MAX-Q

HARA

Newsletter of the Huntsville Area Rocketry Association — Volume 10, Number 1, Feb/Mar1996

HARA Hotfoots Runners

It was a cold morning in December to run 26 miles in Huntsville's Rocket City Marathon, but HARA members were there at the race's start to shoot rockets. The Huntsville Track Club requested the launch again after the great success last year. Neal Redmond, Kevin Cornelius, Brian Day and Vince Huegele had the launcher and models set up to salute the 1200 runners.

Neal and Kevin had *Big Bertha* models on C6-3 motors, Kevin's *Bertha* a veteran of the 1994 Marathon. (See right photo.) Vince had a *Bertha* kit-bash on a D12-5, and Brian brought a Quest *Eagle* on a C. Neal also brought his dog along expecting to retrieve rockets from the Big Spring water hazard.

When the time hit 8:00 am and the gun went off, the first model was fired. As the crowd of runners spread out and came toward the rack, subsequent pads were selected and energized. All four rockets went off on command. (See photo above.) The recovery crew quickly saw their work ahead, as the parachutes were coming down well into the park well away from traffic, but around a muddy construction area. All rockets missed the water and are back for flying again, but the dog was more interested in the ducks around the bridge than the other "birds."

In a post flight discussion, Neal suggested that next year we bring out some big models for a static display beside the launchers for the runners to see as they pass. A static firing of a larger motor for sound and smoke effect was also mentioned.

INSIDE MAX-Q

From the President's Pad

The Elite Meet

On a cold but navigable weekend in January, the ruling parties of rocketry convened in Rocket City. They ate Chinese food and talked rockets. The trustees of NAR and Tripoli held a joint session to discuss their common goals of properly certifying knowledgeable rocketeers to fly rockets within the federal and state regulations. There was a friendly mood of cooperation for mutual benefit, with a proposal for having NAR's national sport launch together with Tripoli's LDRS. All of this is a great advance from several years ago when the organizations wanted to take each other over.

MAX-Q

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Editor: *Vince Huegele*

Contributors: *Tim Pickens, George Gassaway, Brian Day, Mark Tygielski, Greg Warren*

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HARA officers

President: Vince Huegele
Vice President: Joe Robertson
Secretary: Brian Day
Treasurer: Sharal Huegele

NAR address: 1311 Edgewood Dr., Altoona, WI 54720

HARA members Neal Redmond, Mark Tygielski, Greg Warren and myself attended some of the NAR meeting and were necessary for providing ground transportation for trustees to get to restaurants. The board came to order Friday afternoon January, 19, and went headlong until Sunday noon. Essentially, seven guys were doing six month's worth of business on a weekend. From the sessions I attended, the group was extremely efficient, effective, and competent. Having seen them in action, particularly compared to many other meetings I have been in, I have a much greater respect for NAR now, and a greater enthusiasm about what's happening on the national organizational level.

SEP on full throttle

The board talked at length on how to best implement Greg's program. There were several actions involved to reach the objectives, so it took some discussion to set the priorities. It was productive discussion, I will add, that ended with the board having clear understanding of the course of action. There was a great awareness of the potential of SEP in NAR. I had been talking to NAR president Mark Bundick about a number of concerns the board had; membership growth, section activities, funding sources, high power regulation. I suggested that SEP might address and improve many of these areas.

NAR bought into and will support the following SEP initiatives. First, the formation of a substantial home page web site for rocketry education. Next, development of a rocketry promotional video that will introduce viewers to modeling and SEP. The video would become a standard to be shown to teachers and students, and on cable channels or in hobby shops. SEP will visit the National Science Teachers Association and set up a booth to advertise the program. (You think those big rockets on the convention floor will attract attention?) There's even a plan on the drawing board to create an interactive CD rom rocketry tutorial.

All of this will tie to the expectation and encouragement of other NAR sections becoming outposts of SEP by contacting schools and launching student experiments. HARA has stepped forward to be SEP's first designated satellite station. We hope by continuing to do what we've been doing with the schools we can be a model to other sections to get in on the fun.

SEP is driving rocketry into a new level of recognition and involvement. Imagine that what has been done with rockets in Huntsville can be done in countless other cities. Soon, many NAR sections will be able to claim too, that every student in their county has seen a rocket launch. High power rocketry will proliferate to the public as school sponsored science experiments rather than fringe amateur dare-deviling.

We shall see this year, and beyond, a new acceleration in our favorite activity. With Greg as the Director of SEP and the chairman of NAR education, I want us all to fully support him in continuing the success.

Brian Elected

Clap your hands for Brian Day, who agreed to take the HARA secretary duties. He will be keeping up with the membership list, and developing and maintaining the new HARA homepage. Thanks to Greg Warren, who previously held this office and served therein for several years.

ROCKETRY ADDICTION
A High Tech Abuse

by Vince Huegele

"I was just a kid when I got started on rockets. It was innocent, simple, harmless at the time. I never thought it would lead to this."

These are the words of a rocket addict. He's not a monster or a freak but a regular person who got too involved in model rocketry. A hobby that gives simple pleasure and intellectual diversion to many becomes a source of abuse to a few. This person took rocketry farther than it was ever intended to go. From this abuse came a dependency. Now he's got a problem.

"I don't want to spend all my time, my whole life with rockets. But I do. I love the roar of the engine; the smell of the exhaust. It's a high. A high I have to have."

He's hopelessly hooked. The path down the road to ruin is always the same story.

"I'll never forget my first launch. Astron Alpha with a 1/2A62 engine. Sweet little thing. Just a beautiful experience. But as soon as I got it back I had to shoot it again. This time- what would an A engine do? Another model and B engines came quickly, And before I knew it, C65's were my mainstay. After awhile it wasn't enough."

The addict never plans to get in very deep. But the lure of bigger kicks, higher highs, and faster rushes soon takes over, and he has to shoot more.

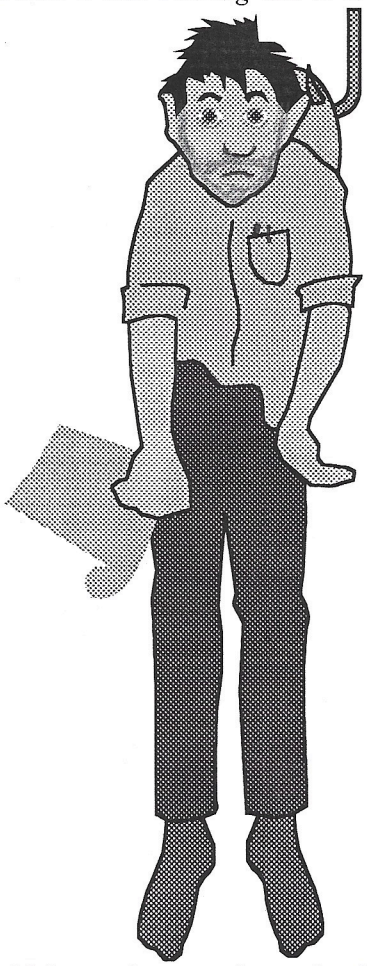
"The move to D engines was scary, but it was worth it, I thought. This was good stuff and I knew it. Sure beat those little T size jobs. I was doing those for breakfast, man. Then I 'd go out that afternoon and cluster a few D's."

'Cluster' is user talk for lighting several engines at once. He was no longer an occasional flyer like most rocketeers who fly socially.

"Yeah, I was up to several packs a day. Seemed like nothing. I could handle it. My life was still under control. Then one day this guy introduced me to composites."

Composite motors are federally regulated and restricted to professional use for industrial strength applications. With the right connections, they can fall into the hands of amateurs. And the people who use them are never the same.

"They told me it was the ultimate high, and man it was. Nothing like it in the



world. It was clean, quick, good and just out of sight. But it was expensive, even with the reloads. I had to have those motors, not too often I thought, but I had to have them. So I began to deal"

To support his own habit, he was now compelled to entice others into his desire. By selling, he could keep a steady supply of whatever he wanted flowing though his hands.

"Finally, I had everything. All the time. Everything was rockets and rockets was everything. I had the highest powered stuff there was; H,J,K,L and other letters of the alphabet. I thought I had it all, but actually, it had me. It didn't hit me til I ODed."

The details of an overdose are not pretty. Sometimes it's clustering an obscene number of H engines. Sometimes it's confusing models with military ordinance. Sometimes it's accumulating more kits than ever possible to build. Regardless of the trigger, the persons' life comes crashing down. They call it 'pranging'.

"I never knew I had it so bad. It didn't seem bad. It was so - - educational. That's what they said. But there was a lot they didn't say. I had to find out the hard way. I want other people to be warned, be careful. You play with fire, you get burned."

Fortunately, this addict is responding well to treatment and is finding a place in society. There are others out there, lost and hurting who don't know where to turn. Still others aren't even aware of the trouble they're in. The following warning signs indicate a person may be a rocket addict:

Does he give a countdown before simple acts like flushing the toilet?

Does he declare,"we have ignition," when starting the car?

Does he insist his rockets "aren't models but real rockets?"

Does he have a room that looks like an armory for a third world nation?

Do his clothes smell smoky?

If you know anyone with these symptoms, they need help. Call the nearest crisis help line and turn the guy in. While you're at it, report for a checkup yourself. Besides being addictive, rocketry is highly contagious and many an unsuspecting soul has been caught up in another's wake. Our friend knows all too well.

"Tell them to go easy. You can do rockets in moderation and its all right. Moderation, yeah, that's the ticket. Or just say no."

Finishing 95, Starting 96

By Brian Day

Brian's SKYCAM Falcon on "I"

HARA's last launch of 1995 was held on a beautiful November day at our Athens, AL site, with 7 participants flying everything from C-I motors.

George Gassaway came up from Birmingham and made several impressive flights with a variety of radio-controlled rocket/boost gliders. Mac Weathers and Stephanie flew his Aerotech Arreaux for several nice flights on F motors, and Vince Huegele discovered how fast an Initiator leaves the pad on a G80!

Neal Redmond flew a scratch-built fiberglass Patriot, which he's still tweaking for optimum performance. Mark and Emily Tygielski had a beautiful flight of their scratch-built 4" rocket on a H97 and 6 airstarted D12's! Brian Day flew his first "real" payload, a sequenced aft-looking 35mm camera, in a modified THOY Falcon with an I161W. The photos from that flight were seen in the last MAX-Q.

Since everyone's been complaining that Greg Warren hasn't been flying enough rockets at the launches, Greg brought out his venerable Alpha III! He also flew the Estes Orbiter, which ejected its recovery pod on impact. The pod shot in the air like a mortar rebound and amused everyone. Greg doesn't always get the thanks he deserves for securing the flying field and hauling out the launch equipment, so from all of us, "Thanks, Greg!"

The first launch of 1996 was exceptionally mild in February, and brought out most of the same modelers as listed above, plus David and Isaac Gannett, and the whole Cornelius clan. Almost the same models were flown, too; Neal cycled his Patriot on some H & I jobs, Mark was successful again with his cluster rocket that's painted now. Greg fired his 4" diameter V-2 and several Aerotech kits. Vince tested his new reload set on his Initiator and proved a Glenco Jupiter-C plastic conversion attempt. Kevin deployed his usual fleet on F & G power. Brian showed off his fiberglassed Phoenix on an F. David landed his Strong Arm in a tree -only temporarily, we hope. Not a bad day at all, with spring still to come.

Below: Mark Tygielski re-reads the instructions for prepping his cluster bird. And it worked!

Several lift-offs; Vince's Federation Star Probe, Greg's foam Orbiter, and George's RC glider.

Rocket Heads

During a break in the heavy discussions, the NAR board paused for Mark Tygielski to take this shot. See page 2 for more on the meeting.

Back row l-r, Vern Estes, Jack Kane, Pat Miller, George Gassaway, Front row, Mark Bundick, Vince Huegele, Ed LaCroix.

Project HALO Status Report: Rocket Motor Test Day #7

by Tim Pickens

The seventh Project HALO rocket motor test day was held on Saturday, August 12. That old baseball superstition --- about bringing bad luck for mentioning no-hitter during a no-hit game--- struck Project HALO, not once, but twice!

While setting up the first test, a HALO member (who will remain anonymous) noted that Mother Nature had been kind to us so far, and that all our tests had been held in fair weather. Within a half hour, Mother Nature taught us a lesson with a downpour even Noah would have appreciated! The path between the barn and the test site, mostly dirt from recent excavation, turned into thick, sticky mud. Although the rain stopped, for the rest of day we felt like World War I infantry. Man, did we get exhausted!

Test Objectives

We were to test five HALO hybrid motors, this time with a longer burn time, 6 seconds instead of the usual 3. We were also to test two hybrid motors made by James Mitchell of Tennessee.

The HALO motors were all designed to deliver a total impulse of 2000 lb-sec. The planned 6 second burn time would allow us to measure the regression rate of the asphalt propellant, as well as other pertinent data for later analysis.

Our objectives for the day would be: to increase our motor's efficiency or specific impulse (Isp), to test our new flight-capable aluminum motor casing, to test our new plug valve design, to measure the flow characteristics of our new motor injector, and to test our motor's ability to survive a 6-sec burn.

First Test to Check Motor Design

We first tested a motor in a standard steel casing (as in the past). The first test was primarily to see if the Isp and oxidizer-to-fuel (O/F) ratio would deliver the required performance.

The test would use an all-asphalt motor with a 1-inch core diameter and an 11-inch length. The test proceeded very well, with good ignition, and a burn time of 6 seconds. All hardware appeared unharmed. Nozzle wear was minimal. The motor yielded an average thrust of 161 lb. and an Isp of 203 sec.

Aluminum Casing Has Burn-Through

Next up, after a lunch break, was an all-asphalt motor with a 1.25-inch core diameter and an 11-inch length. This motor would be placed in a light-weight aluminum casing, similar to what would be used for an actual flight. Like the steel pipe used previously, the aluminum casing had pipe threads on each end to accommodate our current nozzle and injector end-caps.

The test had good ignition --- the new plug design was working very well! After 4 seconds into the test, fire erupted from the side of the casing, located just above the nozzle in the post-mixing combustion chamber. We immediately aborted the test. Aside of the casing, no damage was caused to the test stand, property, or personnel. Prior to the burn through, the motor yielded an average thrust of only 150 pounds and an Isp of 200 seconds.

Post-test analysis revealed that the casing threads (which reached almost to the post-mixing chamber) locally weakened the casing. Once heat burned away the carbon-phenolic mixing tube, it quickly melted the locally thin aluminum, creating a hole by which flame could pass through. The hole grew to two inches wide and one inch high, before the test firing was aborted.

One solution to the problem is to use snap rings instead of pipe threads. Another is to insert either an ablative or flame-resistant liner inside the carbon-phenolic mixing chamber tubing. Both solutions will probably be implemented.

Back to the Steel Casings

With an obviously damaged aluminum casing, we decided to return to using our sturdier steel casings. Three more HALO motors were successfully test fired, and all but one ignited on the first attempt. The only ignition failure immediately followed a member remarked "At least the new ignitors are working well." (Baseball's 'no-hitter' curse strikes again!)

The third test involved an all-asphalt motor with a 1.25-inch core diameter and an 11-inch length. A completely successful 6.0 second test yielding an average thrust of 154 pounds and an Isp of 192 seconds.

The fourth test involved an all-asphalt motor with a 1.25-inch core diameter and a longer, 12-inch length. Another successful 6.0 second test yielding an average thrust of 175 pounds and an Isp of 182 seconds.

The fifth test involved an asphalt-with-aluminum motor with a smaller, 1-inch core diameter, but still a 12-inch length. Again, another successful 6.0 second test, yielding an average thrust of 171 pounds and an Isp of 184 seconds. So far, no significant performance

gains have been achieved by adding the aluminum powder to the asphalt.

More Firings into the Night

James Mitchell had driven a long way to attend this event, and we were all determined to test-fire his motors, despite the hot, muggy weather and the mud - which by then was on everyone's nerves (and clothes). Chris Pickens came to rescue again with some delicious, home-made ice cream. Just what we weary infantrymen needed!

James came down from Tennessee to test home-made solid motors. He had expressed an interest in creating a hybrid motor, but using PBAN rather than asphalt as the propellant. Steve Mustaikis and I gave him the critical design information, such as the injector area, grain length, core diameter, and nozzle dimensions.

James' first test, performed just after sunset, involved an all-PBAN motor with a 1-inch core diameter and a 12-inch length. A successful 4.0 second test yielding an average thrust of 114 pounds and an Isp of 168 seconds.

James' second test, performed at night following a dinner break, involved a PBAN-with-rubber-and-charcoal motor with a 1-inch core diameter and a 12-inch length. A successful 6.0 second test yielding an average thrust of 129 pounds and an Isp of 202 seconds.

This is extremely good for a first timer! James has also had a very good success rate with solid motors. He builds all his own hardware and is quite a machinist. He has offered his services to Project HALO for building some hardware that we cannot do locally because of time.

End of a Successful, but Tiring, Day

It was the end to another good day at the HALO Rocket Motor Test Facility. The group agreed not to purposely test-fire motors at night again, not only for safety reasons, but also out of courtesy to the neighbors of Herman and Chris Pickens.

Overall, the performance was very good for all these tests. Ignition was excellent, startup looked good, and our Isp was above 200 seconds --- which is very good for asphalt fuel grain with a N_2O oxidizer. Steve has done an excellent job in his mathematical modeling of the chemical combustion for the asphalt-and-N_2O combination.

Based on the results of several rocket design reviews, we will be scaling up our propulsion system in order to improve the vehicle propellant mass fraction. The new design should yield a thrust of 340 pounds and a 10 second burn time, for a total impulse of 3400 lb-sec.

What's a Hybrid?

There has been a lot of local activity in rocketry with hybrid rocket motors, so this overview is presented to explain some basics.

Hybrid rocket motors offer significant advantages over conventionally fueled solid or liquid rockets. Among these advantages are low development and production costs, inherent safety, thrust throttling, motor restart, and environmentally friendly exhaust products.

Operation

Hybrid motors use a solid hydrocarbon fuel lining a combustion chamber and a liquid oxidizer that is stored in a separate tank. The oxidizer is sprayed into the forward end of the combustion chamber and is ignited. Hot oxygen vapors flow down the combustion port, vaporizing the flame zone that sits above the fuel. Heat from this flame vaporizes more fuel and thus the process is self sustaining, as long as oxidizer is available to continue combustion. The burning process is controlled by the flow of oxidizer down the combustion port. Less flow, less burning, and less thrust; no flow, no combustion, and thrust is terminated.

Manufacture

The hybrid rocket motor is easy to manufacture and uses widely available commercial grade materials. The rocket motors are produced by casting the fuel, a synthetic rubber, called polybutadiene, into a combustion chamber to form a solid. Polybutadiene is a liquid during the casting operation and cures in the combustion chamber to form a solid. Mold fixtures are used to form the desired fuel grain shape. The motor casting utilizes nontoxic, environmentally safe materials and standard industrial techniques. The oxidizer tank is manufactured using standard industrial techniques and uses a simple injector, similar to a conventional bathroom showerhead, to spray the oxidizer into the head end of the combustion chamber.

Unique Features

Hybrid rocket motors can not explode.

The hybrid motor utilizes a solid synthetic rubber fuel and liquid nitrous oxygen as the oxidizer. These propellants are separated both physically and by phase, one solid, one liquid; thus, the potential for mixing of the fuel and oxidizer leading to a catastrophic explosion is eliminated. Hybrid rocket motors are not classified as explosive devices and have a zero TNT equivalent.

Hybrid rocket motors can be produced quickly at low cost.

The production cost of the hybrid rocket motor is significantly less than that of an equally sized liquid or solid rocket motors. This is due to the hybrid's greater tolerance to manufacturing defects and their inherent safety. Hybrid rocket motors can be manufactured in light industrial facilities with no special safety requirements.

Hybrid rocket motors have greater economies of scale than either solid or liquid rocket motors.

The larger the solid or liquid rocket motor, the more explosive it is and the greater the cost of development, testing, production, and operations. Since the hybrid fuel is inert, safety is not a factor in the scaling of a hybrid motor. A three million pound thrust hybrid still has a TNT equivalence of zero.

Hybrid rocket motor exhaust products are environmentally friendly.

Unlike existing solid rocket motors, hybrid motor exhaust contains no HCl or Al_2O_3 . The propellant used in hybrid rocket motors, solid polybutadiene and liquid oxidizer, impose minimum handling and health hazards. Their combustion by-products are benign and nontoxic, resulting in minimum environmental impact.

Tri-F-O

By George Gassaway

The name Tri-F-O stands for Triangular UFO. This model is a relatively easy to build balsa model which flies somewhat similarly to the circular cardstock Flying Saucer introduced by Centuri in 1977 and also in plastic from by Estes years later.

Parts

The model is primarily built from 3/32" balsa. Non-wood parts required are one 2" length of 18mm tube for the engine mount, an engine block, and a launch lug for flying off 1/8" launch rods.

The plan shows full size templates for the struts and spin tab joint reinforcements, photocopy them so as not to cut into the newsletter to use them. Due to space limitations the triangular body side and spin tab shapes are shown 1/2 size, but those are easy to draw out. Cut out all parts, being careful that the wood grain runs in the right direction.

Prepare the wood parts by sanding the leading and trailing edges of the struts, the leading edges of the side plates for the triangular body, as well as the trailing edges of the spin tabs. Sand the 45 degree diagonal edges of the side plates to a bevel of about 45 degrees, so the joints will match up well when the three side plates are glued together.

Finish

If you want to have a smooth finish on the model, it needs to be done before assembly as most of the balsa surfaces cannot be easily reached by sandpaper after assembly. A coat or two of sanding sealer is all thats needed for a somewhat reasonable finish. However, the prototype had no sealer, it was sanded smooth then after assembly sprayed flat white for an undercoat and fluorescent orange for the final color.

Assembly

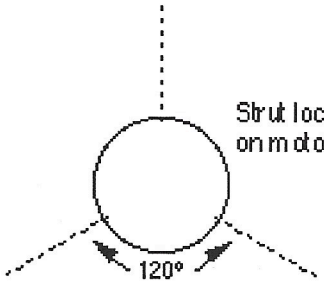
Use tape to hold the edges of the side plates together, to create the triangular body. The tape should go across the top of the corners, and the placement adjusted so that the three side plates are held aligned in the proper position for gluing. Use thin Cyanoacrylate glue (CA) along the inside of the corners (opposite of the side with the tape) to tack-glue the side plates together. After the CA has cured, remove the tape, careful not to pop the tack-glued joints loose. Than use more CA along the inside of the joints for a solid bond. Be careful not to use so much CA that it runs. After the CA is cured, use sandpaper to round off the sharp outer corners of the joints.

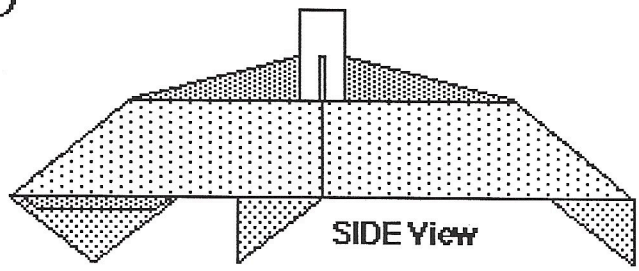
Use the guide in the plan to mark onto the engine tube the location for the 3 struts. Use a door jamb as a guide to redraw those marks into parallel lines for the strut roots.

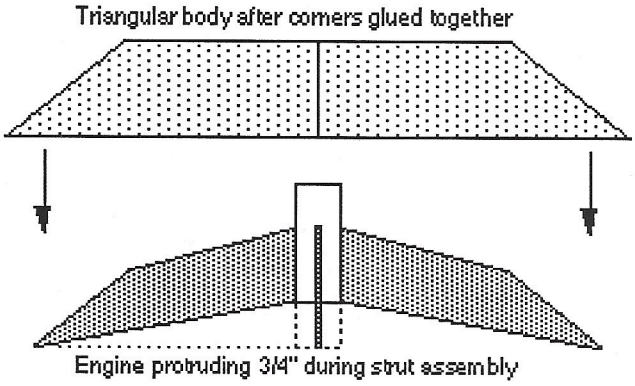
Insert a standard size 18mm engine into the engine tube, using tape for a friction fit so the engine top is flush with the top of the engine tube. This should leave exactly 3/4 of the engine protruding down from the tube. Place this on a flat surface. Hold one of the struts in position alongside the motor tube, with the trailing edge of the strut root even with the bottom of the motor tube. The tip of the strut should just barely touch the building surface, as the strut has 3/4 sweepback. Apply a little CA to tack-glue the strut into place on the engine tube, being careful not to let the CA run to accidentally glue the engine into the tube. Repeat with the other two struts. Remove the engine. Since the struts may not be exactly 120 degrees apart, lay the strut/tube assembly upside down into the triangular body assembly (also inverted). With the strut/tube assembly centered, carefully pry the struts if necessary to get them seated into the inner corners of the triangular body. Then apply CA for the root edges of the struts, along the tube, to permanently glue the struts to the tube (do not glue to the triangular body yet).

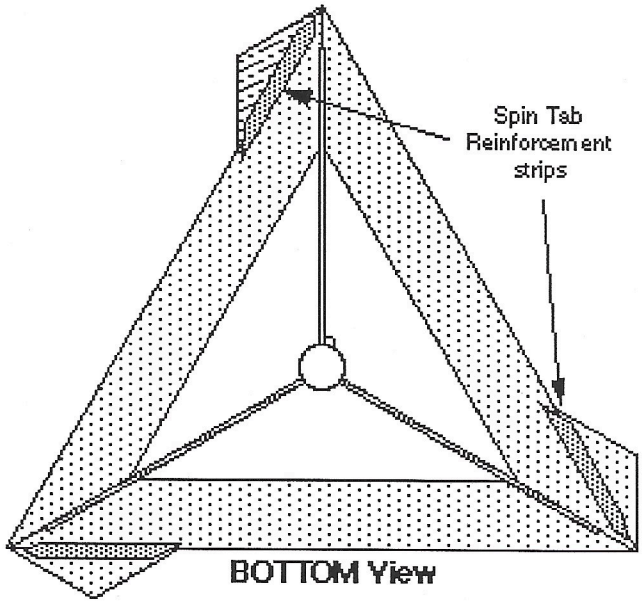
Insert the engine back into the engine mount tube, leaving it hanging out by about 1.5, with a slip-fit that is not too tight or too loose. Set the strut/mount assembly onto a flat surface, with protruding engine holding the assembly above the work surface. Carefully slip the triangular body down over the strut tips, keeping it centered. Press so that the engine tube/strut assembly also slides down the engine, until the triangular body touches the flat surface. If you have done this right, the engine bottom is still flat to the work surface, assuring the engine tube is properly aligned. If not, repeat the process to get it right. When you're sure it is aligned, apply some drops of CA to the strut tips to tack glue them to the

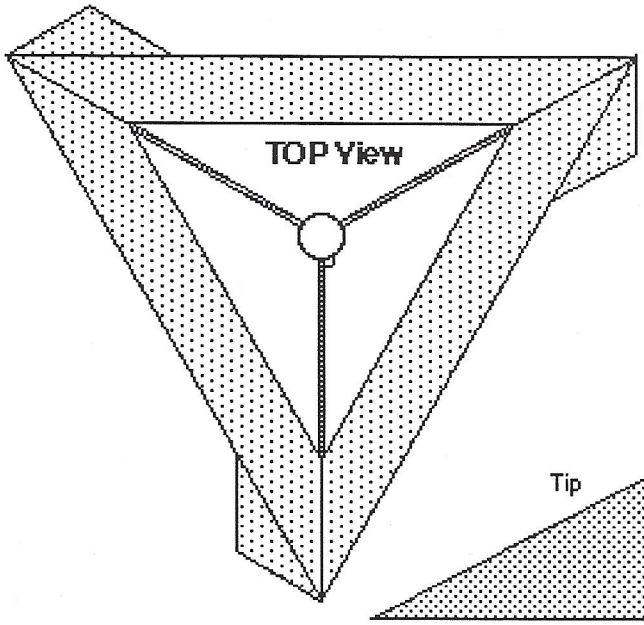
Tri-F-O

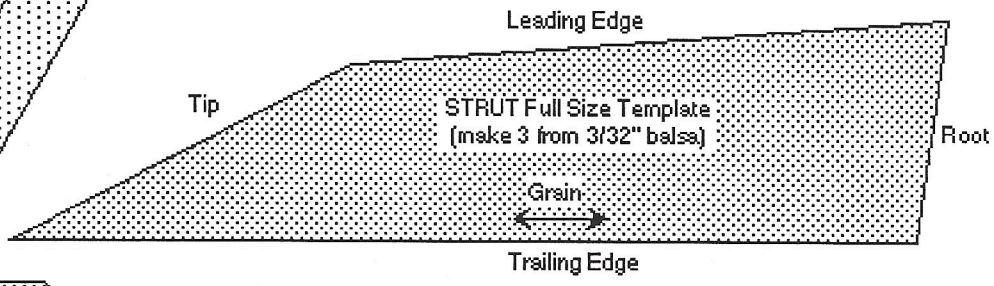




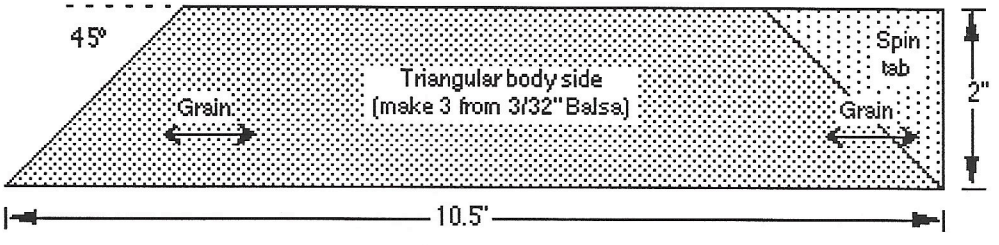








Body and spin tab shapes below shown at 1/2 size



inner corner joints of the triangular body. After curing, lift off the model from the surface and apply more CA to make the strut tip to body joints permanent.

To help even out any errors in alignment, as well as add some extra flair to the flying, the model uses spin tabs which also look like landing pads (OK, sort of...). Making sure the spin tab grain is in the correct direction, glue the spin tab root directly to the trailing edge of the side plate, so that the tab is the same angle as the side plate. Make sure all three tabs are located to the same corners in order to produce the desired spin. The prototype had a problem with spin tabs getting broken in transport, so the plan shows a 1/2" wide reinforcement strip. The reinforcement can be 1/32" plywood, or 1/16" to 3/32" balsa. Glue the reinforcement strip to the underside, half of it across the spin tab root and half across the side plate, as shown in the bottom view.

Remove the engine from the tube, and glue in an engine block (or 1/8" tall piece of burned out casing acting as an engine block). Glue a launch lug to the engine tube, at the root of one of the struts.

The model is now complete, other than adding a final finish. Color as desired.

Flying

Intended engine power is B6-0 and C6-0. B6-2 or C6-3 engines are *not* recommended due to the ejection charge firing too close to the ground. Tape the motor in for a friction fit.

When flown the model will climb to about 100 feet on a C6 motor, spinning slowly. When the motor burns out, the model will come to a stop almost immediately, then flip over and descend while rotating. Due to the very high drag, the model will land relatively softly. With no recovery system to prep, reflights go fast.....until you run out of engines!

HARA has a homepage! It is http://www.hats.org/hara.htm We are also compiling an email list of all MAX-Q readers and local rocketeers. To get on the list, send your address to brian.day@msfc.nasa.gov

Countdown 96

All HARA launches will be conducted at the SEP Range in Athens, Alabama, for high power and model rockets; FAA Waiver to 5,000' AGL unless otherwise noted. The range opens at 10:00 a.m. and closes in late afternoon depending on participation level and weather conditions.

March 14 HARA Meeting, 7:30pm HATS office
March 18-22 Huntsville Spaceweek
March 23 Open range; Sport Launch

April 11, HARA Meeting, 7:30pm HATS office
April 13, 14 Barrens Launch, Manchester, TN
April 27 PAYLOAD MISSION LAUNCHES and Open range; high power and model rockets; FAA Waiver to 10,000 feet AGL. Rain Date is May 4.

May 9, HARA Meeting, 7:30pm HATS office
May 11 PAYLOAD MISSION LAUNCHES and Open range; high power and model rockets; FAA Waiver to 10,000 feet AGL. Rain Date is May 18.

June 13, HARA Meeting, 7:30pm HATS office
June 29 Open range; Sport Launch

July 4-8 LDRS, National Launch Orangeburg, SC
July 11, HARA Meeting, 7:30pm HATS office
July 27 Open range; Sport Launch

August 8, HARA Meeting, 7:30pm HATS office
August 24 Open range; Sport Launch

Sept 12, HARA Meeting, 7:30pm HATS office
September 21 Open range; Sport Launch

October 3 Rocket City Classic XV, Model Contest and Exhibition, Old Airport, 9am-12
Oct 10, HARA Meeting, 7:30pm HATS office
October 26 Open range; Sport Launch

Nov 14, HARA Meeting, 7:30pm HATS office

Note: The SEP Program Payload Launches are April 27 and May 11. These launches DO have alternate rain dates. In the event of bad weather, the April 27 launch will be moved to May 4; likewise the May 11 launch will be moved to May 18.

Please contact Greg Warren, Director of the SEP Program at (205) 230-0353, Fax (205) 230-3380 for launch status, and Vince Huegele 881-2904 for HARA information.

HARA Membership Roster

Name	Address	City	ST	ZIP	Phone	email
Bennett, Tim	202 Purdy Rd	Huntington	TN	38344		
Buddington, Pat	120 Water Oak	Harvest	AL	35749	895-9583	
Burdine, Robert	Rt. 4, Box 335-1	Fayetteville	TN	37334	(615)433-8544	
Christian, Lary	1031 Monroe Rd.	Toney	AL	35773	828-6037	
Cornelius, Kevin	2519 Birchfield St.	Huntsville	AL	35810	859-4283	
Day, Brian	1120 Pratt Ave.	Huntsville	AL	35801	536-0508	brian.day@msfc.nasa.gov
Ford, Hans	7714 Logan Dr.	Huntsville	AL	35802	881-2888	
Gannett, David	274 Pleasant Valley Rd.	Union Grove	AL	35175	498-2841	dgannett@redstone.army.mil
Gassaway, George	1600 Oxmoor	Birmingham	AL	35209	879-3649	george.gassaway@the-matrix.com
Gustin, Carl & Alisha	4963 Mountainview Pkwy.	Birmingham	AL	36244	991-6643	
Hornbuckle, Gene	103 Norfolk Circle	Madison	AL	35758	721-1659	
Huegele, Vince & Sharal	11108 Argent Dr.	Huntsville	AL	35803	881-2904	vince.huegele@msfc.nasa.gov
Kelling, Randy	Box 153	Mt. Olive	AL	35117		
McCain, Wayne	Box 1323	Athens	AL	35611	233-6501	drwayne@companet.net
Misner, Lonnie	1011 Kennesaw Dr.	Huntsville	AL	35803	883-4911	
Pickens, Tim	104 Lindell Rd.	Madison	AL	35758	971-1566	tpickens@hiwaay.net
Prince, Cameron	Rt. 4, Box 171B	Decatur	AL	35603	773-6844	
Redmond, Neal	204 Gokee Rd.	Madison	AL	35758	721-1097	redmond#m#_neal@cpms.saic.com
Robertson, Joe & Sondra	122 Gibbon Dr.	Harvest	AL	35749	721-1338	
Russell, Jayne	103 Huxton Ct.	Huntsville	AL	33824	461-1411	
Saint, Scott	605 High St.	Florence	AL	35630	767-5892	
Sherrill, Matt & Lee	Box 3053	Muscle Shoals	AL	35662	381-5013	
Tygielski, Mark	6614 Robinhood Ln.	Huntsville	AL	35806	464-2668	mrt1@infoctr.chrysler.com
Waller, Richard	9208 Navios Dr.	Huntsville	AL	35803	882-0670	
Warren, Greg	P.O. Box 1934	Athens	AL	35807	232-0830	gwarren@companet.net
Weathers, Malcolm	610 Coronado Dr.	Decatur	AL	35603	306-0616	
HARA homepage						www.hats.org/hara

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HARA Membership Application Date _____

Annual Dues: $10.00 first family member, $5.00 each additional member.

Name_____Phone_____

Address_____

_____email_____

Age (if under 18)___ NAR / TRA Member? Y N, #?_____

Send to: HARA, 11108 Argent Dr., Huntsville, AL 35803

M A X - Q

Huntsville Area Rocketry Association
11108 Argent Drive
Huntsville, Alabama 35803

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