THE LEADING EDGE

Newsletter of the Northern Illinois Rocketry Association, **Volume 26, Number 3**
NAR Section #117 **May/June 2003**

Club News and Notes

Midwest Fun Fly - Discussion at the May meeting was to hold a ‘MRFF Lite’ for the June launch, possibly at the Beaver Run sod farm.

Check the NIRA Info line or the website for more information on this launch.

Watch The Grass Grow - Todd Bavery has volunteered to run WTGG this year. Current plans are to have it at the Beaver Run sod farm.

There is currently some discussion about having it in place of the September launch instead of having a separate launch.

If you’d like to help, please let Todd know.

Club Flyers - Tom Pastrick has volunteered to handle the distribution of club flyers to local hobby shops.

If there is a hobby shop that you go to that does not have NIRA flyers, please let Tom know.

Field Search - One of the issues with MRFF (and all club launches) is the lack of a large launch site. If you know of a site that would be suitable for MRFF (50+ cars, vendors on site) or just for regular club launches, please let one of the officer know about it.

April Model of the Month contest –
Tori House – Wacky Wiggler (Youth Winner)

Cole Arntzen – modified Estes Mercury Redstone (Adult Winner)
Marty Schrader – scratch-built “Mr. Fixit”

May Model of the Month contest –
Ryan Ochs – Custom Aztec (Youth Winner)

Ken Goodwin – Estes Phoenix (Adult Winner)
Marty Schrader – scratch-built “Box Rocket” Ω

So Long, and Thanks for All the Fish!

As most of you know, this is my final issue as editor. It’s been a fun and interesting 4.5 years, but it’s time to turn the reins over to someone else. Thanks to everyone who contributed material - you’re the real reason the newsletter's been outstanding and the reason it’s won awards.

Please support Adam as editor, it’s not always an easy job. Adam, it’s all yours! Ω

Team America Rocketry Challenge in Northern Illinois
by Norm Dziedzic

March 24 brought the close to the qualification phase of the Team America Rocketry Challenge. This was a High School level competition sponsored by The National Association of Rocketry and Aerospace Industries Association in which each team had to design and build a two-stage rocket to lift a payload of 2 raw, large hens eggs to as close to 1500’ above ground level as possible.

Each team paid an entry fee which included a copy of the RockSim design & simulation software, an ADEPT-A1 altimeter and a copy of G. Harry Stine’s book *The Handbook of Model Rocketry*. Over 875 teams representing schools from every state in the union signed up for the competition. The top five student teams will receive shares of a total prize pool of approximately $50,000 in savings bonds, and the total prize pool for the winners' sponsoring schools is approximately $9,000 in cash.

In the qualification phase, each team had two chances to make a qualifying flight which had to be observed and signed off on by an NAR member not related to the team. Flights were scored by taking the number of feet deviation from the 1500 ft. goal and adding a penalty of 50 for each cracked (but not leaking) egg and/or a penalty of 100 for each egg with escaping liquid (oozing). The 100 teams with the lowest scores were invited to participate in a fly-off event near Gainesville in Northern Virginia May 10-11, 2003. In the fly-off, any cracking of the eggs would result in a disqualification and except for motor CATO’s and a few other rare instances only one attempt could be made per team.

The Northern Illinois Rocketry Association (N.I.R.A.) hosted practice and qualifying launch opportunities on March 1^{st}, 2^{nd} and 3^{rd} at the East Branch site and the Fermilab Association of

*(**Team America** continued on page 4)*

BATFE NPRM Comments Needed Desperately!
by Mark Bundick, NAR President (as posted to the NIRA mailing list)

Our lobbyist and our lawyers in Washington have again asked the NAR and TRA membership - every member of NAR and TRA - to please write to the BATFE in opposition to their proposed new regulations. Significant opposition to the proposed rulemaking is critical and supports BOTH our legislative and legal actions.

As of right now, so few people have written to BATFE opposing the proposed regulations that BATFE is actually using this against us on Capitol Hill.

The very Senators and Represenatives whose support we are trying to enlist are being told by ATF that “no one really cares about this issue” because no one is writing in to oppose the proposed regulations.

Our lack of opposition is actually helping ATF. Your choice is simple. If you want to help preserve our hobby, write a letter today. If you want to help ATF, do nothing.

Letters should be brief and original, and specifically oppose the proposed regulations and the 62.5-gram limit. Some people are simply “cutting and pasting” versions of a letter sent by ISEE - that will not work. All such letters will be treated as a “form letter” by BATFE and lumped together as one letter. Please write a brief original letter, even if it is just a few paragraphs.

The rulemaking process is a significant opportunity to show the BATFE and Congress that we are united, that we have a national presence, and that we intend to fight for our hobby at every turn.

If we fail to vigorously oppose BATFE in the rulemaking process, then we will have made their position against the Enzi legislation even stronger.

[For more information see Mark’s column on the NAR website: www.nar.org] Ω

THE LEADING EDGE

Volume 26, Number 3
May/June 2003

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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 Sport Rocketry is FUN!

Articles, plans, photos, other newsletters, and news items of interest should be sent to the new editor:
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Photos will be returned, other material returned upon requested.

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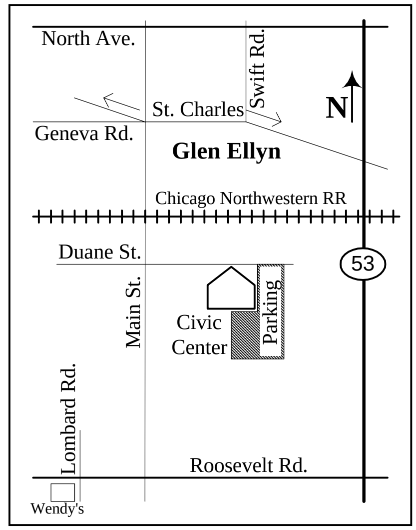
CLUB MEETING DATES



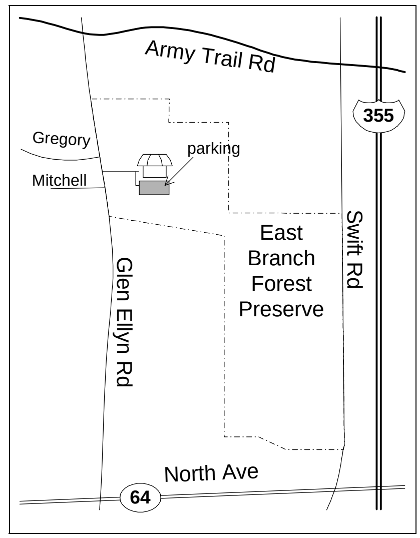
All meetings start at 7:30 pm. Bring a model for 'Model of the Month.' We always need volunteers for pre-meeting lectures, contact Rick Gaff if you want to schedule a date. The location is usually the Glen Ellyn Civic Center, 535 Duane Street (check the board in the lobby for the room number).

June 6

July 11

August 1

CLUB LAUNCH DATES



Launches are BYOL (bring your own launcher). Call the NIRA infoline for pre-launch information: 630-830-1587.

As the map shows, our new launch field is the East Branch Forest Preserve but the arrangement may not be permanent! **Please** call/check the infoline/website before coming!

June 14-15, 2003 - Midwest Regional Fun Fly (site TBD)

July 20, 2003 East Branch Forest Preserve

August 17, 2003 East Branch Forest Preserve

August 21, 2003 East Branch Forest Preserve

Model of the Month Winners! (Jeff Pleimling photos)
April – Cole Arntzen won the adult category with his Estes Mercury Redstone (built for 24mm motors) while Tori House won the Youth category with the new Estes Wacky Wiggler.
May – Ken Goodwin's second Estes Phoenix won the Adult category (along with the remains of his first Phoenix). Ryan Ochs won the Youth category with his well-made Aztec.

Expanding Young Minds with Model Rockets, *or* Having Some Fun with Fifth Graders

by Ken Goodwin (NAR 72245)

Background

Teaching is done best when the lessons are learned as part of some hands on activity. What do you remember most about your fifth grade science class? My guess it wasn't something read from the textbook, but likely a demonstration or activity that you took part in. With this active learning in mind, the fifth grade classes from Frank Hammond Elementary School in Munster, Indiana, spend a day each year at Purdue University Northwest taking part in a "mission" at the Challenger Center. As a follow up, they build and launch their own model rockets. This is the story of how the model rocket portion of this activity came into being.

Two years ago, I made an offer to my son's fourth grade teacher to spend a day with his class talking about model rockets and the United States' space program. This led to a request last year to do the presentation for the fifth grade classes as a follow-up to the Challenger Center trip – for a total of 125 students. I was happy to oblige as long as my employer would go along with me spending a couple of days away from my desk. This turned out to be an easy sell when I learned my boss's spouse *worked* at the Challenger Center. Last year's building and launching went so well that I was asked if I would come back and do it again this year. How could I decline? So in January, I double-checked with the teachers to confirm they were still interested in the rocket building, and I was met with "Let's do it!" Rocket Launch 2003 was underway.

Equipment

The ideal kit for use in this classroom setting, in my opinion, is one that has:

- Plastic Fin unit - balsa fins add a level of complexity, given the time and ability constraints, that make plastic fins work better.
- Streamer recovery – easier to assemble, and school launch conditions are not always ideal with wind and field size (parachute recovery often results in more lost rockets).
- Uses an engine hook – the use of a hook results in few, if any, ejected engines cluttering the school grounds.
- Assembled in less than 60 minutes – working on the same task for much longer is hard for even the best students. Besides, building rockets is usually not the only thing to be done during that school day.
- Cost less then $5.00 – this comes in to play when asking students or schools to cover the cost. Much more then this and I start to find people thinking the effort is too expensive.

This list would seem to lead to the use of the *Estes Gnome*. I decided against their use based on our Cub Scouts having a hard time tracking them due to their speed off the launch rod and small size. An inexpensive *Estes Alpha III* on a streamer would fit the bill, but I couldn't find this kit. Instead, I found the *Quest Viper* for $5.00 at an online Hobby Store. This kit does use a parachute, but it meets the other criteria.

Planning

An activity of this size does not just happen - planning is the key to making sure the event comes off smoothly. I first looked for the best deal on rocket kits and engines, then we figured out how to pay for them. In the past, teachers have asked parents to send $6.50 to class with their child. This covered the cost of the kit and the engine. This year the cost was split between the Principal's fund and the PTO. Working with my supplier, I ordered 4 cases of kits and 5 bulk packs of A8-3 engines, plus a few D12-3 packs to demo some of my own rockets. The order was placed a few months ahead to allow for any glitches in delivery. Another case of Vipers was donated by NIRA from the supply the club had left over from the 2001 Chicago Hobby Show. NIRA, via Mike Jungclas, also loaned us enough hobby knives, white glue, and plastic cement so that each student had their own to use. (In the past the sharing of the hobby knives really slowed down the process, especially when it came time to cut out the parachute, so having the extra knives was a great help).

We scheduled our building sessions and tentative launch date around the regular school activities and my work schedule. Setting a launch date is always a gamble since only God knows if we will have a soggy field, high winds, or liquid sunshine on the launch date, so we also set an alternative date.

Building

While some would find the prospect of standing in front of 30 or so students a fate worse than death, it's really not too bad. When I go into the classroom I have a couple of things in my favor: I am a new face doing something that is fun and different from the normal class activities, and my activity is hands-on, which keeps the interest level high.

Building sessions of 90 minutes were held with each class, in their classroom. I find it is easier to work with a class at a time, with me moving from class to class, rather than trying to work a very large group in a central location. Our building process basically followed the published instructions, with a few deviations so that the flow better fits the class environment (e.g. gluing the nose cone after assembling the engine mount, thus giving the white glue more time to dry). We added 30 minutes to the building session to account for construction of the parachute, set up, and clean up.

Of the two issues that came up this year, one can easily be corrected by using new white glue (the old white glue was hard to use). The other problem centered on the students having trouble tying knots. We use an overhand knot to tie together the kevlar and shock cord, the shock cord and nose cone, and shroud lines to the parachute. In each class, a surprising number of the kids had a hard time making the knots, causing construction to take longer then expected. Even with these hurdles, the rockets were assembled by the end of each day and ready for launch.

Photos of two of the classes that Ken helped (with their rockets).

Launch

As luck would have it, it rained on launch day for the first time in a couple of weeks. We rescheduled the launch to our backup day later in the week to allow for the field to dry and fit into their class schedule. When the backup launch day arrived, the weather did not start out too great, raining just enough to dampen the driveway but not enough to cause a second reschedule. We allocated an hour for each of the four classes to prep the rockets and launch. The model preparation included a talk on how to safely launch a rocket, why we use commercial engines, electric ignition, and the procedure we would use once we went outside. Once the models were ready, we went out to the launch area for the required picture and the launch. On the way past some fourth grade students at recess, I overheard one of the kids telling another, "We get to do that *next* year!"

For launching I used an Estes Launch controller modified to clip onto an external battery; in this case the battery from my cordless drill. The rechargeable battery pushing 9.8 volts to the igniter sure made the rockets jump from the pad. For each rocket I made the connections to the igniters, then the teacher checked for continuity. If the circuit was complete, the student pushed the launch button. This arrangement allowed for us to quickly launch each class's rockets. My reason for having the teacher hold onto the

(***Fun with Fifth Graders*** *continued on page 7*)

(*Team America* continued from page 1)

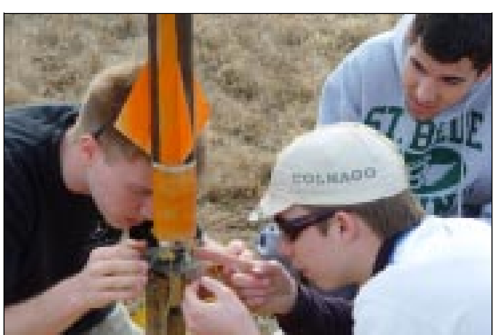
Rocketry (FAR) hosted launch opportunities on March 8th, 9th, 15th, and 16th at the Fermilab National Accelerator Laboratory. There was no limit to the number of practice flights a team could attempt but they had to declare a qualification attempt before the launch was made.

Leading NIRA's involvement with the Team America Challenge is Tom Pastrick who directly mentored teams from Maine East H.S. in Park Ridge, Lane Tech H.S. in Northwest Chicago and Noble Street Charter School in Chicago. Other NIRA volunteer mentors were Bob Kaplow, Ken Hutchinson, Greg Cisko and Mark Knapp. Greg and Mark also organized and ran the Fermilab launches.

As usual in Chicago-land, the March weather proved to be as large a challenge as some of the technical hurdles the teams faced. The **mean** wind speed never dipped below 10 mph on the launch days and March 2nd and 8th saw gusts up to 30 mph. Temperature was the other killer with March 3rd and 9th **high** temperatures only reaching 25 deg. F. Luckily, by the 15th the temperature reached into the 50's and tickled 70 on the 16th (albeit with a lot of fog). For most days, the recommended launch method was to keep the launch and altimeter batteries warm in the car until all else was ready. Then run to the pad, set up and launch before the cold could start degrading the battery performance. Of course you also had to wait for a calm window in the wind. A few teams did not heed this advice and suffered a failed air-start. Their eggs did not crack - they splashed mightily.

I was only able to attend the first launch on March 1st but followed closely the discussions and e-mails of those running and attending the events. The first thing I noticed was that most teams had a good grasp on basic rocket stability. The team members could easily tell you where the center of pressure was and how it had to relate to the center of gravity. It was obvious that most teams had put the Rocksim software to work and at least one team member had become quite familiar with it. One team on the 1st had shown up just to watch and ended up picking the brains of the NIRA members and other school teams present and in general sizing up the competition.

On the flip side, it was also obvious that this was the first model rocket many of the teams had



A team hooking up the igniter wires to their rocket prior to launch. (Tom Pastrick photo)

Teams braved the winter elements to be able to fly their entries. (Tom Pastrick photo)

built. A two stage payload model is daunting enough for seasoned veterans let alone first time students. The most glaring issues were misuse of materials and glues. Other problems were, missing launch lugs, improper coupling engagement between rocket sections, improper alignment between rocket sections. One group neglected to place a recovery device in the first stage booster which was a definite safety violation (after some on site surgery, a small parachute was installed and the model was allowed to fly). Another team found out that it's virtually impossible to glue a metal launch lug to G-10 fiberglass at 25 degrees no matter how much you sand each part. Some built their own launch pads but didn't allow for adjusting the angle of the launch guide or the uneven surfaces of fields. Another early problem seemed to be batteries coming loose during launch resetting altimeters and staging electronics. Taping in the batteries on future flights helped prevent this failure mode. All in all, the teams took everything in stride and tried to learn from their experience and comments from club officials even when not allowed to fly for one reason or another.

It was not unusual for a team to have spent $1000 beyond the entry fee for supplies and especially motors. With some teams using composite motors and others clustering black powder, teams were spending 50% or more of their funds on propulsion to have enough motors for several practice runs and their qualification attempts. Another cost was shipping (sometimes overnight) and handling for mail order and online purchases. Teams using composite motors quickly learned of the shortage of Aerotech motors and sometimes had to change their choice of motor because the desired one was unavailable. Many teams chose to include a second flight computer for staging and/or parachute ejection which greatly increased the complexity and cost of their projects. The lack of experience could also lead to teams purchasing components or supplies they did not need or couldn't use which further increased their budgets. One of the teams had funds which the school had promised them pulled mid-contest causing parents to take up the slack as much as possible.

One of the most interesting aspects of the competition was the variety of models the teams built. In this respect their lack of experience was, perhaps, an advantage. They could approach the task from the proverbial "clean slate" without any pre-conceived ideas of what an egg lofter or two stage model should look like. One model had a cluster of 3 D's in the booster with gap staging to a single 24mm D or E in the sustainer. (I won a gentleman's bet with Greg Cisko when the model staged successfully). Another rather complex design used a 13mm 1/4 A motor in it's ejection scheme. And, although the feeling was somewhat that of a Science Fair (without all the cheesy display boards) no one had that apathetic mood found when students are forced into pro-

(*Team America* continued on page 7)

School Teams Participating in NIRA/FAR Launches

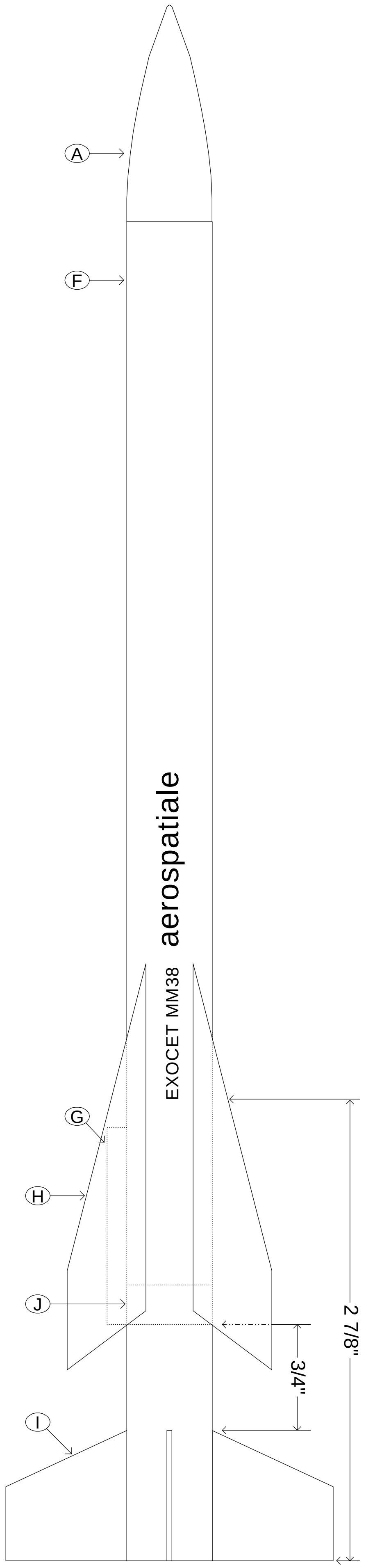
Underlined Schools made Successful Qualification Flights.

The top 4 schools participated in the Finals competition

- <u>Hinsdale South High School</u>
  Darien, IL
  (11th Place @ Finals 1535 ft.)
- <u>Lincoln Park High School</u>
  Chicago, IL
  (DQ - Egg @ Finals 1205 ft.)
- <u>Warren Township High School Team2</u>
  Gurnee, IL
  (DQ @ Finals)
- <u>Peotone High School</u>
  Peotone, IL
  (DQ @ Finals)
- <u>Althoff Catholic High School</u>
  Belleville, IL
- Amos Alonzo Stagg High School
  Palos Hills, IL
- St. Charles East High School
  St. Charles, IL
- <u>Hinsdale Central High School</u>
  Hinsdale, IL
- <u>Maine East Township High School</u>
  Park Ridge, IL
- Noble Street Charter High School
  Chicago, IL
- <u>Lane Tech. High School</u>
  Chicago, IL
- Hononegah High School
  Rockton, IL
- <u>Dundee Crown High School</u>
  Carpentersville, IL
- <u>Washington Senior High School</u>
  Washington, IA
- Jefferson High School
  Rockford, IL
- Marian Central Catholic High School
  Woodstock, IL
- St. Bede High School
  Peru, IL
- Marengo Community High School
  Marengo, IL

Exocet MM38

Semi-Scale model of the Air-to-Surface Missile
Plan 050186B, Designed by Mark Kotolski (NAR 35707, TRA 3609)
Redrawn by Jeff Pleimling (NAR 63951)



Parts List:

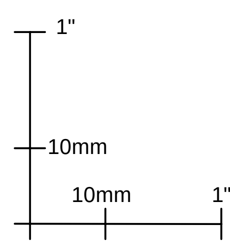
A. Nose Cone, BNC-5E
B. Screw eye
C. Nose weight/washers
D. Shock Cord, 15" Kevlar
E. Streamer, 1" x 18"
F. Body Tube, BT-5 x 8.5"
G. Launch Lug, 1/8" x 1.25"
H. Upper Fins, 1/32" Basswood (4 needed)
I. Rear Fins, 1/32" Basswood (4 needed)
J. Thrust Ring

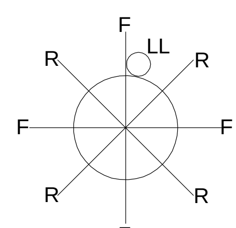
Recommended Motors:

1/4A3-2t 1/2A3-2t 1/2A3-4t A3-4t

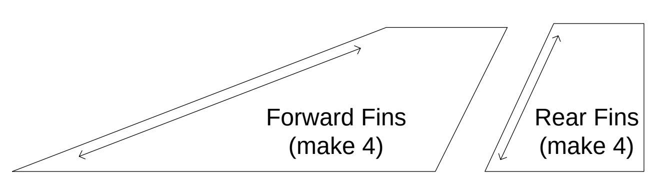
Notes:

- Nose weight may be needed. Use small washers under the screw eye.
- Tie Kevlar shock cord to the thrust ing before gluing ring into place. Glue ring in place so that 1/4" of motor sticks out.
- Glue launch lug to upper fin joint.
- Though not necessary, a short length of elastic shock cord can be tied to the Kevlar.
- Lower 4 7/8" is painted gloss black, the rest is gloss orange.
- "EXOCET MM38" - all capital letters, 1/16" high (approx 8 pt), white. "aerospatial" all lower case letters 1/8" high (approx 14 pt), white.





Fin Marking Guide



Space Launch Report: Lockheed Martin Atlas 5
by Tim Johnson

On August 21, 2002, AV-001, the first Atlas 5, successfully boosted Hot Bird 6, a 3,905 kg communications satellite, into geosynchronous transfer orbit (GTO) from Cape Canaveral Space Launch Complex (SLC) 41. The 334,546 kg, 58.3 meter-tall orange, white, and copper rocket, the first big, all-new U.S. expendable liquid booster since 1967's Saturn 501, ascended slowly past its rail-mobile launch platform umbilical tower. White-hot, supersonic exhaust screamed from its twin-chambered RD-180 kerosene/liquid oxygen (LOX) engine and pounded into an underground flame trench.

The powerful Russian RD-180, fitted to the base of the rocket's 3.81 x 32.46 meter structurally stable common core booster (CCB) first stage, produced 390,000 kgf thrust at liftoff. During its four-minute burn, the engine throttled up and down and consumed 284,453 kg of propellant.

After the first stage fell away, the 3.05 x 12.68 meter single-engine Centaur (SEC) second stage ignited its single 10,113 kgf liquid hydrogen (LH2)/LOX Pratt & Whitney RL10A-4-2 engine. SEC, the most recent in a 39-year long run of Centaur variants, burned for about 11 minutes to put AV-001 into a low Earth parking orbit. After a 9- minute coast to the equator, Centaur re-ignited for a 4-minute burn that pushed the stage and payload into GTO. The inaugural mission for Lockheed Martin's entry in the U.S. Air Force Evolved Expendable Launch Vehicle (EELV) competition went off without a hitch.

Atlas V rolled out for testing after development.
(Lockheed-Martin photo)

Atlas 5 Family

Lockheed Martin offers several Atlas 5 models. A three-digit designator identifies specific configurations. The first of the three digits signifies the vehicle's payload fairing diameter; either 3, 4 or 5 meters. The second digit signifies the number of strap-on solid boosters (0 to 5). The third digit signifies the number of Centaur second stage RL10 engines (1 or 2). For example, the basic Atlas 5 (401) used on the inaugural flight had a 4-meter fairing, no solids, and a single engine Centaur.

Depending on its configuration, Atlas 5 can lift 4,100 kg to 8,200 kg into GTO and 9,000 kg to 20,000 kg into low earth orbit. Lockheed Martin has shelved plans for an Atlas 5 Heavy version that would have used three parallel CCBs.

CCB

All Atlas 5 designs are based on the new structurally stable Common Core Booster (CCB) first stage. The 3.81-meter diameter, 32.46-meter tall stage replaces the old 3.05-meter diameter Atlas stainless steel balloon tanks with aluminum isogrid tanks and an integrally machined aluminum aft transition structure.

CCB consists of, from bottom to top, a 3.05 meter diameter aft propulsion structure, a transition structure, a 3.81-meter diameter RP-1 fuel tank, an intertank structure, and a liquid oxygen tank. A single feed line carries LOX from the upper tank to the propulsion structure, wrapping around the exterior of the RP-1 tank. CCB holds 284,453 kg of LOX and RP-1 but weighs only 20,892 kg when empty.

CCB is powered by the Russian-designed RD-180 propulsion system manufactured by NPO Energomash. RD-180 is derived from the 4-chamber RD-170 engine developed for the Soviet Energia space shuttle booster rockets and also used on the Zenit launch vehicles.

Considered the most advanced liquid hydrocarbon rocket engine in the world today, RD-180 provides 390,000 kgf thrust at sea level (Isp = 311 seconds) and 423,145 kgf thrust in vacuum (Isp = 338 seconds). It uses a staged combustion cycle like the space shuttle main engine, with low-pressure turbopumps feeding propellant to a high-pressure turbopump. Propellant pressure is further increased through use of a preburner. The engine can be throttled over a wide range.

When RD-180 propellants are exhausted 241 to 253 seconds after liftoff, eight retro-rockets fire upward to separate CCB from Centaur. Throughout its flight, tank pressures are maintained by a helium pressurization system. Centaur avionics "fly" Atlas 5 during all stages of flight, but the CCB avionics include flight control, flight termination, telemetry, redundant rate gyros, and electrical power.

Centaur

Centaur, the world's first liquid hydrogen/oxygen upper stage, was stretched 1.68 meters to 11.68 meters for Atlas 5. The stage still uses the time-tested General Dynamics 3.05-meter diameter stainless steel balloon tanks, with the lower LOX and upper LH2 tanks separated by a

Comparison of Atlas family members.
(Lockheed-Martin drawing)

common elliptical bulkhead. The tanks continue to use 1.6-cm thick fixed spray-on polyvinyl chloride foam insulation.

One or two restartable Pratt & Whitney RL10A-4-2 engines power Centaur, each capable of providing 10,113 kgf thrust at 450 seconds specific impulse. Single engines will be used for most GTO missions. Dual engines will most likely be used for LEO missions with heavy payloads. The upgraded engine uses an extendable nozzle for improved performance.

Single Engine Centaur (SEC) uses one fixed RL10A-4-2 nozzle augmented by 12 hydrazine thrusters for steering. Dual Engine Centaur uses two hydraulically gimbaled RL10A-4-2 engines augmented by 12 lateral hydrazine thrusters. Centaur tank pressurization is provided by helium and by gaseous hydrogen. The stage holds 20,799 kg of LH2 and LOX. It weighs a mere 2,026 kg empty.

A Honeywell inertial navigation unit with strap-down ring laser gyroscopes controls the stage. Centaur avionics, which are mounted to an equipment module atop the stage, perform all guidance, navigation, and control functions, flight-sequence the vehicle, control tank venting and pressurization, and provide telemetry, tracking, and range safety.

Solid Rocket Motors

The more powerful Atlas 5 (500), which is expected to fly for the first time during 2003, will use up to five Aerojet solid rocket motors (SRBs) to boost performance. The motors, the world's largest single grain solid boosters, are each 1.55 meters in diameter, 17.7 meters long, weigh 40,824 kg, and provide 115,570 kgf thrust at 275-second specific impulse during a 94 second burn.

Payload Fairings

Atlas 5 (300) and (400) series launchers use 3.05 meter and 4.2-meter diameter aluminum skin stringer and frame clamshell payload fairings,

*(**Space Launch Report** continued on page 8)*

Welcome to the Club!

Chuck Haskin, Robert Jennings and Patrick, Mary Lou, Tom and Billy Voitik have joined NIRA in the past few months. Welcome to the club!

(If I somehow missed your name, please let me know!) Ω

(*Team America* continued from page 4)

jects they don't want to do. Everyone here was actively and enthusiastically involved in the launch.

Although this event was a competition, there was a great sense of camaraderie between the teams (OK, the Warren Township Boys and Girls teams had a healthy rivalry). Teams helped each other recover their models and on the internet I learned of a team sharing their altimeter after they had qualified because another school had lost theirs with a model that couldn't be found.

After the qualifying launches were over, I asked Tom Pastrick what he liked best about the competition. Working with the students was the most rewarding aspect for him. He also enjoyed watching the learning process and how the students translated his instruction from ideas into the physical models.

Advice Tom would offer to groups in similar competitions in the future:

- Start Early
- Seek out funding from any available sources
- Practice

This competition could not have happened without the involvement of literally hundreds of NAR mentors and volunteers from around the country who helped guide the teams and run the launches. Their efforts have made this a shining example of how model rocketry can positively affect large numbers of kids and get them interested and involved in space, science and engineering. With all the positive energy generated by this event, there is already talk of a new challenge for next year.

To find more information about the Team America Rocketry Challenge and sign up for information about any future events, visit the NAR web site at http://www.nar.org and click on the Team America Link. Ω

A team shows off its entry. (Tom Pastrick photo)

(*Fun with Fifth Graders* continued from page 3)

launcher is the kids often take off after their rocket, launcher in hand, or they just drop it on the ground. Once each student had launched, I demo'ed a couple of oddrocs – spools, flying food containers, etc. - to the delight of the crowd. This year we had only one rocket swallowed by the rocket eating trees, the second-to-last of the day. We later recovered that one with the help of a long pole.

I get such a kick out of the reaction of the students when they watch that first rocket leave the launch rod. It is an "OHHH" moment. The final measure of weather the activity is a success comes when the teachers tell you how much fun they and their class had, and then ask if I could do it again the next year. If it all works out again, I'll be there! Ω

NAR Standards &Testing News

R88 Motor Decertifications 26 May 2003

The following motors, having been out of production for more than three years, will lose their NAR certification for general use effective December 31, 2003.

Estes
A10-0T

Estes/NCR
G70-5,7,10

Quest
B6-0,2,6
C6-7

Jim Cook, Secretary for
NAR Standards & Testing

Jack Kane, Chairman Ω

Confused Stages – Stage 31
by Jonathan Charbonneau

'GSE' is used in launching rockets. A 'range box' is used to store and carry rocket equipment. The cardboard range boxes in which starter kits are packaged have a tendency to fall apart after awhile. Care to guess where experienced rocketeers get their boxes? (Hint: it's not a hobby shop.) If you've guessed a sporting goods store or the sporting goods department of a department store, you're correct. Range boxes owned by experienced rocketeers are usually tackle boxes from the fishing department or ammo boxes from the hunting department.

Did you know that these departments of the sporting goods store have other things of value to rocketeers? Read on, as this is the subject of this stage.

In the fishing department, there are a lot of things useful to rocketeers. The phony baits are the only thing I can think of that's useless. Fishing poles are invaluable for retrieving rockets from "Rocket Eatumups.[1]" Fishing rods can be used to retrieve rockets that land in lakes, ditches or lagoons. Hooks and lures help in catching space fish. Filing down the points and barbs of hooks and lures is recommended to avoid catching the wrong fish.

Want to put an end to zippered bodies, buy a fishing bobber and put it on the shock cord right where it touches the edge of the tube. This way the bobber keeps the shock cord/cable from touching the tube.

Sinkers make excellent nose weights because they are denser and take up less space then clay of equal weight. [1oz of clay takes up more space then a 1oz sinker.]

Swivels, these are *invaluable*. They prevent parachute suspension (shroud) lines from becoming twisted up as the rocket descends. Snap swivels allow for easy changing of 'chutes and/or streamers for different weather and/or field conditions.

Waders are those boots that extend all the way up to the hips. These will keep you dry when recovering rockets from wetlands.

Don't forget to check out the hunting department.

Some gun cleaning tools may be useful for cleaning reload hardware. Cleaning squeegees for paintball guns are definitely of use for this.

Hunting clothes are very useful and invaluable in rocketry. This is because many types of hunting clothes have more pocket space then regular clothes. Hunter's jackets with shotgun shell loops can hold engines in those loops. The 'game bag' of the jacket can be used to carry recovery wadding. Not all hunting jackets have game bags, but a good percentage do.

One of my favorites is the 'BDU' (Battle Dress Fatigues) a.k.a. GI Suit or battle fatigues. The shirt has four (4) large pockets and the pants have six (6) roomy pockets. A lot of things can be carried: engines, igniters, wadding, CA, reload cleaning supplies, reload kits, Vaseline, etc. With a set of battle fatigues, you can practically get your rocket prepped for the next flight while walking back to the range head. This saves time, allowing more flights. The pants have ankle ties, these help to keep out ticks. Insect repellant is still strongly recommended.

Tree stands may be useful too. With a tree stand you can reach higher up with a fishing pole to retrieve rockets from those notorious rocket eatumpus.

Superman's Advise

- Visit the sporting goods store from time to time, especially the fishing and hunting departments. I'll bet you'll find something useful for rocketry.

Notes:

1. Rocketeers term for a tree. Ω

(*Space Launch Report continued from page 6*)
respectively. These fairings are little changed from those used by Atlas 2A(S) and Atlas 3. The 4.2 meter fairing is available in 12.2 meter and 13.1 meter lengths, weighing 2,087 kg and 2,255 kg, respectively. Pyro bolts and spring thrusters provide fairing separation.

Thin-skinned Centaur cannot support the heavier payloads carried by Atlas 5 (500). Instead, a new Contraves 5-meter diameter composite fairing will transfer payload weight to the CCB by enclosing the entire Centaur stage. This approach was originally used for Titan 3E Centaur in the 1970s and is still used by Titan 4 Centaur.

The Contraves fairing, which uses graphite epoxy sheets sandwiched on an aluminum honeycomb core, is derived from the European company's Ariane 5 fairing. It will be available in 20.7 meter and 23.4 meter lengths for the Atlas 5, weighing 4,085 kg and 4,649 kg, respectively.

Flight Profiles

During an Atlas 5 (400-series) flight, the CCB RD-180 engine runs at full throttle for most of its 241 second burn, throttling down only near the end of first stage flight. Centaur ignites about 10 seconds after CCB separation, allowing time for RL10 nozzle extension. The first Single Engine Centaur burn lasts about 679 seconds, putting the stage and payload into a temporary parking orbit. The payload fairing jettisons shortly after the first Centaur main engine start (MES1). Centaur typically restarts (MES2) at the first equatorial crossing, about 9.5 minutes after the first main engine cutoff (MECO1), and burns for 220 seconds to reach GTO.

The Atlas 5 (500-series) vehicles will stand 62.2 meters tall and weigh up to 540,340 kg at liftoff, depending on the number of SRBs. During an Atlas 5 (551) flight, all five SRBs will ignite on the pad and the RD-180 engine will run at 75% throttle for the first 60 seconds before throttling up to 100%. The SRBs will burn out and separate after 94 seconds. The Contraves payload fairing will separate during the core stage burn, about 212 seconds after liftoff. The RD-180 will briefly throttle down to 50% for this event. CCB shutdown and separation will occur at the 253-second mark. Centaur will then conduct its two-burn mission to GTO. When Dual Engine Centaur is used, Centaur burn times are reduced by about 25%.

Operations

Atlas V is designed to roll out from the 280 foot tall SLC 41 Vertical Integration Facility (VIF) to the launch pad, only 1,800 feet away, less than 24 hours before launch. It is the off-site checkout of flight stages in the Atlas Spaceflight Operations Center (ASOC), not the "clean pad" itself, that speeds launch pad turnaround. The old Titan 4 launch umbilical tower and mobile gantry at SLC 41 were scrapped to allow construction of the new pad. There are currently no plans to adapt Vandenberg's SLC 3 pads for Atlas 5. Ω

The first launch of an Atlas V on August 21, 2002 carries the "Hot Bird 6" communications satellite into orbit. (Lockheed-Martin photo)

THE LEADING EDGE

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