Free Press

November – December 2003

Blackhawk R&D's SA-5 Gammon (See page 3)

20 January 2004 - Club Meeting at King's Park Community Center at 7 PM;

- Bill Schworer – *"Electronic Payloads"*

24 January 2004 – Sport Launch at Great Meadow – 12 Noon – 3 PM

31 January 2004 - TRAILER PARTY - 9AM – 4 PM - Help the club refurbish the NOVAAR Launch equipment trailer for the upcoming launch season.

- Place: Aurora Flight Sciences at Manassas Airport.

ATTEND NOVAAR MEETINGS AND WIN A DOOR PRIZE!!

Congratulations to Roger Hillson, Jim Brower and Carl Curling—all were winners of the door prizes donated by QRC at the 6 January club meeting. Ken Brown provided the winners a grab bag full of nose cones, tube adaptors and other rocket goodies.

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Fly Safe, Fly Fast, Fly High! HAPPY 2004 !!

NOVAAR FREE PRESS

November – December 2003
Editor: Greg Bock
Contributors: Trip Barber, Jeff Perry and Roger Hillson

The **NOVAAR *Free Press*** is the official newsletter of the Northern Virginia Association of Rocketry, NAR Section 205. Subscriptions are included as part of the membership dues.

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7021 Forest View Drive
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Visit NOVAAR's Web site at:
http://www.novaar.org

Or better yet….

ATTEND NOVAAR MEETINGS!

NOVAAR holds meetings twice a month. We meet the first and third Tuesday from 7:00 PM to 8:30 at the Kings Park Community Center in the Kings Park Shopping Center. The shopping center is in North Springfield, two miles outside the Beltway (I495) at the intersection of Braddock and Burke Lake Road.
Dues are $5.00 per year for ages 13 or younger, $8.00 per year for ages 14-18, and $10.00 per year for age 19 or older. The maximum yearly membership fee for a family is $20. Make checks payable to "NOVAAR" and send to the Treasurer at:

Roger Hillson
ATTN: NOVAAR RENEWAL
4317 Selkirk Drive
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Members who wish to receive important announcements of launches, meetings and other club activities should send their e-mail addresses to John Hochheimer (john.hochheimer@verizon.net)

President's Corner

By Trip Barber

Sometimes NOVAAR has gone into "hibernation" during the cold winter months, with our members quietly building alone at home for the spring, but few club group activities. This year, we are going to stay active as a club all winter. First, we plan to fly every month through January, February, and March "weather permitting" -- although our flying hours will be shorter than in warm weather. Cold alone does not constitute a reason not to fly -- only precipitation falling or snow blocking access to the field, or high winds. If in doubt, check the NOVAAR website (www.novaar.org) or call me at (703)866-4710 at 8 PM the night before a scheduled launch. All our launches are scheduled on Saturdays, but we have the field and the waiver for the next day (Sunday) as well, to use as a weather backup day. Second, we have Sunday rocket-building sessions scheduled on the 3rd Sunday of each month (1 to 4 PM). If we get enough interest from our membership, we will be using these as opportunities to teach our new fliers how to build competition-type model rockets. Come to a NOVAAR meeting and speak up, or send me an e-mail (ahbarber@alum.mit.edu) if you want to be part of one of these. And third, we will be having a couple of "special event" meetings -- a session to overhaul our range equipment trailer, and a session to do the detailed planning for our role in hosting the 2004 model rocket national meet. Come on out of hibernation and be part of NOVAAR this winter, there's lots going on for you!

From the Editor

By Greg Bock

I hope you enjoy the final newsletter of the 2003. This issue contains a great article by Jeff Perry on the Blackhawk R&D SA-5 kit. Jeff goes into detail on how he modified the kit to fly a realistic flight profile. Be sure to check out the Upcoming Events calendar for club activities including launches, building sessions and contests. Finally, I'd like to thank each of you who contributed items to the newsletter throughout the year. You have made in another successful year for the newsletter. And please keep your newsletter editor in mind when you build all those rocket kits you received as gifts. Keep the articles coming and have a safe and happy Holiday Season and a Happy New Year!!

Fly Safe, Fly Fast, Fly High! HAPPY 2004 !!

Blackhawk R&D SA – 5 Gammon Kit

By Jeff Perry

(Editor's Note – *Jeff has been a member of NOVAAR since 2000, and has a Level II certification through the NAR. His interest in rocketry was re-kindled about five years ago while serving as an assistant den leader in his son's Cub Scout pack. Jeff indicates that his interest in the hobby has now gotten way out of control! Jeff now has five high power rockets in his fleet that he flys regularly at NOVAAR's sport launches out at Great Meadow: 4" North Coast Rocketry SA14, 4" BSD Thor (the "Survivor"), 4" Blackhawk R&D SA-5 Gammon, 6" PML Bulldog (awesome on 54s), and an 11" Skunkworks Rocketry V2 (in work with 98mm!). Jeff is a Geospatial Analyst with the National Geospatial Intelligence Agency, and lives with his wife, Linda, and son, Christopher, in Hamilton, VA.)*

I recently completed the SA-5 Gammon kit from Blackhawk R&D, and flew it for the first time after this year's 4th of July event at Great Meadow. This was a really good project, and turned out to be quite a learning experience for me as it was my first attempt at using electronic devices to control motor ignition and recovery device deployment for high power rockets. This article details the construction of the kit and the modifications and techniques I used to make and obtain a successful flight of a realistic performing replica of the SA – 5.

Rocket Fleet

BACKGROUND ON THE SA-5 "GAMMON"

The Blackhawk R&D S-200 SA-5 Gammon is a 1:7 scale replica of a Russian built long-range medium to high-altitude surface-to-air missile system. The actual SA-5, a single-stage missile, has four jettisonable, wraparound solid propellant boosters. Each booster is 4.9m long and 0.48m in diameter with a single fin spanning 0.35m from the booster body. The missile is 10.72m long overall with a wingspan of 2.85m. The main airframe is 0.85m in diameter and has a single-stage liquid fuel 10,000kg total thrust, 51-150 second duration rocket sustainer. At ignition the boosters are fired first for approximately 3 seconds, and then peel away from the main airframe shortly after the sustainer ignites.

The minimum range of approximately 60km is due to the 3-5 second, 160,000kg total thrust duration solid fuel booster time and jettison requirements. These two items limit the rocket to engagements against relatively large, unmanouverable targets at ranges of up to 250km. Course correction command signals from SQUARE PAIR radar guide the rocket beyond the 60km booster jettison point. The final guidance to the target comes from the S-200's own active radar terminal homing seeker head, which is activated near the projected intercept point.

The large HE 215kg warhead is detonated either by a command signal or by an onboard proximity fusing system. When deployed with a nuclear warhead only the command detonation option is used.

THE BLACKHAWK KIT

I purchased the kit from Blackhawk R&D for about $100. Unfortunately, this vendor removed the kit from their product line due to the high cost of its laser cut fins. I'm not even sure if the company is still operating however, as I have not been able to connect to their website in quite some time. Ross (Magnum Hobbies) and Ken (Performance Hobbies) both indicated this summer that the company's owner recently had been out with some kind of injury. In any event I am sad to see that this kit is no longer available. I think it would make an excellent Level III scale project for advanced rocketeers.

The SA-5 Gammon supplied parts inventory

In addition to the kit's supplied parts my plans also required the purchase of the following materials:

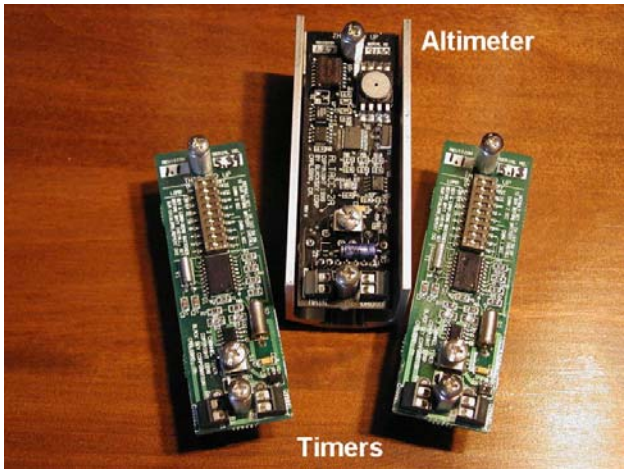
- Sky Angle Cert-3 24" Drogue chute
- Sky Angle Classic 52" Main chute
- BlackSky AltAcc2C Barometric Altimeter
- BlackSky Aluminum Housing
- (2) BlackSky Timer 2N Two Channel Digital Timers
- PML Magnelite Pyrogen kit
- 4" x 14" Payload Tube
- Kapton High Temp Tape
  www.uline.com/ProductDetail.asp?model=S-7595
- Radio Shack Pen Style Digital Multimeter 22-807
- (2) BlackSky E-Jector 4cc Ejection Charge Units
- BlackSky HiRMI Standard Igniters
- DaveyFire 28F Electric Matches
- 1/8" Threaded Rods
- 1/8" Aluminum Conduit Pipe
- 4" x 3.9" 5-ply Bulkhead
- 4" x 3.875 5-ply Bulkhead
- Eyebolt, U-bolt, Wing Nuts, Nylon Nuts, Washers

With five motors the SA-5 Gammon supports many different flight configurations. I chose to build the kit for a dual deployment parachute recovery system, and optional airstarting of 2 or 4 of its outboard motors via timing devices. The rocket has a 38mm centerline motor and four 29mm outboards. Although the SA-5 can be launched with all five motors simultaneously, the rocket can achieve higher altitudes by staggering the ignition of diagonal pairs of the outboards in mid-flight. The kit can also use a single recovery system if desired by using the main motor's ejection charge. However, in my configuration this can only be accomplished without using the timers.

ELECTRONICS

I decided to use a BlackSky AltAcc2C altimeter and BlackSky Timer 2N for recovery and airstarting. The timer would allow for all four motors to be wired to the timer's two channels in pairs. I chose these products because the Gates brothers have used them both extensively in many of their advanced high power projects. [1]

I discussed the use of the Timer 2N in detail with Erik Gates through Rocketry Online's discussion forum and e-mail correspondence. He was a great help, and provided valuable information based on lessons he had learned the hard way.



The electronics used in the model –a BlackSky AltAcc2C altimeter and two BlackSky Timer 2N

The AltAcc2C is both a barometric altimeter and an integrating accelerometer. It is capable of recording over four minutes of flight data per launch. The user can set the type of recovery desired—"Main", or "Drogue and Main". The Main parachute deployment altitude is programmable for 600, 1200, or 2400 feet AGL (600 ft is the default altitude value).

The *BlackSky Flight Analyzer* software allows the user to download the data collected to a PC. The software generates a single graph that shows flight profiles of the rockets speed, acceleration, and pressure altitude in relation to time. Drogue and/or main deployment are also indicated on the graph. The actual flight profile for my flight is shown at the end of this article.

The Timer 2N is a two channel digital timer that incorporates a launch detect G-switch. The unit can be used for staging, recovery, or airstarting at ranges of between 1 to 255 seconds. Each channel is set via small Dual Inline Package (DIP) switches on the circuit board before installing the battery.

With a fresh 9V alkaline battery both units generate >1.5A @ 8.5V igniter output current, weigh approximately 2.8 ounces, and fit in airframes 1.5" or larger. LEDs flash at different intervals when the devices are armed to confirm that proper continuity has been achieved prior to launch.

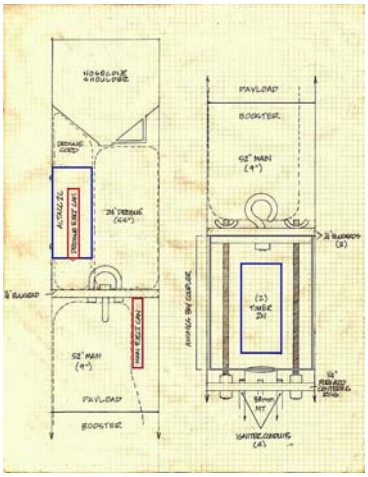
[1] If you've never been to their website do yourself a big favor and check it out www.gbrocketry.com (make sure you go to the movie link – Porthos II 1st flight and Jayhawk 2nd Flight Tower Videos are incredible stuff!!!)

AVIONICS BAY DESIGNS

Before beginning assembly I had to determine how to incorporate the altimeter, timer, drogue, and main chutes into the system's airframe. After reviewing the minimum space requirements for the parachutes I had chosen, I realized that I would not have enough room to work with using the supplied parts.

I acquired a RockSim template for the kit that was prepared by Chuck Pierce, president of the Huntsville Area Rocketry Association, who also evaluated the prototype of this kit for Blackhawk R&D[2]. Using RockSim I determined that by adding four inches to the payload section and incorporating additional nose weight I could safely use the additional components I had selected without adversely affecting the rocket's stability.

The new payload bay gave me just enough room to work with. Originally, I had planned on using only one timer, wiring two diagonal pairs of the outboards to each of its two channels. Erik Gates however indicated that if the igniters wired to channel one misfired the timer's default memory settings (off) would be restored, thereby deactivating the second channel. Therefore, he suggested using two timers ($$!), and wiring a pair of motors to just one channel from each. One advantage in doing this is that it allows for all four motors to be airstarted at once. Activation of both channels simultaneously on a single timer is not possible as the battery is not capable of supplying enough output current to safely ignite all of the electric matches.

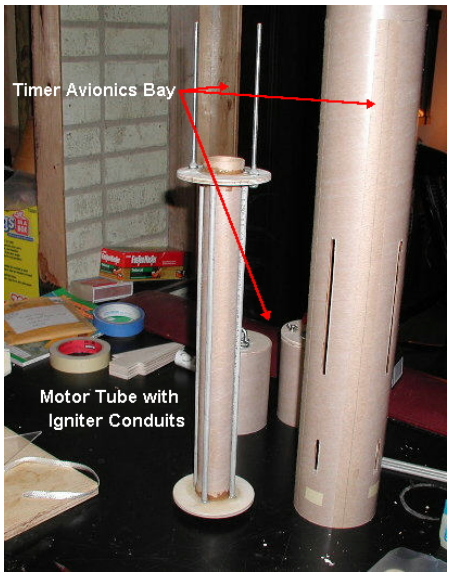


Draft design of avionics bays for the SA-5 Gammon

SA-5 Gammon drogue chute payload bay

I decided to locate the altimeter and drogue chute between the payload section bulkhead and nosecone. The altimeter is enclosed in an aluminum casing that is flush mounted to the airframe wall protecting it from ejection gases. The housing consists of two pieces that are held together by small screws. The joints between these pieces must also be sealed to prevent gas from entering the enclosure. I used masking tape.

Two BlackSky E-Jector canisters are used to actuate the recovery systems. The drogue canister is closely mounted next to the altimeter housing by attaching it to a small piece of aluminum that is then epoxied to the bottom of the housing. The main E-jector canister is attached with a screw to the reverse side of the payload bulkhead, with two 1/16" holes allowing the electric match leads to be passed through to the altimeter.



Timer avionics bay parts prior to assembly

[2] Chuck's review is available at www.rocketreviews.com/reviews/kits/bh_sa5_gammon.html

I decided to create a small avionics bay for the timers located between the forward centering ring of the 38mm motor tube and the end of the rocket's booster section. Igniter wires for the outboard motors are then connected to the timers through four pieces of 1/8" aluminum conduit pipe that are flush mounted to the motor tube and pass through holes drilled in the forward and aft centering rings. The chamber consists of a short piece of coupler tubing slightly longer than the length of the timer's circuit boards epoxied to the inside of the booster airframe just above the forward centering ring. This compartment is then sealed with two bulkheads that are glued together. The topmost bulkhead fits inside the booster airframe (3.9") and the one attached to it (3.875") fits snuggly into the coupler. This bulkhead "sandwich" also has an eyebolt in the center for attaching the main chutes shroud line to. To prevent the bulkhead from then being pulled out when the main chute deploys it is secured to the avionics bay by wing nuts attached to two 1/8" threaded rods. These rods are mounted to the forward centering ring with nylon screws and washers on both sides, run through the chamber, and then pass through holes drilled in the bulkhead. A small bead of weatherproofing putty is also run around the top outside edge of the bulkhead for additional protection from ejection gas penetration. Plugged centerline motors only are required when using the timers in this configuration.

If you decide to use this design in a future project here's an important note to remember. You must drill all common holes that are shared by more than one part <u>at the same time</u>, and the pieces <u>must</u> maintain the same alignment during assembly that they had when they were drilled. If you don't follow this cardinal rule then you will more than likely run into trouble trying to fit the aluminum rods through your bulkhead "sandwich". I also strongly recommend using a drill press for this step to insure that the holes are truly perpendicular to the bulkhead's plane. I cut a piece of body and coupler tubing just big enough to accommodate all of the pieces and dry fit everything together before drilling the holes. This will pretty much assure a smooth fit.

IGNITERS AND WIRING

I purchased two brands of low current electric matches to use for airstarting the outboard motors—the Daveyfire SA 2000 N28Fs (1.0A minimum all fire current) and the BlackSky HiRMI standard Hi-Reliability electric matches (0.40A minimum all fire current). Daveyfire also makes SA 2000 28B (white) and 28BR (orange) electric matches. These both require only 0.37A minimum all fire current, the 28BR having three times as much pyrogen in the match head. I chose the 28F in spite of its higher minimum all fire current, because it burns about twenty times longer than the others.

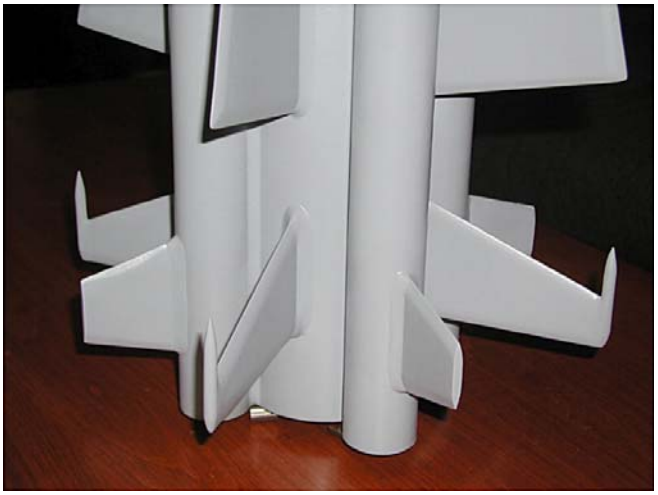
I then single dip each igniter into a Magnelite pyrogen mix to increase its ignition potential. Prior to dipping I also apply a thin layer of GE Silicon II sealant to the bridgewire (soldered connection between the match head and wires). Doing this prevents any increased resistance in the circuit that may be caused by the high metal content in the pyrogen mix. After the igniters have dried I check the resistance with a Radio Shack Multimeter to make sure the matches are still within specs. I also dipped the matches into the pyrogen jar as far as possible to get as much of the compound on the wire as possible. Single dip only as repeated coatings may cause the pyrogen to explode instead of igniting the motor. My test simulations resulted in a good solid one-second plus burn, more than sufficient for ignition of G and H motors.

I plan to wire the igniters for each diagonal pair of motors in parallel having achieved several successful test firings in this configuration with the Timer 2N. Although the manufacturer of both of the selected electronic matches recommends wiring in series I have chosen to use the parallel method because it provides a larger "pipe" for the current to pass through.

Rear of the SA-5 Gammon showing igniter conduits and heavy fillets for the outboard motor tubes.

As an additional safeguard I planned to wrap the igniter wires one inch up into the motors and igniter conduits with high temperature Kapton tape to prevent post ignition heat damage from the main engine.

Completed avionics bay showing mounted timers, plugged forward closure of centerline motor, igniter conduits, and threaded rods for securing bulkhead.



SA-5 Gammon rear reference antennae and fillet detail.

ASSEMBLY

I get a lot of comments on how nice the fillets on my rockets look. The method I use is very easy. I make a dam out of wax paper at each end of the joint, taping it to the airframe and fin with masking tape. I use two hour long set epoxy for all of my joints, and also remove the glassine layer (if present) from the body tube to allow for deeper saturation of the epoxy into the airframe material. After about twenty minutes I remove the dams, generously wet my fingertip with isopropyl rubbing alcohol, and run it up and down the entire length of the fillet several times. At this point the epoxy takes on a taffy-like consistency, which allows you to round off the flattened ends created by the wax paper dams. You can simply pinch off any excess and smooth out the rough edges using plenty of alcohol. You may also find little divets in the surface after it finally cures. These result from small air bubbles in the epoxy that surface and pop. Using a heavy primer before painting can usually fill these. I also rolled wax paper and inserted it into the ends of the igniter conduits to keep epoxy from clogging them when I secured the centering rings to the motor tube.

All of my decals are vinyl, and were custom ordered from Scott Binder at BSD Rocketry (www.bsdrocketry.com).[3]

I couldn't resist adding rear reference antennae to the aft fins on the kit. A hard landing will no doubt break them at some point in the future, but the risks were not substantial enough in my opinion to warrant not adding them. I think the kit just looks too good with them, and more closely resembles the actual missile. These were made from beveled dowel stock epoxied to the outer fin edges. All of the fin stock was beveled using a Craftsman Belt Sander.

I also incorporated the use of "shear pins" as a safeguard against premature separation of the main parachute resulting from forces used to deploy the drogue. The pins are #2 nylon screws (2-56) that were purchased from www.microfasteners.com. I found an informative website put together by Tripoli Minnesota that computed the maximum number of shear pins required. (Unfortunately, this web site is no longer accessible.) In summary *"Jim Januzzo, ROL Construction Forum moderator, found that #2 nylon screws (2-56) make excellent shear pins, reliably shearing under 35 pounds of force. That force must be generated by the ejection charge. The ejection charge force is calculated by multiplying the cross-sectional area of the body tube by the ejection pressure in psi. Divide this force by 35 pounds to get the maximum number of shear pins that can be used."* 16 psi is necessary to create a force of 200 pounds in a four-inch airframe (150-200 lbs. was suggested). The maximum number of pins that could be used with this ejection force was five, but I was concerned about the rigidity of the screws and decided to only use

[3] Scott does great work at a reasonable price. Vinyl decals are easy to apply and produce a really nice, professional looking finish.

four. This was also more aesthetically appealing as a single screw fit between each of the four main fins.

POST FLIGHT REVIEW

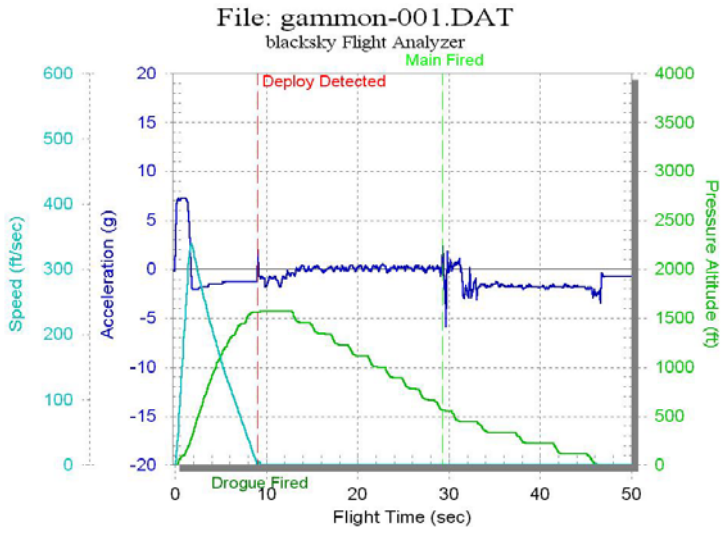
The maiden flight was picture perfect on a Pro 38 SS700J400 Smokey Sam. The altimeter functioned flawlessly with both charges firing right on cue. The rocket landed harder than I would have liked, but a slower descent rate would require a larger chute, which there simply isn't room for. All of the shear pins broke cleanly and there was no damage to the airframe material where the holes were drilled. I was going to reinforce these with cyanoacrylate, but was afraid this might create problems for the screws.

I also found that I very nearly missed suffering substantial damage, if not total loss to the whole project. On recovery I noticed that the nylon shock cord in the drogue payload bay had nearly been burned through by the ejection charge. It was only held together by a few remaining strands! I have replaced it with ¼" flame retardant Kevlar for future flights.

I also noticed that the altitude data collected by the AltAcc2C differed substantially from what had been predicted by the RockSim 5 simulations. Based on discussions with our club president, Trip Barber, I attribute this to a higher actual drag coefficient than what was indicated in RockSim. The AltAcc2C's altitude of 1565 feet seems more accurate based on my field observations.

Many thanks for the valuable feedback and suggestions from Trip Barber, Eric Robinson, and Bill Schworer on this project. I plan to launch the kit in the spring with a Pro 38 SS700J400 Smokey Sam, 2 Aerotech RMS G54 WLs (still waiting on these) and 2 Aerotech RMS H128 WLs. Should be a beautiful and dramatic flight if all goes well. Look forward to seeing you there!

Literally hanging by a thread on the return trip!



AltAcc2C flight profile graph for the SA-5 Gammon's first flight

LEARN AND BUILD WITH THE BEST!!

Attend the club building session on 21 March 2004

Ken Brown, NOVAAR's Senior Advisor and president of Qualified Competition Rockets will lead the session. We will be building B Eggloft Duration and B Payload models. These events will be flown at the club's Section Meet on 3 and 4 April, at ECRM 31 (B Payload) on 5-6 June, and at NARAM 46 in August. Get an early start on the contest year and come to the Kings Park Community Center from 1-5 PM. Bring your building material, Xacto knife, glue and sandpaper. The kits will be available for purchase.

Annual Party Nets Club Over $300.00

By Roger Hillson and Greg Bock

Lots of interesting rocket paraphernalia showed up at this year's auction. The auction has become a tradition at the club's annual holiday party which is held on the 3rd Sunday in December. Club members bring rocket kits and items that have been hanging around the garage or basement, and these items are auctioned off by the entertaining Jonathan Rains. 10% of the proceeds go to the club's treasury.

This year there was lots of high power equipment, rockets, motors and electronic altimeters donated by Jerome Craig, an active club member in the mid-1990s. His large carbon fiber coated rocket was one of the highlights of the auction. For some reason 2003 was the year of the Saturn; there were several partially completed Saturn 1Bs and Saturn Vs at the auction, including a vintage Estes kit. Other items of interest included several plastic model kits (suitable for plastic model conversion, of course), a 1966 Estes catalog in great condition, nylon parachutes, motors, body tubes and more. Overall the club made $333 from the auction proceeds. NOVAAR is particularly grateful to Jerome Craig who donated most of the revenue from the sale of his large collection of models and equipment directly to the club. Other major donations came from Ken Brown of Qualified Competition Rockets fame, and from Tom McClain, VP of the Aircraft Modelers Association, who made a fairly large donation of rockets and motors. The club thanks all who participated by buying, bringing or donating items.

About 2 dozen club members showed up for this year's party.

Auctioneer Jonathan Rains displays a high power rocket.

Lots of great items appeared at this year's auction, including some Saturn kits.

A vintage Estes Industries Apollo Saturn kit →

UPCOMING EVENTS

NOVAAR meets the 1st and 3rd Tuesday of each month at the Kings Park Community Center. Meetings begin promptly at 7 pm and usually last 1½hours. The Community Center is located in the King's Park Shopping Center, Braddock Rd. and Burke Lake Rd. — two miles outside the Beltway in Springfield. NOVAAR flys at Great Meadow - Travel on I-66 to The Plains Exit #31; proceed south on Old Tavern Rd. (Rt. 245) to enter the gate.

4 January 2004 - Club Meeting at King's Park Community Center at 7 PM.
- Trip Barber – *"Tracking"*

20 January 2004 - Club Meeting at King's Park Community Center at 7 PM;
- Bill Schworer – *"Electronic Payloads"*

24 January 2004 (25 January-Rain/Snow Backup Date) - Sport Launch at Great Meadow 12 Noon - 3 PM
- Team America Practice Flights
- Sport Launch

31 January 2004 – Trailer Party!!! Help the club refurbish the NOVAAR Launch equipment trailer for the upcoming launch season.
- Place: Aurora Flight Sciences at Manassas Airport.
- Time: 9 AM – 4 PM

3 February 2004 - Club Meeting at King's Park Community Center at 7 PM;
- Ken Brown – *"Running a Rocket Company"*

17 February 2004 - Club Meeting at King's Park Community Center at 7 PM;
- Roger Hillson – *"Mini-Cam TV Rocket"*

21 February 2004 (22 February-Rain/Snow Backup Date) - Sport Launch at Great Meadow 12 Noon - 3 PM
- Team America Practice Flights
- Sport Launch

28 February 2004 – NARAM 46 Planning Session 1-5PM at Jonathan Rains house.

2 March 2003 - Club Meeting at King's Park Community Center at 7 PM;
- Ivan Galysh – *"Cubesat Satellites"*

13 March 2004 (14 March-Rain/Snow Backup Date) - Sport Launch at Great Meadow 12 Noon - 3 PM
- Team America Practice Flights
- Sport Launch

16 March 2003 - Club Meeting at King's Park Community Center at 7 PM;
- Chris Kidwell – *"Altimeters"*

21 March 2003 – Building Session – 1 - 5 PM at Kings Park Community Center. Ken Brown from QCR will supply kits for B Payload and B Egg Lofter Models. Bring your building supplies and money to purchase kits.

3 – 4 April 2004 (Both Days) - NOVAAR Section Meet /Sport Launch at Great Meadow 9 AM – 5 PM
- Team America Practice Flights
- Sport Launch
- Section Meet (April 3rd)

  Events:
  - B Payload
  - B Eggloft Duration
  - ½ A Streamer Duration

15 – 16 May 2004 Team America Flyoff (16 May is a back-up day) at Great Meadow

June 5 – 6 2004 - ECRM at Middletown, MD, hosted by NARHAMS (www.narhams.org)

Events:
- Plastic Model Conversion
- A Rocket Glider Duration
- B Payload
- 1/2A Helicopter Duration

12 June 2004 - Sport Launch at Great Meadow 9 AM – 5 PM

June 26 – 27 2004 - Regional at Carlisle, PA hosted by SPAAR (www.spaar.org)

Events:
- ½ A Streamer Duration
- ½ A Helicopter Duration
- ½ A Rocket Glider Duration
- ½ A Parachute Duration (multiround)
- B Eggloft Altitude

4 July 2004 - July 4th High Power Rocket Demonstration at Great Meadow

31 July – 6 August 2004 NARAM 46 at Great Meadow 9 AM- 5 PM

28 August 2004 - Sport Launch at Great Meadow 9 AM – 5 PM

18 September 2004 - Sport Launch at Great Meadow 9 AM – 5 PM

6 November 2004 (Backup day -7 November) - Sport Launch at Great Meadow 9 AM – 5 PM

11 December 2004 - Sport Launch at Great Meadow 10 AM – 3 PM

NOVAAR MEMBERSHIP APPLICATION

Dues are $5.00 per year for ages 13 or younger, $8.00 per year for ages 14-18, and $10.00 per year for age 19 or older. The maximum yearly membership fee for a family is $20.00. Make checks payable to "NOVAAR" and send to the Treasurer at:

Roger Hillson
ATTN: NOVAAR RENEWAL
4317 Selkirk Drive
Fairfax, VA 22032

Roger can also be reached by email (hillson@erols.com) and telephone (703-978-6957 evenings). Be sure and put "NOVAAR RENEWAL" somewhere on the outside of the envelope, and enclose a copy of the renewal application.

Date _____Please check one: ___ New Member ___ Renewal

NAME:_____

DATE OF BIRTH _____

STREET:_____

CITY:_____STATE:_____ZIP:_____

HOME PHONE:_____

NAR membership number, if a member: _____

EMAIL ADDRESS
(Optional)_____

I heard about NOVAAR from:
_____

Dues are for one year of NOVAAR membership and do not include optional NAR Membership.

Please check one category based on your age as of the previous July 1st:
One: __ Age 13 or younger ($5) __ Ages 14-18 ($8) __ Age 19 or older ($10)

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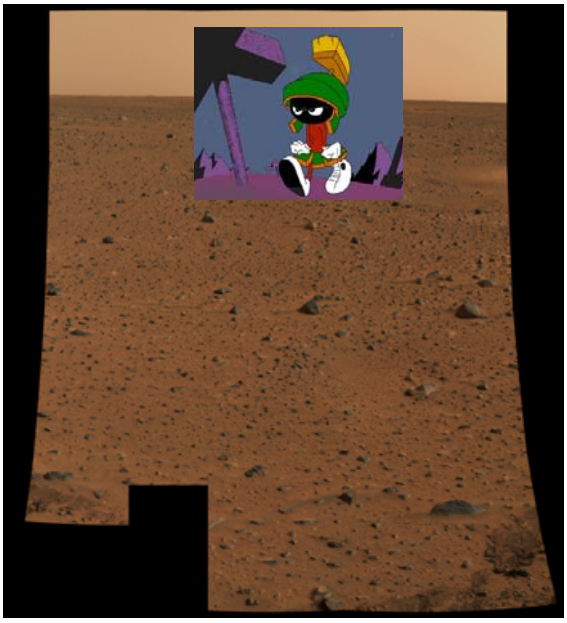
FIRST CLASS MAIL



Congratulations NASA!!!