Competition Rocketry

A Altitude, C Payload, and Flying Altitude Events

By Dan Wolf

Welcome back to this series on competition rocketry. For those of you who are new, this column deals with NAR sanctioned competition and the contest events flown at NAR sanctioned contests. Each article typically examines a specific event flown in NAR competition, and usually a specific impulse class or limited range of impulse classes of the event. In upcoming columns, I plan to cover a few of the contest events for NARAM-38. Currently planned are articles on C Helicopter, C Boost/Glide and Plastic Model Conversion. For more information on NAR Competition, a copy of the "United States Model Rocket Sporting Code, 1995 Edition" can be obtained from NARTS (P.O. Box 1482 Saugus, MA 01906).

This issue's column is a slight departure as two events are being covered. They are A Altitude and C Payload, both NARAM-38 events. Figure 1 shows plans for these two events. While previous plans in this column were of rockets with unique features (boost/gliders, egglofters, flexies, etc.) these two models are your basic "three fins and a nose cone" style. You should not have any difficulty in building them from the plans. A few general comments are in order however.

Construction

First, these are altitude birds. The goal is to build lightweight and low drag vehicles. The key is to find a good balance between a smooth finish and weight. For standard cardboard body tubes, alternating between light coats of clear dope and sanding is one time-honored technique. Or simply filling in the seams and then lightly sanding until smooth, finishing up with 600 grit paper and steel wool works well.

One of the most important aspects of construction is insuring that the fins are attached straight, and that they are not warped. Nicely airfoiled, STRAIGHT and ALIGNED fins are critical to a high altitude flight. Some competitors have had great success using fin jigs. The Estes Rocket Builders Marking Guide (EST2227) can be used here, but scrap material may need to be placed in the slot to take up the gap for the thinner fin materials found on these low impulse models.

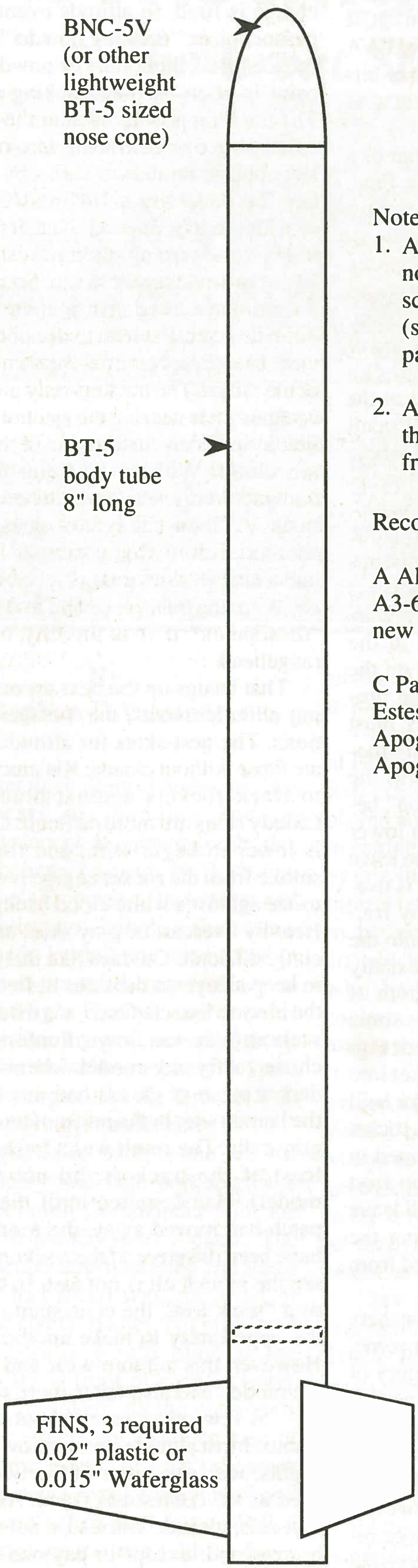
For many years 1/64 plywood was popular for fin material, but it has the problem of warping during finishing (or may be warped to start with). Some competitors have used thin styrene plastic (sold in hobby stores under the brand name Evergreen, often in the train department), usually 0.02" thickness for A Altitude models. And finally, there's good old balsa. Nicely airfoiled 1/32" or 1/16" balsa, lightly finished with clear dope or dope/talc works well for A Altitude. Move up to 3/32" for C Payload or use 1/32" plywood. Eclipse Components (719) 598-6105 sells "Waferglass" (fiberglass "G10" material) in 0.015" and 0.025" which should be good for A Altitude and C Payload respectively. Waferglass is very stiff and so warping is normally not a problem. It requires no finishing other than sanding till smooth.

For C Payload, the rocket must be constructed to house the standard NAR payload. The Pink Book states that the "standard NAR ... payload is a non-metallic cylinder containing fine sand, with a mass of no less than 28.0 grams. This cylinder shall be 19.1 millimeters (± 0.5 mm) in diameter, and 70 mm (± 10.0 mm in length)." Typically, the cylinder is a cardboard body tube, Estes BT-20 or equivalent.

The payload must be carried in the rocket. In order to achieve the highest altitude, the rocket needs to be designed so that the payload section is just large enough to house the payload. Two choices for a body tube that meets this requirement are Eclipse TT-19 and Quest T-20. One other requirement for Payload events is that the rocket MUST be recovered by parachute.

One other note on the C Payload plan. The drawing shows the rocket constructed so that a piston launcher tube (BT-20 size) can be inserted between the motor and the body tube. That is why the BT-20 tube inside the TT-19 or T-20 does not extend all the way to the bottom. If a piston launcher is not to be used, the lower body tube (not the payload section) can be replaced with BT-20, and an appropriate coupling mechanism between

A Altitude and C Payload Plans



Notes:

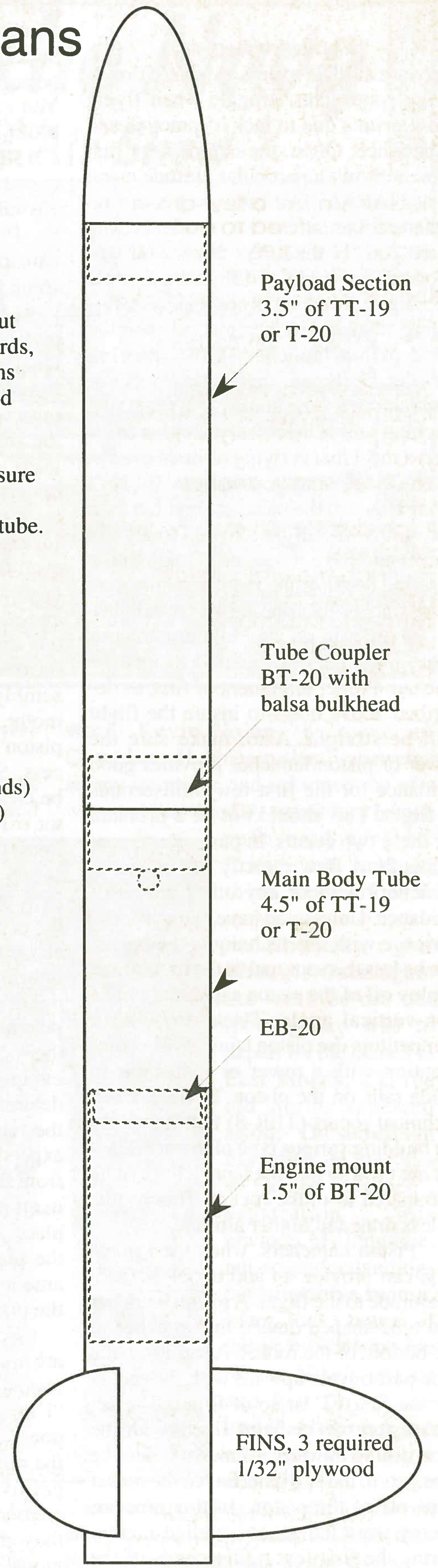
1. Additional items required but not shown include shock cords, screw eyes, recovery systems (streamer for A Altitude, and parachute for C Payload).

2. After inserting payload, be sure that the nose cone is tightly friction fit into the payload tube.

Recommended Engines:

A Altitude
A3-6T
new Apogee A2-?

C Payload
Estes C6-7
Apogee C4-7 (if light, low winds)
Apogee C4-5 (if heavy, windy)



the payload section and the lower body tube used.

Flying Strategies

Because altitude events are rarely flown, many contestants struggle when flying these events due to lack of practice and experience. Often, the competitors first time at flying a particular altitude event is at NARAM! Altitude events are no different than other contest events. The more you fly them, the better you will become. For initial test flights and practice flights, tracking is not required. Test flying to test new designs, to develop good piston launcher skills, tracking powder skills, etc. can be carried out without the use of trackers. Eventually, tracking will be necessary, so plan to attend a meet that is flying altitude events. Even if the event you want to fly isn't being flown at the meet, more often than not, you will still be allowed to fly the rocket and have it tracked (although the baseline used for the meet's events may or may not be appropriate for your flight).

In order to do well in altitude, your flight must be straight, and it must be tracked. Proper alignment of fins, as described above helps to insure the flight will be straight. Also, make sure the tower or piston launcher provides good guidance for the first few milliseconds of flight. This should not be a problem for these two events. In past years, some competitors flew directly off of piston launchers without any other means of guidance. Unless you have extensive experience with this technique, the results can be less than optimal as the rocket may deploy off of the piston early, and/or at a non-vertical angle. These days, most competitors use piston launchers in combination with a tower or with built in guide rails on the piston. NARTS has a technical report (TER-8) that has plans for building various type of towers. Towers are used so that the launch lug can be eliminated from the rocket. This results in less drag and higher altitude.

Piston launchers, when used properly, can provide an additional 10-20% of altitude to the flight. A piston launcher is a tube-shaped device that attaches to the bottom of the rocket. At ignition, the tube part travels upward with the rocket for the first 12" or so of flight. The actual piston part remains fixed, with the tube sliding upward around it. When the tube gets to the end of its travel, the rocket pops off of the piston. In this process, energy from the gases expelled rapidly during the first few milliseconds of the motor burn are collected in the piston launcher tube and these pressurized gases impart additional velocity to the rocket as it leaves ("pops off") the piston launcher. Piston launchers are hard to understand until you see one. The best bet is to have a look at one at a contest. You can also purchase one from QCR (7021 Forest View Drive Springfield, VA 22150). By the way, QCR also has kits for virtually every contest event discussed in this series.

Piston launchers are somewhat of a pain to use for a number of reasons. First, some means of connecting the ignitor must be devised as the engine is completely enclosed. Sometimes the piston launcher will have wires running down through the middle of the piston. The ignitor is attached to the wires at the top of the piston and the launch system clip leads to the other end of the wires at the bottom of the piston. It can be difficult to connect the ignitor and get the whole rocket/piston launcher assembly together such that the ignitor is connected properly and still in proper position in the engine for successful ignition. Misfires and shorted ignitors require the rocket to be removed from the piston launcher assembly, a new ignitor inserted in the motor, and the rocket reinstalled on the piston launcher, a time consuming process. Second, the piston launcher must be cleaned after each launch as the motor exhaust clogs it up and prevents the tube from sliding freely. "Sticktion" between the tube and the piston can lower performance and cause the rocket to leave the piston early. Third, the rocket is usually attached to the piston tube by friction fitting the end of the motor into the top of the piston tube (the motor usually protrudes abut 3/8" from the bottom of the rocket to facilitate this. It takes some experimentation and/or experience to determine how tight to fit the rocket into the tube. Too tight, and the motor will expend more energy separating the rocket from the piston launcher than gained in using the piston launcher in the first place. Too loose and the rocket will leave the piston launcher early, reducing the amount of additional energy gained from the piston launcher.

For these reasons, piston launchers are not seen at many contests. For some, piston launchers fall into the category of "I'm only going to use it if someone else does" and so it remains in the bottom of the range-box at all but the most competitive contests. Because of the increased performance potential however, they are still a common site at large regional meets and at NARAM, where the winning altitude flights usually employ them.

At virtually every contest where altitude is flown rockets are tracked to ejection. That is, the rocket is not tracked to its highest point (apogee), but instead, it is tracked at the point when the ejection charge is fired. In altitude events, competitors place "tracking powder" in their rockets. Red chalk dust or powdered art paint is often used as tracking powder. The tracking powder is put in the rocket either above or below the recovery system. The amount used varies by contestant, but typically a 1/4" to 1/2" thickness in the tube is used. At ejection, the tracking powder forms a red cloud that helps the trackers see the rocket. It is not uncommon for rockets in events like A Altitude and C Payload to disappear from view of the trackers after the thrust phase of the motor. The trackers only pick them up again after hearing the ejection charge fire, followed by the sighting of the tracking cloud. Without tracking powder, tracking these rockets would be very difficult, in all but the best of skies. That's another reason why a straight boost is important. Besides going higher, it is also easier for the trackers to find a model that "disappears" if it is directly over the rangehead.

That brings up the next aspect of flying altitude events, the weather conditions. The best skies for altitude events are those without clouds. It is much easier to track rockets against blue skies. Cloudy skies are more difficult. Contrast is lower to begin with, and the white smoke from the rocket engine is difficult to see against a white cloud background. Heavily overcast or gray skies are especially difficult. On days like that, it pays to keep an eye on the skies before giving the okay to launch. Once, at a meet where scale altitude was flown, I unfortunately chose to fly my model when a small darker patch of clouds had moved over the launch site, in the midst of an already gray t sky. The result was a track lost (at least of the trackers did not see the model). Had I waited until that small patch had moved away, the results may have been different. If the trackers do not see the model, all is not lost. In the case of a "track lost" the contestant is given the opportunity to make another flight. However, this is more wear and tear on the model, and also takes more time.

A few other notes about altitude events. Most altitude events allow for two flights, with the better of the two being used as the contestants score. As a general rule, altitude entries do not need to be returned, except in payload events, specifically egglofting and payload. In

Continued on page 40

Continued from page 36

those events, the portion containing the egg or payload must be returned. For more information on altitude competition and NAR competition in general, contact NAR Headquarters or NARTS for a copy of the new "United States Model Rocket Sporting Code", also known as the Pink Book. The Pink Book is the rule book for NAR Sanctioned competition.

SPORT ROCKETRY

Manufacts

BALSA USA

has introduced a line of triple distilled CA products known as USA Gold CAs. Triple distillation yields a product so pure that specialty CA's like those for plastics, flexible ones etc. are not necessary. In addition, all USA Gold CA's are "surface insensitive" blended adhesives. For a complete, fact filled brochure on the truth about CA glues, please send a SASE to: Balsa USA, P.O. Box 164, Marinette, WI 54143.

ESTES INDUSTRIES

introduces "Backyard RediRocs", ready to fly rockets with no building required, just apply decals prior to launch. The Raider (EST 2123) and Intruder (EST 2122) are one-piece rockets molded from space age TufFlite that can fly off any field, even your own backyard. Both rockets fly to an altitude of 100' and incorporate safe tumble recovery. For additional information on these and other exciting Estes Industries products, visit your local hobby retailer or call 1-719-372-6565.

OPTEK SUNGLASSES

offers a complete line of premium sports sunglasses. Optek premium eye wear is among the world's highest quality sunglasses and is available in 31 exciting styles. Optek sunglasses meet or exceed ANSI requirements, feature nickel/silver and hand-polished frames, 98-100% UV protection, superior infrared protection with many other outstanding qualities. For more information contact: OptekSunglasses Corporation, 30 North Gould Street, Sheridan, WY 82801, 1-307-672-0875.

W.C. LINDEN INC.

announces availability of the SR-71 Ready-To-Fly Rocket Glider. This revolutionary flying model was designed by a team of top aerospace engineers. Everything is included in the box for your first flight! It comes pre-assembled and finished in matte black paint with an electronic launcher, launch stand, rocket motors and tote box. An R/C version is also available which can be fitted with a Cox .049 Glow-Power kit. Order your kit today: SR-71 Blackbird, 660 Preston Forest #374, Dallas, TX 75230, 1-800-536-5327.

TAMIYA

offers a number of quality finishing products for your rocket kits. One item particularly useful is masking tape, which is available in 6mm, 10mm and 18mm widths. This is a thin, self-adhesive paper tape developed for model applications. The tape is flexible and easily applied to curved surfaces making it ideal for masking off areas for painting. It is packaged in a handy plastic dispenser. Visit your local hobby retailer to discuss the wide variety of products available from Tamiya.

WEIR ROCKETS

debuted at the 1995 National Sport Launch with three rocket kits. Presently the kits include the Mae Star, Sweetheart Express *(left)* and Christmas Tree. There will be two more introductions in the near future. Paul Weir of Weir Rockets concentrates on offering a quality product at a fair price. To learn more, write: Weir Rockets, 25 Metten Road, Newark, DE 19713.