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ROCKETRY CHALLENGE, 2005



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Team America

ROCKETRY CHALLENGE, 2005

by Trip Barber, NAR 4322
NAR Vice President and TARC Manager



The TARC model of Team 3093 from Long Reach High School, Columbia, Maryland, lifts off.

Photo by Steve Schwartz



The on-field opening ceremonies for TARC 2005 included the color guard from Osbourn Park High School Navy Junior ROTC, Manassas, Virginia.

Photo by Glenn Feveryear

“Some of the graduates of TARC teams are majoring in aerospace engineering at the University of Florida and applied physics at Cornell... Among this year’s graduates, one is going to major in mechanical and aerospace engineering at Cornell and another in electrical engineering at the University of Florida. The rocketry team has been the main promotional tactic for the science club at our school and has attracted many students who would otherwise have had nothing to do with science.”

The Charles W. Flanagan High School team, Pembroke Pines, Florida

The success of the Team America Rocketry Challenge (TARC) in getting U.S. secondary school students interested in rocketry and in aerospace technology careers has solidified its place as an enduring NAR national event. TARC 2005 was the third year of what was originally planned to be a one-time contest. Each year its success has brought greater positive publicity for



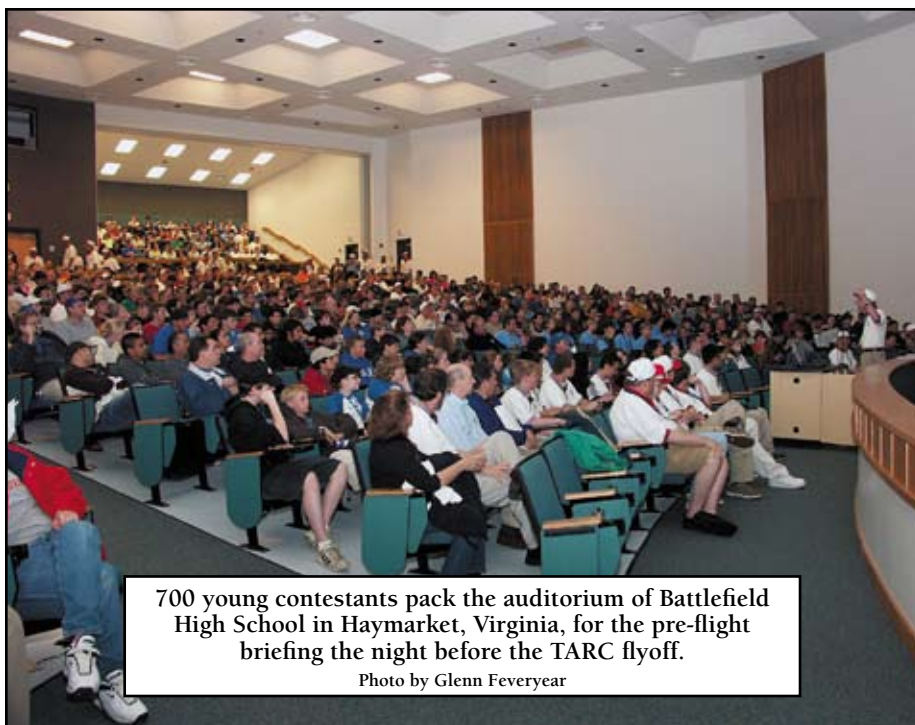
The first place winning team from the Dakota County 4-H of Farmington, Minnesota, pose with their model before its flight.

Photo by Steve Schwartz

our hobby and the NAR, and greater financial support from the Aerospace Industries Association (AIA) professional aerospace industry determined to persuade talented young people to choose aerospace as a career. The contributions of hundreds of NAR members and dozens of sections around the U.S. in mentoring student TARC teams and in providing them launch site support have truly made a difference by “paying forward” to pass our passion for rocketry and aerospace to a new generation. TARC has put the NAR at the forefront of national recognition as an education and safety-related rocketry organization, the guiding principles upon which the NAR was founded in 1957. If you have been involved in TARC, you should take great pride in what we in the NAR have achieved.

Background

The Team America Rocketry Challenge is a national rocketry contest open to 7th through 12th grade students who must enter as teams of three or more (up to 15) students with an adult supervisor/sponsor. Learning to operate as a team is one of TARC’s principal teaching objectives, and one of the experiences that teams report as their best value from the event. TARC is the largest national rocket contest ever held, with the 712 teams entered in TARC 2005 (up from 609 in TARC 2004) representing over 7000 student participants from 49 states, the District of Columbia, and a Defense Department overseas U.S.



700 young contestants pack the auditorium of Battlefield High School in Haymarket, Virginia, for the pre-flight briefing the night before the TARC flyoff.
 Photo by Glenn Feveryear

“Students are more motivated when they are allowed the opportunity to work on a topic they are passionate about. Their success in this Challenge has carried over into the classroom. Their overall grades have improved and it has given them a lot more confidence.”

From Lorraine Quinn, teacher, Mount View Middle School, Marriottsville, Maryland

school. TARC 2005 broadened team eligibility, permitting non-profit youth groups (excluding NAR sections and Tripoli prefectures, but including homeschool associations for the first time) to serve as the official sponsors for teams. Public and private schools, who had been eligible as sponsors in previous years, continued to provide the majority of team sponsorship. There were over a dozen teams in TARC 2005 from Scout groups, a dozen from Civil Air Patrol, and a few each from groups such as 4-H, Federation of Galaxy Explorers, etc. in TARC 2005.

The NAR and the AIA based in the Washington D.C. area, run TARC as a co-operative effort. The NAR provides skilled volunteer rocketeers at both the local level and as the range crew that runs the final flyoffs. The AIA provides full-time staff support (in the person of the energetic and friendly Allison Harvey) to administer the contest registration. JP Stevens, who is Vice President, Space Systems at AIA, provides the energy and creativity for the massive national publicity campaign that gets the word out about TARC and delivers great national media coverage at the flyoffs. He also encourages the member corporations of AIA to provide the funds to run TARC; this year 34 aerospace corporations stepped forward as financial sponsors, compared to 20 in TARC 2004. NASA is TARC's government partner, providing substantial publicity for the event and inviting the top 25 teams to bid for participation in the next year's Student Launch Initiative advanced rocketry program. This year, the American

Association of Physics Teachers was TARC's educational partner; TARC was one of the principal elements of their celebration of the 2005 “Centennial of Modern Physics” anniversary of Albert Einstein's publication of the theory of relativity.

Each year the design “challenge” flight performance goal presented to the TARC student teams is different. Whatever the goal is, the teams are required to design, build, and fly—without adult assistance—a model rocket that meets the challenge while complying with the NAR Safety Code. Registration opens in September, and sometime between then and mid-April each team is required to conduct a local qualification flight in front of a Senior (adult) member of the NAR who measures their flight's performance and rules compliance and signs off on a score report that is sent to TARC headquarters at AIA. The top 100 teams nationally, based on these reports, are invited to attend the final head-to-head flyoff in late May at the beautiful Great Meadow Outdoor Center near the small Virginia horse country village of The Plains, 50 miles west of Washington, D.C. This year the flyoff was on Saturday, May 21.

Local NAR involvement is essential to the success of TARC



U.S. Marine Corps CH-53E and CH-46 helicopters from HMX-1, the Presidential Helicopter Squadron from Marine Corps Base Quantico, Virginia, made a flyover for the TARC 2005 opening ceremonies.
 Photo by Steve Schwartz



Marta Galysh presides over several hundred carefully weighed, measured, and candled eggs available for contestant selection for their flights.

Photo by Glenn Feveryear

Steve Humphrey (left) and Paul Rodgers (right) built this full-size exact-scale replica of Robert Goddard's first successful liquid fueled rocket for TARC 2005. Robert Goddard was a physicist, and the American Association of Physics Teachers was a co-sponsor of TARC 2005 as part of their celebration of the Centennial of Modern Physics.

Photo by Glenn Feveryear



and this support has been strong, with over 250 individual NAR adult mentors signed up to assist teams in their areas for TARC 2005 and most NAR sections providing launch site support on request. There are exceptional stories all around the NAR of the lengths to which mentors and sections have gone to provide the support that teams needed to get in a successful qualification flight. Based on the surveys of participating teams, all the NAR members who supported TARC 2005 can take pride in having made a major positive difference to young people who are trying to decide on their future career fields. TARC will be a success only for as long as NAR members keep making these kinds of contributions. Our grassroots expertise in safe rocketry and dedication to the advancement of aerospace education is the irreplaceable foundation of TARC. If a TARC team calls you or your section for assistance in TARC 2006, please say "yes."

The Challenge

The TARC challenge in 2005 was quite

a bit different from the precision-altitude challenges of TARC 2003 and 2004, which used electronic altimeters to measure the altitude and required that all entries use two stages and carry two eggs. The design goal for TARC 2005 was to

build a model rocket (3.3 pounds or less liftoff mass, using only NAR-certified model rocket motors of G or less power) to fly for a duration of exactly 60 seconds and return the egg payload undamaged. Altimeters were not required; instead two timers on the ground measured flight performance with stopwatches. Also for TARC 2005, rockets were allowed to be one- or two-stage and could carry one or two eggs. There was a small (3 second) score penalty for using just one stage or carrying just one egg. In the local qualification flights to get into the TARC finals, a number of teams got precise enough durations with simple models with one egg or one stage (or both) to make it into the finals despite the penalty.

At the TARC 2005 finals every team flew with two eggs, but a few teams flew with only one stage. All the top 10 winners used two stages, however; the competition was so intense and flight durations so precise that no team could afford to absorb even a small score penalty. Surprisingly, only one team at the flyoff tried to use onboard autonomous electronics systems (timers) to control their flight duration to precisely hit the 60-second target. Most teams tried to control duration through selection of parachute size and rocket ballast weight, based on test flight experience before the flyoffs.

TARC 2006 will once again provide a new flight challenge. The rules will no longer require, or give any advantage to, the use of two stages or two eggs. Single-stage rockets with one egg will be used. This is being done in response to feedback that the clustered-motor lower stages that nearly every team used for TARC 2003 through 2005 introduced some safety and reliability issues for novice teams, while consuming too many expensive rocket motors in test flights. Also, only 38 percent of the teams that entered TARC 2005 were able to make a successful qualification flight to be competitive for selection to the finals. While this was an improvement over previous years, many teams still seriously underestimated the difficulty of two-stage dual eggloft and were not able to get a good flight into the air by April. The basic rockets will be simpler for TARC 2006, but the flight performance challenge will be more complex: scores will be based on how close the rocket comes to *both* a precise altitude (altimeter-measured) and a precise flight duration. We are trying to make it easier

and cheaper for teams to get a basic successful flight off, without reducing the skill and rocket science required to become the overall TARC champion.

The Flyoffs: Preparation

An event as large and complex as the national flyoffs for TARC takes a great deal of advance work to be successful. Allison Harvey of AIA had many interactions with each team to get them properly registered and to get contestant badges and other materials fabricated. JP Stevens and the AIA public affairs staff worked night and day to get national and local media to cover the event and to bring in VIPs from industry, government, and NASA. The 2005 TARC finals were featured on five national TV broadcasts, three national radio broadcasts, and over 60 local TV broadcasts reaching an audience of over 10 million. The NAR management team, largely volunteers from the NOVAAR section, worked out how the flying range would be set up and operated under the leadership of Jonathan Rains; Greg Bock spent dozens of hours fine-tuning

A rocket lifts off from "Goddard" range, one of the two 18-pad ranges used at the TARC flyoffs—the other being the "Von Braun" range. RSO Jay Apt commands the rocket into the sky.

Photo by Glenn Feveryear



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A TARC entry takes to the sky.

Photo by Greg Cisko

two 18-pad range equipment sets; John Hochheimer ordered over a thousand event T-shirts and embroidered NAR range crew shirts; Chris Kidwell (of NAR-HAMS) wrote the results-processing software specific to this year's rules; Eric Robinson and Rose Fichtel built and stuffed all the team on-site registration packets. Each of these NAR volunteers, and many others, devote this kind of time and effort to TARC each year because they believe in the value of what it does for young people.

Below: The St. Andrews School team from Park Ridge, Illinois, signals readiness to launch by raising a paddle with their pad number on it.

Photo by Tom Pastrick



Above: The Fisher Middle School team from Los Gatos, California, checks to make sure the launch rod is exactly vertical for their rocket's all-important single flight attempt.

Photo by Steve Schwartz

day before the flyoff, when the NAR volunteers had to go set up the range, was forecast to be miserable, and it was: it rained nearly two inches, the winds were over 20 miles per hour, and it was very cold. There was no choice but to persevere, so the dedicated NAR team put on rain suits and boots and set up an elaborate, precisely laid-out rocket range in a cold, driving rain.

The first official event of TARC was on Friday evening at a nearby high school auditorium: team registration, a one-hour training briefing to all the NAR range crew, and a one-hour pre-flight briefing to all the student team members. The student pre-flight

brief is an exciting event for those of us who are long-time rocketeers and may have wondered where the teenagers went in our hobby. The auditorium provides the answer: they were there, 700 nervous, energetic, and very competent teenage rocketeers, eager to go fly rockets and happy to have the opportunity for a trip to see the sights of Washington, D.C., as part of their experience. About a quarter of them were veterans of a previous TARC flyoff. The crowd fell silent as we began the pre-flight briefing with a precise time check, to impress on them the importance of following the event's exact schedule and procedures the next day. They remained enthralled as NAR trustee Dr. Jay Apt gave a dazzling 15-minute audio-visual presentation and talk about his personal journey from young model rocketeer to four-time Space Shuttle astronaut. And they erupted with a roar when the briefing ended with the call to "go fly some rockets!" The young people who participate in TARC are wonderful: smart, polite, and ambitious. It is fun for all of us in the NAR to have the opportunity to associate with them.



A team of young competitors focuses intently on getting everything right as they prepare their rocket for flight.
Photo by Glenn Feveryear

The Flyoffs: Saturday

Saturday made up for Friday's miserable weather. As dawn broke over the field, the early-arriving NAR range crew were treated to the beauty of a thin ground fog over the rolling green hills of Virginia's horse country, a fog that the warm sun quickly dissipated before the teams began arriving at 7 AM. By the time the eager teams arrived, everything was in place: launcher electrical systems were rolled out and tested; all the check-in tables were dried off and set up;

and the NAR range crew were on station, all in the "uniform" of a red and white golf shirt with embroidered name and NAR logo (available only to TARC range crew volunteers), khaki trousers, and NAR ball cap. Everything that had been planned and rehearsed went exactly as expected and right on time. With an "all star team" of 90 of the best and most experienced rocketeers in the NAR as the range crew, and Drs. Jay Apt and John Langford as the Range Safety Officers, this came easily.

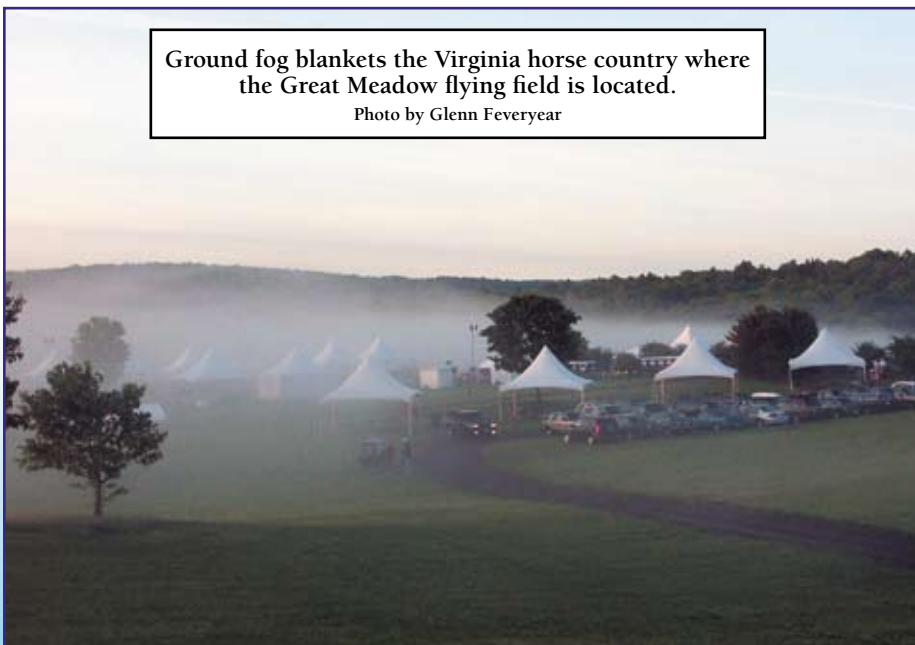
TARC 2005 opened with a chorus of young TARC contestants singing the na-

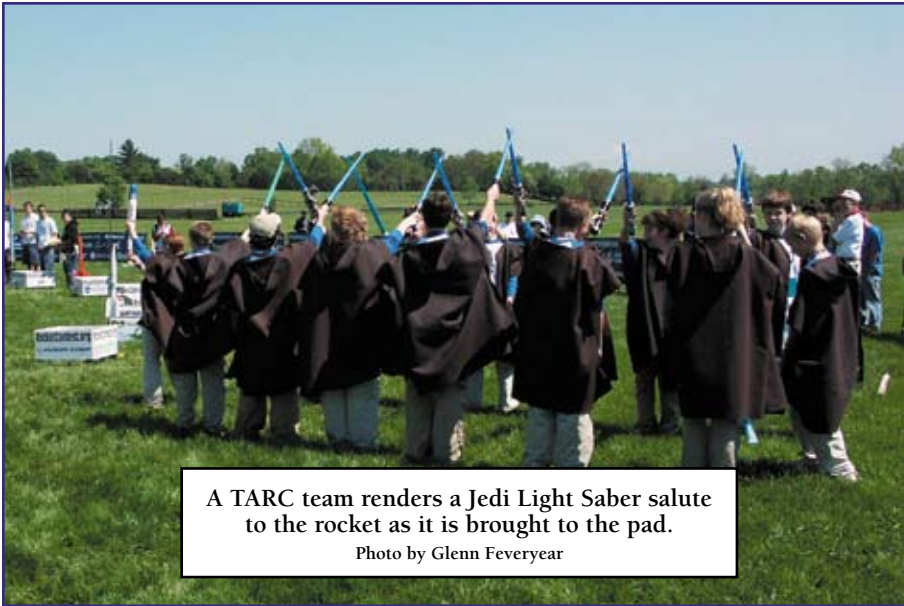
"This is to express our immense gratitude for the extraordinary quality of everything at the recent Team America Rocketry Challenge Finals event. The world's largest ever model rocket event was also the most beautiful ever done by anyone in Great Meadow's 20 year history."

Arthur Arundel, President of the Great Meadow Foundation

Ground fog blankets the Virginia horse country where the Great Meadow flying field is located.

Photo by Glenn Feveryear





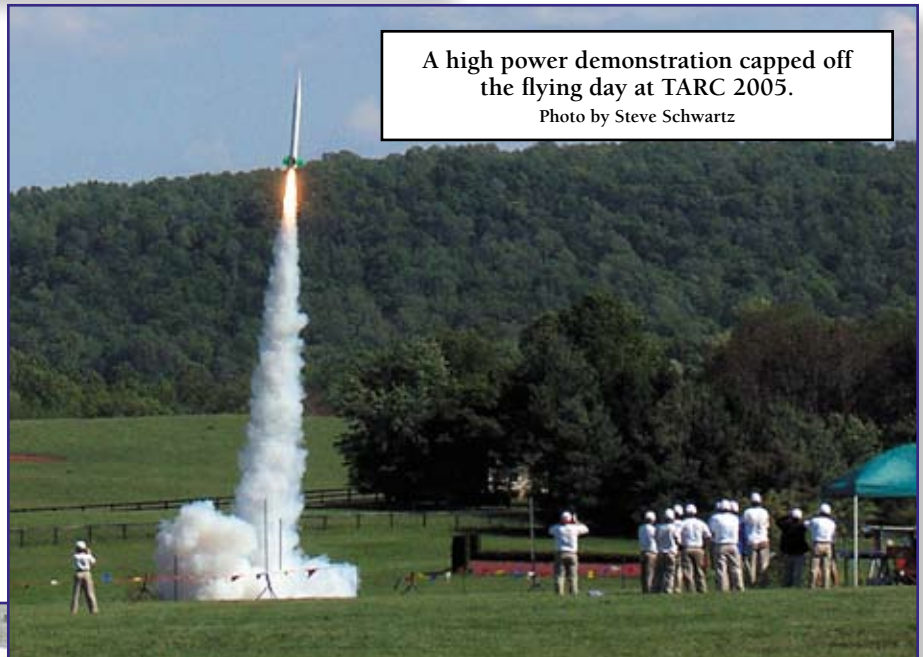
A TARC team renders a Jedi Light Saber salute to the rocket as it is brought to the pad.
 Photo by Glenn Feveryear

There were 8 extra slots in the final window for teams whose flights experienced a catastrophic rocket engine failure in their first flight attempt; there were only two of these all day. Each team had to make their flight during the assigned launch window, having taken the rocket through a rigorous NAR check-in process and loaded it on the assigned launch pad (supervised and advised by an NAR pad monitor) during the hour prior to their window start time. Every team displayed the skill and teamwork required to make their flight within their assigned window.

There have been two basic design approaches to the two-stage dual-eggloft challenge of TARC 2003 through 2005: lower stages with clusters of D12-0's; or lower stages with a high-thrust composite E, F, or G motor and some form of ignition

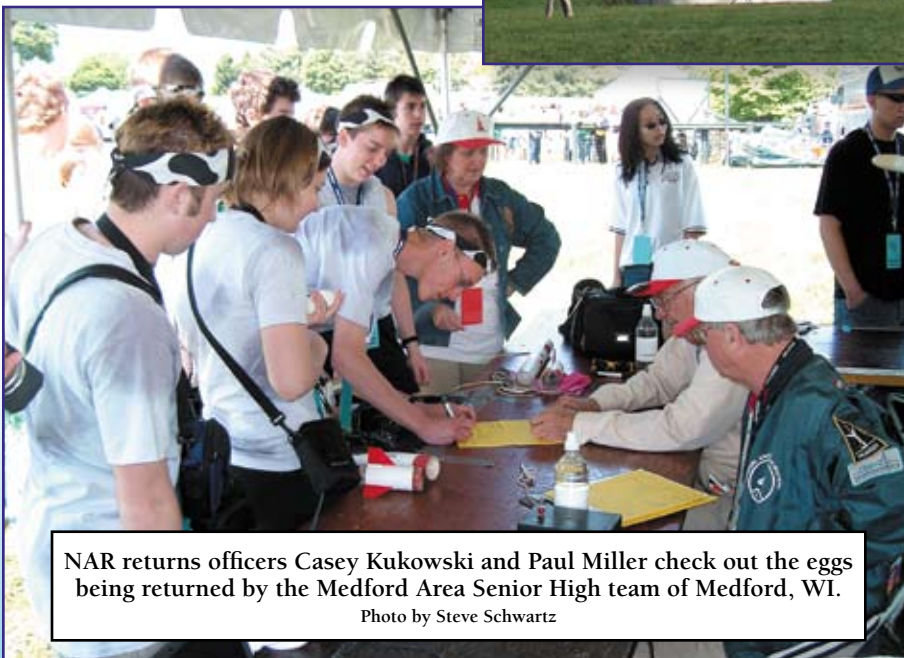
tional anthem next to a color guard from the Navy Junior ROTC unit of Osbourn Park High School of nearby Manassas, Virginia. As the anthem ended, two U.S. Marine Corps helicopters from the Presidential Squadron (HMX-1) did a flyover, and as they cleared a volley of high-power rockets signaled that it was exactly 9 AM and time for the first official contest flights to begin.

The flyoff was organized into six one-hour launch windows, with 18 teams assigned by a lottery process weeks in advance of the flyoffs to each of the first five windows, and 10 to the last one. There were two complete 18-pad ranges, each with its own NAR range crew except for a shared set of timers. As one range was loading rockets for the next window, the other was flying.



A high power demonstration capped off the flying day at TARC 2005.
 Photo by Steve Schwartz

system for the upper stage, often just the ejection charge from a short-delay lower stage motor. This year 19 teams used composite lower stages, and 72 used clustered lower stages. Nine used single-stage designs and paid the 3-point score penalty, keeping them out of the top ten. All the approaches worked; 81 of the 100 teams in TARC 2005 had fully qualified flights with no broken eggs, the highest percentage ever and a testament to the amount of skill and practice flying that went into getting to the finals. It is also a testament to the establishment of Team America in some school curriculums, as 44 of the teams in the TARC 2005 finals were from schools that had sent a team to one of the two previous TARC finals, although in many cases with other students as members.



NAR returns officers Casey Kukowski and Paul Miller check out the eggs being returned by the Medford Area Senior High team of Medford, WI.
 Photo by Steve Schwartz

When the smoke had cleared at the end of the competition flying on Saturday, a team of first-time TARC competitors from the Dakota County 4-H in Farmington, Minnesota, had edged out the field with a duration of 59.9 seconds, only 0.1 seconds off the target, and claimed the first prize of \$9,000. This team was made up of 7th through 10th graders from three different school districts plus a homeschooler, and was the only 4-H team at the TARC finals. Finishing a mere tenth of a second behind them was one of the three teams at the finals from Plantation High School of Plantation, Florida, one of two schools (the other being Fisher Middle School of Los Gatos, California) with three teams competing. Plantation had only one team at TARC 2004 and suffered a disqualified flight; they learned a lot in the year since then. All of the top ten finishers were within three seconds of the target time. They shared \$60,000 in prize money from AIA and their corporate partners. The top 25 finishers were also invited by NASA to send teachers to a NASA-funded educator workshop at Marshall Space Flight Center over the summer, and to submit bids for acceptance as one of the ten teams in next year's NASA Student Launch Initiative advanced rocketry program.

The final flying activity of the day was a series of NAR demonstration flights. To commemorate the achievements of Dr. Robert Goddard, a physicist and the founder of modern rocketry and spaceflight, NAR members Steve Humphrey and Paul Rodgers built a full-size replica of Goddard's first successful rocket. Wearing authentic period costumes, and accompanied by the smooth narration of the NAR's own professional announcer Alan Williams, who had handled the entire day's announcing at the finals, Steve and Paul launched the full-scale Goddard rocket in a perfect, straight-up flight that drew a massive ovation from the crowd. This was followed by a spectacular high-power rocketry demonstration by an NAR high-power team organized by Bill Schworer. They flew nine rockets of various types on I- through K-class motors to demonstrate the breadth, technology, and safety of sport rocketry to the TARC teams and to the aerospace and NASA executives gathered for the end-of-day award ceremony. One of the flights, by Jerry O'Sullivan, carried a live-broadcast TV system built by Bill Schworer. The spectacular downlinked video was shown by AIA to all the chief executives of America's largest aerospace companies a few days later to demonstrate what our hobby is capable of.

Saturday's official events ended with



A TARC team's model lifts off under the power of a composite F motor.

Photo by Tom Pastrick

an award ceremony recognizing the top 25 finishers, and the 34 "AIA Industry Partner Award" recipients, winners of special judged categories such as best team uniform, best finished rocket, best team spirit, etc. Many teams had worked as hard to prepare for winning some of these awards as they had on their rockets! Once the awards were done, the entire crowd—both students and NAR volunteers—enjoyed a huge BBQ provided by AIA. It was a great way to end a great day.

Conclusion

NASA Associate Administrator for Education Adeena Loston spoke to the teams at the award ceremony and congratulated them all for their achievement in getting to the finals, and to assure the young contestants that "there is a job waiting for you at NASA when you graduate." In the end, this is why TARC exists and has generated so much industry support: America's aerospace workforce is largely reaching retirement age, and there are simply not enough young people choosing to enter the field to replace them. What we in the NAR are doing with the Team America Rocketry Challenge is important beyond what it does for our organization and for the hobby. We are helping to maintain America's technological leadership in aerospace.

The NAR needs every volunteer we can muster to help coach and mentor teams for future TARC. It is clearly proven from our first three years of experience that teams with NAR mentors learn more and are less likely to get discouraged and

quit before making a successful flight. If you would like to help "pay forward" for the future of our hobby and America's aerospace future, please contact me at <ahbarber@alum.mit.edu> to volunteer as a local team mentor. To those of you who have already taken this step, thank you—TARC 2005 showed that you've done well. The TARC 2006 flyoff will be held on May 20, 2006; event registration opens on September 7, 2005, at <www.rocketcontest.org>. See you there!

Final Results TARC 2005

Place	School	City	Score (sec)	Rocket Motors (1st/2nd stages)
1	Dakota County 4H Federation	Farmington, MN	0.1	2xD12-0/C11-5
2	Plantation High School (Team 4)	Plantation, FL	0.2	3xD12-0/D12-7
3	Shelby Junior High School	Shelby Township, MI	0.7	3xD12-0/D12-5
4	Hope Christian Academy	Cottage Grove, MN	1.1	4xD12-0/C11-5
5	Southfield High School	Southfield, MI	1.4	3xD12-0/E9-6
6	Grace Christian School	Staunton, VA	1.5	3xD12-0/D12-7
7	Penn Manor High School	Millersville, PA	2.2	G64-7/D12-7
8	Lake Braddock Secondary School	Burke, VA	2.4	2xD12-0/D12-7
9	Plantation High School (Team 2)	Plantation, FL	2.6	3xD12-0/C6-7
10	Fisher Middle School	Los Gatos, CA	2.7	3xD12-0/C11-7
10	Madison West High School	Madison, WI	2.7	2xD12-0/D12-5

The Progression of NASA's STUDENT LAUNCH INITIATIVE Learning the NASA Process with NAR Rockets

by Vince Huegele NAR 37520

There's a great Flash animation on the Skyline High School's homepage (<http://skylinesli.agrummer.com/>) that reads,

"What if you had the chance...
...to build a rocket...
...that goes a mile high...
...to collect data to be analyzed?
We have that chance, thanks to NASA.
We are the six students of the
Skyline High School SLI team."

This website introduction describes the Student Launch Initiative (SLI). The Marshall Space Flight Center (MSFC) in Huntsville, Alabama, is managing the SLI program where junior rocket scientists are designing, building, and flying large NAR rockets with science experiments. The objective is for high school teams "to build a reusable rocket to carry a half-pound payload to a mile altitude." SLI combines the honor of working with NASA and the thrill of making a NAR level 2 type high power rocket. The Huntsville Area Rocketry Association (HARA), NAR section 403 in Huntsville, Alabama, provides launch operations support for the schools to accomplish the NASA challenge.

SLI began in 2000 when Jim Pruitt, Director of the MSFC Academic Affairs Office, approached MSFC physicist and former HARA president Vince Huegele about creating a student rocket program. Huegele's experience with sport rocketry and school launch activities, combined with Pruitt's education office support, produced a program that connected the schools with MSFC to build rockets with available off the shelf hobby hardware, yet "inspire students as only NASA can." SLI teams follow not only the NASA mission design and review process, but also the complete proposal and funding process.

Just like real aerospace contractors, the school teams have to submit a proposal for their scope of work. If their design proposals are awarded, they give monthly status reports and show their progress to formal



The forty-pound vehicle with a five motor cluster the University School of Milwaukee launched was the largest SLI rocket yet.

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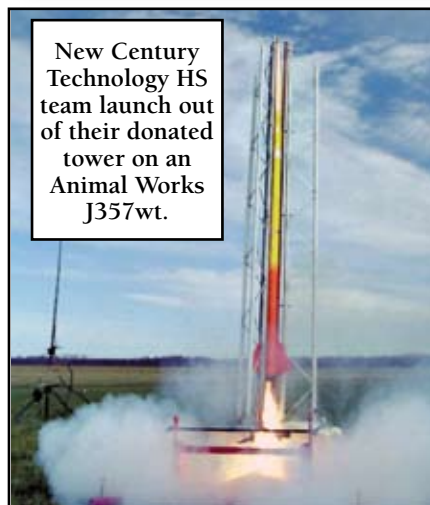
Critical Design Review (CDR) and Flight Readiness Review (FRR) NASA panels. Not only do the students have to do the technical work, but they also have to document and present it on a strict schedule. These reviews represent a "mid-term" and "final exam" of the teams' work. Several students commented that the presentations are the hardest part of the program and that they "just wanted to build the rocket," but the teachers think it is the best part of the program because it makes the students stay on track and prove to themselves they understand everything.

HARA was formally engaged by MSFC to conduct the flight operations and provide range equipment from the beginning for the SLI because of their extensive experience in this type of non-professional rocketry. HARA mentors are the RSO's who inspect and approve the rockets for flight. Brian Day who was HARA President at start of the program wrote a guideline document for SLI to use based on the NAR level 2 certification checklist and Trained Safety Officer (TSO) training program. Teams learn to write and follow procedures rigorously for the safety and mission assurance that both NASA and NAR teach.

The first three schools in SLI were Ran-



The Bob Jones HS team elected to fly a M1015 Hypertek hybrid motor in a Proteus kit.



New Century Technology HS team launch out of their donated tower on an Animal Works J357wt.

dolph school, Johnson High School, and Sparkman High School all from Huntsville. As the 2001 flying season began, students attended the monthly HARA launches and meetings. They were soon bringing their own models out to test on F and G motors to acquaint themselves with mid power technology and formal range operations. The students searched the Internet and found the wealth of information that sport rocketry provides. Rocket designs began to emerge iterated through simulations and calculations. The designs were matched with existing rocketry hardware or custom parts. The entire invention process unfolded in the classroom, not from a lesson plan, but from the necessity of the mission. The three schools passed their reviews and had successful flights in October 2001. Firings were repeated at an encore launch the following April to begin to align the program schedule with the school year (see *Sport Rocketry*, April 2002).

The second season SLI selected four schools, again all from Huntsville. Johnson and Sparkman returned for another year with new teams joining from Bob Jones High School and New Century Technology High School. This SLI class flew in May 2003. During this time Jim Pruitt decided SLI had expanded enough to need a permanent director and assigned education specialist Dawn Mercer to manage the program.

The fall of the same year SLI began its second term, the NAR and the Aerospace Industries Association (AIA) began the Team America Rocketry Challenge



The 2004 SLI class of six high school teams meet together for a tour of MSFC.

Todd Lumpkin of HARA helps Will Minor of Lee HS load "Resurrection Bob" with a Hypertek J330 hybrid.



The real technical supervision would have to come from the teams' local NAR mentors and sections as had been done for the Alabama schools by HARA, now led by President Chuck Pierce, also a MSFC engineer and SLI advisor. Just as these teams were successful with TARC, they did well in SLI putting together a major rocket project and executing it effectively.

Several teams had situations that added drama to the year. Athens had a slow start but was fully up to speed when they reached the FRR. Manlius Pebble Hill had an impressive payload, but MSFC advisors wondered if it would be too complicated to work right. There were certain stability and performance doubts the board had

(TARC). Pruitt saw a connection between the two events and offered J.P. Stephens, Vice President of AIA Space Systems, the NASA contribution of hosting a workshop at MSFC for the winning TARC team teachers. The partnership of NASA with TARC was formed. Beside touring the facilities and hearing speakers, the teachers were invited to have their schools participate in SLI (see *Sport Rocketry*, April 2004).

The third year brought the first TARC teams into SLI and a total of six schools participating. Three TARC schools were selected from those submitting proposals: Goshen High School, Goshen, Indiana; Manlius Pebble Hill School, DeWitt, New York; and Boonsboro High School, Boonsboro, Maryland. Also, local schools Athens Bible School, Athens, Alabama, and Lee High School, Huntsville, Alabama, were accepted into SLI with New Century Technology as the only returning team.

The challenge for SLI this time was to see if teams in other states could be properly directed to design and build their project with only email and phone contact with MSFC and remote videoconference review.



The Boonsboro School team preps their rocket's dual deploy recovery system.

about Boonsboro's design match with their motor selection. Lee had crashed their prototype rocket in a test flight by not correctly prepping the recovery system and would have to rebuild a section quickly to meet the official launch date. (The new version was named "Resurrection Bob.") All these issues were resolved by the launch day and all six flights went extremely well. Two schools even flew their rockets twice. This triumph is a testimony to the perseverance of the teams, the dedication of the teachers and parents, and the supervision of the technical advisors and managers.

The third session had another change bringing MSFC tighter with NAR by decid-

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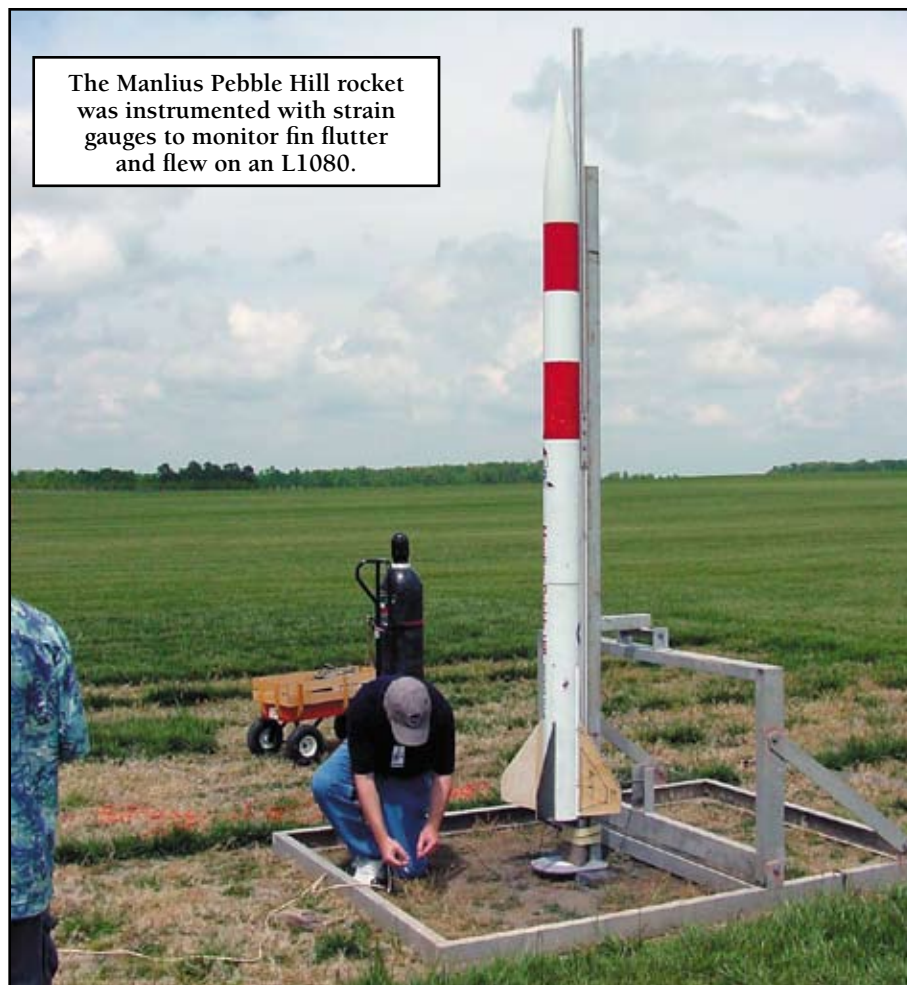
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ing to fly the rockets at a HARA launch. The number of flights and size of the program outgrew the facilities of the Army test range on Redstone Arsenal where the previous two launches had been held. SLI and HARA decided to merge the student flights with the Southern Thunder 2004 regional sport launch. The large sod farm in Manchester, Tennessee, the home field for the Music City Missile Club (MC2) NAR section, and the 10,000' altitude waiver with the FAA in place were assets to support SLI. The joint launch was a tremendous experience for the students and rocketeers. Other expansions to the SLI weekend were a 'rocket fair' the day before the launches to showcase the schools' work to the MSFC employees, and an evening banquet at the Space and Rocket Center.

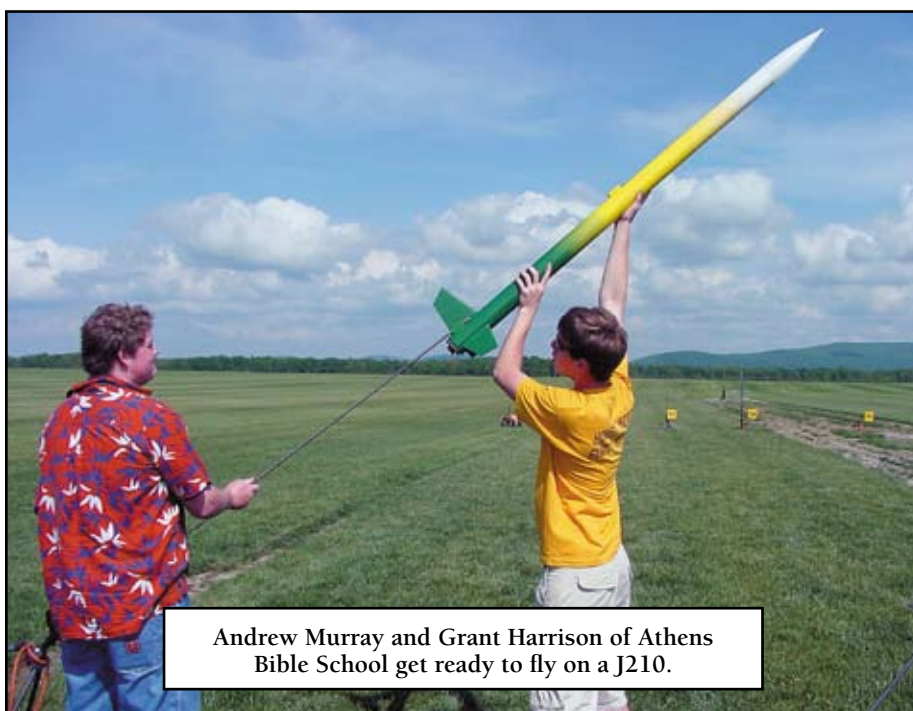
In the summer of 2004 as the second set of winning TARC teachers attended the MSFC workshop, they were briefed on the refined SLI with an improved Request for Proposal (RFP). Six new teams, all from out of state, were selected that fall from the TARC schools with SLI veterans Manlius Pebble Hill and Goshen and one local school, Lee, returning. The rookie teams were Edison High School, Fresno, California; Laguna Creek High School, Elk Grove, California; Madison West High School, Madison, Wisconsin; Oakton High School, Vienna, Virginia; Skyline High School, Sammamish, Washington; and the University School of Milwaukee (USM), Milwaukee, Wisconsin. SLI directors decided at this point from the growth of the program



The Manlius Pebble Hill rocket was instrumented with strain gauges to monitor fin flutter and flew on an L1080.

that schools would participate only two years directly with NASA and would then graduate to make room for more schools to learn the process.

In the first two years of SLI almost any simple experiment in the rocket's nose section was acceptable as a payload, but for 2005 the science requirements were expanded and intensified. As a result of requiring more attention to science, the projects submitted were more thorough, detailed and elaborate. The team mission was now very much like a NASA flight project with the payload and rocket being developed together. Laguna Creek had solar panels on their rocket's airframe to



Andrew Murray and Grant Harrison of Athens Bible School get ready to fly on a J210.

Correction

The last eight words of Carl McLawhorn's NARCON 2005 Recollections article were inadvertently truncated by an edit during magazine proofing. The last sentence of Carl's article, in which he was speaking about Vern and Gleda Estes, should read as follows:

I had so many questions I wanted to ask, but was just overwhelmed with the sheer pleasure of watching two people that had shared so much together and still have so much love and respect for each other.



HARA president Chuck Pierce helps student Daniel Njigha assemble the Johnson High School rocket for launch.

measure the change in sun intensity. Skyline had a series of ultraviolet and visible photo detectors. Lee had an innovative experiment to measure temperature during their flight by counting cricket chirps and included a test program to select the best cricket astronaut candidates. Even as early as the CDR the NASA board chaired by Huegele was impressed with the notable ingenuity of all schools' payloads.

The latest year brought other new wrinkles to the program. USM was the first team ever in SLI to propose a cluster; they wanted to have five motors. SLI advisors responded with criteria demanding the highest level of reliability for firing multiple igniters. The school showed by analy-

sis, measurement, and test that the firing system would light all the motors, and the advisory board accepted the design.

For the 2005 launch on April 23 the HARA support group decided that with eight high power flights planned the SLI had grown enough it could be better served by having it at the same field but as a separate event from the Southern Thunder regional launch. Teams rode the chartered bus from Huntsville to Manchester and spent several hours prepping their rockets and payloads at the field as HARA members set up the range. Tension was high for the students as the time counted down for a whole year's work to be culminated in a two-minute flight. Each time the

count hit zero there was a flash, a roar, and a liftoff. All schools had successful launches and flights although Manlius and Oakton had their rockets drift so deep into the woods beyond the field they had to leave them there. Laguna Creek had the closest altitude to a mile in the SLI program ever reaching 5318 feet. The USM team got all their motors to fire together for a beautiful flight to 5230 feet and second best altitude, also winning the best payload award for their atmospheric sampling to measure carbon dioxide.

As this year's SLI teams headed home from Huntsville, a hundred other teams were packing up to go to the TARC national launch that was held two weeks later in Virginia. After those finals, another twenty-five top placing schools were invited to MSFC to set the field for SLI 2006.

NASA is extremely pleased with the progress of SLI and the schools have raved about their exciting experience. SLI has consistently directed student teams to learn the NASA process and successfully build and fly similar scale missions with sport rocketry hardware. By connecting SLI with TARC there is a path or 'pipeline' developing for students to follow rocketry from the simpler modeling principles to the advanced flight activities. These rocketeers now have tremendous knowledge in directing a technical project that prepares them well for their college studies and the professional workforce.

For more info on SLI visit <http://education.msfc.nasa.gov/docs/127.htm>.

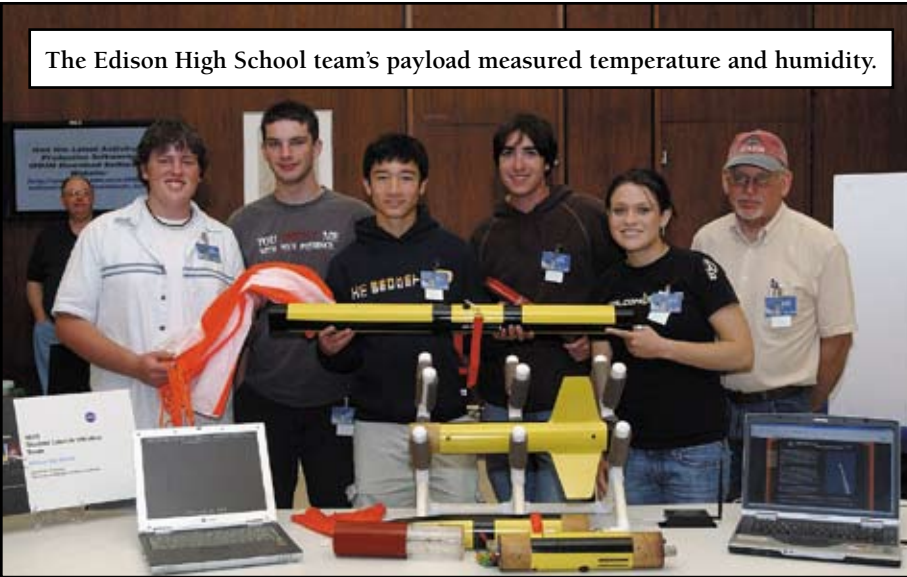
2004 SLI Flight Manifest and Specifications

School	Motor	Length	Dia.	Weight	Alt (ft.)	Payload
Athens Bible, Athens AL	J210	63"	3.1"	8.4 lbs.	4442	R-DAS
New Century Tech, Huntsville AL	J357wt	72"	3.1"	8.8 lbs.	4744	Magnetic field altimeter chalk deploy
Goshen High, Goshen IN	J415W	75"	3.1"	11.8 lbs.	5514	IR sensor
Manlius Pebble Hill, Dewitt NY	L1080bb	108"	6"	25 lbs.	3200	Quarter bridge strain gauges, R-DAS
Boonsboro, Boonsboro MD	J800T	96"	3.9"	7 lbs.	4877	Frog eggs, fruit flies
Lee High, Huntsville AL	J330	75"	3.1"	8.7 lbs.	4590	Planaria

2005 SLI Flight Manifest and Specifications

School	Motor	Length	Dia.	Weight	Alt (ft.)	Payload
Oakton, Vienna VA	J295	82"	4"	9.5 lbs.	NR	Accelerometer, video
Edison, Fresno CA	J415w	74"	3"	6.8 lbs.	4908	Temperature, humidity
Manlius Pebble Hill, Dewitt NY	J380ss	56"	4"	9.4 lbs.	NR	Transmitter signal strength
Laguna Creek, Elk Grove CA	J415w	78"	3"	6.3 lbs.	5318	UV and Solar intensity
Madison West, Madison WI	K1000sk	107"	4"	13 lbs.	5620	Wind speed, direction
Lee High, Huntsville AL	J210	65"	3"	8.7 lbs.	5521	Temperature with crickets
Skyline High, Sammamish WA	L800	122"	6"	37 lbs.	5143	UVA, UVB, light sensors
University School Milwaukee WI	K660	147"	6"	40 lbs.	5230	CO ₂ sensors
+ 2 each J330 & J400						

The Edison High School team's payload measured temperature and humidity.



The New Century Technology HS team used a magnetic apogee detector to deploy their recovery system.



Sparkman High School was one of the first teams in SLI.

The End is Near!

These publications are generally acknowledged to be the standard reference works for hobbyists and professionals alike, but all three are nearing the end of their print runs! If you've been thinking of getting these, *act now!*

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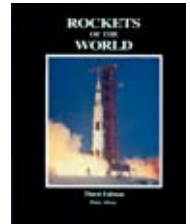


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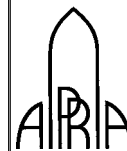


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Rockets at Waccamaw High

by Alan W. Pritchard, Cannon Award Winner



Waccamaw High School at Pawleys Island, South Carolina, received the Robert L. Cannon Award for the 2004/2005 school year. The \$500.00 award was a great asset to our organization allowing WASA to spread the love of rocketry throughout the community and beyond. WASA (Waccamaw Association of Space and Aviation) club has been in existence since fall 2001 at Waccamaw High School. It is an aviation club exploring all aspects of flight, including, but not limited to, rocketry. I wrote NAR Treasurer Stew McNabb last year and told him how I thought our rocketry team deserved the award because of all their accomplishments in rocketry and because we (we being myself and Scott Streiffert, the WASA students, and Jack Orr our new High Power man) teach rocketry at our school.

William McCracken's class tracks a rocket flight.

Actually it is not just our rocket team that benefits from the award; the whole school and community profits. The money supports class projects like Mr. McCracken's science class's participation in building and flying rockets for the first time. Students apply their algebra and measuring skills to every rocket flight. Accurate statistics are kept on each rocket flight. Groups of lab partners report their findings to the class and all have a great time actually applying what they learned in school.

In 2003 our rocket team won fourth place in the nation at the Team America Rocketry Challenge in The Plains, Virginia. They were so popular when they returned to school from Virginia that many new students wanted to learn about rocketry the very next semester. In 2004 WASA returned to Virginia to win a place in the top 25 in the nation. In 2005 a new WASA team earned a place in the top 100 in the nation and participated in the final fly-off at The Plains, Virginia. The Cannon Award helped educate these Team America students. WASA is the only South Carolina rocket team to have earned a place in the top 100 rocket teams in the nation three years in a row.

I was very proud of WASA when the rocket team joined with other WASA members to go to Tara Home for Boys in Georgetown, South Carolina, to teach the youngsters about rocketry and high power rocketry. The children built and flew rockets that very afternoon. I was delighted



Christy Skimmyhorn of Mr. McCracken's 9th grade class prepares to launch a rocket.

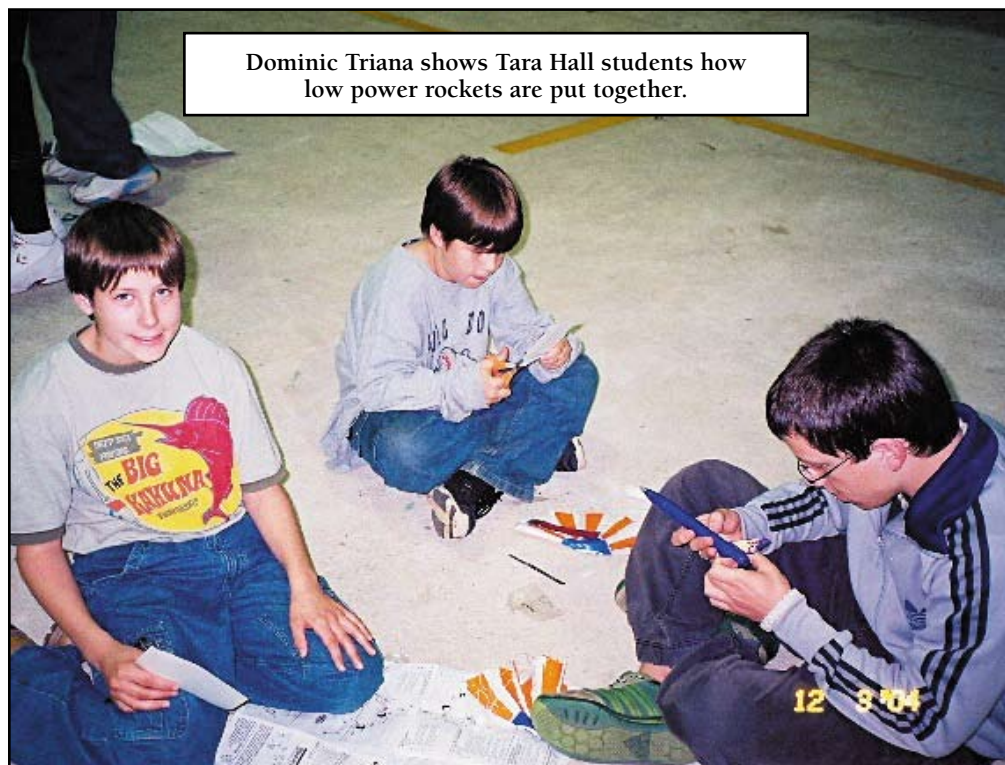
with WASA because they took the time after school to teach others how to fly. I noticed a maturity that I had never seen before while our students taught other students about rocketry. The Cannon Award will make more special trips like this possible by providing rocketry supplies and materials for teaching sport rocketry. Students can go on to adult rocketry and achieve up to Level 3, the highest level obtainable in sport rocketry. In my personal opinion,

adult level rocketry should be an Olympic event.

WASA also hosted a local community project with its annual Spooky Halloween Model Air Show in 2004 entertaining the crowd flying rockets, airplanes, and other flying objects. The Team America rocket teams are always introduced at the show. When the show is over people from the audience are invited to come and fly a rocket. It is a far out fun event held in

Pawleys Island at Waccamaw High every fall. We also have a famous guest to grace our football stadium where the show takes place: Mrs. Elsie Hickam attends the Halloween show every year to see the rockets fly. Everyone who knows anything about rockets knows that Mrs. Hickam is Homer Hickam's mom as seen in the movie *October Sky*. Two years in a row she has launched the last rocket of the day. One of the rockets she launched went so high that it disappeared into a cloud, popped its parachute, and floated out of sight. The Cannon Award will benefit events like this by providing rockets and supplies to teach the public about rocketry.

The Cannon Award keeps the learning about rockets moving forward. Classroom activities, Team America, and Halloween Rocket Shows are just a few examples of how the Cannon Award touches rocket lovers in one way or an-



Dominic Triana shows Tara Hall students how low power rockets are put together.



A group photo of the Tara Home For Boys students.

other. Due to the generosity of Estes and people like Stew our rocket programs can continue with the zest and enthusiasm that rocketry deserves. The world is currently going through a new renaissance in space. Thousands of people are signing up to go to space within the next decade through the private sector. NASA is planning to be on the Moon again soon and has cast its sights on the planet Mars and beyond. Things are getting exciting in space again and rocketry is gaining a momentum that may never stop.

The teachers at my school and my student-rocketry-supporting Superintendent, Randy Dozier, are just amazed how rocketry has changed my life and the lives of our students. We have obtained national recognition through Team America, WASA was featured on TV and newspapers throughout the community and neighboring cities, we discovered other rocketeers in Orangeburg, South Carolina, and moved on to high power rocketry there, and we met friends at the local Georgetown County Memorial airport that we'll never forget. WASA successes won a trip for me to Huntsville, Alabama, in 2004 to stroll with NASA officials, look at space vehicles, and discuss how to bring young people into the space program for employment.

Is the Cannon Award important? It sure is and it provides opportunities to students that might not otherwise be possible.

I predict that the first man or woman to step foot on another planet will probably have had rocketry for a hobby that very well may have originated from the Cannon



Robert Orr teaches Tara Hall Home for Boys students how high power rockets fly while co-advisor Coach Scott Streiffert looks on.

Award. Teachers, go ahead and apply to Stew for the award to use at your school and tell him how you will take advantage of the award to advance rocketry. Go to NAR.org for more information and keep reading great periodicals like *Sport Rocketry* to further your rocketry education.

Oh, remember my article on The Rocket Mom from the 2005 Jan/Feb issue of SR and my WASA rocket boys? Mrs. Hickam (The Rocket Mom) just had her 93rd birthday this past June and received a rocket pin for being a WASA sponsor that she now proudly wears on her dress. WASA members Robert Orr, Kellen Duncan, BJ Havenga, Steve Alston, and Dominic Triana graduated with honors in the 2005 graduating class from Waccamaw High School in Pawleys Island, South Carolina. Robert is going to Embry-Riddle Aeronautical University, Kellen and Dominic will study Engineering at Clemson University, BJ will study computers at Clemson, and Steve will study computers at Horry/Georgetown Tech. I think BJ summed up his entire four year WASA experience for all of us in a note he sent to me in a card at the end of the year simply stating, "I had fun." So did I BJ. So did I.

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