THE LEADING EDGE IS BACK!

NEWSLETTER OF THE NORTHERN ILLINOIS ROCKETRY ASSOCIATION
N.A.R. 1984-85 NATIONAL SECTION CHAMPIONS

MARCH APRIL 1985

CHALLENGER'S LESSON

by Bunny

A flight of 73 seconds. Just your average A RG flight at NARAM-27 last year. And, as Jay Apt put it, seven fine people and a good ship were gone.

I'll leave the technical analysis and decisions about responsibility to the Presidential Commission. After the initial shock and grief, I asked myself if there was a lesson here specifically for model rocketeers. The answer I came up with was an old and simple one: **safety.**

How many of us, particularly old timers, have gotten complacent about safety? How many times last summer did I march out to the pad without disconnecting the battery? How many times did you put in a parachute a little tightly and mutter to yourself, "The ejection charge is strong enough to kick it out; it'll be OK."?

If you see yourself in any of these or similar situations, then it's time to shape up. All those seemingly minor details can add up to a big error. And while model rocket failures are neither fatal or spectacular, the Big One, the accident that causes a major insurance claim or personal injury, could be the next bad model rocket flight. Will you be the modeler involved? If you are, will you be thinking back to some minor item you overlooked in building or preparation?

The next time you fly rockets and think of Challenger, remember all the little things you **MUST** do on every flight to insure safety. And don't fly until you're absolutely, positively sure everything is ready for flight.

NARAM-28 UPDATE

by Bunny

Things are starting to shape up for a really excellent NARAM. While we're still waiting for "official" word from the Air Force on the use of the field, nearly everything else is set.

I spent another afternoon in Champaign discussing our plans with the University of Illinois officials. Barb and I ate in the dorm cafeteria, and can honestly report the food is good! There's a salad bar, cereal bar and sandwich bar, so you won't go hungry even if you don't like the main entree. And it's an "all you can eat" set up!

We decided to replace dinner Wednesday night with an outdoor picnic. There'll be steaks, chicken and fresh corn on the cob, salads, deserts and drinks (something a bit stronger for the adults, too!).

The facilities in the dorm are excellent; several small lounges, a large multipurpose room for bigger meetings, a snack shop, game room and projection TV for the movies. We're planning a "Sci-Fi Movie Night" after the Picnic.

The awards banquet will be held in the Illini Union, and will be fully catered. We have room for about 130 people there. The "tradition" of door prizes continues, thanks to Claude Greenlee, and we're trying to get really unique trophies.

Cost? Looks to be about $180 for double room, board, entry fee, picnic and banquet. If you've ever thought about attending a NARAM, this one is it! Next NARAM planning meeting will be Sunday, March 16. Be there.

HIA TRADE SHOW

by Bunny

This year is going to go down as one of the most active in NIRA history. With NARAM already in our court, the NAR Prez called on us again in January. The HIA trade show was in town, and the NIRA troops had to man the NAR information booth at the Consumer Fair. We didn't get much warning, so the normal NIRA planning got shortchanged. Still, we pulled off the show without too much trouble.

"Greatest hobby in the model rocketry" intoned Gaffer, and this was a opportunity to prove it. NIRA members Bob Kaplow, Ric Gaff, Tim Marcy, George Riebesehl and Bunny pulled models off the shelf for display. Ric had 1,000 handouts for the gawking public, and Jedi brought out the TV set, NIRA video and VCR. The NAR sent some Junior and Senior brochures, and John Pursley, **AmSpac** editor sent some handouts for the Carstens Publication booth. Finally, Mark O'Brien and Woody Woo came down from Michigan to help out.

The video was a big hit, especially one Woody brought down. It was a series of news reports on the hobby, and it stopped the crowd right in front of the booth. Thanks, Woody!

I'll let Ric tell you about all the new Estes products in his catalog review, but suffice it to say, the Estes line is getting better for the average NAR member. Squadron says they're going to put out a book on the Space Shuttle. Great! With my little drawing of the beast, and their photos, I should have minimum scale data.

All in all, it was a pretty nice way to blow off a Saturday. McCormick Place isn't easy to get around in, but we spread the word about model rocketry for 7 hours. The show may be back, so come on! We need more NIRA troops to come out and help educate the public.

MODEL OF THE MONTH WINNERS!

The Model of the Month Winner for January is Tim Marcy and his Mars Lander. Congratulations, Tim!

The Model of the Month Winner for February is Don Linder, Sr. and his R2D2. Congratulations, Don!

T MINUS ONE

NIRA's Scheduled Events

MONTHLY MEETING - MARCH 7
Glen Ellyn Civic Center, 7:30 PM

Bunny will have more data on the NARAM, including (ahem!) some more jobs for you guys to pick up. Don't forget your "Model of the Month"!

CERNAN OUTING - MARCH 23
Join the NIRA troops for an outing to the Cernan Space Center, Triton College, 2000 Fifth Avenue, River Grove. The show starts at 4:00 PM and includes two films; **Halley's Comet** and **Space Shuttle.** Cost is $3.00 per person (assuming the club doesn't pick up part of the tab, which it might. Be at the March meeting to vote on it.) Call Tony Lentini for directions, 455-7756.

MONTHLY MEETING - APRIL 4
Glen Ellyn Civic Center, 7:30 PM

Launch time, folks! Are you ready for the first outing of the season?

NARAM MEETING - APRIL 13
1523 Cleveland Street, Evanston
(Bunny's place; 475-5048)

Review range operations, schedule and budget. Bring your ideas for the "Sci-Fi Movie Nite", and good suggestions for the Dead Last But Finished (DLBF) awards.

NORTHERN ILLINOIS ROCKETRY ASSOCIATION NAR SECTION 117

THE LEADING EDGE

is published bimonthly by and for members of the Northern Illinois Rocketry Association, NIRA, NAR Section #117, and is dedicated to the idea that Model Rocketry is FUN! Membership dues are $3.00 per year and include a one year subscription to the Leading Edge. Non-member subscriptions are available for $5.00 per six issues (normally one year). NIRA exchanges the Leading Edge at no charge with all model rocket clubs publishing regular newsletters. All membership and subscription fees should be sent to Bob Kaplow, 1628 Waterford Lane, Palatine, IL 60074. Articles, plans, other newsletters and news items of interest should be sent to Jedi George Riebesehl, Editor, 513 Brockton Lane, Schaumburg, IL 60193. Any material published in the Leading Edge may be reprinted by non-profit groups if proper credit is given.

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WINTER BOARD MEETING

Decisions in Dallas
by Bunny

The annual Winter Board of Trustees meeting occurred February 14-16 in Dallas. Unlike some recent past Winter meetings, this one ran long. The meetings ran on for twenty hours or so. All the Trustees but Howard Kuhn were in attendance, and the Board had a lot of business.

American Spacemodeling took up a lot of time. John Pursley reports that operational problems seem to have smoothed out. However, Ron Goforth, Business Manager, has had to resign, and John is not satisfied with our current mailing service. Thus, there will be some changes, but nothing John can't handle. The magazine budget for '85 came out OK, a $206 surplus.

Things aren't standing still financially. The Post Office increased postage rates in February. John also has a major expenditure project in the wings. **COLOR COVERS!!!** You read right; a color cover on a model rocket magazine will be back. Surprisingly, after a lengthy financial analysis, the color covers cost about the same as our current two color covers. The color should show up in your mailbox for the June issue. To cover the increased costs of postage and color, the Board voted to increase John's allocation to $0.66 per member per month.

The magazine will probably see wider hobby shop distribution as a result of this cover change. The Board also asked John to investigate using the AMA's ad representative in order to increase ad revenues and coverage.

Claude Greenlee's **Membership Committee** also got an allocation of $3,000 to start a new program. Claude will develop and distribute a "License Station" similar to those used by the AMA. These stations are put up in hobby shops and contain self-mailer applications. The AMA got many memberships from their stations.

Claude also happily reported that the NAR's membership cracked the 3,000 barrier. As of February 1, the membership stood 3,039. The renewal rates are dropping, however. This is due to the percentage of Junior members increasing; Juniors historically have lower renewal rates.

Bunny gave his stellar report on the NARAM preparations. See his report elsewhere in this issue. The Board did appropriate $1,000 to do a target mailing to teachers involved in various Estes Educator programs and to regular Estes mail order customers in states around Illinois. It's hoped that this mailing will attract new people to the NAR.

Terry Lee of **Contest and Records** reported that he is continuing to print the Top Competitors list in **AmSpac**. He also has two persons working to automate the points record keeping. Finally, Terry has started a Pink Book Revision. NIRA members should funnel their suggestions and comments to Bob Kaplow, who is a member of the subcommittee handling the revision.

Matt Steele reported the **LAC** will be revising and reprinting the Competition Handbook. The Handbook will be sold as a NARTS item, but the Board seeded the project with $1,000 to cover the up front expenses.

Jack Kane of **Standards and Testing** reported the Aerotech D8, an 18mm D motor, had been certified, and the Triennial Recertification has started.

Bunny reported on the **Headquarters Automation Project.** He has compiled a 54 page design document, and is about ready to finalize the design. He recruited Chris Tavares and Scott Hunsicker, both Board members who work in data processing, for a final design review. Since the membership is up considerably, this project is very important, and Bunny was instructed to implement the system as soon as possible.

Bunny also reported on **Se. Activities.** The committee's w. is on hold until the h. Automation project and NARAM-28 are completed.

NARTS has been shifted to Nettie Hunsicker. The entire NARTS operation will be moved to Austin in order to reduce Doris's workload. Nettie will be running "NARTS Product of the Month" ads and reviewing the inventory after the transfer.

Jerry Gregorek reported on the **Internats Team.** All went well with the '85 Team, and Jerry is working on the '87 Team Flyoffs. The Board directed Jerry to appoint a "team coach" to assist with the competitive preparations for the '87 World Championships.

On the possible **US-USSR Contest**, we won't know anything until the April CIAM meeting in Paris. Howard Kuhn will be attending this meeting and carrying the ball for the NAR.

Harry Stine's **NFPA Committee on Pryotechnics** reported the NAR proposal to change the definition of a model rocket and model rocket motor passed the committee and is scheduled for a full NFPA review at their annual meeting in November. This is good news for NAR members interested in high powered rocketry.

Reviewing the **NAR Budget**, the Board found themselves working with a good cash balance and a positive cash flow for 1985. This provided the cash needed to finance the projects outlined above. The Board also projected no dues increase for the next year or so.

It's obvious from the reports reviewed and decisions made in Dallas that three key ingredients have combined to make the NAR stronger now than in any time in the past decade. The membership is large enough to support many local activities and provide sufficient people to staff various national committees and projects.

continued on page 6

ETR - 15 The Legend continues...

ETR-15
A Not-Altogether
Impartial Account
by Don L. Linder

After winning the National Section Championship and posting an impressive 11,299 points and 38 individual trophies at NARAM-27, our club decided to hold yet another meet at Bong Recreational Area near Burlington, WI. We held three open meets there for the '84-85 Contest Year, with all events being the same to allow practice for NARAM-27. It was good practice, but boring for the experienced competitors.

We decided to hold an October meet back in August in the comfort of Jedi Morris' home. (Brad hosted the victory party.) I think most people wanted something different out of this contest, so the feature event would be F BG. Condor, they called it. I knew right away that was one event beyond my range of experience. Going up to C for SD from A and B was about all the "high power" rocketry I was ready for.

Conceived in warm August, ETR got off to a slow start in cool, windy November. Not much flying was done on Saturday except for a couple of misguided helicopter flights by an overly eager novice in a very high wind. Ten people spent the afternoon in the shelter, building for various events. Jedi built a helicopter, Tim Marcy worked on his flop-wing BG, Tom Hoelle of Ft. Wayne Scale fame assembled his impressive **Genie** for Sport Scale, and Bob Hart, also of Ft. Wayne, worked on finishing his helicopter. Sport Scale static judging was finished in the afternoon, and we left on CD Ric Gaff's announcement that the range would be open at 7:30 Sunday. Reports promised better weather.

In fact, the weather early Sunday morning was good. My son Don and I, Tim Marcy and the DRUG Team (Jedi George and Pat Peterson) were waiting for Ric, who arrived almost on time. We started Sunday with a couple of nice HD flights from Don, unlike mine from the previous day. My first attempt was a 177 sec. flight in C SD. When told it could be a US record, I went out to recover the birdie with great hope. Since I'd lost sight of it during the flight, I was lucky to find it. Gaff the CD gave me a good line on it, and that helped a lot.

The rest of the competition arrived shortly thereafter: Bullet Bob, Bunny and Barb, Tom Hoelle and Bob Hart. Due to the shortage of time, we decided to drop the altitude events and downgrade the meet to an Open. As the wind picked up, it became clear this was a wise decision.

C Streamer proved difficult due to the wind. Don Linder launched his first flight from a piston I built, and promptly tore off all three fins. Tom Hoelle also flew his new **Ozone Baby** from my piston. He got a nice boost, but the model was never seen again. As suggested by Matt Steele in the May 1985 AmSpac, Tom had built two identical models, so his second and third flights were OK.

A technical note: I built this piston after seeing one Ric Gaff had at NARAM. Tom was quite familiar with this design since he and Ric used to be teammates. I was very happy to see it work properly. (This piston is a non-zero volume design, and Ric has used his for years without replacement. It pays to look around the contest range for good ideas to try, so take this note from Don to heart. - Bunny)

Bob Kaplow, whose 229 second B SD flight at NARAM won the event, had his eye on the 5 year old C SD record. When informed it had already been beaten, he said "If I can beat 127 seconds, I can probably beat 177." He made his usual tower launch, and the model was never seen again. Late in the afternoon, it was returned by Don Linder. The streamer attachment was broken.

Rocket Glider, with 1/2 A engines was not particularly exciting. All attempted flights were recovered, and there were really no outstanding flights. Don's first flight hung on the rod, but his second attempt was sufficient to take the event in A/B.

I saw about five helicopter flights which went fairly well, considering the wind and the usual number of shreads, no rotations and other DQ's. Bob Kaplow unfortunately lost his one remaining NARAM winning **Rotacrock.** It flew away even though Bullet had added extra weight. He got a return from an extremely CHAD spin fin recovery to win the event. Two consistent flights from Don Linder took A/B Div.

Sport Scale qualifying were routine for my **Shuttle Columbia,** which actually glided in (sort of), for Bullet's venerable **Tomahawk,** and for Don Linder's **Titan II.** Both Tim Marcy's **Mercury Redstone,** and the DRUG Team's **Aerobee 350** fell victim to catos. Both model got repaired and flown to get first in A/B for Tim and second in C for the DRUG Team. Tom Hoelle's outstanding **Genie** had a severely underpowered flight. While the prototype is an

air to air missile, this model turned out to be a surface to surface. Yet he won the event on his quality craftsmanship.

Condor BG, the feature event, was retained on the schedule, despite the wind, and was the real excitement of the day. I missed seeing Bunny's flight while recovering my SD bird. Bunny's **Apteryx** was the first venturesome Condor off the pad, and was returned to put him in first place for a while. (It also got the rest of the troops off the dime! They didn't want me to have all the fun. - Bunny) Tim Marcy had one so-so flight. He lost a flop-wing tip during boost, but it glided anyway. After brief repairs, he mad a second try, only to have a spectacular F7 cato. Little damage resulted, except to a replacable engine pod. His third and final try was a valiant effort. 'Nuff said.

The DRUG Team used Jedi's external parasite, a highly strengthened **Flanigan Flyer**, powered by three D12's. George and Pat are excellent modelers, but their recover ability is uncanny. This flight's return put them in first, with the only possible threat from Ric Gaff's newly built, fixed pod BG. It was a nice model Ric had been planning to build for a couple of years. Unfortunately, the enlarged **Teen Angel** pitched down under the excessive thrust of the Aerotech F10-2 motor. The prang destroyed the fuselage beyond immediate repair, but the wings were salvaged. I'd like to see Ric try this again.

Later in the afternoon, Jedi flew two flight of his new **Dark Star** F powered RC BG. The first flight would have been an international 5 minute max, but Jedi had some fun looping. The second flight was well beyond the max. His flights were enjoyed by all and demonstrated his able skill in building, flying and piloting.

At the awards presentation, Tim Marcy got first in A/B and Don Linder took second. In C Division, the DRUG Team took first, and Don Linder (the older) was thrilled to get second. (It's my first meet trophy.)

ETR-15 RESULTS

A/B Division	CONDOR B/G	B H/D	C int SD	1/2A R/G	Sport Scale	
Don C. Linder		30/31	uns/81	hg/26	587 Titan-II	76
Tim Marcy	29/cato/ng	12	84/94	ng/9	619 Redstone	660
C Division						
Don L. Linder		uns/28	177/141	45/21	789 Shuttle	430
Drug Team	108/290	75/nd	96/80/115	23/55	801 Aerobee	868
Tom Hoelle			np/105/90		824 Genii	292
Bob Hart Jr.		50	81/79			108
Mark Bundick	74	39	121	hg/44		318
Bob Kaplow		82/17	np/78	22	739 Tomahawk	290
Ric Gaff	prang					0

Meet was held as an open meet
Altitude events were not flown
NIRA wants to thank everyone who attended.

NIRA - 3330
SCAM - 400

In summary, although ETR was the smallest meet I attended this year, there was a very friendly and supportive feeling among all, and a nice end to the competition season. I will miss going to Bong, and will be eagerly awaiting next spring's contest schedule. See you then.

"This ain't gonna look good on our report, Leroy."

"Well, the Parkers are dead.... You had to encourage them to take thirds, didn't you?"

"Well, of COURSE I did it in cold blood, you idiot!...I'm a reptile!"

Winter Board Meeting continued

The financial state of the NAR is good and provides sufficient funds to finance growth oriented projects. Finally, the "management" of the Association, the Trustees, committee chairmen and other volunteers members, have sufficient expertise and experience to really make the Association grow.

Personally, I'd waited ten years for this Board meeting and the chance to really discuss projects and committees designed and committed to moving the NAR forward. I think the actions taken here may have as big an impact on the NAR as the Safety Code changes we made last year. See you at the NARAM meeting.

THE 1986 ESTES CATALOG

A Review by Ric Gaff

The new Estes catalog is here and it had a number of very interesting things.

A little unusual for Estes these days are the three new scale kits that have been added. The **Black Brand II** (24.87" long, BT-55, D motors, Skill Level 4) is a 1/13 scale model of the Canadian sounding rocket. Plastic is used for the nose cone and tails cones while the fins are balsa. This model looks like a real winner. (NIRA members at NARAM-27 will recall Bruce Carey's prototype of this kit in D Scale Altitude.- Bunny)

The **Nike-Apache** (22.87", BT-55 and BT-5 combo, standard motors, and Skill Level 3) is a 1/12.25 scale model of the US sounding rocket. (I saw my dad launch dozens of these from Wallops in my youth.- Bunny) It uses plastic parts and balsa for fins. It also copies from the D-Region kit, the practice of using decal sheets for the payload section detail. The Nike-Apache is a very nice and easy to build scale model.

The third scale kit is a Mini-Scale Combo Pak, Skill Level 2, containing two models for the price of one. They are mini-engine powered versions of the French air-to-surface **Exocet** (9.5", BT-5) and the **I.S.Q.Y. Tomahawk** (10.9", BT-5). While both are cute little models, I particularly like the Exocet.

Gliders make a return to Estes in this catalog. The **Dragon Fly** (11.5", wing span 10", Skill Level 3, minimotors) is a real honest to goodness front engine pop-pod glider, similar to those used in contests. This looks like a good first glider for competitors. Thanks, Bruce! The **Crusader** Scissors Wing (18", BT-60, standard motors) is a model designed to look like an advanced fighter. I wonder if Al and Jim have seen this. Convert this baby to D's, folks! The third glider is the **Hitch-Hiker Glider** and is sure to warm the cockles of Bunny's heart. It's a styrofoam delta-wing glider that's hitched to side of a conventional model for flight. Hence the name. You have to supply the carrier vehicle.

Other Skill Level 2 kits include the **Hawkeye** (8.5", BT-5). Based on the last of the Mohicans, it has a military styling and uses fiber fins (shades of Centuri!). The **Fireaero** (18", BT-50, standard motors) is a spiffy sport flyer with a two stage appearance. the **Halley's Tail** (16.75", BT-50, standard motors) is a model designed in honor of the famous comet. The kit contains its own ejectable "comet", too. The **Starbird** (19.5", BT-50, standard motors) represents a future peaceful exploration spaceship. A nice change from all the warships. The **Nova Payloader** (21.125", BT-50, standard motors), as the name implies, comes with a clear payload section. I don't think it's big enough to carry a Nova (down Spock, down!). The second kit I ever built was an **Astron Ranger** which I converted to D's from a three engine cluster. Now the new **Ranger** (22.125", BT-55) is back with a new look, and it uses those reliable D's.

Among the new Skill Level 1 kits, we find the **Sparrow** (10.75", BT-5), a slick little model with fiber fins. The **Echo** (10.5", BT-20, standard motors) is a high performance model with forward swept elliptical fins. This has got to be a Bruce Carey designed model!!! A very easy to build, requiring no painting **Blazer** is next (12.75" BT-20, standard motors). Throw away your air brushes, folks. Is the **Mighty Moe** (13", BT-20, standard motors) the first in a line of Three Stooges kits? Actually, it's a fine model with delta shaped fins. The **Viking** (12.125", BT-20, standard motors) lets you chose between three and five fins, all made from fiber. The **Big Bertha** (24", BT-60, standard motors) has been given a facelift, (I didn't know it had wrinkles. - Bunny) and is looking good. The BB is a big NIRA favorite. The **Scout II** (7", BT-20, standard motors) has also been updated. The latest version of the first Estes kit is still an oldie but goodie.

In addition to the new kits, Estes added a new launch controller. The interesting thing about the **Electron Beam Launch Controller** is that it comes completely assembled. It is similar in style to the Solar Launcher, but not quite as spiffy looking in my book.

One final item I almost forgot is the **Rocket Book.** This 224 page soft cover book is a guide to building and launching model rockets "for the space age". We'll try to review it in a future issue.

On a scale from 1 to 10, I'd rate this latest catalog an "8". Would have been a 10 except for the D engine price increase. Oh, well, we'll just have to settle for the scale kits and gliders. Enjoy!!!

SCIENTIFIC ENGINE SELECTION

by Alan Jones

The most common question in model rocketry is "Which engine should I use to fly this model?" Usually, you check the manufacturer's catalog or altitude prediction charts. That's a good place to start, but for contest flying, we want to know what engine or engine combination will give us the maximum performance. I worked out the algorithms for answering this question for the Dual Egglofter Team NARAM-27 R&D project.

I will assume maximum performance means highest ejection altitude. This seems reasonable since this is where the recovery system deploys for duration events. Also, most altitude tracking is done at ejection rather than apogee, especially for high altitudes. I will also limit the results to single engine comparisons.

You could look up in you altitude prediction charts and, after correcting for early or late ejection, decide between using a C6-5 and C6-7. You could also compare this with the C5-3 if you had the right chart. Actually, the charts available are not accurate enough for this type of comparison. Besides, the differences in altitudes may be too small to read off the charts accurately. You need to ask a computer or at least a calculator. I have asked my computer for the answer so many times I worked up a new chart to answer the engine selection question.

The computer program is written in COMAL and run on my C-64. It uses extended Malewicki Equations. But it treats each engine as a multiple stage rocket by dividing the thrust time curve into several steps. In this way, I can model variable thrust and mass in a computationally efficient manner with enough accuracy to select the right engine.

Figure 1 is the chart that appeared in the R&D report. The X-axis is the rocket mass without the engine. The Y-axis is the reference area in square centimeters times the drag coefficient. Locate where your rocket would be on the chart. If you're below the lowest curve, the C6-7 will give you the highest ejection altitude. If you are between the lowest two curves, you should use the C6-5.

Each curve defines a boundary between two engines where the maximum altitude possible is equal. These boundary curves cordon off areas on the CdA-mass plane into engine selection domains.

Every one reading this newsletter knows the C5-3 will outperform the C6-3 because it has more total impulse and a better thrust time curve. But when should you switch between the C5-3 and C6-5?

Any model which falls outside the middle curve should use the C5-3. Note how deeply the C5-3 cuts into the C6-5 domain. I was surprised that the curve was this low. Many model that flew with the C6-5 should be flown instead with the C5-3. All three engines could potentially be selected as the best for eggloft depending on the model. You should also know that observing whether ejection is early or late of apogee is not a good way to select engines. (Too much variability in delay train times. - Bunny)

Figure 2 is the mini-A selection chart. I was a little surprised here. Any model falling between the dashed lines should use the A10-3t. It is about what I'd expect from an A3-3t. But wait! Out beyond 240 grams, the A10-3t takes the lead. Of course, at this high weight, ejection occurs 20 feet off the ground, and Rick has a smile on his face as he films away. Estes recommends a max liftoff weight of 141 grams for this motor anyway. The other observation is that Estes probably should have dropped the A10-3t instead of the A3-2t.

The D engine comparison chart is much more interesting in that there are four good candidate engine from three different manufacturers. Each engine, the Aerotech D7, Estes D12, FSI D20 and FSI E5,has its own distinct character. Canaroc and AVI would have figured prominently in this comparison, but they are no longer with us. I am also neglecting the FSI D18 as a clear loser in single engine competitions. With delays, we have 11 engines to pick from or 55 engine-to-engine combinations.

Figure 3 shows the most important domain boundary curves.

The D7 is the overall winner, even out to 500 grams. This is due to its higher total impulse and low mass. If you consider that a rocket using the E5 could be built with a lower frontal area, then the E5 could beat out the D7 at masses below 30 grams, but not at all ranges of drag coefficient. The lower dashed line represents the boundary between the D7-2 and D7-4.

While the D7 is the acknowledged winner, there is good reason to compare conventional black powder engines separately. The D7 might not be selected due to higher price or lower trackability. You could argue that the D7 simply means you get to carry more tracking powder. I could add a mass penalty, but no one knows what mass of tracking powder will give a model with a D7 the same probability of being tracked as a black powder motor.

Figure 4 shows the conventional D engine selection domains. The unimportant boundaries have been eliminated and the domains are cross-

.tched. It conforms to our expectations. The E5 dominates the light rockets, the D20 excels with the heavy stuff, and the D12 holds the middle ground.

I was surprised to see the E5 domain extending out beyond 100 grams. It is the engine to use in Eggloft. I used to prefer the D20 for eggloft. I keep thing of theE5 as a cheap F7. The current E5 is more like a D18, with more Nt-Sec. packed into the thrust spike. The D20-5 squeezes in with a small domain. The D20-7 has a tiny domain and is not shown. If you considered that you could build rockets for the FSI engines with smaller frontal area, the D12-7 domain would shrink slightly, and the D20-7 domain would be visible.

Each engine has its own domain. These domains could also be mapped onto an altitude vs. mass chart as I did for the C6 domains in the NARAM-27 R&D report.

Have I answered the engine selection question once and for all? No! Engine come and go and change. There are still staging and clustering combinations. You may want to ensure that the rocket is ascending for ejections for rotarocs, etc. Off nominal or "hot" engines will dramatically shift the domain boundaries. Piston launches may shift them, too. You may be concerned about tip-off and weather cocking. These charts showed me some surprises and can settle many arguments,but you still need to use some intelligence and judgement to select the "right" engine.

FIGURE 4.
CONVENTIONAL D ENGINE
SELECTION DOMAINS

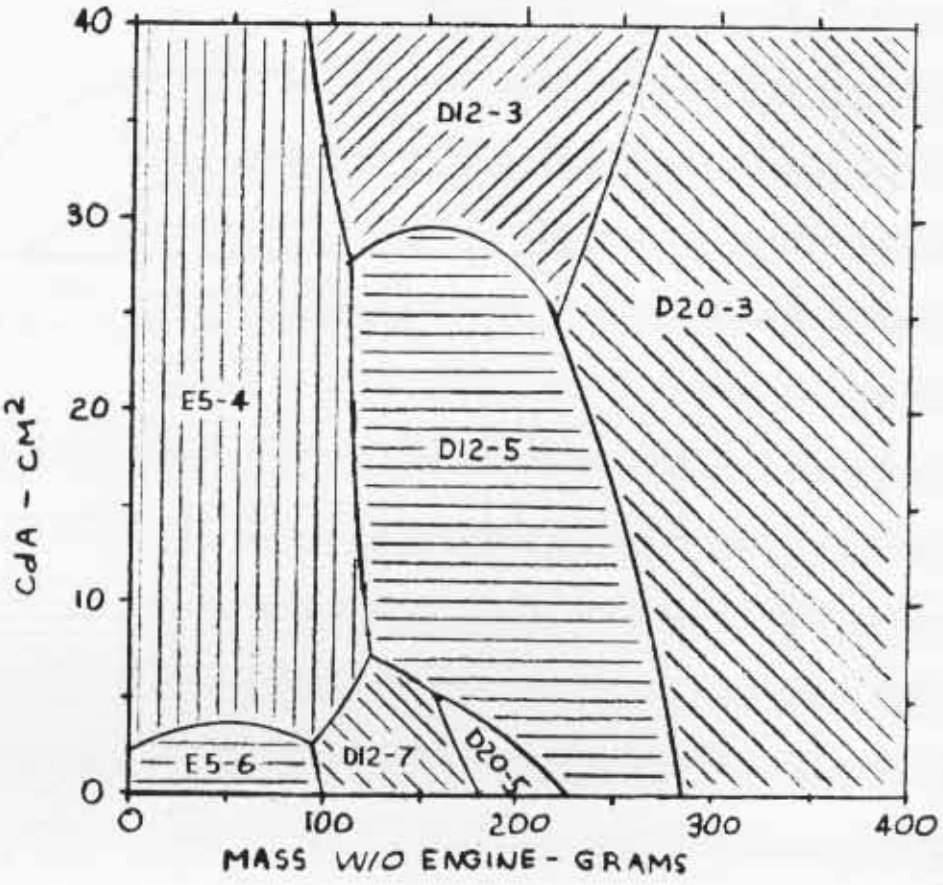


FIGURE 2. MINI A ENGINE SELECTION
DOMAIN BOUNDARY CURVES
1985 NAR SLT REFERENCE DATA

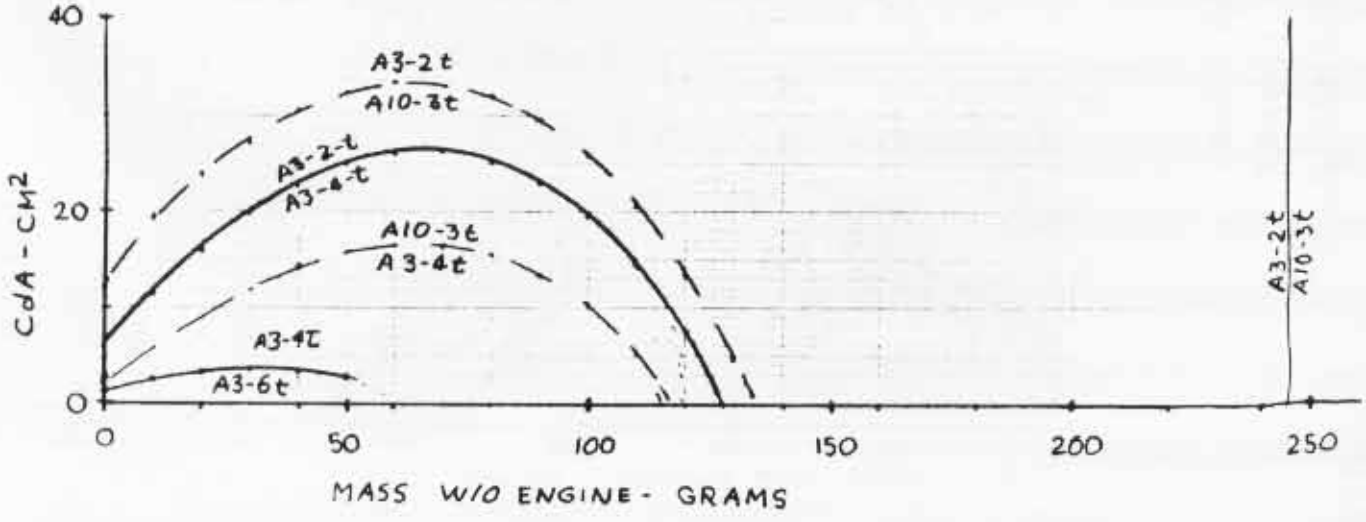


FIGURE 1. C ENGINE SELECTION DOMAIN BOUNDARY CURVES. 1985 NAR S&T REFERENCE DATA

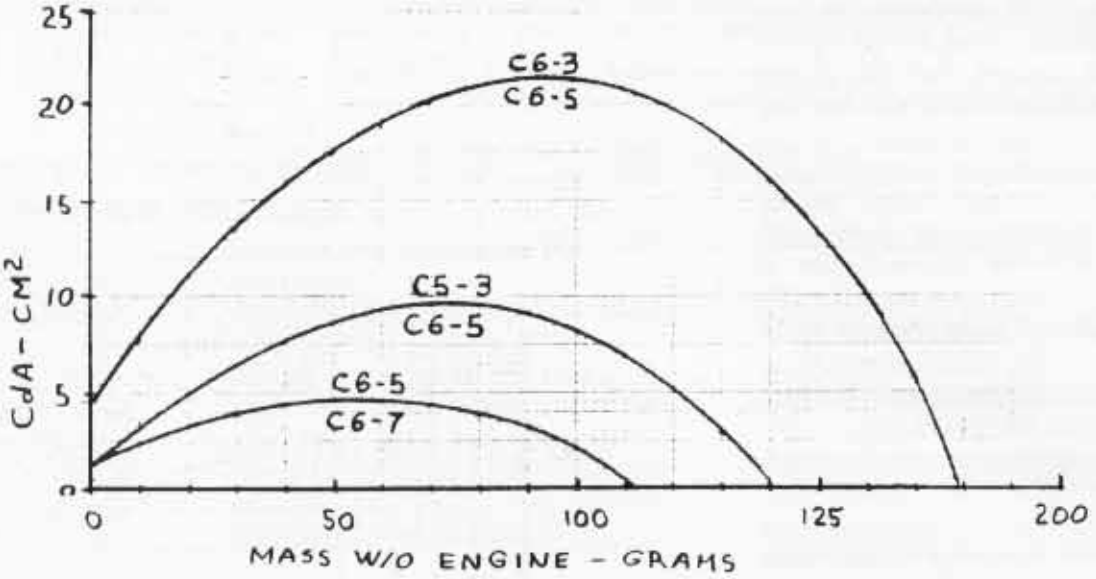
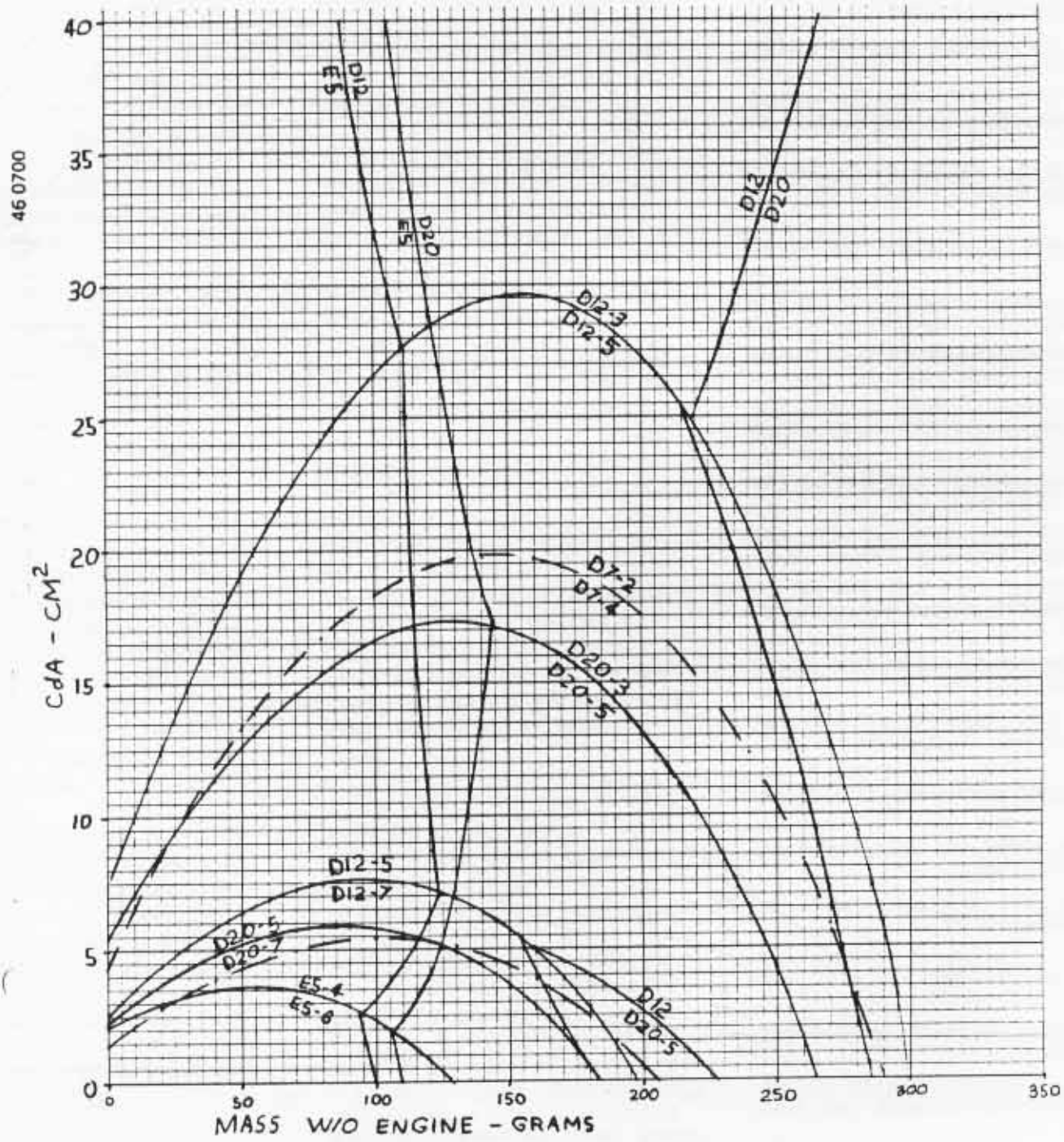
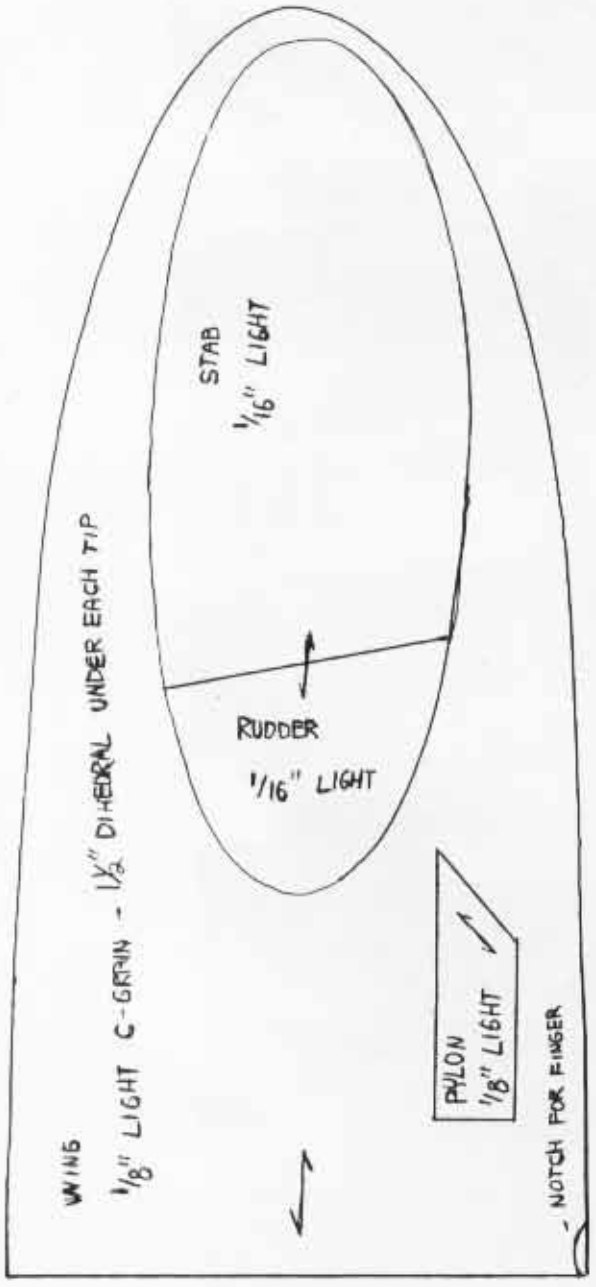


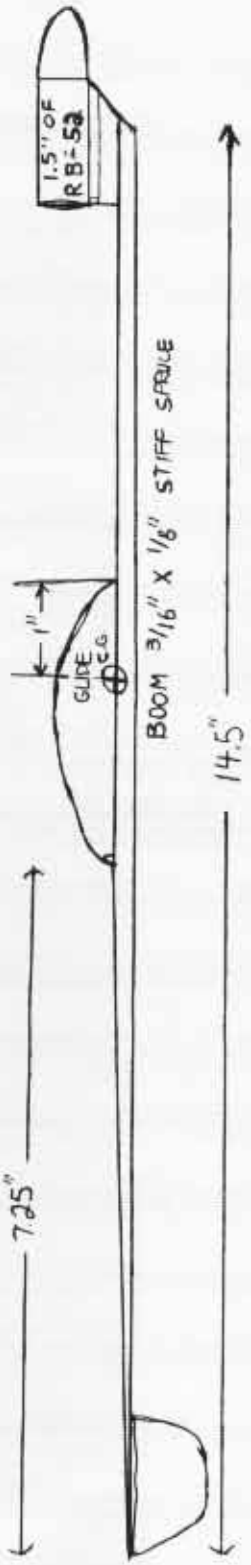
FIGURE 3. D ENGINE SELECTION DOMAIN BOUNDARY CURVES 1985 NAR S&T REFERENCE DATA



build the OTIS 1/2A - A B/G

Although this bird is easy to build, it is quite a challenge to get in trim. It is very important that all wood is carefully selected, sanded, tapered and balanced. Use only "Hot Stuff" to assemble parts. All surfaces are tissue covered. To trim, balance as shown and then warp surfaces to fine trim. Don't be afraid to crease the wood. It usually takes several hours of hand launching to ge the final trim. Because the design is neutrally stable, it has an excellent glide performance. I have thermaled away three of these models, two of them on hand launches while trimming them. To fly, wrap a few inches of crepe streamer around the engine until it fits snugly in the engine tube. The engine will then kick out at ejection and recover with the streamer. This is a challenging glider, but give it a shot. It will definitely help get your throwing arm in shape!





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