

Racing tip sheet

Prepared for control-line racing seminar, April 7, 2001

Pitting

The pit crew chief is normally the race director for the team. Besides starting and restarting the plane and acting as mechanic, he keeps track of the ever-changing circumstances of the race and signals instructions to the pilot. Here are some pit crew basics:

- **Pit basket:** Have exactly what you need to conduct a race, and nothing extra to get in the way:

- Fuel bottle, large enough for the whole race, with appropriate filling fixture.
- Battery and clip or hot glove appropriate to the event.
- Spare prop
- Spare plug
- Prop/Plug wrench

Don't take a lot of extra tools, glues and accessories to the racing circle. They will only get in the way and slow you down.

- **Sequence:** Practice with your equipment and learn the exact sequence that results in the best starting and restarting. Each plane may be a little different. Once you learn the sequence, stick with it and do it the same way every time. Adjust the sequence if you find a better way.

- **Calm down:** The best pit crews don't seem to be in a big hurry. They don't rush and fumble. The best way to make a fast pit stop is to be deliberate and efficient. Do everything correctly the first time; don't make yourself clumsy by trying to go too fast.

- **Selecting pit location:** The best pit location is downwind. If you get first choice, take that spot. If you are not first on the circle, be aware of the wind direction and the location of the other pits in planning your race (see "when to pit" below). Do not pit upwind.

- **The countdown:** The standard racing countdown is "2 minutes, 1 minute, 30 seconds, 15 seconds, 10 seconds, 5 seconds, go." At some races, the countdown will start at the end of the preceding heat at "5 minutes" or "4 minutes." When back-to-back heats are run, there will be a between-heats countdown, usually 4 or 5 minutes. The official will announce these countdowns at the pilot's meeting. Important: It's the official's responsibility to call out these countdowns but it is *your responsibility* to hear them. Pay attention to the countdown!

- **Initial start:** Develop a warm-up sequence that results in a quick initial start. Here's one that may work. Adjust it if you find a better way.

- Before the countdown begins, start the engine and get it loose and warm. Top off tank.

- At "2 minutes," start the engine and run it for 10 or 15 seconds. Top off tank.

- At 1-1/2 minutes, start the engine and run it for 10 or 15 seconds. Top off tank.

- At "1 minute," start the engine and run it for 10 or 15 seconds. Top off tank.

- At "30 seconds," start the engine and run it for 10 or 15 seconds. Top off tank.

- At "15 seconds," look around and make sure your area is clear. Pit box, fuel bottle out of the way.

- At "5 seconds," connect battery, set prop in proper position.

- At "Go!" hit prop, remove battery, release plane. Step back from the circle to make sure you're out of the way of other planes taking off.

- **When to pit:** If you have a shutoff, you have some strategic options. Decide what is

best for you in the particular race, considering the circumstances. Here are some factors to consider:

- Length of race. In a 70-lap heat, a logical pit stop is at 35 laps. In a 140-lap feature requiring three pit stops, logical stops are at 35, 70 and 105. (In a 140/two-pit feature, such as NWSR, your tank should be able to go 50-60 laps, for stops in the 50-60 and 100-120 range.)

- Circle layout: Study your pit position. You may conclude that it would be better to pit while the other planes are in the air. If so, be ready to adjust your pit timing based on what your opponents do. If you are the back pit, you have the advantage of a clear landing path. If you have the front pit, you have an easier takeoff.

- Adjust as necessary. Circumstances of a race can cause you to have to make adjustments in your pit timing. Be prepared to do so (see “Teamwork” below). You may also have to move your pit location. If a plane crashes in front of your takeoff area, or another team misses a catch and ends up in your spot, you will may to signal your pilot to move the landing spot.

- **The pit stop:** Through practice, choreograph this procedure to the point where it is precise and almost automatic. Take it one step at a time and do everything correctly (see “Calm down” above). Here is a basic sequence:

- Catch the plane by the wing or nose, whatever is comfortable and appropriate to the plane. Shift your position to the proper location with regard to the circle markings.

- Fill with fuel.

- Reset shutoff.

- Connect battery.

- Set prop position and flip or smack prop as practice has indicated.

- Release plane.

Note that the precise sequence of these activities will be determined through practice, and that there may be one or two additional steps. For example, with some engines that tend to get hot, you may need to squirt fuel on the engine head for cooling before you fill the tank. Some things can be done simultaneously. You may be able to connect the battery while fueling, especially if you use a hot glove or a battery assistant. When you reset the shutoff will depend on how much fuel charge your engine prefers. You may need to reset while fueling, an instant before stopping fueling, or after stopping the fill. Determine this through repeated pit stops in practice — not on the day of the contest but at home when you have time to experiment.

- A hot glove, or not?: If your racing team uses a single pit person, rigging a hot glove may be the way to go for quick pit stops. However, a hot glove has its drawbacks. Make sure the setup you use is reliable and really is quick to operate. If it is prone to wiring failures, connection problems, or just causes fiddling and fumbling in the pit, you need to work the bugs out. Better yet, use a two-person crew (see below).

- Using a two-person crew: The very fastest way of pitting an uncowed engine is with a two-person crew. The crew chief catches the plane, fills the tank, resets the shutoff and launches. The assistant connects the battery, checks the meter to see that the plug is lit, and removes the battery when the engine starts.

- Keeping track of the race: It is the pit crew chief’s responsibility to know how many laps have been completed, what the current position of the team is in relation to the other entries, how many pit stops each team has made, etc. The pit crew chief decides whether to vary the pit stop timing, move the pit location if necessary, and other factors. You should be aware of how long your tank can run if it’s necessary to pit early or late. In events with no shutoff, you should know about when the plane will quit and be prepared. Most pit crew chiefs count the laps in their head, but you can check with the timer if you lose count or just want to confirm. The crew chief should be paying attention to the race at all times, even between pit stops, because something might happen to cause an early stop such as a

mishap or blown plug. The point is, be aware at all times, and don't let yourself be surprised.

— Safety issues: Normally, the plane is released when it starts, but the pit crew chief should be aware of traffic. If a moment's hesitation to let traffic clear makes for a safer, cleaner launch, that's OK. The pit crew is in a dangerous zone. Make sure you are pitting in the appropriate area, but don't assume that everyone else in the race will look out for you. Keep one eye on planes landing and taking off, and make sure they're not aimed at you. Better to duck and lose a few seconds than to take a whack on the noggin with an airplane. If you must enter the circle to retrieve a plane, you must ask for the event director's permission to enter, and you must enter at right angles to the circle and leave as quickly as possible.

— Don't get snagged: The pit crew and pilot are responsible for keeping the lines on the ground when the plane is at rest. Watch traffic and put the wingtip down if a landing plane is coming by your pit. If you don't, and the incoming plane snags your lines, you're disqualified.

Piloting

The pilot's job is to maintain complete control of the airplane at all times that it is in motion. It's a big job. The pilot must fly within the rules, must always be aware of the safety of the people on the ground and the other pilots, and at the same time work to make the plane's travel through the course as efficiently and quickly as possible. Here are some piloting basics.

• **Safety First:** We're doing this to have fun and win races, but the first responsibility of a pilot is to make sure nobody gets hurt as a result of his actions. This means the pilot must take special care to assure a safe race. Some safe practices to observe:

— Takeoff: Get the plane in the air and inside the racing circle before it reaches the next pit area. That means the pilot should be stepping back toward the center circle immediately as the plane is launched. This not only assures good tension and control, but clears the other pit. If you just hang on to the handle and watch the plane take off, you will place the next pit crew in danger. The pilot must take an active role on takeoff, pulling good line tension and hauling the plane into the circle. At the same time, the pilot must avoid a skyrocket takeoff into traffic, which can cause a collision or line tangle. Come off the ground smoothly and don't interfere with traffic above.

— During the race: Occasionally a mishap will occur which involves another plane coming to rest inside the circle, on the ground. The pilots of planes in the air should note the position of that plane and be on the lookout for a pit crew entering to retrieve it. If you have to fly a little higher than normal for safety's sake at this time, do so. Pilots of planes on the ground should position themselves as follows: If your plane is being pitted, you should be just outside the pitting circle, so that your plane is in the proper pit position. As you take off, you quickly move back toward the center. If your plane is out of the race, either finished or broken, you should position yourself outside the pitting circle, down and out of the way. In the event of a line tangle or other emergency, pilots must cooperate for safety. Shut down if necessary, or if shutoffs are not available, cooperate to improvise a solution. Watch out for officials entering the circle to assist with the tangle.

— On landing: Be aware as you land of other pit crews at work in your landing path, and make sure that you clear them. Your plane should be inside the circle until it passes the last pit; then you can move outward. Pit crews are supposed to be in the proper location, but pilots should remember that, if a plane hits a pit crew member, it can cause a serious injury. Be sure that you clear the pit crews, wherever they are!

• **Piloting techniques:** When you pilot a race plane, you are not just hanging on for the ride. You are in control, and there are many ways you can shave seconds off your heat time. Here are a few piloting tips:

— Get up to speed: As you take off, be in active control of the plane. Pull on the lines to get good tension on takeoff (this is especially helpful in windy conditions or when you have a poor pit location), and use the first lap to get up to racing speed. Rules allow whipping during the first lap.

— Walk a tight circle: Your goal is to make the circle as small as possible. If you walk around the outside of the center circle, you make your plane fly a longer distance. A pilot should try to keep his handle at dead center. Imagine a speed pylon in the center, and try to keep your handle as close to the location of that imaginary pylon as possible. Some contact between pilots is assumed as part of normal racing. Don't worry if you find yourself shoulder to shoulder with other pilots who also are trying to keep their circle tight. If you find it difficult to get between two other pilots who are shoulder to shoulder, muscle your way in (see "courtesy" below). (Also see "backsiding" below).

— Keep up with your plane: Note the angle that your lines leave your handle in relation to the circle. If they are angled out to your left, you are behind your plane. Besides holding back your speed, this causes problems for the other fliers. Tighten up your circle and pull your handle around to where the lines are going out straight from your handle to the outer edge of the circle (see "whipping" below).

— Fly smooth: A plane that bobs up and down will not go as fast as a plane that moves smoothly. When you have to change elevation to pass, do it smoothly, not with sharp elevation changes.

— Fly your own race: If other pilots in the race use sloppy techniques — walking big circles, being behind their planes, etc. — you are not bound to fly the same way. If your opponent walks a big circle, he's giving you the center, and a much tighter race. Take advantage of it.

— Get it to the pits: On landing, the pilot is responsible for putting the plane in the pit crew's hands. Tow the plane at a low altitude from the shutoff location to the pit, and bring it in at the proper position and moving at a reasonable speed for the catch. Don't make the plane hard to catch and, for heaven's sake, don't land somewhere other than in the pit location!

— Courtesy: Cooperate with the other pilots in the race. If you are shoulder-to-shoulder with another pilot and a third pilot needs to get between you, let him in. Talk to one another in the circle if it helps keep things clean — let the others know when you are going down for a pit stop, and advise them about other unusual circumstances. If you have the slow plane, fly the low groove. If another plane is having stability problems, give it extra room. Do what it takes to have a clean, fun race.

• **Piloting rules:** There are rules — some written, some not — governing piloting. The race will be more fun for all if you follow the rules — and you'll avoid penalties, complaints and hard feelings.

— Whipping: It is illegal to tow the plane while it is under power. If your lines are moving out from your hand to the right, you are whipping. Whipping is of questionable value as a speed-enhancing technique, because it forces you to enlarge the circle. And it is easy for officials to see and penalize.

— Backsiding: You may keep your handle in the center of the circle. But when you take it to the back side of the circle, you actually shorten the lines. This is unacceptable. Keep it in the center, but not at the back.

— High flying: There is a prescribed maximum height for each category. If you fly above this height, you are subject to lap penalties. If you are a slow plane and fly high, you cause every one else to fly even higher — causing you a speed disadvantage and raising safety concerns. If you have the faster plane, you are allowed to go up to pass, but you can't stay up there. Bring it down between passes!

— Proper passing: The rules allow one-half lap for passing. You should lift your handle over the slower plane's pilot at the same time that your plane passes his. Do not lift your

handle over the pilot before the plane passes. This creates a crossed-lines situation that is unsafe, illegal and subject to penalties. If you have to pass two planes in succession, you must return to normal flying height between passes if you can do so. If you are piloting the plane being passed, keep your plane low; don't bob up as your eyes shift to the passing plane.

— Walk the circle: Even when you are the only pilot with a plane aloft, you must walk a circle. Standing and pivoting is not acceptable.

— Unsafe flying: Anything a pilot does that an official considers to be reckless, dangerous, or in disregard of the rules is subject to disqualification.

Protocol

• **Be ready:** Have your equipment ready to race when your heat comes up. Have things tuned, adjusted, repaired, prepared and pull-tested. Plug checked, prop on tight, fuel bottle filled, etc. The time to do this is before the heat is called, not during the countdown.

• **Show up:** Know where your heat falls in the schedule, and when it is called, move immediately to the circle. The clock marches on. Don't expect officials to wait for you.

• **Picking a pit:** Pit position on the circle is first-come, first-served. Take your plane and lines to the spot you want. If somebody else has your spot, you must move to a second choice a safe distance away. Do not put your pit unsafely close to the pit that's already there.

• **Dealing with officials:** The officials are in charge. Their word is law. You may ask questions, you may make suggestions, you may register a complaint. But once the official has responded, do not argue with them. Arguing with officials is subject to disqualification.

Teamwork

Racing is a team event. You should practice with your partner as much as possible and work out procedures and job assignments that best suit your team.

Sometimes, however, you must pick up a partner for a particular race — a pilot or pit crew. If you must do this, make sure to discuss procedures, signals, etc., with them before the race.

• **Signals:** Work out and practice a set of signals so that the pilot and pit crew can communicate during the race. Following are some common ones used by many racing teams. You can work out your own signals if you prefer.

The first signals listed here are those from the pit crew chief to the pilot:

— Time for a pit stop: Pit crew chief raises one hand. Sometimes the crew chief will use an audible signal to catch the pilot's attention. A high-pitched "hoot" can be heard well.

— End of race: Pit crew chief raises two hands high.

— Laps remaining: Pit crew chief holds up fingers representing the number of laps remaining. These are held up low, in front of the body, to distinguish from the time-to-pit or end-of-race signals.

— Fly low and smooth to conserve fuel: Pit chief holds hands spread out, palms down, like an umpire's "safe" signal. This is used when there is a question about whether there is fuel enough to finish the race.

— Keep going: Pit crew chief holds up one finger and moves it in a circle. This means there is no need for further pit stops, fly to the finish on this tank.

— Change pit location: Pit chief points to a spot on the circle.

— Emergency: Pit chief points to trouble: A plane in the circle, etc.

— Wag for shutoff: In events without a shutoff, sometimes a plane will be in danger of flying too many laps and being disqualified. Sometimes bobbing the plane up and down will cause the plane to stop. Pit chief tells the pilot to do this by wagging his hand up and

down as if shaking a handle.

Sometimes the pilot needs to signal the pit crew. On some teams, the pilot makes some of the decisions normally made by the pit chief, or emergency circumstances may require the pilot to take control. Here are some pilot-to-pit-chief signals.

- Time to pit: Pilot points to the pit location.
- Move pit location: Pilot points to a new location.
- How many laps remain? Pilot holds up free hand and wiggles fingers.
- Check or change glow plug: Pilot taps his nose with free hand.
- Change needle setting: Pilot points up for “lean out,” down for “richen” or holds up “OK” sign for no change.

YOUR AIRPLANE

Each racing event has specifications for the airplane. You should read the rules carefully and make sure anything you build follows those specifications. If you are a novice racer, don't try to reinvent the wheel. Find a proven design in use by established competitors and start out with that.

Some things are common to all racing planes:

- **Build it straight:** Like all other modeling events, alignment is important.
- **Build it stiff:** Vibration saps horsepower from the engine. You should make sure the plane is very stiff. Examine the design, especially if it is a kit, to determine whether it would be a good idea to lengthen the motor mounts, substitute a wood doubler with aluminum, etc. Cover airplane parts with fiberglass cloth where possible. Use carbon fiber to strengthen weak areas, such as the fuselage right behind the wing.
- **Build it clean:** A smooth, clean plane will go faster. Is there anything you can legally and safely put inside the structure, such as leadout connectors, shutoff trip wires, etc.?
- **Landing gear:** Study other competitors' planes to determine what type and location of landing gear works best. Usually a wheel approximately on the center of gravity will result in smooth landings and rolls to the pit.

Most of all, in CL racing, plan your racing program carefully, and with the chief goal of **having fun!**

Let's go racin'!

— Written by John Thompson, updated July 29, 2004