13,501-foot 35R with a slope of only 0.62 percent. Plugging in the data showed us that the reduced slope would allow us to depart at gross weight and we would need only 9,600 feet to do it.

Slope is important.

I found this out again recently during a visit to Sedona, Arizona (KSEZ). Sitting at 4,830 feet MSL and 500 feet above the town on a large mesa, the airport is often referred to as the "aircraft carrier of the desert." It is truly spectacular, surrounded by dramatic red rock outcroppings. The airport's location creates its own local weather as the mountains absorb heat during the day and generate significant winds at night and early morning.

We departed Dallas in the Mustang at 0815 in order to arrive before the daily landing turbulence. The approach was fairly routine even with both PAPI's NOTAM'ed out of service. The hardest part was focusing on the flying instead of the incredible terrain surrounding the airport.

When it came time to depart, I had some thinking to do. The winds were forecast to be out of the northeast at 10 knots, favoring runway 03. The only obstacle departure procedure however, was to the southwest off runway 21. Should I depart with a 10-knot tailwind? That's not something I would normally do, but here is where the runway slope came in. The handy Cessna calculator said I could depart on 03 into the wind and use about 4,300 feet or depart with a 10-knot tailwind on 21 and use 4,100 feet. Again, all due to the runway slope of 1.83 percent.

On the morning of departure, Mother Nature made the decision for us with winds from the northeast gusting to 17 knots, exceeding takeoff limitations. The young line person operating the pickup truck with the tow bar didn't understand why we needed to be turned around facing the wind for our engine start. "It's all about limitations," I said.

Runway 03 it would be.

Years ago, before performance calculators, we often just guessed the outcome of winds and weather. Today, we don't have to.

Fly safe.

Sitting at an elevation of 4,830 ft, the runway at Sedona, Ariz., has a 1.83 percent slope, which requires careful consideration to ensure adequate runway is available for given aircraft weight and weather.

With 6,000-plus hours in his logbook, David Miller has been flying for business and pleasure for more than 40 years. Having owned and flown a variety of aircraft types, from turboprops to midsize jets, Patty and David currently own and fly a Citation Mustang. You can contact David at davidmiller1@sbcglobal.net.


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