

Erbman's Notes on Being a Tow Pilot

December 2023

Scope

Towing gliders almost seems like an artisanal craft, with knowledge passed on from master to apprentice through the years, with little formal courseware or publications available for the budding tow pilot to independently study. These notes are an attempt to address that need, as well as to supplement my own memory, since I will go many months between opportunities to practice towing. I stay current on the basics of how to fly the airplane because in many ways the Pawnee is similar to my own Bearhawk that I fly frequently. However, like any activity that requires proficiency, the nuances of towing are easy to lose in the long gaps between exercise.

I do not claim to be an expert tow pilot—far from it. As I write this, I have made 294 tows, which is a pittance in comparison with those who have taught me, whose tows number in the double-digit thousands. I am just a slightly experienced schmuck who is willing to take the time to actually record the knowledge I have gained in a form that will hopefully be useful to those who come after me. To increase my confidence in what I wrote, these notes have been reviewed by every tow pilot I know, with incorporated comments from Gary Aldrich, Bill Laningham, and Jimmy Doolittle III.

All of my experience towing has been with Skylark North Soaring at Mountain Valley airport (L94) in Tehachapi, CA in the Piper PA-25 Pawnee. Some of this information will be general to any location, while some of it will be specific to that operation.

I started training to be a tow pilot in June 2018, where Gary Aldrich, with additional help from Bill Laningham and Jimmy Doolittle III, taught me enough to be legal and safe. However, it was very difficult to teach many of the subtleties (like what it feels like) because the tow plane is a single seat aircraft. They taught me as best they could, then metaphorically kicked me out of the nest. Much of what I knew about flight paths and other operational details came from observing the tow plane from the ground and the back end of the rope over 4500 times.

How Is Towing Different From Regular Flying?

Hooking a rope to the tail of an airplane and attaching the other end to another aerospace vehicle has the amazing effect of greatly reducing the performance of the original airplane. A PA-25 Pawnee was built to carry 1200 pounds of agricultural chemicals and the drag-producing equipment to distribute those chemicals. Once stripped of this payload and drag devices, the Pawnee becomes a high-powered, light weight aircraft with significant excess power and climb capability. String a 1000+ pound glider to the back, and much of that climb performance disappears into the ether.

As I was first learning to fly airplanes, one of the big lessons I had to learn was to separate whether aircraft responses were caused by my control input or by atmospheric disturbances. This was critical, because if I assumed all aircraft responses were caused by my actions, it was very confusing because I saw aircraft motions in response to seemingly no input on my part. I would eventually learn to think that it mattered not what caused the aircraft to move. What mattered was what I was doing to make the aircraft go back to doing what I wanted it to.

One of the first revelations I had when I started actually towing was that there was now a third entity making control inputs to my aircraft. That entity would be the glider that was dragging my tail around. This feeling was almost not noticed while towing experienced glider pilots who could stay in position, but very prevalent with new glider pilots struggling to learn aerotow. Again, the solution seemed to be not to worry about the cause, but to focus on my response to it. On my first tows, I remember having a strong feeling of “What am I doing here? How did I get here?” in spite of my actual flying looking perfectly fine to an outside observer. It took me about 200 tows to finally start feeling comfortable while towing.

It is also important to realize that towing gliders is a confidence game. Not that either party is trying to swindle the other, but that there is a certain level of trust and confidence required between the tow pilot and the glider pilot that each will act as expected. The primary expectation of the glider pilot is that he/she will stay in position within the accepted aerotow box. Allowing the glider to “kite” (climb rapidly well above the tow plane on takeoff) or to blow downwind without correction, or just be well out of position, can place high forces on the tail of the tow plane that the tow plane control surfaces cannot overcome. While the tow plane is equipped with a rope release for this contingency, when the tow pilot has his first hand on the control stick and the second hand on the throttle, it can be difficult to use his third hand to pull the tow release. Since Shiva is usually not available for tow pilot duty, this can be a real problem for mere mortals with only two hands. Depending on the magnitude and direction of the force from

the errant glider, the towplane tow hitch may be loaded in a direction where it will jam and cannot be easily released. While glider pilots typically think of the critical phase of flight being up to 200 feet AGL, there is evidence that an out of control glider can crash a tow plane up to at least 1000 feet AGL. As Bill briefs regularly, a primary responsibility of the glider pilot is DON'T KILL THE TOW PILOT!!

Upgrade Requirements

To become a tow pilot, 14 CFR 61.69(a)(2) requires that you have a minimum of 100 hours of PIC time in aircraft category and class. In this case, that would mean to become a tow pilot, you would need to have at least 100 hours of PIC time in airplane single engine land (ASEL).

The PA-25 Pawnees used at Skylark North are tailwheel airplanes, so by 14 CFR 61.31(i) you will need a tailwheel endorsement. Local Skylark North rules require that you have a minimum of 200 hours of PIC time in a tailwheel airplane before being considered for upgrading as a tow pilot. If approved, insurance rules require that you have a minimum of 3.0 hours time in type before doing any towing, so you get to start off by practicing takeoffs, landings, and generally getting used to the Pawnee before actually hooking up any gliders.

The FAA requirements for training to be a tow pilot are slightly confusing about who can do your instruction, because strangely enough nothing requires an instructor holding an airplane rating on an instructor certificate. 14 CFR 61.69(a)(3) states (emphasis added)

“(3) Has a logbook endorsement from an **authorized instructor** who certifies that the person has received ground and flight training **in gliders** or unpowered ultralight vehicles and is proficient in—

(i) The techniques and procedures essential to the safe towing of gliders or unpowered ultralight vehicles, including airspeed limitations;

(ii) Emergency procedures;

(iii) Signals used; and

(iv) Maximum angles of bank”

Because this training is done in a glider at the back end of the rope, it would appear to need to be done by a CFI-G, not a CFI-A.

14 CFR 61.69(a)(4) goes on:

“(4) Except as provided in paragraph (b) (*grandfather clause*) of this section, has logged at least three flights as the sole manipulator of the controls of an aircraft while towing a glider or unpowered ultralight vehicle, **or** has simulated towing flight procedures in an aircraft while accompanied by a pilot who meets the requirements of paragraphs (c) and (d) of this section (*basically a currently qualified tow pilot—some restrictions apply*).”

Note the first option would require a two-seat tow plane, which currently is not available at Skylark North. Thus, I satisfied this requirement by simulating tows in my Bearhawk at Mountain Valley. Note that the “instructor” does not require an instructor certificate, but instead must be a current, qualified tow pilot. 14 CFR 61.69(a)(5) states that you need a logbook endorsement from the qualified tow pilot stating that you did what was required in 14 CFR 61.69(a)(4).

Finally, 14 CFR 61.69(a)(6) addresses recency of experience, stating

“(6) Within 24 calendar months before the flight has—

(i) Made at least three actual or simulated tows of a glider or unpowered ultralight vehicle while accompanied by a qualified pilot who meets the requirements of this section; **or**

(ii) Made at least three flights as pilot in command of a glider or unpowered ultralight vehicle towed by an aircraft.”

Paragraph (i) seems a bit confusing, if read as three actual tows would require you to have a qualified tow pilot with you. I'm not sure what that would accomplish. For most of us, we fly gliders also, so we can claim paragraph (ii) instead.

Thus, even though I do not hold a CFI-A, by the FAA rules I could check out a new tow pilot. However, there are other far more experienced tow pilots available that I am sure Skylark North would rather have do that job.

Commercial vs Private Pilot Certificate

It is common knowledge that you need to have a commercial pilot certificate to be paid to fly. One of the great things about common knowledge is just how often it is wrong. In an FAA legal interpretation dated 3 Nov 2010 to Phillip C. Umphres of the Soaring Society of America, "Accordingly, 61.113(g) permits a private pilot to act as PIC for compensation or hire of an aircraft towing a glider or unpowered ultralight vehicle." It goes on to say that a private pilot cannot carry passengers or property in the tow plane for compensation or hire. Not a real problem, since the Pawnee doesn't have room for that anyway. If you are flying with at least a third class medical certificate you are fine. I have not seen any resolution on the question if you can get paid to be a tow pilot if you are flying under Basic Med (commercial or private pilot certificate), because Basic Med includes operating requirements of "Flight not operated for compensation or hire".

Preflight

Grab a tow ticket from the desk and the large aluminum rectangle with keys. One key unlocks the gas pump. Do it now. The other key is for the hangar in case you need oil.

Upon reaching the tow plane, check the fuel level. It should be full, but may not be all the way up. If not full, decide now if you are going to refuel before flying or fly a shorter period before refueling. The fuel level may be low if the tow plane has been in maintenance, since the maintainers don't check the fuel level when putting the tow plane back on the line. Note the current tach time on the back (also on the front) of your tow ticket. Two tach hours after that you should be at the pump if you started with a full tank. Fuel flow is generally around 13 gal/hour, so two hours will be 26 gallons. The tank holds 38 gallons and the fuel gauge is totally useless/unreliable. Don't push this—at two hours tach time stop and get gas.

Grab a rag (assuming one is stuffed in the instrument panel) and go check the oil dipstick. You need to have at least 9 quarts of oil when you start. If there is less than that, go to the hangar and pick up a quart of oil and a funnel (which is just the top of an oil bottle cut off). Add the oil, then return the empty to drain into the cutoff oil bottle provided. Record on the tow ticket how much oil was added and the current tach time. Return the keys to the front desk.

Check the static ports for evidence of bugs leaving deposits behind.

Remove the control locks. Untie the tie-down ropes. Make sure the little cover on the Pitot tube moves easily.

Under the cowl, confirm the spark plug leads are connected snugly. Make sure the magnetos are not loose. Look for leaks from the oil filter. Look for signs of bird nests, including in the oil cooler inlet (this may require a flashlight). Confirm the exhaust pipes are securely attached. Check the alternator drive belt. Close cowl doors securely.

The prop leading edges will not be pristine—it's a hazard of the job. If you see damage that concerns you, alert maintenance. Make sure all of the screws are in the spinner that should be there.

Be sure to sit in the cockpit before you are ready to go. Make sure you can see over the nose. Make sure you can get full rudder deflection. Make sure you can reach full down elevator. If you can't and the seat is already slid full forward, you'll need to get some cushions to reposition yourself.

You'll want a good noise reducing headset, like a Bose A20 or such. It is insanely loud in the cockpit and you really need to protect your hearing. Any 2-plug general aviation headset should work.

Engine Start

1. Master Switch ON
2. Move mixture control up to the mark (POH says to start in Full Rich)
3. Left Mag ON, Right Mag OFF (only the left mag has the impulse coupling for starting)
4. Pump the throttle to prime (3-5 times when cold, none when warm)
5. Starter engage
6. After start, Right Mag ON
7. Adjust throttle for 1000 RPM
8. Check oil pressure and temperature (Shut down if no oil pressure in 30 seconds)
9. Altimeter set 4200 feet

Run Up

1. Brakes ON
2. Full aft stick
3. Throttle for 1800 RPM
4. Turn mags OFF one at a time, 125 RPM max drop
5. Carb Heat ON, small RPM drop, Carb Heat OFF
6. Throttle for 1000 RPM

Optional: Confirm that both magnetos are grounded by turning off one magneto, then turn off the other magneto and quickly turn it back on. If the magnetos are properly grounded, the engine will stop running while both magnetos are off. Turn the first magneto back on.

Confidence Flight

The purpose of the confidence flight is to build your confidence that everything on the airplane is working correctly before you have a thousand pounds of glider tied to your tail. Plan to takeoff on the main runway. Set the trim to mid-range. Because the airplane is so light compared to the aerotow configuration, it may reach liftoff speed and fly before you even get to full throttle. Be ready for it. Climbing out at the pitch attitude you are used to for towing will be around 80-90 mph indicated. Per the POH, best rate of climb speed in this configuration is 83 mph, noticeably faster than our tow speeds. Climb above 5700 feet and retard the throttle for a power off stall. Stall speed should be around 52 mph indicated. If not, the Pitot-static system may be compromised.

If there are clouds or questions about winds or turbulence, fly around enough to gather information to help the glider pilots make decisions about flying.

After landing, select a tow rope for your day. As you pull it out of the bucket, inspect the entire length of the rope for anything unusual. Attach the proper end to the tow plane tow hitch.

Flight time per tow

From empirical observation, a 3000 foot tow will put about 0.2 on the tach time. A 4000 foot tow will put about 0.3 on the tach time.

Towing

If taking off to the east (Runway 09L), do not hesitate to get glider pilots to push back for longer takeoff runs, especially when there is a large south wind component. There is frequently an invisible performance decreasing shear or dry rotor spilling right over the departure end of 09L.

Take note of your pitch attitude picture while on the ground. This is very close to the climb attitude while towing a glider.

Adjust the mirrors so that you can see the glider behind you on the ground. For the outside mirrors, I find that the top of the vertical tail should be right at the top of the mirror field of view.

Record on the back of the tow ticket the tail number or contest number of the glider and the requested tow altitude. Not only does Jane want this information when you are done towing, but it is really useful as you are approaching the glider pattern IP on the initial climbout and you can't remember what type of tow you were planning to do.

Set the trim close to full nose up. The direction of the trim is defined by the forward half of crank rotation. For the crank in the forward half of its rotation, going up trims nose up. Going down trims nose down.

Because the SGS 2-33 tows at a slower airspeed, some tow pilots will tow with one notch of flaps down. This lowers the pitch attitude, such that the pitch picture towing a 2-33 with one notch of flaps is essentially identical to the pitch picture towing a fiberglass glider with no flaps.

NOTE: At least one tow pilot disagrees with using flaps on takeoff and tow, stating concern about the strength of the flap pushrods. He further states that the POH directs that the flaps be up for takeoff. I would respond to that saying that the POH assumes you are taking off with a load of agricultural chemicals and expect to be flying at a higher speed than we are towing at, thus not needing flaps. The POH makes no comments about glider towing because the authors did not anticipate that use.

Assuming you have shut down the engine, the radio may not come up after starting the engine. If not, simply turn the radio off and back on again.

I make the takeoff radio call ("Mountain Valley traffic, Tow 1 departing runway 27R, glider in tow, Mountain Valley") as I am taxiing forward to take the slack out of the rope. Watch in the mirrors for the bow in the tow line to

pull out. On the first tow of the day, look over at the glider line to see about where you are for a taut rope. This will help on later tows. Check each day, because there is some variance in rope length (they get shorter with time).

Watch for the rudder wag of the glider. On the DG-1000, you can only see the top 6-8 inches of the rudder, and its chord is very short, so it is hard to see. Hopefully the wing runner is on his/her game and will signal you to start the takeoff. Reply to the glider by wiggling your rudder.

Confirm that both Mags are on. Smoothly push the throttle forward. If you do it too fast, you will set a 2-33 back on its keester and the glider pilot won't be thrilled. Extend your right hand forward (without moving your shoulder) to help get the tail up. Dance on the rudder as required. Use aileron if needed for crosswind. Liftoff should be around 60 mph indicated. If the trim is set correctly, it will take some force on the stick to liftoff at 60 mph, but this force will quickly subside to a trimmed condition as you accelerate to climb speed.

For the school gliders, tow the 2-33 around 60-65 mph. Tow the glass ships around 70-75 mph. For private ships, if you're not sure what speed to tow at, ask the glider pilot for the desired tow speed.

For tows above pattern altitude, nominal ground tracks are shown in Figures 1 and 2. Each tow pilot has his own variation on this. The key point is to stay close to the airport until gaining enough altitude for the glider to return to the airport if experiencing a Premature Termination of The Tow (PTTT) (*FAA speak for rope break*).



Figure 1. Nominal initial tow ground track, west flow, Runway 27R



Figure 2. Nominal initial tow ground track, east flow, Runway 9L

For Runway 27R, turn right to cross the midpoint of the dam west of the airport. This should put you above 200 feet AGL before crossing the dam, and usually before turning. For Runway 9L, turn left after crossing the far side of the dam east of the airport.

Avoid crossing the IP at pattern altitude (5000-5200 feet) as an unseen glider may be entering the pattern. This can also be avoided by flying downwind outside the glider pattern. Watch out for airplanes on downwind for KTSP. While as published there shouldn't be a problem, the ground track for the patterns is not painted on the ground and some pilots are known to fly "bomber patterns" farther from the airport than necessary, and they probably won't be watching out for you. Avoid turning across the glider pattern until you are well above the altitude of a glider in the pattern. Try to be established going into the wind by 5700 feet (1500 AGL).

Remember that if you just released a glider at 3000 feet in no lift conditions, you will likely meet that glider around the IP on your next tow. Watch out.

If the glider decides to box the wash/wake, concentrate on maintaining your pitch attitude and pointing at one location in the distance. If you do this, you will always know where the glider is, even if you can't see it in the mirrors, and you won't see it in the mirrors if it isn't in the high tow position. As the glider descends, you will need to push forward on the stick to maintain your pitch attitude. The more you push, the lower the glider is. If the glider moves to the right, you will have to apply right rudder to maintain your direction. If the glider moves to the left, you will have to apply left rudder. Between the position of your stick and which rudder pedal you are pushing on you will be able to know where the glider is.

If the glider is not maintaining a constant tension on the rope, you will feel the tow plane accelerate when the line goes slack. Likewise, when the slack comes out, it will feel like you just caught the 3 wire on your carrier landing. The polypropylene tow rope has a lot of stretch in it, and it will feel like you are being slowed down by a big rubber band.

Make every effort on the way up to the planned release altitude to keep the glider within normal gliding range of the airport. That is...don't climb in a canyon or drag the glider downwind (or even too far upwind on a weak lift day). This is where your glider pilot experience is applied. Some private owners will want you to violate this practice. Don't tow the glider downwind of the airport (except for the initial pattern around the airport) unless the glider pilot specifically requests it. Even then, question the glider pilot as to why he/she wants to go downwind.

Approaching the release altitude, be thinking about which way you plan to go to descend back to the field. Watch the mirrors for the release. If there is tension on the rope when the glider releases, you will feel a small "kick in the butt" acceleration forward. If the rope is slack at release you may not feel anything.

If the glider pilot does not release where you expected it, keep climbing and make sure it's not because you have taken the glider to a bad spot for release. When in doubt, start climbing toward the airport.

If the glider requests a pattern tow ("1"), you may want to modify your ground track slightly, as shown in Figures 3 and 4.

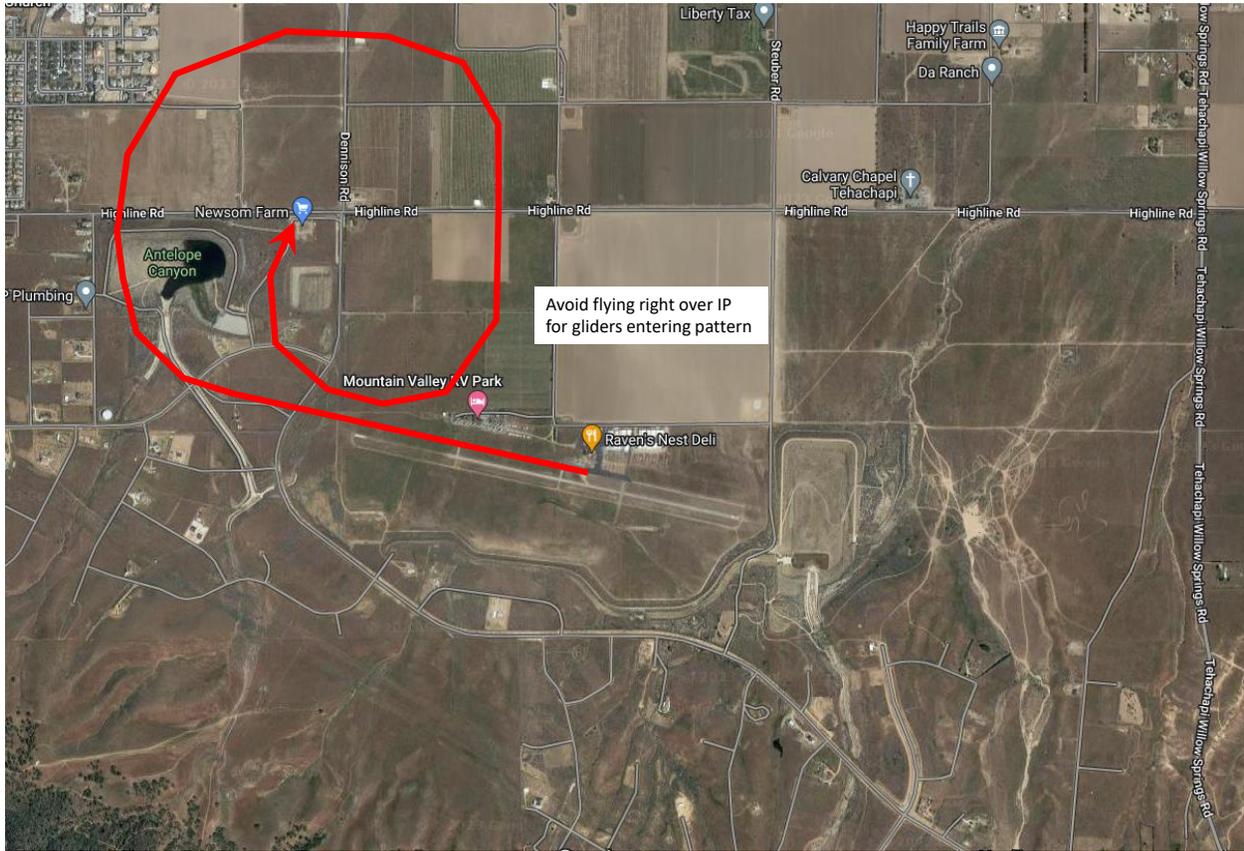


Figure 3. Nominal pattern tow ground track, west flow, Runway 27R

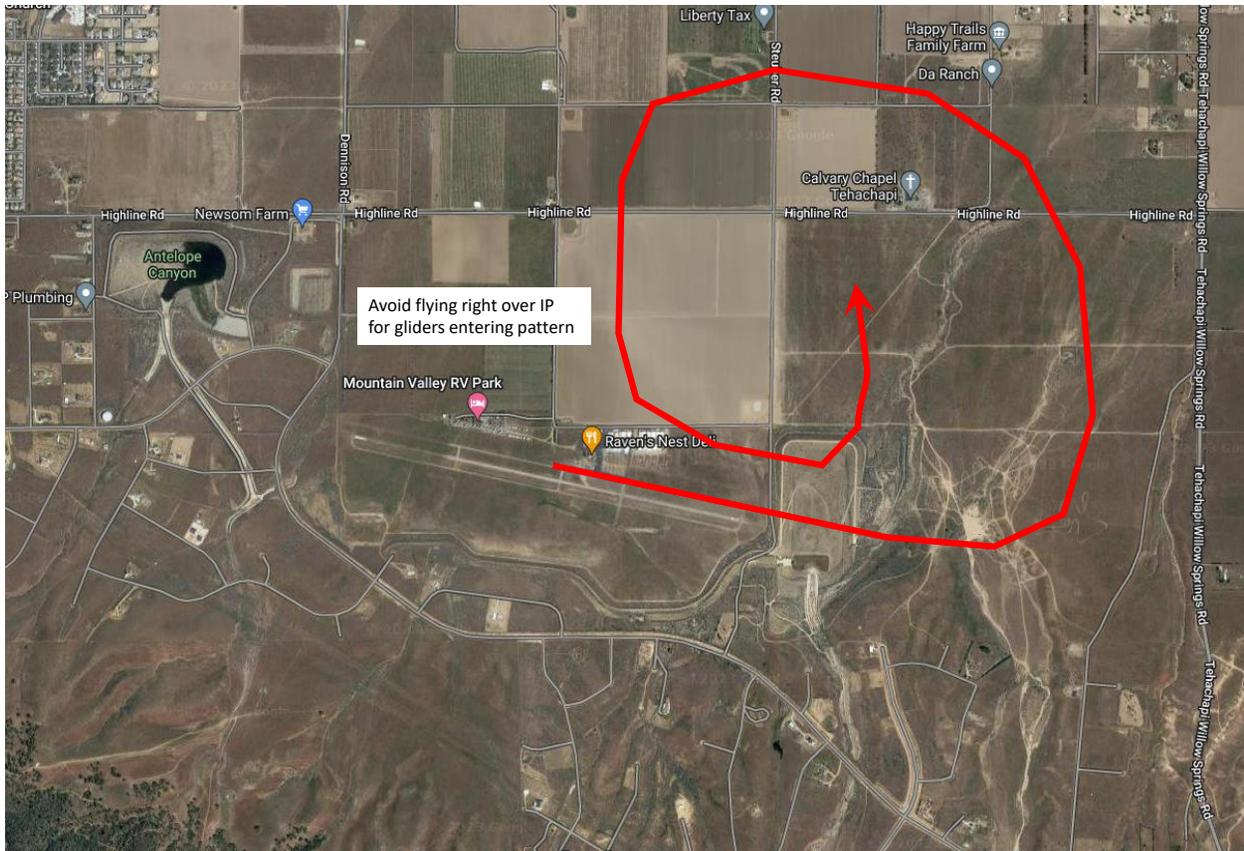


Figure 4. Nominal pattern tow ground track, east flow, Runway 9L

First, extend your initial turn slightly. For Runway 27R, turn right over the far edge of the dam instead of the middle. Turn downwind a little farther outside the glider pattern to give yourself more distance to climb. Do not fly directly over the IP, as some glider pilots have made a habit lately of circling directly over the IP. Turn short of the IP and make a gentle circle on the upwind side of the IP as required to get to altitude.

Release and Recovery

Upon tow release, turn left and lower the nose to stop the climb. Pull the throttle back about halfway. If the flaps are down, raise the flaps now to avoid overspeeding. The flap limit airspeed is 109 mph. Trim nose down to begin the descent. As speed increases, RPM will increase because of the fixed pitch propeller. Adjust the throttle as required to maintain around 2400 RPM. This keeps enough power on the engine to minimize shock cooling of the cylinders.

In calm air, adjust pitch and trim for an airspeed around 100-120 mph. Some tow pilots will descend faster, up to redline airspeed. I'm not quite that adventurous. Adjust throttle to maintain around 2400 RPM. In bumpy air, slow down below maneuvering speed. While the POH publishes a maneuvering speed of 120 mph, that is at a gross weight of 2900 pounds. At 1500 pounds, which is about where we operate the tow planes, maneuvering speed is 86 mph.

Pick a flight path that gives enough distance to descend to 5000 feet approaching the airport. At 5000 feet, level off. I find that about 1/2 turn up on the trim crank is just right to stop the descent. On downwind, slow to 80 mph and lower one notch of flap. At the perch, slow to 75 mph and lower the second notch of flap. At this point you will be around 1700 RPM. Move your feet up on the rudder pedals so that you can reach the brakes if you need them on the rollout.

I generally turn base for 27L over/around the house with the trapezoidal trees. For 9R I turn base around the big water tank.

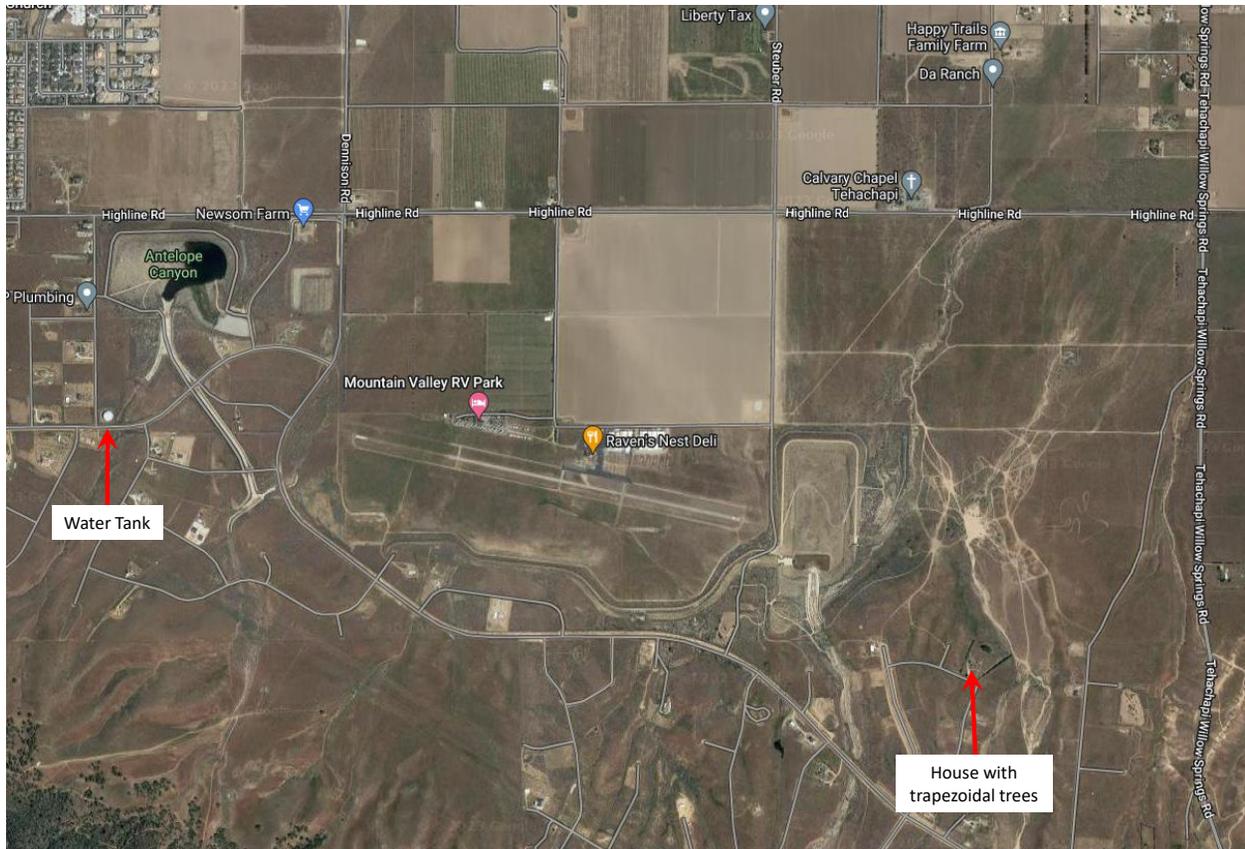


Figure 5. Suggested Base Turn References

Final approach should be at 70-75 mph. Remember you are dragging a long tail behind you. For 27L, shoot for an approach angle similar to that of a glider. Larry “Bear” Barrett recommended crossing the final berm at or above 4400 MSL. This will keep the rope above the wire fence and let it be used again.

If you get too low, the rope will snag on the fence and yank the end off. You will feel a sharp deceleration that will go away almost immediately. You’ll know for sure when the line person shows you the end of the rope. Ask me how I know.

Prior to the flare, ensure you are not pressing the toe brakes. Just like a 2-33, you don’t want to touch down with the brakes on.

After touchdown, retract the flaps to help stay on the ground and improve braking action.

After release from a pattern tow, you are just above pattern altitude and around pattern speed. If you have a notch of flaps down, you can leave it down—just don’t accelerate too much. Turn and head across the runway to intercept the towplane pattern.

After landing, clear the runway. If no gliders are waiting, remain clear of the glider runway and shut down the engine. Consider getting out and pulling the tow rope off of the landing runway. If a glider is waiting, pull on to the glider runway in front of the glider, stopping in a position where you can see the glider. If line crew is available to hook up the rope, leave the engine running while the rope is hooked up. Studies have shown that the accumulated cost of the fuel saved by shutting down for a minute or two is far less than the replacement cost of the starter accelerated by unnecessary engine starts.

Securing the Tow Plane

Go to the fuel pit and refill the gas tank. Record on the tow ticket how much fuel was added and the tach time.

Get the rope bucket. Release the rope from the tow plane tow hook and start stuffing the rope in the bucket. The trailing edge of the wing walkway is a nice place to plop your butt while stuffing the rope in the bucket. Put the rope bucket back near the dungeon.

Park the tow plane back in its spot. Chock the wheels and tie on 5 tie down ropes. Adjust the pitch trim until the elevator is even with the horizontal stabilizer. Install 3 control locks. Put the flaps full down so they don't flap in the wind. Record the final tach time on the tow ticket. Clean your krap out of the cockpit and close the windows.

Do the addition/subtraction on the tow ticket to determine your total tach time duration, oil added, and fuel added. Turn it in at the front desk.

Another Resource

The Soaring Society of America publishes a book in the Bob Wander's Gliding Mentor series written by Burt Compton titled "SSA Towpilot Manual". I have never seen or reviewed this book, so I can't comment on what it contains. Available at <http://ssa.org/product/towpilot-manual/> . Cost at this writing was \$17.

- **Russ Erb**

