Power Adders.

We all start with the basic engine. Take that engine and refine it to improve performance. We know there is an optimum stoichiometric ratio of air to fuel. Minor adjustments to the air fuel ratio will improve performance. Remove power robbing hardware to put more power at the flywheel.
Things like this are more tweaking or fine tuning to improve performance.
We learn the real key to performance starts with air. The more air flow we can get through the engine, the more fuel we can add to make more power.

Now you improve the exhaust flow, improve the cylinder head air flow, add bigger induction hardware such as the device to mix the air and fuel be it a carburettor or fuel injection. Now that you can move more air, a larger camshaft to take advantage of the improved air flow which raises the operational RPM (Revolutions Per Minute) of the engine which moves the torque band higher.

Soon as the hardware is optimized any large gains in performance are very difficult to find, and the small gains only come with a lot of work.

Enter the power adders.

The go to power adder for many is some method to mechanically move more air through the engine. This is done with either the supercharger or the turbocharger. In some cases, the choice is to use nitrous oxide often called “laughing gas” and is used by dentists during dental procedures to block the pain of the work they are doing. Used in an engine injected into the engine induction system, nitrous oxide will break down into oxygen and nitrogen upon heat application. Combustion of the extra oxygen produced and more and the added fuel that is injected with it generates more power...for this reason, cars usually have a few minutes of nitrous oxide injection, and it is fired selectively when necessary.

The mechanical methods of increasing air flow all have a cost-benefit ratio, more on that later. The supercharger is belt driven off the front of the crankshaft to pump more air into the engine and with the increase in air to maintain the correct air fuel ratio the added fuel will make more power. The turbocharger is essentially two fans bolted to a common shaft with the exhaust coming out of the engine driving one fan which rotates the fan on the input side to push more air into the engine. There is an operational cost to both systems. The belt driven supercharger takes power off the front of the engine this stresses the front of the crankshaft with a side load often far beyond what the original engine manufacturer meant to taken off the REAR of the engine. A supercharger can easily double the horsepower of the engine even showing an increase of many hundreds of horsepower but this power is not free, if the supercharger takes 300 horsepower to drive to push that much air at those pressures and it makes 1000 more horsepower at the flywheel or rear of the engine the total amount of load on the hardware in the engine is 1300 horsepower. To make 1300 HP, it costs you 300 HP and the change left over is 1000 HP. Many will consider that a bargain cost. Your engine may not agree with you on that one.

Is there a limit to how much supercharger overdrive you can use to get more air into the engine? Yes. Depending upon the design of the supercharger be it a standard helix roots, a high helix roots, or a screw blower be it a PSI or a Whipple - everything has its limits. There are many times reducing the overdrive will make you go faster as the blower is slowing you down. The details of this information will range from supercharger design and the speed of air in the ports going sonic, either way, there are limits to how much overdrive you can use to optimize the power you make at the flywheel, the only place it counts. Know this though that load on the front of the crankshaft comes at a cost as it is not uncommon to get less than thirty runs out of a blown alcohol crankshaft. Let's consider a new crank at $4000 (plug in the cost of your crankshaft) and divide the number of runs you get before you have to replace it because it is cracked in the front of the first rod journal, let's say 30 runs. $4000 crankshaft divided by 30 runs means each run cost you $133.00 cost for every run…just for the crankshaft, then add on the other associated costs. No free ride.

The Turbocharger using the exhaust flow does not load the front of the engine but the costs are in air flow as the exhaust is restricted and one of the negative effects of turbocharging is the heat retention of the restricted exhaust air flow. Better have some damn good exhaust valves. Turbocharging is actually more efficient than most supercharging but the challenge to turbocharging is the very delicate balancing act as far as hardware selection to optimize the performance.

At this point in our conversation about of how to go faster i.e. make more power was mainly conceptual. Now the practical side is "How does it relate to us as individuals?"

For my personal experience it started with my street cars and progressed to the point where our street cars are not really viable for road use and now we are racing at a race track. Like many of us my had taken the often usual path from our daily drivers to our weekend rides, in some cases (like mine) I realised that at the time, my daily driver was my 55 Chevy, a great little car that every cop in town had memorized the licence plate number. Between making the car lighter and moving more air through the engine I had made the car almost "unstreetable". I could drive it, but few others could, this is because I could live with the inconveniences of the changes I had made. The fact is there is never one package that will do everything, in order to optimize you have to specialize.

My next decision was to take the great little engine I had in the 55 into something lighter, much lighter and put a near stock engine in the 55. And instead of trying to take something that General Motors made and turn it into a race car my decision was to start with something ground up. Starting with a pile of tubing, I built my first center steer car, much lighter, and keeping in mind the minimalist thinking, "There was nothing on my car that was not needed to find the finish line", and I had not cut up my 55. The Hilborn fuel injected 327 with a Vertex mag, and a big roller cam and ported and polished heads was right at home in the pile of tubing that was my A/Altered. Later the engine found its way into my first Front Engine Dragsters. Normally the power adder of choice would have been a supercharger but at that point in history mandated by NHRA we were restricted to gasoline as methanol was not permitted or that other fuel, nitro.

After racing injected gasoline for four years the idea of using a supercharger with gasoline did not appeal to me due to the heat problem I saw all of them having. My choices were buy a supercharger, blower drive, new injector and new manifold …. Or put some big nozzles in and switch to nitro to run B/Fuel Dragster. The choice seemed simple to make.   Enter Nitromethane.

This stuff is a different kettle of fish so to speak.
The same rules do not apply as we were to learn…slowly.

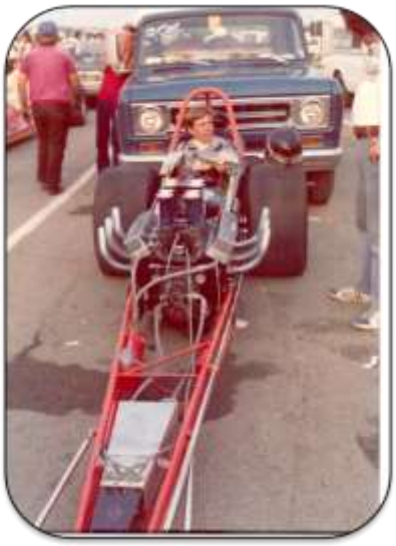
Let's consider for round numbers that gasoline needs an approximate 14-1 ratio of air to fuel (by weight, not volume) and methanol is about half that of 7-1 ratio. Some of the problem here comes from the amount of liquid takes up the space in the ports and heads when using methanol. With the benefits of methanol only being the ability to use much higher compression to obtain the benefits you really need very high compression, even to the point that methanol instead of diesel is often used in diesel tractor pull applications.

Nitromethane needs about 1.5-1 air-fuel ratio. This is a really wet induction mixture and using the same considerations as methanol at first glance you may think you would have trouble getting enough air in the engine except for the fact that when nitro burns… it makes oxygen. Not air it makes oxygen. Don't forget only 21% of the air you put in the engine is oxygen and it is only oxygen that is the third leg of the combustion chart. Heat, Fuel and Oxygen… not air.

Nitro is a fuel and carries its own oxygen, well a lot of it anyway. In fact is it not really a great fuel as far as BTU's go but it carries its own oxygen. This is important, very important now instead of franticly trying to get every CFM out of your cylinder heads, you get to pour the oxygen in the engine.

Now to supply the heat - ignition is king. If you can light it and burn it you will make a lot of power. Some of the benefits are it makes power at less RPM making it easier on the engine, there is no massive load on the front of the crankshaft from the supercharger unless you have a supercharger and nitro (aka Top Fuel and we are not going there).

Ignition is the heat. There are two combinations for the heat, single ignition source and twin ignition source, in other words, twin mag or single mag. For obvious reasons, the twin mag combinations are all hemispherical engines and the twin mag cars will have a completely different hardware combination due to the massive increase in power they have over the single mag combinations. The upside of the single mag combinations are that it covers a wide range of engine designs and configurations and this is important, the single mag making less power costs a LOT less to run both in terms of money and the scope of the work done between rounds of racing. A single mag car may adjust the clutch between rounds while the twin mag car will replace the clutch between rounds.

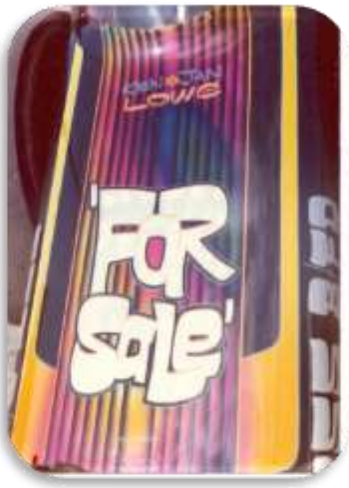


Single mag combinations are much easier for new nitro racers to get their heads around nitro with and as such provide a valuable first stepping stone into nitro.

The challenges of nitro are finding out what it wants. She is an elusive mistress and will only give you happiness if you give her what she wants, and what she wants will change depending upon the percentage and volume. It is definitely not one size fits all.

You can count on your hands the number of people that can afford to run nitro and a supercharger, aka Top Fuel, but unblown or injected nitro is only slightly more expensive than running a car in a DYO category. Yes the fuel is more expensive than methanol but remember - no free ride.

Now the question comes how much nitro do you use, i.e. what percentage? And what fuel volume? Now enter the dragon. Small doses of nitro will make very little difference to the engines performance. The oxygen bearing value of nitro does not really come into value at very low percentages. At 30% or less you just tune it like hot methanol, not nitro. Moving to the other end of the scale racers will use between 85% and 100% nitro. The other liquid is either all or part methanol or toluene, depending upon what you are trying to do. The toluene is a great anti knock agent formerly used in high octane gasoline as an additive. Know this, once you step over a certain percentage, as you go up in percentage, you go down in compression, and up in ignition lead. Nitro is a slow burning fuel so it likes a lot more lead than any other fuel. For example, in 1974 I ran injected nitro in a Small Block Chevy all year. Never hurt a part, even when I tried to. I did not know a thing about nitro, there was no internet and no one to talk to.



It was an iron headed 355 (0.060 over 350) with some 11.5-1 TRW pistons and cast iron rings. Rods were BRC as I recall. Camshaft was a mild roller and a Hilborn Stack injector with a 7 gallon 150-1 Hilborn pump, 24AS nozzles and a 0.060 main jet (no high speed) and Hayes Clutch with a B&J transmission and a 4.11 diff. The weak link in the whole car was a 1.5amp Vertex mag -

which the best we had at the time - even cranked up to 70 degrees ignition lead. It usually ran 7.20's at 192, on the last run it ran a 7.09 at 198 but only because I shifted too early (give it what it wants). I tried collector headers since I had a set from the previous year when I raced on gasoline. I do not recommend them. The limitation on the whole combination was the mag, but again, it was the best that was available at the time. The following year NHRA allowed blown methanol and us and everyone switched, not because nitro could not make the power, but it could not make the power with a piss weak mag. Blown methanol was not so fussy.

I am convinced that high six second runs are easily possible with a combination like this today, even with a Powerglide and a good mag. Possibly even better numbers are there, it's been a long time since this has been done, and what was available back then as far as mags go was pretty weak, today off the shelf stuff is pretty damn good.

So what combination do you want to race injected nitro with?
Small block Chevy, Big Block or Hemi, which ever one you have or choose ya gonna love it.

All racers love the snap crackle and pop of nitro, don't you?

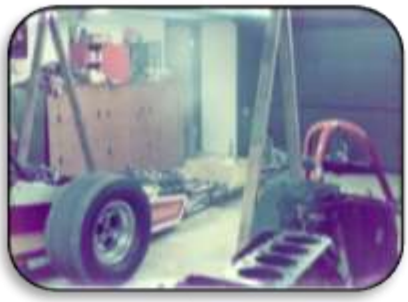
The history of the original Junior Fuel.

The inventor of the Junior Fuel concept was, CJ "Pappy" Hart, who was running the race track in California called, "Lions Dragway", in the late 1960's where he introduced the class.

It was push starts because none of the cars had on-board starters, at the beginning there were no LENCO's or B&J transmissions so all the cars were direct drive with no reverser so after the burn out the car had to be pushed back to the starting line. The total car weights with driver could easily be 850-900 pounds.

As far as the push back goes, on high percentage loads you only pushed back on the engine, not the tires and pushing on the tires will give you a big load of nitro up the nose which is not very pleasant.

The limitations of the class as original designed was a 305cid limit on the engine and that is the class, other than the 305cid limit it was as light as you wanted as there was no weight break.



In fact we did run our injected nitro small block Chevy as a direct drive car in 1975 as a match race car and it ran a bunch of 7.50 runs as a direct drive combo. We had two cars but only one Lenco so the blown methanol car got the Lenco as it was this car we were chasing the performance to race as AA/DA. We never chased the nitro combo and it was still on a 7 gallon 150-1 Hilborn pump and a Vertex mag. I wonder how quick we could get it to go today with some spark on board, and while we are at it lets put a Lenco or B&J in it with a 1.50 ratio, be a good place to start. Even a Powerglide with a 1.60 ratio and a tight converter would be a neat deal.

By the early 1970's to run a Junior Fuel as an eliminator all by itself in many places in the country the numbers were not high enough and the cars were brought into Competition Eliminator as two classes A/Fuel Dragster for the hemi engines and polyspherical engines and B/Fuel Dragsters for the wedge engines.

What killed participation in Junior Fuel or injected nitro at the time was when NHRA allowed supercharged methanol in November 1974 as the cars would run quicker being the limitation at the time was the lack of ignition power needed to light the nitro and the supercharged methanol needed less spark to light the fuel.

Injected nitro grew popular as ignitions were upgraded as it was still a class in NHRA as part of the Top Alcohol Eliminator. The Chrysler engines with the twin spark plug option allowed the use of two of the big sparklers and injected nitro was back with a vengeance. As late as the 1988, there was only one racer still making a go of injected nitro in Top Alcohol, his name is Chess Bushy as I raced him first round at Dallas. At the time his weight break was such that he could have a very large engine to maintain parity with the blown alcohol cars everyone else was running.

A very few years later as better mags were made the injected nitro cars took over and for a while they were winning everything but to try to maintain parity with the blown alcohol cars who were at their performance peak NHRA kept changing the weight break for the injected nitro cars making the engines smaller and smaller to try to slow them down to the blown alcohol cars even limiting the diff gear ratios to limit how quick the cars could go. Currently there is a bit of parity with all the cars running in the low five second range in the quarter mile.

Often the conversation goes to how quick would they go if they could run the 500cid engines as the TF cars can run and run the whatever diff ratio they want the conclusion of experienced racers seems to think that 4.80's in the quarter mile would happen pretty quickly. For us racing single mag injected nitro I think we are keeping the spirit alive that "Pappy" Hart started with the Junior Fuel cars at Lions all those years ago. Going fast on a small budget.

The Australian Junior Fuel Association is the umbrella organisation for all single magneto injected nitro race cars regardless of engine type or chassis design.

If you would like to join our organization send us an email to ajfa.nitro@gmail.com with your name and address and mobile phone number, it costs nothing and gives you a way for us to stay in contact with you. Let us know if you are an interested party or a racer, either ready to race or have a race car in the works.

I have attached the proposed class structures for the single magneto injected nitro cars to be brought into Competition Eliminator in Australia.

Single Magneto Injected Nitromethane in Competition Eliminator

For Engine Design Distinction see last page

All cars in this proposal are required to meet these standards and safety mandates.
* OEM bore centers required.
* Nitro Fuel Permitted.
* Maximum three forward gears
* One magneto or ignition source only, one spark plug per cylinder
* Only Single Stage Oil pumps allowed either external or internal.
* Aftermarket cylinder heads permitted as long as they are commercially available and bolt to OEM engine block using original fastener positions

Safety Considerations
* Safety considerations the same as the supercharged methanol applications.
* Floater rear axle hubs required for any national record quicker than 6.50ET

Rear Engine Dragster – **Single Ignition Source Injected nitro classes**

Chassis Configuration
* RED driver must sit in front of the engine.
* Chassis must meet RED SFI 2.5C specification or FED SFI 2.4C

A/FDA (Hemi) 4.2 lbs per cube, Nitro Permitted, Single points mag or distributor only – Auto trans+C
B/FDA (Poly Spherical) 4.1 lbs per cube, Nitro Permitted, Single points mag or distributor only–Auto trans+C
C/FDA (True Wedge) 4.0 lbs per cube, Nitro Permitted, Single points mag or distributor only – Auto trans+C
Any OEM Trans/Converter allowed, replacement cases permitted, no external control lock up converter.

A/FD (Hemi) 4.2 lbs per cube, Nitro Permitted, Single points mag or distributor only
B/FD (Poly Spherical) 4.1 lbs per cube, Nitro Permitted, Single points mag or distributor only
C/FD (True Wedge) 4.0 lbs per cube, Nitro Permitted, Single points mag or distributor only
Any Trans/Clutch Combination Single stage lock up clutches limited to two fingers

Front Engine Dragster – **(“N” representing Nostalgia) Single Ignition Source Injected nitro classes**

Chassis Configuration
* FED driver must sit behind the rear axle.
* Chassis must meet SFI 2.4C specification

A/FNDA (Hemi) 4.2 lbs per cube, Nitro Permitted, Single points mag or distributor only – Auto trans+C
B/FNDA (Poly Spherical) 4.1 lbs per cube, Nitro Permitted, Single points mag or distributor only–Auto trans+C
C/FNDA (True Wedge) 4.0 lbs per cube, Nitro Permitted, Single points mag or distributor only – Auto trans+C
Any OEM Trans/Converter allowed, replacement cases permitted, no external control lock up converter.

A/FND (Hemi) 4.2 lbs per cube, Nitro Permitted, Single points mag or distributor only
B/FND (Poly Spherical) 4.1 lbs per cube, Nitro Permitted, Single points mag or distributor only
C/FND (True Wedge) 4.0 lbs per cube, Nitro Permitted, Single points mag or distributor only
Any Trans/Clutch Combination Single stage lock up clutches limited to two fingers

Altered – (“A” representing Altered & Funny Cars)

Single Ignition Source Injected nitro classes

Chassis Configuration
* Altered driver must sit in front the rear axle and limited to a 125” Wheelbase.
* Chassis must meet SFI 10.2 specification

A/FAA (Hemi) 4.3 lbs per cube, Nitro Permitted, Single points mag or distributor only – Auto trans+C
B/FAA (Poly Spherical) 4.2 lbs per cube, Nitro Permitted, Single points mag or distributor only – Auto trans+C
C/FAA (True Wedge) 4.1 lbs per cube, Nitro Permitted, Single points mag or distributor only – Auto trans+C
Any OEM Trans/Converter allowed, replacement cases permitted, no external control lock up converter.

A/FA (Hemi) 4.3 lbs per cube, Nitro Permitted, Single points mag or distributor only
B/FA (Poly Spherical) 4.2 lbs per cube, Nitro Permitted, Single points mag or distributor only
C/FA (True Wedge) 4.1 lbs per cube, Nitro Permitted, Single points mag or distributor only
Any Trans/Clutch Combination Single stage lock up clutches limited to two fingers

Rear Engine Dragsters Clutch			Rear Engine Dragsters Converter	
Class	Minimum		Class	Minimum
A/FD	6.60		A/FDA	6.70
B/FD	6.90		B/FDA	7.00
C/FD	7.00		C/FDA	7.10
Front Engine Dragsters Clutch			Front Engine Dragsters Converter	
Class	Minimum		Class	Minimum
A/FND	6.80		A/FNDA	6.90
B/FND	7.00		B/FNDA	7.10
C/FND	7.10		C/FNDA	7.20
Altered or FC Chassis Clutch			Altered or FC Chassis Converter	
Class	Minimum		Class	Minimum
A/FA	6.90		A/FAA	7.00
B/FA	7.10		B/FAA	7.20
C/FA	7.20		C/FAA	7.30

*** Suggested National Record Minimums suggested here far exceed anything the current racers performance levels have achieved.**
Basically there is a tenth between chassis design and a tenth between converter and clutch. In the end National Records will sort this out to level the playing field.

Engine Design Distinction		
By leaning the intake or exhaust valve towards the direction of the flow of air to dramatically improve the engines ability to move air and the associated performance that goes with that.		
If you draw a plane that intersects the centre of the crankshaft main bearings straight up through the centre of the piston and wrist pin and on through the cylinder head the different types are as follows.		
Type	Valve Alignment	Typical Engines
Wedge	Both valves are on one side of that line AND the valve stems are at the same angle, in other words, they are parallel to each other	Small Block Chevy 283-350 Chrysler Wedge 383-426
Poly Spherical	Both valves are on one side of that line AND the valve stems are NOT the same angle, in other words, they are NOT parallel to each other	Big Block Chevy 396-454 FORD Cleveland 302-351
Hemi	The valves are on opposite sides of that line drawn from the centre of the crankshaft main bearings and out and up through the cylinder heads.	Early Chrysler 331-392 Late Chrysler 426

We did not mandate a certain percentage minimum or maximum because you can run a wide range of engine combinations by changing fuel volumes. Classes are pounds per cube just like everything else in Comp then choose, engine type, trans type and chassis type. Let’s go racing.

Every drag racer needs to run Nitro once in their lives.

We don’t recommend running less than 70% as it is reported that at lower percentages there is a slim possibility that in certain situations it could nuke a piston. THAT is not personally confirmed just something that was told to us. Right now none of us have run anything less than 70% and since it is the nitro that makes the power.. use the nitro.

If you have a methanol engine with high compression even up to 14-1 there are racers currently running 85-90%. I personally have run 98% with 11.8-1 compression. If you have a high compression methanol engine you can put some thicker head gaskets on to lower the compression to run some 98% or keep the percentage at 90-92% and you will still go very fast.

A little heads up to Powerglide trans racers if you leave at idle RPM, be careful of low line pressure at that can let the band slip. Either raise the start line RPM a bit to raise the trans line pressure or run an aftermarket high volume front pump. Personal experience this caught us out.

Another heads up, If you are using an on board starter you will probably need some 24v to generate some engine crank speed, so you will need a very good starter. Starting the engine on methanol with a warm up tank can be a little fiddly, it is easy to wash out the plugs filling the gaps with methanol and making it hard… sometimes impossible to start. Good to practice this at home and get good at it, no one likes it when you hold up the race trying to get the engine started. You don't have to have a big 48v RCD starter, just be experienced with your on board starter and you will be fine.

Never hit the starter button unless you have blown out the nitro from the fuel system previously and keep the fuel shut off closed letting the fuel pump send all the nitro back to the fuel tank until you are happy with the engine idling on methanol then push the fuel shut off to the on position, when you hear the sound of the engine change when it picks up the nitro, then close off the warm up tank and remove it from the car.

If you ever need assistance with your injected nitro car at the race track I think you will be amazed how much the other nitro racers are willing to help.