PYLON RACING 101

By: Scott Smith (8/08)

This is a basic look at AMA Pylon racing with special attention for a new racer to the AMA 424 Sport Quickie class. In this document I will give you some basic overall view of pylon racing, what you should do to prepare your equipment, set-up, race day breakdown of spotter/caller & pilot duties as well as how to make sure you are ready for the next heat while in the pits. This is by no means an all-inclusive guide, and some of the methods I use may or may not be right for everyone. I would suggest you use it as an informational guide to get you started, and then modify and add what you learn that works best for you.

Good luck, and get ready to have a ton of FUN!

Preparing your Equipment

Aircraft Set-up:

The first (and one of the most important) things you need to do to have success in racing is to have a well set-up aircraft so that when you give it an input, it will respond correctly. You may also want to set all of your planes up with the same set-up so that parts can be switched from one plane to another. A good example would be to drill your motor mounts and pushrods in the same location, so if you ever needed to switch engines between planes, it is very quick and easy. Here are a few things to pay special attention to:

a.) **Servo screws, grommets and bushings** – Make sure all servos have all the screws thru the grommets and bushings and that they are tightened properly. If the screws are mounted into wood, use thin CA and harden the holes. You may want to replace the servo mount screws with the type of servo screw that have an Allen head so that they are easier to get to and replace as needed.

b.) **Make sure all servo arms are at 90 degrees –** Whenever you hook up a control surface make sure the servo is centered; no radio trims or sub trims are activated, and set the control arm so that it is 90 degrees to the direction of motion. If it is not, the surface will not move equally each direction.

c.) **Connect control rods to the servo arms with z-bends** – One rule of racing is that only one end of a control rod is adjustable, so set the un-adjustable end at the servo.

d.) **Connect the control rod close to the servo** – The closer to the servo gear train you set the rod, the less play and slop you will have. This also will give you the best mechanical advantage (*more power*) and faster servo rotation speeds.

e.) **Set the ATV (travel volume) –** Make sure the throw of the servo on all rates will move the surface as much as needed, WITHOUT BINDING. Make sure you can shut the engine off with the trims, or with a throttle cut mode. Use a throw meter on all surfaces to check that they ALL move the EXACT amounts needed. If the v-tails aren't exact, the plane will not go thru the corners correctly.

f.) **Mount your switch inside –** This is a common way to mount the radio switch and it should be operated from side to side. This will aid in preventing vibration from turning it off, allowing oils or fuel to short a switch and from keeping the switch in an off position during transportation. Use a string to run thru either sides (each direction) or, a wire to turn the airplane on or off. If the switch is mounted on the outside, place it away from the exhaust and in a forward 'on' position under the wing to keep it from being bumped during the 'push'.

g.) **Keep everything secure –** Use zip ties, foam padding and whatever else needed to keep all the wires bound up, receivers padded and batteries safe from vibration. Tape or otherwise secure all connections (*as well as receiver crystals*) in place. Keep antennas away from wires and metal as much as you can. Race planes vibrate tremendously.

h.) **Avoid metal-to-metal connections –** Use plastic clevises for controls or use a jamb nut against metal clevises as well as a thread-locking compound. Try to use nylon bolts instead of metal whenever possible (*EXCEPT for engine mounting*).

i.) **Use short fuel tubing binders on clevises** – Cut a small piece of fuel tubing and slip it over all clevises to make sure they don't accidentally disconnect themselves.

j.) **Gap seal all surfaces** – The last thing you need to happen is a part falling off in flight! This is also a very important trimming process, as an unsealed surface will change trim.

k.) **Secure fuel tanks and lines** – If you use a round fuel tank, silicone it in place to keep it from rotating and cutting off your fuel flow to the engine.

l.) **Use a fuel cutoff** – Especially with bladder tanks, you need an external way to stop the fuel from flowing. A standard helicopter fuel shut off (clamp) works fine.

m.) **Tape over all wing bolt screws** – The tape will not only clean up the airflow, but will stop a loose bolt from backing out due to vibration.

n.) **Make sure your wheels are free** – If one wheel spins better than the other on, the plane will turn towards the one that binds on launch.

o.) **Mark the aircraft ID on the outside** – If you have the same type of planes with the same color scheme, put a number or other indication on the fuselage and wing so you know which plane you are flying! This way you get the right wing on the right fuselage and can verify you have the right plane selected in your radio.

p.) **Put your racing numbers on** – It is a rule! AMA number on right wing {*1" high min.* ***N*** *(last 2 or 3 numbers of your AMA) (First letter of your last name) Example -* ***N92S****}* or on both sides of the fuselage behind the wing, or your NMPRA number on the left wing. You may have both, but you have to have at least one.

<u>Engine preparation:</u>

The only approved engine for AMA 424 class is the Thunder Tiger Pro .40 ABC. While you may want to question this for one reason or another, the fact is this is a very dependable engine that will out perform any other sport engine in its class and is very inexpensive. The rules state that the engine must be stock except for longevity-enhancing modifications (*16.3.2 Powerplant*). There are not a lot of things you are allowed to do to these engines, but the ones you are allowed to do are needed to help the engine last. I would highly suggest you do these things to a NEW engine, so you get the maximum benefit from them.

a.) **<u>NEVER</u> turn over a new engine by hand** – The engine is not lubricated or warm, and you will only damage the piston/liner assembly. ABC engines are very tight before they are broken in. Always thoroughly clean an engine before running it for the first time.

b.) **Replace the bearings** – Disassemble the engine and remove and replace the factory bearings with a heavy duty set. High speed or ceramic bearings are not needed, and will only add expense.

c.) **Check for and remove any debris** – Remove any foreign debris from the engine prior to re-assembly.

d.) **Remove the tensioning spring from the carburetor rotor assembly** – This spring is not needed for racing, but if left in, will eventually be sucked into your engine and could possibly destroy it in seconds.

e.) **Seal the muffler up** – You should disassemble the muffler, clean it good, and put it back together with either high temp RTV silicone or JB Weld. Make sure you DO NOT over tighten the bolt that holds the rear chamber on, or it will break in the air. Uses a thread locking compound, hand tighten the bolt, and then put the lock nut on the back with more thread lock.

f.) **Un-screw the idle needle valve** – Add thread lock or JB Weld and insert back in. Only tighten it 2 to 3 turns. (*you have no need to idle anymore, and this will increase fuel flow*)

g.) **Put all the bolts back in using thread lock compound** – And also make sure to use good quality oil when re-assembling the engine. Properly oiling an engine after a days running will keep bearing and surfaces free from corrosion until the next flight.

h.) **Use a back-plate type mount** – This is the most secure and rigid type of mount. The more rigid the mount, the more power the engine will transfer to the propeller.

Make sure you follow all directions for the bearings you install and use a torque wrench to make sure you don't over tighten the bolts in the engine. Be sure to clean the bolts to remove all oils and install with a thread-locking compound. I prefer to reassemble the muffler using JB Weld, but if you have to take it apart for inspection, it is a bear! A high-temperature gasket seal can also be used. SEMPRA does inspect for baffles so there is no reason to even consider tampering with the muffler. SEMPRA uses a 16,500-RPM limit and randomly inspects at the line for this and baffles. I have included some cutaways of the engine and carburetor as a reference.

PARTS LIST

CARBURETOR

FIG	DISCRIPTION	9258N PRO-36	9244N PRO-40 PRO-46	9240N PRO-61 PRO-120
A	CARBURETOR BODY	PN1164	PN1169	PN1172
B	CARB. ROTOR ASSY	PN1106	PN1028	PN1002
C	NEEDLE VALVE ONLY	PN1029	PN1029	PN1173
D	SPRAY BAR ASSEMBLY	PN1166	PN1166	PN1174
E	NEEDLE VALVE ASSY.	PN1171	PN1171	PN1175
F	THROTTLE LEVER	PN1107	PN1006	PN1006
G	BOLT&FUEL INLET	AA1108	AA1108	AA1108
H	RATECHET SPRING	AA1025B	AA1025B	AA1025B
I	O RING SET	PN1168	PN1168	PN1176
J	MIXTURE METERING SCREW SET	PN1104	PN1031	PN1009
K	THROTTLE ROTOR SET	PN1108	PN1032	PN1010

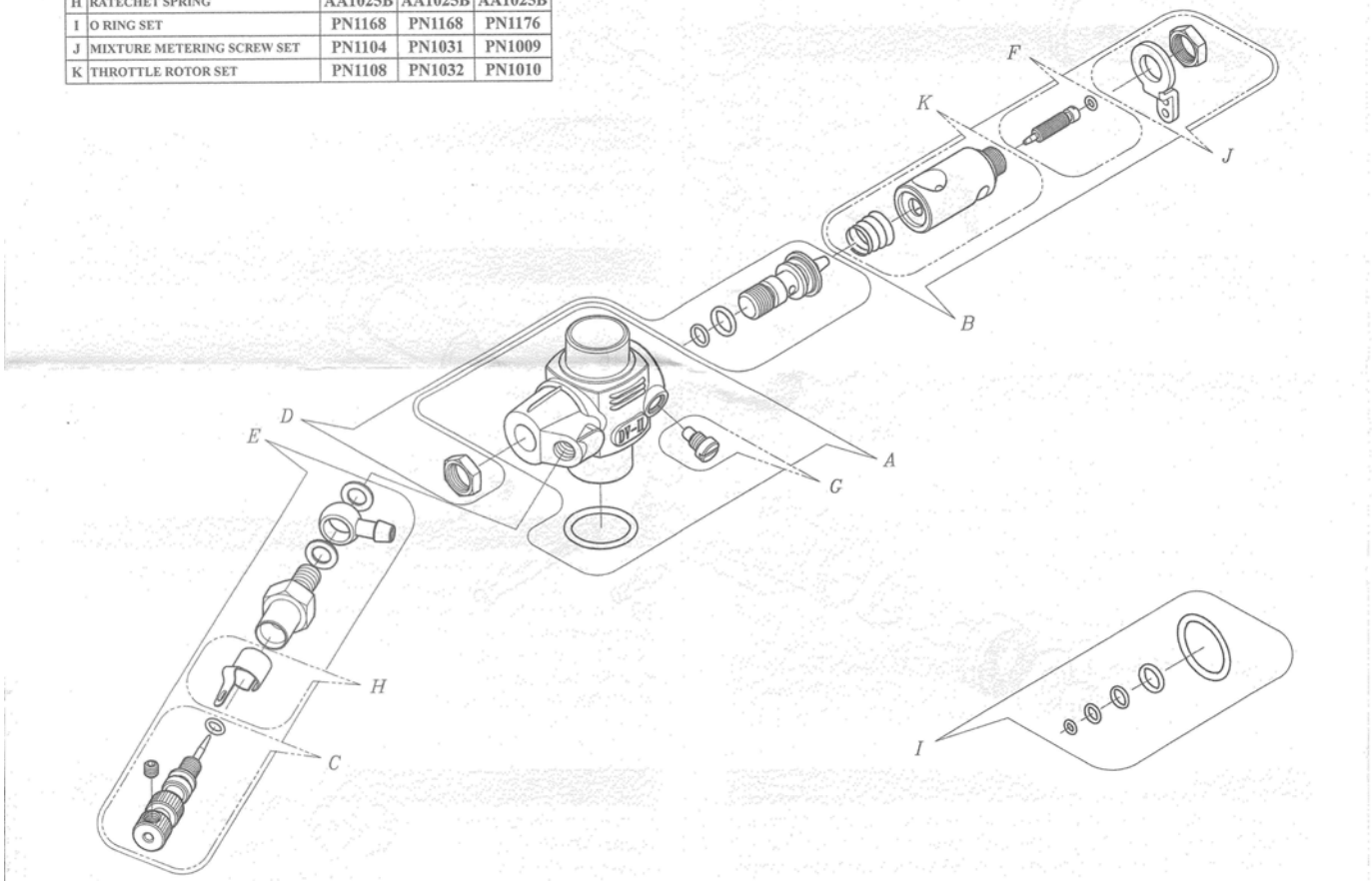
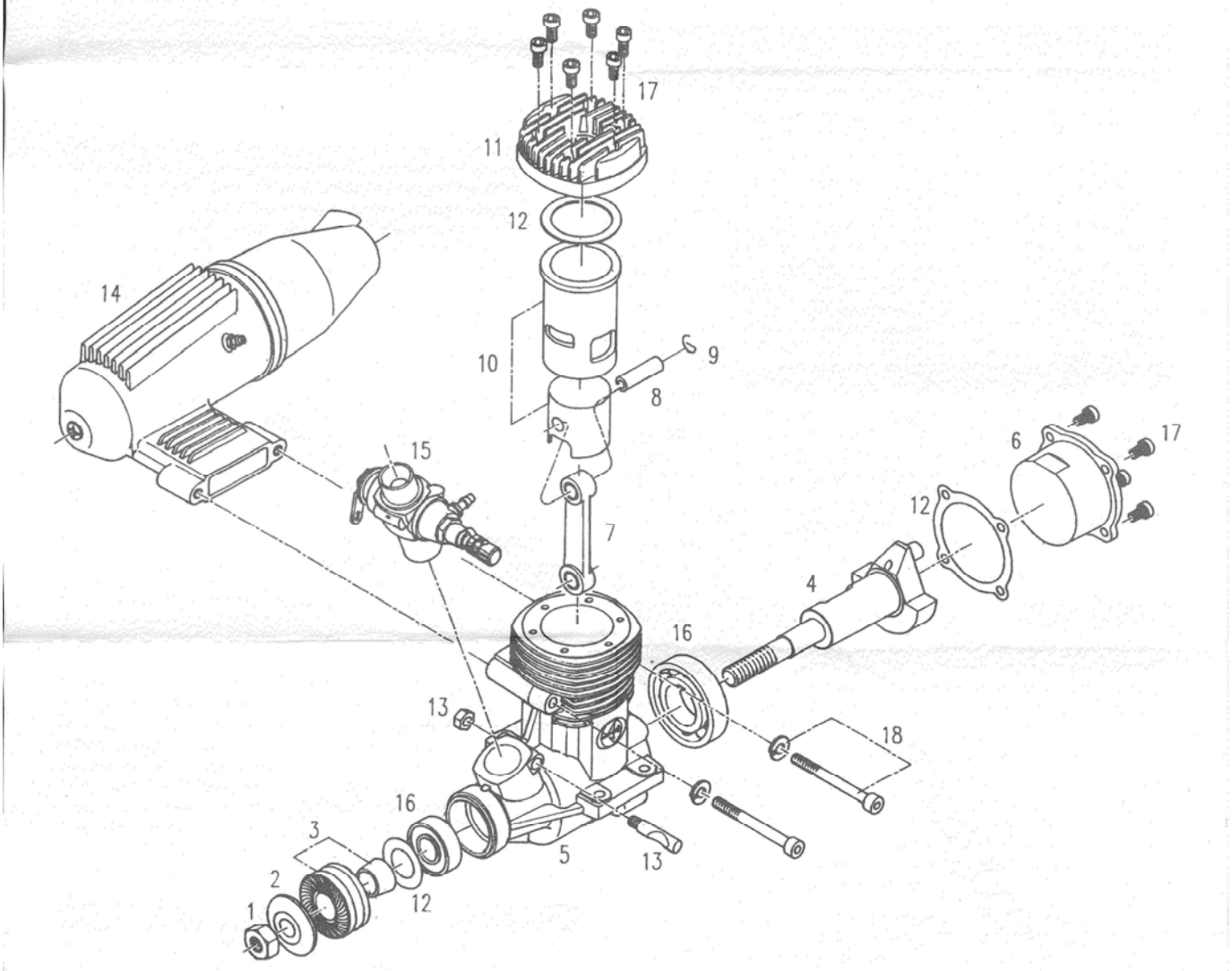


FIG DESCRIPTION	PRO-36	PRO-40	PRO-46	PRO-61
1.PROP NUT	AA0025B	AA0025B	AA0025B	AML5/16B
2.PROP WASHER	AA0026B	AA0026B	AA0026B	AA0280B
3.DRIVE WASHER	AA0221	PN0023	PN0023	PN0006
4.CRANKSHAFT	AA0236	AA0322	AA0335	AA0298
5.CRANKCASE	AN0237	AN0343	AN0342	AN0306
6.BACKPLATE	AA0224	AA0324	AA0324	AA0284
7.CONNECTING ROD	AN0225	AN0325	AN0325	AA0285
8.WRIST PIN ASSEMBLY	AN0226	AA0326	AA0337	AA0286
9.CIRCLIP		AA0327	AA0327	AA0287
10.CYLINDER & PISTON	AN0228	AN0328	AN0338	AN0300
11.CYLINDER HEAD	AA0235	AA0330	AA0340	AA0302
12.GASKET SET	PN0007	PN0020	PN0022	PN0004
13.CARB RETAINING BOLT	PN0008	PN0028	PN0028	PN0002
14.MUFFLER ASSEMBLY	9207	9209	9209	9225
15.CARBURETOR ASSEMBLY	9258	9244	9244	9240
16.BEARING	PN0040	PN0021	PN0021	PN0005
17.SCREW SET	PN0032	PN0035	PN0035	PN0003
18.MUFFLER BOLT SET	PN1511	PN1502	PN1502	PN1501



Engine Break-in procedures:

There are a lot of ways to do this, but this is the method used for the Nelson racing engines and I would suggest doing it this way too.

"I have always felt that break-in was important for all model engines, but I also think that most of today's flyers have been conditioned to believe that it isn't necessary.

I mix my own fuel for the break-in consisting of 10% castor oil, 10% synthetic oil, 15% nitro methane and the balance methanol. All by volume, not by weight. Those of you who cannot mix your own can add 6 oz. castor oil per gallon of your usual fuel.

Start the engine and allow it to run rich for about 1 minute, then slowly screw the needle in until you are running in a rich 2 cycle at about 3000 off the peak. Pinch and hold the pressure line allowing the engine to come up to peak rpm for about 10 seconds, then release and the engine will drop back to a rich setting to cool for about 1 minute. Continue this procedure through all 12 tanks of fuel, allowing the engine to cool completely between tanks.

The engine is now ready to race, but always keep it a little rich during the test flights. No sense in hurting it during practice."

From the Performance Specialties website
http://www.pspec.com/breakin.asp

I use an APC 8 x 6 propeller for break-in and target the RPM's for around 17,000 to 17,500. The fuel we race with is Power Master 15% (castor / synthetic) so I would suggest doing your set-up and break in with this fuel. Remember to allow the engine to completely cool down between runs in the normal air. Don't try to cool it down with chemicals or ice or anything else, the parts will cool at different rates and you can damage the engine beyond repair. Once you done this mount your engine and put on an APC 9 x 6 propeller.

Engine Adjustments and tweaking:

There are a few things about engine tuning I would like to share with you. These are not really secrets, but things you need to know to be able to get the most out of your race engine:

a.) **Make sure the engine muffler is sealed tight** – If your muffler isn't sealed, you are losing backpressure and the engine will not be performing at its best. Seal it so that no air escapes from anyplace it isn't supposed to.
b.) **Make sure the engine is mounted tightly** – In order for all the power the engine has to offer to be transferred to the prop, the engine must be mounted solid. Any loose bolts, nylon mounts, loose firewall or a flimsy nose section will all rob you of performance.
c.) **Seal the idle needle valve** – Add thread lock or JB Weld and insert back in. Only tighten it 2 or 3 turns. This will give you slightly more fuel to the engine and a little more power.
d.) **Lower or remove the head gasket** – This will increase the compression of the combustion chamber and boost power. This is legal, since it is called a "gasket" and not a shim, but don't forget the 16,500-R.P.M. limit!
e.) **Use a colder plug** – This will allow you to increase the compression. If you do not use a colder plug, you will get pre-detonation and burned out plugs.
f.) **Balance your propeller-** An unbalanced propeller causes undue vibration and robs power from the engine.

I consider all of these to be pretty much standard operating practice, and they are all legal changes. The problem you will most likely end up with is too high of compression and blowing out plugs. In that case, you can de-tune the engine by simply adding a second glow plug spacer (*no more than 2*) or adding some thin shims (*I mean "gaskets*") under the head until the problem disappears.

Propeller selection:

In 424 the only legal prop is the APC 9 x 6 propeller. Even though they all say 9 x 6 on them, they are not created equal. The best thing you can do is to buy a few (*the more the better!*) and do a base line comparison. How I do this is simple. Bolt on the prop, tweak it to maximum RPM, and then cut the engine off. Write the RPM on it and go to the next prop. I will do this for ALL the props I have. This will tell you how

each one performs right now, compared to the others. How does this help? In SEMPRA, we have a 16,500-RPM maximum limit. If I am running 200 rpm's high, I can swap props with one that tested 200 rpm's lower and I am ready to go.

Another thing people make a mistake on is to run the prop with the highest rpm's thinking that it will be faster. In reality it is spinning faster because it has less pitch than the others. Less pitch equals slower speed. Pick a prop that is a few hundred lower than the maximum and you will see it unload in the air and end up being a faster prop.

Working in the Pits

How to be prepared in the pits:

The pits are where the real racing happens! I am not just talking about the stories of the "race to beat all races"! If you don't get your airplane ready for the next heat, you're race is done. People are creatures of habit (good or bad), so get into a routine so that you don't forget to do something. On a test day, there is no real time limit. However, on race day, the clock is ALWAYS ticking.

In order to complete all of these things in a timely manor, you need to have everything you need at your fingertips. I set up my worktable with some cloths, airplane cradle and no slip pads so that everything has a place. I suggest you set up similar to this if you can:

a.) Big toolbox or flight box – Set this on a corner of you space where you can get to it easy, but it is not in the way.
b.) Assortment of parts and screws – I use a tackle box organizer to sort all my nuts, bolts and screws by size so I can find the rapidly when I need them. I keep this by the big toolbox.
c.) Battery and chargers – I like this at the top of the table, so that I can charge the plane, transmitter or extra packs anytime, yet it is still out of the way.
d.) Flight packs – Spare batteries packs, charged and ready to go.
e.) Pad or cradle for my airplane – This is front and center since it is the reason we are here! I keep a pad underneath in case I need a place to put something or if I drop anything.
f.) Pad to the engine side of the airplane – This pad will hold only the wrenches, screwdrivers and Allen head drivers I need to pit my airplane with.
g.) Crash box – this box sits just under the table with what I might need for minor repairs. (*5 min. epoxy, balsa & plywood scraps, fiberglass cloth, CA glue, sandpaper, etc…*)
h.) Spare parts – This box is next to the crash box and will contain extra landing gear (*with wheels ready to roll*) props, glow plugs, servos, receivers, mufflers, various servo arms, pushrods, throttle cables (*premade, since they are all set-up the same, right?*), throttle arms, etc… Anything you can quickly replace or bolt on, without having to roll out a back-up airplane.
i.) Back-up airplane – This is the "if all else fails" answer! It is ready to go, except for putting the wing on, fueling and placing the sticker on the wing.

As long as you didn't damage your plane in the past heat or have a problem, you can get ready for the next heat. If you had a problem, fix the problem or switch to your back up if you don't think you will have time between heats to make the needed repairs. You can always fly a back up and work on your primary plane in your extra time or over lunch. Here is the list of things I do to the airplane after a heat to be ready for the next one:

a.) Disconnect the fuel line – This will let you know that the plane is not fueled up yet. Close the line to keep fuel from spilling out.
b.) Clean the plane- Cleaning the plane will help check for damage and allow your caller to give a good push in your next race. A clean plane is a happy plane!
c.) Pull the glow plug and inspect it – If your plug is damaged or showing wear, replace it. Test ALL plugs (new or used) prior to installing.

d.) **Check all bolts and screws** – Vibration will loosen everything! I check head bolts, muffler bolts, engine mount bolts, the carburetor nut, fuel and muffler pressure nipples, wing bolts and landing gear screws. (*During lunch I will take the wing off and check all servos and equipment also*.)

e.) **Check batteries** – Check the receiver batteries and insure that they and the transmitter are fully charged.

f.) **Record your last heat results** – I keep a running record on my wing flag which also includes information such as heat #'s, what flag to go on, place of finish and points. I put my information on the wing sticker with a sharpie in this type format:

LANE # **3**

HEAT	FLAG	FINISH	POINTS
1	1	2nd	3
5	2	1st	4
7	1	DNF	0
13	2	DNS	0
18	1		
21	2		

g.) **Take your plane & flight box up to fuel** – The last thing you do is to stage your plane and fuel it. Once the plane is fueled it cannot go back to the pits, so be sure everything is done and ready to race.

Along the same lines of being organized in the pits, a well-organized flight line box will make it easier and more convenient for you. I have one that my caller and I both use. We place 1 transmitter on each end, 1 starter, 2 glow igniters, plug wrench, 2 spare props, Tachometer and new plugs in a rubber glow plug caddy mounted to the front of the box. We also keep a spare fuel clamp as well as the tools to change a prop or tighten a loose engine nut or bolt and a couple of spare wing bolts. This small box is all we take to the line besides our planes and ourselves. Keep this box as simple as you can as it is a long walk to the flight line!

Racing

First and foremost, pylon racing is a **TEAM** sport. The pilot and spotter/caller must learn what each other needs, and how to get the most out each other. Try to plan for things you know will happen, and how to handle a problem that could happen. (*If a fuel line breaks, who does what? If a plug burns out, the engine floods, broken prop, etc… have a plan for how you will handle it at the line*.) Baring a problem at the line, this is how my caller and I break down the jobs at the line:

What the pilot does at the line:

a.) **Carry plane and flight line box to the line** – The pilot places his plane and box in the lane and gets it ready to start by placing it in the starting position.

b.) **Turn on plane and transmitter** – Turn everything on and make sure everything works. This includes checking for the right model, rates and channel. (*Did you switch to a back-up plane?*)

c.) **Connect glow driver and verify the plug works** – This is your last chance to change it if it is bad before the 60-second clock is on. A driver with a meter is very useful here.

d.) **Turn the prop over** – Spin the prop over with the starter to make sure the prop nut is tight, and that the engine is not tough to start. If your starter is weak, you have a few seconds to bargain for a spare one or find a chicken stick.

e.) **Remind your caller what flag you go on** – Remember the wing sticker? If you have filled it out for each round then the heat information is easy to see and is a last minute reminder so you won't jump the start and get a cut.

f.) **Start the engine** – Once you are on the clock, start the engine whenever you and your caller are ready. Make sure your throttle is at FULL throttle. If you want to tach the engine, it is your job!

g.) **Put the starter and glow igniter in the flight line box** – As I put the starter into the box my caller will undo the igniter and hold it out to the side away from the prop for me to grab. (*Safety!*)

h.) **Tweak the engine** – Remember time is short and it is LOUD! It is best for your caller to know if they are to make any other adjustments after you leave (Do this prior to starting the engine), so do what you need to and get out.
i.) **Grab your line box and head back to position** – Tote the box to the sideline, drop it off, and run back to the position you want to fly from and get ready!
j.) **Nod to my caller from my position** – My caller will look for me with 15 seconds to go to make sure I am ready and to know where I am standing. After checking all of my switches and ensuring everything is set, I will nod to let them know that I am ready to go. From this moment on look at nothing but your plane, the caller will handle the rest.
k.) **Add any inputs for take-off and wait to GO** – Add any corrections needed for a straight and level take off. (*A clean takeoff can give you a big lead to turn 1 and help keep you out of trouble*.)
l.) **Race as smoothly as I can and listen to your caller** – The best way to go fast is to fly smooth and tight. Your caller will guide you; you will just need to listen and follow their directions!

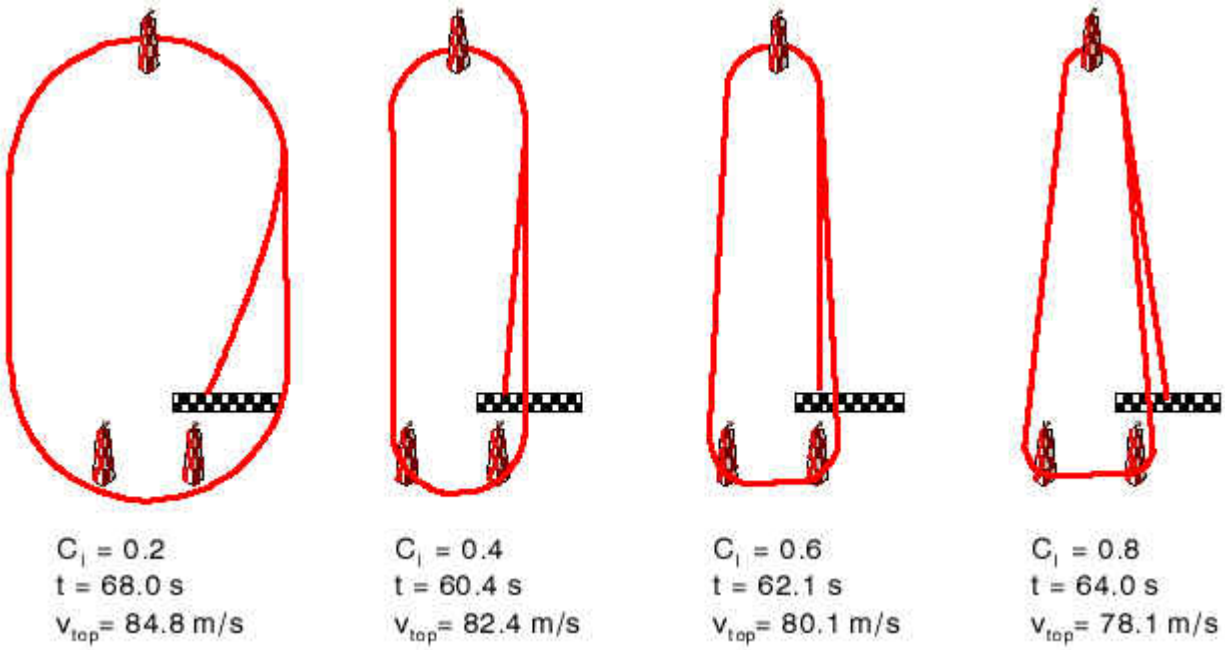
What the spotter/caller does at the line:

a.) **Follow your pilot to the line –** Once your pilot has placed the plane into position, your job is to keep them calm and make sure nothing is forgotten. If you have agreed on plan for the heat, go over it once more. Check the control movements with the pilot and verify the launch flag.
b.) **Hold the plane –** Once the clock starts, hold on to the plane at all times. Once the pilot is on their way to fly, keep an eye on the clock.
c.) **Keep the engine cool –** If you hold the nose of the plane down, it will richen up and run cooler. You can also partially cover the carburetor opening to keep it cooler or if the pilot prefers to, slightly close the throttle setting.
d.) **With 15 seconds till start, locate your pilot –** Look to your pilot and know where they are standing and that they are ready. They should nod to let you know they are ready.
e.) **10 seconds to go –** Hold the plane straight up to lean it, and place it on the pavement. If the pilot retarded the throttle, then this is his signal to go to full throttle.
f.) **Launch the airplane –** When your flag drops, push the plane as HARD and STRAIGHT as you can WITHOUT lifting the tail! DO NOT try and compensate for the wind; the pilot should be doing this with the rudder.
g.) **Run back towards your pilot –** Keeping your eyes on your lanes turn light and avoiding other callers, run back towards your pilot, being prepared to **YELL** your pilots name when the turn light comes on.
h.) **Start your counting for the turn –** Begin when the plane passes pylon 3. (I count like this: **1**–*and*–**2**–*and*–***3***–*and*–**ready**–*and*–**TURN!**) The key is to be very consistent and maintain the same cadence. If you need to change length to the turn call, then change your count starting point.
i.) **Keep your pilot calm and informed –** Depending on your pilot's need for information, you can inform him of how long the light was, if they have a cut, what lap they are on, if they need to tighten or loosen their course. I try to only talk to the pilot between turn 1 and 2 unless it is absolutely necessary to say something elsewhere. Try to keep the pilot aware of the other planes and their position in the race, knowing if you are racing against a particular plane could keep you from a midair! You as the caller are the most important resource the pilot has, as well as their only friend on the line!
j.) **Help the pilot land safely –** After the heat stay with your pilot guide him by voice or light hand pressure on the back (not the shoulders or arms) to an area where he can safely stand to land the plane. You are also his spotter to help them get thru the traffic and on the ground safely.

Racing Strategies

Racing is not only a team sport; there is a certain amount of planning involved too. Of course, if you go out and win every heat and are the fastest plane each time out, the strategy is simple; don't screw up! It will be rare when this happens (*if ever!*), so here are some tips to help you plan a little better:

a.) **Remember to check everything in the pits** – Make sure you don't beat yourself.
b.) **Take everything you need with you to the line** – Don't forget your line box, plane, transmitter, helmet, caller, etc…
c.) **Know your competition** – Some pilot/caller teams are known for being really aggressive, so why not use this to your advantage! You may be able to make them jump a start or a turn early and get a cut. You may just have to hang in on the lead lap and wait for them to make a mistake!
d.) **Keep track of the standings** – If you know whom you need to race hard for points and position, you may save yourself from making a costly mistake.
e.) **Finishing last is better than not at all** – To win, you first must finish! Everyone who finishes gets points, if you cut out or fail to take off, you get nothing! Every point adds up for the total.
f.) **Take the short way around the course** – The closer you fly to the pylons, the less distance you have to travel. This (*and consistency!*) is the key to winning races. Just make sure you don't turn so sharply that you actually slow yourself down. Take a look at this example below:



This is a sample of the data from: http://www.mh-aerotools.de/airfoils/index.htm showing coefficient of lift, Time for 10 laps and the max speed. Notice the differences between the times and speeds!

g.) **Be aware of your surroundings** – There are obstacles all over like pylons, trees, buildings, other airplanes and the ground. Make sure to avoid all of them!
h.) **There is more than one race** – The point's winners will get something, but there is also a fast time trophy. No matter how bad your day looks, it only takes 10 good laps to win this one!
i.) **Never surrender**! – It isn't over till it's over! If the top pilots get a bad start, DNF or crash, they get zero points. That means there are 3 or 4 points in that round (*for each heat*) available to everyone who finishes in the heat EXCEPT them. It is easier than you might think to go from first to last with one DNF. If you are up for a fly off for a trophy, DO IT! Even if that person has beat you all day long, you never know what could happen.

I hope this document has given you a better understanding of AMA style 3-pole Pylon racing, as well as some information you can use. The information in this document is what I have learned and experienced thus far in my racing experiences, and are not to be taken as the only way to go. These methods are what have worked for me, and I hope they can help you to get a head start in Pylon racing as well. If you have any questions or comments, feel free to contact me. I will be glad to help in any way I can.

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Racing related Web Links

Forums:

NMPRA - http://www.nmpra.org/
RCUniverse - http://www.rcuniverse.com/forum/forumid_226/tt.htm

Engines:

Nelson racing engines - http://www.pspec.com/
Jett racing engines - http://www.jettengineering.com/
Profi racing engines - http://www.flycontrolline.com./
Thunder Tiger engines - http://www.acehobby.com/ace/index.htm
http://www.thundertiger4u.com/

Q500 Aircraft:

Seeker and Hurricane - www.supertrc.com
Vortex - email marcus18992000@yahoo.com
Bird of Prey - www.calspeedpros.com/Q500.htm
Slingshot & Shotgun - www.darrolcady.com
Ninja - www.flycontrolline.com
Dawg Gone it, Mad Dog, Pit Bull - www.matneymodels.com/q500.html
Scat Cat - www.lonestar-models.com
Xciter - www.aerocrafts.net
Neme-Q Plus - www.flyfastcomposites.com
Sam-Rai - www.sam-rairacing.com/default.asp
Viper - www.towerhobbies.com

Q-40 Aircraft:

PoleCat, Loki, Somethin' Else - http://www.bigbruceracing.com/
Vendetta, Dago red, Proud Bird 2 - http://www.calspeedpros.com/
Miss Candace - http://www.hmracinginc.com/
Miss Ashley II - email to : rvanbare@kings.k12.ca.us
II Sweet, Proudbird - http://www.flyfastcomposites.com/
GR-7 - http://russellracin.com/
AJ/2 and Napier at http://matneymodels.com/qm.html

Aircraft Design:

* Great site for pylon racing information - http://www.mh-aerotools.de/airfoils/index.htm
http://www.desktopaero.com/appliedaero/potential3d/3dtheory.html
http://www-scf.usc.edu/~tchklovs/Proposal.htm
http://selair.selkirk.bc.ca/aerodynamics1/Drag/Page8.html
http://www.mh-aerotools.de/airfoils/index.htm