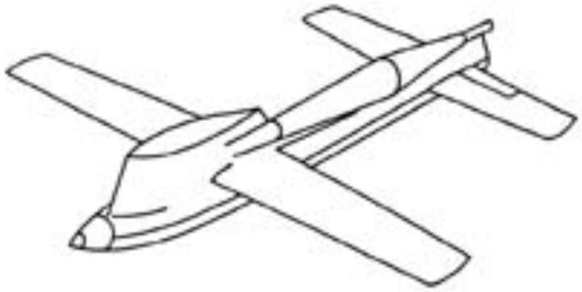
THE NORTHWEST SPEED FLYER



A newsletter published every now and then, promoting control line speed activity
in the Northwest district of the North American Speed Society
Ye Olde Editor: Mike Hazel, Po Box 505, Lyons, Oregon 97358

January 2016 Issue #13 Hey Speed Critters.....just about time for another exciting issue, so here it is! Note that this mailing includes the WOLF CALL, newsletter from the home of the Salem flying field. Just an extra this time round. Some of you may even consider joining (hint! hint!)

2016 Contests: At this point here is what is likely: Portland April 15-17, probably with speed on Friday, Roseburg Regionals May 27-29 with two days speed, and Salem date(s) unknown at this time.

New Regionals E.D: Will Naemura has graciously volunteered to take over the speed event director post for at least this coming year. Mucho thanks from the editor for this. He will of course also need some volunteers for officiating help.

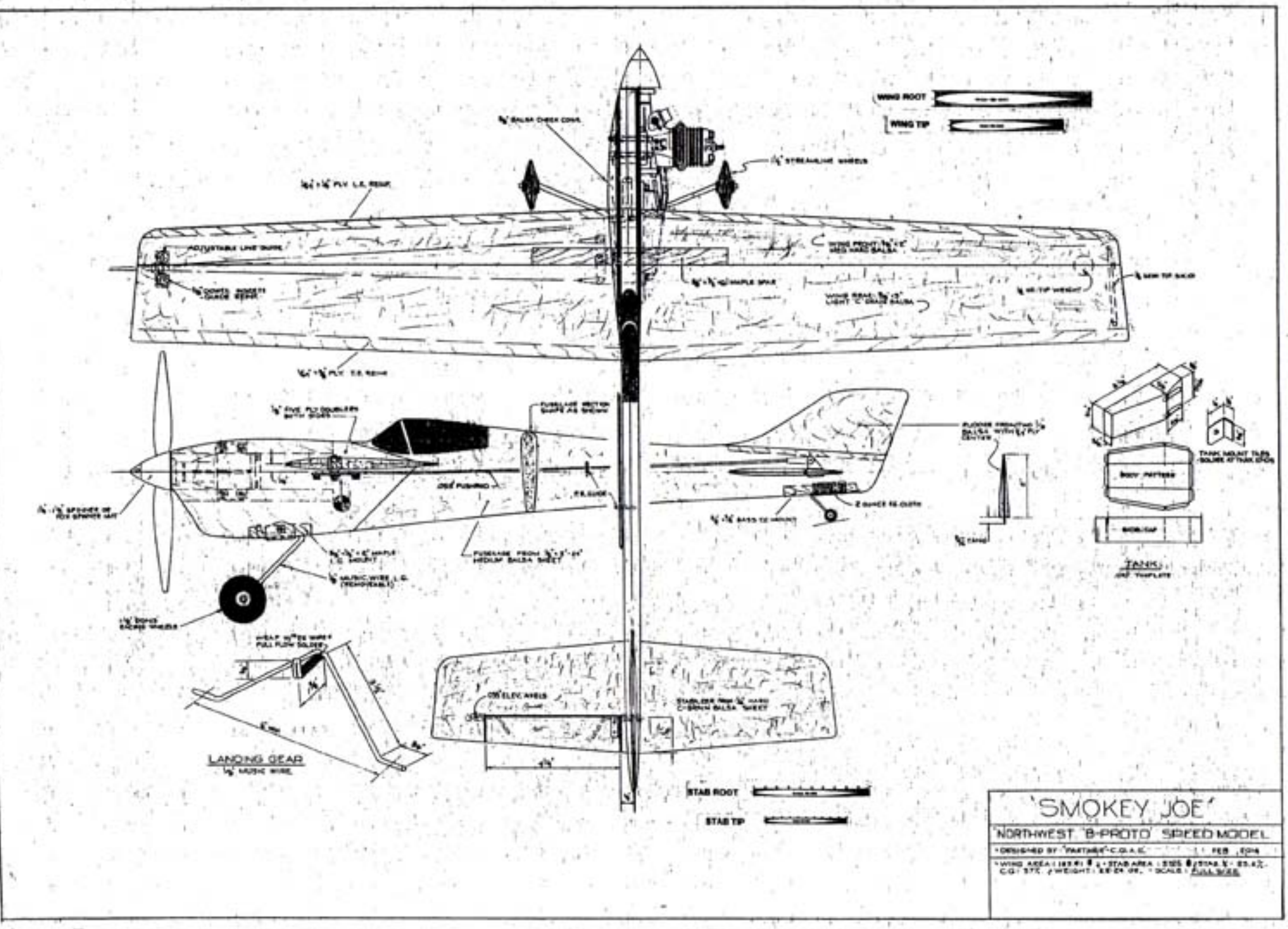
Electronic Timing? Ron Bennett has generously sprung some bucks for an electronic timing system to time our speed planes. This is the transit system that Goran Olson has developed. It sounds like there still needs to be some software pieces that need to be put in place to make the system work for us. The idea of not having to always round up timers sounds great. The accuracy factor also sounds great! Maybe Ron can give us an update on this. (Again, thanks Ron!)

Our Pal Joey who flew all those jets at the last Regionals suggests that we add NASS sport jet to the roster this next year. He believes he can talk some of the Texas and Southwest guys into coming if we do. (speaking of Jet, next issue we will try and get some jet stuff included, have some in the "hopper").

Propylene Oxide? We stopped using this fuel ingredient because it suddenly became hard to get (and expensive) Imagine my surprise when I found it listed in the current Brodak catalog. Something like $24.95 for a quart, not cheap! Some folks might still want to use it for specialized uses in other events.

NW B Proto Speed: Just a reminder to give this event a try if you haven't already. Easy to get into and great for novices or intermediate speedsters to practice tuning and flying techniques at low expense. By the way the O.S. LA 25 engine was unavailable last we heard, but no worry as there are lots of them out there. Scoop up a couple whenever you see them. The RC version is fine too, as the carb is an easy swap out with a venturi.

Articles: In these har pages include a very interesting read on Nitromethane. It seems every article we come across has some more interesting tidbits. There are also some interesting notes on related fuel ingredients as well. We also have a reprint of the Prather Prop Pitch gauge instructions, just ignore the dated stuff! Also an article that came from a Racing newsletter regarding weather conditions & performance. And of course the usual nostalgia clippings....... enjoy!



'SMOKEY JOE'

NORTHWEST 'B-PROTO' SPEED MODEL

· DESIGNED BY 'PARTNER' - C.G.A.C. · FEB ,2014

· WING AREA : 183.91 [illegible] · STAB AREA : 33.25 [illegible] · STAB % · 23.4% ·
C.G. : 37% · WEIGHT : 23-24 OZ. · SCALE : FULL SIZE

FULL SIZE PLANS AVAILABLE... $6...cpartner@shaw.ca

WEATHER CONDITIONS & PERFORMANCE

by DAVE ROLLEY

How does the weather affect performance? High air density is the starting point. Remember that the fuel burn equations are using mass of air/fuel (pounds or KB of air and fuel) to determine the amount of energy available. The fuel, within a limited range doesn't really change in density per unit of volume. However, the air can vary wildly.

The only variable you can control is location. Basically this sets your altitude above sea level. Everything else modifies that base density (or altitude).

Beyond the physical altitude above sea level, there are three components that drive the remaining portions of the air density equations. They are barometric pressure (often expressed as sea level adjusted pressure), humidity (moisture contest of the air), and temperature.

You want high barometric pressure for the location. But barometric pressure only varies over about a 4 in/hg range and the end to end (28-32 in/hg) only represents 2 psi difference or roughly 4,000 feet of equivalent altitude. So basically changes in barometric pressure contributes a maximum of +/- 2,000 feet from the physical altitude above sea level.

Humid air is less dense than dry air. So you want low humidity. The biggest single variable to air density is temperature. The higher temperature is, the less dense the air. Going from 68 degree F. to 95 degrees F can make a density change equivalent of increasing the locations's height above sea level in the 4,000 foot range. So you want high barometric pressure, low humidity, and low temperature.

The definition of a standard day is 59 degrees F (15C). I don't know the humidity level, and 29.92 in/hg (1013 mBar). Temperature decreases at the adiabatic rate of 3.5 degrees F (2C) per 1000 feet above sea level. Barometric pressure decreases by 1/2 to approximately 14.96 in/hg at 18,000 above sea level (it halves again at 36,000 above sea level). You can figure just under 1 in/hg per 1,000 feet change.

While the ratio of oxygen to all the other components of air does not change with density, the amount of oxygen available for combustion in a unit of volume (cu/ft or cu/M) will vary with density.

I've found that using one of the electronic weather stations that can report density altitude (the altitude equivalent of the current air density) is real useful. By tracking density altitude during a given day I can make informed decisions about the adjustments I want to make to my equipment (rich/lean, more/less compression).

All of this depends on how the equipment is set up. For instance, if the setup is perfect at 2,000 density altitude, it will likely be over compressed at 0 foot altitude.

There is one last little thing. There is an oft repeated rule in full size aviation: You can not get more than 75% of rated power from a normally aspirated engine about 7,500 density altitude. Obviously they are talking about a gasoline fueled engine. Methanol and nitro will change that somewhat. But the overall relationship still holds, power decreases with (density) altitude.

OK, so much for the basics. How do you use the information?

Right now my racing interest is F2C. I happen to live in Colorado. The field elevation of the airport 8 miles from my house is 5512 feet (1680 m) above sea level (abbreviated MSL for "above Mean Sea Level). The standard day atmosphere for the airport would be with a sea level adjusted barometric pressure (what you hear on the TV weather show) of 29.92 in/hg with a temperature of about 40 degrees F (4.5 C). Under those conditions the density altitude should equal the field elevation. Anything that makes the air less dense increases the density altitude.

The Labor Day contest for Denver is held on this airport. Over the years I have observed that the temperature for the Denver contest can range from roughly 55 degrees F (13 C) and wet, up to 100 degrees F (38 C) and very dry. From this you can conclude that for any likely contest in Denver the air density is going to be less than a standard day. When the temperature gets into the 95 - 100 degree F (35 - 38 C) range the density altitude can exceed 10,000 feet (3048 M) MSL.

Can you race under these circumstances? Obviously! Everyone is working with the same handicap.

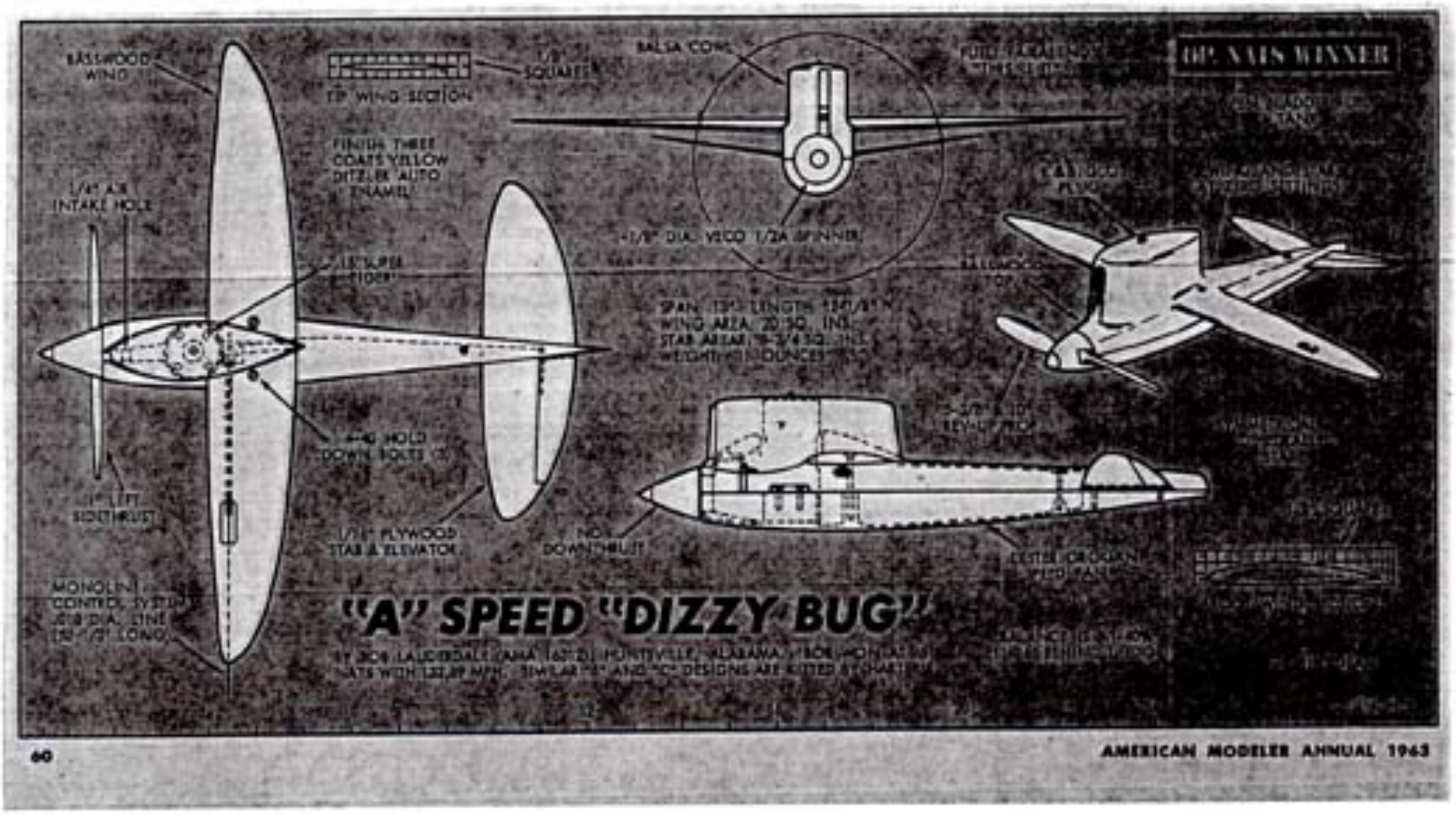
Can you do development work that is meaningful when you go to a contest at a more reasonable field elevation? It depends on what you are trying to do. Engine related development has its limitations. Working on team coordination is one area that is worth the effort. One thing that is in general not worth working on past a point is propellers. In general, you can run higher pitch under such circumstances. But when you find yourself racing at 2,000 feet (600 m) MSL density altitude the extra pitch is too much for the engine. One interesting observation has to do with acceleration on takeoff. A prop that is really good at 1000 - 2,000 MSL density altitude is lousy at 8,000 feet MSL density altitude. The decrease in lift on the wings and control surfaces has an interesting effect on the takeoff characteristics for an F2C model. The model accelerates slowly and almost always over-rotates catching the prop on the pavement. Want to guess what one of the quick fixes is? Use an APC prop trimmed to the proper diameter. It provides a higher load to the engine (more heat) and it pulls harder in the thinner air.

I mentioned a portable weather station earlier. This device won't tell you where to set the head clearance or the needle. But it can help you to determine what has happened with the weather and you can use that to guide how you want to adjust the engine for the new conditions. For instance, at the Dallas F2C team trials in 2007 the day felt very different from mid-morning to early afternoon. However the density altitude had not varied more than about 300 feet (100 m). Since the density altitude was about 2300 feet MSL, making any changes in a good setting were not called for. Had I been relying on the way the air felt against my skin, would I have been making unnecessary changes? Probably.

You have to be careful how you interpret the weather measurements. Temperature alone is not sufficient. In Dallas the temperature was going up, the barometric pressure was going up and the humidity was all over the place. The reason the air density stayed relatively stable was the decrease in density caused by the increased temperature was being offset by increased barometric pressure and it didn't become so hot that the temperature effect overwhelmed the impact of the change in barometric pressure.

In an event where the fuel can be varied for the conditions, the fuel can be used to offset some of the atmospheric effects. For instance, as the air density decreases, additional nitromethane can be used to restore some of the lost power.

How do I use all this? I started keeping a notebook where I record the weather information and the model performance and configuration. At some point I should be able to use that data to guide the configuration and settings. We'll see..........



Editors' note: The following was picked up off the internet from Hot Rod Magazine website. It's an interesting read with some useful dope on other fuel ingredients as well.

What is Nitromethane, Anyway?

Written by **Marlan Davis** on March 27, 2013
Contributors: Ron Lewis

We Take a Look at the Ultimate, No-Holds-Barred, Greatest Power-Adder Ever for the Internal Combustion Engine

Over the last 75 years, hot rodders have tried souping-up their engines with every possible exotic fuel and power additive. After trial and error, they settled on nitromethane-a dry-cleaning solvent and sometime rocket fuel-as by far the most potent. High loads of nitro are so volatile and add so much power that engines run with it are literally skating on the edge of destruction. Nitro's volatility, its unique cackling sound, the flames shooting out the exhaust pipes-it's all become the source of myth and legend. To get the straight scoop on using nitro, we consulted a number of experts, including nitro pioneer Gene Adams, who still builds fuel Hemis; Jim Archer, who has mixed just about every possible fuel with every other fuel; Jeff Prock, purveyor of high-end nitrous oxide systems (yes, you can mix nitro and NOS); and the very informative data at Ray Hall Turbo's Australian-based website (TurboFast.com.au). We think you'll find that nitro truth is a lot stranger then any fictional tall tales.

Nitromethane-or CH_3NO_2-is one member of a family of explosive compounds that contain nitrogen and oxygen. Remember the old safecracker crime movies where the "specialist" had to be real careful with the small vial of nitroglycerin, lest any sudden impact cause it to explode? Then there's TNT (trinitrotoluene) and gunpowder (nitrocellulose). Yup, anything with "nitro" in it is bad stuff!

What makes them so bad is the oxygen in the nitro group, which breaks down into gaseous combustion products that create large amounts of heat and pressure without the need for further oxygen. Nitromethane and its relatives have the potential to be monopropellants; they can combust without any air at all. That's why nitromethane was once used as a rocket fuel. Fortunately for hot rodding, nitromethane also has industrial-world uses-for example, as a cleaning solvent and as an aid for synthesizing pharmaceuticals, pesticides, and coatings-which is why it's widely available.

Who's On First?

Reputedly the first to use nitro as a fuel were model tether-car racers; the current descendents exceed 200 mph, circling a pole on a string. For fullsize race cars, the first documented use was in the mid-to-late-'30s Auto Union Grand Prix and land speed record cars designed by Ferdinand Porsche. These were subsidized by the Nazis, who wanted to prove the superiority of German technology. The open-wheel racers had streamlined bodies and were decades ahead of their time, but most of the technology was lost when the Third Reich collapsed at the end of World War II. The last version built before the war was a 340ci (5,577cc) V12 with nonintercooled, two-stage Roots superchargers rated at 485 hp and 405 lb-ft. The fuel is believed to have been a mix of 85 percent nitromethane, 5 percent benzole, 5 percent acetone, and 5 percent castor oil, with fuel consumption around 2.5 miles per gallon. German racing driver Berndt Rosemeyer was killed in one of these cars when running 268 mph on the Autobahn in attempt to set a new world land speed record.

Totally unaware of the Nazi efforts, American hot rodders reinvented the technology in the late '40s. According to most hot rod historians, nitro's first competition use in America was by Vic Edelbrock Sr. and his associates. As related by Vic Edelbrock Jr., who was there when the events went down, back in '49, Midget racer Ed Haddad came into the shop after he'd been given 1 gallon of a nitromethane-based fuel by slot-car manufacturer Dooling Brothers, but didn't want any part of it because he had heard "it will blow up in your face." Edelbrock, Bobby Meeks, and Fran Hernandez added 10 percent nitro to the methanol in their 136ci V8-60 Midget car engine. With no tuning or familiarity with nitro, Vic Jr. recalls that the strange brew "just about broke the beam on Dad's old 200hp-capacity Clayton dyno. The spark plugs were so hot they turned into glow plugs. When they tried to shut it off, the engine kept running. They finally had to throw a towel on it to get it to quit." The engine was toast, but eventually they learned to add lots more fuel, colder spark plugs, and stronger internals to stand up to both the higher output as well as nitromethane's corrosive effects. The Stromberg 81 carbs had to be nickel-plated, as did the fuel containers (hidden from prying eyes inside cardboard boxes). Eventually, Edelbrock settled on a 20 percent nitro/80 percent methanol mix that added 40 hp.

Later in 1949, powered by the secret sauce, Edelbrock's Fran Hernandez's '32 Ford beat Tom Cobbs' blown Roadster at the Goleta, California, airport in the first sanctioned drag race ever held. But what really made everyone take notice was Vic Edelbrock Sr.'s circle-track Midget driven at the famous Gilmore Stadium in 1950 by future Indy 500 winner Roger Ward. At the time, Midget racing was the rage in Southern California. Purpose-built Offenhauser four-cylinder racing engines had a significant power advantage over other setups and dominated the top circuit. The Ford V8-60 flatheads were relegated to their own class. But on that historic night at Gilmore, Edelbrock entered its Kurtis Kraft V8-60-powered Midget in the Offenhauser class, fueled by his secret brew, and smoked them all. It was the only time a Ford V8-60 won at Gilmore over a field of Offys. In San Bernardino the following night, Edelbrock blew off the Offys again.

Edelbrock was able to keep the fuel a secret for a while, but with flames coming out of the exhaust, fellow racers knew something was up. Vic disguised the distinctive odor by blending in a little orange oil. By 1952, an Edelbrock Ford flathead running 40 percent nitro had run 201 mph one way at Bonneville (before the exhaust valves got sucked into the ports). Other racers experimented with fuel in the early '50s, including Joaquin Arnett of Bean Bandits fame. Tony Capana is said to have been the first to take nitromethane to the dry lakes, and, by 1954, to the Indy 500 (where it was legal at the time).

The Rich Get Richer

According to Gene Adams, if you consider high-octane racing gasoline as the baseline fuel, replacing it with methanol-the best alcohol fuel-is worth a 5-to-10-percent power gain. But 80-to-90-percent nitro is worth two to three times the power of the alky.

What's the secret? Nitromethane carries its own oxygen, so it needs much less atmospheric oxygen to burn. The theoretical ideal or stoichiometric air/fuel ratio for gasoline is 14.7:1. That means, 14.7 pounds of air are needed to burn 1 pound of gas. Methanol, which also carries oxygen, has a stoichiometric ratio of 6.45:1. But with 100 percent nitro, the ratio is 1.7:1! Because the displacement of an engine cylinder is fixed, this means-assuming 100 percent volumetric efficiency (VE)-8.7 times more nitromethane than gasoline can be burned during one combustion cycle.

On paper, gasoline has about four times more heating value than nitromethane: at least 19,000 Btu/lb for gas compared with just 4,850 Btu/lb for nitro. But that doesn't take into account the fuel's specific energy (SE) value, which is derived by dividing the heat value by the air/fuel ratio (Btu/lb ÷ A/F), telling us how much heat energy is delivered per pound of air into the motor. At stoichiometric air/fuel ratios, the nitro's SE value is around 2.2 times greater than gasoline!

Racing nitro motors run far richer than the theoretical 1.7:1 ratio, and Adams says it's possible to dump nitro at ratios approaching 0.5:1. "At 80 percent nitro and above, the optimum air fuel/ratio no longer exists and the power output becomes well related to the actual amount of fuel fed into the engine by weight," adds Ray Hall Turbo. At 0.5:1, the SE potential of nitro could be six times greater than gas.

"Gas is for washin' parts. Alcohol is for drinking. Nitro is for racin'!" -Anonymous Racer

Compared to methanol, nitro's theoretical SE advantage is nearly 40 percent at stoichiometric and more than 110 percent at theoretical max power ratios. When you add in nitro's high heat of vaporization (about twice that of methanol), you also get a significant cooling effect in the chamber. Since nitro wants to explode instead of burn in a controlled manner like a properly tuned gasoline-fueled engine, anything you do to reduce chamber hot spots is critical!

All this still doesn't take into account that at extremely rich ratios, the nature of nitro's chemical reaction under combustion changes, producing new end products including hydrogen-another compound that really likes to go "boom" (remember the Hindenburg?).

The 98 percent Solution

Although it's possible to run 100 percent nitro-Art Chrisman is said to have done so, with carburetors to boot-experts like Gene Adams don't recommend it. "Even if the rules allow it," Adams says, "cutting nitro with another fuel makes the car more consistent. It'll run cleaner and there's less tendency to drop cylinders. In my experience 98 percent is best overall."

Thanks to improvements in magneto technology, 98 percent is doable today. The ignitions of the past just weren't up to the job. Regardless, NHRA currently restricts Top Fuel and Funny Cars to a 90 percent nitro solution in an effort to hold down speeds. A normally-aspirated A/Fuel dragster can run 94 percent nitro. At Bonneville, it's still "run what ya brung."

Methanol Brews

Methanol remains the most popular fuel used to cut nitromethane, if only because many sanctioning bodies currently ban the alternatives. Nevertheless, there's a good reason to cut nitro with up to 10 percent methanol: It helps suppress detonation. Ray Hill Turbo recommends a 2.5 percent water/7.5 percent methanol cut to reduce both preignition and detonation tendencies with, it claims, "almost the full power capability of undiluted nitromethane."

Weird Science

When running nitro absent of rules restrictions, the following methanol-blend alternatives are known to either increase power, improve efficiency, and/or suppress detonation and preignition .

Propylene Oxide: Ray Hall Turbo says adding 10 percent propylene oxide is worth about a 10 percent power increase. It's possible to run up to a 50/50 propylene oxide solution, but with anything over 10 percent, additional power gains aren't proportional to the added amount. To prevent corrosion as well as polymerization in the container that could cause a possible explosion, store propylene oxide in a polyethylene container in a cool location (the fuel boils at 93 degrees F), or polymerization in the container could result in an explosion.

Acetone: Up to 5 percent acetone can reduce preignition by raising the autoignition point. On a cold day, up to 10 percent acetone can ease initial start-up.

Benzene: Gene Adams and Jim Archer say cutting methanol with benzene or benzole (a coal-tar product consisting mainly of benzene and toluene) may produce better results than cutting nitro with methanol. There's one drawback: Benzene is a hard-core carcinogen. That's probably why just about every sanctioning body bans it.

Hydrazine: The most dangerous additive of all.

Hydrazine: Go Up Like a Rocket

Legends persist of mixing hydrazine with nitromethane for a significant power gain. Hydrazine (N_2H_4) was developed in World War II as a rocket fuel. It powered the first operational rocket-based interceptor, the German Me-163B, and is still used in some spacecraft and myriad industrial processes to this day.

A colorless, flammable liquid with an ammonia-like odor, hydrazine is so volatile that it's outlawed virtually everywhere. Jim Archer has some experience mixing nitro and hydrazine: "Yes you can do it, but it's dangerous as hell and very toxic." Nitro is slightly acidic, while hydrazine is slightly basic, and opposites attract, with a vengeance: When the two come into contact, a spontaneous chemical reaction starts that ultimately creates a salt-like, high-explosive compound that's extremely sensitive. So, any mix's efficacy for improving performance is extremely time sensitive. It takes a while for the reaction to really get going, so if you mix the two together and run it right away, nothing is gained. Somewhere around 25 to 30 minutes after mixing you will see a power gain over nitro alone. Around 45 minutes, the mix will blow up inside the engine or even self-detonate in the tank.

Nitromethane, dangerous as it is, looks like water compared with hydrazine. Don't breathe it, don't ingest it, and don't get it on your skin (it absorbs right through it).

Pass on the Gas

Nitro doesn't mix with gasoline-they separate, with the gas on top. You can, however, mix nitropropane (C3H7NO2) with gas, and even 10 percent nitropropane in gas can provide small power increases. A test by Jeff Smith is available at HOTROD.com/techarticles/42018/. Klotz (KlotzLube.com) sells a product called Nitro Power Additive, a mixture of nitropropane and antidetonation agents (nitropropane is extremely detonation sensitive).

What about running straight nitropropane? It provides about the same gain as running 60 percent nitromethane.

Tipping the Can And the Bottle

Nitrous oxide and nitromethane? It's possible-but only preliminary development has been done because most sanctioning bodies outlaw it. Mike Thermos says he's built systems that run up to 25 percent nitrous oxide, but even at that level, supplying enough fuel is problematic. You need huge fuel-side solenoids with special internal orifices capable of handling thick, viscous, lacquer-like nitromethane-probably at least two 0.180-inch-orifice models.

Applied Nitrous Technology specializes in hard-core systems for just about every race venue; as owner Jeff Prock puts it, "We've put nitrous on everything from model cars and lawn mowers up to Fuelers." More than a decade ago, Prock built a system for Keith Stark's A/Fuel Dragster. The goal was to prevent dropped cylinders induced by ignition that had trouble lighting off the 100 percent loads of nitromethane. It was hoped that nitrous would speed the flame front, which would permit retarding ignition timing, reducing ignition stress. Expectations were met: instead of 65 degrees, the engine ran best at 50 with nitrous. The nitrous jet sizes were roughly the size used on a 125hp system for gasoline car, with eight 0.018-inch orifice jets-but with nitro, that added more than 300 hp. Fuel flow at 6,300 rpm had been 31.1 gallons per minute; with the small nitrous shot that increased to 35.5 gpm. Times plummeted from 5.40 seconds to 5.29, and eventually 5.08. The big problem was shredding clutches.

Stark reports that the engine combo was never optimized for nitrous oxide: "We would have taken out some compression ratio if we kept pursuing it." Nitrous contains 36 percent oxygen by weight; nitromethane about 52 percent. High compression isn't needed with all that oxygen and fuel-you just want max volume of fuel into the cylinder. "You no longer have controlled combustion but a pure chemical reaction," warns Prock. Prock feels that with sufficient development, the normally aspirated, nitro/nitrous combination could have given blown Fuelers a run for their money. On the other hand, another nitromethane combo running 0.030-inch-orifice nitrous jets is said to have blown the side of the block clean off!

White-Hot

Several explanations are offered for the phenomenon of flames shooting out the exhaust pipes. Gene Adams says it's due to superchargers that "blow through unburned fuel on overlap." Flames have gotten longer as fuel pumps and magnetos have improved, allowing higher fuel volumes to be pushed through the engine. According to Adams, more volume means longer flames. "Back in the '60s and '70s, 1- to 2-foot flames were common. Now it's more like 10 feet."

An alternative explanation is that not all the nitro has the time to ignite within the engine and goes out the exhaust, where it ignites on contact with atmospheric oxygen, burning with a characteristic yellow flame. If a rich mixture has entered a monopropellant phase, hydrogen and carbon monoxide are produced as a byproduct. Bright white flames are then generated by burning hydrogen.

Hard to Start, Hard to Stop

Initial start-up with high nitro concentrations is very tricky. Jeff Prock says, "You must get the engine cycling. It won't start up spinning at 200 rpm like a gas engine would. You need to get some heat in the engine and spin it at 1,800 to 2,000 rpm." There's so much fuel pouring into the cylinders that failure to get the engine spinning fast enough before controlled ignition can hydro-lock the engine, or even blow a head off. The common practice is to start and warm up the engine on gas or alcohol.

High percentages of nitro required massive breakthroughs in ignition technology. Today's top-of-the-line MSD units put out 50,000 volts and 44 amps on the top end. That's about the output of an arc welder at each cylinder-and the Fuelers run two of them.

Once you get a nitro engine going, it may not want to stop. At 7,500 rpm on the top end, there's so much heat in the engine it may keep running under autoignition even if you shut off the magnetos. Essentially, it becomes a diesel. Fuelers today shut down by turning off the fuel pumps as well as the ignition.

Don't Get Mixed Up

Correctly lending nitro involves far more than a mixing cup. The specific gravity (SG) of fuels varies per batch and purity; methanol's out-of-the-barrel concentration can vary 5 percent or so. The by-weight mixture is also dependent upon temperature, both during the initial mix as well as if the temperature changes afterward. As temperature rises, the weight (as measured by SG) decreases. For tuning, it's the percentage by weight that's important, so it is necessary to mix the fuel using a hydrometer and keep track of mixture temperature.

Stayin' Alive

Gene Adams, one of the old masters, offers some tidbits:

"Normally aspirated, nitromethane-fueled, engines don't like to rev as high as a gasoline- or alcohol motor. At high rpm, there's just too much volume of fuel and not enough time to burn it all. A blown alcohol dragster with a screw-compressor supercharger will run to 10,000 to 10,500 rpm; normally aspirated nitro cars in the same class run around 6,700 rpm and they make about the same power. If you try to rev them up higher, the power falls off. Adding a supercharger allows the engine to rev up higher, to about 8,200 on the top end.

"Lightweight parts are not as important since the engine isn't turning big rpm. Keeping everything together is, so we build things stouter-bigger piston wrist pins and heavier cranks, for example. Aluminum rods are obviously lighter than steel rods, but we use them for shock resistance, not weight savings. The 7075-T6 billet aluminum rods are much larger physically, so they are physically as strong as a mild-steel rod-but you can't keep bearings in a steel rod.

"Bearings, pistons, and everything have more clearance, and are run with heavy, single-weight 70W oil. This works better under nitro's tremendous loads. There's also a tremendous amount of blow-by even when running good, due to the tremendous internal pressure and rich fuel mixtures. There's a lot of cylinder-wall wash-down. Typically we use a Dykes top ring with a 0.017-inch-step, 116-inch second, and 316-inch heavy-tension oil ring.

"Nitro engines require lower compression ratios. Normally aspirated with modern race gas or methanol, 15:1 compression ratios are typical. With nitro, you're looking at about 10 to 11:1. A blown motor might run 6.0:1 compression with nitro, 8.5:1 with gasoline, and 12.0 to 13.0:1 on alcohol.

"Even with 'low' compression the Hemi heads are O-ringed, with the receiver groove in the block's sleeves. The ports are so huge you can put your legs in the heads. Valves sizes are 2.450-inch intake/1.94-inch exhaust.

"Typical cam specs might be 280-to-290-degrees duration at 0.050 with around 0.750-to-0.800-inch valve lift. That's not as radical as a Pro Stock car or alcohol dragster, but we don't turn the rpm, so why sacrifice durability? With so much ignition lead, excessive duration would only increase blow-through anyway. The cams are single-pattern because Hemis are not exhaust-side limited."

Running Out of Timing

Popularly, nitro is considered a "slow-burning" fuel, but the burn rate is between gas and methanol. The problem is that on high end, nitro-fueled engines, only about 10 percent of the fuel in the chamber is vapor when the burn starts; the rest is liquid. The vapor burns first, which ideally creates enough heat to vaporize the rest of the fuel. But it takes time to create that heat-hence the great amount of lead needed, about twice what you'd use with an equivalent gasoline-fueled engine. Adams says, "Normally aspirated we usually run 60 degrees of lead or 50 degrees with a supercharger. A gasoline-fueled, normally aspirated Hemi might only need 27 to 28 degrees."

Hammered

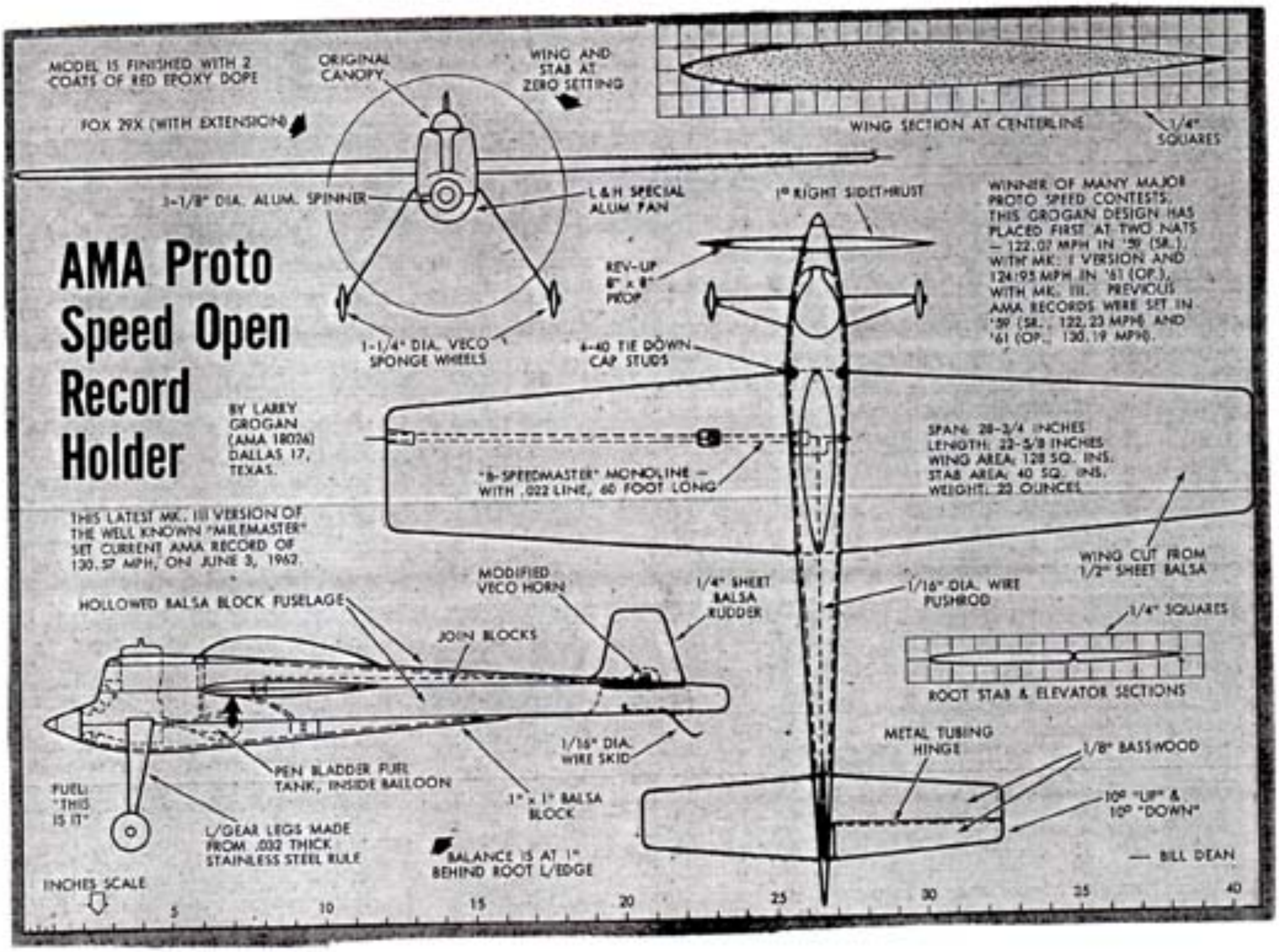
Nitromethane is weird stuff. You can strike a match next to a puddle of it and nothing will happen. But Jeff Prock says-based on personal experience when he was a kid-if you put a few drops of it on an anvil and hit it with a hammer, there will be a small explosion, somewhat akin to an old cap going off in a toy gun. More seriously, that means you don't want to risk dropping barrels off a truck. The explosion chance is remote, but it is possible, especially on a hot day.

16 HP/CI

With the current rules-restricted 90 percent nitro/10 percent methanol blend, modern Top Fuel 500ci Hemi engines make about 8,000 hp. That's 1,000 hp per cylinder or 16 hp/ci. It takes about 15/100 of a second for the power to reach the rear wheels.

Knock Your Block Off

If spark fails early in the run, unburned nitro can build up and then explode with a force that can blow the heads off the block-or even blow the block itself in half.



AMA Proto Speed Open Record Holder

BY LARRY GROGAN (AMA 18026) DALLAS 17, TEXAS.

THIS LATEST MK. III VERSION OF THE WELL KNOWN "MILEMASTER" SET CURRENT AMA RECORD OF 130.57 MPH, ON JUNE 3, 1962.

WINNER OF MANY MAJOR PROTO SPEED CONTESTS. THIS GROGAN DESIGN HAS PLACED FIRST AT TWO NATS — 122.07 MPH IN '59 (SR.), WITH MK. I VERSION AND 124.95 MPH IN '61 (OP.), WITH MK. III. PREVIOUS AMA RECORDS WERE SET IN '59 (SR., 122.23 MPH) AND '61 (OP., 130.19 MPH).

SPAN: 28-3/4 INCHES
LENGTH: 22-5/8 INCHES
WING AREA: 128 SQ. INS.
STAB AREA: 40 SQ. INS.
WEIGHT: 20 OUNCES

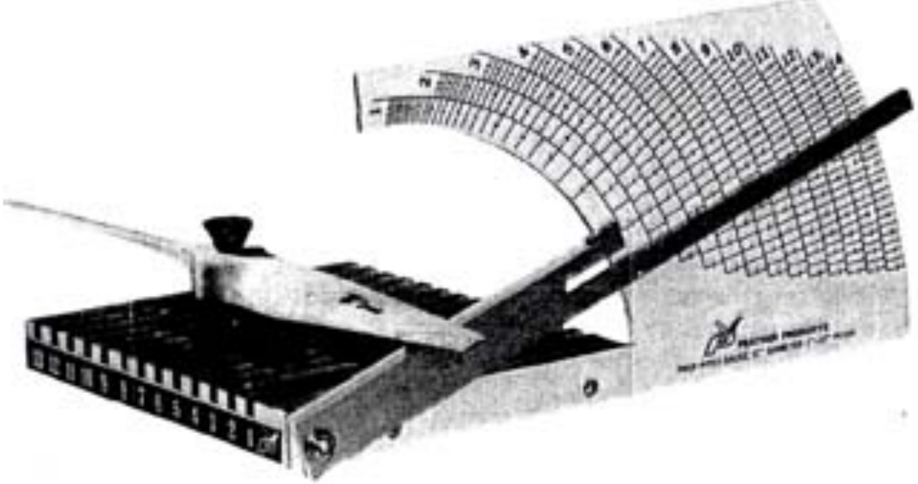
MODEL IS FINISHED WITH 2 COATS OF RED EPOXY DOPE

— BILL DEAN

PRATHER

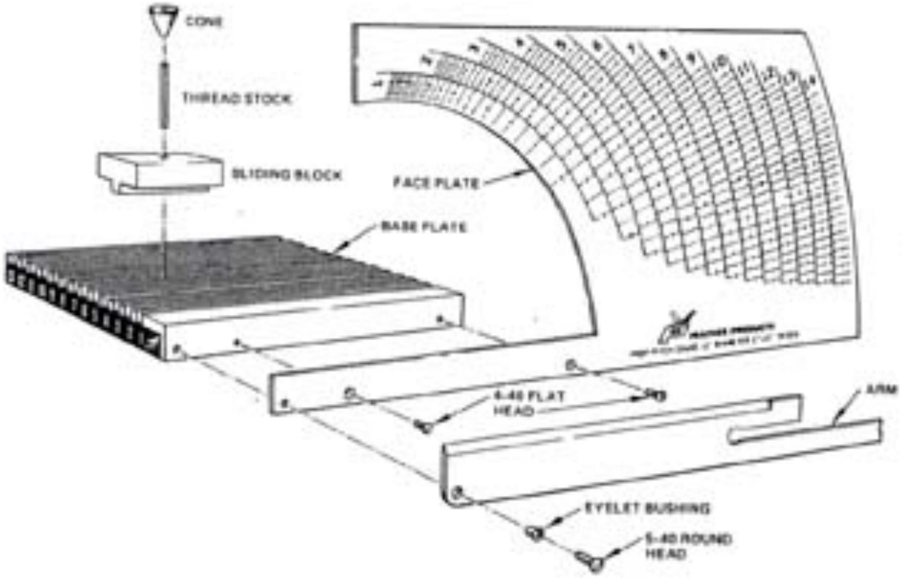
PROP PITCH GAUGE

TRUE THE PITCH – CHANGE YOUR PITCH



INSTRUCTIONS

Assembly Instructions



With the printed side of face plate facing you and grooved side of base plate upright align the three holes in the face plate and base plate. Use two 4-40 x ¼ flat head machine screws, one in the center hole and one on the right to hold face plate to base plate. They should be flush after screwed into position.

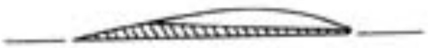
Insert eyelet bushing in arm on the side with the taper on it. The part of the eyelet bushing extending beyond the arm fits into the face plate in the remaining hole (one on left). It is held into place with a 5-40 x 3/8 round head machine screw. As the screw is tightened it will expand the bushing and hold the arm securely in place. The 5-40 round head machine screw should be tightened until there is enough tension on the arm to hold it in any position.

Screw threaded stock into sliding block. Tapered cone is used to hold prop into position on sliding block.

How to Use the Prop Pitch Gauge

Place prop on sliding block with back side of prop against the block and thread stock extending through center hole of prop. Screw tapered cone down against prop to hold it into position. The 13 grooves in the base plate are called stations and correspond to columns and numbers on the face plate.

Start checking the pitch from the hub of the prop out toward tip, on larger engines you should start at station 2 since a spinner or prop washer covers that portion of the prop near station 1. To check at station number 2 insert sliding block in second groove from face plate. Slide prop along groove until the bottom of the prop fits flush with the top edge along the tapered part of the arm. You will have to raise and lower the arm at the same time you slide block to make bottom of prop and arm flush. Read the pitch along the face in the column where station 2 is indicated with upper side of arm which covers printed face plate. Don't be surprised if that portion of the prop near the hub is lower than the pitch indicated by the manufacturer. Use a 6" ½ round file or rasp to bring prop to desired pitch. File prop on the bottom tapering toward the front edge to raise the pitch and file prop on bottom tapering toward the trailing edge to lower the pitch of the prop. Be sure to keep the bottom side of the prop flat as you file it. Continue checking the pitch at each station to the tip of the prop. Use sandpaper to smooth prop after filing. Start with 150 grit then go to 220 and finish with 400 to 600 grit sandpaper.



File area toward trailing edge of prop to lower pitch of propeller

File area toward leading edge of prop to raise pitch of propeller

How to Improve the Performance of Your Prop and Engine

A. Select good wood for your prop

It is very important that your prop be made out of even grained hard wood. If a prop has one blade with soft flexible wood it can cause the blade to change pitch in the air or to flex and cause significant reduction in rpm and performance. When you purchase your props select the ones with even hard grain that will not allow one blade to flex.

B. True up the pitch of your prop

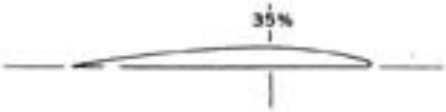
Most props commercially available today will vary in pitch from one prop to another or from one side of the blade to another. This is not entirely the manufacturers fault as wood grain can twist after it leaves the factory due to humidity and other characteristics of the wood itself.

A significant difference can be realized by truing the blades of your prop. Instead of one blade pulling and one doing relatively little a true prop will allow both blades to pull equally.

By checking and truing all of your props against each other you can get consistant flights that will not vary do to a poor prop.

C. True up the airfoil of your prop

The airfoil of your prop is extremely important. It can cause reduction in rpm and loss of power. Your airfoil should have a flat bottom with the high point on the top side of the blade about 35% back from the front edge, use the ½ round file to true up the airfoil and then smooth the wood with sandpaper.



D. Balance your Propeller

After you have reworked your propeller make certain that your prop is properly balanced. An out of Balance prop can cause loss of rpm, engine wear, and will fatigue your airplane. The Prather Prop Balancer is an inexpensive, accurate and easy way to check the balance of your prop. Ask your dealer for the Prather Prop Balancer.

E. Correct RPM for peak Performance

Finding the right rpm to run your engine can be the most difficult but the most rewarding. Although you can experiment using the sound and performance of your engine a good tachometer is a great help.

It is best to run your engine on the ground roughly 2000 rpm under the point where it develops its peak horsepower, then when your engine unloads in the air it will reach near its peak horsepower.

Torque is another factor that must be considered along with horsepower. Torque is the twisting force of your engine. Torque is most important in maneuvers or tight turns. Since the peak torque on most engines is developed before the peak horsepower we must run our engine rpm slightly below its peak horsepower. This is especially true on pattern ships. Racers that fly a level course and don't require power for maneuvers can run closer to their peak horsepower.

Most manufacturers of engines not only recommend a propeller but also tell you where your engines develops its peak horsepower. The recommended propeller by the engine manufacturer or kit manufacturer is a good starting point.

You can gain rpm by lowering the pitch of your prop or by cutting down the diameter. You can decrease the rpm by raising the pitch or by increasing the diameter. Another factor is the width of the propeller. A narrow prop will result in more rpm than a wide one.

Generally speaking larger and heavier airplanes work best with longer, wider props with a low pitch. The smaller and lighter planes work best with shorter, narrow props with a higher pitch

Example:

Lets say we want to fly an R/C pattern ship with a 60 size engine that develops its peak horsepower at 14,000 rpm. The manufacturer recommends a 11-8 prop.

After we true up the airfoil and true up the pitch the engine runs only 11,000 rpm. Then we fly the plane and its sluggish and sags during maneuvers. Now decrease the pitch to 11-7½ or if a 11-7½ prop is available true one of these up and try it. Say it tachs 13,500 rpm, the engine sounds great but the plane just doesn't have the speed it should. Increase the pitch of the prop to 11-7¾. Let's say it now runs 12,000 rpm, the plane should perform much better now since it now reaches near its peak horsepower in the air.

More combinations can be tried which may even be more effective. Say shorten the prop to 10½" diameter and increase the pitch to 8½ to make a 10½ – 8½.

Another Example:

The high performance racing engines available today are extremely critical as far as developing their peak horsepower within a fairly narrow rpm range. This makes your prop pitch, diameter and width even more important.

Let's take an example of one of the racing 40's. A standard prop for R/C pylon racing is a 9-8 or 10-8 cut down to 8½" or 8-5/8" diameter. The reason for starting with a larger prop is to have more wood on each blade to prevent flexing at high rpm. Normally cutting the length of the prop alone is not enough to allow the engine to reach high enough rpm. You have two choices. Narrow the blade or depitch the prop to bring the rpm up. Most of the racing 40's peak horsepower is reached between 20,000 and 21,000 rpm. This means your ground rpm should be between 18,000 and 19,000 rpm.

I have been using a Super Tigre G-40 R.V. on my R.C. Goodyear racer. I use an 8½" diameter prop with a pitch between 7-1/2 and 7-3/4. The width of the tip is 1/2", 5/8" at the center and 3/4" near the hub. I normally tach 19,000 on the ground so the engine can peak near 21,000 rpm in the air. Naturally the type of prop that will work best on your engine and plane will vary and only by carefully experimenting can you reach an optimum for your particular need. I have improved the performance of my prop and engine using the prop pitch gauge. I know it will help you. Good luck and Good flying.

Terry Prather

2015 Northwest Speed Bash
September 26-27, Bill Riegel Model Airpark, Salem, Oregon

We had a moderate turnout of speedsters with a couple of no-shows that kept it from being well-attended. Also attending but not entering were Loren Howard and Will Naemura. The wind was quite variable both days but was less of a challenge than it looked. The temperature barely managed to get close to 70 each day.

Results

NORTHWEST B PROTO SPEED (4 entries)
1. Chris Sackett, Maple Ridge, B.C. -- 106.20 mph
2. Ken Burdick, Kamloops, B.C. -- 93.39
3. Bruce Tunberg, McMinnville, Ore. -- 93.09
4. Mike Hazel, Mehama, Ore. -- 92.27

One other entry did not fly.

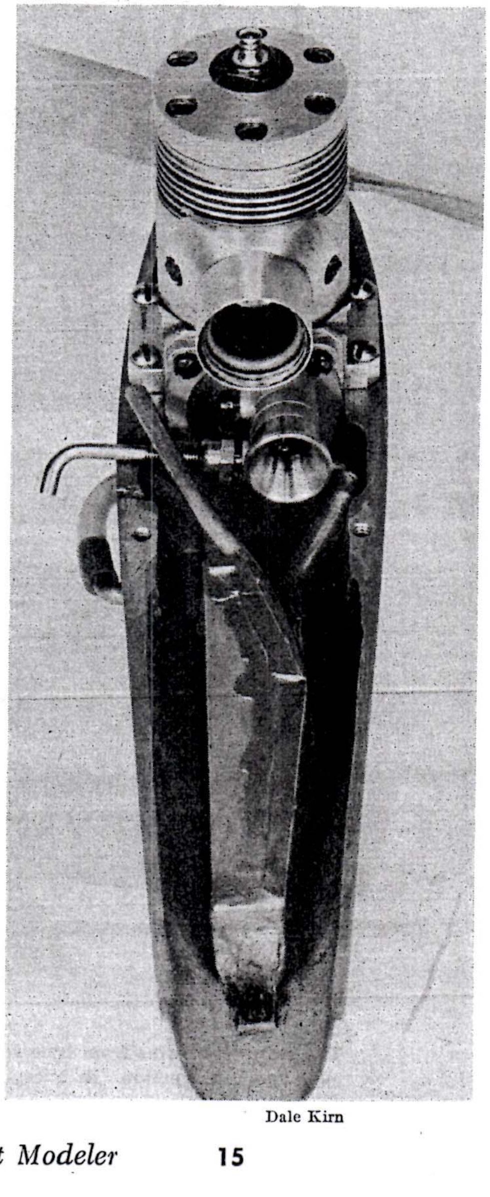
1/2 A PROFILE PROTO SPEED (1 entry)
1. Bruce Tunberg -- 64.26 mph

NORTHWEST SPORT JET SPEED (1 entry)
1. Jim Booker, La Grande, Ore. -- 153.91 mph

.21 SPORT SPEED (2 entries)
1. Scott Newkirk, Snohomish, Wash. -- attempt
   Ron Bennett, Monmouth, Ore. -- attempt

B SPEED (1 entry)
1. Ron Bennett, Monmouth, Ore. -- attempt

FAI SPEED (1 entry)
1. Jim Booker -- 158.60 mph



Dale Kirn

Closeup of a world champion

According to advertising on American television, "it's whats up front" that counts. Here is a close look at Theobald & Wisniewski's TWA 2.5 cc engine from the rear. This is the engine which Wisniewski used to win the FAI speed event for the U. S. at the 1966 control-line world championships in England. Note exhaust opening, air intake and the "suction" metal tank. Tuned exhaust pipe slips into exhaust opening after the pan and engine are attached to the plane. The 1966 tuned pipe performance started a revolution in international competition. European pipes dominated the Criterium of Aces control-line meet last year, and the 1967 free-flight world championships was won with a tuned exhaust engine from W. Germany.