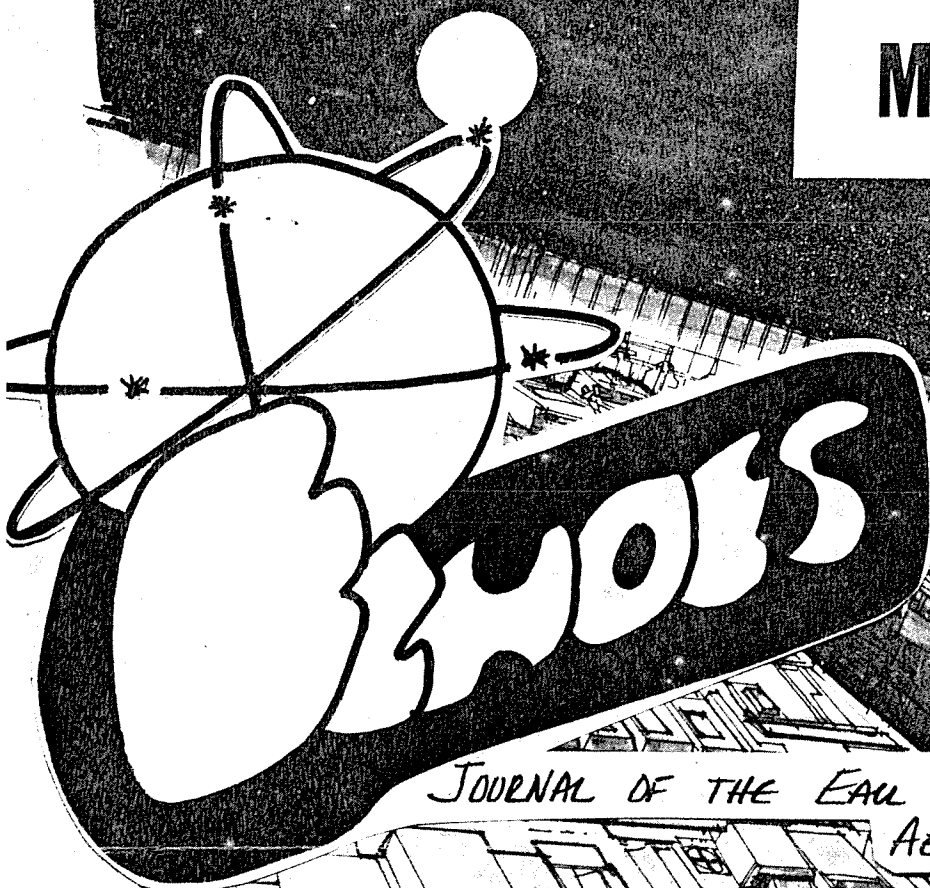
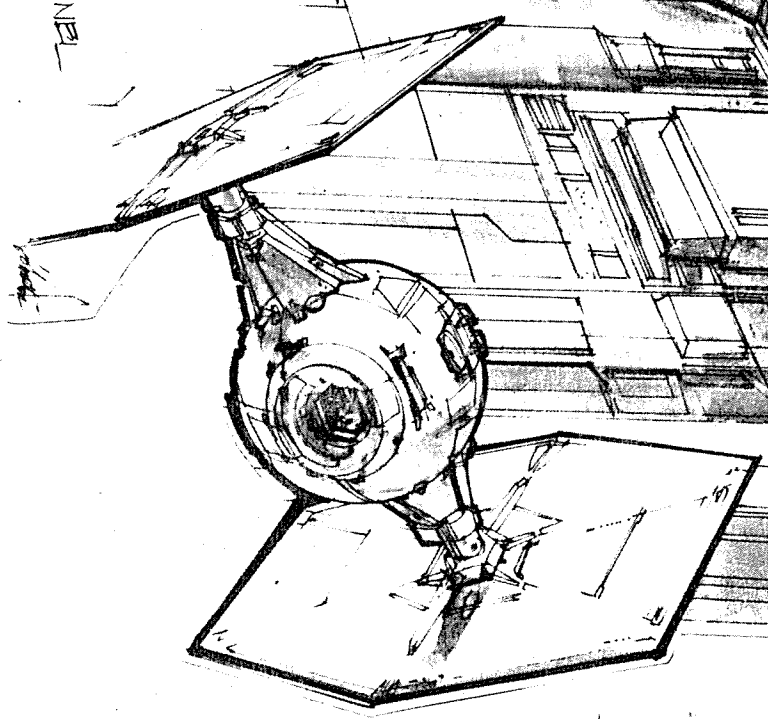


VOL. two
no. 3
Mar. - Apr. '78



JOURNAL OF THE EAU CLAIRE HIGH ORBITERS
AEROSPACE MODELING CLUB **

ATOMIC CHANNEL



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Our COVER: This month's cover shows two T.I.E. fighters patrolling the Equator of the Death Star. Picture taken from The Star Wars Sketch-book by Joe Johnston.

T • M I N U S Z E R O !

Well, here it is April and I haven't gotten a March issue out, so I'm combining two months to give you all a big issue to make amends. The reason a March issue never materialized is that Jon Rains (a new NAR Trustee) asked me to re-write and redesign the NAR publicity pamphlet. I was given three weeks to do it, and that had to take precedence. It's done now and Echoes is back.

Please mark your records that ECHO HQ will have a new address as of May 1, 1978. Send all correspondence, newsletters, contest applications, club dues and everything else to: ECHO, 513 Erin St., Eau Claire, WI. 54701. Which reminds me, the following members owe \$3.00 to re-up: Nels Anderson and Dan R. Lundquist. I have to send our Section Charter renewal in shortly, so get those bucks in asap guys!

Snoar News for March did an excellent job of rounding up info on all the contests to be flown in the Midwest this summer. I also enjoyed an article by the Man of Steele (MF himself) in which he predicted the outcome of the individual, team and section National Championship races. Would you believe however, that Matt has chosen VALSUM from Phoenix to take top section honors! He picks ECHO as # 2. Need I say more ECHO?

In the plans department this month we feature the Parksley Eaglet, a companion design to the Bundick Parksley Eagle we gave you last issue. This B/G is suited to the Hornet event, and took 2nd in the class at NARAM-18. A Pee Wee Payload bird by Eric Nixdorf will also be found in these hallowed pages for those of you out there who are undecided on a choice for the event at Pole Cat II. Speaking of Pole Cat II, the contest package will be found on pages 4 thru 8. A map and entry blank along with all other necessary info is included. Hope to see all of you at what looks to be a great regional. Trophies and ribbons will be awarded.

Eau Claire area members shouldn't forget our Demo Launch at DeLong J.H. on April 15th. I will be doing a promotion on the Peter Murphy radio show on April 12th. around 9 am., so get your friends to listen in. We could sure use more ECHO and NAR members, and this is a good way to get them. We are also considering a Car Wash in early May to generate club funds, and we need your physical support. We're broke right now! Guess who's been paying postage on the newsletter and buying stop watches for the club lately.

Get out there and test, test, test guys. We need all the points we can get. See you all at Ground Hog April 22nd.

Bruce

CRO

CLUB CALENDAR & NEWS.

April 11, 1978. DeLong J.H. rm. 168 7 to 9 pm.

Club Meeting. Glider tissuing demo. Flying strategy discussion in preparation for Ground Hog II section meet.

April 15, 1978. DeLong J.H. Football field. 1 to 3 pm.

All manufacturer demonstration. All area ECHO members should attend !

April 22, 1978. Craig Road launch site. 9 am to finish.

Ground Hog II section meet. Cl.00 P.D., Cl.0 P.D., Cl.1 S.D., Sparrow B/G, Hawk R/G, Cl.1 Helo. Entry fee : 50¢ .

April 25, 1978. Parks and Rec. 7 to 9 pm.

Club Meeting. Tracking discussion and demonstration.

May 27 & 28, 1978. Craig Road launch site.

Pole Cat II (regional). Cl.0 P.D., Cl.0 Helo., Cl.1 P.D., Cl.2 S.D., Hornet B/G, Sparrow R/G, Eagle B/G, Condor R/G, Pee Wee Payload, Robin Eggloft, Dinosaur Superroc. Fees: A- \$2.50, B- \$3.50, C- \$4.50.

June 10, 1978. Bong Recreation Area, Milwaukee.

NARBAR-78 (regional). Scale, Pigeon EL, Gemini Dual EL, Cl.00 P.D., Cl.2 P.D., Cl.2 S.D., Sparrow B/G, Condor B/G, Hornet R/G, and Cl.2 Helo. Contact: Chris Weege, 7614 N. Bell Rd., Milwaukee, WI. 53217.

June 17 & 18, 1978. Fort Wayne, In.

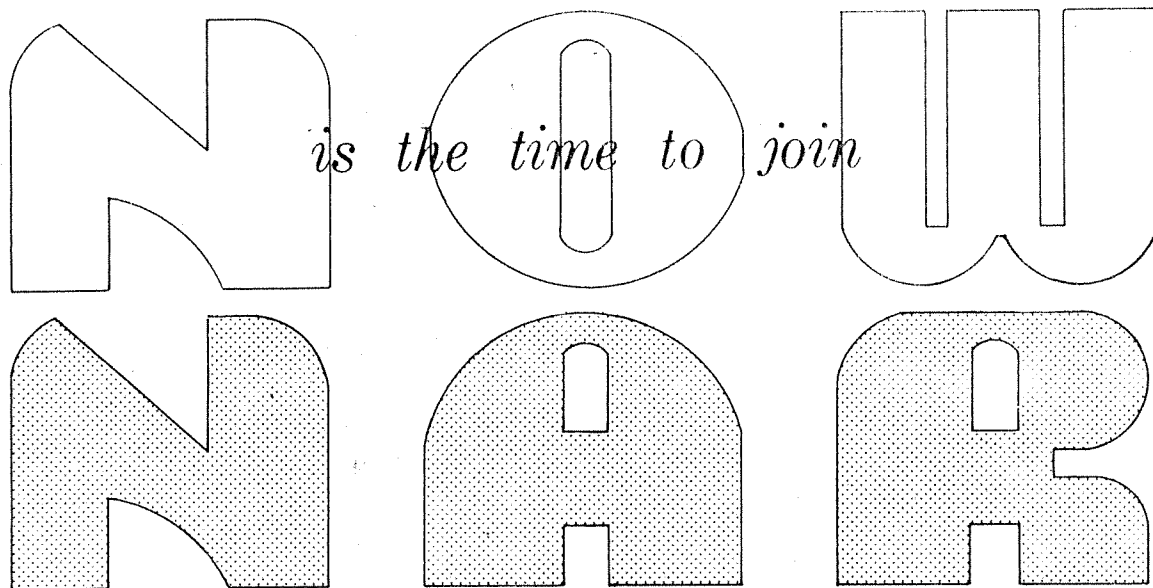
Daughter of Mar (regional) Sparrow B/G, Hawk R/G, Cl.00 S.D., Gnat R/G, Cl.1 S.D., Cl.2 Helo., Cl.3 P.D.w/ egg, Swift B/G, Hornet R/G, Cl.1 Flexwing (will probably be changed). Contact: Tom Hoelle, 2231 Charlotte Ave., Fort Wayne, In. 46805.

July 8 & 9, 1978. Joliet, IL.

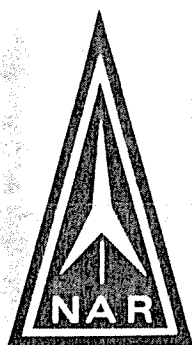
ETR-8 (regional). Condor R/G, Eagle B/G, Plastic Model, Gnat B/G, Swift R/G, Hawk B/G, Cl.0 Helo., Cl.3 S.D., Cl.0 S.D., Parachute Spot Landing, Cl.3 P.D. (minimum 36" length). Contact: Jim Murray, 116 N. Chapel St., Waukegan, IL. 60085.

September 9 & 10, 1978. Craig Road launch site.

WAMO II (open meet). Eagle R/G, Gnat B/G, Swift B/G, Cl.0 P.D., Cl.1 S.D., Cl.3 S.D., Cl.3 Helo., Predicted Altitude.



ONLY THROUGH NAR CAN YOU . . .



- * Keep Current with the latest events on the model rocketry scene through your own copy of the exciting, all-new MODEL ROCKETEER!
- * Proudly Display your NAR colors with the new decals - - one large sheet containing all the useful sizes of the NAR symbol!
- * Enjoy the Peace of Mind of your \$1,000,000 liability protection!
- * Avail Yourself of the opportunity to be a part of the international model rocketry fraternity - - the Fédération Aéronautique Internationale (FAI)!
- * Learn all about the latest NAR regulations and contest rules in the revised "Pink Book"!

Additionally . . .

- * For the first time - - the NAR FAMILY PLAN! one family member joins at the full rate - - any and all other members deduct \$2.00 from their membership dues! (Sorry, you're going to have to share your family copy of MODEL ROCKETEER, but you still get all of the other benefits).
- * And last but not least - - evidence of your membership in NAR - - the newly, redesigned wallet-size sporting license!

DON'T DELAY . . . JOIN TODAY!

NAR MEMBERSHIP APPLICATION

National Association of Rocketry, P. O. Box 725, New Providence, N. J. 07974

MEMBERSHIP CATEGORY (Please check one box only)

- ☐ JUNIOR MEMBERSHIP (Under 16 as of January 1) \$7.00
- ☐ LEADER MEMBERSHIP (Under 21 as of January 1) \$8.00
- ☐ SENIOR MEMBERSHIP (21 or over as of January 1) \$10.00

DATE OF BIRTH _____ NAR NO. _____ AMOUNT ENCLOSED _____
 Month Day Year

NAME _____ DATE _____
 STREET _____ NAR SECTION _____
 CITY _____ STATE _____ ZIP _____

- ☐ Family Plan Membership (Deduct \$2.00) ☐ New ☐ Renewal
- ☐ FAI Stamp \$2.00 NAR No. _____

If I am accepted in the National Association of Rocketry, I pledge to observe and follow the NAR safety code. I am aware that a reported violation of the NAR safety code may lead to the revocation of my membership right. I also agree to abide by the by-laws and the standards and regulations of the NAR.

Signature _____

* POLE CAT II

The Eau Claire High Orbiters Aerospace Modeling Club (ECHO, NAR Section #367) is hosting its' first annual regional meet for Midwest modelers. The event will be held in Eau Claire, Wi. on May 27 and 28, 1978. This is an NAR sanctioned event!

Our launch site will accomodate a full tracking baseline (300 meters), and we have a programmable calculator to reduce all tracked data. We have three six-pad racks which will accept towers and piston launchers as well as any other homemade contraptions you may have. Masts for clipping ignition wires out of the way on B/G and R/G flights will also be available.

There is a McDonald's and an Italian food restaurant within walking distance of the launch site as well as a Roadstar Inn, Howard Johnson's, Holiday Inn, and several other food and lodging establishments within half a mile of our site. In addition, although farther from the field, there is a Kamp Dakota for the camping buff. There should be no problem obtaining food and lodging at the meet. Below are phone numbers for some of the motels, etc. you may want to contact, or let me know and I will make reservations for you. Rain dates for the contest will be June 3 & 4, 1978.

Motels and Camp Sites:	(1 bed)	<u>single</u>	<u>double</u>
1. Howard Johnson	(715) 834-6611	17.00	20.00
2. Holiday Inn	(715) 834-3181	18.00	23.00
3. Road Star Inn	(715) 832-9731	13.00	19.00
4. Midway Motor Lodge	(715) 835-2242	18.50	26.00
5. Highlander 8	(715) 835-2261	10.88	13.00
6. Kamp Dakota	(715) 832-7379	4.00 to 5.00 (depending on services)	

Events:

Condor R/G, Sparrow R/G, Class 0 P.D., Class 1 P.D., Class 2 S.D., Robin Egg Loft, Dinosaur Super Roc, Hornet B/G, Eagle B/G, Class 0 Helicopter Duration, and Pee Wee Payload.

Pole Cat II (continued)

Fees:

Division A - \$2.50

Division B - \$3.50

Division C - \$4.50

* Make checks payable to : Eau Claire High Orbiters.

Send entries to:

Bruce Carey, Contest Director

2013 Cameron St.

(715) 834-1149

Eau Claire, Wisconsin 54701

** We would like all entries to us by May 12, 1978.

Notes and Reminders.

1. Don't forget that you must have insurance to fly in a sanctioned contest now. You will receive more information on this in the Model Rocketeer, but the cost will be \$3.50 per year for an individual (payable to NAR HQ). You will have to display an insurance stamp or a valid AMA membership card to fly in the contest, so don't forget these things and your NAR card !
2. You have to fill out and sign a contest entry form (included in this package). If you're under 21 your parents have to sign it too ! Don't forget to add your section number and team number if they apply.
3. We will be flying all tracking events from starting time Saturday morning (10:00 am) until 3:00 pm that afternoon. All flights will have to be flown during this time. All other events can be flown whenever you like.
4. We hope to see you all at Pole Cat II !!!!!

PO1. Super Roc

PO1.1 Super-Roc competition comprises 6 events open to single-staged model rockets powered by a single engine with no more than 80 Nt-Sec of total impulse. The model shall have a gross launching weight of not more than 453 grams and shall have a body length of no less than the minimum allowed for the class in which it is flown.

PO1.2 Super-Roc points will be awarded according to the following schedule:

PO1.2.1 The number of centimeters in the overall length of the body of the entry, rounded off to the nearest centimeter, will be awarded as static points.

PO1.2.2 The number of static points awarded to each entry will be added to the maximum altitude in meters achieved by the entry as tracked and reduced. If track lost, no flight points will be added. The entry with the highest number of total points thus awarded will be the winner.

PO1.3 An entry that comes apart; bends so as to crimp the body or has a similar structural failure before ejection will be disqualified.

PO1.4 The following classes are established for Super-Roc Competition:

Class	Total Impulse Range	Minimum Length (CM)
1 Atlas	0.00 - 2.50	50
2 Titan	2.51 - 5.00	100
3 Mammoth	5.01 - 10.00	100
4 Dinosaur	10.01 - 20.00	150
5 Monster	10.01 - 40.00	150
6 Colossus	40.01 - 80.00	150

PO1.5 The weighting factor for Super-Roc competition is 3.

PO1.6 The model is not required to be returned to the officials except as stated in Rule 9.6.

PO3. Helicopter Duration Competition

PO3.1 Helicopter Duration competition comprises 7 events open to any single-staged model rocket which uses the principle of autorotation as its sole means of recovery.

PO3.2 Each entry must be decelerated during descent by an autorotating recovery device. Each entry must comply fully with the provisions of Rule 3.4.

PO3.3 Except for recovery system protectors or wadding, the model may not separate into two or more unattached parts, and will be disqualified if it does so.

PO3.4 The purpose of this event is to determine which entry achieves the longest flight duration time. The model will be timed from the instant of first motion on the launcher until the instant any part of the entry, excluding recovery system protectors or wadding, touches the ground in accordance with Rule 15.

PO3.5 The entry that achieves the longest timed flight is the winner.

PO3.6 This competition is divided into classes based on the total permissible impulse of the engine(s). The following classes of Helicopter Duration competition are established:

Class	Total Impulse (Newton-Seconds)	Max. Wt. (grams)
00	0.00 - 0.625	60
0	0.626 - 1.25	60
1	1.26 - 2.50	85
2	2.51 - 5.00	85
3	5.01 - 10.00	120
4	10.01 - 40.00	240
5	40.01 - 80.00	453

PO3.7 The weighting factor for Helicopter Duration competition is 3.

PO3.8 Any model that cannot be returned to the officials will be disqualified except as noted in Rule 10.3.

There will be trophies given for first place in A, B, and C Divisions. In addition, we will give ribbons for first, second, and third places in each event in all age divisions, and a plaque for first, second, and third place will be awarded to the three top scoring sections.

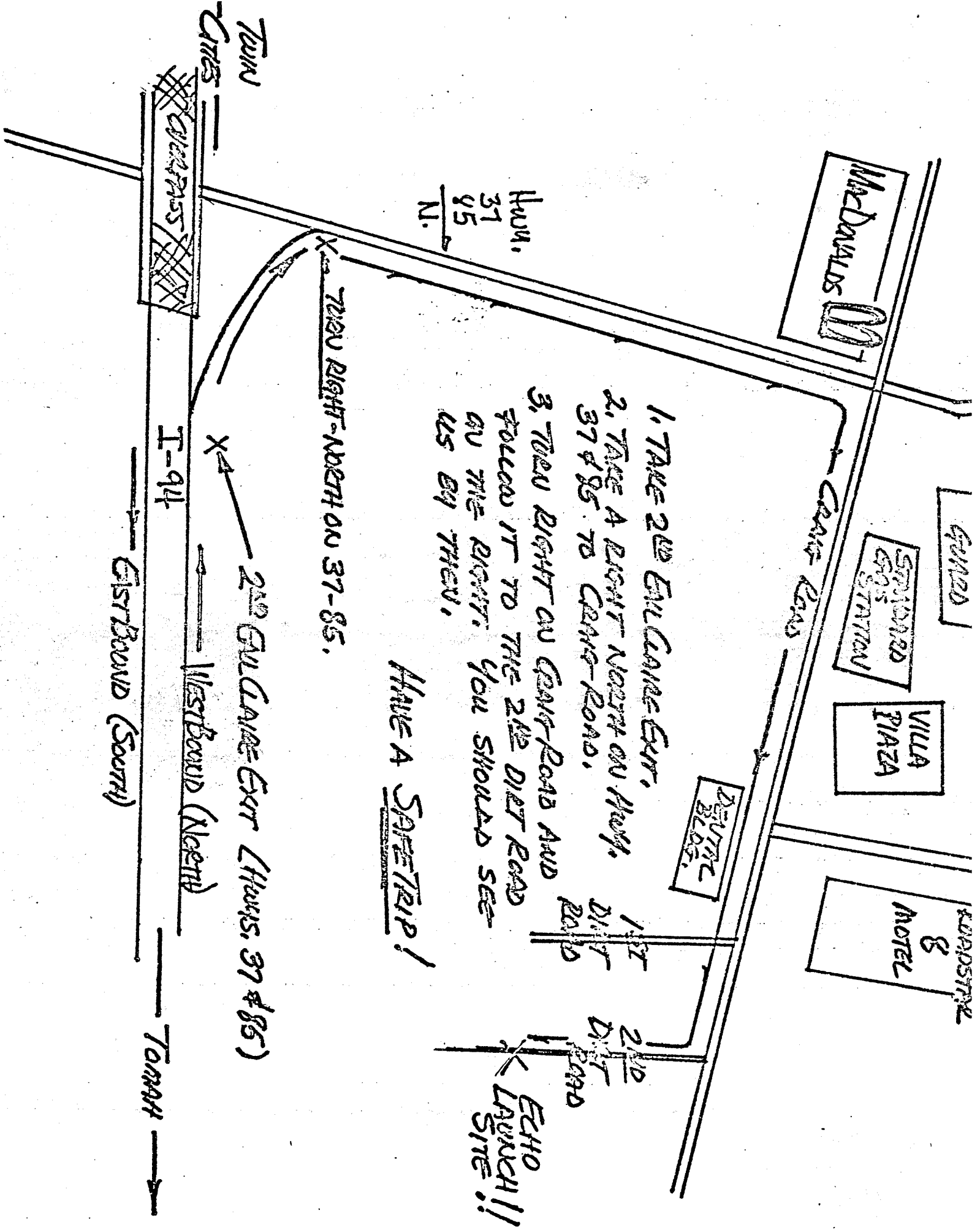
REMEMBER! You have to have a valid (paid up) NAR License. You now also have to have an insurance stamp to fly in a sanctioned contest. You can send your \$3.50 insurance fee to NAR Headquarters, P.O. Box 725, New Providence, N.J. 07974.

NAR NEWS

As you may have already heard, the NAR Trustees have initiated a dues increase that will go into effect May 1, 1978. The fees will be: A Division \$7.00 (no increase), B Division \$10.00, and C Division \$15.00. Their idea was to let those who have it help out those who don't.

Terry Lee has told me that the Pink Book Revision Committee is considering a proposal that would liberalize the Regional qualification rule. It would do away with the clubs from two or more states clause. You could fly a Regional if you had 3 clubs from a large geographical area as long as no more than 40% were from one club. Terry also mentioned that the committee was up to the Altitudes section in their revisions.

Insurance is now available from NAR HQ, so if you plan on flying in any sanctioned meets this season get your \$3.50 in asap !!



Hwy.
37
85
N.

1. TAKE 2ND EUL CLINE EXT.
2. TAKE A RIGHT NORTH ON HWY. 37 & 85 TO CAMP ROAD.
3. TURN RIGHT ON CAMP ROAD AND FOLLOW IT TO THE 2ND DIRT ROAD ON THE RIGHT. YOU SHOULD SEE US BY THEN.

HAVE A SAFE TRIP!

X TURN RIGHT-NORTH ON 37-85.

X 2ND EUL CLINE EXT (Hwy. 37 & 85)

Westbound (North)

I-94

Eastbound (South)

TOWARD

McDouglas

STANDARD
GAS
STATION

VILLA
PIAZA

Knapstock
8
MOTEL

DUNN
BLDG.

1ST
DIRT
ROAD

2ND
DIRT
ROAD

ECHO
LAUNCH!!
SITE!!



National Association of Rocketry

OFFICIAL CONTEST ENTRY BLANK

Official use only

Entry number

Flight sheets
issued by

Please enter me in the following events:		Official use only		CONTESTANT DATA	
Event	Event No.	Flight Sheet No.			
			Full name of contestant —		
			Street address —		
			City —		
			State —		Zip code —
			Phone No.		
			NAR number —		
			Age division (circle one) A B C D		
			Official name of contest — Pole Cat II		
			Section name —		
			Section number —		
			NAR team no. —		
			Date of birth —		
			REMARKS:		

FORM NO. CB-1-70

(Must be signed by all contestants before flight sheets can be issued. If team entry so state and have all members of the team sign.)

I am familiar with the standards and regulations of the National Association of Rocketry and with the Safety Code of the NAR and I agree to abide by them. I further agree to observe and abide by the orders of the presiding range safety and control officer. I also agree that the ruling of the judges shall be final.

Date _____ Signed _____
Contestant

*PARENT'S CONSENT, (Must be signed before entry of any contestant under 21 years of age can be accepted and flight sheets issued.)

As parent or legal guardian of _____, a minor, I hereby give my full and unqualified consent to his/her participation in this NAR-sanctioned meet, and to his/her accepting any and all awards whatsoever that he/she may win, whether it involves travel or otherwise.

Date _____ Signed: _____

Getting Started in Contest Rocketry Part two

by Jeff Flygare, NAR 1164

(This is the fifth in a series of articles adapted from "Satellite," the newsletter of the Buffalo NAR Section. It is assumed that the reader of these articles has a basic knowledge of model rocketry, has built and flown many of the kits on the market, has designed some rockets of his or her own, and has a knowledge of the workings of the model rocket engine.)

The material that Jeff presents in this article is based on his experience with contest model rocketry, but much of it is his own opinion. Comments and questions may be addressed to Jeff at 323 Parkwood Avenue, Kenmore, New York 14217.)

Boost/Gliders —

We turn now to one of the most fascinating parts of the hobby of model rocketry: boost/gliders. B/gs first appeared on the scene in 1961, when John Schutz and Vernon Estes developed the rear engine boost/glider. Later, in 1963, Larry Renger added the front engine b/g as an outgrowth of hand launch glider designs. With more recent additions such as pop-pods, gliders have come a long way since they were first fired into the sky on a rocket motor nearly fifteen years ago.

B/gs are one of the most fascinating parts of the hobby because, from a purely engineering viewpoint, the problems which are confronted when one tries to take a vehicle meant to produce high lift and drag and operate it at low speeds and send it into the air at high speeds in what should be a no-lift low drag situation, are enormous. This was the difficulty encountered by early rocketeers when the first b/gs were developed. There have been numerous methods to solve the problem, but all of these methods look at the problem in a similar manner.

As with all contest events we have been talking about, the designer has to arrive at a decision about which way he intends to lean in the model he is designing and its method of operation. Here, as in other events, a trade-off must be made between two extremes. At one end of the spectrum is the purely "rocket" type vehicle, one which flies upward at the best possible performance and achieves a high altitude. At the other end is the purely "glider" type vehicle, which is

designed for low speed, high lift, long duration flight. The rocket is not a good glider and the glider is not a good rocket. With either of these, you can solve only half the problem. The trick is to combine the best aspects of both designs.

Here is where we encounter the trade-off. We have to arrive at a design which best combines the better aspects of both extremes of design (good boost and good glide) and minimizes the poor aspects of both extremes (bad glide and bad boost). Usually the model rocketeer will arrive at a design which is a pretty good combination of the good features, and which, with minor modifications, can be changed to provide a better boost or a better glide, whichever may be favorable for the conditions under which one is flying.

Well, enough theory. But keep in mind that there are two aspects to the flight of b/gs, and that every b/g that is designed, built and flown must have characteristics for both aspects of flight. Now to get down to the nitty-gritty. First, if you have never flown a boost/glider before, I suggest that you go out and purchase one of the commercially manufactured b/g kits which are available. (Note: Here I am talking about the Centuri Swift, the CMR Manta, the Centuri Mini-Dactyl, or even the Estes Nighthawk — if you can still find one lying around — and not things like the Estes Orbital transport, Scissor-Wing Transport, or Sky Dart. Designs like these are not found in competition and will not give you the basic knowledge of glider construction which you need to know.)

Next you have to do some reading — and I don't just mean this article. Get a hold of a copy of Dr. Gregorek's Basic Boost/Glider Design report (It was printed in the June, 1974 *Model Rocketeer*). This report will give you the essentials of boost/glider design and will give you a basic design from which you can do modifications of your own. Next, you may want to look up some information on aerodynamics (this isn't necessary, but it helps). For this, get hold of Theodore von Karman's book *Aerodynamics* (McGraw-Hill, 1963). With that basis we can go on to talking about some aspects of glider design and competition.

First, let's discuss how a glider works. The major part of the glider is the wing. The wing produces lift, which allows the glider to

glide. Now, if we just glide a plain wing through the air, we can note that it tumbles and turns through all three axes. It is necessary to stabilize the wing in all three axes in order for the wing to glide properly.

First, the wing rotates around its long axis, or span-wise axis. This is rotation through the pitch (or up and down) axis. This occurs because the wing produces lift and the lift acts at such an angle so as to produce a rotational motion of the wing about the pitch axis. In order to stop this, we must provide another surface to produce a force to counteract this rotation. This is accomplished by the addition of a horizontal stabilizer, which creates lift behind the wing and counteracts the pitch-up force.

Next, we find that the wing turns left or right, rotating through the yaw axis. (In a drawing, this axis is perpendicular to the span-wise pitch axis and the longitudinal — or along the body — roll axis.) In order to halt rotation in this axis, we add a vertical stabilizer or rudder.

Finally, we can see that even with these motions stopped, the glider has a tendency to roll about its long axis, a motion which would produce a severe banking movement of the glider. In order to correct for this, we add dihedral. Dihedral involves tilting the wings or the wing panels in such a way that the wing serves to create both a lifting force and a counterforce to the rotational movement of the glider about the roll axis. This can be done in many different ways — by making a "V" with the wings, by cutting the wing into two pieces and gluing the proper amount of angle into them, by just raising the wing tips into the proper angle, or by combining both into a "polyhedral" design. As indicated in the Gregorek report, the proper amount of dihedral is obtained by dividing the wing span by 4 (Sw/4). This is the total amount of dihedral, so if you want the wing tips to be raised equally on each side, each tip should be raised by $\frac{1}{2}$ that amount or $\frac{1}{8}$ the span of the wing (Sw/8). See diagrams in the Gregorek report, figure B).

By using the basic design concepts found in Dr. Gregorek's Basic Boost/Glider Design report, you can design a good working glider. The Gregorek report follows the basic parameters I have copied in Figures A-C and in the section labeled "Steps In Designing A B/G." He will give you some actual

suggested dimensions for a BB/C, and you can take it from there. Now is the time to get his report and read it thoroughly.

Assuming you now have a basic idea of the competition glider from the Gregorek report, we can start designing a glider, no matter what restrictions are put on it by the competition event. Here I have outlined the procedure for designing a contest b/g, as I do it, and it seems to work.

The essential part is the wing. Once you have the dimensions of the wing, the entire glider fits together. Here you have to come to a decision about the type of glider (shape) you wish to make. It is now that the trade-off takes place. Do we want a bird that looks more like a rocket and will boost well, or do we go for duration with a bird that's more like a glider and disregard a good boost? There, of course, is no set answer to this question. (If there were, it would take all the fun out of building gliders.) You have to decide for yourself. I personally try to split it up the middle; make a glider that glides well but also gets as much out of the boost as possible. What we are really talking about here is the aspect ratio of the wing. There is much controversy over aspect ratio and what the ideal aspect ratio for a b/g is. You should make up your own mind on this, but a brief discussion of aspect ratio will help you to decide. Aspect ratio refers to the numerical designation found by dividing the span of the wing by the chord. (See diagrams, section labeled "Aspect Ratio.") The lower the aspect ratio, the fatter and stubbier the wing will be and the less drag it will produce during boost. The higher the aspect ratio, the longer and thinner the wing will be and the more drag it will produce in boost. Notice here I am talking about boost drag; it is different during the glide phase. I have found that gliders with aspect ratios of between 5 and 8 work well for me. You can choose your own favorite area of aspect ratio with which to work.

In gliding, the high aspect ratio wing has it all, because it produces more lift and less drag. Drag is produced every time lift is produced in a wing. This drag is caused by the air rushing over the wing tips because there is a high pressure region under the wing and a low pressure region on top of the wing.

Let's take off on a tangent for a moment and discuss how a wing produces lift. The wing is shaped like an airfoil. (See diagrams, section labeled "Airfoils.") In the case of the flat airfoil, which is most commonly used on a glider, the air moves quickly over the upper surface of the airfoil and more slowly over the bottom surface. The increased velocity over the upper surface creates less pressure there than on the lower surface, and the difference in pressure creates lift. It is actually quite a bit more complex than that. (Von Karman covers this quite adequately in *Aerodynamics*.)

Now, in a high aspect ratio wing, the air under the wing, as in any wing, tries to move to the area of lower pressure above the wing. As it moves over the wingtip, it creates what is known as a vortex, or a downwash of turbulent air. This creates a great deal of

drag, especially when it passes over or near other parts of the glider. But in a high aspect ratio wing, the tip vortices are positioned well out from the rest of the glider, and so the drag is much less.

One more point and then back to designing that glider. There is a way which is being used now to reduce the drag created at the wingtip by tip vortices. (See diagrams, section labeled "Tip Vortices.") Instead of a straight wingtip, the edge of the tip is curled under slightly. (The diagram is greatly exaggerated.) This causes less drag at the wing tip since the tip vortex at each tip is reduced. Many model rocketeers are making use of this in their contest designs.

Well, anyway, back to that glider we left somewhere around the wing area. Once you decide the amount of aspect ratio you want to use, the next step is to select a planform. There are many different planforms which are currently being used; three of them are pictured in the section labeled "Area Formulas — Various Planforms." The elliptical and the trapezoidal, or rather the clipped rectangle, are the most popular. Again, here it is a matter of taste as to which you prefer to use.

Now we can proceed. We need now to know the wing area of the glider we are building. Here it is a case of getting to know how much to use. Gregorek gives you wing areas for Hornet, Sparrow and Swift B/C, and you can approximate the amount of wing area by expanding the progression formed from those three sizes of wings. For Hornet, Gregorek recommends 20 sq. in.; for Sparrow, 30 sq. in.; and for Swift, 45 sq. in. We can assume for Hawk about 60 sq. in., for Eagle, about 75-80, for Condor about 80 to 100. Again, use your own judgement. Also, in some cases, as the engine gets bigger, more wing area isn't always the answer. In some conditions, especially under the high thrust of D through F engines, a smaller glider may do better.

So now we know the wing area and can plug that into the basic area formulas for the type of planform being used to get the dimensions of the wing. One of the dimensions, however, must be arbitrarily selected. (For example, if you are using a rectangular wing, the area formula is $A = s \times c$, where s is the span, and c is the chord. If you know you want to have a wing area of 30 sq. inches, you might want to have a span of about 10 inches. Plugging this into the formula gives you a wing chord of 3 inches.)

In this manner you can determine the dimensions of the wing. Next, referring to the segment labeled "Steps In Designing A B/C" on the diagram sheet, we determine the area of the horizontal stabilizer. Gregorek recommends $1/3$ to $1/4$ of the wing area. I find that $1/4$ works best for the birds I build; you can determine what you like as you build more gliders. Once you determine the area of the stabilizer, you can plug that into the area formula for the planform you are using and select one dimension; then you will have the other dimension.

We now do the same thing with the rudder. Gregorek recommends $1/10$ th of the

wing area. I find this a little large, but it works. Again, use the area formula for determining your dimensions. In the case where you use the elliptical and trapezoidal planforms, you are using only $1/2$ the planform in the rudder, so you should divide all of the right side of the area formula for that particular planform by 2.

We now have determined the size of the three surfaces of our glider. Next we need to know the length of the body of the glider between the surfaces. Gregorek recommends the distance between the wing and the stabilizer to be 0.4 to 0.6 of the wing span. He also mentions that the size selected for the length "l" should be judged by the area of the horizontal stabilizer, "the shorter the distance 'l,' the larger the area of the stabilizer should be."

The distance from the leading edge of the wing to the nose, "n" is given by Gregorek as 1 to 2 times the wing chord. I always use at least 2 times the wing chord and sometimes more. I like a lot of nose length on my gliders; it gives more distance for any nose weight to work through, and therefore makes it more effective. You can experiment with this, and choose a nose size which you like.

Next we should determine the dihedral. This is found by dividing the span of the wing by 4. If you are planning to build a bi-hedral wing (two panels), you simply glue the wing together so that the determined amount of dihedral is glued in. If you are building a tri-hedral wing (3 panels, similar to Gregorek's BB/C) you divide the wing span by 8 and raise each tip that amount. If you are building a polyhedral wing (similar to the one pictured in Fig. B), you should raise the two inner panels about $1/2$ the amount of dihedral and divide the rest among the remaining panels.

You will also have to build a pod, and we'll get into that more in Part II. However, the pod should be at least $1/2$ in. higher than the wing surface and more if you are using the larger engines.

In Part II we'll delve into construction techniques, built-up wings, covering wings, and perhaps a few words about rocket/gliders. You should have enough information here and in the Gregorek report to go out and build a basic design glider and try some of your own ideas with it.

We now continue where we left off last time, starting with a discussion of glider construction techniques.

When choosing materials to work with in building gliders, we have to find ones that are both lightweight and strong. This limits the material available to balsa wood, spruce, certain types of very thin plywood (veneer), and some other lightweight materials.

Let's turn to the wing first. Generally, the material here will be balsa wood, although foam wings have enjoyed a recent come back in popularity and tissue covered balsa and built-up wings are also used to a great extent.

When sanding a balsa wing to shape, care must be taken not to hurry. A major mistake which many modelers make when sanding an airfoil is to hurry. There are basically two methods which can be used. The first is to slowly sand the airfoil to shape, and this is a very effective way to do it unless you are using balsa which is greater than 1/16 inch thick, then it takes forever to finish the airfoil. In the case of thicker balsa, get a very small plane (X-Acto sells one which is ideal) and slowly (and carefully) chip away portions of the wing until the general shape of the wing airfoil is achieved. Then sand to the final shape with gradually finer and finer grades of sandpaper. Just remember to be careful when using this technique; one cut too deep and the airfoil is ruined.

Most modelers make their airfoils with the apex (high-point) about 1/4 of the way back from the leading edge of the wing. The area in front of the high point is rounded after being tapered down slightly. The portion behind the apex is then tapered down so that the edge comes almost to a point.

The next step is to glue in the proper dihedral angle. Cut the wing apart with an X-Acto knife at the appropriate places. (In the middle if only building a dihedral wing, at the points 1/4 of the wing span from each tip if making a trihedral wing, at all three places for a four-paneled wing). Place the wing on a piece of waxed paper when gluing the dihedral in so that the wing doesn't stick to the surface it is resting on.

Shape the airfoil on the horizontal stabilizer in the same manner. Here, normally no dihedral is built into the stabilizer, so it can be glued directly on to the boom. However, when first gluing the stabilizer on, glue only the forward portion of the stabilizer. A small piece of scrap balsa is then glued underneath the rear portion of the stabilizer, once the glue on the forward section has dried, in order to raise the rear portion of the stabilizer. This is known as decalage, and it is helpful to the glider when the glider is in a dive. Decalage will help to pull the glider out of the dive and start it into a proper glide.

The materials which can be used for the body of the glider are many. Generally, the power of the engine to be used will determine what type of material is used for the body, since with the more powerful engines, stronger bodies are required for the glider. With engines in the 1/4A to A category, a balsa boom will suffice; however, be sure that you get a piece of balsa which is not only

lightweight but also strong. If you are building a glider which will be using larger engines, then go to a spruce body. Spruce is a much stronger material than balsa wood, but it is not much heavier and can be used in smaller sizes than a balsa body. In other words, if you use a balsa body, you might have to use a body with a diameter of 1/2 inch and a 1/8 inch width. However, in a similar type glider with a similar engine, you might be able to use a 1/4 inch diameter spruce body of 3/32 inch width.

Several methods have been developed over the years for detaching the engine portion of the model from the glider after ejection. By far and away the most popular method in use today is the pop-pod with a piece "x" attachment. The nick-name "piece x" comes from the fact that for the past several years, this piece was always referred to as piece "x" in drawings and plans for boost/glidors. The piece X is a piece of the body which is cut out of the top of the body and glued to the bottom of the pop-pod. It is pictured below.

The pop-pod is a very effective method of attaining maximum altitude in a boost/glider and then releasing the glider for the gliding portion of the flight. The pop-pod is made of a short piece of body tube and a nose cone with a piece of wood, usually balsa wood making a pylon to raise the engine up from the wing of the glider. The piece "x" is glued to the bottom of the pylon and the pop-pod, with the engine and separate recovery device fitting right into the body of the glider. The piece "x" moves forward in the body during thrust and the angle of the forward cut assures that the glider is caught on the pod and travels upward. When the ejection charge goes off, the pod slows down due to the extra drag, and the nose cone comes off. But the glider still has momentum, and it leaves the pod as it slides forward, guided by the rearward cut of the piece "x".

When flying a pop-pod, I have found that a small parachute is very much superior to a streamer as a recovery device. A streamer is often easily caught in the wing of the glider after it deploys, and the glider does not separate and dives. (This is called a Red Baron). A parachute takes a little longer to deploy and isn't as large, and therefore it is less likely to tangle in the glider.

When flying large engine gliders, the pop-pod becomes a less reliable method of boost. Although it can be used in most cases, an often more reliable system is the parasite glider.

The parasite glider was first used in large engine competition back in 1971 by Dave Craiton of the Fox Team of Pittsburgh's Steel City Section. At that time, Condor (F engine) Boost Glide was a new, and as yet unconquered, science. Dave came up with the idea of using an extremely stable core booster and strapping a small glider to the side of it. The booster was generally a larger rocket than a normal pop-pod type rocket, and usually has extremely large fins to increase the stability factor. In fact, Dave used a two-stage Omega vehicle, with two D engines and a 1/4A booster to just nudge it into the F engine category (40 m-sec). The glider was a Micro-Manta, a very small version of the CMR Manta.

This method can be very successful, and I still often use it. It can be a big help if you have to fly a large engine glider event on a day when it is excessively windy, since pop-pod gliders are inherently less stable and the booster rocket of a parasite glider, being very stable, will still fly almost straight up. You can then trim the glider so that it is somewhat nose-heavy, and therefore will come down rather quickly and you will be able to recover it.

As you can see from the above example, strategy is a big part of boost/glider competition, as it is in any competition. It is important to think through what your rocket will do, even before you build it. When you sit down to design your bird, you should be able to think through the entire flight in detail and know what will happen in almost every contingency. Also, when you get out to the flying field and you are going to fly, pay attention to the weather. You may want to change to a different glider with worse weather conditions. So it is a good idea to have two gliders with you; one for fair weather flying and one for foul weather. The modeler who has the optimum glider in each case will be the winner.

Now let's look at finishing gliders. This is again a big area of controversy at the present time. How much finish is optimum? In my opinion, a couple of coats of clear dope with a light but thorough sanding in between is sufficient. Others like to put heavier finishes on gliders, in order to get smoother surfaces. Here they may cut down drag, but they pay a heavy price in weight. You would be surprised at the amount of weight that the pigment in colored dope can add to a glider. There are still others who put no finish on a wing at all, but leave the surfaces of the balsa uncovered, although sanded. Here, there is very little weight to the glider, but a great price is paid in the amount of drag which is added due to surface drag. As with almost every scientific question, I think the answer lies in a tradeoff between the two extremes, and a couple of coats of clear dope with sanding in between is the answer I have found.

As you get deeper into gliders, you will want to try other methods of construction, and the tissue-covered wing and the built-up wing are two important steps you will want to try.

Tissue covering a wing can add a great deal of strength to a balsa wood wing, and at the same time put a good finish on the wing without adding very much weight. The method is very easy, and with a little practice is a very effective method of strengthening wings.

Cut and sand the wing with its airfoil to shape. Cut a piece of tissue a little larger than the wing to the shape of the wing. Heavily dope the top of the wing with a mixture of 1/2 clear dope and 1/2 dope thinner, and lay the tissue, shiny side up on the wing, smoothing it carefully with your fingers. Place the wing on waxed paper, place another sheet of waxed paper over the wing, and weigh it down so the wing will not warp. Let this dry 24 hours. Then cut the tissue, where it overlaps, at the corners of the tissue, dope the tabs protruding from the wing and turn them

under, doping them to the bottom of the wing. Place the wing under the weights and allow to dry. Now cut another piece of tissue to the dimensions of the wing, dope the bottom of the wing and smooth out the tissue on the wing. Allow this to dry 24 hours. The resulting wing will be extremely strong and lightweight.

A built-up wing is made from pieces of balsa glued together to give a very lightweight but thick and strong wing. Tissue is placed over the wing to give it shape and strength. Here again, the tissue should be placed on the wing one side at a time with the shiny side up, but it should be applied wet (doped with a 1/2 clear dope 1/2 thinner mixture) and pulled gently so it is taught. When the wing dries, it is sprayed with water and when the water dries, the tissue shrinks, making the wing very tight. Here again, weighting the wing to prevent warping is essential.

This concludes our look at B/G's. They are intriguing model rockets, fun to build and, as you can easily tell from this article, there is no set way of designing them, so there is room for innovation.

Manufacturers Update

There really isn't much new on the manufacturers scene these days. We can only update you on when the new things you know are coming out will be coming out.

I spoke with Dane Boles at Estes a week or two ago. He said the small X-Wing fighter was due for shipment in a few weeks (I guess that's now). For you guys in Houston who put out Vertical, I asked Dane about the E engine rumors you mentioned. He said there is no truth to the rumor unfortunately.

All other unreleased Star Wars models from Estes will come out during the summer months, and Dane said there would be 3 to 5 new kits from Estes during midseason.

Centuri will have its ALCM Cruise Missile ready for sale in May of this year. The remainder of their

Strike Force will be released during the summer.

GOOFED AGAIN!

As usual we got a few things fouled up in the February issue of Echoes, so now it's time to correct our errors.

1. If you're a rules fanatic you'll know a 4"x30" streamer isn't legal. Well that's what I had as the size streamer for my Class 1 S.D. bird on page 12 of the February issue. Please note that it should have been 3" x 30".
2. On page 19 of the last issue it was mentioned that MARAM-19 lost \$600. I spoke with Terry Lee, chairman of the Contest and Records Committee, who wanted me to make it clear that the committee did not lose \$600, but rather lost only \$100 seed money given to Doug Pratt to get things going. Doug lost \$500 out of his own pocket.

These are the only goofes we made that we know of. If you see a mistake let us know. We will be glad to eat Crow pie if we deserve it. Send letters to ECHO HQ, 513 Erin St., Eau Claire, WI. 54701.

(Editor)

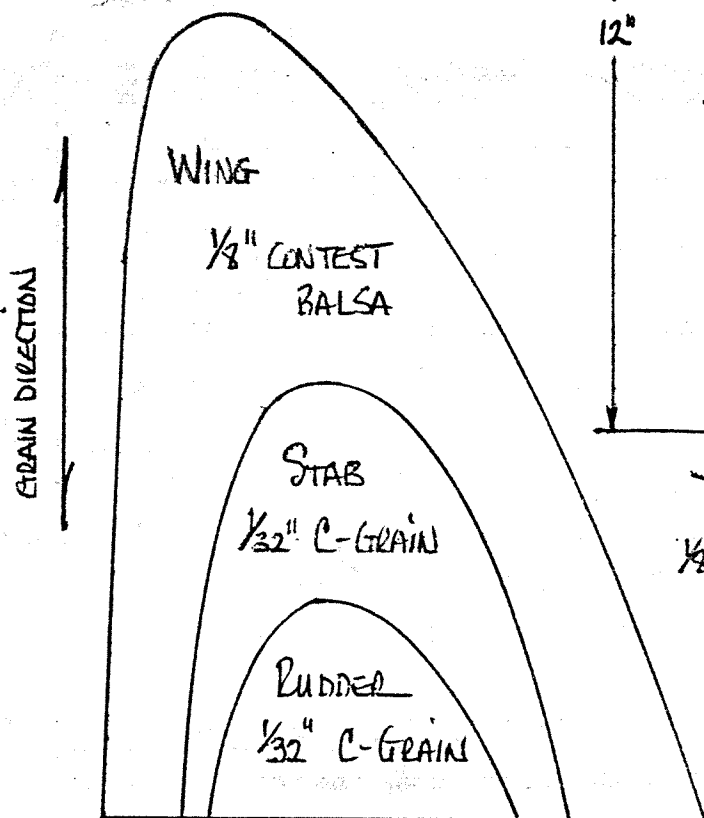
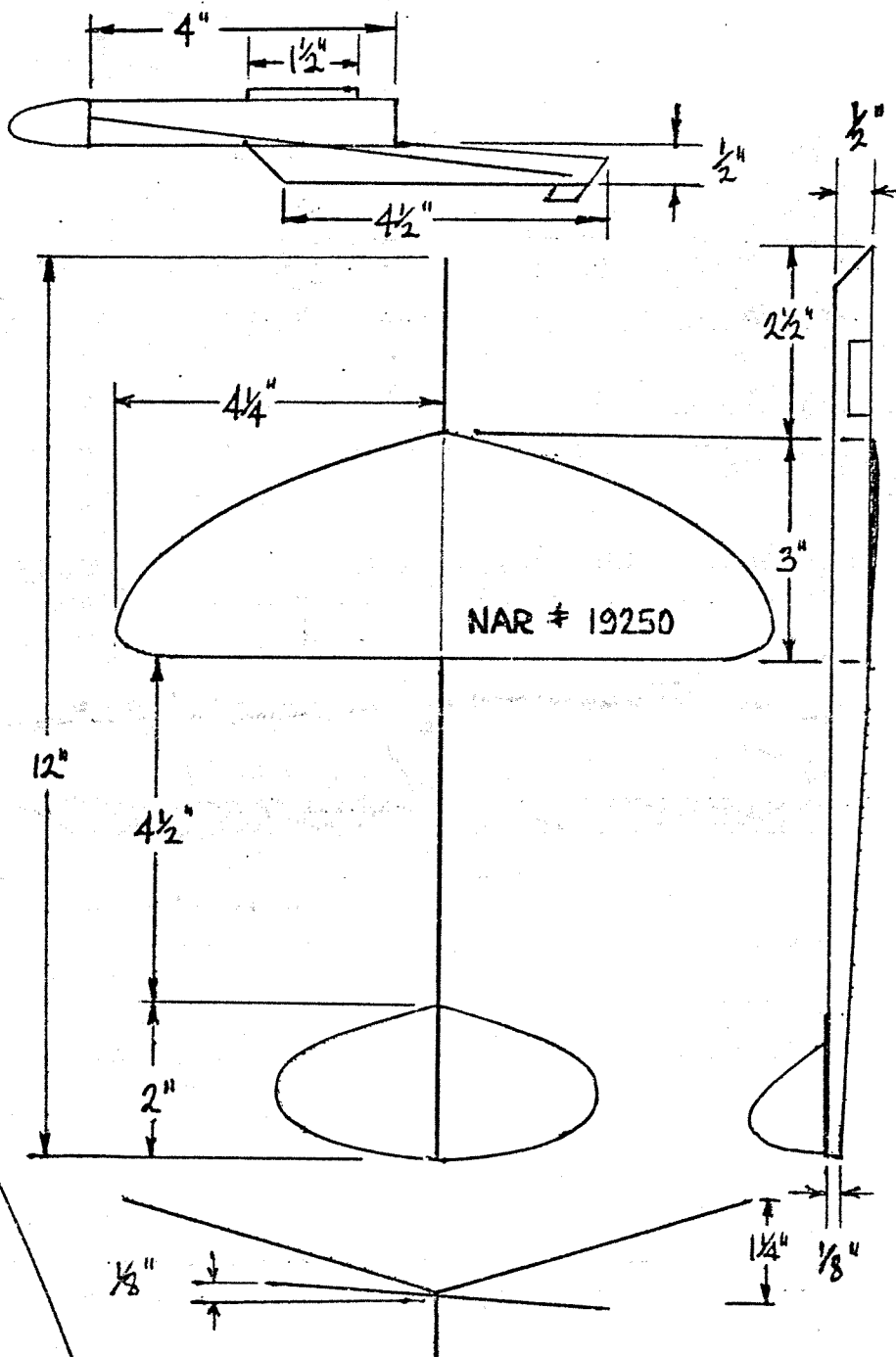
the Parksley Eaglet: A HORNET B/LG DESIGN

by Mark "Bunny" Bundick - NAR #19250.

(2ND PLACE IN A DIVISION HORNET B/LG AT NARAM-18)

Materials

1/8 x 3 x 9 contest balsa
 1/32 x 2 x 6 C-grain blasa
 1/8 x 1/2 x 12 hard balsa
 or spruce
 1/8 x 1/2 x 1 1/2 hard balsa
 or spruce
 4" BT-5 or RB-50
 BNC-5E or NC-50S
 1 1/2" launch lug
 12" of 30 lb. test fish line
 6" x 1" streamer
 white glue
 modeling knife
 220, 320 grit sandpaper
 clear dope and thinner
 Jap tissue
 3-2T engine
 clay trim weight



DIHEDRAL DETAIL

WING AREA (A_W)	20 in. ²
STAB AREA (A_S)	7 in. ²
ASPECT RATIO (AR)	2.2

PEE WEE 1

by: Eric Nixdorf

DRAWN BY: BRUCE CAREY NAR 27552

NAR 28662

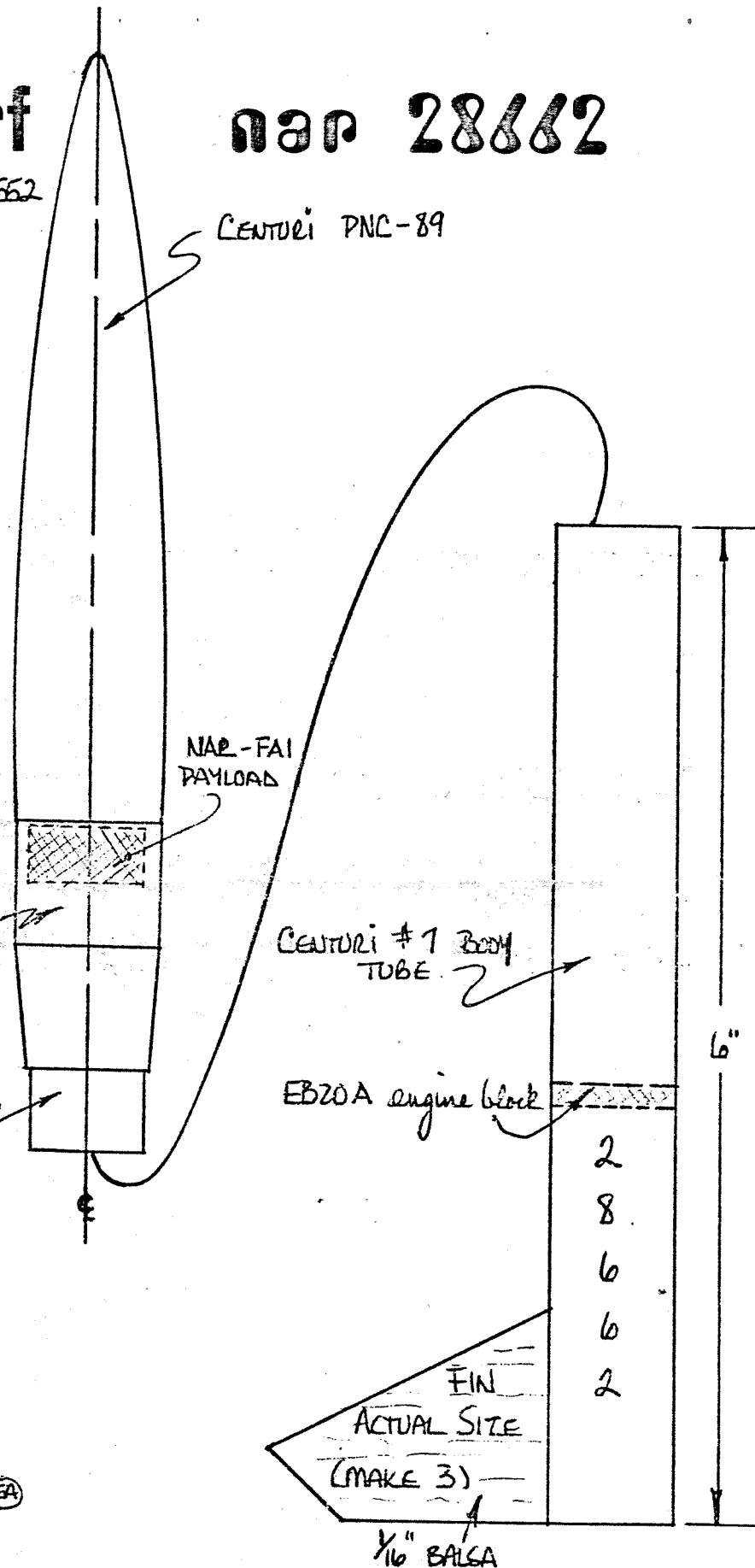
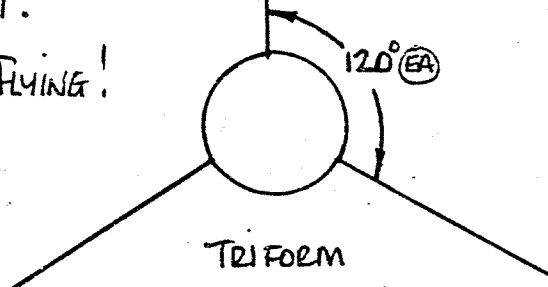
PARTS LIST.

- (1) 6" LENGTH OF CENTURI ST-79 BODY TUBE.
- (1) 3/4" LENGTH CENTURI ST-8 BODY TUBE.
- (1) CENTURI PSR-78 ADAPTER.
- (1) CENTURI PNC-89 NOSE CONE.
- (1) ESTES EB20A ENGINE BLOCK.
- (3) 1/16" BALSA OR .40 STYRENE FINS.
- (1) 14" LENGTH OF ELASTIC SHOCK CORD.
- (1) CMR 1/4 MIL. MYLAR CHUTE (12").

NOTES:

1. GLUE 3/4" LENGTH OF ST-8 TO PSR-78 ADAPTER. USE PLASTIC CEMENT.
2. FRICTION FIT NOSE CONE INTO #8 TUBE - ADAPTER ASSEMBLY AFTER PAYLOAD HAS BEEN PUT IN PLACE.
3. FLY WITH A B14-5 OR B14-7.

GOOD FLYING!



How to Apply for Records

NOTE: The procedure for filing an FAI international model rocket performance record is identical to that for filing a United States national model rocket performance record. The differences are in the homologation fees and in the number of copies of the data that must be submitted. FAI record categories are limited to Altitude, Payload, Parachute Duration, and Boost-glider duration.

1. The RECORD ASPIRANT or the LOCAL CONTEST DIRECTOR must notify NAR CONTEST BOARD by telephone or telegram within 3 days of the date of the record attempt. The following information must be given: name, NAR number, address, age, record category, contest sanction number, date of record attempt, place of record attempt, value of performance claimed, and whether NAR or FAI record attempt (or both).

2. NAR CONTEST BOARD, upon receipt of notification, replies by letter to the RECORD ASPIRANT (with copy to NAR RECORDS SUBCOMMITTEE along with copy of notification information) acknowledging receipt of notification. If FAI record, NAR CONTEST BOARD immediately notifies John Worth, Academy of Model Aeronautics, 1239 Vermont Avenue N.W., Washington, D.C. 20005 (202-347-2751) who will notify appropriate FAI offices.

3. The RECORD ASPIRANT insures that the LOCAL CONTEST DIRECTOR and judges comply with the requirements of Paragraph 32, U.S. Model Rocket Sporting Code, 1967 Edition. LOCAL CONTEST DIRECTOR must mark all entry blanks and flight cards pertaining to the record attempt with the words "RECORD ATTEMPT". All flight cards involved must be countersigned by the three witnessing judges. A standard NAR Application for Record Homologation may be used. The actual contest paperwork properly signed must be postmarked to the NAR CONTEST BOARD within 7 days as prescribed in the pink book.

4. The RECORD ASPIRANT must forward to the NAR CONTEST BOARD the homologation fee of \$25.00 for FAI records and/or \$5.00 for USA records at the time the LOCAL CONTEST DIRECTOR submits the competition paperwork to the NAR CONTEST BOARD. The FAI fee is required by FAI to cover costs; NAR fee is necessary to reimburse costs of postage, telegrams, form, telephone, and other material costs of homologating the record.

5. The RECORD ASPIRANT completes all requirements of Paragraph 32.6 and submits 3 copies of the photograph, drawing, and other material (6 copies in the case of FAI records) to:

NAR CONTEST & RECORDS COMMITTEE
Terry Lee, Chairman
802 Nantucket Court
Richmond, VA 23235

This documentation must be postmarked no later than 60 days after the record attempt and should be transmitted by Certified Mail to insure delivery.

6. The NAR CONTEST BOARD forwards to the NAR RECORDS SUBCOMMITTEE all official contest documents pertaining to the record attempt. This should include the standard NAR Application for Record Homologation (if used), the record aspirant's contest entry blank, and the flight card of the record attempt.

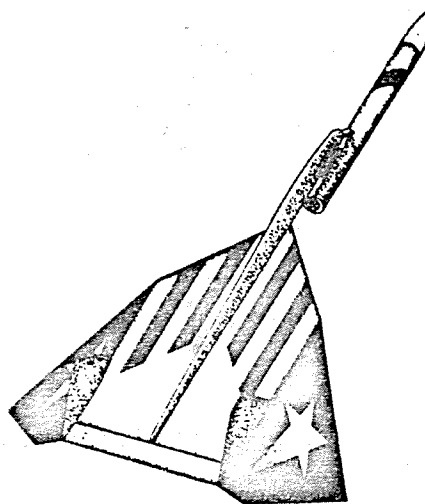
7. Upon receipt of all data, the NAR RECORDS SUBCOMMITTEE reviews the data and documentation. It must be complete, accurate, and beyond question. The NAR RECORDS SUBCOMMITTEE may invoke Paragraph 32.7 for additional information or may require the RECORD ASPIRANT to re-do the drawing or photograph if the

RECORDS SUBCOMMITTEE feels that it is necessary. The NAR RECORDS SUBCOMMITTEE then assembles a Record Attempt Dossier (RAD). For FAI records, 3 copies of the RAD are submitted to the AMA for transmittal to the FAI. For USA records, the NAR RECORDS SUBCOMMITTEE issues a letter of acceptance to the RECORD ASPIRANT, files one copy of the RAD, and forwards a copy of the acceptance letter and the RAD to the NAR CONTEST BOARD and to the EDITOR MODEL ROCKETEER.

8. For an FAI record attempt, the NAR RECORDS SUBCOMMITTEE will notify the EDITOR MODEL ROCKETEER upon submittal of the RAD to the AMA. The EDITOR MODEL ROCKETEER will publish, as soon as practical, the name, address, NAR number, age, record category, contest sanction number, date of record attempt, place of record attempt, and value of performance claimed, noting the fact that the record attempt has been filed for FAI homologation.

9. One of the reasons for submittal of complete information about a record attempt is so that the information can be published to notify other model rocketeers of the full details so that they may construct a model of the record attempt vehicle themselves; full publication of information is deemed by NAR to be necessary in the scientific tradition in order to advance the state of the art of model rocketry. A RECORD ASPIRANT therefore tacitly grants publication rights of the photograph and drawing to the NAR for this purpose. Therefore, upon notification by the NAR RECORDS SUBCOMMITTEE that either a USA or FAI record has been homologated and accepted, the EDITOR MODEL ROCKETEER may at that time publish the drawing, photograph, and full particulars of the record-holding model in the earliest possible issue of THE MODEL ROCKETEER, official newsletter of the NAR.

10. For an FAI record attempt, a homologation notice will be received by the AMA from the FAI. The AMA will retain a copy for its files, send the original to the NAR RECORDS SUBCOMMITTEE, and send a copy to the NAR CONTEST BOARD. NAR RECORDS SUBCOMMITTEE will notify the RECORD ASPIRANT and EDITOR MODEL ROCKETEER.



SPACE HISTORY

March 4, 1968. Ogo 5 (Orbiting Geophysical Observatory), an unmanned 1,347 pound satellite, was launched from complex 13 at Cape Kennedy atop a modified Atlas Agena booster. The initial orbit apogee was 91,195 mi. and the perigee was 181 mi., with a period of almost 63 hours. Its purpose was to obtain additional information about the Sun's effect on Earth.

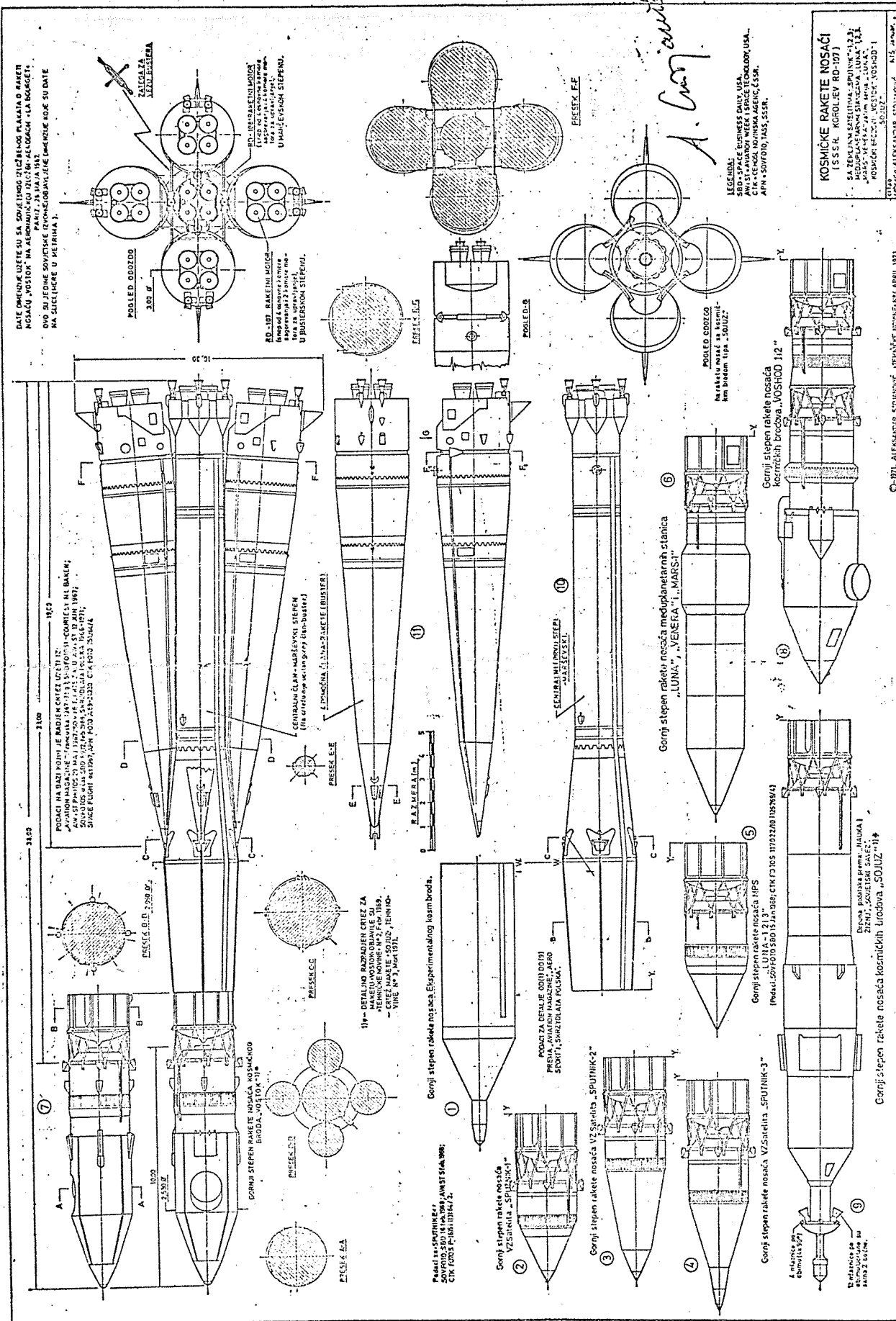
March 5, 1968. NASA and the Naval Research Lab (NRL) launched a four stage Scout vehicle with a 198 lb. Explorer satellite (#37) on board. It was launched from Wallops Island, Va. at 1:28 pm. This satellite was a SOLRAD (solar radiation) spacecraft, used to monitor solar radiation.

April 6, 1968. Two satellites, 1 weighing 220 lbs. and the other weighing 236 lbs., were sent into orbit by means of a single F2 booster rocket launched from Vandenberg Air Force Base. Their purpose was to measure cosmic radiation in space.

March 3 to 13, 1969. The flight of Apollo 9. This mission spent ten days in Earth orbit, and cost an all time high of \$340,000,000.00. The space-worthiness of the LM. Two of the astronauts flew the LM a total of $6\frac{1}{2}$ hours on its own during the mission. The mission started at Cape Kennedy on pad 39A at 11:00 am EST on March 3, 1969. The three astronauts were: Air Force Col. James Alton McDivitt, 39, the commander, Air Force Col. David Randolph Scott, 36, command module pilot, and Russell Louis (Rusty) Schweickart, 33, LM pilot (a Civilian). The launch vehicle was a three stage Saturn V. It was 363 feet tall, and weighed 6,483,320 lbs. at liftoff. The command module was nicknamed Gumdrops, and the LM was dubbed Spider. Reentry was accomplished in the Atlantic at 12:01 pm. EST on March 13, 1969 only one mile from the target, 360 miles NW of San Juan, P.R. The Guadalcanal recovery ship was a mere $4\frac{1}{2}$ miles from the splashdown site.

March 31, 1966. Luna 10 was launched from Soviet territory at 1:47 pm. Moscow time. This was the first man-made object to achieve a selenocentric (near-lunar) orbit. It was put into orbit around the Moon at 9:44 pm. on April 3, 1966.

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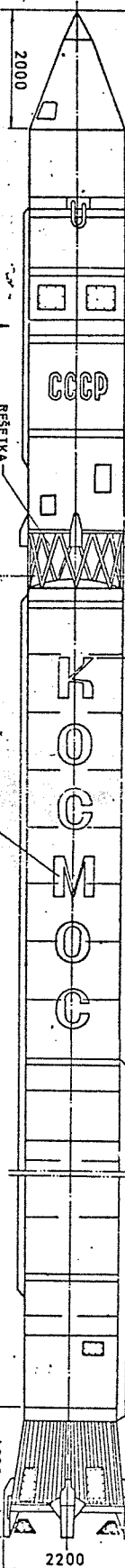
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DRUGI STEPEN

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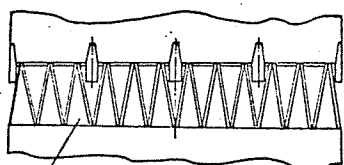
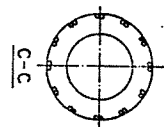
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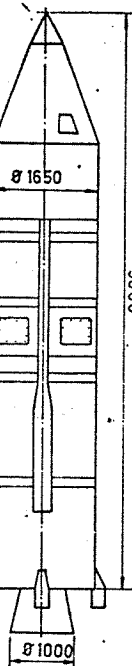
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RAZVIJENI OBIM REŠETKE

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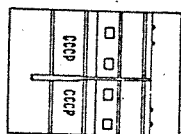
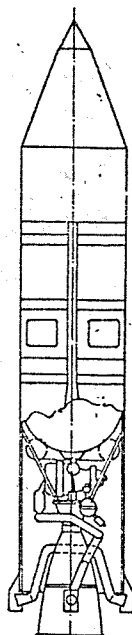
POGLED - A



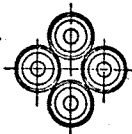
POGLED - B

OBLIKA MOTORA ZA UPRAVLJ.

SMEŠTAJ RAKETNOG MOTORA RD-119

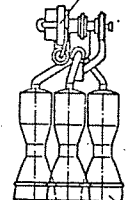


DRŽAVNI GRB SSSR



TURBO PUMPA

SNOP OD 4 KOKODRE

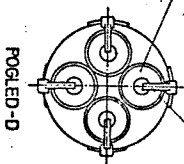


RAKETNI MOTOR RD-114

POGONSKA JEDINICA I-og STEPENA

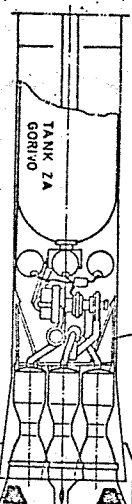
POTISAK 73 tone

MLAZNICA ZA UPRAVLJ. (4)



POGLED - D

GASNA KORHULA



SMEŠTAJ RAKETNOG MOTORA RD-114

TANK ZA GORIVO

RAM-NOSAČ MOTORA

CRTEŽ Front

SLOVA CRVENE BOJE, VERTIKALNA KOLONA SA DVE STRANE (180°)

INDEKS



RAZMERA 1:50

RADNI CRTEŽ

PRVI KOSMOS LANŠIRAN 16. III. 1962 god.

RAKETNI MOTOR RD-119

POGONSKA JEDINICA II-og STEPENA

POTISAK 11 tone

Karakteristike mlaznice



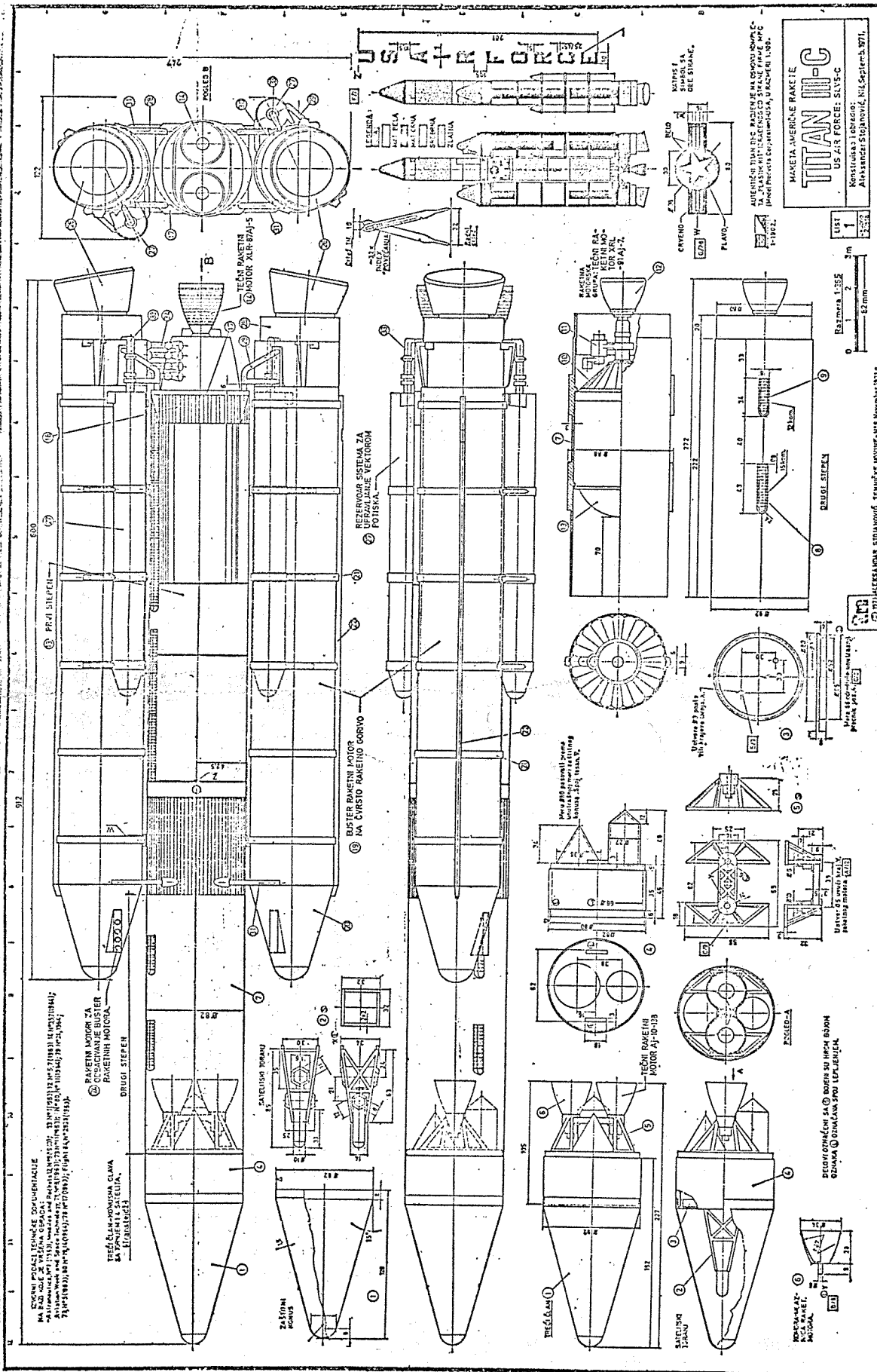
KOSMIČKA RAKETA-NOSAČ
SSSR "KOSMOS"

CRTAO I OBRADIO: Aleksandar STOJANOVIC

Obrada u tušu: Viktorija STOJANOVIC

BOJA
[Symbol] CRVENA
[Symbol] KREM IZUC-KASIA

AMERICKA KOSMICKA RAKETA NOSAC • TITANIC



WIScon - I (RESULTS)

NAME	CLUB	SCALE	LIAR	DISP.	OD	IC	CR	CO	PTS.	OP
A DIVISION										
H. GIESLER	TAC	2			1		3		37	8
C. KING	TAC			3	2				17	10
K. HOBSON	TAC					3			4	14
P. PATHOS	ECHO	1			3	1	1	1	61	2
K. ZINGLER	TAC					2	2		12	12
B DIVISION										
V. ASP	JND				3				6	13
E. BERNHARDT	TAC	3	2		2		3		40	7
T. QASEM	TAC	1				1	1		50	4
S. ZINGLER	TAC	2		3	1	2	2	2	56	3
C DIVISION										
B. CARLEY	ECHO	1			2		2		45	5
D. COOK	DART		1						25	9
D. JONES	TAC		3			3			14	11
A. NIENAST	TAC	2		2	1	1	3	3	61	1
J. ZINGLER	TAC			1	3	2	1		42	6

Key: Liar = Liar's Contest, Disp. = Display Contest, OD = Original Design,
 IC = Identical Craftsmanship, CR = Craftsmanship, CO = Costume Con-
 test, pts. = Total Points, and OP = Overall Place.

Newsletter Contest winner - Echoes , Newsletter of the Eau Claire High Orbiters.

Club Points Totals:

Tomah Aerospace Club - 333
 Eau Claire High Orbiters - 106
 Des Moines Area Rocket Team - 25
 Independents - 6

Most Active Section:(TAC disq.)
 Eau Claire High Orbiters.

Championship Rocketeers:

1. Alvin Nienast (TAC)
2. Pete Pathos (ECHO)
3. Scott Zingler (TAC)

We in Eau Claire thank the Tomah Aerospace Club, now known as the Western Wisconsin Association of Rocketry (WVAR), for a fun and educational convention.