[■] TECH STOP

TRACKSIDE WITH TOP FUEL – THE TUNEUP

by Robert Szabo

IHRA drag racing is highlighted by one of the most unique racing vehicles in the world, Top Fuel. Now with nitro Funnycar added to National Competition, the spectators and other competitors who watch these amazing cars experience the chest vibrating noise and rumble from 650 pound, 7,000+ horsepower engines, so powerful, they are lucky to last one quarter mile race. I have been curious for many years about the tune-up of these cars when writing drag race books and the IHRA Tech Stop gave me access to some secrets of their spectacular power achievement. Recall from previous articles that an IHRA Top Fuel engine is based on an all-aluminum Hemi V-8. It is equipped with a Roots supercharger turning as much as 50% faster than the engine. It has a huge fuel injection hat above the supercharger grabbing air at a rate of over 3,700 cubic feet a minute. A very high volume fuel pump at as much as100 gallons per minute flow rate is used. Ignition is two magnetos providing over one amp of current (and over 50,000 volts) at each spark plug for each cylinder firing. In one 4.9 sec. run, that is a little over 300 cubic feet (or over 530,000 cubic inches) of air during the run and, as reported earlier, over a gallon of nitro per second.

TUNE-UP: Top Fuel Dragsters and Funnycars idle at 2,500 to 3,500 RPM. Some tune-ups involve a lean idle to build a specified engine temperature. Then the driver engages fuel enrichment that causes a pull-down of the engine idle speed. Pull-down is a term used by some and a tuning adjustment to set the launch idle speed. At the launch, the driver floors the throttle. Then the engine goes instantly to over 8,000 RPM; spark advance is 55 to 60 degrees before top dead center. Keep in mind that the intake valve has closed at about 100 degrees before top dead center. That leaves only about 40 to 45 crankshaft degrees for engine compression before ignition or about one quarter turn of the crankshaft. At the launch, the tire twists up and plants into the VHT prepared concrete or pavement. The contact patch of rubber is over 17 inches wide and well over one foot long. The tire is spinning ahead of the track surface at about 15% slip. If power is down or traction is up and the slip is less, tire shake can occur. If the slip is more, the tire can be launched into shake. There is a fine-tuning line of the exact amount of slip to wind up the tire and the driveline so that tire shake does not occur. If slip is even more, the tire may "blow away" into tire smoke. That is also a fine line between shake from too much slip and tire smoke from even more tire slip. The tire is squashed from 18 inches of radius at the hit to less than 15 inches after the hit. The tire immediately starts to grow with acceleration and rotational speed.

LESS THAN ONE SECOND OUT: As the tire grows, tire width is reduced a couple inches. The contact patch narrows and gets shorter. During that time, several fuel enrichment stages occur. In addition, several clutch stages are automatically tightening against engine power a moment after each fuel enrichment stage. The result is that the engine speed is pulled down probably around 500 to 1,000 RPM. The tune-up task is the selection of (a) the number of fuel enrichment steps, (b) clutch engagement steps, (c) time for each fuel enrichment stage, (d) time for each clutch engagement stage, (e) the amount of initial clutch engagement and (f) the amount of clutch engagement for each step. Whew! Most teams develop a baseline of a set of adjustments. Probably every one of them are different than the others. Then small adjustments are made from that baseline. Those adjustments are probably unique to each racecar also. In some cases, teams change only a couple settings and leave the others constant. The tuning skill is very dependent on experience, record keeping, and just plain brainpower (ERKBP). The adjustment task is comparable to all the brainpower to set up a small factory. At 0.8 to 0.9 seconds after the hit, the tire radius grows to over 22 inch. The Top Fueler is going around 100 MPH. At this time, the MSD ignition timing is dropped between 10 and 30 degrees. That is done to instantly reduce power for the tire patch reduction. The tune-up task is (g) adjustment of this specific time and (h) the amount of spark plug advance to be removed for power reduction. More ERKBP. If the power reduction is insufficient, the racecar may be lazy or the tire may shake from under-power. If it is too much, the tire may shake from over-power or blow away into smoke.

AT TWO SECONDS: (i) (j) (k) … more clutch stage engagements have subsequently occurred. At a little over 2 seconds, the engine is pulled down to around 6,500 RPM. In most cases, the full volume of fuel is going to the engine. For an 85% nitro15% methanol combination at 6,500 RPM, that can be at a rate of up to 80 gallons per minute. For a 90% nitro 10% methanol combination at 6,500 RPM, less fuel is used although that can still be quite high at a rate of around 50 gallons per minute. The clutch is fully engaged (although slipping into recovery for over 3 seconds out). Jack Wyatt, nitro Funnycar owner and driver reports as many as 15 stages can occur for a tune-up. In addition, ignition advance is gradually restored. From that point on, engine speed creeps up. Fuel is again removed in stages to keep the fuel volume more or less constant. Timing is restored in steps. More ERKBP. At some point, intake manifold heat becomes excessive, and engine power starts to go away. More ERKBP is necessary to balance the tune-up aggressiveness against the engine heat buildup limit. At the finish line, the engine is well over 8,000 RPM, and the vehicle is over 300 MPH. The tune-up must also be adjusted ahead of time for air density, humidity, track condition, engine combination, parts deterioration, and amount of aggressiveness against the competitor, blower overdrive, ignition advance, …tune-up tasks (x) (y) (z) then (1a) (1b) 1c) … and so on!

RUN INTERRUPTION: A time-based regulator controls fuel enrichment, clutch stage engagement, and timing. If the driver has to momentarily lift from tire spin, shake, or getting out of shape, the tune-up may be lost. It can be anyone's race from that point. To my knowledge, there is no recovery tune-up. That is one reason track preparation is critical. Another reason it is doubtful that a Top Fueler could run record performance at anything but a well-prepared National event racetrack surface. The amount of track washing before treatment and VHT application is enormous and an art form to some raceways.

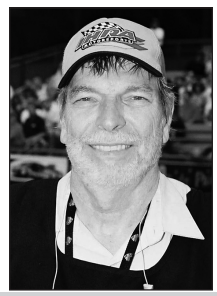
NOTE: As a courtesy from IHRA to our readers, previous Tech Stop articles can be viewed or downloaded from our web site: www.racecarbook.com

Thanks to the following for information about the Top Fuel Tune-up:

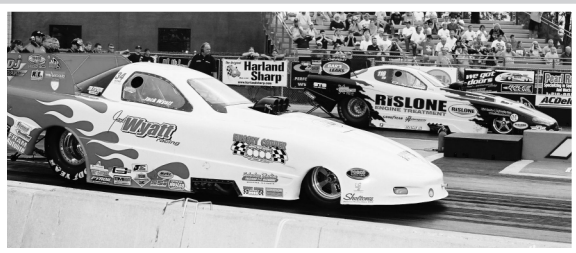
1. Pete Jackson Gear Drives (323) 849 2622, manufacturer of race engine camshaft gear drives and the special Top Fuel fuel-metering valve used on many nitro burners

2. Don Jackson, DJ Engineering (714) 269 9645, supplier of the standard BDK metering valve used on most nitro burners to accurately control the amount of high fuel volume bypass; and also provider for instrumentation and blower dynamometers for measuring Top Fuel performance values

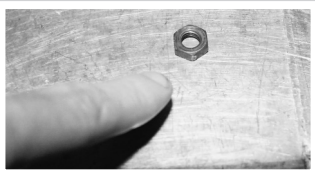
3. Jack Wyatt, owner-driver of a nitro Funnycar, is an IHRA event winner and fierce competitor for the IHRA world championship.



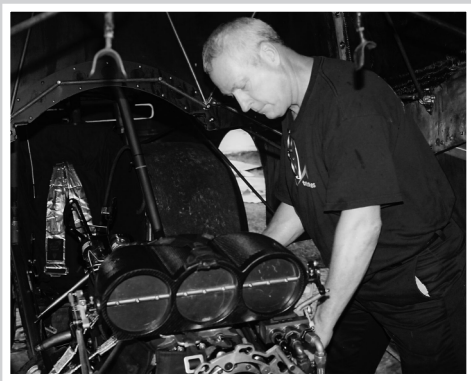
Bob Szabo is an owner / driver of a blown alcohol drag racecar and author of the technical book: "5,000 Horsepower on Methanol," a perfect gift for Holidays. While much of it is about methanol fuel for racing, information is also provided about nitro, racing gas, nitrous oxide, and ethanol as well. His first book "Fuel Injection Racing Secrets," also a perfect gift for Holidays, is all about mechanical fuel injection for racing. It is already standard reading for a growing number of IHRA drag race competitors. Check the DRM Yellow Pages for Szabo Publishing or look on the Internet at http://www.racecarbook.com or call (707) 446 2917.



Jack Wyatt's Hussy Copper Head Gasket Nitro Funny Car and Paul Lee's Rislone Monte Carlo Nitro ride lining up their 7,000+ HP entries for a round of competition that will shake the chest, arms, and legs of spectators and roar in their ears.

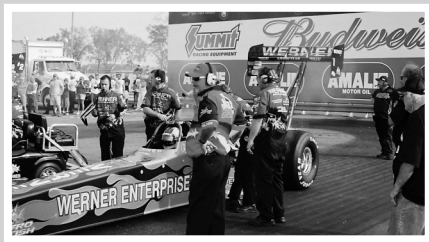


One of a dozen or more clutch adjuster nuts for Top Fuel; putting it in or deleting it from the clutch (before each round) makes the difference between a record setting run or up in smoke.



Jack Wyatt working on his Nitro Hemi between rounds; at least 5 to 10 hard labor hours of work are needed on a Top Fueler between every round, to replace or maintain parts for 8,000+ foot-pounds of torque produced by the special engine; a feat only possible with a large crew of specialists, all working in concert.

The Gilbertson, Autolite Competition Products sponsored, Nitro Funny Car getting ready to start up. A team of experts surrounds the racecar to get it started and ready for the round.



Clay Millican's Werner Enterprise Nitro Top Fueler behind the starting line, ready to fire up. Crew must hand prime engine and turn it over with a 36 volt removable starter to get it going.