

Evolution of the Racing Mind

LEARNING

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You may remember from last month we talked about theories and facts and how we need to operate on facts and not worry ourselves into oblivion thinking about what “might” happen. We also saw how that we will typically maximize our potential for running well by doing this. This month we’re going to talk a little about how and when we need to step outside of our baseline and our proven program so that we can evolve our racing program. The first thing we need to understand is that we cannot learn effectively when our program is in chaos. What this means is that the time to test new things is *not* when we’re struggling every time we hit the track. If we try new things under these conditions then one of two things typically happens. The most common is that the change has no effect. When this happens it should not be a surprise because a kart which isn’t biting and working won’t typically respond anyway. The other possibility is the kart will respond, either by getting better or worse. Certainly if the change does cause the kart to get better that’s a good thing but if it causes it to get worse, and even if it causes it to get better, we haven’t really understood as much as we need to so that we can use what we’ve learned to our maximum benefit.

What types of things am I talking about? Well, most anything. I regularly get questions like, “Do you think

I’d be better with a little more cross,” or “Do you think I should add a little more left,” or any number of very similar questions. Most of the time, the best way to learn these things is to test them on a well handling kart. This way you can be confident that any change you make will actually have an effect on the kart. For example, let’s say we want to see what will happen if we run more left percentage. The first thing we want to do is figure out how much more we want to try. When testing changes, I like to ensure that I make a change big enough to feel because if we don’t do this then we won’t really know what it’s done. In our example of changing left, I’d change it a percent or so to start with. Once we know what we want to try we need to get the kart on the scales during the week and actually make the change. It is

very important to understand exactly what we ended up changing to get the extra left because if, for some reason it kills the kart we want to be able to go back quickly. At the track we want to be careful not to abandon the change too quickly before the track has come in. What this means for most is that we’ll need to run the kart with the change at least until the last practice and often keep it on during the heat race as well. The reason for this is that we won’t really know what effect it will ultimately have until the track has come in.



All right, we've got our change made, we're at the track and the track has come around, now it's time to figure out whether our extra left helped the kart or hurt it. At this point we need to evaluate several aspects before we can tell if it is actually better or worse. The one everyone thinks about is laptime, and this certainly is important. What we want to look at from a laptime standpoint is how fast is the kart compared to our normal times as well as to everyone else. Many times, especially on dirt, what we're comparing to isn't any specific laptime but is a combination of what we normally get out of the kart tempered by what other karters are running.

If we are normally one of the faster karts and with the change we're the fastest kart then that might lead us to believe that the change has helped us make speed. In addition to the outright fastest lap, there are several other things that we need to consider. In karting today, it is intolerable for a kart to take five laps to come in and that's one of the things we want to evaluate with our change. We need to look at the first five or so laps to see if anything changes. For instance, the kart might come in faster or slower on its way to it's fastest laptime. This is very important because sometimes it can be advantageous to have a kart that starts really quickly even if it means giving up a small amount of outright speed; a two or five lap qualifying run is an example of when this is especially important. Another thing that we need to look for is the kart's consistency over several laps. Sometimes we can make the kart faster but less stable and what can result is that, although the kart is faster, the driver can't get the speed out of it consistently so it's no good. We have to look hard for this because the kart's fastest lap may be faster but if the other four or so are slower then we have probably gone backwards rather than forwards.

Now that we know what types of things we need to look for it comes time to figure out exactly how to look for them. We've all heard the phrase "the stopwatch never lies" and this is very true, well, at least it's true in theory. The fact is that a hand operated stopwatch can easily lie because it is nearly impossible for a person running a stopwatch to consistently and accurately trigger the watch in such a manner that the amounts of time difference we're looking for will be visible. Most of time at the track we hear things like "the kart picked up a tenth" or "I slowed down a tenth" or something like that. The problem is that a tenth of a second on track is huge and most of the time the changes we make to the kart won't produce that much

change. Rather, we find we're looking for 0.020 sec or 0.050 or something like that. It's in this range that a manually operated stopwatch just won't get it done. I'm sure many are thinking, "That's such a small amount of difference, why should I care about that?" Well, if we make a change that causes our kart to be 0.020 sec faster, we probably won't see much difference in a qualifying run but what about a twenty lap race? Let's see, that's 20 laps times 0.020 seconds which gives us 0.4 seconds - and 0.4 seconds at 50 mph is just over 29 feet; and a kart is about six feet long so that 0.020 second a lap gain is worth almost five kart lengths.

At a competitive show, five kart lengths could easily mean the difference between fourth and first - not such a small gain after all.

Now we understand that we want to make controlled changes, we understand what conditions we need to have to truly learn from our testing and tuning, we know how to prepare our kart for the testing, we understand that we are looking for very small laptime improvements

and we've learned that we can't use our stopwatch to detect those improvements; so how do we do it? The answer is data acquisition. I know some are thinking, "I can't afford a data acquisition system which costs several thousand dollars." Well, neither can I. Fortunately for all of us we probably already have a system capable of delivering the accuracy and recording that we need to do the analyses that will help us see those small gains. Nearly everyone in karting has a tach which will record RPM and lap times at a minimum and that is enough to get us started. Way back in 1999 I picked up a MyChron 2 which stayed on my kart until this year. I had it recording laptimes, engine RPM, and cylinder head temperature. Even this inexpensive tool which has been around for nearly a decade was able to give me excellent data which could be analyzed to help me understand which changes on my kart were making speed and which ones weren't. Nowadays most of what I see at the track are MyChron3s and MyChron4s which are easier to use than my old 2 and can record much more data and present that data in a user friendly manner without the use of a computer. For this reason we'll use the MyChron4 as our instrument of choice realizing that the 3s and 2s and several other instruments will get us the basic information we need. Once we've gone over the basics that nearly anyone can get from their gauge set we'll delve a bit deeper into a few of the add-on goodies that MyChron has made available for their gauges as well as a few of the more advanced tricks we can take advantage of if we choose to invest in the hardware to allow us to download our data to a computer.



You may recall from a few paragraphs earlier that we covered the importance of taking lap times accurately and this is one of the areas that the MyChron shines. It's true that using infrared triggering from a beacon isn't perfectly accurate, but it is still far more accurate and repeatable than trying to eye it and then press the button of a stopwatch. With the instrument taking lap times properly we need to head out on track and run some laps to see what happens. Here again we observe another advantage of having a lap timer on the kart which is that we don't have to have someone clock us. But, we still need someone running a stopwatch for us who can help us understand how we stack up against our competition. **Do not** underestimate the necessity to understand both what your competitors are doing lap times wise as well as the track.

Once we get back to the pits, with our tach on we should see a screen like the one on page 16.

From here we want to press the MEM/OK button which will bring us to our fastest three laps which will look like the photo on page 17.

What we are looking at is our three fastest laps in the run. Immediately we can see which three laps are our fastest, what our maximum and minimum rpm was on each of the three laps and our total RPM drop based on our maximum and minimum RPM.

From this screen alone we can see several critical pieces of information. The first is the actual value of our three fastest laps. You can see that during this run the three laps are in a relatively tight pattern (just over a tenth) and that all of them occurred right together in the run.

One of the things we want to notice from this screen is whether the kart and driver were able to produce three laps which were close together in total time. If the fastest lap is significantly faster than the other two then it may be

that our tires came in or went away in a large way or that our driver wasn't consistently able to push the kart to the max, although he/she did get it all put together for one lap. It might also tell us that we caught a draft at an opportune time. In addition to the lap times themselves we can see very quickly from the RPM values how our gearing is working. Many only look at the maximum value for one lap to set gearing but it is also helpful to see the minimum to ensure that the engine isn't dropping out of its power band. The presence of three laps allows us to ensure that the maximum and minimum that

occurred on the one lap are truly representative of what the kart saw rather than one off where the one was very different than the rest.

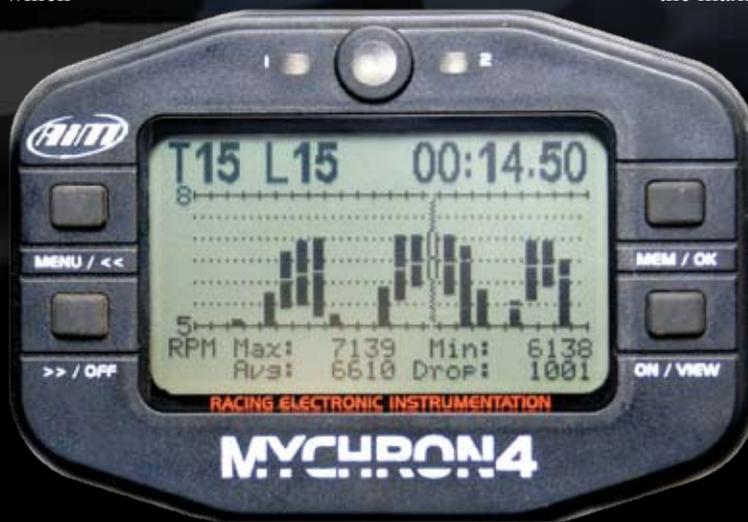
If we hit the MEM/OK button once more we'll come to this top screen on this page.

On this screen what we see is the RPM bands for the laps in the run.

The one shown by default is the fast lap. Also shown is the maximum and minimum RPM for the lap, the RPM drop and the average RPM. The advantage of this screen is that, graphically, we can see the RPM for every lap in the run. This quickly allows us to verify that what we saw on the fast lap summary screen is representative for the entire run. By hitting the MENU/<< or >>/OFF buttons we can scroll through the laps so that our lap times and rpm data are shown.

Once again we'll hit the MEM/OK button which will take us to the bottom screen on this page:

This screen is very powerful because it allows us to immediately see how our lap times progressed. We can see if the kart got faster or slower through, we can see if the lap times were fairly consistent or more erratic and we can get an idea of how much lap to lap variation the kart had during the run. Again, by hitting the MENU/<< or >>/OFF buttons we can scroll through the laps to see the summary data which on this screen is the actual lap time and how



much longer it was than the best laptime in the run.

The final screen on page 19 shows us an rpm trace. On this screen we see an RPM trace for a given lap. It shows us the temperature and RPM value at that moment. Using the buttons on the left we can move the cursor (denoted by the black triangle) to see the actual RPM value at any point on the lap. It will also scroll to different laps as we move off to the left or right so that we can view the actual values for those laps as well.

By now we've covered the main screens that anyone with a MyChron4 can bring up and have briefly gone over the things that they tell us. Just to wrap everything together, we've learned that even simple data acquisition hardware can be very advantageous and even very necessary if we are to test different things on our kart and truly understand if they've made it better or not. We've also seen some of the powerful

things that everyone needs to be looking at as they test and tune on their karts. This included realizing how small of a difference in an individual laptime can turn into a huge difference at the end of a race, looking at how our laptimes progressed through the run, looking at how our RPM spread progressed through the run, and we learned how we can look in detail at an individual lap's RPM trace and view the specific value.

Armed with these valuable pieces of information we are better prepared to use our data acquisition equipment to our advantage next time at the track. Next month we'll download our data to our laptop and begin to look at what other types of things we can learn.

Next month... Part Two.



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