

MODEL ROCKET NEWS

Winter, 1979
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twenty national meets

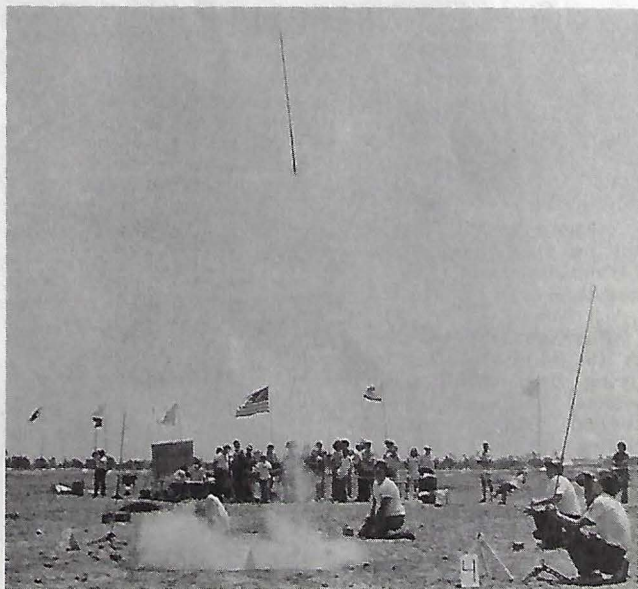
by G. Harry Stine
NAR #2

On July 16, 1959, twenty-one model rocketeers stood in the middle of a field in the foothills of the Rocky Mountains near Denver, Colorado and flew in the First National Model Rocket Championships --- dubbed NARAM-1 for short.

And on August 7, 1978, eighty-three model rocketeers and more than twenty officials stood in the middle of an abandoned Marine helicopter airport near Anaheim, California and flew the twentieth National Model Rocket Championships.

There were only two people at NARAM-20 who had also been at NARAM-1: Vernon D. Estes, President and founder of Estes Industries, Inc., and myself, past-president and one of the founders of the National Association of Rocketry (NAR). The NAR has hosted and sanctioned twenty consecutive National Meets (NARAM) where the best model rocketeers in the United States gather to compete for trophies, awards, ribbons, and the title of National Champion Model Rocketeer.

There was a lot of difference between NARAM-1 and NARAM-20. The hobby has grown tremendously and now enjoys international recognition. NAR and model rocket companies such as Estes



"Liftoff!" A "Mammoth" class Superroc with a Type C engine in its tail heads for the California sky at NARAM-20. Range was set up with twenty-five individual launch alleys, each with its own pad, ignition system, and battery. Field was a mile square!

All Photos In This Article Courtesy of G. Harry Stine.

have co-operated over the years to insure the safety and progress of this Space Age hobby/sport. Today, we enjoy the advantage of having thousands of parts, hundreds of different kits, and over a hundred different model rocket motor types to choose from. Back at NARAM-1, Estes had only four different model rocket motor types available and had not yet put their first kit on the market.

NARAM-20 reflected this progress. The boost-glider---the rocket-powered glide recovery model rocket type---was invented by Vern Estes back in 1961 and today is one of the most active competition

Vernon Estes Publisher
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areas. NARAM-20 saw flight of "Hawk" class boost-gliders that used Type C engines, 10 Newton-seconds of power. "Superroc" is now a favorite competition event with long models such as the Cobra 1500 (#1294) and the Mean Machine (#1295) being flown in a contest where the length of the model in centimeters is added to the altitude achieved in meters to arrive at a final point score; this year's Superroc event was "Mammoth" class powered by a single Type C engine with a minimum length of 100 centimeters. A new event, helicopter recovery duration,

(Continued on next page)

was also flown. In this category, the model must return using autorotation as the recovery method, and the longest flight time is scored. One of the most popular designs in the helicopter event was the Estes Gyroc (#1224).



Vern Estes and Harry Stine, the only two people who were at NARAM-20 and also at the first NARAM in 1959.

For five days, we stood in the middle of the field flying over 2000 model rockets and getting sunburned. Other events included Scale, Parachute Duration, Streamer Duration, and Egg Lofting where the contestant had to fly a fresh hen's egg to as high an altitude as possible and recover it without breaking it, the altitude in meters being scored.



Jim Smack presents his scale "Black Brant III" model for safety inspection at NARAM-20. Model was built from a basic Estes kit.

NARAM's have always included some sort of tour related to space flight or model rocketry if possible. At NARAM-11 held at the U.S. Air Force Academy in Colorado Springs, all NARAM-11 contestants

were treated to a tour of the Estes factory. But at NARAM-20 we went to the Rockwell International Space Division in Downey, California where we got the chance to climb all over the non-flying, wooden, full-sized mock-up of the NASA Space Shuttle Orbiter. Naturally, it's a little bit bigger than the Estes kit! In fact, do you know that you could put a full-sized, loaded railroad boxcar inside the 15 by 60 foot Shuttle payload bay? Think of it: When the Shuttle starts flying next year, it will be able to put the equivalent of a loaded railroad boxcar into Earth orbit every week!



Larry Peters modified an Estes Black Brant III kit for his entry in the Scale competition at NARAM-20.

When all the smoke had cleared from the skies over Anaheim on Friday, August 11, 1978, the Awards Banquet was held at nearby Knott's Berry Farm where trophies, awards, and prizes were handed out to the winners.

Estes Industries has always supported each and every NARAM, and both Dane Boles and Vern Estes were there to give each winner a gift certificate for whatever Estes equipment he wanted. Major trophies were donated by such aerospace firms as Rockwell International's Rocketdyne Division, Aerojet-General Corporation, Northrop Corporation, and Systems Development Corporation. Estes donated all the ribbons given to win-



Matt Steele and Chris Pearson, the new U.S. National Championship Team, prep their scale "Sandhawk" model for flight at NARAM-20.

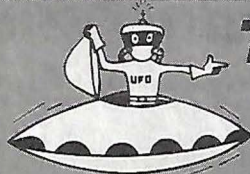
ners through fourth place in each of the eleven events flown.

But NARAM is always more than just competition flying and good sportsmanship among model rocketeers from all over America. It's a time to see what Estes and other manufacturers have in the way of new products. It's a time to find out what little tricks and tips on building model rockets have been worked out by fellow model rocketeers a thousand miles away.

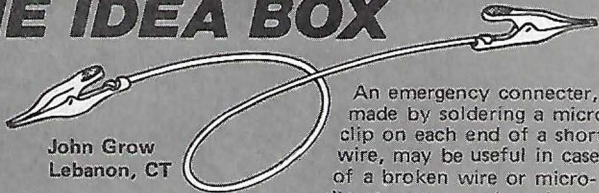
Vern and I always manage to get together for dinner to catch up on what each of us is doing and to talk about "the old days." Like the time at NARAM-8. . . Well, that's another story!

Both the NAR and Estes are celebrating their twentieth anniversaries this year. Both are looking forward to another twenty years. NAR under its new president, Pat Miller, is growing and adding new membership programs. No, NAR is not in competition with EAC because it exists for a different purpose as the United States' non-profit organization for all of model rocketry. NAR charters local clubs, sanctions official competition, certifies United States model rocket performance records, publishes a monthly magazine for its members, offers insurance for

(Continued on page 7)

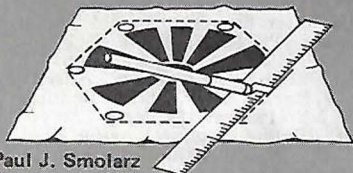


THE IDEA BOX



John Grow
Lebanon, CT

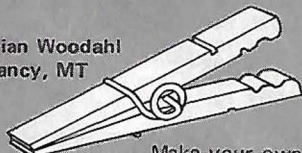
An emergency connector, made by soldering a micro-clip on each end of a short wire, may be useful in case of a broken wire or micro-clip at your next launch.



Paul J. Smolarz
Rego Park, NY

Parachutes can be cut quickly and easily by cutting along the edge of a metal ruler placed along side the dotted line.

Brian Woodahl
Clancy, MT



Make your own clothespin tweezers to aid in model rocket construction.

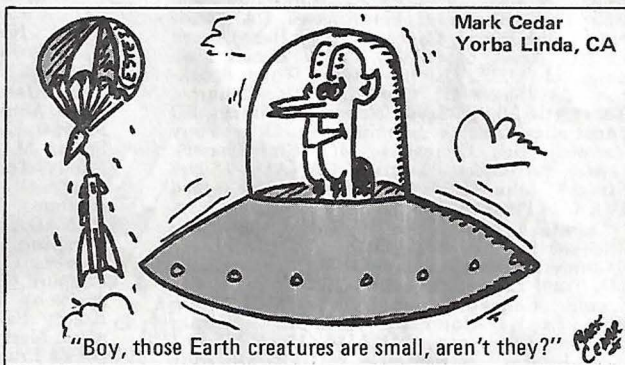
Help Us Publish The Model Rocket News

Got any good ideas for MODEL ROCKET NEWS articles, technical information, cartoons, anecdotes, club news of unusual interest, etc? Then why not submit them to us for possible publication? Our constant aim is to make MRN a better, more interesting magazine, and you might be just the type of contributor we need.

If you send us photos, please make sure that you pack them between cardboard sheets so that they won't get creased in the mail. All contributions become the property of Estes Industries and cannot be returned. Address all material to: MRN Editor Estes Industries, Penrose, Colorado 81240.

Should your article or photos be used in MRN, we'll reward your efforts and talent with an Estes merchandise certificate, the amount of which will be determined by the MRN editorial staff.

Hope to hear from you soon!



Mark Cedar
Yorba Linda, CA

Attention Rocketeers: "Have You Joined The NAR?"

Now that you are an active rocketeer we would like to recommend membership in the National Association of Rocketry.

As an NAR member you will be able to compete in officially sanctioned local, state, national, and even international model rocketry meets. Your rockets and designs will become eligible to set national and international records and most important, you will be kept informed of happenings in model rocketry around the world. Flight insurance is available now too!

Also as a NAR member you will receive a monthly

copy of Model Rocketeer, a magazine published as a service by the NAR for its members. It contains news of upcoming model rocketry and space events, manufacturers news, modroc tips, designs and plans, news of the NAR, its members, and other people in the aerospace field. Also, it contains editorials, humor, and rocketry history.

For more information and a membership application write: NAR Headquarters, Dept. E-8, P.O. Box 725, New Providence, NJ 07974.

JOIN TODAY!

DESIGN OF THE MONTH WINNERS

Congratulations to another fine group of Estes Rocketeers for their outstanding DOM entries.

First place winners will receive \$75.00 merchandise certificates and honorable mentions will be awarded \$10.00 certificates. Keep those entries coming, maybe you'll be our next winner!

FEBRUARY 1977 - First Place Two-Way Tie: Ted Polorny, Nevada, MO (Multi-Pad Launch System). Thomas E. Stipe, Durbin, WV (Pegasus). Honorable Mention: David J. Poloway, Phoenixville, PA (USS Velva). Brian Phillips, Nova, OH (Space Odyssey Display Stand). Bill Engar, Salt Lake City, UT (Auriga I Warship). Steven R. King, Houston, TX (Commander IM-21). Bill Dunham, Burlington, CT (Sceptre). Francis Pang, Stockton, CA (Scorpion). Steven Cosby, Bayville, NJ (Eagle "1"). Mark Saunders, Huntsville, AL (Nova). Carroll B. Froah, Newton, IA (CB-4). Anthony Poon, S. San Francisco, CA (Aquarius II). Scott Ormsby, Bay Village, OH (Sidewinder). John Cole, Atlanta, GA (Eminar-VII).

MARCH 1977 - First Place Four-Way Tie: Bob Dinsmore, Wilberforce, OH (An-5 Spider). David W. Reasoner, Bowling Green, KY (XF-21 High Altitude Interceptor). Rick Meidal, Auburn, IL (Launch Control). Michael R. Hambricht, Midland, TX (Aerie). Honorable Mention: Carlos E. Lopez, Los Angeles, CA (Super Nova). Joe Futral, Cayce, SC (Egg Head). Mark Carson, Ames, IA (Bijan). Ed. W. Croall, Magnolia, NJ (U.S.S. Calypso). Gary Wong, Stockton, CA (Shark II). Gordon Willis, Cleburne, TX (Little Max). Wayne Nelson, Brookings, SD (Australian Acolus Sounding Rocket). Tony Zarinelli, Ste. Genevieve, MO (Star Phaser). Costas Petroustas, Montreal, CANADA (Silver Streak). John H. Ostar, Bethesda, MD (Quad IV). Lyle Pittman, Gering, NE (Mantis).

APRIL 1977 - First Place Four-Way Tie: Richard D. Barnes, Bountiful, UT (Emporer). Tommy Mizelle, Thomasville, GA (Little Charger). Todd Lietha, Cochrane, WI (Interplanetary Lander). Kenneth Poppel, New Britain, CT (Star Ship Exit). Honorable Mention: Rodney Djukich, Edmonton, CANADA (Moon Missile). Mark Rychwalski, Baltimore, MD (DOM1). John Penney, W. Palm Beach, FL (Star Streak). Tommy Huie, Houston, TX (Avenger 101). Sam Black, Cincinnati, OH (Skeleton). Michael De Lillo, Rutherford, NJ (Starlitter Ignition System). Thomas Reidenbach, Beloit, WI (Starburst). David Miller, Menasha, WI (U.S.S. Constellation). Rodney Nelson, Morehead City, NC (Experimental J-7). Master Joannes Mario Costa, Kowloon, HONG KONG (Phantom II). Ricky Kramer, Granville, ND (Silver Streak). John Carlson, Minneapolis, MN (Pursuit).

MAY 1977 - First Place Three-Way Tie: James Harris, Orange, TX (Rocket With Glider). Billy Greenberg & Peter Diamandis, Kings Point, NY (Launch Pad Control). John Rose, Euclid, OH (Moonbeam). Honorable Mention: Phillip Nicholson, Johannesburg, MI (The Red Hornet). Douglas Ferrell, Cleveland, OH (Southern Night). Mark Alessio, Sacramento, CA (Jupiter 5). Donald E. Novy, La Grangé, IL (Galaxy Prowler). Ken Garnhart, Loves Park, IL (Earth Star I). Brian Phillips, Nova, OH (Alienus). Duane Miller, Greenwood, DE (Starlite Transport). Brian Hanson, Chico, CA (Brian's "D" Mon). Matt Harris, Jackson, MI (Midas). Mike LaBarge, Damar, KS (Spirit of 76 Rescue). David Fisher, Nashville, TN (B-2 Starfire).

JUNE 1977 - First Place Four-Way Tie: Mike Englund, Minneapolis, MN (Delta Interceptor). Tom Lindblom, Vancouver, WA (Sky-jacker II). Larry Sloop, N. Wilkesboro, NC

(Model Rocketry Mini-Unit). Jon Whipple, West Vancouver, CANADA (Hang Glider Recovery). Honorable Mention: Augie Martinez, Reedley, CA (Delta Vega). Richard Jones, Garden City, KS (The Outsider). Lance Jones, Winnipeg, CANADA (Chameleon). Danh Cong Le, Norcross, GA (SST-747). Dan Semon, Kentwood, MI (Blue Water Express). Donald T. Mutchler, Jr., Portland, PA (Delta Orbit Navigation Station). Roy Richter, Country Club Hills, IL (Rocket). Ronnie Degenhardt, Antioch, TN (Saturn V Rocket Stand). Scott Bendura, Pennellville, NY (Pioneer II). Jerry Coley, Lewisville, NC (Deltan Cruiser). Aaron A. Landy, Doylestown, PA (Star Clipper Zephyr). Julian R. Lambert, Wheeling, IL (Harpoon). David Foss, Chagrin Falls, OH (Lockheed YF-12A). Dan Becked, Rifle, CO (Fathom II). Brian Johnson & Jon Hilden, Ellsworth, WI (Launching System). Michael Walton, Montgomery, NY (Devil Bat). P. L. Tracey, Simi Valley, CA (Hound Dog). Leo Vaulin, Richmond, ME (ALCM Cruise Missile). Jack Giordano, Staten Island, NY (Gama Probe). Tim Burlingame, Williamsville, NY (Eagle). Andrew Searby, Montana, CANADA (Fireball XL-5).

JANUARY 1978 - First Place Four-Way Tie: Scott Annis, Culver City, CA (Eclipse). Monty Michael, Land O' Lakes, FL (The Moon Cruiser). Steven M. Tate, York, PA (Phantom Fighter). Randy Thomas, Portland, OR (Cineroc Film Analysis). Honorable Mention: Euc Nelson, Roxboro, NC (Jaws). John Parker, Thornhill, CANADA (Omicron). Doug Johnson, Lake Hamilton, AR (Para-Glider). Chuck Zallow, Warren, OH (Tri-Pad Launch System). Scott Cogburn, Houston, TX (Cosmic Cruiser). Terry & Richy Wittmer, Knoxville, TN (Voyager). Ronny Sadler, Leavenworth, KS (Nike-Hercules). Martyn J. Richey, Indianapolis, IN (Tomahawk Cruise Missile). Craig Power, McKeesport, PA (LD 28680 U.S.S. Pittsburgh). Tim Sherman, Bernardsville, NJ (The Pioneer 2000). Nicholas V. Kroeze, Tlacolula, Oaxaca, MX (F-111 Strategic Fighter-Bomber). Paul L. Nosek, Decatur, IL (Columbia II). Pat Allegood, Moultrie, GA (Neptune Needle). Joe Nagle, Hickory Hills, IL (The Loftier). Don Wampole, Lansdale, PA (Auriga III). Jim Bailey, Milwaukee, WI (Rechargeable Launch System).

FEBRUARY 1978 - First Place Five-Way Tie: Steve Simkins, Irmo, SC (Galactic Raider). Pat Hartley, Bisbee, AZ (The Aries Project). Mike Bade, Chelsea, SD (Swallow). John R. Edwards, Jr., St. Petersburg, FL (Icarus). Joe Ashby, Westford, MA (Launch Pad Carry Case). Honorable Mention: Dale R. Minter, Janesville, MN (The Enforcer). John Drake, Monroe, NY (Polaris VII). Gary Pryor, Cincinnati, OH (Explorer). Carl H. Griffiths, Los Angeles, CA (Shooting Star). Alexander Pucciariello, Roscoe, NY (Estes Powered). Mike Givens, Roanoke, VA (The Clustar). Donald Matlack, Pittsburgh, PA (The Equinox). Mark Jacoby, Burnsville, MN (Black Knight). Keith McKinney, Wharton, TX (The U.S.A. Transport). John Coker, Pittsburgh, CA (The Falcon). Ken Davis, Cherry Hill, NJ (Aggressor). Steven Publitz, Chester, VA (Skaray). Alan J. Reindl, Mansfield, OH (Stratus 9). Jon D. Schmitt, Geyser, MT (Gader). Mark D. Nibbe, Goodhue, MN (Perpetual Launch Controller). Chuck Schlehr & Dean Francescone, West Seneca, NY (Four Rocket Launcher).

Eclipse

SKILL LEVEL 3

WINNER JANUARY 1978
 DESIGN OF THE MONTH CONTEST
 By SCOTT ANNIS Culver City, CA

Build THE ECLIPSE with Estes High Performance Parts and Accessories.

PARTS LIST

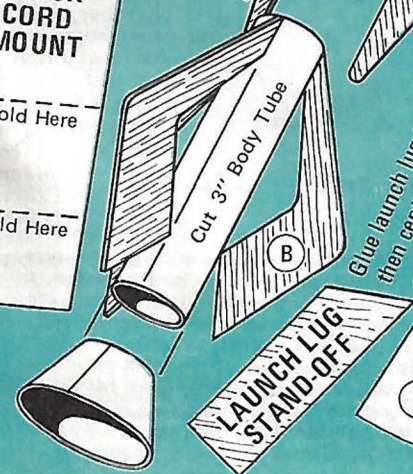
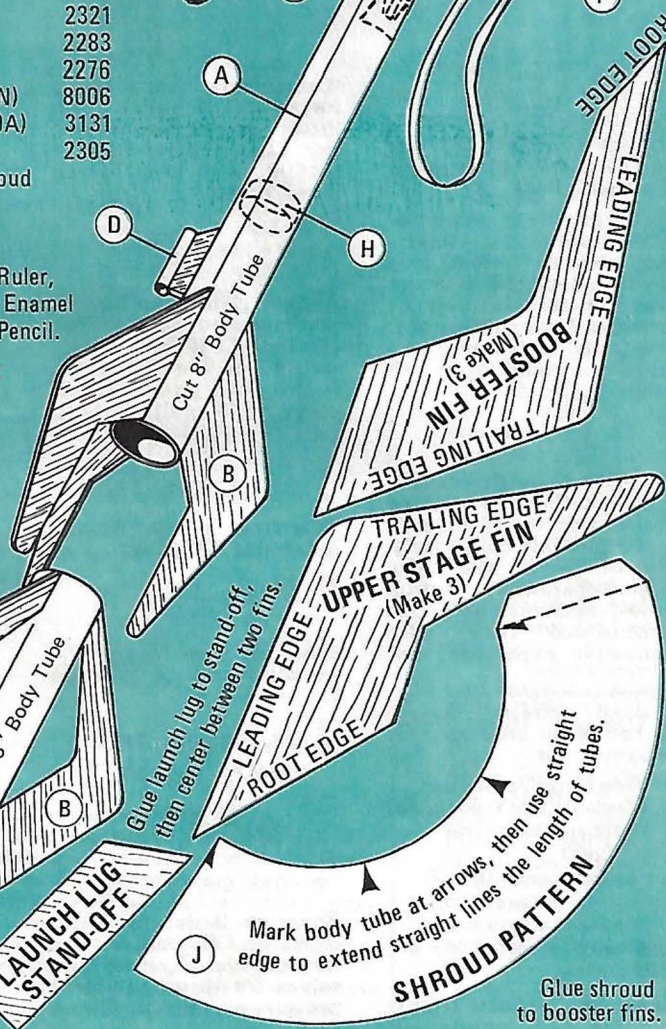
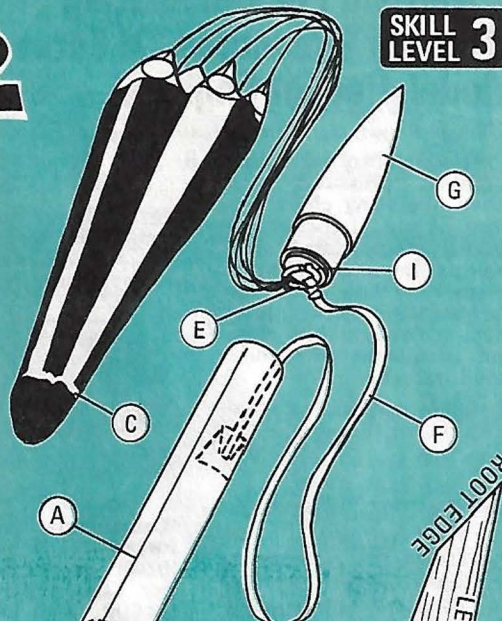
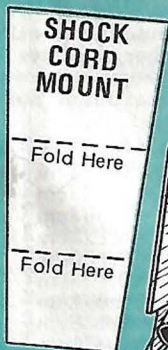
A) 1 Body Tube (BT-20)	3072
B) 1 Fin Stock (BFS-20L)	32106
C) 1 Parachute (PK-8)	2261
D) 1 Launch Lug	2321
E) 1 Screw Eye	2283
F) 1 Shock Cord	2276
G) 1 Nose Cone (BNC-20N)	8006
H) 1 Engine Block (EB-20A)	3131
I) 1 Weight (NCW-1)	2305
J) Heavy Paper for Shroud	

Additional Materials:

Hobby Knife, White Glue, Ruler, Sandpaper, Sanding Sealer, Enamel Paint (Spray), and a Sharp Pencil.

Recommended Engines:

UPPER STAGE	
A8-3 (First flight)	B4-4
BOOSTER	
A8-0 (First flight)	B6-0



A Method For Calculating Chamber Pressures Of Estes Model Rocket Engines

By Edwin Brown, Mgr. Estes Industries Engine Development

It's possible to determine chamber pressures and other operating characteristics of model rocket engines by using simple algebraic expressions and thrust versus time data. Although the results are not absolute, they are reasonably close and consistent with measured values.

A simple mathematical expression for thrust is:

$$(1) F = C_f P_c A_t$$

where

F = Thrust in Newtons (N)

C_f = Thrust Coefficient

P_c = Chamber Pressure in Newtons per square centimeters (N/cm²)

A_t = Nozzle Throat Area in square centimeters (cm²)

Thrust can be measured or taken from manufacturer's data. Nozzle throat area can be calculated if throat diameter is measured or provided by manufacturer. Now, if we knew C_f's value, we could easily calculate P_c.

$$(2) P_c = \frac{F}{C_f A_t}$$

The thrust coefficient (C_f) can be defined (neglecting corrections for divergence of nozzle exit cone, variation of specific heat ratio, flow separation, friction losses, and assuming one dimensional flow with isentropic expansion) by:

$$(3) C_f = \sqrt{\left(\frac{2K^2}{K+1}\right) \left(\frac{2}{K+1}\right)^{\frac{K+1}{K-1}} \left[1 - \left(\frac{P_e}{P_c}\right)^{\frac{K-1}{K}}\right]} + \frac{(P_e/P_c) E}{P_c}$$

where

K = Ratio of specific heats (approximately 1.3 for Estes Engines)

P_e = Static pressure at nozzle exit (N/cm²)

P_a = Ambient pressure (N/cm²)

P_c = Chamber pressure (N/cm²)

E = Ratio of nozzle exit area to throat area (nominally 2.0 for all Estes engines).

Equation 3 looks tricky, but can be simplified. If

we fired our engines in a vacuum, P_a would be zero. The vacuum thrust coefficient would then be:

$$(4) C_{f_{vac}} = \sqrt{\left(\frac{2K^2}{K+1}\right) \left(\frac{2}{K+1}\right)^{\frac{K+1}{K-1}} \left[1 - \left(\frac{P_e}{P_c}\right)^{\frac{K-1}{K}}\right]} + \frac{P_e}{P_c} E$$

Now we can see that thrust coefficient is also:

$$(5) C_f = C_{f_{vac}} - \frac{P_a}{P_c} E$$

We can now obtain C_{f_{vac}} for a given E and K from thrust coefficient tables. For Estes engines C_{f_{vac}} = 1.4609. And also for all Estes Engines:

$$(6) C_f = 1.4609 - \frac{2 P_a}{P_c}$$

At first glance, we haven't accomplished much. We can calculate C_f if we know P_c and P_a if we know C_f. Rather than give up at this point, we'll multiply both sides of equation 6 by P_c:

$$(7) C_f P_c = 1.4609 P_c - 2 P_a$$

This rings a bell. We can determine C_fP_c by:

$$(8) C_f P_c = \frac{F}{A_t}$$

Since we wish to find P_c, we will rearrange equation 7.

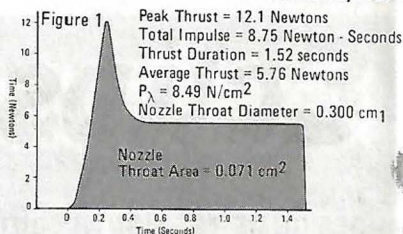
$$(7) C_f P_c = 1.4609 P_c - 2 P_a$$

$$1.4609 P_c = C_f P_c + 2 P_a$$

$$P_c = \frac{C_f P_c + 2 P_a}{1.4609}$$

$$(9) P_c = 0.685 C_f P_c + 1.369 P_a$$

Equation 9 defines P_c in terms of C_fP_c and we can now calculate P_c if we have values for thrust, ambient pressure and nozzle throat area.



Step 1. Determine C_fP_c using equation 8.

$$(8) C_f P_c = \frac{F}{A_t}$$

Step 2. Calculate P_c using equation 9.

$$(9) P_c = 0.685 C_f P_c + 1.369 P_a$$

Let's try a few calculations. Figure 1 is a reproduction of a thrust curve of a C6 engine tested at an ambient pressure of 8.49 N/cm².

Example #1. What is the peak chamber pressure?

$$\text{Step 1. } C_f P_c = \frac{12.1}{.071} = 170.423$$

Step 2.

$$P_c = 0.685 \times 170.423 + 1.369 \times 8.49 \\ = 116.740 + 11.623 \\ = 128.363 \text{ N/cm}^2 \\ (\text{approximately } 186 \text{ psia})$$

Example #2. What is the average chamber pressure?

$$\text{Step 1. } C_f P_c = \frac{5.76}{.071} = 81.127$$

Step 2.

$$P_c = 0.685 \times 81.127 + 1.369 \times 8.49 \\ = 55.572 + 11.623 \\ = 67.195 \text{ N/cm}^2 \\ (\text{approximately } 97 \text{ psia})$$

If you would like to calculate chamber pressures for our other engines, here are nominal (maximum) nozzle throat areas:

$$\begin{aligned} 1/4 A_3 &= 0.063 \text{ cm}^2 \\ 1/2 A_3 &= 0.063 \text{ cm}^2 \\ 1/2 A_6 &= 0.123 \text{ cm}^2 \\ A_3 &= 0.063 \text{ cm}^2 \\ A_8 &= 0.123 \text{ cm}^2 \\ A_{10} &= 0.100 \text{ cm}^2 \\ B_4 &= 0.123 \text{ cm}^2 \\ B_6 &= 0.071 \text{ cm}^2 \\ B_{14} &= 0.138 \text{ cm}^2 \\ C_6 &= 0.071 \text{ cm}^2 \\ D_{12} &= 0.183 \text{ cm}^2 \end{aligned}$$

H. S. Siefert and J. Crum, *Thrust Coefficient and Expansion Ratio Tables*, Ramo Wooldridge Corporation, Guided Missile Research Division, 29 February 1956.

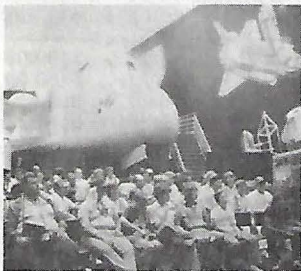
G. P. Sutton, *Rocket Propulsion Elements*, John Wiley and Sons, Inc. 1963.



The 1978 National Champs. Top row, l to r: Pete Pathos, Div. A Champ; Joel Kenny, Div. B Champ; Phil Barnes, Div. C Champ; Matt Steele and Chris Pearson, Champ Team; Chris Tavares of NOVAAR, champ Section. Kneeling: John Squirek, Div. A Reserve champ; Larry Peters, Div. B Reserve champ; Bruce Carey, Sportsmanship Award; George Gassaway, Reserve champ team. Not shown: Trip Barber, Div. C Reserve champ.

those members and clubs who require such a thing to secure their flying fields, conducts numerous educational programs, sponsors awards at national science fairs, operates skill level improvement programs, and has just inaugurated a totally new program for

non-flying space modeling buffs. Basically, NAR takes up where EAC leaves off, and both organizations work together for the benefit of model rocketeers everywhere. A lot of NAR members are also EAC members; I am.



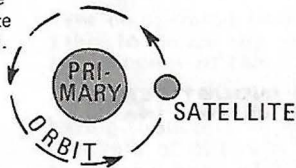
NARAM-20 contestants and officials were given a special tour of the Rockwell/NASA Space Shuttle mock-up.

So now it's been twenty years of national meets, NARAM's. And it's been twenty years that have proven beyond a doubt that "Model Rocketry Is Fun!"

Stump Your Teacher Quiz

Question for your teacher: What is the orbit of a satellite?

Answer: The orbit of a satellite is the path followed by a satellite as it revolves around its primary.



Question for your teacher: What is meant by "decay of an orbit"?

Answer: A satellite which encounters air resistance (aerodynamic drag) will be slowed down. This effect is usually greatest at the satellite's perigee (lowest point in the satellite's orbit). As the satellite slows down, its apogee (highest point in its orbit) decreases as well as its perigee. As the satellite's orbit becomes lower, the aerodynamic drag increases, further reducing the satellite's velocity. Eventually the satellite is no longer able to stay in orbit. (Its orbit has decayed.), and it reenters Earth's atmosphere. It may burn up in the atmosphere due to aerodynamic heating or its remains may crash onto Earth's surface.

mrn and Free goodies... For you!!

Model Rocket News is now published four times a year—Winter, Spring, Summer, and Fall. We will, whenever possible, mail your MRN to you with our seasonal mailings in addition to including it with return mail-orders as long as our supplies last as an exclusive service for our mail-order customers.

To receive our seasonal mailings you must be an active Estes mail-order customer which requires you to have placed an order for Estes merchandise within the past four months.

Additional Bonuses. . . All orders received on even numbered months, (February, April, June, etc.), will be returned with a "free" plan to help increase your Estes fleet. These new plans feature a variety of designs from single-stage sport models to far-out exotic rockets you will be proud to display. All "free" plans can be constructed from the Estes hi-performance parts and accessories listed in our catalog.

All orders received on odd numbered months will be returned with a free iron-on decal for your t-shirt, windbreaker, or range jacket. These iron-ons feature a variety of super-neat designs. You iron it on right at home to any surface containing 50% or more polyester.

Remember. . .these items are available only with return mail-orders!!!

Designer's Special Contest

Like to design your own model rockets? The Estes Designer's Special (#1463) contains an ideal parts assortment, packaged especially for rocketeers wishing to design their own "originals".

Designing your own model rocket from the parts included in the Designer's Special now offers you a chance to win "Free" merchandise and prizes. Enter now and you may win any of the following:

Grand Prize	\$100.00 in Merchandise
First Prize	\$ 50.00 in Merchandise
Second Prize (3 Awarded) ...	Star Wars Maxi-Brute X-Wing
Third Prize (10 Awarded) ...	Battlestar Galactica Viper

RULES:

1. All entries become the property of Estes Industries and cannot be returned.
2. Employees of Estes Industries and members of their families are not eligible.
3. You may enter as many times as you like.
4. All designs must be constructed from only those parts included in one Estes Designer's Special (#1463).
5. You must include a diagram and parts list of your design. Photos are appreciated, but not required. Please DO NOT send actual models.
6. Entries will be judged on neatness, completeness, originality, clarity, and workability.
7. All designs must be flight proven.
8. Decision of the judges is final.
9. Deadline for receipt of entries is 7-1-'79.
10. Be sure to include your name, age, address, city, state, and zip code with each entry. Also, be sure to include your EAC Skill Level.
11. Mail entries to MRN DESIGNER'S SPECIAL CONTEST
Estes Industries
Penrose, CO 81240

GOOD LUCK!!



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