EXCLUSIVE!
PATRIOT
SCALE DATA!
TRIPOLI:  
Will It Stay, 
Or Will It Go?

The National Association of Rocketry is poised to make one of its most sweeping decisions ever. When the Board of Trustees makes the decision whether or not to incorporate Advanced High Power Rocketry (AHPR) into the association, it will have vast implications. One of the most interested parties will be the Tripoli Rocketry Association, Inc.

Assume, for the sake of discussion, that the NAR forms a new AHPR division. Suppose that the NAR makes provisions to certify and control Class B rocket motors up to "J" or "K" classes, provides a mechanism in which members can become qualified to purchase progressively larger Class B motors, provides insurance for AHPR activities, works with local, state, and federal officials (Continued on Page 21)

LEGAL, ACCOUNTING, PERSONNEL, AND DEPARTMENT

QUOTEABLE:
"Until the high power consumers recognize that the real "bargain man" is the NAR, but the public safety officials and legislators who will write restrictive codes and regulations with or without consumer input... this will be a tragic mistake for the future of sport rocketry in this country."

- Pat Miller, discussing the NAR-AHPR issue

COVER STORY:
The Patriot Surface to Air Missile Blast off, and you can see, with your own scale models, made from the exclusive idea presented in this issue (US Army photo)

CREDITS:
Don't play this newsletter backward on your stereo. Don't do it! There are no subliminal messages! And now we want that fancy white boy back. See:

- Dying Boss: Jim Hickle, W1CC, Report to Mr. Mac M.
- Slides: Other folks been in contact with James Ryan, George, and Society Bob, Otho, and Don and Terri Lee, Gary, Mary, and the KGB.
- Tony Williams gets special thanks... wonder if he switched to pins... The Mary and Gary, Carmen and Ronald, and Sally and Harry... Beck and Bob, Larry, Gary, andminer Ted.

That's all, Hammers, Don't hurt em... bye!

IMPORTANT STUFF

SNOAR NEWS will be published for a few more issues by SNOAR, NAR Section #537.

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Subscriptions are no longer available except to get the remaining few issues to be published. Contact Matt Steele to get more information at 2301 Branson Rd., Huntsville, AL 35806.

You can reach our editorial offices at: SNOAR NEWS, PO Box 195, Huntsville, AL 35802.

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Publishing Funds: Courtesy North Coast Rocketry

Published with a Mac SE and a Laserwriter UNX.

Th, Th, Th, That's all, folks!
Introduction

Model rocket engines were first flown in a cluster in the very early days of the hobby, 1958. Back then, clusters were the only way to have high liftoff thrust. The only engine available was the M.M.I. type A engine (equivalent to an A3-5). Yet today with wide availability of many types of engines, including high power-high thrust D, E, F, and G engines, models using clustered engines are still with us.

Right away it should be pointed out that clustered models are trickier to fly than most. They require special attention to flight preparation of the engines. If an engine fails to ignite there will be an imbalance in thrust which will cause the model to pitch over during launch, reducing the altitude capability and sometimes crashing into the ground while thrusting. Therefore, it is important to understand the design ignition techniques of clusters before trying your first cluster model.

It is generally best to use a single high power motor if it can fulfill your needs as well or better than a cluster. Some people will use clusters as a lower cost alternative. A model using a cluster of three D12's can fly in an F class event for about half the price of a suitable thrust composite F engine. Some people like the aesthetic "fire n' smoke" exhaust of clustered black powder engines, since early composite engines had little or no visible exhaust. And of course, some scale type models are more realistic if they use clustered engines as the full size vehicles did.

Clustering is usually used to develop high thrust for heavy rockets or to lift heavy payloads. The modeler needs to decide how many engines are necessary to do the job, depending on the liftoff mass (including the engines), the desired acceleration rate, and required performance. When engines are fired simultaneously in a cluster, the total thrust is equal to the sum of the thrust of all engines used. Likewise, the cluster total impulse is the sum of the total impulse of all of the engines. Thus a cluster of three G6 engines will be roughly equivalent to a hypothetical E18 engine of 27 Newton-seconds (three engines times 9 n/sec per engine). The time/thrust curve also triples in thrust value, such that the maximum thrust of the cluster will be 40 newtons (13.33 newtons max thrust per engine). It is very important to keep these in mind when deciding on the number of engines, their n/sec rating, their average and maximum thrust, and the design and structural strength of the model they will power.

Without using Estes TR-10 Altitude Prediction equations or a computer program, you can get a general idea of the performance by comparing your planned cluster design to a known similar single engine rocket with roughly the same drag. If that single engine design flies up to 300 meters on a D12 and weighs 7 ounces at lift-off you can expect your similar cluster model to fly to about 300 meters if you use two D12 engines and have a liftoff mass that is double, 14 ounces. This is a big oversimplification, but will be a good ballpark guide for initial power and performance considerations.

Cluster Configurations

Many cluster designs use three engines, in part because that often is a good tradeoff for performance and economy (obviously the more the engines, the more expensive the model is to fly). Three engines also happen to fit perfectly in a triangular layout inside certain larger body tubes, such as three BT-20 mount tubes in a BT-60 or three BT-50 mount tubes in a BT-70. A parallel layout of three engines is also good, with the three engines side-by-side, although with some designs this presents more frontal area and thus more drag. This includes the "strap-on" approach, which is simply adding two small engine pods to the sides of the model. It adds some expense (two small nose cones, plus longer mount tubes), but does avoid the problem of sealing the gaps between the engine mount tubes in the main body (just use a normal single engine mount in the main body).

The two-engine cluster is uncommon, although it is certainly the cheapest and most reliable way to cluster (the fewer the engines, the fewer to potentially fail to ignite). It is possible to perform some slick modeling tricks to put two engine mounts inside of a body tube that is less than double the diameter, by compressing the main body tube into an oval cross section at the tail. In this manner, two BT-20 mount tubes can fit inside a BT-55 or with extreme care two BT-50 mount tubes can fit in a BT-60. This type of pinched tail method usually requires that the model use 4 fins, as it is very tricky to align three fins on an oval cross section tube.

Typical Time-Thrust Curve for Single Motor vs. Clustered Motors
Common Cluster Layouts

3 Motor Tri-Oval

3 Motor Core/Strap-ons

3 Motor In-Line, 3 Strap-ons

3 Motor Circle

7 Motor Star

3 Motor Inboard/Outboard

4 Motor Diamond

2 Motor Oval

4 Motor Square

2 Motor Circle

3 Motor In-Line
Four engine clusters can do the jobs that three can't. The engines can be aligned in a square pattern equally with a small space in the center, or a diamond pattern with two mount tubes touching at the center and two others flush against those center-most mounts. There are not many reasons to use four engines aligned parallel. With a four engine square or diamond cluster you can simplify things a bit by just using two of the engines' ejection charges to activate the recovery system (unless the model has a lot of body tube to pressurize), the other two engines' ejection charges vented. This can let you use the proper delay engines for two of the mounts and any delay or even boosters for the other two (just be SURE to put the right engines in the right mounts!). Another thing this allows is flying the model with just two engines on some occasions, if it is light enough to fly safely on just two engines.

The four engine square technique also lets you use a "Mix n' Match" approach to clustering. You can tailor the thrust characteristics of a given model by combining two distinctly different types of motors to get a spectacular effect. For example, two D12's clustered with two E6 motors has all the smoke of a black powder liftoff with the long burn of the E6.

There are many different engine arrangement combinations possible. While there have been over a dozen model rocket engines clustered successfully, there really is little reason to cluster so many. The use of two, three, or four engine clusters are adequate for most any legitimate clustering requirements. The more engines used, the more likely there will be one engine to fail to ignite (if 1 out of every 30 engines fails to ignite, a three engine cluster will have one failure out of 10 flights, a six engine cluster one failure out of 5 flights). It is also easier to spot trouble or avoid mistakes when working with just a few engines.

Regardless of the number of engines used, the engines must be arranged so that their thrustlines and thrust levels equally lift the rocket through the rocket's center of mass. In this case the center of mass should be considered from rear-view roll-axis aspect, but we will refer to it as the centerline. The centerline should run through the center of the model's main body tube for all but the most unusual designs. The engine arrangement should be equal such that if a triangular three engine cluster has one engine placed 1/2" away from the centerline, the other two engines must also be.
Oval Rocket Centering Detail

Typical Oval Rocket Cluster Applications
placed exactly 1/2" away from the centerline. Further, those
two engines must be spaced equally away from the first
engine just as a three finned rocket has the fins spaced equally
apart. The way to determine the angle is to simply divide 360
by the number of engines that will be at the same distance
from the centerline (you probably know by instinct that a
three engine triangular cluster should have the engines spaced
120° apart, but might not know that for a five engine
pentagonal cluster the engines would need to be 72° apart).
Many engine combinations will take away the need to
calculate the arrangement, such as three BT-20's fitting
perfectly aligned in a BT-60, but keep this in mind for unusual
combinations.

Avoid placing the engines far away from the model
centerline, such as gluing engine pods to the fin tips.
Increasing the engine distance from the centerline increases
the effect of a late or failed engine ignition to pitch the model
twice during launch. The closer together the engines are to
the centerline, the less pitching effect there will be from a late
or failed engine ignition.

Clustered models almost always are more tail-heavy than
single engine designs, and the more engines used the more
tail-heavy it will be. Therefore, clustered designs usually
require more fin area or noseweight to be stable. If the cluster
model is designed to carry a payload, it is likely that the
payload will be heavy enough to allow the model to be stable
with normal fin size. It is a good idea to build all of this model
except for the fins, insert all engines and additional liftoff
masks (such as payload & recovery system) in their proper
locations, and place some weight approximating the intended
fin weight at the tail. Balance the model horizontally to find
the center of mass. If the center of mass is more rearward than
you expected, or your stability calculations planned for, you
will have to increase the fin area or add noseweight to
compensate. Unstable single-engine models are safety
hazards, clustered ones are even more so.

When the fins are made, be sure they are strong enough to
take the high speed and resulting high stress that most cluster
models achieve. C-Grain 1/8" balsa or 1/16" plywood is
sufficient for most clusters of three C engines. Higher power
models using black powder engines can require fins of
up to 1/4" thick balsa or 1/8" plywood. The fins must be
securely mounted to the model, using thick strong glue fillets
(Epoxy may be somewhat heavy, but it does a good job). Extra
strength can also be had by the "glue rivet" method of
punching a few small (1/16-3/32" diameter.) holes into the
main body tube along the fin root area. Rub some glue into the
holes before gluing the fins on so that the glue will form
"rivets" inside the body tube that hold the fin to the body tube
more securely. Some models like the older Enerjet 2650 achieve
good fin bond strength and perfect alignment by having the
fins glued in-between where two of the three triangular
configuration engine mount tubes meet, a trait many cluster
models use today.

It is very important to fill any gaps between the clustered
engine mounts and the main body tube. Otherwise, the
ejection gases will escape through the gaps and not eject the
recovery system. An easy way to do this with these BT-20
mounts in a BT-60 is to use an AR-2060 centering ring as a gas
seal around the outer edges of the BT-20 mounts, but the
center gap still must be filled. The long-time method for filling
gaps is to mix a little white glue with facial or toilet tissue and
jam portions of the glue-soaked tissue into the gaps. This is
somewhat messy, but effective. It is neater and lighter to cut
out a proper shape seal from 1/32 plywood and glue it into
position. Just make sure it is securely glued, especially around
large gaps. For models that have some free space between the
outer engine mounts and the inner main body tube, it is best
to make special centering rings to align the engine mounts.

The centering rings should be strong enough to take the force
of the maximum thrust of the engines. For models with a total
maximum thrust up to 80 newtons (two D12's), 1/32 plywood
is adequate, otherwise 1/16 or thicker plywood may be
needed. If you do make special centering rings, be very careful
that the holes are spaced equally apart from each other and
the center. If not equal they could cause the thrustline to be
out of alignment with the center of mass, with thrust-induced
pitching problems.

Whether centering rings are used or not, all engine mounts
must be aligned equally, usually exactly parallel to each other
and the main body tube. If an entire cluster mount is a couple
of degrees out of parallel from the roll axis centerline, the
model will pitch to one side during thrusting causing a non-
vertical flight at best, an arcing boost into the ground at
worst. It is not too difficult to build cluster mounts correctly,
but this is what may happen if you're careless.

It is possible to reduce the effects of an engine failure by
centering the engine mounts inward toward the center of mass.
It can also help to cause the rocket to roll by slightly tilting the
engine mounts equally in the same clockwise or
counter-clockwise direction. The rolling effect will help to
even out the pitching effect if an engine fails to ignite, but
even this may not keep the model from crashing.

You can mix and match groups, achieve a 3 engine cluster
with a conventional triangular three engine cluster inside of
the main body tube and add two "strap-on" type engine pods
to the outside spaced 180° apart. That can be considered a five
engine cluster with a three engine sub-cluster and a two
engine sub-cluster. It is important to use the same engines for
equal thrust levels and burn times. However, in a model with
sub-clusters it is permissible to use one type of engine in one
sub-cluster and another type of engine in another sub-cluster,
such as three C6's inside the main body and two B4's in the
outside engine pods. Here are some other examples of
sub-clusters:

A four engine square or diamond cluster can also be
considered as having two sets of two engine sub-clusters.

A three engine parallel cluster can be considered as having
a conventional single engine (center engine) and two engine
sub-cluster (side engines).

The performance of clustered models can be improved by
dropping burned-out engines or pods containing burned-out
engines with a sustainer engine or engines to continue
accelerating the model. An example of this would be a model
using a F7 engine with 8 second burn in the main body and
two D12-0 engines with 1.5 second burn as "strap-on" engines.
Such a model would have very high thrust to accelerate
quickly until the D engines burned out, then they could be
made to drop away so the F7 could continue to push the
model without the extra weight and drag of the D12's and
their mounting pods. Cluster-staging can achieve much the
same effect and is usually simpler. An example of
cluster-staging would be a first stage of three D12's arranged
in parallel so that the center engine can directly ignite the
upper stage engine (another D12, for example). Such
cluster-staging is well-suited to flying payloads.
Cluster Igniters

There are several ways to ignite two or more model rocket engines simultaneously. We are limiting this article to igniters used for black powder type engines as sold by Estes and FSI. Engines using composite propellant, as sold by Aerotech and Vulcan Systems, often have special ignition needs that most black powder type igniters do not fulfill.

The first model rocket clusters were ignited by using relatively long 3-4" Jetex type fuses leading from each engine to a central point underneath the model where one nichrome igniter set off the whole group. This left a lot to be desired. The fuses were unreliable and sometimes the long slow-burning fuses resulted in some engines igniting late or not at all if the rocket liftoff caused the fuses to be yanked out of the nozzles.

Later on with the improvement of nichrome type of igniters like the "Astron" type, it was possible to achieve near-simultaneous ignition of all engines by using an electrically activated igniter in each engine. This required very special care to avoid any shorts or poor connections or one or more engines would fail to ignite.

Reliability was improved with the Centuri "Sure-Shot" igniters. The Sure Shot consisted of a piece of nichrome wire and a short fuse wick. Electrical current through the nichrome wire heated it enough to set off the short fuse wick, which burned up into the nozzle to ignite the engine. It was slightly slower, but was consistent and not so slow as to have uneven ignition. The demise of the Sure-Shot came about when the special fuse wick could no longer be obtained by Centuri.

The Estes Solar igniter was Estes' answer to the Sure-Shot, but has never been quite as reliable. The biggest feature of the Solar is that it takes less current than most other igniters so that just four AA batteries are adequate to set it off. Some people have had success with Solar for cluster ignition, but they are not the best way to go for clusters. If Solar igniters are used for a cluster, choose igniters which have a good thick pyrotechnic coating (the black "blob" on the end of the igniter), as some Solars have more of a coating than others. The pyrotechnic coating is heated by a very thin nichrome wire element until it ignites, so obviously the coating is very important to the reliability of ignition. Extreme care must be taken in installing the igniters so as not to break the fragile nichrome element and hooking up the micro-clips to avoid shorts or loose connections.

In the early 1970's John Langford developed cluster ignition by using igniters incorporating camera flashbulbs, called "flashbulb ignition". It consisted of using one flashbulb and one short Centuri Sure-Shot igniter fuse wick. The flashbulbs can be wired up very securely and insulated from shorts, and require little current to set off (so little current that checking continuity can provide enough current to set them off). The heat of the flashbulb going off is enough to ignite the fuse wick, which in turn ignites the engine. The Flashbulb ignition method has proven over the years to be the most reliable method for igniting black powder engines.

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Cluster Rocket Wiring Schemes

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Wiring Igniters

All igniters must be wired in PARALLEL, so that the current will be sure to pass through all igniters properly. Parallel wiring means that each of the two igniter leads are connected to the firing leads directly, not through another igniter. If the igniters are wired in series, with the igniter leads "daisy chained" from one to the other, it is almost certain that one igniter will happen to go off first and break the current flow to the other igniters, like a bulb going out in series-wired Christmas tree lights.

There are several ways to wire up the igniters in parallel, depending on the number of engines and the arrangement of the engines. The best way is to have extension wires coming from the igniters, as with Flashbulb ignition. The extension wires can be medium gauge hook-up wire about 6" long with 1" of insulation removed from each end. As with flashbulb ignition, wrap one end of the extension wire around each igniter lead, and insulate with tape. It is modeler's preference whether to add the extension wires before or after the igniter has been installed in the engine. The extension wires can be bundled together, one bundle for the positive (+) igniter lead and one bundle for the negative (-) igniter lead. The bottom end of positive and then negative extension wires twisted together to form the two bundles. In truth, igniters are not polarity sensitive, but it is a good idea to think of the two igniter leads as positive and negative for purposes of connecting them in parallel with other engines. You don't want to connect BOTH igniter leads to the same firing lead!

If you do not use flashbulb ignition or add wire extensions to conventional igniters, you can use the tried and true methods of the past. A twin engine cluster can be easily done by twisting the two igniter leads together if the two engines are close enough and the igniter leads are long and flexible enough. The catch-all is to make up extra sets of micro-clips to do the extension job. Rather than use a pair of micro-clips for every engine, it may be possible to twist together some ignition leads. Remember to keep the wiring in parallel, it would be a good idea to sketch out what you need to do and use the sketch as a sort of "wiring checklist". Also double check that no wires or micro-clips are shorting.

Generally, cluster ignition requires much more electrical current than single engine ignition. A 12-volt car battery is preferred for all cluster launches, especially non-flashbulb
ignition types. The firing system should not use light gauge wire for the firing leads, as the thin wire may not deliver enough current to fire the entire cluster. Use at least 18 gauge wire (most extension cords are this gauge) or even 16 gauge.

**Flashbulb Preparation**

The following are needed for flashbulb ignition:

- Flashbulbs (individual AG-1 bulbs, or bulbs removed from Flashcubes).
- Igniter fuse wire (Sure-Shot or Thermallite).
- Thin electrical hook-up wire (about 20-24 gauge).
- Masking tape, pliers, and knife or wire strippers.

If the bulbs come from conventional Flashcubes, carefully remove the bulbs from the plastic case. The wire leads from Flashcube bulbs can be easily straightened for wire hook-up.

For most clusters about 5-6 lengths of hook-up wire will be sufficient, so cut two lengths for each engine (preferably using two colors of wire). Remove one inch of insulation from each end of the wire. Twist the bare wire end around one of the flashbulbs. If the flashbulb is an AG-1 type with wire loops, it will be necessary to twist and crimp tightly to assure of a secure connection, but be careful not to damage the bulb or wire. If you cannot get a secure connection any other way, it will be necessary to solder the lead wires to the bulb leads. Put a wrap of tape around the wire connection to the flashbulb to electrically insulate it. Repeat this procedure for the second wire to the flashbulb.

Sure-Shots are no longer available, so a substitute must be used. Thermallite is a professional pyrotechnic fuse somewhat similar in burning rate and consistency to the old Sure-Shot wick. However, it has both a protective plastic wrapping and a spiral-wrap of nichrome wire. The plastic wrapping must be completely removed. At least part of the nichrome should be removed to insure the wick itself contacts the bulb surface for proper heat transfer to ignite the wick. (Removing all of the nichrome wrapping is best if the wick is not so brittle that parts of it break away when it is bent to go in the nozzle.) Thermallite is available from companies selling high power rocket engine supplies such as FSI (it is their standard igniter) and North Coast Rocketry. A piece of Thermallite one inch long is sufficient for most engines, but for engines with unusually deep nozzles and engine cores longer wick length will be necessary.

Place the fuse wick in the nozzle of the engine and then push the flashbulb up snugly against the nozzle. This will cause the fuse wick to bend out at an angle, so bend it back flush against the side of the bulb (this will give the wick a slight "2" bend). Check the wick for any major breaks as the thermallite is a bit brittle, discard the wick and try again if parts of it have broken off. Use a 1-2" long piece of masking tape to secure the fuse wick to the side of the flashbulb. It is important to be sure that the fuse wick is touching the side of the bulb so that the flashbulb heat will be properly transferred to ignite the fuse. It is also important to use masking tape for this, as other tapes such as Scotch cellophane tape can melt and literally let the fuse fall out before the engine ignites.

At this point you can separate the prepped flashbulb from the engine and wait until shortly before flying to continue prepping. There is a slight possibility of static electricity setting off the flashbulbs, some some people prefer not to have the flashbulb igniters in the engines until needed. In any case it is a good idea to twist the two wire leads of each flashbulb together temporarily to provide a short against static electricity during storage.

In preparing there are two ways to go, install the engines in the model first and then install the flashbulb igniters, or vice-versa. I prefer to have the flashbulb igniters fully prepped in the engines and then put the engines in the model, being careful not to put stress on the flashbulbs.

The final step in preparing each engine is to make a masking tape "collar" around the base of the engine so that with 3/4" wide tape about 1/4" sticks to the base of the engine and 1/2" protrudes down. Put the flashbulb igniter into place inside the collar, with the fuse wick inside the nozzle. Then press the collar down around the flashbulb to secure it to the engine. For 24mm diameter (i.e. D12) engines a longer collar may be necessary to properly secure the flashbulb.

With the engines installed into the model, connect the ignition wires together (undo the temporary twist shorting the flashbulbs first). This will be an easy test if the wires are color-coded, just connect all of the wires of one color together and then connect the wires of the other color together in a separate bundle. If not color-coded, be sure that only one wire from a flashbulb goes to one bundle, and that the other wire goes to the other bundle. If two wires from the same flashbulb go to the same bundle, that engine is not going to ignite.

Temporarily short the two wire bundles together until the model is put on the pad and nearly ready to launch.

Before hooking up any ignition system, understand this. Flashbulbs require so little current to go off that MOST regular rocket model rocket ignition systems can short them off during a continuity check. **DO NOT CHECK CONTINUITY!** The simple way to avoid problems is to disconnect the power source from the launch system, if possible, or otherwise make certain that no current whatsoever can flow through the firing leads. This means making certain the safety key is not in place. Once the firing leads have been connected in the separate wire bundles, remove the temporary short between the bundles.

When ready for flight, do not check continuity, or the model may take off earlier than you want. Since most firing systems have the continuity automatic when the safety key is inserted, either remove the continuity light bulb or do not activate the safety key until the desired ignition time, pressing the firing button simultaneously.

**Launching Cluster Models**

It is preferable to use a large diameter and longer than normal launch rod when launching clustered models. A 3/16" diameter rod 4" long is the minimum for clusters of 20 n/sec or less, and rods up to 1/4" diameter and 6" long are highly recommended for model rocket clusters over 20 n/sec. If one or more engines ignite out of sync with the others there can be enough uneven thrust for the model to bend a regular 1/8" diameter rod. The extra rod length will keep the model straight for a longer distance until hopefully all engines are running, or at least give the model a faster vertical velocity before it is free to pitch over.

A good blast deflector is needed too, as the multiple engines create a lot of exhaust. One good effective blast deflector is a 90° elbow-bend piece of 3-4" diameter duct pipe, available at most hardware stores for about $2-3. This type of deflector will disperse the exhaust horizontally like most full
1) Flashbulb Assembly

2) Completed Flashbulb

3) Insert the Wick

4) Tape the Igniter to the Motor

5) Tape the Leads Together
size rocket launch pads. When this type of deflector is mounted at least a couple of feet above ground level, it is extremely unlikely that the exhaust can cause a fire in the launch area.

Carefully set the model on the pad. Be sure that the launch system is turned off or otherwise disabled. Hook up the micro-clips to the appropriate extension clips or extension wire bundles. Give the wiring connections one last look, and when everything is right clear the pad area.

Enable the launch system, but if flashbulb or other sensitive igniters are being used, do not check continuity (on most systems, this means don't insert the safety key until the moment of launch). Alert everyone in the area that a cluster flight is imminent, both for safety and to be sure they don't miss the excitement. Count down and launch. You should be rewarded with a pleasing roar of multiple engines and the sight of lots of "fire n' smoke" pushing your model quickly into the sky....

Below: Ed Holland's Mini Katana lifts off under the cluster power of an Aerotech E15 and seven Estes B4 motors!

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### A DIVISION

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THE MISSILE

The PATRIOT Surface to Air missile is a mainstay of NATO's defenses in Western Europe. The missile was introduced to replace the HAWK and NIKE HERCULES air defense missiles in the early 1980's. The missile is manufactured by Martin Marietta Missile Systems in Orlando, Florida. The prime contractor for the Patriot System (including radars, communications system, missile transporters, etc.) is the Raytheon Company of Andover, MA.

Recent tests with upgraded software have allowed Patriot missiles to intercept and destroy incoming ballistic missiles (Lance missiles have been used in tests to date). Major software upgrades are planned for units deployed in Europe and Japan to take advantage of this capability in the next ten years.

THE MODEL

The Patriot makes a great scale, sport scale, and scale altitude model. In fact, it has placed very well in scale altitude competition, including a first place in D Scale Altitude at NARAM-27.

If you look around, you can find a number of nose cones that will work well for sport scale versions of the Patriot. Good candidates are the Estes BNC-50K and the PNC-80K. A BT-80 sized model would be particularly impressive.

The fins can be built up from sheet plastic or cast from a plastic casting compound, using an RTV silicone mold.

The tunnels can be constructed from Plastruct sheet plastic and putty.

Markings can be applied with paint, dry transfers, and decals. Five different colors are needed to paint the model. We have had a lot of luck using black decals to make the roll pattern stripes.

The lettering on one side of the missile ("U.S. ARMY") appears to be in Helvetica font, which is easy to find in many sizes of dry transfers.

For best performance, fly the model from a tower.
End View
Cable Tunnel and Fin Layout
(Enlarged View)
Patriot Fin

Full Size Dimensions

| G.C.G. | 6 Aug '85 |

Drawing Scale: 1" = 5"

Notes:

(1) Paint Ablative Red

(2) Four fins required for missile assembly

(3) Leading and Trailing edges are slightly rounded
Notes

(1) Patriot uses two cable tunnels

(2) Cable Tunnels are spaced 180° apart, 45° between fins
Patriot Paint Pattern

0° and 90° Rotations

G.C.G. 11 Aug '85

Color Key

- White
- Black
- Ablative Red
- Chromate Green
- Silver: Tip of Nose

Tip of Nose is Silver
Patriot Paint Pattern
180° and 270° Rotations
G.C.G. 11 Aug '85

Color Key
- White
- Black
- Ablative Red
- Chromate Green
- Silver: Tip of Nose

Tip of Nose is Silver
From Your Sometimes Sober Editors
(Continued from page 2)

Editorial

members will now also be offered by the NAR, leaving
Tripoli with only the ultra-exclusive L motor and above
rocket category.

Can Tripoli survive such a situation?
If Tripoli continues in its current state, I'm afraid that the
answer is no. Look carefully at Tripoli today and you will
see the following significant problems:

1) A lack of a timely publication. One of Tripoli's biggest
benefits is the publication of the informative Tripoliian. One
of Tripoli's biggest problems in the past two years has been
to maintain a regular publication schedule for the Tripoliian.
Unless an individual comes forward and is willing to devote
the time and effort that Tom Blazanin has in the past, Tripoli
will lose one of its biggest benefits. To date, it doesn't look
like this problem is solved.

2) Lack of coherent direction and leadership. Tripoli went
through a terrible leadership crisis that ended in Chuck Rod-
gers replacing Ed Tindell. The crisis was damaging and de-
structive to the organization as a whole. Chuck has stepped in
and done a considerable amount of damage control. But
he is being hampered by a lack of support by the Tripoli
Board (many of the members have never even met each oth-
er) and by a perception that there is an "East vs. West"
problem. With the leadership focusing their efforts on resolving
internal problems and squabbles, there is little time left to
deal with the real issues that Tripoli needs to address, like
the insurance, motor certification, and membership growth.

3) Lack of a stable organization. Every time one looks
around, things are changing in Tripoli. The headquarters has
been moved three times in about the last year. The national
meeting location and date was not decided until early this
spring. The magazine editors, motor certification effort,
and NPPA representative have all been "in transition" in the
past year.

All of these problems point to a more basic problem: Tripoli
is not being supported by its members. With the exception
of Tim Blazanin (who is a common thread through all that
works or worked in Tripoli), no one has stepped forward and
assumed the necessary leadership positions in Tripoli for any
length of time. No one wants to commit to edit the magazine;
no one wants to organize LDLR; no one wants to travel to
Board meetings and commit to making the key decisions. The
only thing that most Tripoli members want to do is fly high
power rockets. That's fine for a hobby, but it will do nothing
to insure that Tripoli will exist as a hobby organization.

Unless Tripoli members step forward and volunteer to take
care of the key positions that make an organization work,
Tripoli won't survive. Right now, it's questionable whether
Tripoli's membership has reached the critical mass (in both
number of volunteers and type of people likely to volunteer)
to sustain the organization.

If the NAR steps in and offers similar service programs,
eventually Tripoli will lose the bulk of its members to the
NAR, largely due to the NAR's established volunteer base. If
that scenario comes about, the NAR will probably be blamed
for Tripoli's demise.

The real reason for Tripoli's demise (if it happens), though,
will be a lack of commitment on the part of Tripoli's member-
ship. If enough Tripoli members band together and hold
the organization together, then Tripoli will survive. If the sit-
uation continues as it exists today, then Tripoli will probably dis-
appear in the next few years. Given the track record, it's a
good bet that the latter will take place.

Of course, I'd love to be proven wrong.

J. D. McNeil

THE IGNOMINIOUS ADVENTURES OF
FRANK AND KATE, HIS PET CIGARETTES

WHY ARE ALL THOSE PEOPLE WATCHING ME, KATE? I'M ONLY LOFTING A SMALL CANNISTER OF TOXIC WASTE?

RELAX, IT'S JUST SOME MEMBERS OF THE NAR-ASPICA SUB-COMMITTEE .... THEY'RE JUST HERE TO MAKE SURE YOU DON'T DO ANYTHING DANGEROUS ..... LIKE LAUNCH A HAMSTER!
Aerotech's industrial division, ISP, has just announced a new line of reloadable motors from G to N class in a variety of diameters, lengths and total impulses. The cases and end closures are aluminum, and what is replaced is the propellant, liner, nozzle, and delay section. The initial cost is high, but after a few flights, the cost of the reload kit (RK's) is very inexpensive, especially if you are flying the higher impulse motors, like K to N. The best part is that motors up to and including the I motor are CLASS C SHIPABLE! They will be rolling out these motors at Black Rock II and will have some at NARAM for show. Some of the larger ones will be flown at LDRS-9 in Hartsel, CO.

Three IRA terrorists that were Tripoli members were convicted of conspiracy to create surface to air missiles. The plan was to manufacture a missile that could knock down a British helicopter, using model rocket type technology. Former Tripoli President Ed Tindell testified in the Boston case for the prosecution, after the FBI conducted a thorough investigation of Tripoli records. The total sentences for the group run to 54 years and $2 million in fines. The long term implications for power rocketeers could be much stricter control and regulation.

There is promising news regarding the FAA and the 3.3 lb change to the FAR's. After the NAR pressure was applied through various political connections, the following letter was received:

"Dear Mr. Miller:
This is in response to your May 13 letter to Administrator Busey and me regarding your petition to amend Part 101 of the Federal Aviation Regulations.
We have placed your petition on the Federal Aviation Administration's regulatory schedule and we expect to publish a proposal regarding your request within the next 12 months.
The study commissioned to analyze technical aspects of your petition has been completed and its results will be included in the proposal.
Sincerely,
William H. Pollard
Associate Administrator for Air Traffic"

North Coast Rocketry has obtained a number of Coaster E and F motors which it will be offering for sale. The first lot of 10 each of the E and F motors is available now, with a limit of one of each type motor per person. For more information and pricing, please send a SASE to NCR, P.O. Box 24488, Mayfield Hills, OH, 44126. The guy we got them from told us he had actually flown about 10 of them, and they all worked fine! It makes you want to scream!!

Tripoli Headquarters is up and running at a new address: Tripoli Rocketry Association, Inc., P.O. Box 40475, St. Petersburg, FL 33743-4075.

The NAR-AHPR Commission will complete its work next February, with an interim report due at NARAM-32. The Board will also conduct a question and answer session at NARAM to gain a sense of what the NAR membership wants. The Board will eventually decide what direction the NAR will take in regards to service expansion for AHPR programs.

NARCON-6 may be held this spring in Huntsville, Alabama, if the NAR accepts a proposal now on the table. Hosts would be Matt Steele and the Rocket City Aces, and the idea would be to revive the national convention on a rotating basis, like NARAM is handled.

Both partners in the now-defunct "rocket motor manufacturing company" Reaction Labs have had their previous phone numbers disconnected, and the new ones are unlisted. The P.O. Box for them has also been closed. They were probably tired of hearing people complain about their motors, wanting their money back, or asking why it was taking so long to get their orders. Certainly, the legitimate rocket community won't miss them.

Rocketflight is experiencing manufacturing difficulties with their black powder motors. The black-powder, 38mm diameter, G100 motors are made in Indiana. They are kind of like large, heavy FSI F100's, except that 1) they're louder; 2) they're more powerful; and 3) up until recently, they've been more reliable. Rocketflight is testing out new casing materials for their G100 motors, because their old supplier started sending them poor-quality ones. Rocketflight is developing a 29mm F motor, with about 50-55 newton seconds total impulse. That's all you can squeeze out of 62.5 grams of black powder. We understand that the F motor will be submitted for NAR certification when developed.

Harold Reese at FSI has indicated that they've discontinued the F7 motor because of the reliability problems! He doesn't know why it's happening, since they mix their own black powder and they've been pressing the motors the same way for 10 years. They're experimenting with different casings; since that's the only part made out of house, it's the most likely problem. There may be a new steam machine F with a thicker casing in the future. FSI also has a new catalog out that's worth a look.

NCR's new catalog will be out August 15, with more kits and motors. Included will be a RC BG kit, a new altitude sensor payload, and a gliding high power kit.
PATRIOT DETAILS

Left:
Tail Section Details
(Matt Steele photo)

Right:
Warhead Section Detail
(Matt Steele photo)

Left:
Motor/Warhead Section Assembly Joint Detail
(Matt Steele photo)

Back Cover:
A Patriot takes out a target drone during operational testing.
(US Army photo)