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Unimaginable Acceleration

What actually happens when you light off your top fuel dragster.

I ONCE CHATTED BRIEFLY WITH THE LATE Peter Gregg at a Porsche Club function, and I mentioned that the Mercedes-Benz I was driving that weekend was a lovely road car and a wonderful cruiser, but it lacked really startling acceleration. Peter gave me a sidelong glance and said,

"It's been my experience that straight-line acceleration is probably the first aspect of automotive performance that any intelligent driver gets bored with." Ever since that day, probably thirty years ago, his statement has crossed my mind as I nailed the throttle in some Porsche 911 Turbo or Mercedes-Benz S600 and giggled like an idiot.

It crossed my mind again when I received the following e-mail, forwarded from my great friend Mr. William Neely. Bill Neely and I have been enjoying each other's company since I first took over Car and Driver magazine in 1962. Since that time, he has written about a jillion magazine pieces and some three dozen books, including Stand on It, the fictional memoirs of the infamous Stroker Ace, which he co wrote with our mutual friend the late Bob Ottum. Here is the e-mail:

Subject: Top Fuel Dragsters

- One Top Fuel dragster's 500-cubic-inch Hemi engine makes more horsepower than the first four rows at the Daytona 500.
- A stock Dodge Hemi V-8 engine cannot produce enough power to drive the dragster's supercharger.
- With 3000 CFM of air being rammed in by the supercharger on overdrive, the fuel mixture is compressed into a near-solid form before ignition. Cylinders run on the verge of hydraulic lock at full throttle.
- At the stoichiometric 1.7:1 air-fuel mixture for nitro methane, the flame front temperature measures about 7000 degrees Fahrenheit.
- Nitro methane burns yellow. The spectacular white flame seen above the stacks at night is raw burning hydrogen, separated from atmospheric water vapor by the searing heat of the exhaust gases.
- Dual magnetos supply 44 amps to each spark plug. This is the output of an arc welder in each cylinder.
- Spark plug electrodes can be totally consumed during a single pass. After half-distance,

the engine is dieseling from compression plus the glow of exhaust valves at 1400 degrees Fahrenheit. The engine is shut down by cutting the fuel flow.

- If a spark plug fails early in the run, un-burned nitro can build up in the affected cylinder and explode with sufficient force to blow the cylinder head off in pieces or split the cylinder block in half.

- In order to exceed 300 mph in 4.5 seconds, dragsters must accelerate at an average of more than 4 g's. In order to reach 200 mph before half-distance, the launch acceleration approaches 8 g's. A Top Fuel dragster reaches more than 300 mph before you have completed reading this sentence.

- With a redline that can be as high as 9500 rpm, Top Fuel engines turn approximately 540 revolutions from light to light. Including the burnout, the engine needs to survive only 900 revolutions under load.

- Assuming that all of the equipment is paid off, the crew works gratis, and nothing breaks, each run costs an estimated \$1000 per second.

- The current Top Fuel dragster elapsed time record is 4.441 seconds for the quarter-mile (October 5, 2003, Tony Schumacher). The top-speed record is 333.25 mph as measured over the last 66 feet of the quarter-mile (November 9, 2003, Doug Kalitta).

- Putting all of this into perspective: You are driving the average \$140,000 Lingenfelter twin-turbo Corvette Z06. More than a mile up the road, a Top Fuel dragster is staged and ready to launch down a measured quarter-mile as you pass. You have the advantage of a flying start. You run the Vette up through the gears and blast across the starting line and past the dragster at an honest 200 mph. The "tree" goes green for both of you at that moment. The dragster launches and starts after you. You keep your foot down, but you hear a brutal whine that sears your eardrums, and within three seconds, the dragster catches you and beats you to the finish line, a quarter-mile from where you just passed him. From a standing start, the dragster spotted you 200 mph and not only caught you but nearly blasted you off the road when he passed you within a mere 1320 feet.

That doesn't sound too excruciatingly boring, now, does it? I called my equally good friend Don Prieto, of the Prietive Group in Torrance, California, to check the facts. He suggested that the business about heat from dragster exhaust igniting the hydrogen in the atmosphere was probably hypothetical.

Prieto then reminded me of a factoid he had passed along in the days of front-engined dragsters. He said, "You know that you're in deep trouble in a dragster if you can suddenly see things clearly. That means the supercharger has been blown off the top of the engine and the raw nitro methane fuel has eaten through your visor."

Prieto has written a terrific history of hot rods called *Hot Rod Chronicle*, and if anybody can capture all of that, it would be my pal Prieto. The book is beautiful as well as

instructive, published by Publications International Ltd. Well worth your attention.

Here are a few more tidbits that I was able to collect:

- The exhaust headers when at full throttle, produce 1,500 lbs of down force on the car
 - The exhaust headers produce 120_{db} of sound.(the decibel pain threshold is 125_{db}, a jet engine at 100' is 140_{db})
 - The rear wing produces 6,200 – 6,500 lbs of down force
 - The front canards (winglets on the nose) produce 1,800 lbs down force
 - The clutch will reach 1000 ° during a 4 second run.
 - The supercharger on top of the engine spins at 10,000 rpm and displaces 100,000 cubic inches of air per second
 - The fuel pump moves 50 gals of fuel per minute using 15 gals during a run at a cost of \$18.00 dollars per gal. (23 gals including warm up & burnout).
 - The parachutes produce 5 negative G forces, enough to throw even a well harnessed person forward several inches. (*In relationship to acceleration & deceleration g's of a top fueler, astronauts only experience 3 g's during take off*)
 - A top fuel motor produces 7,500 horsepower.
 - One cylinder in a top fuel engine produces more horse power than an entire NASCAR engine.
- Top Fuelers go from 0-60 in 0.84 seconds and cover the quarter mile in about 4.5 seconds.
 - Violent tire shake can produce 21 g's of harmonic vibration, which can destroy the car or even render the driver unconscious.
 - The chassis is designed to arch up under acceleration as much as 8", taking on a curve similar to a banana.
 - In order to depress the clutch of a top fueler you leg needs to exert a force of 140 lbs.
 - Top Fuelers twist the crank (torsionally) so far (20° in the big end of the track), that sometimes cam lobes are ground offset from front to rear to re-phase the valve timing somewhere closer to synchronization with the pistons.
 - Top fuel dragsters exceed 300 mph before you have read this sentence.