THE LEADING EDGE

Newsletter of the Northern Illinois Rocketry Association, NAR Section #117

Volume 22, Number 3 May/June 1999

Club News

NIRA in the *Chicago Tribune* – There was an article about NIRA and rocketry in the *Chicago Tribune* on May 26th. The well written, mostly accurate, article was written because a newspaper photographer saw members waiting in the rain at Greene Valley and wondered why we were just standing in the middle of the field...

Range Equipment – There was some discussion at the April meeting regarding the poor condition of the clubs altitude trackers. Tom Pastrick suggested that if the club wanted to continue to do altitude events at our contests, new trackers would be needed.

Also, there was discussion about the club purchasing several 'family band' radios for use at both contests and our normal launches. Since several members work for one of the leading manufacturers (Motorola), it was decided to wait to see if some could be obtained with employee discounts.

First Youth Group Launch Scrubbed – The first scheduled youth group launch was scrubbed due to the lack of youth! Mike Ugorek, one of the coordinators explained that there was very short notice for this launch and that the next one – scheduled for August 22nd – should be much better attended.

Anyone who would like to assist with this launch should contact Mike or Bill Thiel

New Quest Rockets – Mike Hellmund brought his stash of the new Quest mini rockets to the April meeting. These cute, but tiny, rockets should be available in stores soon.

Meeting Lectures – Both the April and May meetings had very informative lectures. Tom Pastrick gave a talk on parachutes in April while Bob Kaplow talked about selecting balsa (and other materials) at the May meeting.

If you would like to give a talk before the business portion of the meeting, please let Rick Gaff, NIRA President, know.

RSO/LCO Duties – At the first club launch of the year, Bob Kaplow and Rick Gaff performed the vast majority of range duty. This was discussed at the May meeting and it was decided to have a signup list for range shifts so that the duty could be spread evenly.

One of the concerns voiced at the meeting was that people weren't sure of the responsibilities of the positions and that there wasn't training available. A formal 'job description' is being prepared for the positions. Also, anyone interested in learning how to LCO can sit with the on-duty LCO at a launch to get some hands-on training.

Midwest Regional Fun Fly '99
by Mike Ugorek

This year's MRFF is going to be the gala event that you all fondly remember only better than ever. MRFF will be held at Bong Recreational area in Wisconsin on June 19-20 this year. In line with the state it will be held in I will remind you all of the children's poem:

Birdie birdie in the sky
Left some whitewash in my eye
But I'm no baby I don't cry
I'm just glad that cows don't fly.

Well it's up to the MRFF flyers to see to it that cows **do** fly. Cow rockets that is.

How do you make a COW ROCKET? That's up to the ingenuity of the rocket builder.

Some of the cow rocket events will be:

- Put your cow in the barnyard (spot landing). The first person to put their Cow Rocket in the barnyard wins the prize, so start flying early.
- Cow chip throwing on Saturday afternoon. The "official cow chip" is in my basement as we speak (and as my wife complains). Of course we can only use the Official Cow Chip so everyone has an equal chance. Politicians are banned from this competition as it is limited to amateurs and professionals are excluded.
- In the evening, during the kit bash, a contest for **Best Cow** will be held with points awarded for quality of construction, humor, design excellence, etc. To be eligible the rocket must have flown safe and stable during the day. May the best cow win.
- If no one landed a cow in the barnyard during the day, a people's choice of cows will be held to give away that prize.

The usual Kit bash and peoples choice contests will be run and Bill Thiel has threatened to run Marshmallow LaMans on top of it. He has my blessing.

Camping is allowed at Bong but from what I understand of the rules, it isn't on the flying field. Bong has a regular campground. All sun shades and shelters must be taken down overnight but you may put them up each day, all day.

Even though we got the planning started very late (due in part to a change over in leadership) I have **high** hopes of breaking the 1000 rocket barrier. We will have a much higher Waver than the last 2 years and Tripoli launches from the field regularly. Let's see that big stuff guys and gals. Please refer questions on the Waver to Bob Kaplow.

For camping at Bong call (414) 878-5600 for reservations.

The "official" motel of MRFF is the Rainbow Motel. Call (414) 763-2491 for reservations. It has a pool and air conditioning and indoor plumbing and everything. It is at 733 Milwaukee Ave. Burlington, WI. 53051. It is just north of Burlington on Hwy. 36.

Articles Wanted!

Just a quick reminder, the Leading Edge exists because of your articles.

If you aren't sure what's wanted, just look through an issue or two. We can always use an original rocket plan (and can re-draw as necessary), kit reviews, launch reports, and technical articles. Poetry, cartoons, are also welcome.

If you have an article, or wonder if a particular article is wanted, my contact information is on the next page. I'm always willing to talk about how we can make the Leading Edge better.

THE LEADING EDGE

Volume 22, Number 3
May/June 1999

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Vice President – open
Secretary/Treasurer – Ken Hutchinson
RSO – Bob Kaplow

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Photos will be returned, other material returned upon requested.

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Send membership applications (dues: $6 per youth, $8 per adult, $12 per family, including a six issue subscription to the Leading Edge), non-member subscriptions ($10 per six issues), and change of address notification to:

Ken Hutchinson
84 Jefferson Lane
Cary, IL 60013.

The NIRA web site is at:
http://nira.chicago.il.us/

CLUB MEETING DATES

All meetings start at 7:30 PM, with the pre-meeting lecture starting at 7:00 PM. Bring a model for 'Model of the Month.' We always need volunteers for the pre-meeting lecture, contact Rick Gaff if you want to schedule a date. The location is the Glen Ellyn Civic Center, 535 Duane Street (usually the 3rd floor, but check the board in the lobby).

June 4 – Prang Film (Rick Gaff).

July 2

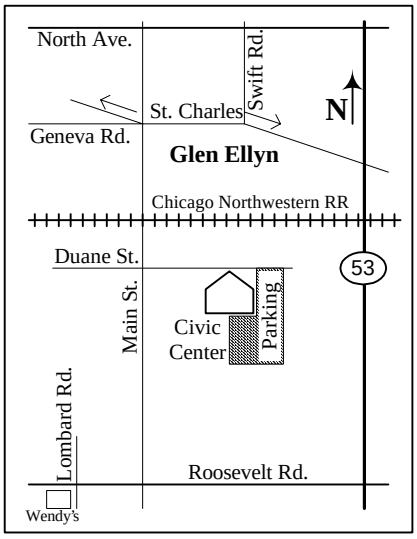
August 6

September 3

October 1

November 5

December 3



CLUB LAUNCH DATES

Launches are BYOL (bring your own launcher). The location for our 1999 launches is the Greene Valley Forest Preserve (see map at right). Call the NIRA hotline for pre-launch information: 630-483-2468 (this is a new hotline number).

June 19-20 – Midwest Regional Fun Fly (at Bong State Park, WI).

July 18 – Regular club launch.

August 15 – Regular club launch.

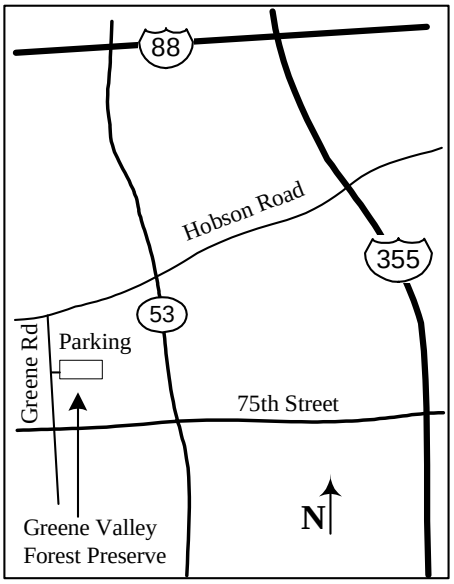
August 22 – Youth Group launch.

September 19 – Regular club launch.

October 17 – Regular club launch.

November 7 – Hobby Show launch.

November 21 – Regular club launch.



Model of the Month Winners! (from left to right, photos by Ric Gaff)

April – Peter Olivola won in Adult with his scratch-built 2 stage rocket (3-24mm to 1-24mm). One of the first stages engines uses a delay to eject a parachute for the booster. Matthew Duckworth won for Youth with a beautifully finished Estes Mercury Atlas.

May – Teddy Farmer took the Adult category with his well-crafted Estes Sidewinder. This is his 2nd Sidewinder, and incorporates a 29mm motor mount. There were no youth entries...

Modifying the LOC/Precision STARBURST

by Richard Wartick (NAR 56693)

In professional rocketry, engine clustering is a time honored way of building weight lifting capability—an absolute requirement to place heavy payloads into orbit and beyond. The Delta II launch vehicle is a modern example of clustering rocket engines to attain high thrust at liftoff. On a much smaller scale, flying model rockets powered by clusters of motors is high-powered fun! One way to learn this interesting and valuable technique is to build and fly a LOC/Precision "Starburst."

Starburst is a forty-nine inch long "three fins and a nosecone rocket" powered by a cluster of two motors. As a learning tool, it's as basic as it gets. This is a kit composed entirely of heavy-duty parts. At almost twenty ounces, the rocket is not a lightweight. Epoxy resin is the recommended adhesive, but use it with care! To protect the vehicle from unnecessary weight-gain during construction, be careful not to use more epoxy resin than necessary to build a solid airframe.

Modifying The Airframe

Starburst is designed to use two composite-fuel motors for thrust. To my way of thinking, igniting a pair of composite motors appears much more intimidating than igniting a pair of "Estes-style" black powder motors. While I have bean using black powder propellants for years, flying rockets with Aerotech composite fuel is a brand new experience. Right now, I have no desire to try to ignite a composite motor cluster. For timid (read: cautious) people like myself, the LOC/Precision catalog lists the "Estes D12" as a workable minimum powerplant. Familiarity with the performance characteristics of black powder propellant, coupled with safety concerns and my own cautious nature, led me to the decision to use the Estes motors.

The modified Starburst on the pad at MRFF-1998
(Richard Wartick photo)

Shaving unnecessary weight from a large rocket is important if it is going to fly with a pair of Estes D12's. While they are capable of lofting small payloads, they are certainly not known for being high performance motors. With this in mind, how can I safely trim some weight from this heavy rocket? Should I modify the airframe by cutting off some of the body tube? That will take some weight off the vehicle. Can I substitute the supplied airframe tubing with lighter weight thin wall tube? Is it a safe modification? Hmmmmm. After making a careful examination of the kit components, I decide to cut off some of the tube. However, a few words of caution are in order: the aerodynamic stability of a rocket becomes an issue to think about when altering any kit design, especially when making the airframe shorter than it was intended to be. Do not make any modifications without first having a thorough understanding of the principles involved. An excellent source of information on this subject is the "Handbook of Model Rocketry." Read. Read! Read the text carefully prior to altering any rocket kit!

Wielding a hobby knife, I cut twelve inches off the length of the body tube and modified the internal structure accordingly. The Starburst is now thirty seven inches long, and somewhat lighter.

How To Launch It

Available battery power, especially the lack of power, becomes a factor to think about when attempting to ignite a cluster of motors. With that in mind, Estes designed the "Solar Igniter" to draw less current than most other types of igniters on the market. Many fliers launch their rockets using Solar igniters triggered by hand held launch controllers containing only four "AA"-batteries. While these systems supply sufficient current to ignite a single motor, they are not suitable for cluster ignition. I currently use a launch control system wired with eighteen gauge lamp cord and powered by a set of four "D"-size batteries. The larger batteries deliver just enough amperage to successfully ignite two motors which have been prepped with Solar igniters. Needless to say, at best it's a minimum system. To be certain sufficient ignition energy is available, I use fresh batteries at all times. Do I maintain a high level of confidence with this equipment? No, not for this application. Most of the time, I prefer to fly my rocket at MRFF. Why? The launch equipment used at MRFF can safely handle cluster ignition.

Without a doubt, flying a twin-motor rocket requires greater care than flying a single motor rocket. Preparation for safe flights begin long before putting the rocket on the launch pad. It begins during construction! When at the field, use common sense and exercise patience when prepping for flight. Remember these three rules and you should fly a safe rocket.

1) Be sure to select only the best looking igniters for use in the cluster. Do not hesitate to reject an igniter that appears to have a defect.
2) Keep the micro-clips away from the blast deflector! Beware of short circuits. Make sure that all electrical connections are secure. Remember, both igniters must start the motors in unison if the flight is to be a success.
3) Don't take chances. If something does not look right, stop what you are doing; find the problem and fix it!

The liftoff of any cluster motor rocket is impressive. Learning how to do it reliably opens the door to being able to fly a vast array of vehicles, including realistic sport scale models. If you think that flying cluster rockets is for you, try a LOC/Precision Starburst.

Send Your Name to Mars!

NASA invites you to send your name to Mars on the Mars 2001 Lander! Names are being collected that will be placed on a CDROM that will be carried on the Mars 2001 lander. A certificate is also available and is provided free of charge by NASA. Our goal is to collect several million names! Names can be submitted here:

http://spacekids.hq.nasa.gov/2001/

The Mars Surveyor 2001 Lander is scheduled for launch on April 10, 2001, and will land on Mars on Jan. 22, 2002. The lander will touch down near the Martian equator, carrying a spare Mars Pathfinder rover, a robotic arm and several other science instruments, including three that will return data in support of eventual human exploration.

The 2001 Lander will carry an imager to take pictures of the surrounding terrain during its rocket-assisted descent to the surface. The descent imaging camera will provide images of the landing site for geologic analyses, and will aid planning for initial operations and traverses by the rover.

The 2001 Lander will also be a platform for instruments and technology experiments designed to provide key insights to decisions regarding successful and cost-effective human missions to Mars. Hardware on the Lander will be used for a demonstration test of rocket propellant production using gases in the Martian atmosphere. Other equipment will characterize the Martian soil properties and surface radiation environment.

For more details, please visit the Mars Surveyor 2001 mission home page:

http://mars.jpl.nasa.gov/2001/

COSMOS-2: A neck-snapping blast!
by Adam Elliott

For the second year in a row, Your Friendly Contest Director, Adam Elliott, has done it again! Undaunted by marginal weather, eleven enthused elevation and endurance fanatics showed up to test the mettle. This year was highlighted by the first appearance of an altitude event with Set Altitude of 110 meters. The good thing is, nobody blasted way above that, saving us from whiplash.

The UNOFFICIAL results are presented for your enjoyment below.

1/2A Helicopter Duration

Name	Score(sec)	Points
Tom Pastrick	89	190
Bob Kaplow	59	114
Steve Piette	46	76
Norm Dziedzic	37	38
Bill Theil	34	19
Adam Elliott	26	19
Cal Jestice	0	0
Ron Kamiski	0	0

1/4A SuperRoc Duration

Name	Score	Points
Bob Kaplow	1900	130
Bill Theil	1260	78
Tom Pastrick	1215	52
Adam Elliott	1150	26
Steve Piette	700	13
Norm Dziedzic	518	13
Cal Jestice	432	13
Jonathan Charbonneau	300	13

Set Altitude – 110m

Name	Score (%)	Points
Bill Theil	4.5	80
Adam Elliott	10.0	48
Cal Jestice	32.3	32
Tom Pastrick	47.3	16
Jonathan Charbonneau	49.1	8

So there you have it. And I would like to extend a very big **thank you** to Tom Pastrick, Bill Theil, and Ron Kamiski for sticking around and running the trackers! Also thanks to Norm Dziedzic for lending all that nice equipment. You can be sure I'll be calling you when we do this again at CHAOS-2 in October!

Adam Elliott, Ron Kamiski, and Bill Thiel at COSMOS-2 (John Barrett photo)

Build a Tube Finned Rocket (Just for the fun of it)
by Rick Kramer

You've seen them at all the club launches, you've seen the kits in the hobby shops, and you wonder, "What's the big deal with tube fins?" First of all, these rockets are easy to design and build. Second, they rarely have stability problems unless you go out of your way to make them tail heavy. They don't weathercock as much as a standard rocket on windy days. And last but not least, they are very forgiving if your ejection charge does not completely deploy your recovery device. In fact when this occurs, a tube finned rocket will usually glide to a safe landing.

Well, let's get started. Do you want to build a kit, or design your own? Custom Rocketry markets two tube finned rockets, the "Razor" and the "Serval." Quest Rocketry has one called "Totally Tubular." All of these kits are simple to build and they fly well.

"How do I design my own?" you ask. First you need a little geometry lesson. Select a body tube diameter; for example a BT-60. Six BT-60 tube fins will exactly encircle your main BT-60 body tube. As a matter of fact, as long as the body tube diameter and the tube fin diameters are equal, no matter what size (BT-5, BT-20, BT-50, BT-55, BT-56, BT-60), exactly six tube fins will fit around your body tube. How long should the main body tube be to ensure stability. This is answered in NIRA Reprint Series booklet "Lawrence Bercini Collection of Rocket Plans Volume 10." The article by Robert Alway states that you can take any standard Estes body tube 18 inches long. (The diameter doesn't matter.) You cut this tube in half. You use one of the 9-inch pieces as your main body tube. You cut the other 9-inch section into six 1 1/2-inch long tube fins. Add a plastic nose cone, a motor mount and a recovery device and you have a tube finned rocket for the next model of the month contest. From previous knowledge of normally finned rockets, when you lengthen the body tube and leave the fins the same you put more distance between the center of gravity and the center of pressure which increases stability. So let's keep our 18 inch piece of BT-Whatever as the main body tube. How long should the six tube fins be? Obviously, 1 1/2 inches will still provide a stable model, but it doesn't look quite right. Since you have already doubled the length of the body tube from our first model, go ahead and double the fin length dimension to 3 inches. You will find that this model is also stable and flies well too. I have gone so far as to use a 36-inch length of BT-60 (two 18-inch sections and a tube coupler) and used 3-inch long tube fins. This rocket flies beautifully on D-12-3 motors and recovers with a Top Flight 6" X 60" nylon streamer.

For a bigger tube finned rocket, try a BT-80 size. Estes changed the rules for the BT-80 body tubes. These are only 14 inches long and come two in a package, which leads to the best way to build a BT-80 tube finned rocket. Buy two tubes and use one tube as the body and cut the other tube into six equal parts for the fins. I like using the metric system to measure and mark BT-80 tubes. They are 36 centimeters full length and thus each tube fin is 6 centimeters long. Put a "D" motor mount in this one folks and you have a great performing model that is well suited to the Greene Valley flying field.

I have also built tube finned rockets using mailing tubes, LOC Precision 3 inch and 4 inch diameter tubing, which fly on "F" and "G" power. With these models I used the same rationale as I did with the BT-80 example. I bought two long tubes and divided the second one into six equal parts for the fins. These models are very stable and turn in terrific flights. E pluribus Tubes, Enjoy!

Central Illinois Aerospace presents GARLO 1999

The Great Annual Rocket Launch Of 1999

What: A purely-for-fun rocket launch. NAR Safety Code approved rockets only. We will be awarding ribbons for winners of 5 fun (for fun) events, Sci-Fi/Fantasy design (these must fly successfully), paper airplane boost glider duration (see below), Best of Show (Static), Best of Show (Flying), and Spot Landing (controlled and uncontrolled). We also have a large number of "Prang" ribbons as consolation prizes. A potluck dinner and cookout following the launch.

Where: Dodds Park near Parkland Jr. College in Champaign, IL (about a mile southeast of the junction of I-57 and I-74). Picnic location to be determined.

When: Launch from 10:00 a.m. to 4:00 p.m. on Saturday July 3, 1999.

Waiver: FAA waiver to 4000' MSL (~3250' AGL), H motor limit (320 newton-sec).

Paper Airplane boost glider duration: Each person wishing to participate will be issued an official GARLO 99 souvenir paper airplane kit (a numbered 8.5x11 sheet of paper). This can be folded in any manner and flown on any rocket with any engine. The plane can be boosted inside the booster rocket or as a parasite glider on the side. Paper clips will be supplied as nose weights and hooks. Each person will be allowed two flights with the best time being used for the competition. The glider must be recovered for the flight to count.

For further information contact Alan Carroll (amc@cisco.com) at 217-359-3221, or Jonathan Sivier (j-sivier@uiuc.edu) at 217 359-8225 or Greg Smith (gd-smith@uiuc.edu) at 217-352-9655.

First Club Launch of 1999

April 18th was the first launch of the too short NIRA flying season. It started out wet and rainy, but the weather improved through out the day.

COSMOS-2, the first contest for NIRA this year, was flown as part of the launch. See Adam's article at right.

The rain was actually good for one thing, however. As reported earlier in this issue, a photographer for the *Chicago Tribune* found us standing in the rain. He passed the story to a reporter who talked at length with several NIRA members.

Bob Kaplow, Rick Gaff and Jonathan Charbonneau arriving at the launch. (John Barrett photo)

Sometimes, prepping a rocket is a task for the entire family (Rick Gaff photo)

Jonathan Charbonneau finishes preping his rocket at the pad. (John Barrett photo)

Rick Gaff taking a turn (a **very** long turn) as LCO. Thanks Ric! (John Barrett photo)

Martin Schrader prepares a flight card prior to a successful(?) flight. (John Barrett photo)

Prepping a Phantom 4000 while the next generation watches and learns. (Rick Gaff photo)

PML debuts the Quantum Tube

We are excited to announce two important items…

A totally new airframe product, and reduced retail pricing on existing phenolic airframes.

After large investments of time & capital, plus months of extensive testing, we are proud to deliver a totally new airframe tube for the rocket industry. Public Missiles Ltd. will introduce the new *Quantum Tube* on May 12, 1999**.** These new tubes are made in the USA from a special blended polymer that is extremely durable and easy to use. You will find this new material easy to work with and very forgiving, even during those "less than perfect" flights. Most epoxies and paints will readily adhere to this material. The *Quantum Tube* has been tested and found compatible with the following paints: lacquer, enamel, epoxy and urethane, as well as many different primers. The *Quantum Tube* can be squeezed, dropped, or even thrown and will not suffer any damage as can sometimes occur to cardboard or phenolic tube. The *Quantum Tubes* are molded in medium gray and have a glass smooth finish. The *Quantum Tube* does have one thing missing: the spiral groove!!! You will appreciate the fact that you no longer have to fill and sand the airframes to achieve the perfect finish.

We will initially introduce the *Quantum Tube* in 2.15 ID and 2.56 ID diameters, at $9.50 and $10.95 respectively per 36" section. These tubes will be phased into all of our kits of those diameters. Shortly after this introduction we will release Public Missiles Ltd. *Quantum Tube* in the 3.002 ID and 3.90 ID diameters. The 3- and 4-inch kits will then be upgraded with the *Quantum Tube* as well. The *Quantum Tube* can be purchased separately and will be priced lower than what the current phenolic retails at. *All Quantum Tube* part numbers will be prefaced with the letters QT, such as "QT-2.152".

Our premium phenolic tubes will still be available in all popular sizes. Motor tubes and other internal components will remain phenolic as they always have been. All phenolic airframes through PT-7.512 will be reduced in price as much as 19% (depending on the diameter). Phenolic tubing pricing, effective May 17, 1999 is as follows:

PT-1.145, $6.95
PT-1.525, $7.95
PT-2.152, $9.50
PT-2.560, $9.95
PT-3.002, $11.50
PT-3.900, $12.95
PT-6.007, $29.95
PT-7.512, $34.95

If you have any questions about the *Quantum Tube* or the rest of our product line, you can contact PML at **1-810-468-1748**, 9-5 pm EST, Monday-Friday.

Microcosm's Scorpius SR-S
by Jeff Pleimling (NAR 63951)

First Flight

On January 27th, 1999, the Scorpius SR-S flew for the first time at White Sands Missile Range in New Mexico. Due to the winds aloft and the removal of the vehicle destruct system for the test, it was launched 20 degrees from vertical and was loaded with only enough propellant to fly to 20,000 feet and 6 miles down range.

This historic flight ended when the SR-S returned to earth – at a considerable velocity. When the recovery crew found the rocket, the tail fins were level with the ground and the top was found only 2.5 ft down. This shortened souvenir is now at Microcosm's headquarters in California.

This was the second attempt to launch a SR-S. The first attempt, on September 16th, 1998, was unsuccessful due to a problem that prevented liquid oxygen (LOX) from flowing to the engine. Kerosene did flow briefly, however, and caused damage to the lower portion of the vehicle when it ignited.

Background

The SR-S (Suborbital Rocket – Small) is part of the Scorpius family of rockets being developed by Microcosm, Inc. with internal funds and with funding from the Air Force, NASA and the Ballistic Missile Defense Organization (BMDO). The objective of the Scorpius development program is to reduce launch costs by a factor of 5 to 10.

As the first member of the Scorpius family to fly, the SR-S exists mainly to validate the various elements of the Scorpius low-cost launch technology with a real launch. The most important element of this technology is its very low-cost rocket engine. Microcosm has built and test fired more than 25 of their 5,000 lb thrust engines at an average manufacturing cost of about $5,000 per engine (about $1/lb of thrust). They have also built 20,000 and 40,000 lb thrust engines based on the same technology, and an 80,000 lb thrust engine is already in development.

Launch of Microcosm's Scorpius SR-S on January 27th 1999 (Microcosm photo)

One of the ways Microcosm is lowering the price per engine is to reduce their complexity. The engine is made up of less then 40 parts, many times fewer then the average commercial liquid rocket engine, and takes less then 40 man-hours to build from raw materials. The engines are made of composite material and are ablatively cooled, making them very simple in design and operation.

Another major expense in most launch vehicles is the avionics. Microcosm is using a commercial off-the-shelf navigation unit developed for other purposes by Rockwell. Southwest Research Institute of San Antonio, Texas designed the flight computer and pod electronics box specifically for the Scorpius program. Flight units of both the computer and pod electronics have been delivered and cost less than $4,000 each.

Whats Next

The next step in the Scorpius program will be the continued development and testing of low-cost Scorpius components and the launch of the substantially larger SR-1 – a single-stage, 3-engine suborbital rocket, hopefully in the fall of 1999.

After the SR-1, Microcosm has plans on scaling the Scorpius technology to orbital vehicles, including the SR-3 Micro Lift (170 lbs to Low Earth Orbit), Sprite Mini Lift (330 lbs to LEO), Liberty Light Lift (2,200 lbs to LEO), and Exodus Medium Lift (15,000 lbs to LEO).

At this point, Microcosm seems to have the technology well in hand. Their major hurdle, like that of most small space firms, is funding.

The SR-S and its transport cradle being moved by a standard fork lift during roll out tests. (Microcosm photo)

Finding More Information

Microcosm has put quite a bit of information about the entire Scorpius program on their web site (http://www.smad.com), including plenty of photos of the SR-S, Quicktime videos of the launch and engine test, and conference papers from various presentations.

One of the interesting tidbits is in the paper 'Application Of Scorpius Low Cost Launch Services to Mini-Lift Market' by Dr. Roger Conger (the Scorpius Program Manager). This paper details the proposed Sprite Mini-Lift vehicle. Included is enough scale information to make a very nice Future/Science Fiction competition model.

The rest of their web site is interesting because it contains links to other facets of Microcosm, including their book store, journal (*Journal of Reducing Space Mission Cost*), space systems division, and software division! For being a small company, they have many interests!

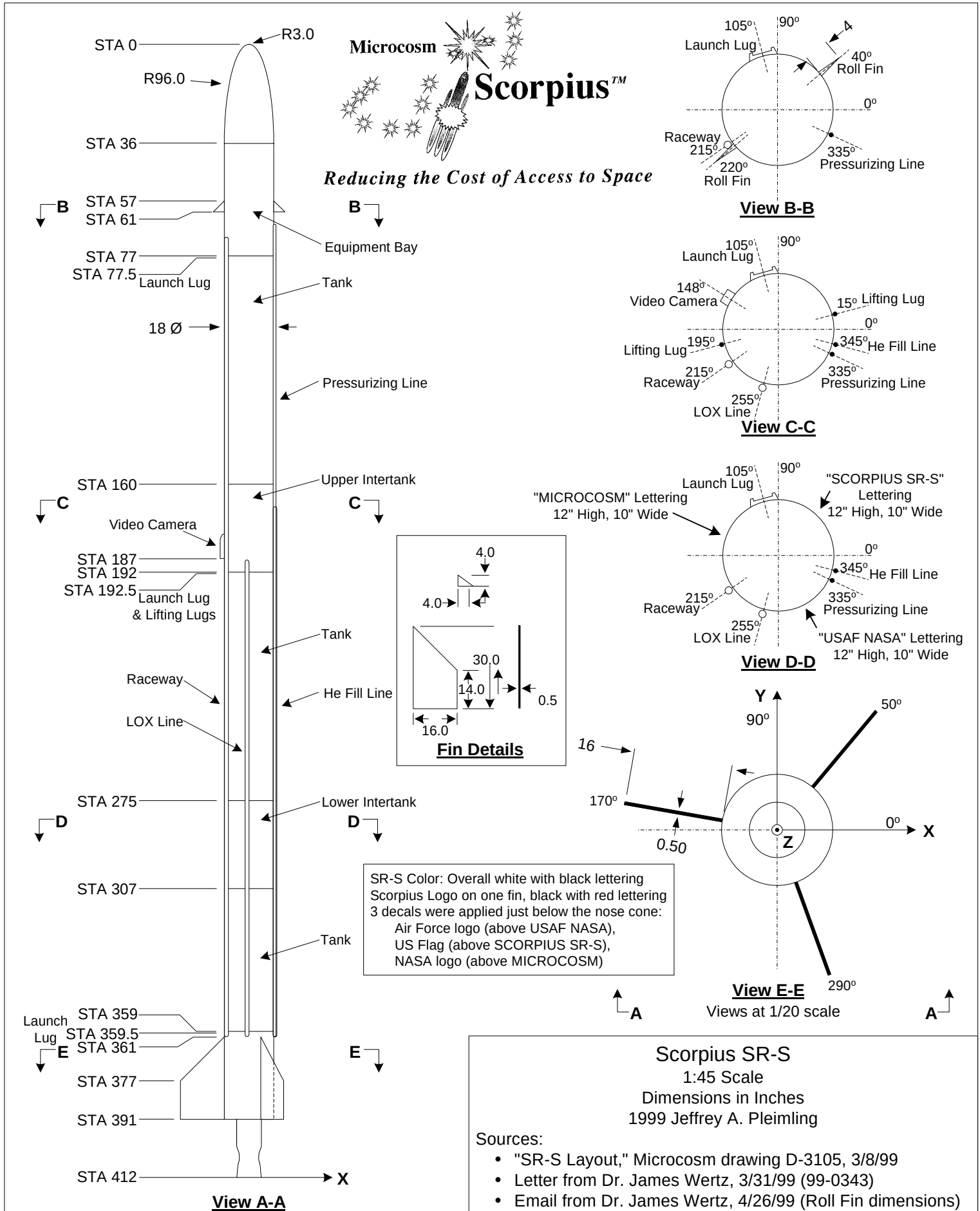
Scale Data

Although I've tries to accurately summarize the SR-S scale data into a single page (at right), I am willing to send copies of the original data Microcosm enthusiastically provided to me. This included drawing of the launch tower for the Space Systems enthusiasts. My contact information is on page 2 in the masthead.

In our email conversions, Dr. Wertz (President of Microcosm) seemed interested that people would want to build scale models of Scorpius rockets. As part of this, he expressed interest in receiving photos of completed models. If you build an SR-S, you can send a photo to:

Dr. James Wertz, President
Microcosm, Inc.
2377 Crenshaw Blvd, Suite 350
Torrance, CA 90501

Raising the SR-S to attach it to the launch rail during roll out tests. (Microcosm photo)



Scorpius SR-S

1:45 Scale

Dimensions in Inches

1999 Jeffrey A. Pleimling

Sources:

- "SR-S Layout," Microcosm drawing D-3105, 3/8/99
- Letter from Dr. James Wertz, 3/31/99 (99-0343)
- Email from Dr. James Wertz, 4/26/99 (Roll Fin dimensions)
- Images at www.smad.com (Microcosm's web site)

Space Launch Report for March/April 1999
by Tim Johnson

There were four space launches worldwide in March and ten in April – a month Lockheed Martin would like to forget. Two of the company's Titan 4s failed, making three consecutive failures for the U.S. Air Force launcher. One Lockheed Martin Athena 2 also failed. Offsetting these failures were successful inaugural flights by Sea Launch Zenit 3SL and Kosmotras Dnepr.

Two Titan Failures

Titan 4, the world's most powerful unmanned booster, returned with two launches in April, but both stranded satellites far short of the planned 22,300-mile geosynchronous earth orbits (GEO). Four of 27 Titan 4s have now failed, including the last three at a cost exceeding $3 billion.

Titan 402B-27 launched on April 9 from Cape Canaveral, but an Inertial Upper Stage (IUS) failure stranded the $432 million rocket's $250 million Defense Support Program (DSP-19) early warning satellite in a useless elliptical orbit. It was the first Titan launched since Titan 401A-20 exploded 42 seconds into its August 12, 1998 flight; a $1 billion failure.

This time, the failure occurred 6.5 hours after liftoff, when the Boeing IUS SRM-2 upper stage was to provide a 110 second-long apogee kick burn to put 5,200-pound DSP-19 into GEO. Instead, the burn left DSP-19 tumbling in a useless transfer orbit. Investigation focused on the IUS/SRM-2 extendable nozzle and on this flight's first use of re-engineered IUS avionics. It was the second IUS failure in 20 missions. A 21st was destroyed on the ill-fated 1986 Challenger flight.

Titan 402B-27 was the last Titan launch from Space Launch Complex (SLC) 41. The pad, host to 27 Titans in 34 years, will now be stripped and rebuilt to support Atlas 5.

$433 million Titan 401B-32 lifted off from the Cape's SLC 40 on April 30, but its Centaur upper stage, TC-14, apparently failed, stranding the $800 million, 10,000 pound Milstar 2 F-1 comsat in a useless 460 x 3,100-mile orbit. TC-14 was supposed to fire three times over a 6.5-hour period to reach parking, geosynchronous transfer (GTO), and geosynchronous orbits, respectively. The parking orbit was wrong after TC-14's first burn. TC-14 then fired two more times before Milstar auto-deployed only 2.5 hours after liftoff.

Athena 2/IKONOS 1 Failure

A Lockheed Martin Athena 2 carrying Space Imaging's Ikonos-1 lifted off from Vandenberg Air Force Base SLC-6 on April 27, flew smoothly downrange, disappeared over the horizon during its fourth stage burn, and was never heard from again.

Subsequent review showed that Athena's 7.7 foot-diameter, 1,400 pound payload fairing failed to separate 4.5 minutes after launch. With the extra weight, the hydrazine-fueled Orbit Adjust Module (OAM) fourth stage could not achieve orbital velocity. OAM/ Ikonos-1 reentered over the South Pacific. It was the second Athena failure in five flights.

Ikonos-1 would have been the first commercial one-meter resolution Earth imaging satellite. Lockheed Martin Sunnyvale built the 1,600-pound LM-900 satellite for Denver-based Space Imaging, a company formed in 1994 by Martin and Raytheon.

Athena 2 Liftoff (Lockheed Martin Photo)

Sea Launch Inaugural

International Venture Sea Launch conducted its first test flight on March 28. The first Zenit 3SL lifted off from launch platform "Odyssey" with DemoSat, a 4,500 kilogram Hughes HS-702 mockup, from an equatorial launch site near 154 degrees West, about 1,400 miles south of Hawaii. Sea Launch is a joint venture of Boeing; Kvaerner Maritime of Oslo, Norway; RSC-Energia of Russia; and KB Yuzhnoye/PO Yuzhmash of Ukraine.

Self-propelled Odyssey, a 436 foot-long converted North Sea oil platform, and control ship "Sea Launch Commander" journeyed for almost two weeks from Long Beach. At the equator, Odyssey was partially submerged for stability. The Russian-Ukrainian-American-Norwegian crew then erected Zenit and transferred to Sea Launch Commander.

Zenit 3SL is Saturn 1 class, weighing 1.012 million pounds at liftoff. Its four-chamber Energomash RD-171 main engine provides 1.632 million pounds of thrust for 146 seconds. Its RD-120 second stage produces 206,900 pounds thrust for 400 seconds. Zenit's Energia Block DM-SL third stage provided 17,600 pounds thrust for 4.5 minutes to reach a parking orbit. A second, six-minute burn 47.5 minutes after launch put DemoSat into GTO.

1st Launch for SeaLaunch (Boeing photo)

First Dnepr

The first Dnepr, a space launcher named for Europe's third longest river, orbited British-built UoSat-12 from Baikonur Cosmodrome, Kazakstan on April 21. Kosmotras, a Russian-Ukrainian joint venture, plans to convert 150 R-36M2 (SS-18) ICBMs for use as Dneprs, which are actually bigger Tsyklons. During the 1970s, Western analysts code-named the feared R-36M "Satan". The USSR deployed as many as 308 of them. START 2 calls for all to be deactivated by 2003.

Compressed gas blasted Dnepr from its LC 108 missile silo. The 201,000 kilogram, 34 meter tall missile rose 40 meters before it's three, fixed dual-chamber RD-251M engines and four small steering chambers started, creating 300,000 kilograms-force (kgf) thrust. After 121 seconds, the second stage fixed dual-chamber RD-252M engine, augmented by four steering engines, took over, providing 115,000 kgf thrust for 145 seconds. A small R-36M2 ICBM maneuvering bus third stage orbited the payload. All stages burned UDMH/N2O4. The 350-kilogram earth observation satellite, built by Surrey Satellite Technology Ltd. (SSTL), reached low earth orbit 15 minutes after liftoff.

WIRE Failure

The 26th Orbital Sciences Pegasus successfully orbited NASA's Wide-Field Infrared Explorer (WIRE) on March 5, but the 561-pound spacecraft promptly failed. Pegasus XL was drop launched from L-1011 "Stargazer" off the central California coast. WIRE was to perform a four-month deep sky survey with a 12.5-inch Cassegrain infrared telescope, cooled to -425 degrees Fahrenheit by a hydrogen ice cryostat. Unfortunately, the telescope cover ejected early. WIRE overheated and the ice sublimated and vented, spinning the spacecraft. The science mission was lost, but controllers later stabilized WIRE for engineering tests.

Other Launches

The second and third Starsem Soyuz-U/Ikar launches orbited eight more Globalstar cellular telephone satellites on March 15 and April 15. Both took place from Baikonur LC 1. Globalstar now has 20 of its planned 52-satellites in low earth orbit.

The tenth ILS Proton, a Proton-K/DM3, put AsiaSat 3S into high-perigee GTO on March 21 from LC 81L, Baikonur, using a two-burn Block DM3 mission profile. The satellite replaces identical AsiaSat 3, which was stranded in a useless orbit by a 1997 Proton Block DM3 failure.

A Russian Soyuz-U launched Progress M-41 with 2,438 kilograms of supplies for Mir on April 2 from LC 1, Baikonur. Progress automatically docked with Mir two days later.

Ariane V117 (L486), an Ariane 42P with two solid strap-on motors, launched Insat-2E into GTO on April 2 from ELA-2, Kourou, French Guiana. The 2,550-kilogram satellite will provide telcom and meteorology services for India.

Ariane V117 on the pad
(Arianespace photo)

AC-154, an ILS/Lockheed Martin Atlas 2AS, put 3,183 kilogram Eutelsat W-3 into a supersynchronous transfer orbit on April 12 from Cape Canaveral SLC 36A. AC-154 was the 120th Atlas Centaur and the 554th Atlas.

Delta 268, a 2.5 stage 7920-10C model, orbited NASA's $650 million Landsat 7 multispectral imaging satellite on April 15 from Vandenberg SLC 2 West. The 4,342-pound Lockheed-Martin built satellite entered a sun synchronous low earth orbit. Landsat 7 replaces Landsat 6, lost in a 1993 Titan 23G failure.

A Cosmos International/Polyot Kosmos-3M (11K65M) two-stage rocket put Germany's 470 kilogram ABRIXAS X-ray telescope into low earth orbit on April 28. It was the first launch from Kapustin Yar LC107 since 1988.

The second Boeing Delta 3 suffered three scrubs and one abort during April. The April 22 abort occurred when ground software failed to initiate the proper engine start command at T-3 seconds.

Lockheed-Martin erected its first Atlas 3A (AC-201), equipped with a twin-chamber RD-180 Russian rocket engine, at Cape Canaveral SLC 36B on March 9. The vehicle's single-engine Centaur second stage was lifted into place on March 19. AC-201 is to launch Telstar 7 in mid-June.

Confused Stages 9

By Jonathan Charbonneau

In the previous stage, I mentioned how to do clusters. A cluster rocket makes a great payloader. If you didn't build or fly any clusters don't worry. It's not necessary to build or fly a cluster rocket to learn about payloads, which are the subject of this stage of the series.

A payload is something that is carried onboard a rocket. There are many kinds of payloads and they are divided into phyla and classes. The two phyla are fixed and free.

The classes under the phylum of fixed payloads include: passive, eg. competition payload; biological, eg. mouse (definite no-no); optical, eg. AstroCam 110; electronic, eg. altimeter; special, eg. raw egg.

The term "fixed" doesn't mean "repaired". It means that the payload stays with the rocket for the whole flight. Sometimes the payload section descends on a separate parachute, but the payload itself stays in the payload section.

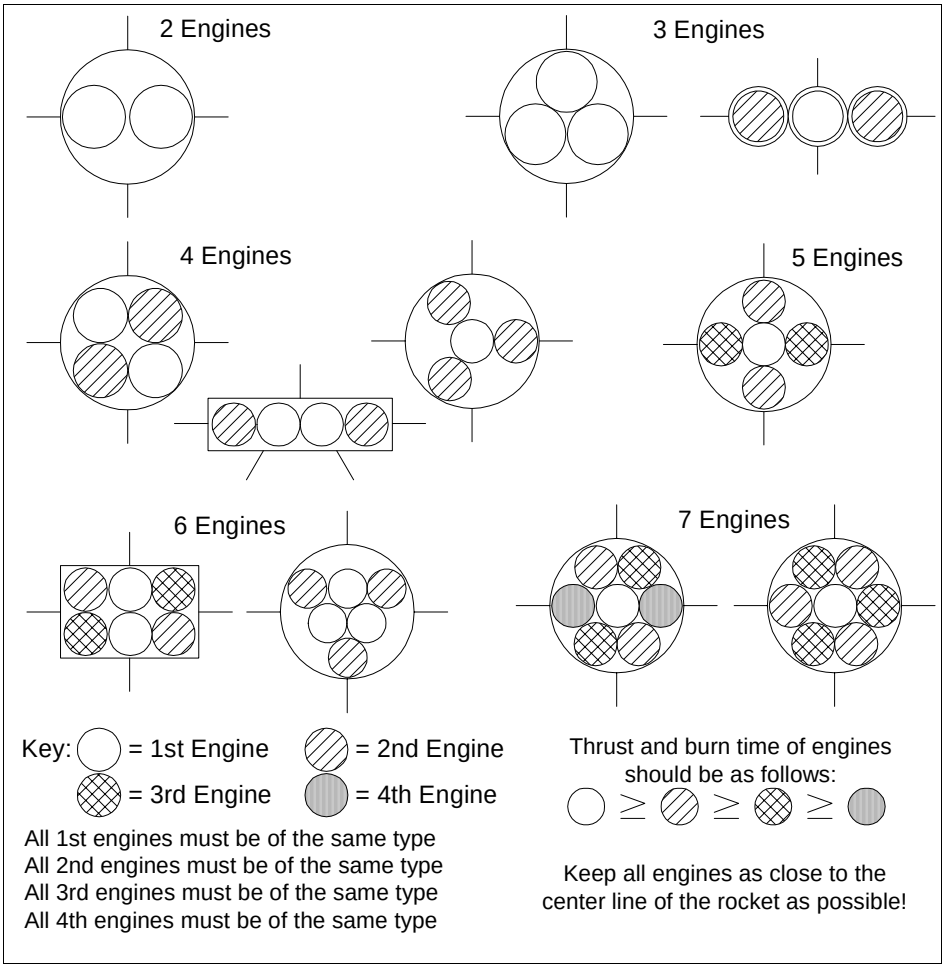
Payloads under the phylum "free" include ping-pong balls, gliders, paratroopers/sky divers, shuttlecocks (birdies), and whirly birds. The term "free" doesn't mean the payload costs nothing. It means the payload is to be released from the rocket to fly on its own for the rest of the flight.

Free payloads are a lot of fun to fly, **as long as it is done safely**. They should be equipped with recovery devices as appropriate so they pose no hazard to persons on the ground.

Most important of all in regard to payloads:

Never fly any live animals. The NAR explicitly prohibits this.

Never, never, never fly anything that is explosive, flammable, or in any way harmful. This includes fireworks. It may seem harmless and innocent to put fireworks onboard a rocket and have them go off in mid-air. But, it is **extremely dangerous**. I, myself, once thought of doing this with ground display fireworks to sidestep the law. I have since abandoned this idea without ever having tried it, because I learned from G.H. Stine's "Handbook of Model Rocketry" about the hidden but very real danger of dormant fuses. A dormant fuse can spring back to life at any time later. Even hours later. It is therefore impossible to guarantee that the fireworks will go off before they hit the ground.



Cluster Configurations and Balance of Thrust (for Confused Stages 8, Jan/Feb 1999)

At the Edge of Space: The X-15 Flight Program by Milton O. Thompson

A Book Review by Bob Wiersbe (NAR 44588)

"At the Edge of Space" chronicles the men, machines, and missions of the X-15 program, as told by one of the twelve men who flew the world's fastest airplane. It is an inside look at the X-15 program itself, the problems encountered, the dangers, the triumphs and the tragedies.

You may have heard of two of the X-15 pilots, Neil Armstrong and Joe Engle. Armstrong walked on the moon and Joe Engle became a shuttle pilot. The other X-15 pilots were Scott Crossfield, Joe Walker, Bob White, Jack McKay, Bob Rushworth, Pete Knight, Bill Dana, Mike Adams, and the author of the book, Milton Thompson.

At the Edge of Space: The X-15 Flight Program
By Milton O. Thompson,
Foreword by Neil Armstrong
Format: Hardcover, 375pp.
ISBN: 1560981075
Publisher: Smithsonian Institution Press
Publication Date: April 1992

Only three X-15 aircraft were built. One blew up during ground tests with Scott Crossfield onboard, he survived without injury and the plane was rebuilt. Another X-15 suffered severe damage on a rough landing, which also injured the pilot Jack McKay. It too was rebuilt and flown again, proving how rugged the X-15 was.

The three X-15s made a total of 199 free flights from June of 1959 to October of 1968. The original purpose of the X-15 was to study hypersonic flight (speeds above Mach 5.0) and study the upper fringes of the atmosphere. As the program matured, many scientific payloads were flown and new materials tested for the space program. The X-15 was used to test many of the ablative materials used in the Apollo program. It was the perfect vehicle to allow scientists to obtain real data on experiments that couldn't be done anywhere else.

A typical X-15 flight would last a little over 8 minutes from drop to landing. During that time it would cover over 300 miles, soar to altitudes over 230,000 feet, and glide at over 2000 mph before slowing down and landing. The X-15 could glide unpowered up to 400 miles after a successful motor burn, but none of the flights ever needed to go this distance for a safe recovery.

Edwards Air Force Base was the center of operations for the X-15 program, and was the primary landing site for X-15 flights. Many flights, however, did have to make emergency landings at secondary landing sites, which were nothing more than dry lake beds 3-4 miles long. The pilot typically had only a few seconds to decide which lake he was going to have to land at, based on altitude and airspeed.

Milton tells many tales of what went on behind the scenes during the X-15 program, as well as giving good technical information about the machine and some of the problems encountered. One of my favorite stories was about a close encounter between an X-15 and a camper. On one of the flights the X-15 had to make a landing at one of the emergency lakebeds, and the only way to get it back to Edwards was to put it on a flatbed truck and drive it on the highway. The X-15 only has a 25 foot wingspan, and the roads out in the desert were usually deserted, so this wasn't a problem. On this particular trip they saw a camping vehicle coming at them at a high rate of speed and tried to warn them to slow down by flashing their lights. The camper passed them at about 70 mph, and they felt a jolt. The steel wing of the X-15 had hit the camper about a foot from the top and sliced it open from front to back. The X-15 wasn't damaged at all.

The first X-15 built now hangs in the National Air and Space Museum at the Smithsonian Institute in Washington, D.C. The number two aircraft can be seen in the U.S. Air Force Museum at Wright-Patterson Air Force Base in Dayton, OH. The number three aircraft was destroyed during Flight 191 when it went into a spin while traveling at over Mach 5 at an altitude of 230,000 feet. It broke apart due to high g forces and stress. The pilot, Mike Adams, was killed. He was the only X-15 pilot to die during the program.

Thompson's book is well worth reading, and is the only one of its kind on the X-15 Program from the pilots point of view.

Moon rock to be displayed at Tribune Tower in July

Chicago Tribune News Release
May 10, 1999

CHICAGO – The National Aeronautics and Space Administration (NASA) has awarded Tribune Publishing Company and the Chicago Tribune the long-term loan of a moon rock for public display at Tribune Tower in downtown Chicago.

"We're pleased and honored to be the first private entity entrusted with a lunar sample," said Jack Fuller, president of Tribune Publishing Company. "We know that access to these priceless samples has been limited in the past to government agencies, schools, museums and planetariums."

The fist-size sample will be the centerpiece of an exhibit on the history of the Apollo space program and the geological nature of the moon. The exhibit will be mounted in a secure display case on North Michigan Avenue adjacent to the main entrance to Tribune Tower.

The exhibit will be dedicated on Wednesday, July 21 at a ceremony in Pioneer Court, immediately south of Tribune Tower. The ceremony will commemorate the 30th anniversary of the landing on the moon by Apollo 11 astronauts Neil Armstrong and Buzz Aldrin.

Aldrin, 69, will be the featured speaker at the July 21 dedication. Retired from the Air Force in 1972, he lives today in Southern California, where he promotes space tourism through the not-for-profit ShareSpace Foundation. He lectures widely, recalling his time on the moon and advocating public support for manned space exploration.

The Tribune's moon-rock exhibit is being developed by Clifford Abrams and Alan Teller of the Chicago-based design firm of Abrams, Teller & Madsen, Inc. Lawrence Grossman, Chairman of the Department of the Geophysical Sciences at the University of Chicago, and Steven Simon, a Senior Research Associate in the department are advising Tribune Publishing Company on the educational content of the exhibit and a companion brochure.

The moon rock joins a collection of fragments from 138 historically significant sites around the world – including Westminster Abbey, Taj Mahal, the Pyramid at Giza and Independence Hall – embedded in the walls of Tribune Tower. Brochures on the building, its history and the fragments are available in the Tribune Tower lobby.

Heard on the Street

(with apologies to the Wall Street Journal)

Welcome to the Club!
Michael Arman, Randall Dust, Greg Padovani, Joe Rush and Jacob Stucki have all joined NIRA in recent months. Welcome to the club!

Newest NIRA Member
Wesley Aaron Dziedzic became the newest NIRA member, he was born Tuesday 5/18/99 at 12:46 PM. Parents Norman and Sonja Dziedzic have yet to announce what his first rocket would be.

Close The Window and Clean Your Room
Navstar spacecraft GPS SVN 50 (GPS-IIR production number SV-10), awaiting launch by Delta nII from Cape Canaveral, was damaged in a thunderstorm on May 8. Rain leaked into the clean-room on SLC-17A's mobile launch tower. Launch will be delayed while they figure out whether the satellite has been damaged.

I Can't Do That, Dave
For the first time ever, an artificial intelligence (AI) program was given primary responsibility for a spacecraft when NASA controllers handed off the Deep Space 1 (DS1) spacecraft Monday, May 17. In a two-day test that started at 2pm EDT (1800 UT), the Remote Agent program on board DS1 will control all aspects of the spacecraft to carry out defined mission goals without input from human controllers on the ground. "While we watch over its shoulder electronically, we are giving Remote Agent the responsibility to monitor Deep Space 1's activities and position in space, including any engine firings it needs to keep on course," said Pandu Nayak, deputy manager of development for Remote Agent. If Remote Agent is a success, it may spur the development of other AI programs that could be used to control future missions, reducing the cost of spacecraft operations considerably since less human intervention on the ground would be needed.

Warner, Disney Race To Mars
Warner Bros. has put its SF movie Mars on the fast track in hopes of getting it into theaters ahead of Disney's similarly themed film 'Mission to Mars.' According to The Hollywood Reporter, Warner is hoping to cast its film-formerly titled 'Alone'-as soon as possible so that shooting can get underway in August.

Meanwhile, 'Mission to Mars' is scheduled to begin filming in July for a release in May or June of 2000. Tim Robbins, Gary Sinise and Don Cheadle have already agreed to star in the film, which is being directed by Brian De Palma.

Anthony Hoffman will be helming Warner's Mars, while Meg Ryan and Joseph Fiennes have been approached to headline the film. Both films involve expeditions to the Red Planet that go awry.

NAR Introduces its Level 3 Certification

The National Association of Rocketry recently announced the addition of Level 3 to its High Power Certification program.

NAR members seeking details of the recently approved Level 3 Certification program should visit the NAR Website (www.nar.org). A complete description of the requirements and procedures are available there.

Anyone who has a current Tripoli Level 3 certification can use that certification to become NAR certified. In addition, the NAR is seeking members who are Tripoli certified to assist with jumpstarting the NAR Level 3 Certification Committee.

WOOSH says to 'Eat Cheese or Fly'

The Wisconsin Organization Of Spacemodeling Hobbyists (WOOSH) announces the 1999 Eat Cheese or Fly (ECOF).

ECOF will be held Saturday July 17th from 9 am to 5 pm at the Bong State Recreation Area in Burlington, Wisconsin.

The launch will cost $5 for Adults (16+), $2 for children, or $10 for the entire family. Bong is a Wisconsin state park so there is an entrance fees also.

There will be a 10,000' waiver, but rockets above a K motor need to be approved prior to the launch by the launch manager.

Al's Hobbies will be on hand to deliver preordered high power motors (in accordance with BATF requirements). They will also have kits and non-regulated motors available for on-site sale.

For more information about ECOF, see the launch web site at:

http://members.tripod.com/deanroth/ecof/

You may also contact Dean Roth, the Launch Manager at (414) 228-0739 or Kurt Schachner, WOOSH President, at (414) 328-5193.

Rick **still** doing LCO duties! (John Barrett photo)

NAR Standards & Testing News

R55: COMPLETE NAR S&T ROCKET MOTOR DATA SHEETS NOW AVAILABLE ONLINE

NAR Standards & Testing is pleased to announce the availability of data sheets for all in-production rocket motors certified by NAR S&T. The NAR website, http://www.nar.org, contains a link to a list of complete list of NAR-certified motors (http://www.nar.org/SandT/NARenglist.shtml).

Each motor on the certified motor list is now a link to a data sheet in Adobe Acrobat Portable Document Format (PDF). The data sheet contains certified and test values for total impulse, time delays, and other measurements, together with a thrust/time curve. These curves may be viewed online, from your web browser via a plugin, or printed at high resolution on your printer.

The free Acrobat reader for Adobe PDF files for a dozen platforms is available at http://www.adobe.com. Hardcopy versions of all data sheets remain available to anyone through the NAR Technical Service (NARTS). A NARTS catalog is also available at the NAR website.

Jim Cook, Secretary for
NAR Standards & Testing
<JimCook@AOL.COM>

Jack Kane, Chairman

R56: NAR S&T NEW MOTOR CERTIFICATIONS

The following motors have been certified by NAR Standards & Testing for general use as model rocket motors on the individually indicated dates. All are certified for contest use effective May 1, 1999.

Quest:
6mm x 16mm:

- Micro Maxx-1 (0.20 Newton-seconds total impulse, 0.4 grams propellant mass, certified 12/25/98)

18mm x 70mm:

- A8-3 (2.5 Newton-seconds total impulse, 3.5 grams propellant mass, certified 8/27/98)
- B4-4 (5.0 Newton-seconds total impulse, 8.3 grams propellant mass, certified 8/27/98)
- C6-0 (9.45 Newton-seconds total impulse, 12.0 grams propellant mass, certified 2/22/99)
- C6-3 (8.45 Newton-seconds total impulse, 12.0 grams propellant mass, certified 8/27/98)

Jim Cook, Secretary for
NAR Standards & Testing
<JimCook@AOL.COM>

Jack Kane, Chairman

This may be your last newsletter! Check your label for the expiration date.
If it says Membership Expired or Membership Expiring, this will be your last newsletter!

THE LEADING EDGE

C/O Jeff Pleiming
245 Superior Circle
Bartlett, IL 60103-2029


TribWest

Real bombshells in DuPage 7 trial yet to surface

Having a blast off

Hinsdale South demotions spur faculty outcry

Old school building given one last hope

CTA riders will enter tokenless era in June

NIRA makes the cover – of the west suburban section – of the *Chicago Tribune* (May 26, 1999)