EAA Chapter 691 Newsletter
October/November 2023

On the Web @ eaachapter691.org

EAA 691 is:

President: Will Fox

Vice President: John George

Secretary: Pierre Levy

Treasurer: David Young

Web Editor: Marilyn Phillips

Newsletter Editor: April Fox

Young Eagle Coordinator: April Fox

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Upcoming Events

Meetings Schedule (unless otherwise noted)

9:30am - social time

10:00am - business meeting

10:30am - speaker/workshop/training

Upcoming Events

- Los Alamos Young Eagles/Cookout, October 21, 2023, (LAM), 8:00-12:00.
Coordinator- April Fox

November- Chapter Fly-out to Conchas Lake – date to be announced,
Coordinator- John George

Check out our Chapter Website at https://www.eaachapter691.org for more information about upcoming activities.

This Saturday
Nov. 4th

Conchas Lake Flyout

by John George

Join us for the final EAA Chapter 691 Flyout of the season, to Conchas Lake in Eastern NM, this weekend, Saturday, November 4.

Please see the attached flyer for details.

Note that if you want to purchase a breakfast burrito on site, you need to let us know by Thursday evening. We need to notify the food truck operator, since this is the off season.

Hope to see you there!

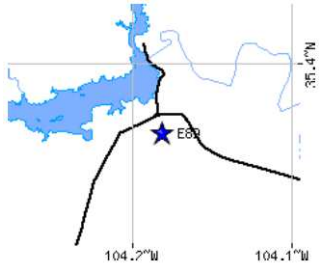
EAA Chapter 691:

Flyout to Conchas Lake (E89)

Come with us to Conchas Lake Airport!

Saturday, November 4, 2023.

Last Flyout of the Season! Preview a proposed O/N lake trip, next summer.
Plan to arrive 9-10 am.
Join us for a short trip to a house and dock for brunch on the lake. If enough interest we can preorder (by Thursday evening) breakfast burritos from a local vendor. RSVP!
Plan to return homeward by 2 pm.



Sectional chart

Photo by Austin Heermann
Photo taken 18-Mar-2007

SurfNTurf boats of Santa Fe will provide transport to and from the airport.

Airport is unattended, with no services.
Runway 9/27 is 4800 x 60 ft, asphalt, in good condition.
Elevation (and gate code): 4230 CTAF is 122.9
Left Traffic 1 mile from Conchas Dam, NM

Nearest Airports
Las Vegas, NM KLVS (50 nm W)
Tucumcari, NM KTCC (30 nm E)
E89 is 100 nm (direct) from E14, 106 from KLAM, 95 from KSAF

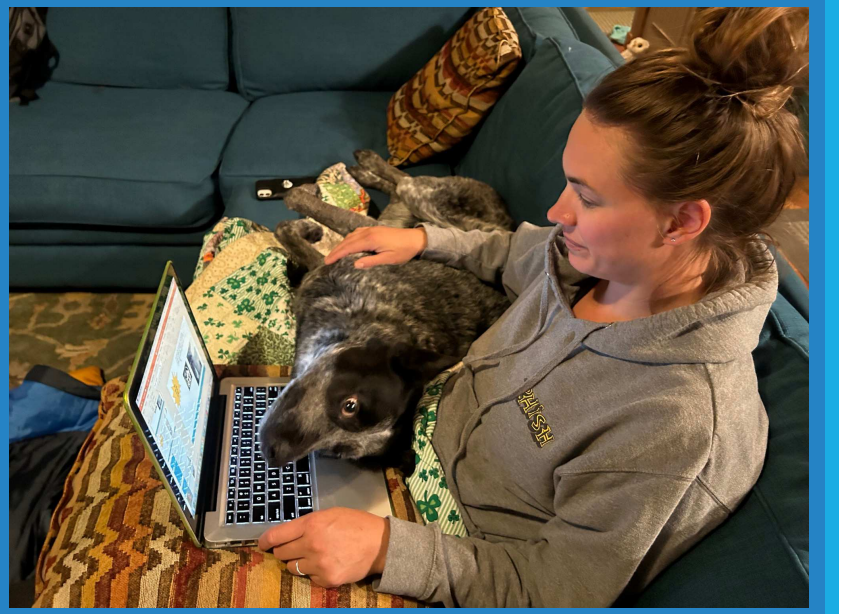
For more information, or to request or volunteer to give a ride, contact John George or Will Fox.

jsg.lanm@gmail.com
tailspinfox@gmail.com
EAAchapter691.org

Lat/Long: 35-22-04.2200N 104-10-49.8300W
35-22.070333N 104-10.830500W
35.3678389,-104.1805083

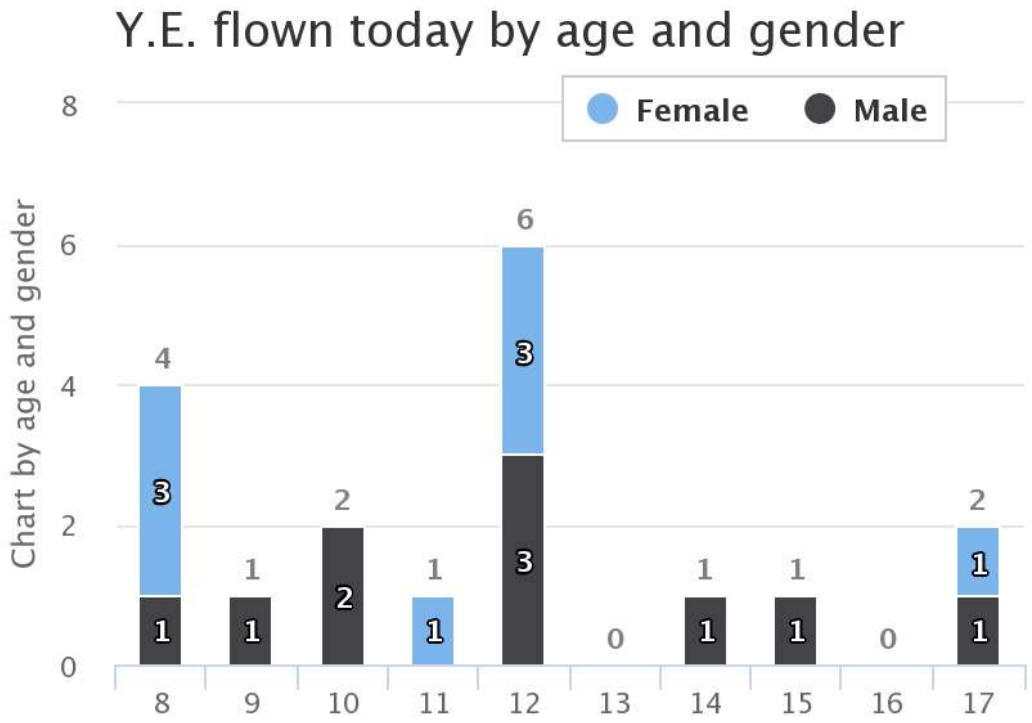
Letter from the editor(s)

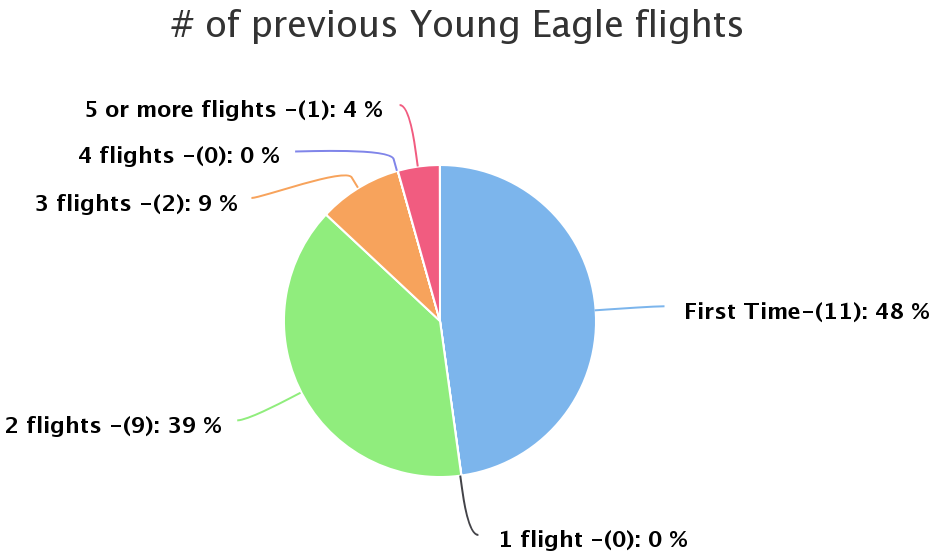
by April Fox



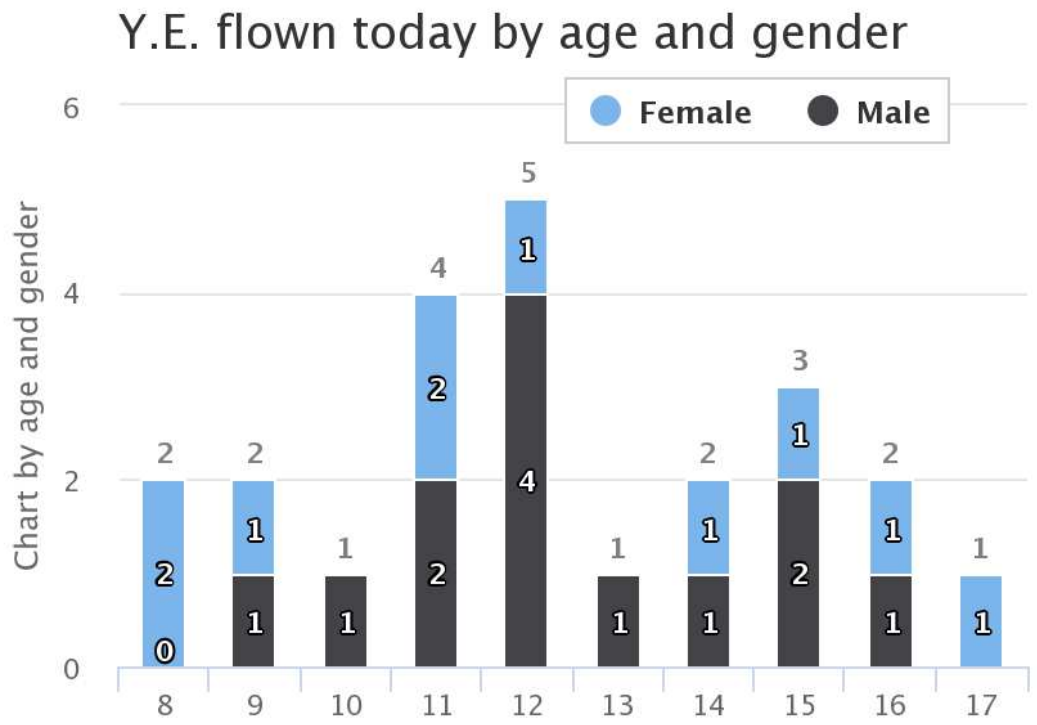
I wanted to give our Young Eagle volunteers a huge round of applause, we hustled two YE events (one month apart) and **flew 47 kids**! We had volunteers from as far away as Colorado and kids who came from Moriarty, Albuquerque, Peñasco, Española, Abiquiu, Los Alamos, and Santa Fe. Two members let us use their aircraft as static display at E14 and answered questions the parents and kids had about aviation. CAP was a great help in providing information and entertainment at the LAM rally. Both events were catered by the airport managers at LAM and E14, and we had a great response from the community. Thank you to everyone who made this happen ☺

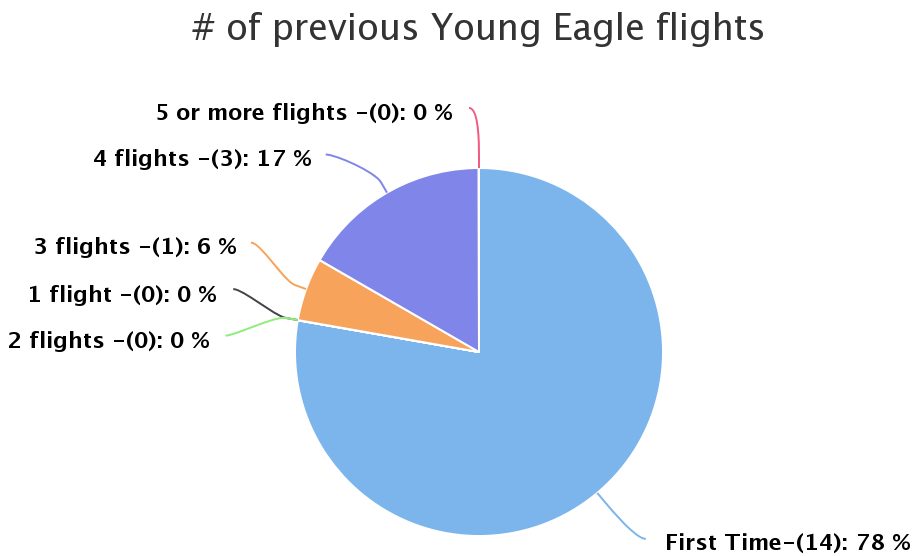
Española YE Charts





Los Alamos YE Charts





President's Report

by Will Fox

Rides, Rides, Rides

This past couple of months have been really busy giving rides to the public and introducing folks to aviation. The Ford TriMotor event was a real success thanks to Board member Marc Bonem's hard work organizing and fund raising for the event. In addition, we had a tremendous turn out from our Chapter members who volunteered to be ground crew. Before it was all done over 200 people got rides in the TriMotor with more than 30 flights conducted over three and a half days. A lot of Santa Feans came out to see and photograph the historic aircraft as well as get a ride in it. A few of our ground crew also sat in the copilot seat and got some TriMotor time in the process. What a blast for all involved with smiles all around.

We also had two very successful Young Eagle Rallys, one in Espanola and another in Los Alamos thanks to the tremendous efforts of April Fox, our Young Eagle Coordinator, and our volunteer pilots and ground crew. Parents and kids love these events and with balsa wood airplanes flying around and real airplanes taking to the air every few minutes there was a lot of action going on. The Civil Air Patrol was also there, thanks to Robert, Silas, and Mark. Thanks also to Rusty who got some great pictures of the action. All told we flew more than fifty kids at the two events. Finally, I want to thank Jorge and Bobbi, the airport managers at E14 and KLAM respectively, for their support and the free lunches they provided.

There's more news on the Kitfox that was donated to the Chapter. Jared Haney purchased it and has taken a real interest in restoring it and getting it flying again. Knowing Jared, that won't take too long and he will do a great job of it. I also think he has a few improvements in mind for the Kitfox that will improve its reliability and performance. Stay tuned for more progress reports in the future.

Our next meeting is coming up on November 18th in Los Alamos and features a presentation by yours truly on how to fly the "Impossible Turn". We will also have our biannual elections for the Board. Please consider becoming a Board member if you would like to take a more active roll in running the Chapter and shaping its future. The Board has also proposed raising annual dues from $25 to $30 per year so we will discuss and vote on that as well.

Happy flying and keep the blue side up:-)

Ground Crew member Barb Fox sits in the co-pilot seat for a ride in the Ford TriMotor.

Dane Spearing with a group of happy Young Eagles after their flight.

Recording Flights of Fancy

By Vivek Saxena

I have always naturally gravitated toward the technical side of aviation, and since my day job as a physicist involves grappling with problems of a more theoretical/mathematical nature, flight training has given me the opportunity to revisit and more deeply appreciate basic physics, engineering and aerodynamics. Between May and July of 2022, I took a series of introductory flights at a few flight schools in New Jersey with no plan of pursuing flight training. After all, it seemed very expensive and quite unaffordable unless one were to pace it out (resulting in protracted delays, lack of proficiency, and higher costs in the long term). I began gathering information and pestering my father (a rite of passage for all my technical pursuits) to partake in the knowhow. An important turning point for me was the Los Alamos Airport Open House on July 23, 2022, where I met Will Fox and David Young and other friends from EAA 691. Until that day, I had not been exposed to the world of experimental aviation and I was struck with awe to see all the complex airplanes that people had built with their bare hands.

It took me another year to develop enough conviction to actually get started with flight lessons, after some hiccups. Despite the sensible advice of flying multiple times in the week to retain proficiency, my primary occupation as a physicist does not leave much time for non-physics activities (mostly a personal lifestyle choice) and flight lessons are expensive at least here on the East Coast, so I am taking the slow approach and flying once a week, with occasional breaks. Will and David have very generously provided advice, suggestions and much needed critical analysis from a distance throughout this endeavor, and I am extremely grateful for my (mostly) long-distance association with EAA 691.

As I tend to be a slow learner and learning to fly involves acquiring and honing various motor skills and appreciating as well as anticipating the dynamics of the airplane, it struck me early on in my flight school research that it might be extremely beneficial to record my flight lessons for review. In this article, I will share details of my setup which I hope will be of use to others.

First of all, if you record your flight lessons with cockpit audio, it is important that your CFI be comfortable with it. Many flight schools and instructors are justifiably wary of this, as publicity often leads to problems. Also, the instructor should not feel inhibited in their instructional criticism of the student just because they are being recorded, so it definitely helps to have an honest conversation about the goals and expectations on the ground. My personal goal was to use these videos strictly for review and document my flight lesson journey, and I felt reviewing all the comments from the instructor (beyond the venerable “More right rudder!”) would be very helpful especially if I were not flying regularly enough; I never desired to put them in the public domain. I have been fortunate so far to have instructors who have permitted this. But if you do decide to put your aviation videos online, the AOPA has some useful advice **[1, 2]**.

Recording requires a camera, and GoPro cameras seem to be popular choices. One does not need the most expensive or the fanciest camera in my view, but it is useful to have a camera with an inbuilt GPS and sensors to record some basic telemetry data. I currently use a GoPro Hero 10. (Note that the newest GoPro model, the Hero 12 has no GPS.) Where should you mount the camera? This boils down to a personal choice – see this video by cub pilot Joe Costanza for some pointers **[3]**. If you would like to use a single camera that also records cockpit (intercom) audio like I do, the best place to put it is inside the cockpit, preferably on the ceiling of the cockpit. GoPro cameras come with plastic mounts with double-sided 3M adhesive tape. These prove to be quite sturdy and can be easily replaced. Also, your camera is less likely to fly away into the wilderness if you mount it inside.

If you can afford to have additional cameras and the flight school/instructor allow mounting them externally (using mounts that do not run the risk of breaking off and impairing control surfaces in flight) this can be helpful for judging landing approaches – see **[4, 5]** for some worthy examples. But these external cameras will naturally not record or be linked to the same inflight cockpit audio track, which will have to be carefully synchronized and re-embedded using video-editing software later.

An important point is that the camera setup should not interfere with piloting or flight instruction. If the camera stops recording, or malfunctions or misbehaves in any way, the pilots should not be distracted by it. I think it works best if the camera is simply switched on sometime before one begins with the checklist, and then switched off when the flight is complete and the airplane is secured. Any video editing should only be done on the ground. Suction cup mounts can fail in flight and fall, and if the camera is hooked up to audio cables connecting to an aviation headset, this can be a dangerous distraction especially in single pilot operations.

To record cockpit audio, one needs an interface cable and adapter that effectively sits in between the PJ jack on the airplane and the aviation headset and splits off the audio feed to the GoPro. This is a 3-pronged audio splitting cable: one end is a USB-C connector that connects to to the GoPro's USB-C port, the second end is a female PJ-068 (or M642/5-1) connector for the aviation headset's PJ-068 male microphone plug, and the third is a male PJ-068 connector that goes into the cockpit PJ-068 female microphone jack. The PJ-055 (or M642/4-1) headphone cable from the aviation headset connects directly to the cockpit PJ-055 female headphone jack. I use a cable+adapter from NflightCam **[6]**. A 6 ft cable seems adequate for an airplane like a Cessna 172. Note that most GA airplanes have mono audio channels, so the video produced may have audio only in the the left or right channel. This is quite normal and can potentially be fixed using software.

The audio cable and adapter are the most crucial items in the setup. Out of an abundance of caution, in single pilot operations, I recommend using an audio port from a passenger's PJ jack to connect to the GoPro, to isolate the pilot's audio channel from the GoPro setup. Alternatively, one could consider keeping a second pair of headphones and/or a handheld radio, just to have a redundant failsafe for radio communication in the rare scenario of a defective audio cable/connector disconnecting the pilot's microphone from the airplane intercom.

So this 3 piece setup consisting of (1) a GoPro camera, (2) an aviation headset cable + microphone adapter, and (3) plastic slider mounts with double-sided tape, are all that one needs to get started with video + inflight cockpit audio (ATC) recording.

However, unsurprisingly, there are some engineering limitations of this minimal setup. First of all, almost all GoPro cameras are known to overheat and shut down, especially when recording at 4K @ 30 frames per second for more than 40-45 minutes. To partially alleviate this, one can direct the cockpit air vent at the GoPro to keep it cool, but I found this to be inadequate. Secondly, battery life on the GoPro is poor, especially when recording at such high resolutions. There are a few tricks one can adopt like turning off wireless connectivity between the GoPro and your cellphone, reducing the resolution to 1080p (1920x1080), tweaking sharpness settings, etc. But 4K video really looks much better and it is hard to downsize once you're used to it!

One thing that helps the most with battery life (and heating) is to not have the battery at all, keep the battery door open, and instead use an external USB-C power charger to power the camera. I use an old Anker PowerCore 26,800 mAh as my rear seat passenger, along with a long USB cable. Sporty's FlightGear Backup Battery **[7]** seems to be a popular choice among flight instructors, and can also be used to keep one's iPad charged.

However, for whatever reason, the factory installed GoPro operating system (OS) does not permit the use of the external microphone adapter (needed to connect your aviation headset) with the battery removed, and this requires flashing the OS with a "GoPro Labs" experimental OS, which is perhaps only fitting given that this is an article for an EAA newsletter. (This is not nearly as dramatic as "rooting" your cellphone with a custom OS – there is no voiding of the warranty, and you can safely go back to the factory OS if you so wish.) For those interested, I provide some details in a footnote **[8]**.

To circumvent overheating – which remained an issue for me despite keeping the battery enclosure open and vacant, and caused some rare perfect landings to never be documented in the annals of history – I found it helpful to mount a small USB powered fan to the camera. There are some inexpensive ways of doing this but I eventually chose CAMCooLER **[9]**, a 3D printed enclosure for the GoPro Hero 10 consisting of a USB fan, manufactured by Roy Potter in Arizona. (A cheaper alternative is to purchase a $15 USB fan and use a rubber band to attach it to the camera, but this arrangement is flimsy and can get dislodged in flight. The CAMCooLER housing does provide some protection to the camera if it were to fall off.)

Finally, one also needs to use a neutral density filter to account for the stroboscopic effect **[10]** from the propeller. I use an ND8 filter sold by Nflightcam **[11]**. Here is a picture of my setup:

The telemetry data on GoPro recordings can be extracted and overlaid on the videos using a telemetry extractor software program such as Telemetry Overlay **[12]**, created by an independent software developer, Juan Irache, based in Barcelona. This can be useful for instructional purposes, although the data is not as reliable as what aircraft instruments report (and notably, there is no tachometer available). Moreover, this data is corrupted by quantization noise. (For example, the attitude indicator gauge sourced from the GoPro data would often show me as making an inverted landing, or a 90 degree banking turn while taxiing – exponential progress that should surely impress my instructors.) After extensive experimentation and discussions with Juan, we concluded that the telemetry data is affected by the camera being mounted in an inverted posture, particularly because of the orientation of the GPS antenna on the camera. This can be partially overcome by relying instead on a recording of the cockpit instruments, provided the camera is angled at them. It is worth noting that Telemetry Overlay can accept alternative sources for flight data, such as AHRS data from Garmin devices. The instructional value of such data may be questionable, but I have always been interested in flight data acquisition so it seems only natural to push this further.

Everything you need to get started with GoPro video recording can now be acquired in one shot as a single packaged kit from Nflightcam **[13]** – this includes a camera and all the accessories mentioned above except the USB battery pack and the external fan, which must be purchased separately from other sources. The entire setup described here should cost about $560. Jaymo, a member of Nflightcam's technical staff, recently produced a video with some suggestions about audio and video recording and gave me permission to share it **[14]**.

So much for the setup. How has it contributed to my flight training? It has given me the confidence of being able to review and go over my mistakes, and stay honest about my progress. It also helps to have a targeted set of questions for my instructor, especially when I am still pondering at the end of a 2-3 hour long lesson and don't have every question articulated for a debrief. It has also helped me isolate weak spots or things that need fine tuning in training. But it obviously does not compensate for flying infrequently, and no amount of ground analysis can replace the important experiences and skills developed in the air.

I end this article by sharing a few resources that I have found useful in my flight training. There is no shortage of engaging books on aviation – see **[15]** for some suggestions. I highly recommend using Google Earth (as opposed to Google Maps) for exploring unfamiliar areas while on the ground, and scouting for emergency landing sites, especially to prepare for engine failure after takeoff. (I have recently found it useful even to spot landmarks around my home airport to help with pattern work, and I anticipate it will be beneficial also for planning longer trips.) Finally, Youtube has a rich (and ever expanding) collection of instructional videos about flight maneuvers and techniques, although one does have to be a bit discerning to avoid some silly (and occasionally downright wrong) physics ideas.

About the author: Vivek is an "at large" member of EAA 691. He is a theoretical high-energy physicist with a background in physics and electrical engineering. He is enthusiastic about tailwheel flying, backcountry/bush flying, and experimental aircraft in general.

References:

[1] *For The Record: What's Not To `Like' : Sharing Your Videos Online*: https://www.aopa.org/news-and-media/all-news/2019/january/pilot/for-the-record-sharing-flying-videos.
[2] *What Not to Record When Flying*: https://www.facebook.com/watch/?v=1332474867548699.
[3] *Safely Mounting GoPro and Insta 360 Cameras on your plane, on strut, tail, rudder and cowling*: https://www.youtube.com/watch?v=Tm5fQyeFOyc.
[4] *Chase View of Tailwheel & Footwork Required to keep a Taildragger straight down the runway*: https://www.youtube.com/watch?v=cqAJav3lLaE.
[5] *Slipping an Airplane, Descend like an elevator while having fun and shortening your approach*: https://www.youtube.com/watch?v=zLwRJQY0CPg.
[6] NflightCam Aviation Audio Cable + Power Cable for GoPro: https://www.nflightcam.com/collections/cables/products/nflightcam-audio-solution-for-gopro-hero5.
[7] Sporty's FlightGear iPad Backup Battery: https://www.sportys.com/flight-gear-ipad-backup-battery.html.
[8] Steps to enable concurrent use of external battery pack with mic adapter on a GoPro:
1.Back up and format your SD card.
2.Download the GoPro Labs firmware on your computer and decompress it to your SD card (follow these instructions to install it on your GoPro). This lets you configure a bunch of settings by encoding them in a QR code which the camera can then read (by simply hovering it over the QR code).
3.Visit https://gopro.github.io/labs/control/custom/, and pick your favorite settings. But be sure to add the line!MTUSB=1 as an "Additional Command".
4.Hover your GoPro on the QR code so generated. The camera will beep and a tiny picture of the QR code will appear on the LCD display with a check next to it. This signals a successful setup.
See https://gopro.com/en/us/info/gopro-labs/walkthrough-and-features and https://community.gopro.com/s/article/GoPro-Labs?language=en_US and https://gopro.github.io/labs/control/notes/ for more details.
[9] CAMCooLER 9Ten11&12: https://camcooler.com/product/camcooler-a-gopro-cooler-for-hero-9-10-11-12/.
[10] Stroboscopic effect: https://en.wikipedia.org/wiki/Stroboscopic_effect.
[11] Nflightcam Propeller Filter for GoPro Hero 9, Hero 10, Hero 11 and Hero 12: https://www.nflightcam.com/products/nflightcam-propeller-filter-for-gopro-hero9?_pos=1&_sid=3214a3e35&_ss=r.
[12] Telemetry Overlay: https://goprotelemetryextractor.com/.
[13] Nflightcam Content Creator and Student Pilot GoPro Package: https://www.nflightcam.com/collections/frontpage/products/youtube-pilot-package.
[14] Audio recording instructions by Jaymo, pilot and tech support member at Nflightcam: https://shorturl.at/afBKV.
[15] Suggested reading:
•Barry Schiff, "*An Illustrated Guide to Flying*," https://www.youtube.com/watch?v=3HXKJjW_K_Q
•Rod Machado, "*How To Fly An Airplane*," https://rodmachado.com/products/rod-machado-s-how-to-fly-an-airplane-handbook-ehandbook
•Rod Machado, "*Private/Commercial Pilot Handbook*," https://rodmachado.com/products/rod-machados-private-commercial-pilot-handbook.
•Rick Durden, "*The Thinking Pilot's Flight Manual*," http://www.rickdurden.com/book.html.
•Rich Stowell, "*Learn To Turn*," https://www.richstowell.com/wp-content/uploads/Booklet-Learn-to-Turn-Rich-Stowell-Aug2021.pdf.
•Rich Stowell, "*The Light Airplane Pilot's Guide to Stall/Spin Awareness*," https://www.richstowell.com/shop/books/book-stallspin-awareness/.
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•Dale Crane, "*A Pilot's Guide To Aircraft And Their Systems*," https://asa2fly.com/a-pilots-guide-to-aircraft-and-their-systems/.
David A. Lombardo, "*Aircraft Systems: Understanding Your Airplane*," https://www.thriftbooks.com/w/aircraft-systems-understanding-your-airplane_david-a-lombardo_steve-woerner/749581/#edition=3605729&idiq=3898612.
•H.C. Skip Smith, "*The Illustrated Guide to Aerodynamics*," https://www.barnesandnoble.com/w/illustrated-guide-to-aerodynamics-hubert-c-smith/1101368640.
•ASA, "*The Pilot's Manual - Ground School and Flight School*": https://www.pilotmall.com/products/asa-the-pilot-s-manual-flight-school?_pos=7&_sid=b02149b67&_ss=r and https://www.pilotmall.com/products/asa-the-pilot-s-manual-ground-school?_pos=15&_sid=3e967b2f0&_ss=r.
•PilotWorkshops.com manuals on airplane engines, and VFR communications: https://pilotworkshop.com/.

Member Happenings

Española Young Eagles, September 23, 2023

Los Alamos Young Eagles, October 21, 2023


Hello
David


N604CP


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YOUNG EAGLES CERTIFICATE
Trey Wernicke
YOUNG EAGLES CERTIFICATE
David Thornton
EAA


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Tech Corner

by Will Fox

Turn Back Time

The recent accident that took the lives of Richard McSpadden and Russ Francis was a tragedy. Little is known about the accident at this point, but apparently McSpadden and Francis had taken off in in Francis' Cardinal C177 for a photo shoot and shortly after takeoff experienced a problem that caused them to turn back to the airport in Lake Placid, NY. They crashed 400 feet short of the runway. One could chalk this accident up to another failed attempt at the "Impossible Turn", but McSpadden was a very accomplished military pilot. He was also a safety advocate for AOPA in his role as senior vice president of the Air Safety Institute. In that role he had published a video on the "Impossible Turn" that demonstrated that it was not impossible and depended on the performance characteristics of the plane being flown. The cause of the accident is not known as of yet. Hopefully the NTSB can shed some light on what really happened, but we will have to wait a year or two for them to generate a final report.

Richard McSpadden was a leader in Aviation Safety.

A turnback to the runway is possible, but its success depends on the aircraft you are flying, your piloting skills, and environmental factors like wind and density altitude. It is possible thru calculation or experimentation to determine what conditions allow for a successful turn back to the runway following an engine failure. From that you can use a simple decision process to determine when it is impossible and when it is not. More importantly you can do this on the ground before you ever start the takeoff roll, so the decision can be made ahead of time. Let me tell you about it.

The first thing you need to know is how much altitude you need for the turn back. You can do this a couple of ways. One way is to measure it by climbing to altitude and simulating an engine failure and turn back, and the other way is to calculate it. The formula I use to estimate it is quite simple. The required turn back altitude in feet is equal to the best glide speed in knots squared and then divided by the glide ratio. In formula form it looks like this:

$$TBA = V_{GB}^2/GR$$

where,

- Turn Back Altitude (TBA) is the approximate height in feet to make a turn back to the runway.
- Best Glide Speed (V_{GB}) is the best glide speed of the aircraft in knots.
- Glide Ratio (GR) – is the glide ratio of the aircraft at the best glide speed.
- The bank angle is 45 degrees.
- The estimate includes a 3 second delay before the start of the turn due to the surprise factor.

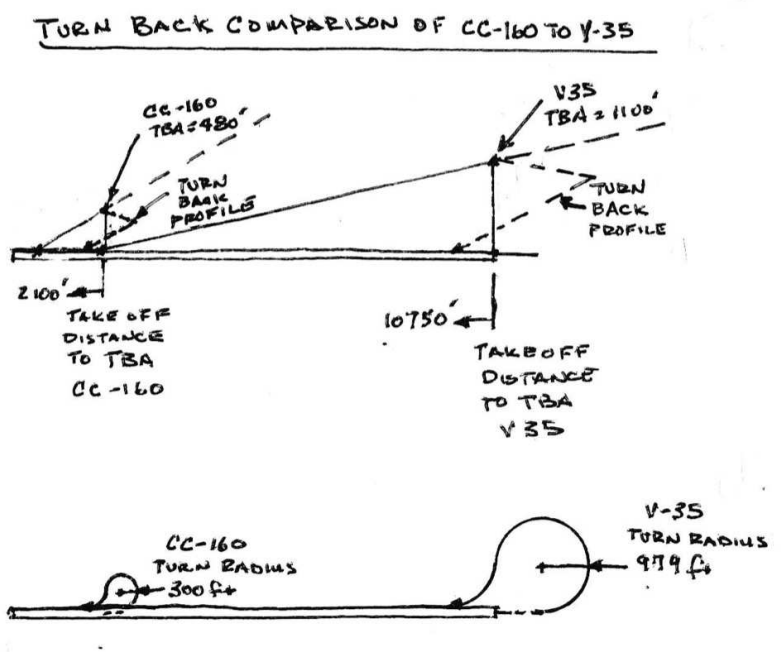
For example, in the case of my Bonanza, where the best glide speed is 105 knots and the glide ratio is 10 to one, the estimated TBA is 1103 feet. See the calculation below:

$$TBA\ (ft) = \frac{105(knots)^2}{10}$$

$$TBA = 1103\ ft$$

No fuss, no muss. If I'm below this altitude I can't complete the turn safely. What's more, this is just the altitude required to complete the turn. It does not allow for any significant glide besides the flare to land after the turn is completed. In other words, unless I'm still over the runway when the failure occurs it doesn't guarantee I'll be able to glide back to the runway. To do that. I need to know two other numbers. One is my climb angle and the other is my glide angle. If my climb angle exceeds my glide angle, and I reach my turnback altitude before the departure end of the runway, then I can make the turnback AND glide back to the runway safely. So I also need to know the length of runway required to reach TBA. Let me show you a couple of examples.

In the Bonanza, the climb angle at sea level is about 6.7 degrees and the glide angle is about 5.7 degrees at gross weight on a standard day. It takes 1700 feet to clear a 50' obstacle plus another 9050 feet at a climb angle of 6.7 degrees to reach 1100 feet AGL. That adds up to a total of about 2 miles to get to TBA. If the runway length is less than that, I won't be able to get to TBA before the end of it. So, if the engine fails, I can't make the turn back, and I will need to land pretty much straight ahead. However, if I reach TBA before the end of the runway and my climb angle is greater than my glide angle, things are golden, because I can turn back at any point after I reach TBA **AND** glide back to the runway. But, it is not very often that I takeoff on a 2 mile long runway, so a turn back in the Bonanza is usually not a viable option. Lets look at another example.



Sketch of profile and plan views comparing a V35 Bonanza to a Carbon Cub LSA during takeoff and turn back to the runway. Note that the numbers shown are based on standard conditions at gross weight in calm conditions. Density altitude, weight, and wind conditions can affect the outcome of a turn back significantly and also need to be considered. For more information about the effect of these factors check out David Rogers paper.

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Let's consider a Carbon Cub LSA. How much runway would it take to reach TBA? With a best glide speed of 59 kts and a glide ratio of 7.2 to one, the TBA is only 483 feet AGL. The takeoff ground roll only takes 290 feet and the climb to 483 feet takes another 1782 feet for a total of about 2072 feet of runway. So a Carbon Cub LSA can make a turn back after a takeoff distance of around 2100 feet. The climb angle of the Carbon Cub is 15 degrees which is considerably better than the glide angle of 7.9 degrees. Once the Carbon Cub climbs past TBA it cannot only turn around, but also easily glide back to the runway. In fact, with that kind of climb rate, one might find themselves quite high following the turnback and need to add flaps and slip aggressively to get down to land before running out of runway, particularly if there is a stiff headwind on takeoff. Ask me how I know this.

So, in the case of the Bonanza, a successful turn back requires a two mile long runway whereas in the case of the Carbon Cub it needs less than a half mile of runway. Why is there such a big difference between the two when comparing the required runway length? It is the fact that the best glide speed and climb speed are so much lower for the Carbon Cub, not to mention the higher power loading of the Cub. You can see now that it is important to consider the airplane's characteristics to know whether a turn back to the runway is possible or not. Pilot experience and proficiency are also extremely important factors. The turnback maneuver is a fairly aggressive maneuver done close to the ground and is not suited for the average pilot (I know, we all think we are above average, but unfortunately, half of us are not). So if you want to put this maneuver in your tool box, become an above average pilot. Also, find a CFI and practice it at altitude first.

A turn back to the runway after an engine failure on takeoff will require aggressive maneuvering near the ground.

I think the data on the dangers of the turn back maneuver is misleading. We know when it doesn't work, because there is an accident report, but we don't know how often it does work. I have made a turn back to the runway following an engine failure on three occasions. In two of the cases, I was flying a high performance STOL aircraft and knew ahead of time that once I reached TBA, I could make the turn back based on the criteria I just showed you. The other time I was flying a two place training aircraft and the engine began slowly losing power about a mile after the end of the runway. I and the other CFI with me agreed to turn back for the runway. The engine continued to lose power and it became questionable whether we would make it or not. Plan B was to land in an emergency field in the canyon below the airport if we had to. In the end we made it back to the runway. The turn back was a judgement call and we were lucky, but we did have a plan B just in case.

In summary, determine the TBA for the aircraft you fly either by experimentation or calculation or a combination of both, and then use it in concert with your climb and glide angle to make a decision of whether you can turn back to the runway or not. Why guess in the middle of an emergency, when you can know the answer ahead of time.

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