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# COPA<sup>®</sup> Pilot



**CIRRUSPILOTS.ORG**

**MAY 2022**

**VOLUME 17 | NUMBER 5**



---

## **COPA U CORNER**

**Planning for an Off-airport Landing**

**DON DUBIN » PG 24**



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# MEMBER GUIDE



CIRRUS OWNERS &  
PILOTS ASSOCIATION

## WHO IS COPA?

We are the **Cirrus Owners and Pilots Association (COPA®)** – a not-for-profit membership organization established to educate, promote the safety of and support the owners and pilots of certified aircraft manufactured by Cirrus Aircraft Company. We encourage ownership of these aircraft and provide online interaction, training programs and social activities for our members. Additionally, COPA® will promote goodwill towards the general aviation community.

Founded in 2001, with over 6,000 members worldwide, COPA® is a volunteer-run organization completely independent of Cirrus Aircraft Company.

## BECOME A MEMBER

Open to all interested individuals. Dues are \$95 per year, which includes a subscription to *COPA® Pilot* magazine as well as the benefits listed below. Join now by registering at [cirruspilots.org](http://cirruspilots.org) or [membership@cirruspilots.org](mailto:membership@cirruspilots.org).

- » **COPA® ONLINE FORUMS:** One of the most active online forums in general aviation, the COPA® forums have hundreds of messages posted each day. It is the ideal place to absorb information or get any question answered.
- » **MAGAZINE ARCHIVES:** Past issues of COPA's exclusive magazine can be downloaded from our website – a treasure-trove of information.
- » **TECHNICAL LIAISON ACTIVITIES:** COPA's Technical Liaisons regularly forward member issues to vendors and provide members with feedback on critical issues affecting Cirrus aircraft.
- » **MEMBER ADVANTAGE PROGRAM:** Provides benefits for COPA® Members through special access and relationships with companies that provide parts and services for Cirrus aircraft. Many providing special pricing and packages.
- » **REGIONAL FLY-INS:** Volunteer regional coordinators regularly announce one-day and weekend events where COPA® members will gather to socialize and meet face-to-face. Often held at attractive locations with special talks, tours, and activities.
- » **ANNUAL MIGRATIONS:** Each year in the U.S., hundreds of Cirrus aircraft gather to celebrate their heritage during a long weekend of excellent seminars, a vendor trade show and socializing. A European Migration is also held annually and attracts members from many countries. Attendees visit local landmarks at each specially chosen destination and attend a half-day educational seminar.
- » **COPA® PILOT PROFICIENCY PROGRAM (CPPP):** The most in-depth, two-day weekend training program available for Cirrus pilots. Scheduled throughout the year in both the United States, Europe and Australia. CPPP offers both ground-only or ground and flight sessions with seasoned certified Cirrus Standardized Instructor Pilots. Many members attend annually as part of their recurrent training. Now offering one-day classroom sessions.

## FOLLOW COPA ON SOCIAL MEDIA



# COPA® CALENDAR

## SAFETY EVENTS

### CPPPs

<b>MAY 13-15, 2022</b>	»	Concord, CA (KCCR)
<b>JUNE 24-26, 2022</b>	»	Chicago, IL (KDPA)
<b>JUNE 24-26, 2022</b>	»	Avignon, France (LFMV) <i>(English and French language)</i>
<b>JULY 9-10, 2022*</b>	»	Salzburg, Austria (LOWS) <i>(Mountain Flying Workshop)</i> <i>(German language)</i>
<b>AUGUST 13, 2022*</b>	»	Pella, IA (KPEA)
<b>SEPTEMBER 9-11, 2022</b>	»	Baden-Baden, Germany (EDSB) <i>(English language)</i>
<b>SEPTEMBER 16-18, 2022</b>	»	Spokane, WA (KSFF)
<b>OCTOBER 1, 2022*</b>	»	Plymouth, MA (KPYM)
<b>OCTOBER 29-30, 2022*</b>	»	Eelde, Netherlands (EHGG) <i>(Avionics Workshop)</i> <i>(English language)</i>
<b>NOVEMBER 2022</b>	»	Orange, NSW, Australia (YORG) <i>(English language)</i>

*\*specifies ground classes on Saturday and 8 flight training slots on Friday and 4 on Sunday*

**To register for these events, go to: [copppevents.com](http://copppevents.com)**

## SOCIAL EVENTS

<b>CONTINENTAL FACTORY TOUR</b>	»	May 14, 2022
Mobile, AL		
<b>EUROPEAN COPA MIGRATION</b>	»	May 26-29, 2022
Le Castellet, Provence, France		
<b>COPA MIGRATION</b>	»	October 6-9, 2022
Amelia Island, FL		



**Please refer to the COPA website for the most up-to-date information.**

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**MAY 2022**

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# COPA<sup>®</sup> PILOT

*Published exclusively for Cirrus Owners and Pilots Association members worldwide*



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Sanford, NC 27330

[cirruspilots.org](http://cirruspilots.org)

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Articles submitted for publication by members may contain opinions or specific recommendations. Such opinions and recommendations are solely those of the author, and do not necessarily reflect the official viewpoint of COPA<sup>®</sup>. COPA<sup>®</sup> does not endorse any practice in violation of published FAA regulations or the aircraft POH/FOM.

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### COPA PRESIDENT

SCOTT WILLIAMS

E-mail: [president@cirruspilots.org](mailto:president@cirruspilots.org)

Phone: (805) 231-4965

### EDITOR

KIM BLONIGEN

E-mail: [editor@cirruspilots.org](mailto:editor@cirruspilots.org)

### ADVERTISING DIRECTOR

KATIE ROLLERT

2779 Aero Park Drive

Traverse City, MI 49686

Phone: 231-590-7845

E-mail: [Katie.Rollert@vpdcs.com](mailto:Katie.Rollert@vpdcs.com)

### ADVERTISING COORDINATOR & PUBLICATIONS SERVICE

MOLLY COSTILOW

231-674-5369

[molly.costilow@vpdcs.com](mailto:molly.costilow@vpdcs.com)

### GRAPHIC DESIGNER

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### MEMBERSHIP AND SUBSCRIPTIONS

To join COPA® and get a subscription to

this magazine go to [cirruspilots.org](http://cirruspilots.org)

### ADDRESS CHANGES

Please contact the Membership

Coordinator at [Membership@](mailto:Membership@CirrusPilots.org)

[CirrusPilots.org](http://CirrusPilots.org) for any address

changes. Membership updates are

handled at COPA® headquarters, call

+1 (320) 999-COPA (2672)

### COVER PHOTO

New COPA Member Tom Charles' 2016

G5 SR22T, based out of Leadville,

Colorado (KLXV).



## COPA Member Forums: Rights and Responsibilities



**SCOTT WILLIAMS** began flying lessons in 1987 while attending United States Air Force ROTC at UCLA, and earned his private pilot certificate and instrument rating shortly thereafter. While on active duty, he completed his Commercial and MEL. Scott resigned his commission years later as a Captain in the reserves.

In 2006, Scott bought his first airplane, an SR20 G2, which he flew almost 2,000 hours before upgrading to an SR22T in March 2022.

Professionally, Scott is an attorney practicing aviation and business law. He assists owners with aircraft purchase, sale, and co-ownership matters. Scott also represents pilots being investigated by the FAA and appears in NTSB hearings nationwide.

**Scott welcomes your feedback** and can be reached at *President@CirrusPilots.org*. You can also email the entire COPA Board at *Directors@CirrusPilots.org*.

**COPA is fortunate to have so many members who take the time to share their knowledge and wisdom on our forums.** From maintenance to avionics to airmanship, COPA continues to be the best \$95 in aviation.

While our member forums are generally civil, occasionally things heat up. COPA members are often passionate about their positions, and there are times when those passions collide. As much as your leadership would like to allow people to post freely, sometimes freely goes too far. For years, COPA has had a dedicated team of moderators who tackle the difficult task of balancing freedom of expression with civility and decorum.

When a member has a post hidden through our forums' flagging system, I often hear the phrase: "I have free speech rights." While most countries where COPA has members do have varying degrees of free speech protections, COPA is not a governmental agency. We are a private, nonprofit organization with rules designed to balance the desires of the members to post freely with the need to maintain a civil organization.

In furtherance of civility, COPA has established important policies that all members are expected to live by:

COPA Terms of Use:  
<https://www.cirruspilots.org/Terms>  
and COPA Online Media Use  
Policy: <https://www.cirruspilots.org/Online-Media-Usage>

I ask that all members take a few minutes of their valuable time to review these policies. COPA does strive to update and refine them from time to time. As always, we welcome your feedback on how to make COPA a better place for all.

Now that I have your attention with all this policy mumbo-jumbo, let's have some fun! I encourage all members to visit our forums frequently to learn what they've been missing. We have hundreds of members who visit and lurk but don't actually post. Please post, even if to say: "Hi, I'm a member, and this is my first post." The more, the merrier. You'd be surprised how much you can contribute to the best aviation-type club anywhere.

Blue skies,  
Scott Williams ☺

# CIRRUS | STORE

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# WRITER'S GUIDELINES



**We welcome your story and photography submissions to *COPA Pilot*, but we'd like to share a bit of guidance that might make the process easier for you and hence easier for our editorial staff.**

*COPA Pilot* is the monthly magazine of the 6,000-plus members of Cirrus Owners and Pilots Association (COPA) who either own or support the ownership of Cirrus aircraft. COPA is a 501(c)7 non-profit corporation. In each issue, *COPA Pilot* focuses on a variety of topics, supporting our members in the use of their aircraft through articles that include piloting skills and techniques, safety topics, maintenance issues, destination stories, product reviews and spotlights on individual members. Our readers crave stories with fresh perspectives on these topic lines or prose that can highlight a new area that will benefit our members.

We're interested in stories from authors who write precisely and know how to make every word count. Too much detail can be as problematic to a story as too little. Most stories will be written in the third-person, although we occasionally will assign very specific first-person accounts of destination or safety related articles. Our typical stories run about 1,500 words in length.

We prefer that you query our editor first before you begin writing any story rather than simply sending in a completed manuscript unannounced. If you are unsure about an idea for an article, you may propose the article in a written query via email to the *COPA Pilot* editor at

[editor@cirruspilots.org](mailto:editor@cirruspilots.org) which will then be reviewed by the editorial board. We prefer any final manuscripts to be saved in MS Word. Be sure to include your name, address, telephone number and e-mail. We do not accept manuscripts that are also being considered by another publication. We may consider stories that have already run in another publication, depending upon their relevance to the *COPA Pilot* readership.

If you'd like to include a sample of something you've written with your query, that can always be helpful.

**Photography** – Every great manuscript deserves quality photography to help illustrate your tale. We prefer original high-resolution color photos with a resolution of at least 300 dpi at an 8 x 10-inch size. If you're shooting from an iPhone or something similar, please choose the high definition setting to ensure the best quality. Also, it's best not to use the zoom function. The photos can be cropped by the designer if needed. If you choose to send photos not taken by you, we must have verification that you are authorized to share them in order not to violate any copyright laws. Please check with the person who shot the original photos to obtain that permission. Photos taken off the internet must also have permission to use unless they are royalty free or can be used without fee for photo credit.

We also welcome photography submissions of your Cirrus either in flight or an outside ground shot with no background clutter – buildings, other airplanes, etc.

**If you have additional questions** about writing for *COPA Pilot*, please e-mail the editor at [editor@cirruspilots.org](mailto:editor@cirruspilots.org).



# MEMBER ADVANTAGE PROGRAM



CIRRUS OWNERS &  
PILOTS ASSOCIATION



When you join COPA, you're automatically enrolled in its Member Advantage Program, giving you unique access to some of the best deals in the industry. From substantial savings on training and safety seminars, to exclusive discounts on essential products and equipment, you'll save time and money with a membership that practically pays for itself.

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- PROPELLING AVIATION** » Get 10% off eligible items at [www.propellingaviation.com](http://www.propellingaviation.com)
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Go to the COPA website for more information on offers and watch for added vendors.





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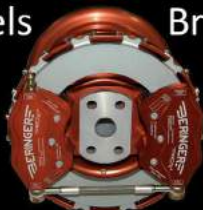


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## FROM THE FORUMS

» Information sharing among COPA members

# Mountain Bike Trip

Tom Charles COPA Member

**Curious what works for mountain bike trips.** Looking for suggestions on bike storage bags for full-size mountain bikes and how you are able to get them in the plane. I am assuming with the right protective bag and the seats laid down, it should be manageable. I have a G5. Looking to do some epic trips with my son this summer, just want to get set up to do it properly in one shot. Thanks for the suggestions.

### Responses:

Chip Hunter (aerochip) COPA Member

There are probably many ways to do this, but the only way that I've done it is to lay the seats down, lay a packing blanket down, take both wheels off, lower the bike seats and load through the main door with the bars down. Bags can still be loaded through the baggage door. I also bring a collapsible Park Tool Bike Stand to facilitate wheel removal/install and a bunch of large trash bags to put the wheels and frames in if they are dirty. This is us packed with Medium and Large "29ers" on a trip to Moab to ride the Whole Enchilada.



**TOM CHARLES** is a cabinetmaker by trade, based out of Leadville, Colorado. He is a newer member to COPA and owns a 2016 G5 SR22T. He received his private certificate in January, has a total of 150 hours and is currently working toward his instrument rating.

[cirruspilots.org](http://cirruspilots.org)

---

Robert Farthing (robfarthing) COPA Member

Similar to Chip's reply, here's a pic of loading three XL 29-inch MTBs in my SR22 to fly back to Calgary after riding in St. George Utah:



Two peeps and two bikes would be no problem.

---

Timothy Spear (tspear) COPA Member

My wife and I are NOT hard-core bikers; we use them as transportation and to sightsee. So we went with foldable eBikes, and bought the Discovery Series from Jupiter. I measured the dimensions and the Defiant should fit also. The Defiant is the "off road" version.

---

Scott Hopkins (sthopkins) COPA Member

I have seen a picture of an EVOC case in a Cirrus on Facebook, but it takes up a ton of space. Some good work here. I haven't tried it yet, but being from the East, I usually go commercial for riding trips (Moab, Saint George, Sedona!). I did travel with bikes in our Diamond a few times, though access and cargo space were totally different in that plane.

A wreath bag is good to protect the interior from wheels and tires. If you're handy, taking the forks off and disconnecting the shock can really trim the bike down to almost nothing. Dump the air from the dropper and push it all the way down. Use pipe insulation and some cords or wire ties to protect the parts and tie them to the frame. An old sleeping bag will contain the frame well enough (pull the derailleurs off as well).

All this said, I'm a big fan of renting at vacation spots – Poison Spider in Moab is EXCELLENT and gives you a good opportunity to try something new, and the big days of desert riding really thrash the bikes. Thunder Mountain in Sedona is a good shop too.

[cirruspilots.org](http://cirruspilots.org)

---

Robert Farthing (robfarthing) COPA Member

Saw that picture too. Looks slick and would like to try getting it in and out of the plane (appears to be a tight fit). Anyone with experience here?

---

Scott Hopkins (sthopkins) COPA Member

I suspect that this will go into the main doors pretty easily but will report back here if I get a chance to try it (several friends own that case and I occasionally borrow them to do trips).

---

Erik Bruce (erik1COPA) COPA Member

Second the EVOC is a great bag. Borrowed one and took it commercial last summer to Maui and it was a breeze. Curious how easily it fits through the main door and if a second would also make it.



---

Jack Long (wjlong) COPA Member

Just a general reminder that it is good practice to secure loose items in some fashion. When I carry our bikes (not a Cirrus, but same principle) and they are not behind the baggage net, I always run a tie-down strap through the frames and wheels. Same with any luggage not behind the cargo net.

From the SR22 G5 POH...

**Baggage Tie-Downs/Cargo Net**

**• Caution •**

If not adequately restrained, baggage compartment items may pose a projectile hazard to cabin occupants in the event of rapid deceleration. Secure all baggage items with tie-down straps or cargo net.

Four baggage tie-down straps are provided to secure items in the baggage compartment. Each strap assembly has a hook at each end and a cam-lock buckle in the middle. The hook ends clip over loop fittings installed in the baggage floor and in the rear bulkhead. The tie-down straps should be stowed attached and tightened to the fittings.

The aircraft is equipped with a retractable cargo net to secure items in the baggage compartment. Integral inertia reels attached to the rear bulkhead allow the cargo net to be extended forward, placed over baggage, and secured to the seat back via four latch assemblies. The cargo net should be stowed attached to the seat back fittings.

The cargo net is not functional when rear seats are folded forward. Use conventional tie-down straps in this configuration.

For baggage area and door dimensions see Section 1, [Airplane Interior Dimensions](#).



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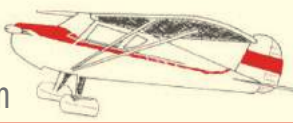
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# MIGRATION

» COPA's Largest Event



**ETHAN NARBER** is COPA's Director of Operations and besides overseeing the day-to-day operations of the organization, one of his other responsibilities is being the primary lead for the U.S. Migrations. Ethan started flying at 17 years old, holds a commercial certificate with instrument and multi-engine ratings, and is currently working towards a CFI rating. He lives in Des Moines, Iowa.



## Registration is Open Don't Miss Out on Special Early Bird Prices!

by Ethan Narber, Migration Chair





*“ ... hosted by the  
Omni Amelia Island  
Resort ... with  
spectacular views of  
the Atlantic Ocean.”*

**Registration for Migration 2022 is now open and features special early bird prices for those who sign up by June 15.** So why not sign up now and set your sights on COPA's largest annual event – this year on beautiful Amelia Island, a barrier island off Florida's northeast coast.

Each year Migration offers educational seminars, a vendor trade show

highlighting aviation products and services, and fun social events all held at a luxurious site. This year is no different and we will be hosted by the Omni Amelia Island Resort, located on 1,350 acres with spectacular views of the Atlantic Ocean.

Those flying to Migration in their own aircraft will fly into Fernandina Beach

**The vendor trade show** at Migration offers one-on-one access to representatives from aviation products and service providers, where attendees can take their time asking questions or gathering information.



**Traditionally, COPA Migration is kicked off with COPA Cabana** where attendees enjoy drinks and hors d'oeuvres while reconnecting with old friends and making new ones.



**The annual COPA Migration gala dinner** is a great way to cap off the special gathering of Cirrus aircraft owners and enthusiasts.



Municipal Airport (FHB), located just 10 minutes from the Omni resort. FHB has three runways with the primary one measuring 5,300 feet.

Those flying commercially will fly into Jacksonville International Airport (JAX), about 30 miles away from Omni Amelia Island. All major airlines and rental car companies use JAX. Airlines include: Allegiant Air, American, Delta, Frontier, JetBlue, Southwest and United.

COPA Migration is a great time to renew old friendships and develop new ones – even personally meet some of the people you've become friends with on the forums.

The early bird price of \$749 is available for those who sign up now through June 15. Registration costs for Migration include Thursday evening's COPA Cabana party with heavy hors d'oeuvres and an open bar, two days of aviation-related seminars with lunch and snack breaks provided, access to the vendor trade show featuring Migration specials, and Saturday night's annual COPA gala banquet dinner.

If you haven't already, make your room reservations at the Omni Amelia Island Resort (QR code below). Room reservations and costs for the hotel are separate from Migration fees, but as always, there is a special negotiated rate.

**Registration is now open! Please visit <http://migration.cirruspilots.org> and take advantage of the special early bird pricing before June 15.**

Remember – the beach, spectacular views, a world-class resort and COPA Migration await you at Amelia Island Oct. 6-9! ☺



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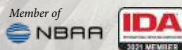
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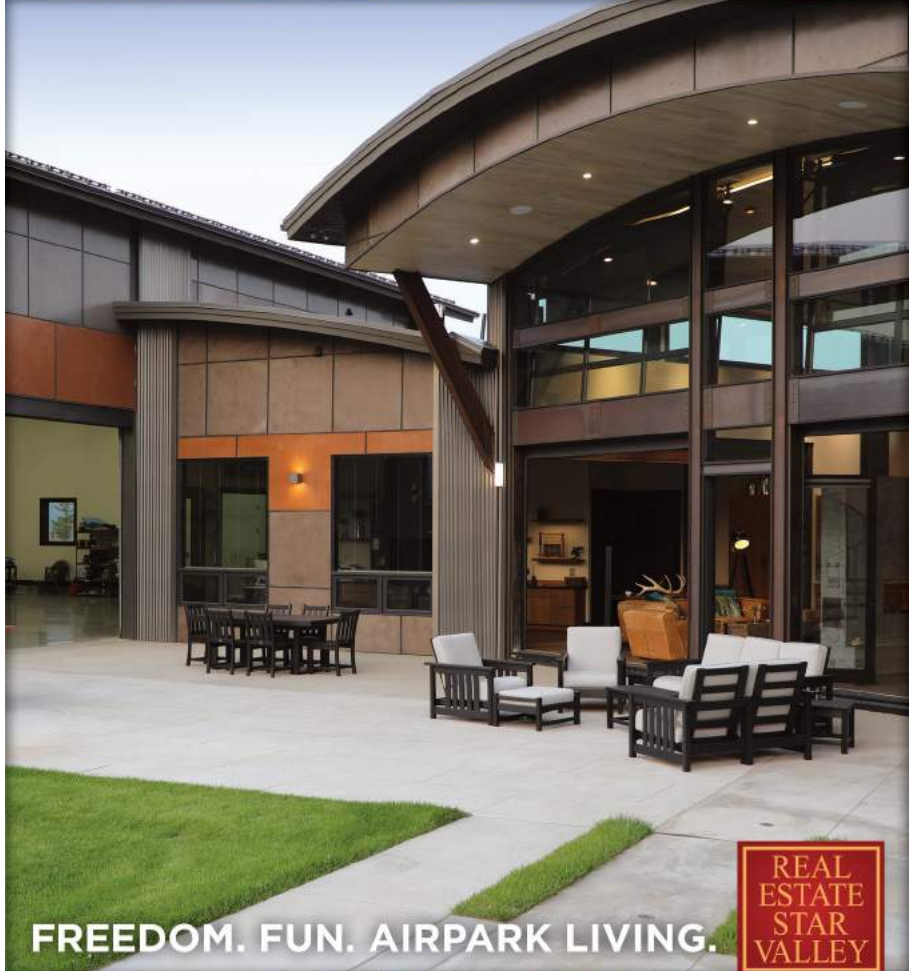


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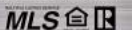
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# MEMBER SPOTLIGHT

» Getting to Know COPA Pilots



**Carrie and John Lundeby** started taking flight lessons just over a year ago and have already gained (Carrie) or plan to obtain (John) their commercial rating. They enjoy flying together and also work together in their businesses and running John's family ranch.

# Pilot Partners

by Kim Blonigen

---

**COPA members Carrie and John Lundeby took to flying like they do many things in their lives ... together.** They both started flying lessons in April 2021 and by February of this year, Carrie had received her commercial rating and John plans to earn his this summer. The couple also own an ambulatory surgical facility and other businesses in addition to operating John's family ranch in Idaho. They enjoy flying their 2021 SR22T they have named "Charlie" which has given them the freedom to travel in their busy lives.

**COPA Pilot:** Can you provide a summary background of your lives?

**Carrie:** I was born in Michigan and moved to Libby, Montana, with my parents when I was 11 years old. I graduated from the University of Montana and spent my early adult life raising children and working in the operating room as part of the "open-heart" surgical team. I met John almost 20 years ago in the operating room but didn't know we were meant for each other until quite a few years later.

**John:** I was born on the family homestead in north-central Idaho that my grandfather started ranching in 1895. Carrie and I still operate the ranch today. I graduated from North Idaho College, the University of Idaho and received my M.D. from the University of Washington. After a five-year surgery residency in California, I returned to the Northwest, where I have lived ever since.

Today, Carrie and I are owners of a Cosmetic Surgery Ambulatory Surgical Facility and multiple other businesses, including the ranch and commercial real estate.

**COPA Pilot:** Do you have any unique hobbies besides flying?

**Carrie:** We both golf. John has golfed for 15 years, and I had never golfed before spending two days doing so in Napa Valley recently, and then started taking lessons. We flew the Cirrus to Napa Valley – one of the many reasons we became pilots.

**COPA Pilot:** When did you think about becoming a pilot? Was there something that sparked it?

**Carrie:** I had never thought about being a pilot until an old friend stopped by. Her boyfriend is a pilot, and she was talking about how they traveled during COVID and all the fun they have using the plane.

**John:** I had thought about flying my whole life, but figured the dream was dead. When Carrie brought it up, we called Dan at Northwest Flight Service to discuss learning how.

**COPA Pilot:** How did you learn about Cirrus aircraft?

**John:** We learned about the Cirrus during our introduction flight and knew it would be our first aircraft. After our first flight, we started looking into purchasing one. In late September 2021, we welcomed our new blood-red and white SR22T and call her "Charlie." Northwest Flight Service had balloons, wine and a bunch of folks there to welcome us and our airplane into the Cirrus community.

**COPA Pilot:** When did you take your first flight lesson and receive your private certificates?

**Carrie:** We took our first lesson April 14, 2021, with Northwest Flight Service, and both earned our private certificates in August 2021.



« **Carrie in the Lundeby's SR22T they named "Charlie."** They enjoy the freedom owning and flying their aircraft provides.

**COPA Pilot:** Do you have any other ratings? If so, what are they, and when were they acquired?

**Carrie:** I earned my instrument rating in November 2021 and commercial rating in February 2022. John received his instrument rating in February 2022 and plans on gaining his commercial rating later this summer.

**COPA Pilot:** Have you owned or regularly flown any other aircraft?

**John:** We have both only flown a Cirrus aircraft to date.

**COPA Pilot:** What made you decide on the Cirrus? Were there other airplanes considered at the time you were looking at purchasing it?

**John:** We researched all airplanes prior to the purchase; the main thing that drew us to the Cirrus was the parachute and its digital cockpit. We decided Cirrus was the best option for us.

**Carrie:** We also like the support from Northwest Flight Service with our aircraft and are fond of them in general. It is an amazing place to learn how to fly and you become part of the community.

**COPA Pilot:** What sort of flying do you do – personal, business, or both?

**John:** Flying is a great aid for us both in business and we also take advantage of it in our personal life.

**COPA Pilot:** Do you have a favorite flight and/or one you take often?

**Carrie:** To date, our favorite flight is to Jackson Hole, Wyoming. We have visited a few times during the winter and one time we took my folks!

**COPA Pilot:** What do you like most about flying?

**Carrie:** The freedom it gives us to travel with our busy work life. The satisfaction that we are flying our own airplane is probably the top reason! It's truly the best thing to date that we have learned! The sky is our place to be. It's a good stress reliever for our busy life.

**COPA Pilot:** Describe the dynamic of flying with your pilot spouse.

**Carrie:** Flying together for us is a continuation of what we do every day, since we work together. We enjoy weekends together and share some hobbies. When we fly, we work together. I am the senior

pilot, and very adept at managing the flight systems. John is good at stick and rudder and spotting airports. Both of us are very competent pilots in our own right, but we think that two really is better than one.

**COPA Pilot:** When did you join COPA, and how did you hear about it?

**John:** We joined during the spring of 2021 and heard about it from Northwest Flight Service.

**COPA Pilot:** Do you frequent the COPA forums? What COPA events have you attended, if any?

**John:** Unfortunately, neither of us has had time for any of it yet, but hope to in the future.

**COPA Pilot:** What are your future plans? Are there any big trips, licenses or different aircraft on the radar?

**Carrie:** As mentioned, John will be getting his commercial rating, and we are currently looking at the Vision Jet as a future airplane. ⊕





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**DON DUBIN** is a retired entrepreneur and is based at Harriet Alexander Field (KANK) in the mountains of Colorado. He is a certified Wilderness First Responder, a certified Rescue Rope Technician, an advanced Swiftwater Rescue Technician, and has been teaching survival techniques and working with rescue teams for over 40 years. He is currently an incident commander with Chaffee County Search and Rescue-South. Don is also a 2,200-hour, instrument-rated pilot and bought his first Cirrus and joined COPA in 2002.

## Get rescued fast! It's your best chance for survival

When flying over remote or mountainous terrain, plan for an off-airport landing.

by Don Dubin

---



**As an incident commander for Chaffee County Search and Rescue (SAR) in Colorado, I'm the guy who gets called out of his warm bed to help find you if your plane goes down in my area.** Our team participates in about 35 high mountain rescues each year. You can help us rescue you by planning ahead.

As a pilot, a 40-year veteran of teaching survival techniques and working with search and rescue teams, I have watched the facts surrounding the CAPS pull and subsequent rescue of two Cirrus pilots at Woody Creek near Aspen, Colorado, in January 2020. In that instance, the pilot's fortunate ability to communicate to rescuers with his cell phone was the deciding factor for a fast and successful rescue. Even then, it took nine hours!

Chaffee County, where I am based, lays claim to the highest concentration of mountains over 14,000 feet within the lower 48 states. No matter what direction I fly from my home airport, I find myself over high and generally inhospitable mountainous terrain within minutes of takeoff.

Regardless of where your flying missions take you, having to pull the chute and land off-airport is always a possibility. How prepared are you? Obviously, the more remote the location, the higher the risk of having a quick recovery. Many of us fly over remote locations like the mountainous western U.S. or Baja. Even the Appalachian Mountains may be a rescue challenge. These locations require some thought of how you would handle yourself after a successful landing under canopy.

Understanding what our ELTs and other devices do and how a rescue is initiated will go a long way toward a fast and successful outcome.

### **Who will rescue you?**

The first thing you should know is that Seal Team Six will not be repelling out of the sky 10 minutes after the aircraft sets down. In the Mountain West, it will more than likely be the county SAR team. If you have a better understanding of how search and rescues are handled, you might speed up what could be one of the worst days of your life.

**A member of the Chaffee County Search and Rescue** waiting with a load of equipment as a search helicopter lands. The Chaffee County team of Colorado participates in about 35 mountain rescues each year. (Photo courtesy: Don Dubin)



## Making Emergency Contact

Like all emergencies in our airplanes, the calmer and cooler we can keep our minds, the better. On the way down, hopefully, you have had the presence of mind to reach over and activate your ELT and squawk 7700 on your transponder.

If you are east of the Rockies, there are good odds you can keep in radio and radar contact with ATC and radar almost to the ground. However, in Colorado over the Rockies, the MEA is generally 16,000 feet MSL, but you will lose contact with ATC generally below 14,500 MSL. Where the plane ends up could be 35 to 40 miles from where you last talked to ATC. Or you might have canceled your IFR flight plan on your descent and may not be talking to anyone when you find yourself having to pull the red handle. A typical weather permitting departure in the mountains is departing VFR and picking up your IFR clearance in the air. You may be climbing and not able to talk to anyone for the first 8,000-9,000 feet of your climb.

## First Things First

You have pulled your chute in a remote area like the Rockies, now it is time to exit the aircraft. One of the first rescue items to carry with you in the aircraft is something to cut your seat belt. They can become jammed, or if you were upside down or at a strange angle, the seat belt could be very hard to unlatch. There are specific tools made for this exact situation; I recommend keeping such a tool in the center console of the airplane.

You should also carry a survival pack that is easy to reach. You'll need the proper clothing and equipment to survive the conditions outside for a minimum of 24 hours. You can purchase premade rescue packs and medical kits if you are not

interested in building your own. Here is a link to all things survival:

[http://www.dougitter.com/DR-aviator\\_survival\\_pak\\_index.htm](http://www.dougitter.com/DR-aviator_survival_pak_index.htm)

Remember you are working hard to keep a calm head, especially if you have passengers looking to you to maintain your role as pilot in command (PIC). The priority is to move everyone to a comfortable spot away from the aircraft in case of fire. The next step is to tend to any injuries with your well-stocked first aid kit in your well-stocked emergency pack.

## Waiting for Rescue

You should prepare that you won't be rescued immediately. You have the most energy during the first few hours. Keeping your passengers busy with tasks like gathering firewood and building shelters will keep them occupied and keep their morale up.

It is imperative to stay with the plane where you can be seen from the air and be rescued as fast as possible. You have activated your airplane's ELT, which statistically works about 80% of the time. It could have become disabled upon landing, or if the plane ended in the trees, the antenna could have been damaged, so you may not want to put all your eggs in that basket. Your passengers are looking for you to rescue them.

## Communicating Helps a Quick Rescue

The single best way to help facilitate a quick rescue is to take control yourself and have some way of communicating. Regardless of what ATC or other agencies may or may not be doing as a result of activating your ELT, you can communicate via satellite texting, either with loved ones on the ground or directly to the sheriff or rescue teams.

*“It is imperative to stay with the plane where you can be seen from the air and be rescued as fast as possible.”*



⤴ **The new technology in Personal Locator Beacons (PLB)** allows you to communicate via satellite and has been a game-changer in backcountry rescues. Above, two mentioned by the author, the Garmin InReach (right) and SPOT communication devices.

## “Attach a satellite communicator to yourself before every engine start. This step is the most important, in my opinion ...”

To enable a fast and successful rescue, you need to be able to communicate your GPS position and status after the crash. Attach a satellite communicator to yourself before every engine start. This step is the most important, in my opinion, and I hope it is your takeaway from this article.

Today, most pilots like the latest and greatest avionics – ForeFlight pro plans, XM weather, iPads, etc. I would recommend you also equip yourself with the latest technology in Personal Locator Beacons, commonly referred to as a PLB. The new technology in these devices allows you to communicate via satellite to text message to whomever you wish.

These lifesaving communicators have been a huge game-changer the last few years when it comes to backcountry rescues. A PLB also includes the normal SOS button, which sends your GPS coordinates to an international call center when activated. Yes, in addition to the cost of the device, there is a charge of around \$12 per month, depending on what type of plan you want – it’s cheap insurance, in my opinion. Two of the better devices on the market today are the Garmin InReach or SPOT communicators.

### What Happens When You Signal an Emergency?

When you push the SOS button on a PLB, depending on the type you have, a signal

is sent either to a government (COSPAS/SARAST) or private (GEOS) monitoring center. Then a slow process begins trying to verify what has happened. First, they will contact the emergency contacts you listed when you bought your device. With a few exceptions, like coastal waters or National Parks, eventually, the county sheriff where you ditched the plane will be notified.

In the Mountain West, the sheriff will then notify SAR or whatever emergency system the county uses. The county SAR team, like the one I work with, will oversee your search and assemble a rescue team. With just an SOS signal and no ability to text, the search team starts with very little information other than your position. If you have someone who is critically injured or needs something special, no one will know without two-way communication.

### Speed Matters

The bottom line at this point is that the speed and success, especially related to medical needs, is highly dependent on the information the rescuers obtain. As an incident commander who has been involved in hundreds of rescues, the more information we have, the faster and better the rescue will go; the less information we have, the slower it will go.

In most cases, extraction resources such as Flight for Life or military helicopters cannot be called until the extent of injuries, the number of passengers, etc.,

can be verified. They need information regarding exactly where you are and the type of terrain you may be trapped in.

As an incident commander, if I know the exact extent of the injuries and what resources you need, a possible description of the area around you, etc., I can send the right resources instantly without having to move slowly and verify things. Knowing the extent of injuries makes a huge difference in the kinds of medical resources we send immediately. The difference between a positive and negative outcome often is tied to whether I’m able to have direct contact with the injured or lost party to provide medical or other situational advice.

### Bottom Line

Put the odds in your favor, as survival favors the well prepared. ⊕

*Notes: The above opinions apply only to the United States and generally the lower 48.*

*The author has no affiliations with any of the companies mentioned.*

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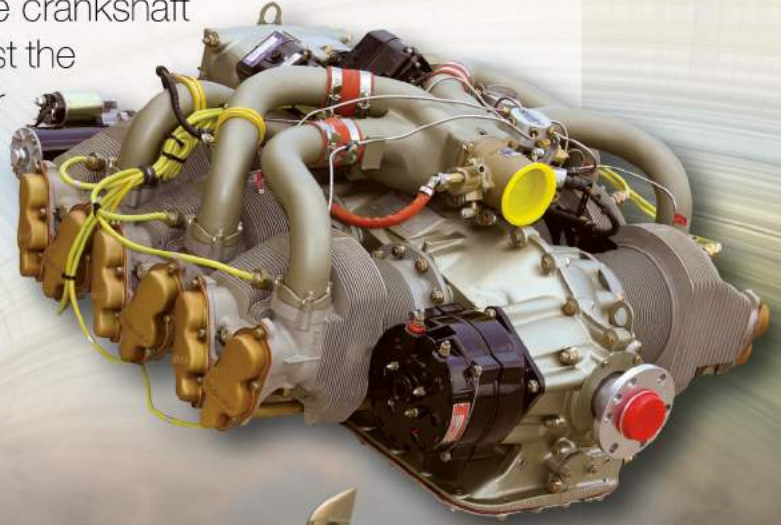
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# PILOT POINTERS

» *Tips for Cirrus Pilots*

**A squall line of thunderstorms** near the Cayman Islands in July 2016. While tropical squall lines do not normally have the solid, long convective wall and fast movement of midlatitude cyclone cold fronts, they are still very hazardous to aircraft and should be avoided. (Credit: Karsten Shein)



**KARSTEN SHEIN** is a former NASA and NOAA climatologist and was director of the Midwestern Regional Climate Center at the University of Illinois. He holds a commercial instrument license and Ph.D. and has been writing about aviation weather for the past 26 years. Karsten can be reached at [karsten@sheinenterprises.com](mailto:karsten@sheinenterprises.com)



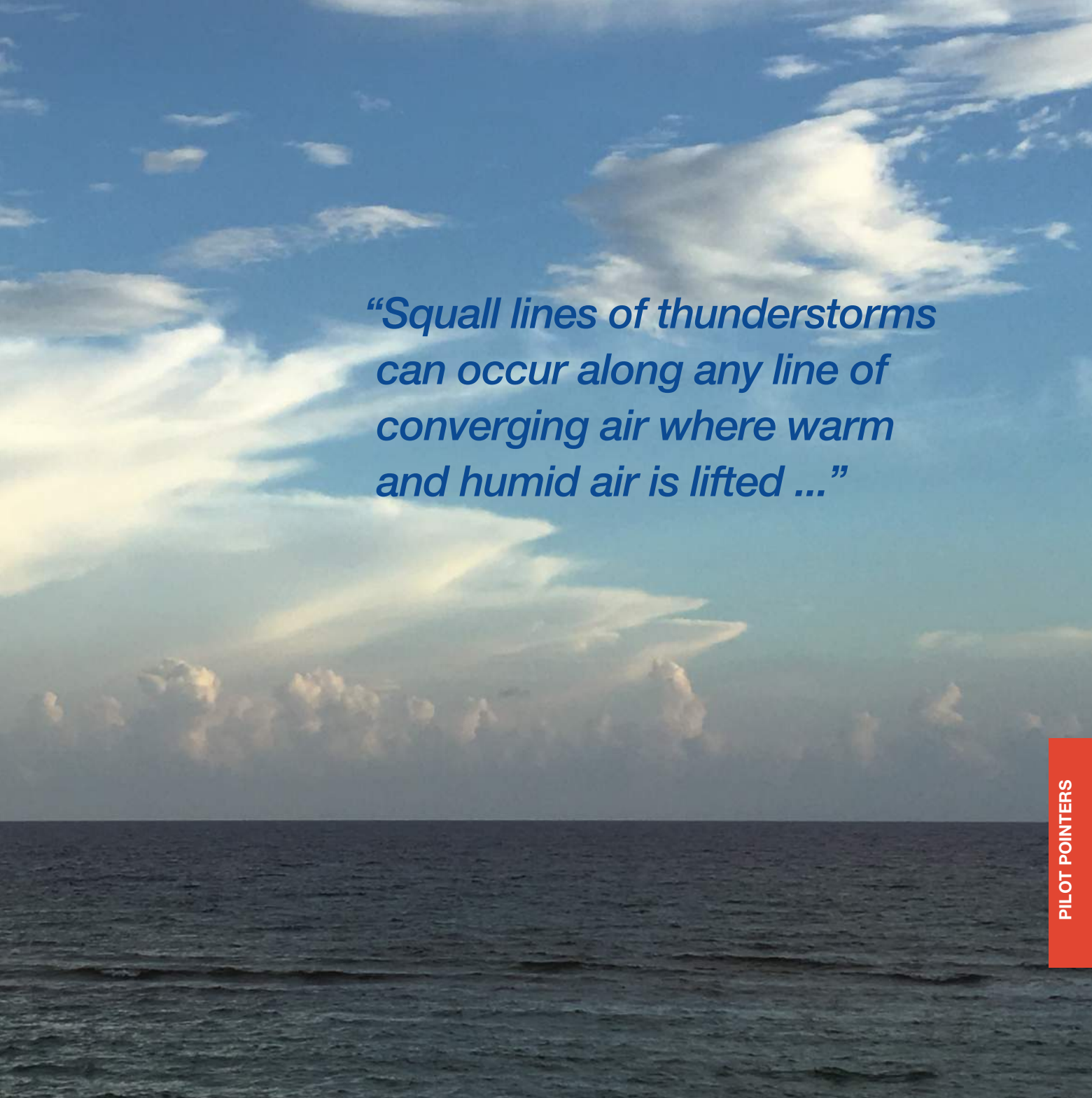
# Squall Lines

by Karsten Shein

**In the fading twilight, the route ahead of José was filled with looming shadows illuminated by frequent lightning flashes.** Though it looked ominous, his trusty Stormscope and data-linked weather radar on his MFD were supplying him with information that showed a nice-sized gap he could shoot through to

reach his home airport on the other side. Though the ground-based radar returns showed no precipitation, he still lost visibility as he flew into the rising cumulus wall which his instruments had shown as a gap. A few minutes in, his cockpit lit intensely from a nearby lightning strike, and José was pushed into his seat as





*“Squall lines of thunderstorms can occur along any line of converging air where warm and humid air is lifted ...”*

his VSI shot up. Immediately, a river of rain pelted the windscreen, and the VSI reversed as he strained against his harness. Just then, his MFD updated with the most current radar image showing the gap had disappeared, and he was now in the middle of a large storm cell. José initiated a 180-degree turn to return to clear air, but it was no use; the storm

was moving in that direction as well; he was turning back into the core of the storm. The forces were just too great for his small airplane. Witnesses reported seeing the aircraft, minus a wing, spiraling out of the base of the storm.

Squall lines of thunderstorms can occur along any line of converging air where

warm and humid air is lifted – such as along the Intertropical Convergence Zone (ITCZ) near the equator or cold fronts in the middle latitudes located between the tropics and the polar regions. While ITCZ squall lines can be substantial, rising to FL600 and extending thousands of miles, these squall lines often have wide gaps

(Continued on page 34)

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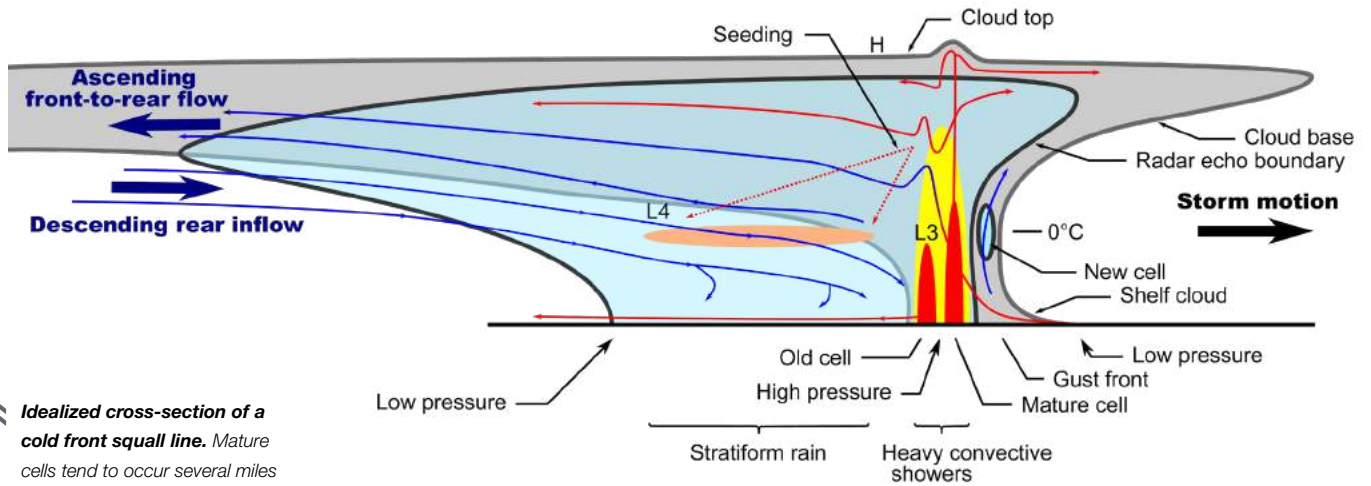


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⌘ **Idealized cross-section of a cold front squall line.** Mature cells tend to occur several miles ahead of the front and can be severe. Storm outflow and frontal movement initiate new cell development, sustaining the squall line. (Credit: R.A. Houze, redrawn by Whidou, own work CC BY-SA 4.0)

**“The reason squall line gaps may be cloud-filled but appear clear in both radar and Stormscope displays is that developing storms will usually not produce lightning or precipitation.”**

of clear air between storms, and they do not move quickly.

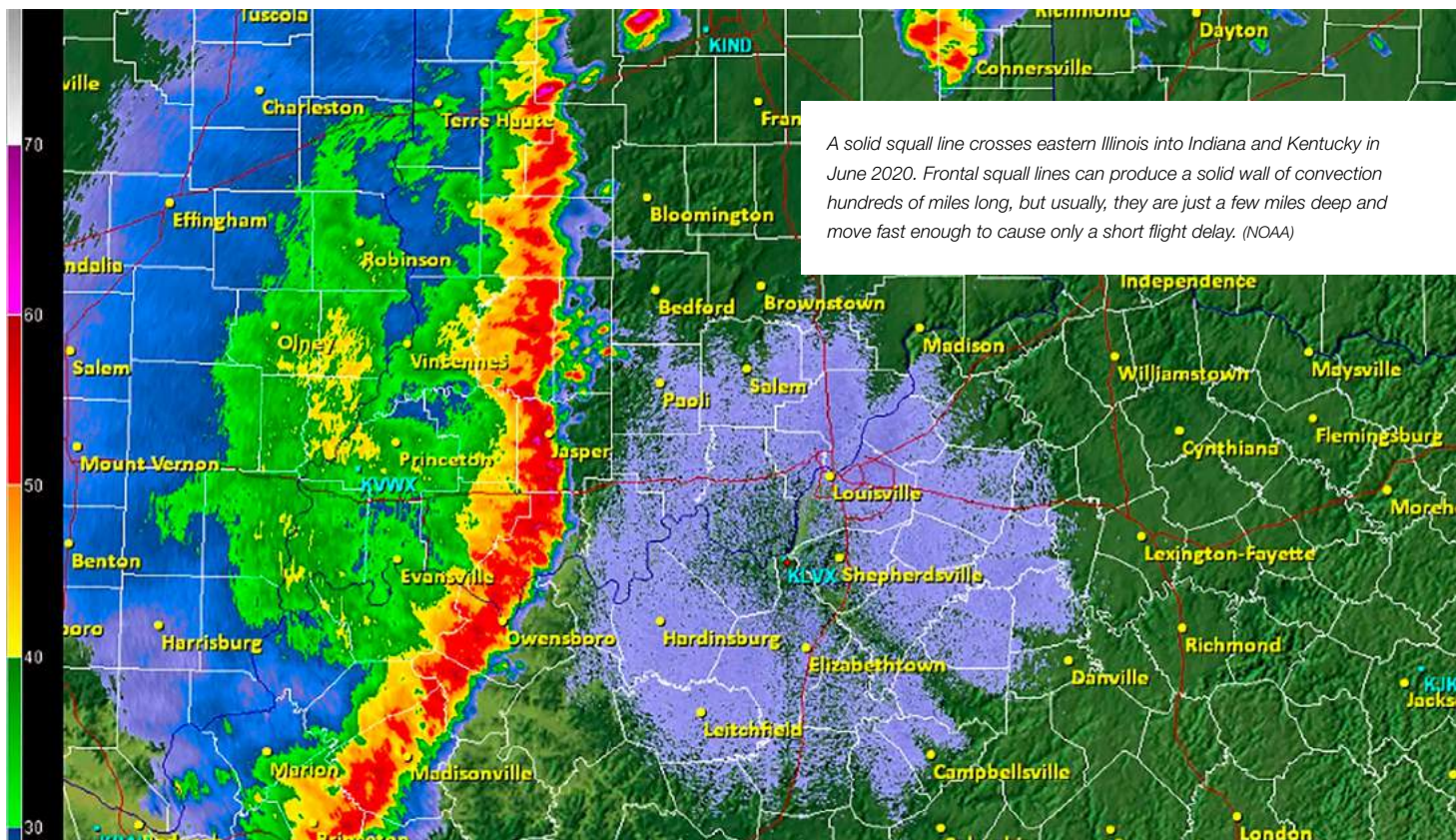
Conversely, squall lines associated with mid-latitude storm system fronts can move very quickly (often 50 knots or more), sometimes advancing faster than the front itself, and storms within the line can be severe. Importantly, squall lines may fill in to create unbroken strings of convective cells (often hundreds of miles long), quickly filling in the gaps between cells, and the storms can move along the front toward the central low (a process called “training”) even if the front stalls. The severity of the convective cells can also produce downwind turbulence and toss hail up to 20 miles ahead of the storm. All these features make squall lines something pilots should avoid.

In addition to frontal squall lines, pre-frontal squall lines may also develop. As the front pushes into warmer air and storms develop, higher-level atmospheric flow and low-level disturbances can move the line well ahead of the front. This can create a localized front 50 or more miles ahead of the main cold front if atmospheric conditions are favorable. Often, because the air out ahead of the front is warmer and more humid, these pre-frontal squall lines can be even more intense than the frontal squall line.

The reason a squall line appears to sustain over long periods and distances is that older convective cells generate new cells, both ahead and next to them. The forward movement of the trailing front ensures the cells continually push into a region of warmer, humid air. The gust front outflow from mature cells creates the lifting needed to generate a new cell as the older cell decays behind it. Similarly, and simultaneously, the gust front spreads from the sides of the mature cell. This alone can initiate the lifting of the air next to the cell, but that lifting can be greatly enhanced if gust fronts from two adjacent cells converge in the gap between them. This is how those enticing gaps through which we are tempted to fly can close so quickly.

The reason squall line gaps may be cloud-filled but appear clear in both radar and Stormscope displays is that developing storms will usually not produce lightning or precipitation. In the developing stage, thunderstorms are primarily upflow and cloud building, so a pilot may easily mistake a region of development for a flyable gap between squall line storms.

Everything pilots have learned about thunderstorms applies to squall lines, but at a larger scale. Though 20 miles



A solid squall line crosses eastern Illinois into Indiana and Kentucky in June 2020. Frontal squall lines can produce a solid wall of convection hundreds of miles long, but usually, they are just a few miles deep and move fast enough to cause only a short flight delay. (NOAA)

of clearance is recommended as a minimum, a good rule of thumb is to avoid thunderstorms by 1 mile for every 1,000 feet of cloud tops. In general, this means at least 20 miles, but as much as 40-50 miles for the largest supercells. Hail and moderate to severe turbulence can be encountered the closer one gets. For flying gaps, this means that even if sticking with minimum separation, the gap should be at least 40 miles wide but preferably closer to 80-100 miles wide to consider crossing. Often such gaps simply don't exist in squall lines.

Fortunately, squall lines that exhibit solid returns over great distance also tend to move quickly. A brief departure delay or a pitstop near the front can give enough time for frontal passage and a continuation of the flight in clear air. If you are waiting out squall line passage on the ground, be sure to tie your aircraft securely, as winds can easily gust over 50 knots. Frontal squall line positions and movements are readily identified and forecast by meteorologists. Weather

briefings and even preflight planning a day or two in advance can help pilots avoid having to tangle with a squall line.

When approaching a squall line from behind, pilots may find themselves in IFR with stratiform clouds and rain, even after crossing the frontal boundary into warm air – the strong cells of the squall line may still be several miles ahead. In this situation, it may be difficult to identify the line ahead of time, so situational weather awareness via avionics, data-linked tablets or Flightwatch are critical here. Ahead of the front, one is normally VFR with an ability to see the line, though summer haze may obscure it at lower altitudes. Though datalink radar service is a great feature to help avoid storms, pilots should remember: that data may be 5-15 minutes old by the time it reaches the cockpit. Storms can go from development to maturity in only a few minutes. Similarly, a Stormscope will only detect lightning, not predict it – meaning it will show clear air until the moment a mature storm delivers its first strike.

Should a pilot inadvertently penetrate a squall line thunderstorm, extraction should be in accordance with the pilot's training, including slowing to maneuvering speed and turning on deicing functions, if available. However, with the growing ubiquity of datalink weather in the cockpit, pilots can now gain insight into the best route out of the storm, which may not be a 180-degree turn that exposes the aircraft to additional stress. Available radar information may show the path behind you has closed, and the safest route may be to continue straight ahead. Though, without radar assistance, the 180 remains the preferred option. Squall lines may be hundreds of miles long, but most are only a few miles deep. If you do encounter conditions near a squall line that your fellow pilots should know about, please file a PIREP once it's safe to do so. ⊕

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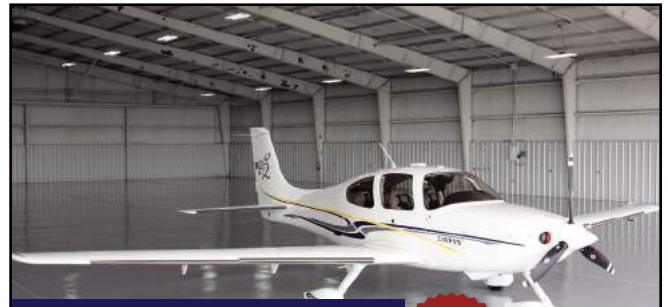
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## TECH TALK

» *Maintaining and Knowing  
Your Aircraft*



**MIKE BUSCH** has been a pilot, aircraft owner and CFI for more than four decades and 7,500 hours. He became increasingly interested in the maintenance aspects of aircraft ownership about 20 years ago, ultimately earned his A&P/IA, and in 2008 was honored by the Federal Aviation Administration as “National Aviation Maintenance Technician of the Year.” Mike is founder and CEO of Savvy Aircraft Maintenance Management, the world’s largest firm providing professional maintenance management for owner-flown aircraft, which presently manages more than 7% of all Cirrus airplanes in North America and growing 5% per month. In his spare time, Mike is also a prolific aviation writer, teacher, consultant and expert witness. He has written many hundreds of technical articles published in *American Bonanza Society Magazine*, *Aviation Safety*, *AVweb*, *Cessna Pilots Association Magazine*, *EAA Sport Aviation*, *IFR*, and *The Aviation Consumer*. In addition, he conducts free maintenance webinars on the first Wednesday of each month. Mike co-founded AVweb in 1995 and served as its editor-in-chief for more than seven years. Questions for Mike may be emailed to: [mike.busch@savvyaviator.com](mailto:mike.busch@savvyaviator.com).

# (What we have here is a) Failure to Rotate

*Is the conventional wisdom  
wrong about why exhaust  
valves burn?*

by Mike Busch



⤴ *A burned exhaust valve.*



### **Piston aircraft engines have an awful lot of moving parts.**

Way too many, if you ask me. The thought of thousands of separate metal parts reciprocating, rotating, wiggling, wobbling and rubbing against one another thousands of times a minute ought to make you nervous – it does with me. It’s something I try hard not to think about while airborne, mainly because I fly a lot better when not distracted.

Of those thousands of moving parts, two kinds are the most worrisome: the ones most likely to blindside you with a costly, premature, unbudgeted-for engine overhaul or replacement, and the ones most likely to make you fall out of the sky (or at least soil your undies). The biggest offender in the safety-of-wallet category is the camshaft – and for Lycomings, the cam followers, aka tappets – which pre-presents by far the leading cause of premature engine teardowns. (Especially if you don’t count prop strikes, which you really shouldn’t since the prop isn’t part of the engine.)

In the safety-of-flight category, hands-down the most-wanted villains are exhaust valves. Exhaust valves can ruin your day in at least two different ways: they can stick, or they can burn. Although these problems can occur in any piston aircraft engine, sticking is much more common in Lycomings and burning is more common in Continentals. I discussed sticky valves at length in the September 2020 issue of *COPA Pilot* (“Why Valves Stick” ... hint: the answer is “leaded avgas”) so this column will focus on what we’ve learned about burned valves.

### **Don’t Blame the Pilot**

After I purchased my first airplane in 1968 – a new Cessna 182 powered by a Continental O-470-R – it didn’t take long for me to recognize that exhaust valves were the most vulnerable components of my engine. Burned exhaust valves were the principal reason that cylinders flunked the annual compression test; in those days, anything less than 60/80 was considered unairworthy and condemned the cylinder to removal and replacement or rework. Mechanics invariably blamed burned exhaust valves on pilot mismanagement of the powerplant and warned us not to lean our engines aggressively so we wouldn’t overheat the valves and cause them to burn. The standard A&P mantra was “fuel is cheaper than engines.”

Single-probe EGT gauges were just coming into vogue then, and we were taught that the best way to prevent exhaust valve problems was to avoid operating at excessive EGTs. The implication was that EGT was a good proxy for exhaust valve

*“There is simply no statistically significant correlation between EGT and exhaust valve burning. It’s a myth.”*

temperature, and that keeping EGTs cool would assure that exhaust valves wouldn’t overheat.

This all sounded logical and convincing at the time, and most of us believed it. But it turned out to be complete hogwash!

If high EGTs were the cause of exhaust valve burning, then low-compression engines like the O-470-R in my Skylane would suffer more burned exhaust valves than high-compression engines like the IO-520-K in the Bellanca Viking I owned after I sold the Skylane. After all, a high-compression engine inherently has much lower EGTs than a low-compression engine does, because the high-compression engine is more efficient at converting the heat energy liberated during combustion into mechanical energy (horsepower) so it wastes less heat energy out the exhaust. That wasted heat energy is what we see in the cockpit as EGT, and it’s inversely correlated with compression ratio.

Of course, it’s simply not true that high-compression engines suffer fewer burned exhaust valves than low-compression engines. There is simply no statistically significant correlation between EGT and exhaust valve burning. It’s a myth.

Nor is aggressive leaning the culprit. In the 3,300 hours that I put on the 12 cylinders of the Continental TSIO-520-BBs in my Cessna Turbo 310 before finally retiring them, I never suffered a single burned exhaust valve ... not one ... and those engines were always leaned very aggressively, almost exclusively lean-of-peak except for takeoff and initial climb.

(continued on page 42)

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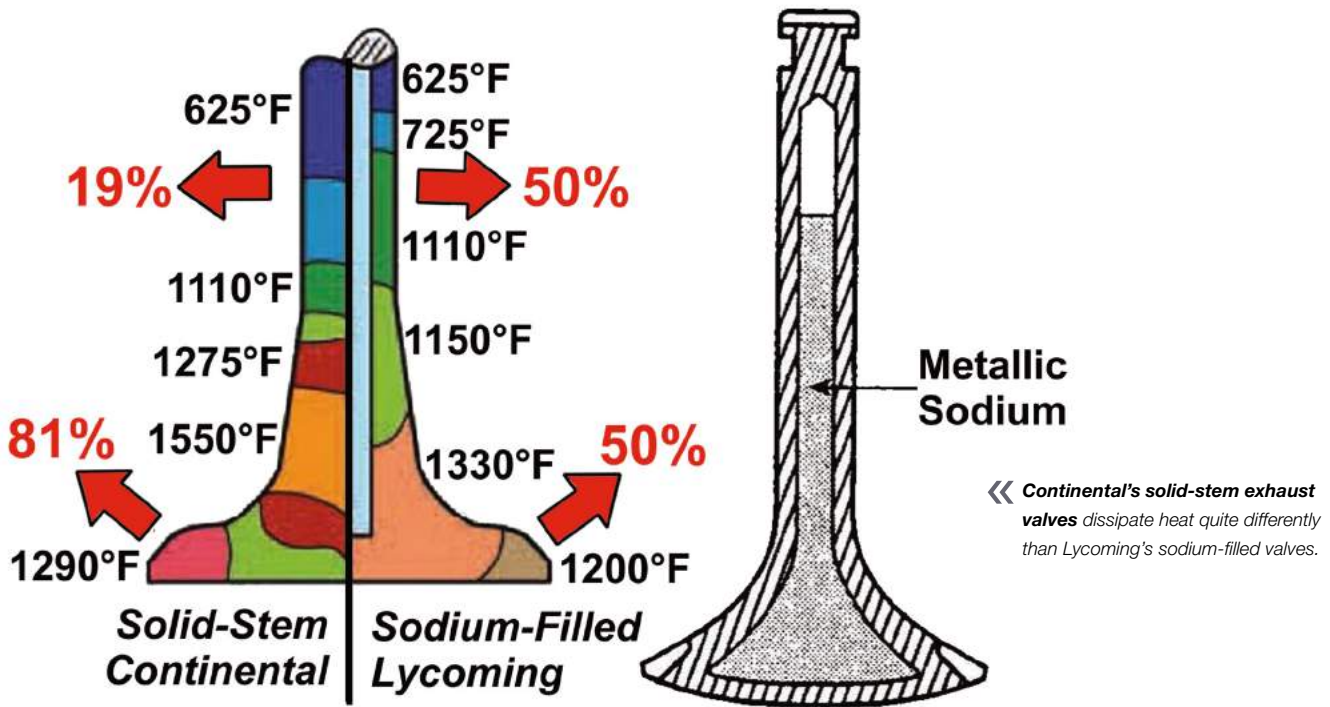
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No, when an exhaust valve burns, it's seldom the fault of the pilot. This turns out to be just another old wives' tale. But if it's not the pilot's fault, whose fault is it?

Well, the short answer is that it's generally the fault of the hardware. And that's where the story really starts to get interesting.

## Exhaust Valves Survival Strategies

Exhaust valves must survive in an atmosphere of incredibly hot and corrosive gas whose temperature can reach 4,000°F at the peak pressure point of the combustion event. To make matters worse, the valve stem must oscillate smoothly through a valve guide without benefit of lubrication (since the stem runs so hot that engine oil would just carbonize). It's a miracle that these valves last as long as they do.

Key to the exhaust valve survival is the valve's ability to shed this intolerable heat by transferring it to the cylinder head, which acts like a giant heat sink for the valve. There are two ways the valve can transfer its heat to the cylinder head: via contact between the valve's head and the valve seat when the valve is closed; and via contact between the valve's stem and the valve guide all the time.

Continental and Lycoming employ subtly different construction and heat-sinking strategies for their exhaust valves. Continental valves have solid stems and heads made of an

exotic nickel-chromium superalloy called Nimonic® known for its high-temperature, low-creep characteristics.

Lycoming valves are made of not-so-exotic stainless steel but have hollow stems partially filled with metallic sodium that has the consistency of toothpaste at room temperature, an unusually low melting point (208°F) and high boiling point (1,621°F), plus exceptional thermal conductivity. The sodium liquifies as the valve starts to heat up, sloshes back and forth inside the hollow valve stem, and greatly improves transfer of heat from the head of the valve to the stem.

As the graphic above indicates, Continental's solid-stem exhaust valves shed their heat predominantly through contact between the valve head and the valve seat, while heat dissipation of Lycoming sodium-filled valves is split evenly between the head-to-seat interface and the stem-to-guide interface. That's why a close-tolerance fit between the stem and guide is essential to the survival of Lycoming valves, while Continental valves can usually cope with sloppy-fitting guides so long as the head of the valve makes firm, leak-free contact with the seat throughout its entire 360-degree circumference when the valve is closed – about two-thirds of the time.


## Threats to Survival

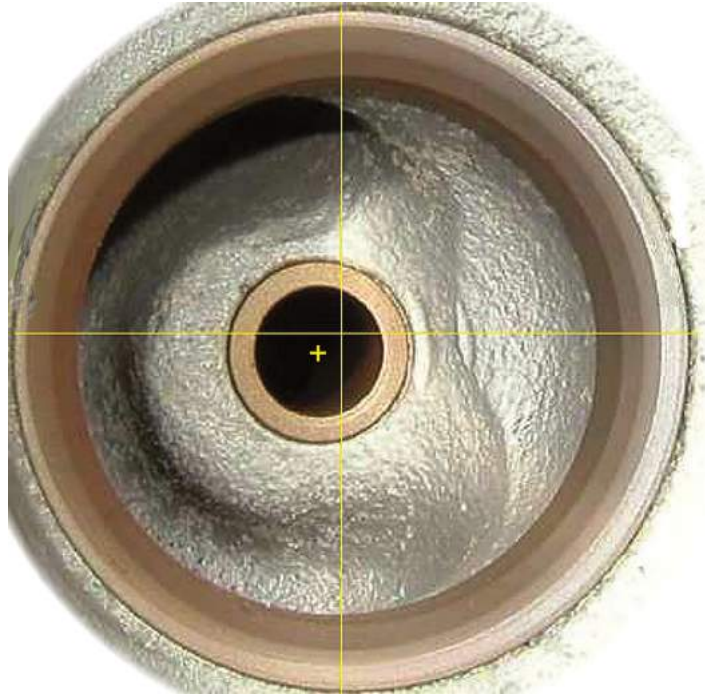
Exhaust valves burn when the heat transfer path from the valve to the cylinder head is compromised. If the valve loses its heat sink, it can overheat and start to warp and possibly

start to crack around the edges. This causes it to lose its seal with the valve seat, allowing extremely hot combustion gas to leak past the valve during the hottest part of the combustion event when the valve is supposed to be closed. The escape of this extremely hot gas results in metal erosion and warping, increasing the leakage of hot gas past the valve. Lather, rinse, repeat, and pretty soon the valve is toast.

Sometimes this is baked into the cake when the cylinder leaves the factory or the engine shop. For example, if the valve guide and valve seat are not perfectly concentric, the valve won't seal perfectly around its entire 360-degree circumference. There was a period of years during the 1990s when the Continental factory stopped "post-reaming" valve guides after they were installed in the cylinder, and instead was pre-reaming them before installation. That turned out to be a very bad idea and resulted in serious concentricity issues. We started seeing large numbers of Continental exhaust valves burned after just 400-500 hours in service. Eventually, Continental went back to their tried-and-true post-reaming process and the concentricity problems largely went away. (For a while at least ... read on.)

Grinding the valve so it makes proper contact with the seat is harder than it sounds. The overhaul manual calls for the face of the valve to be ground at a slightly different angle than the seat angle in order to provide a narrower contact footprint that will seal better. It turns out that this is tricky business. If the contact area is too wide the valve won't seal well, but if it's too narrow the heat transfer path from the valve face to the seat is compromised. Valve and seat grinding is as much of an art

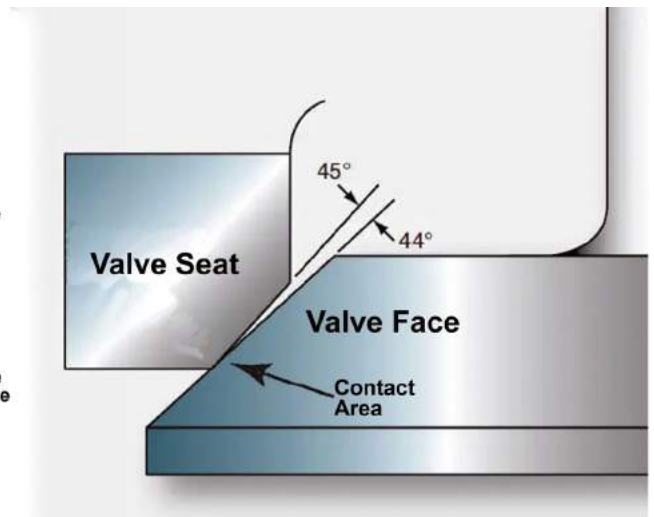
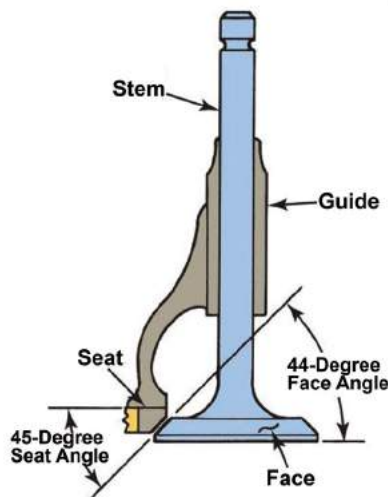
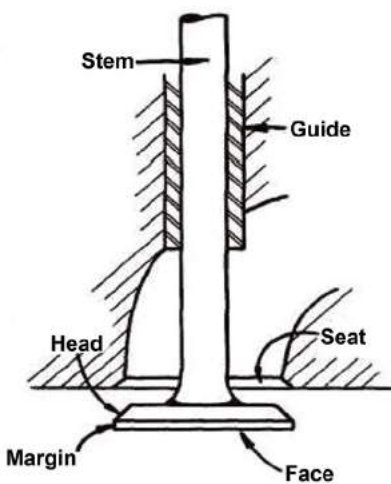
**Example of poor concentricity**   
of guide and seat.



as a science, and some engine shops do it better than others. Doing it right is particularly important for Continental valves because they are so dependent on face-to-seat heat transfer.

Lycoming sodium-filled valves are more dependent on the stem-to guide heat transfer path, so worn guides that have a sloppy fit to the valve stems can lead to burned valves. This is one reason that Lycoming recommends regular "wobble testing" (Service Bulletin 388C) to check for play in the stem-to-guide interface. This is much less important for Continental engines, which tolerate worn guides far better.

 **Valve terminology** and face/seat angles.



## Failure to Rotate

Rotation is also essential to exhaust valve survival. Most Continentals and Lycomings employ exhaust valve rotators – Lycoming calls them “rotator caps” and Continental calls them “rotocoils” – that cause the valve to rotate a fraction of a degree each time the valve opens. At typical cruise RPM, the valve typically rotates a full 360 degrees each minute.

Exhaust valve rotation accomplishes two things: It ensures that the heat load is spread evenly and symmetrically across the face of the valve and prevents the development of hot spots that can cause the valve to warp and then burn. Rotation also helps prevent the formation of deposits on the valve seat that can interfere with the valve’s ability to seal properly.

In recent years, we’ve been finding an increasing number of burned valves caused by failure of the rotator, particularly in Continental engines. My colleague Dave Pasquale A&P/IA who

operates Pasquale Aviation in Pottstown, Pennsylvania, has done extensive research on this, and he provided many of the photos in this column.

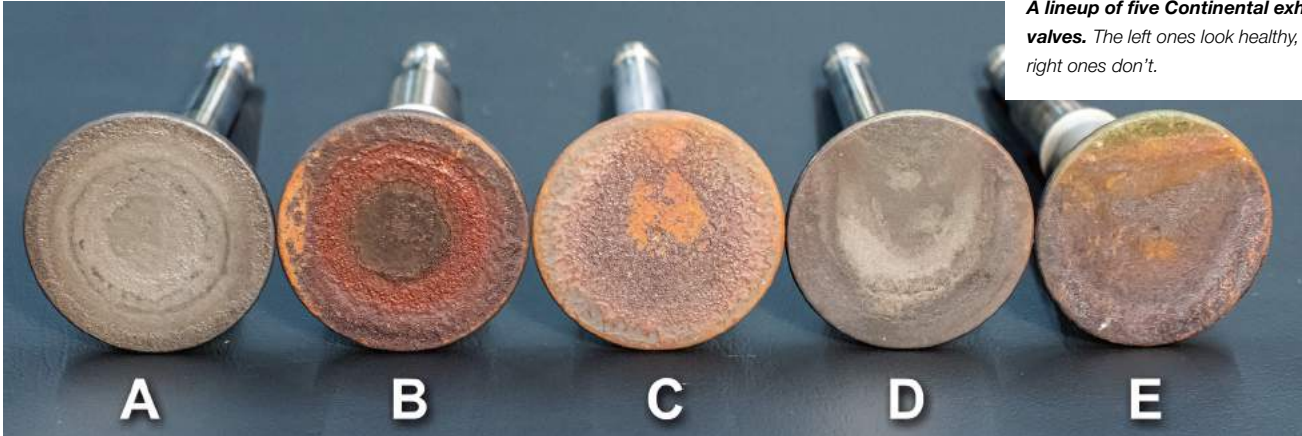
The Continental rotocoil contains a garter spring that gets laterally “squished” every time the valve opens, and it’s the squishing of the spring that produces the rotation. Unfortunately, this squishing action also causes the spring to wear and eventually it wears enough that the rotocoil stops rotating the valve. Once that happens, it doesn’t take long for the non-rotating valve to develop a hot spot and eventually burn beyond salvation.

We’ve had the feeling that these rotocoil failures are happening a lot more frequently than they used to. There may be a good reason for this. It turns out that Continental’s vendor (Federal-Mogul, formerly TRW) made some subtle changes to the rotocoil that seem to have adversely affected its longevity. The older rotocoil (Part No. 629117) used a larger-diameter garter spring and was held together by a circlip, while the current rotocoil

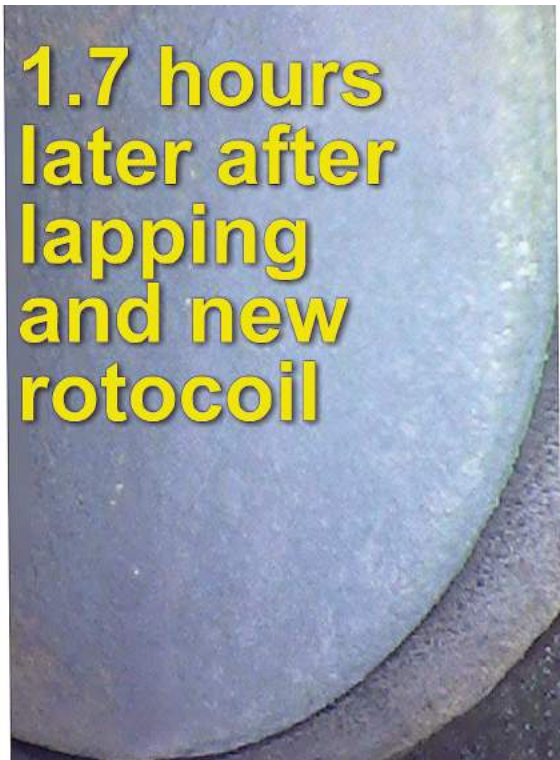
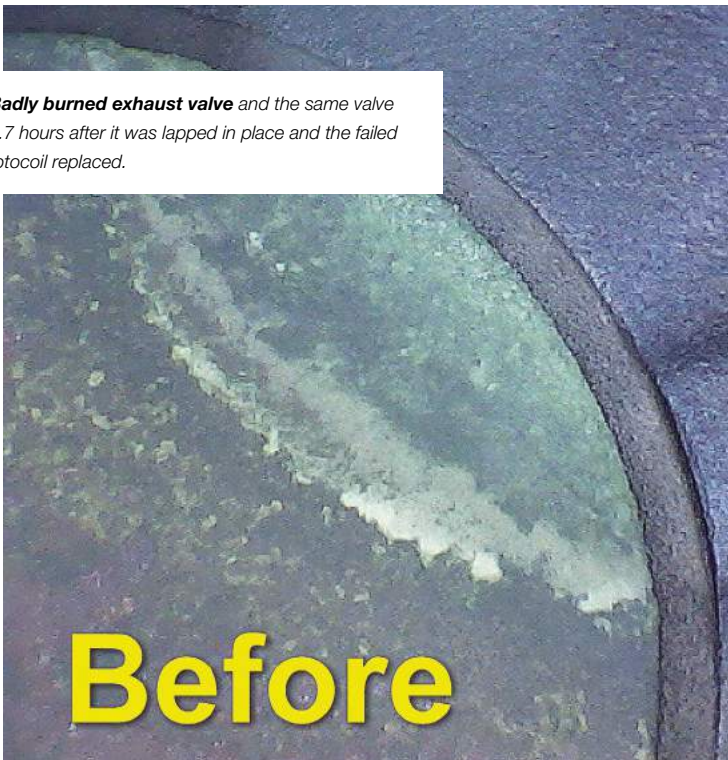
≡ **Top: Continental rotocoil** disassembled, showing the garter spring. **Bottom: Two garter springs**, one in good shape, the other badly worn.



**A lineup of five Continental exhaust valves.** The left ones look healthy, the right ones don't.



**Badly burned exhaust valve** and the same valve 1.7 hours after it was lapped in place and the failed rotocoil replaced.



(part No. 652112) uses a smaller-diameter garter spring, has no clip, and seems to be failing more quickly, sometimes after as few as 500 hours.

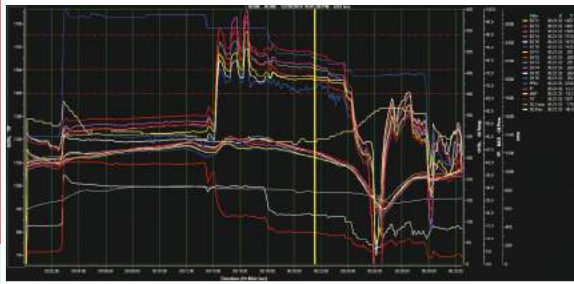
The good news is that it's fairly easy to detect exhaust valves that have stopped rotating simply by inspecting them with a borescope. A valve that is rotating properly will have a symmetrical appearance the way valves A and B in the top photo above do. Valve A is cleaner because it has been operated mostly LOP, while valve B has more deposit buildup because it has been operated mostly ROP, but both are symmetrical and healthy-looking. Valve C exhibits subtle signs of asymmetry, probably because its rotocoil has started to fail. Valve D is profoundly asymmetric and definitely not rotating, though

it hasn't burned yet and might just need a new rotocoil. Valve E is also not rotating and has started to burn, though there's a good chance the valve could be saved by lapping in place and installing a new rotocoil.

It's amazing how quickly a failing valve can heal if it's caught early enough. Look at the striking before-and-after photo I received from Dr. Gary Silver A&P/IA who owns, flies and maintains a Cessna 421 powered by a pair of Continental GTSIO-520s. The photo above shows a borescope image of a badly burned #4 exhaust valve in Gary's left engine, and another image of the same valve only 1.7 hours after Gary lapped it in place and replaced the failed rotocoil. Remarkably, the nasty hot spot has almost completely disappeared.

(continued on page 48)

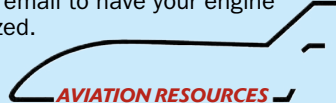
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⏪ **Failed Lycoming rotator cap** (left) resulted in a hot spot on this exhaust valve (center). Lapping the valve in place and installing a new rotator cap resulted in a healthy-looking valve 10.7 hours later.

***“Burned valves aren’t your fault, they’re almost always a hardware problem.”***

## What About Lycomings?

Lycoming exhaust valves use a completely different style of rotator and we don’t see them fail nearly as often, but it does happen occasionally. The Lycoming rotator is a small cap that sits on top of the valve stem and the photo above shows one that exhibits a deep linear groove worn by the tip of the rocker arm – a sure sign it’s not rotating. This one made it to 1,362 hours before the failure was discovered. Lapping the valve and replacing the rotator cap resulted in a much healthier-looking valve when it was borescoped again 10.7 hours later.

**Here are the key takeaways:** Burned valves aren’t your fault, they’re almost always a hardware problem. If you inspect your cylinders frequently (at least every 100 hours, 50 would be even better), you can catch valve issues early and avoid the need for cylinder removal. The borescope will show whether the valve is a viable candidate for lapping in place. Always replace the rotator when you do this. A follow-up borescope inspection 10 to 25 hours later will hopefully confirm you dodged the bullet. Pulling the jug should always be treated as the last resort. ⊕

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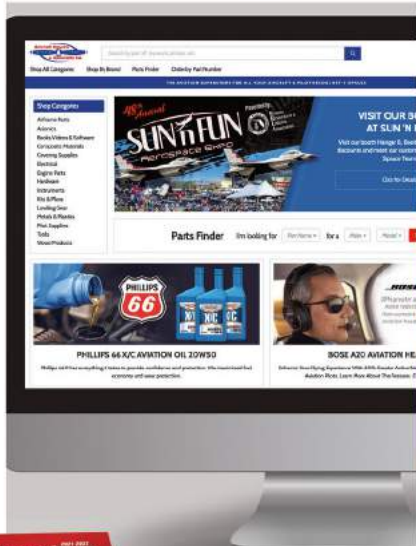
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# Practical G1000 Tips from a Cirrus Pilot

by Norbert Vorstädt



**NORBERT VORSTÄDT** made his first flight in a Cirrus in 2004 and has since explored the American, Canadian and European skies with his wife Rosina. They have visited many places on a pilot's bucket list including Alaska, Atlantic Canada and the Swiss Alps, in which they have kept a blog about their travels at [www.vorstaedt.de](http://www.vorstaedt.de). Being a software developer by profession, Norbert loves to analyze user interfaces of aviation devices. He makes frequent use of the G1000 Trainer which eventually led to his book "The G1000 Exercise Book" describing practical ways of becoming proficient on the G1000 or regaining currency after periods of inactivity. His book is available on Amazon and Apple Books. Questions and comments can be sent to Norbert at: [TheG1000ExerciseBook@gmail.com](mailto:TheG1000ExerciseBook@gmail.com)

**The advent of avionics systems like the Garmin G1000 has made navigation so ridiculously easy that aviators of the past would be jealous of us.** They wouldn't be able to believe the degree of perfection navigation has reached today. Nevertheless, occasionally cockpit automation has some surprises for us, particularly for pilots like me who do not fly regularly, but in seasonal chunks. Admittedly, my situation is kind of unique. I live in Germany but usually visit the U.S. twice a year for a couple of weeks of intense flying.

Together, my wife and I, who luckily is as enthusiastic about flying as I am, have visited almost every region in the U.S. and Canada over the past 20 years, mostly flying a Cirrus SR22. As we don't own an airplane, we rent from flying clubs and cope with whatever avionics the aircraft offers; but about two-thirds of our flight time has been in G1000 cockpits. We have seen this system develop from its early versions to what it is today. As a diligent note keeper, I have collected an entire notebook full of remarks about kinks in the G1000's user interface,

deficiencies of my understanding of the system, and all the mistakes I have made. In this article, I want to share some of these notes and tips with you.

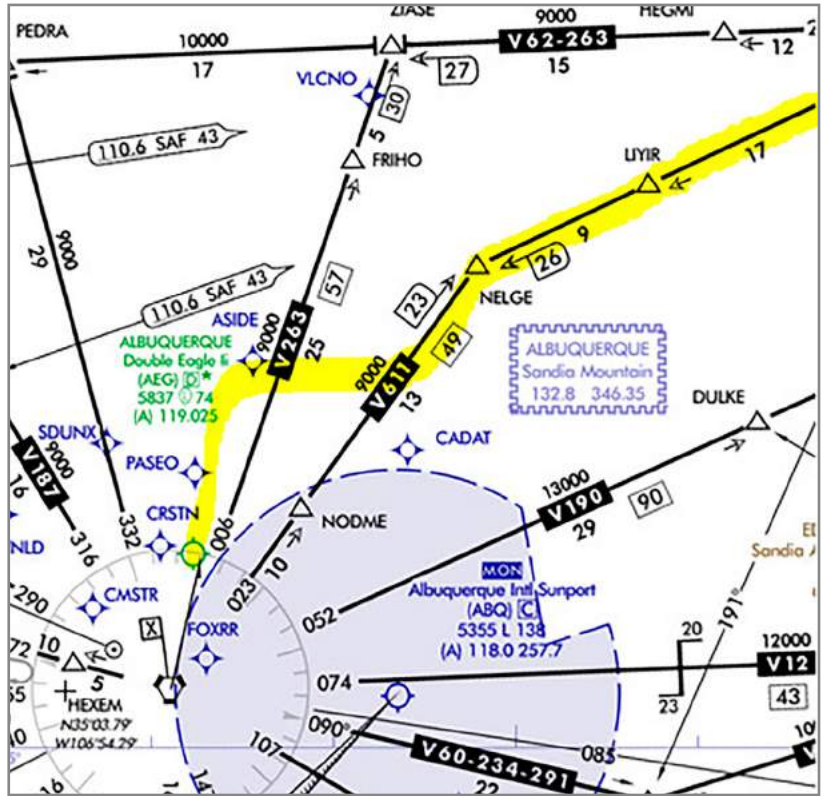
If I could name a single tool that has helped me over the years, it is Garmin's G1000 Trainer software, also called the Perspective Trainer, in the version customized for the Cirrus SR22. About a month before we go on one of our extended trips, I start practicing with it and become proficient again in the G1000's "buttonology." The \$35 I paid for this software was one of the best investments I've ever made. If you happen to have the G1000 Trainer installed on your PC at home, you might want to use it to reconstruct the following scenarios.

As a warmup, I start with an easy instrument departure.

## Joining an Airway on Departure

The majority of instrument flight training is dedicated to instrument approaches, not without reason. But as simple as many departure scenarios look, they

Figure 1: Joining V611 south of NELGE intersection. >>



can sometimes hold a surprise or two. One of these surprises greeted me when departing the Albuquerque Double Eagle II Airport (KAEG) to the north. After some initial vectors, we were just north of the airport when ATC asked me to join V611 direct NELGE intersection (see Figure 1, upper right). This was not totally unexpected, as NELGE was the first waypoint of my flight plan. I had expected to receive vectors ending in “proceed direct NELGE,” and now had to quickly program the G1000 to join V611.

The easiest way to join V611 south of NELGE is certainly to add another waypoint before it, for example, NODME or ABQ, then activate the leg to NELGE and arm NAV mode ... and that’s what I did. Thankfully my wife was my co-pilot and I could delegate that to her. Let’s consider alternative methods for a moment. How about doing a direct-to NELGE and setting an inbound bearing of 023, which is the ABQ radial leading to NELGE (see Figure 2, right)?

**Clue No. 1:** Radials are not identical to magnetic bearings! Airway V611 runs along the ABQ 023 radial, but this line



<< Figure 2: Direct-to dialog with course set to 023°.

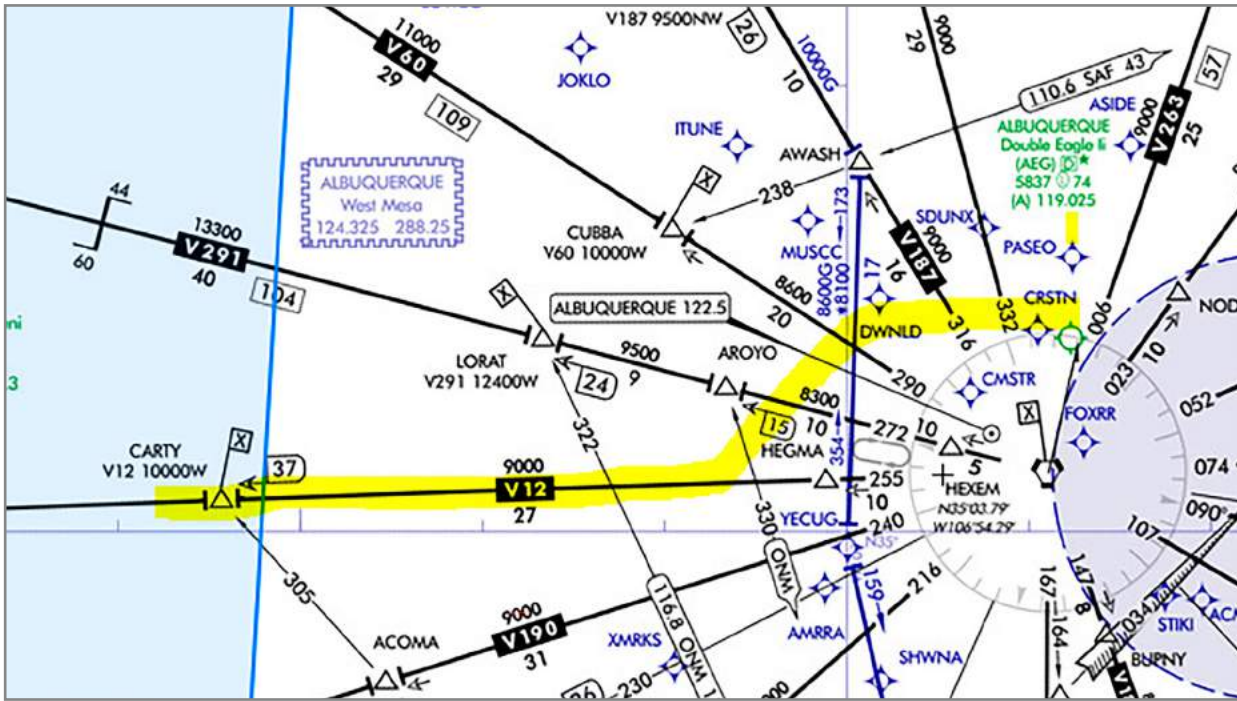


Figure 3:  
Joining  
V12 east of  
CARTY  
intersection.

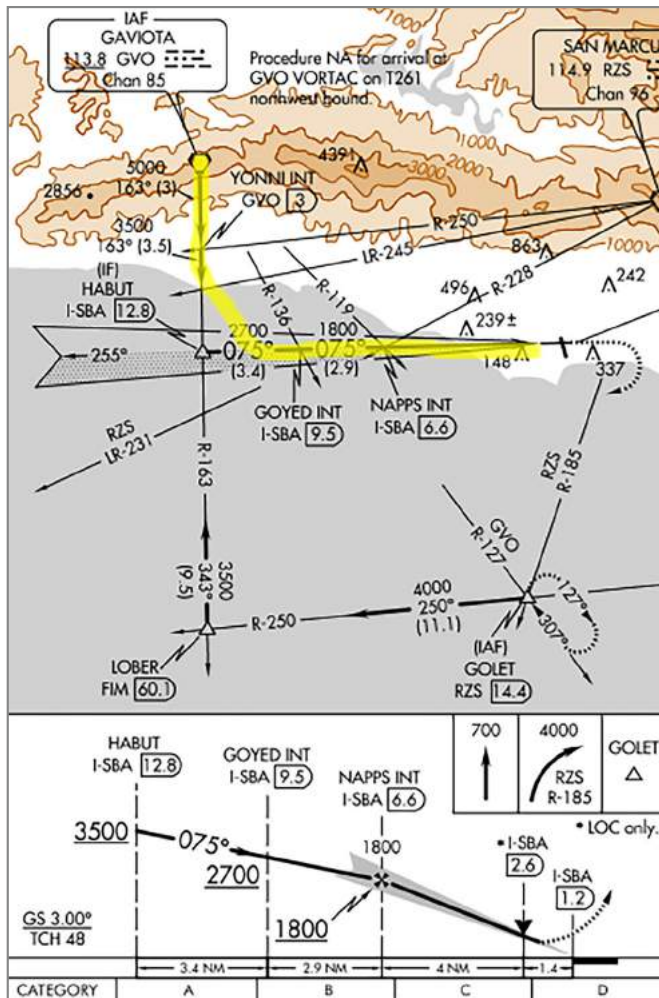


Figure 4: Excerpt  
of ILS 07 Approach  
into KSBA.

happens to have another magnetic bearing, namely 028°. A difference of 5 degrees! Surprised? So was I.

Why are VOR radials not perfectly aligned with magnetic bearings? The reason is that the magnetic field of Mother Earth changes; at most places only some arc minutes per year, but that adds up. When the ABQ VOR was installed in 1965, the magnetic variation at this location was 13°E. Back then, it was calibrated for magnetic north, and its radials were perfectly aligned with the magnetic bearings. Looking at a current sectional chart, today's magnetic variation is about 8.5°E – the reason for the five-degree difference between today's radials and bearings of the ABQ VOR. Why does the Federal Aviation Administration (FAA) not re-adjust our VORs to keep both in sync? Besides being very labor-intensive, this would mean redefining all airways each year. Consider that the ABQ radial 023 is



still running over the same geographical locations as it did in 1965. It's just no longer on a bearing of 023.

Besides these interesting findings about VOR radials, what did I learn from this little surprise on departure?

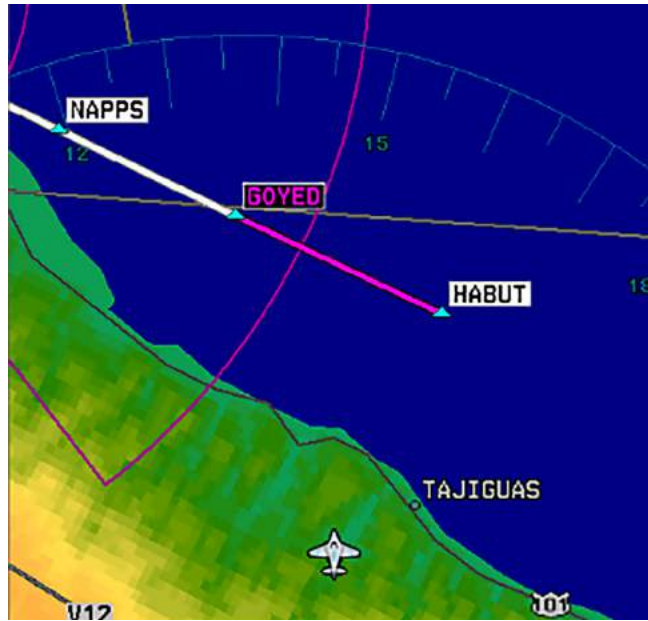
**Tip #1:** If my first waypoint is at a bend of an airway, I will always include the previous waypoint in my G1000 flight plan as well. In our example, I would have programmed NODME, NELGE, SAF ...

What if the first waypoint is not at the bend of an airway but in a straight segment? Doesn't the same problem arise also in this case? Let's, for example, assume that our first waypoint is CARTY on V12 (see Figure 3, left). Fortunately, when we set a direct-to CARTY, the G1000 will correctly intercept the airway, even if our intercept point falls before CARTY. Hence, the above tip only needs to be followed when the first waypoint is at a point where the airway changes direction.

## Intercepting an Intermediate Approach Leg

In the second scenario, we'll look at a more straightforward ILS approach into Santa Barbara, California, and see what can go wrong in a situation when you least expect it. I was sim-flying the ILS 07 approach into KSBA, coming from the north via the Gaviota VOR (GVO), when the following happened (see Figure 4, left).

I loaded and activated the ILS 07 into the G1000, selecting the GVO transition. When near YONNI intersection, I received instructions from my virtual ATC to descend to 2,700 feet, fly heading 140, and was cleared for the approach. That put me on a course that intersected the final approach course about halfway between HABUT and GOYED (see figure 5, above). I activated this leg and pressed the APR key on the autopilot, whereupon



« Figure 5: Intercepting leg HABUT - GOYED

LOC and GS were shown as armed in the AFCS status box. The correct ILS frequency had been loaded into NAV1 and NAV2 and properly identified. I expected the G1000 to intercept the final approach course and the CDI to auto-switch to LOC1 mode, neither of which happened! What had gone wrong?

Had GOYED been the final approach fix, everything would have happened to plan. But GOYED is an intermediate fix, hence the auto-switch to LOC1 did not work. Why did the G1000 not intercept the final approach course, but fly right through it? The current navigation source was still GPS, and the autopilot was waiting for the localizer signal to become active, which never happened as I was still in GPS mode. This is an example where manually switching the CDI from GPS to LOC1 would be appropriate. The following technique would have avoided this mishap:

**Technique 1:** While still in heading mode on a 140 heading, press the CDI softkey on the PFD to switch manually to LOC1 navigation source.

Let's step back for a second and ask: Why did I even consider pressing the APR key in this situation? The answer is I have always thought of APR mode as being an advanced version of NAV mode, just with a higher sensitivity in lateral direction and with vertical guidance. This might be true for some autopilots, but not the GFC700. It treats NAV and APR very differently. So, it's important to understand these differences:

- » NAV mode intercepts whatever navigation source is momentarily selected. Had I gone into NAV mode, the GFC700 autopilot would have intercepted the leg HABUT - GOYED just fine.
- » APR mode is not so indiscriminate. The G1000 tries to be "smart" about the APR key. It does, for example, not intercept a GPS leg outside the context of an approach procedure. APR mode always intercepts the navigation source that is called for by the selected approach procedure, not the one that is currently selected as a navigation source.

(continued on page 58)

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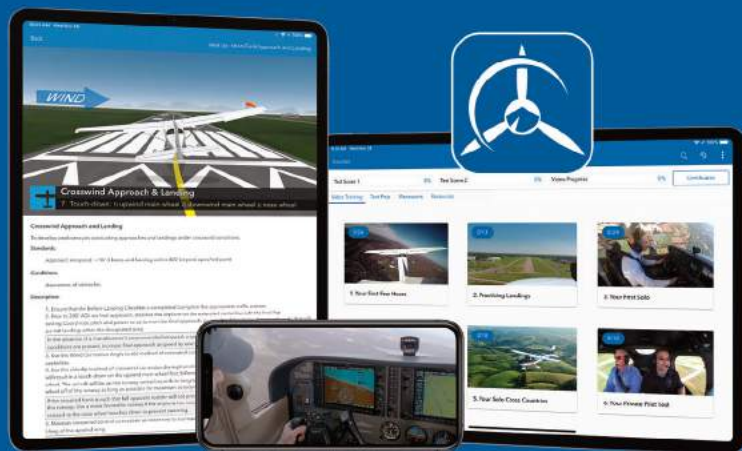
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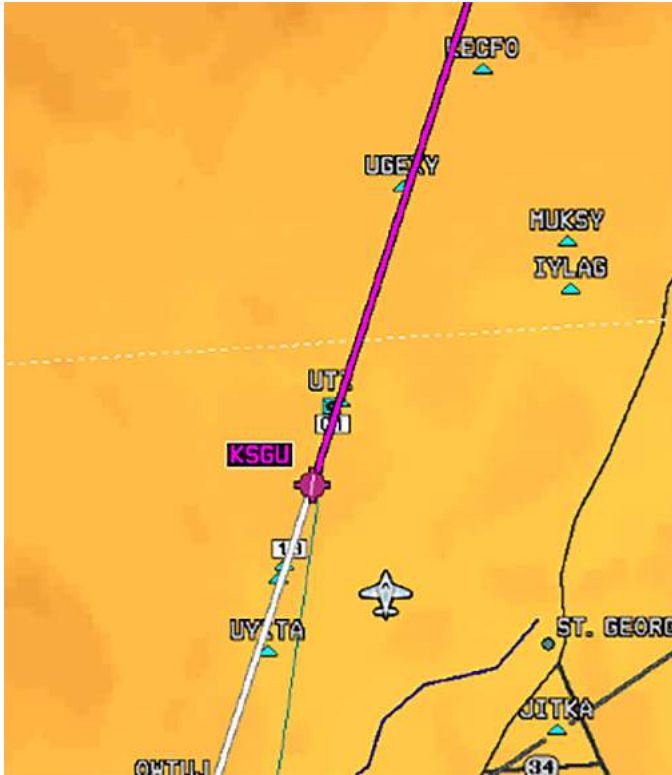


Figure 6: Using OBS mode for a visual approach into KSGU.

There are two lessons to be learned from this example: (1) APR mode is not just an extension of NAV mode by adding vertical guidance, but a specialized mode reserved for flying approaches. (2) Press APR only after the navigation source prescribed by the approach procedure has been switched to – automatically or manually.

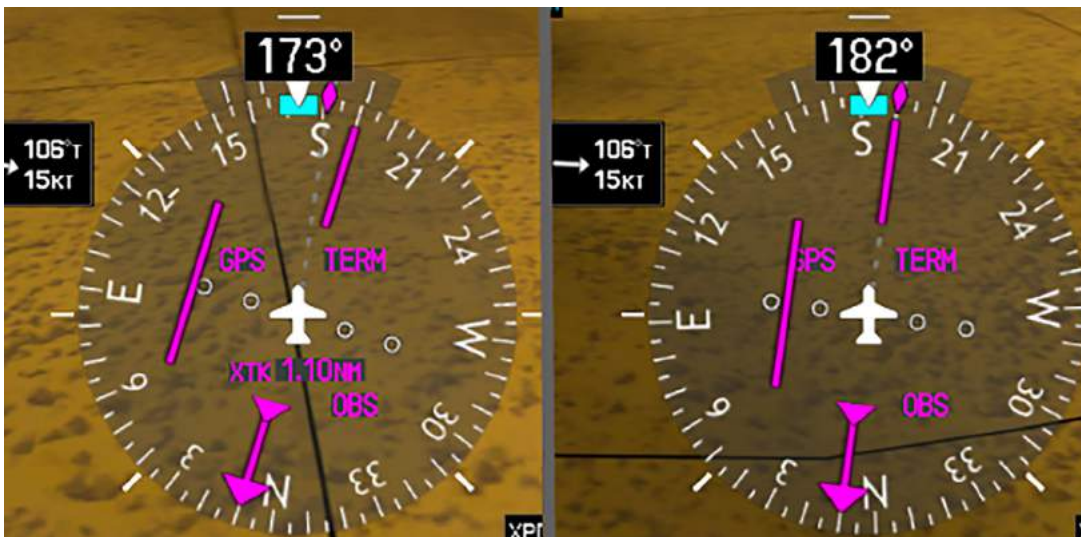
Here is yet another solution to the original problem, and the one I would prefer in hindsight:

**Technique 2:** Instead of activating the leg HABUT – GOYED, I could select vectors-to-final for the approach. The CDI will immediately be switched to LOC1, and all I have to do is simply press the APR key on the autopilot panel to arm the intercept – straight and simple.

Vectors-to-final has (for a long time) been frowned upon by some flight instructors, and that was justified in the times when the GNS430 or the early G1000 deleted all intermediate waypoints from the flight plan when vectors-to-final was selected. Newer software versions don't do that anymore. The example above demonstrates how valuable vectors-to-final can indeed become.

**Tip #2:** Be careful when intercepting an intermediate leg of an ILS and use one of the techniques described above.

Figure 7: Cross-Track Error display



## OBS Mode for Visual Approaches

My next tip was inspired by a Papua, New Guinea bush pilot. Flying a precise traffic pattern into a typical bush location is sometimes a challenge due to the lack of landmarks like roads and power lines. Instead, the dirt runway is often surrounded by a lot of uniformly looking jungle. For orientation purposes, this pilot uses OBS mode when approaching his next destination, setting the runway direction as course. This produces a similar magenta line as in vectors-to-final mode, which helps visualize the exact courses for downwind, base and final approach (see Figure 6, left).

It also shows an exact readout of the cross-track error on downwind, showing how far your downwind leg is offset from the desired inbound course (see Figure 7, lower left). Note that in the image, the CDI is slightly below full-scale deviation, which in terminal mode corresponds to an offset of 1.0 mile. For higher offsets, the amount will be displayed in numbers as shown on the left side. What helps further is that you can easily find the ideal wind correction by bringing the dashed gray line in correlation with the course needle.

What keeps us from using this simple technique when flying visually into an unfamiliar field? Perspective+ systems offer an even more elegant variation: visual approach guidance, which also offers informational vertical guidance. If you don't have Perspective+ in your cockpit, this method may at least help you fly a precise pattern geometry, and that is often the recipe for consistently good landings.

**Tip #3:** Use OBS mode with your destination airport as target point and course set to your landing runway's direction to improve situational awareness and fly a precise pattern. ⊕



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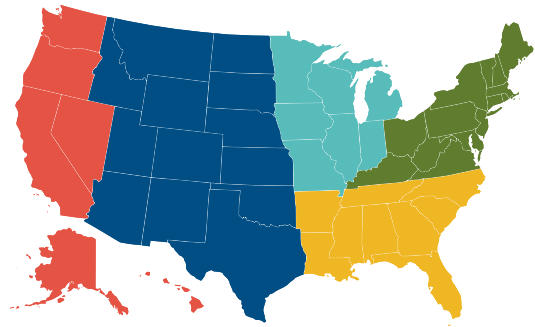
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 Coastal Valley Aviation (SMX) / 805-928-7701 / Santa Maria  
 Foothill Aircraft Sales & Service (CCB) / 909-985-1977 / Upland  
 Gryphon Aircraft Services (F70) / 951-698-4260 / Murrieta  
 Kim Davidson Aviation Inc. (SMO) / 310-391-6293 / Santa Monica  
 Martin Aviation (SNA) / 714-210-2945 / Santa Ana  
 Mather Aviation LLC (MHR) / 916-364-4711 / Mather  
 Mather Aviation LLC (MOD) / 209-577-6831 / Modesto  
 Mather Aviation LLC (VNY) / 818-782-7473 / Van Nuys  
 Scanlon Aviation (DVO) / 415-897-9787 / Novato (AD pg 60)  
 Sierra Aero (TRK) / 530-359-8751 / Truckee  
 Sierra Mountain Aviation, Inc. (GOO) / 530-273-5273 / Grass Valley  
 TDL Aero Enterprises (MCE) / 209-722-7300 / Merced  
 Woodland Aviation Inc. (DWA) / 530-759-6036 / Davis (AD pg 19)

### HAWAII

Hawaii Aero Mx LLC (HNL) / 808-838-7788 / Honolulu

### NEVADA

Lone Mountain Aviation (VGT) / 702-309-2200 / Las Vegas

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 Northwest Flight Service (SFF) / 509-838-8883 / Spokane

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 Keystone Aviation LLC (SDL) / 480-991-5387 / Scottsdale

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 Legacy Air, Inc. (BJC) / 303-404-0277 / Broomfield  
 Vector Air (EIK) / 303-664-0633 / Erie

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 Rocky Mountain Aircraft Services (GPI) / 406-752-5810 / Kalispell (AD pg 50)  
 Signature TechnicAir (BZN) / 406-388-3805 / Belgrade

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Ross Aviation Flight Maintenance (LNK) / 402-475-8600 / Lincoln

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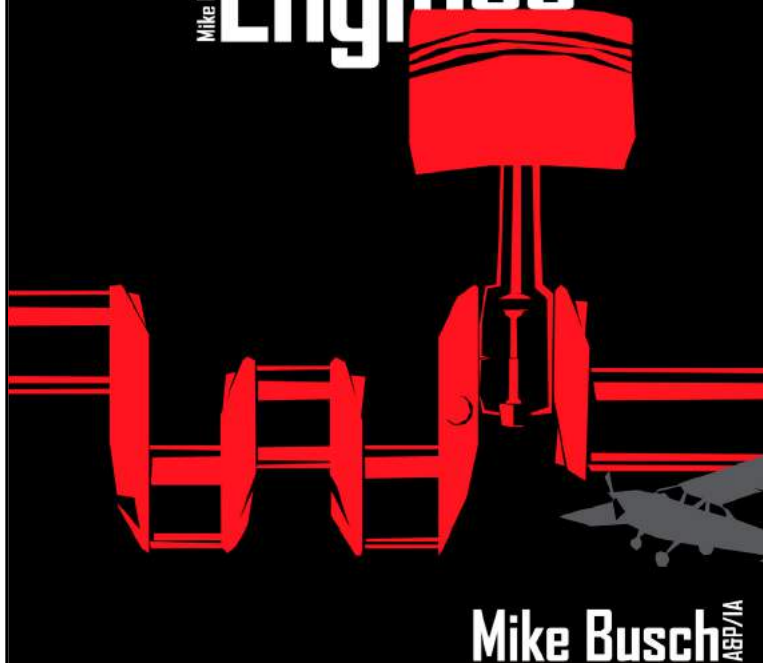
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