TRIPOLI GERLACH Research Rocketry News

TRIPOLI PREFECTURE # 138

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TRIPOLI GERLACH Research Rocketry
TRIPOLI PREFECTURE #138

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PUBLISHED EXCLUSIVELY FOR
THE MEMBERS OF TRIPOLI GERLACH
AND ANYONE ELSE INTERESTED

Tripoli Gerlach was founded as a National Prefecture under the Tripoli Rocketry Association, Inc. Devoted to Research Rocketry and the Black Rock Desert area of Nevada, we welcome all qualified Tripoli Members having a Level 2 certification or higher.

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If you have anything to contribute in the way of information, articles, photos or whatever, please send them to Tripoli Gerlach Headquarters. Visit our WebSite on-line at;

WWW.TRIPOLIGERLACH.ORG

ON THE COVER

Tripoli Gerlach member Doug Gerrard's ODYSSEY lifts off with multiple video both on board and on the ground. Read about Doug's adventure in this issue starting on page 7.

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With this issue of *TRIPOLI GERLACH NEWS* we begin our second year as a Prefecture under the Tripoli Rocketry Association, Inc. We also increase our page count to 16 expanding our coverage of stuff we like.

NEW MEMBERS

The new year starts off with new members to Tripoli Gerlach. They are listed here in alphabetical order. More information can be found on our WebSite under CURRENT MEMBERS.

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NEW SAFETY CODE

For 2012 the National Tripoli BOD has released a new RESEARCH ROCKETRY SAFETY CODE which affects Research Launch activities and who can do what and where. Since Tripoli Gerlach conducts only Research Launches and only Tripoli Members are able to participate, the code's new approach to co-mingling does not apply. It will however affect all your local Prefecture activities.

To download a copy of the new 2012 Research Safety Code visit our WebSite.

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WWW.TRIPOLIGERLACH.ORG

2012 ECLIPSE IN GERLACH, NV

By Francis Graham

Tripoli Gerlach Prefecture

At the first meeting of the Gerlach Prefecture, Prefect Thomas Blazanin had the by-laws approved and they contained a commitment of the Prefecture to environmental activities and cultural activities in Gerlach, Nevada. This is especially important since with the closure of the gypsum mine in nearby Empire, Nevada. Empire has become a ghost town and Gerlach risks becoming so also (there are now only 11 children left in the K-12 Gerlach school). The homes in Empire were company owned and the 95 families of the miners had to vacate June 20. It is so bad that Empire had its zip code decomissioned.

But there is some activity coming, besides the Burning Man festival and the Tripoli launches. There will be an annular solar eclipse May 20, 2012 visible from Gerlach and points west along the California-Oregon border, and a few points east as well.

An annular solar eclipse differs from a total solar eclipse in that the Moon will not completely cover the Sun, but instead be at the more distant parts of its orbit and thus be silhouetted against the Sun. It still is very spectacular and will make a great impression photographically at Pyramid Lake and Nixon. Shown is an Annual Eclipse representative of what might be observed. Remember, I said representative.

At Gerlach, latitude N 40o 37' 22", longitude 119o20'29" W, elevation 3129 ft., the following circumstances are calculated: first contact, 5:14 PM, solar altitude 32o, second contact (beginning of annular phase) 6:27 PM, solar altitude 18o, third contact (end of annular phase) 6:31 PM, fourth contact 7:35 PM, solar altitude 6o.

I plan to observe this eclipse, but it depends on income whether I will observe it from Nevada. I probably will. But I am not sure. The eclipse will not be visible from Pittsburgh, not even as a partial eclipse, the Sun being exactly on the horizon setting when the partial eclipse starts in Pittsburgh.

SUBMISSIONS REQUESTED

We are looking for submissions for *TRIPOLI GERLACH NEWS*. The above article from Francis Graham is an interesting example. Our first year in publication has drawn several people as regular readers, although we can't seem to collect them as members - yet.

We have had very good comments on our Black Rock area interest stories as well as our "Let's Visit" series. Get your shop published so others can see were you do your rocket thing. You don't have to have a high tech place. People just want to see how others accomplish their projects; large or small.

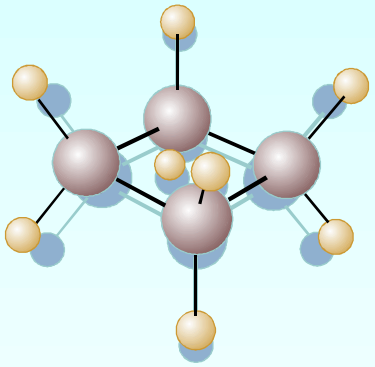
If you have anything of interest you would like to share with fellow Tripoli Gerlach members, and the world for that matter, please submit it, (don't forget the pictures!) to the Editor, who is the Prefect, who is just TOM

Mailto:

shadow@pghmail.com

INTRODUCTION TO PROPELLANTS

All solid propellant contains at least two components -- an oxidizer and a fuel. Chemically speaking, the oxidizer accepts electrons, the fuel supplies them. In double-base propellants, oxidizer and fuel are contained within the same molecule. A common double-base propellant is nitrocellulose (smokeless powder) plasticized with nitroglycerin. There is little amateur experimentation with double-base propellant, for obvious reasons.



Blackpowder (typically 75% potassium nitrate oxidizer, 15% charcoal, 10% sulfur) is still used for small motors, and has some desirable characteristics. It is quite cheap and has a high burn rate suitable for endburning motors. It can be "toned down" for coreburning motors. However, it has a fairly low specific impulse of about 80 seconds (meaning that one pound of the propellant configured to produce one pound of thrust will burn for 80 seconds). Blackpowder motors are made by pressing the ingredients into the paper casing at 1 ton/sq.in., which gives many amateurs pause. And blackpowder is prone to cycling (affected by heat change) and is much more sensitive to spark, and consequent accidental ignition, than some other solid propellants.

Some amateurs work with potassium nitrate-sugar mixtures, sometimes referred to as "candy" propellant. The mixture is usually melted at a low temperature. Candy propellant has higher specific impulse than blackpowder, up to 130-140 seconds. Its burn rate is slower than that of blackpowder, but is still fast enough to be used in coreburning motors. Richard Nakka's site http://members.aol.com/ricnakk/index.html gives a very comprehensive description of this and related propellants.

Composite propellant is made using a rubbery binder-fuel (sometimes just called a binder) and a granular oxidizer. As the name implies, the binder-fuel holds the propellant together and also acts as a fuel. Like epoxy glue, a binder-fuel has two ingredients that, when mixed, harden into a rubbery mass. To prepare the propellant, the resin part of the binder-fuel is mixed with the oxidizer and other solid ingredients. The curative part of the binder-fuel is then added, the mixture is packed, poured or extruded into paper tubes or directly into the motor, and the mixture is then cured (sometimes at elevated temperatures). A core may be formed before curing or drilled/cut after curing. Most rocketeers who experiment with solid propellant, work with composite propellant, as it is fairly simple to make and presents less danger from accidental ignition than does blackpowder. The most commonly-used oxidizer in composite propellant may be Ammonium Perchlorate, NH_4ClO_4, also known as AP (composite propellant is sometimes -- erroneously -- referred to as AP). AP produces the highest practical specific impulse obtained for typical experimental propellant, 140-250 seconds or so. It is relatively simple to use, ignites easily, has a reasonable burn rate, does not require a burn rate catalyst or a thermic agent, and is nonhygroscopic. Many AP compositions burn well only under pressure, and the motor must be designed to take this into account. The burn rate of most AP compositions means that they are best suited to coreburning, rather than endburning, motors.

Ammonium Nitrate (AN) is another oxidizer sometimes used in experimental motors. AN compositions have lower specific impulse than comparable AP compositions. AN propellant is also less dense than AP propellant. A 29mm motor 10" long that uses AP propellant would likely be a full-H impulse motor. With AN propellant it is likely to be a low-H or even high-G motor. AN propellant generally requires higher solids loading, around 80% for proper operation than does AP propellant. Either a burn rate catalyst (speeds the burn rate; ammonium dichromate) or a thermic agent (most commonly magnesium) is required; however, AN propellant still burns more slowly (0.1"/sec) than most AP compositions (0.3"/sec). AN undergoes a phase change that can render a propellant unusable from temperature cycling over time, however, this is not a major concern for propellant that will be properly stored and used within a few days or weeks. AN is very hygroscopic and propellant containing it must be prepared and stored under low-humidity conditions. It is quite cheap and readily available in many US localities, though it may require recrystallization and milling for propellant use. Phase-stabilized AN, already milled to size and suitable for propellant use, is available from CP Technologies.

Other oxidizers are used by the experimental rocketry community, but not as commonly as are AP or AN.

ARROW HEAD HUNTING

with CHUCK DUFFY

L to R Dave Rose, Larry Benek, Craig Brewer, Deb Koloms, Dianne Brewer, Chuck Duffy and Tom Blazanin

Black Rock Trekking in 2011 saw us Arrow Head Hunting with local resident Chuck Duffy. Chuck is the daytime Bartender at Bruno's and a good friend to Tripoli Gerlach. He is also a very active sportsman having bagged a Desert Bighorn in 2007 and a California Bighorn in 2011. His house is a virtual wildlife museum of desert game. It also holds one of the best ever collections of prehistory Indian artifacts that he's collected over the years.

Chuck promised to take us arrowhead hunting and delivered a very interesting expedition for. We started out thinking we were heading to an Indian dig site. In the past we have passed many places where we concluded (probably wrong) might have been old Indian camping area. We were amazed at the site Chuck took us to.

We left Bruno's Tuesday morning and headed north out of Gerlach up Rt447 toward the town of Eagleville, California. A few miles before Duck Flats we turned off the paved highway onto a dirt road we found out to be running through Bruno's cattle property. This was all open hilly flat land. No trees at all, just a few bushes here and there.

We kept looking for outcroppings that we'd usually see along the roadway. These would be ideal places to look as they would offer a source of material to make arrow heads from. Even a lake side would provide a camping area Indians might settle down near. But none of these were in view, just open and flat forever.

After about a half hour driving on a dirt road we came to a stop in the middle of a wide open expanse of nothing. As he hopped out of the car Chuck told us, "We're here".

Chuck passed out several golf clubs with the heads missing. These he told us would save our backs if we used them to turn over things we spotted we thought might be arrowheads. They worked great and DID save our backs.

The area we were at was, as explained, a wide open range. More than likely this was a hunting ground as you could easily envision great herds of buffalo and critters ranging about. It was nothing like any of us expected.

After Chuck demonstrated the art of flipping stones with the headless golf clubs we all set out on our own.

Much of the ground was filled with loose basalt, agate and obsidien. We can't count the number of times we thought we'd found something only to flip it over and see that it was nothing

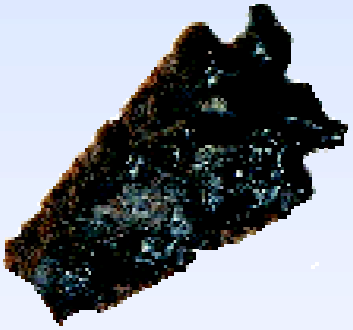
We each head out in different directions following small washes that led down the open "meadow" All sorts of rocks of interest abounded. If was hard to keep the monkey rock syndrome under control..\

DAVE ROSE, "WHAT THE HELL IS THIS?"

Monkey Rocks are those shiny interesting things we come across and just have to put in our pocket to save.

We spent the better part of the day hunting with our golf sticks. To no one's surprise the girls were the only ones to collect arrow heads.

Deb Koloms found a neat little point, as arrow heads are called. The tip was missing but it was still a find.



Dianne Brewer turned out to be the expert. She found two small points, both with broken tips and one really neat 3" piece that was definitely a keeper.

The day in the field past quickly, as it always does when having fun. Chuck revealed to us one of his secret sites and taught us a lot of Black Rock is not all desert and dry lake.

Next year we may check out yet another area Chuck knows of. As he says, "More in line with what we think Indians might have used". Until then we have something to look forward to.

Doug Gerrard's ODYSSEY

DOUG GERRARD

photos by Doug Gerrard, Art Hoag, or James Russell unless noted

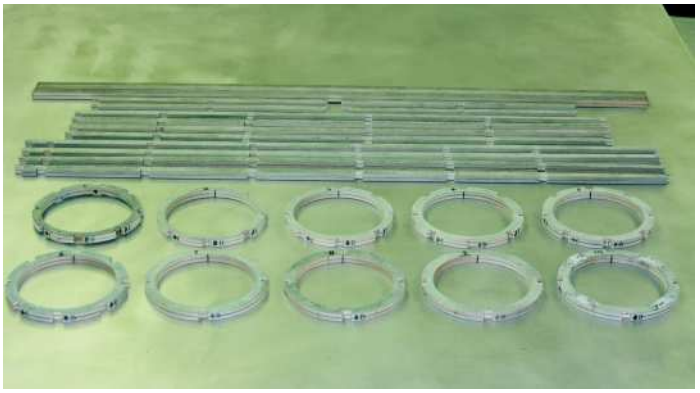
I arrived at work one Monday morning and went to my first meeting after getting a cup of coffee and checking my e-mail for any urgent correspondence. My co-workers and I sit around a large table to discuss any maintenance issues that had occurred over the weekend and before the meeting gets started there is always a variety of small talk that usually precedes meetings like this. The person next to me asks, "How was your weekend?" and I had to think about the question for a minute. It was my first day back to work after flying Odyssey (www.odyssey.us.com) for its second flight.

Doug Gerrard, James Russell and Art Hoag at LDRS

Odyssey had started a few years earlier with the proposal to my good friend Art Hoag about building a rather large project. We had both done numerous level 3 flights but we were looking for a different kind of challenge. We wanted a research project that challenged our abilities but also developed new skills. We wanted to fly my high speed motion picture cameras on a large impressive rocket. Also at this time our friend James Russell had acquired a 6 inch diameter 62 inch long casing for a full size O motor and I had accumulated some 7.5 inch diameter airframe from Hawk Mountain. And so the concept of Odyssey was born.

This project not only presented design and building challenges but also logistical ones as well. Art lives in Colorado and I live 600 miles away in New Mexico. Not an impossible obstacle but it did require travelling to both locations to plan, discuss and build the rocket. Like most large group projects I worked on one aspect and Art on another and we would get together to swap parts as necessary.

Odyssey is a 15 foot tall, 230 pound rocket designed for a 6 inch diameter 5 foot long full O motor. Some of the characteristics of the rocket that made it distinct include its booster construction. The booster has no motor mount tube. The concern for strength was not for the flight but for landing. The casing weighs a lot even empty and the fear was for possible damage when the booster fell over upon landing. So it has ten centering rings and eight vertical interlocking spars for structural support. These pieces were made from two pieces of 12 ply 1/4 inch plywood laminated with three layers of 10.9 ounce carbon fiber and two layers of 8.9 ounce fiberglass. This skeletal system allows for air flow around the motor while adding strength and rigidity to the booster.

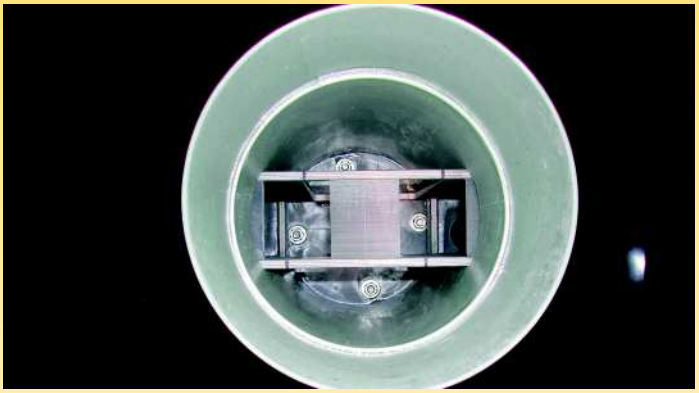


The fins are also made from this same composite material and the leading and trailing edges are tapered at a 10 degree angle using a jig that held the fins for the router table. There is an extra long coupler tube at the top of the booster for anti zipper design and the motor extends up into the coupler tube.

The skeletal structure runs the entire length of the booster and the fins are also interlocked to the structure. Every spar and centering ring was glued in with fillets to the fiberglass tubing. The final touch on the booster was that it was covered with several layers of pre-preg carbon fiber fabric including

tip to tip on the fins, vacuum bagged and cured in an oven. The result was a booster that is unbelievably strong.

The payload bay and electronics bay are not as remarkable but still required careful design and building. The camera mounts in the payload section were designed to be balance and symmetrical because of the forces the rocket would be going through. The entire section of the payload body tube was lined with coupler tubing for added strength needed because of the openings cut into the airframe. Two cameras



are mounted looking down the side of the rocket but without the use of mirrors. The cameras were mounted in a cowling that hangs off the side of the rocket. The cowlings were designed to be built as one "box" consisting of two side plates separated by spacer pieces that are the width of the camera. The payload section body tube has two rectangular openings that are opposite sides to each other. The box is installed by sliding it through the payload section body tube openings and centering it.

After securely gluing the box inside the payload body tube, the "connector" pieces between the two camera mounts are cut away from the box opening up the center of the payload bay. This method was the best way to ensure consistent alignment between the two cowlings on opposite sides of the rocket. The area above the camera cowlings had to be filled

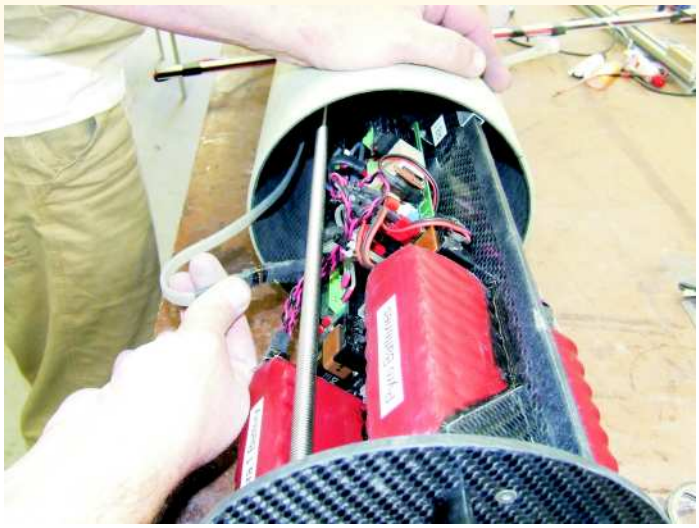
in to make it more aerodynamic so two pieces of hard balsa wood was cut and shaped to fit. They were glued in place and carbon and fiberglass fabric were installed over the entire cowling structure and vacuum bagged.

Since the payload section also acts as the dividing point between the drogue compartment and the main parachute compartment, two 3/8 inch stainless steel all threads run through the center of the payload compartment for recovery attachment points. These all threads are connected to stainless steel u-bolts in the drogue compartment and eye-bolts in the main parachute compartment. Finally the lower portion of the payload section was laid up with pre-preg carbon fiber under vacuum in a oven since we were concerned about the possibility of damage to the body tube upon landing.

The Electronics Bay was built into a piece of coupler tube for the 7.5 inch diameter airframe. Because this section could be especially susceptible to very high stresses in flight, a few layers of pre-preg carbon fiber was held into the coupler under vacuum and cured in an autoclave under very high temperature and pressure. The forward and aft bulkhead plates for the electronics bay were made from a carbon plates made in the autoclave. The forward plate was mounted in the electronics bay and two 3/8 inch stainless steel forge eye-bolts were mounted to this plate. The all thread couplers were used to attach the all threads that run the length of the

payload section. These all threads transmit the forces from the parachute in the recovery section to the booster. Two aluminum channels that ran the length of the inside of the electronics bay were mounted on opposite sides to each other that would act as rails for a carbon electronics plate. The channels were glued in with epoxy and held in place with two flathead screws.

The electronics plate was made from 3/16 inch thick carbon and is used to mount all the electronics for the altimeters as well as the batteries and electronics for the cameras. It is attached to a base that is secured into the electronics bay with the all-threads. The electronics plate and base are removable



from the electronics bay by sliding the unit from the electronics bay on the rails. Felt was used on the plate to fill the loose area between the plate and the rails but still allowed the unit to slide in the channels.

The electronics are mounted with standard hardware by tapping the plate or running screws through the electronics plate but miniature high current connectors are used at the top and bottom of the electronics plate to be able to completely detach the electronics plate from the rest of the

rocket. These connectors are mounted in the top of the electronics plate for the main recovery section and in the electronics base plate for the drogue recovery compartment and the cameras. The wire used to connect the altimeters to the ejection charges is 20 AWG silver plated copper wire with a braded silver plated copper and PTFE jacket.

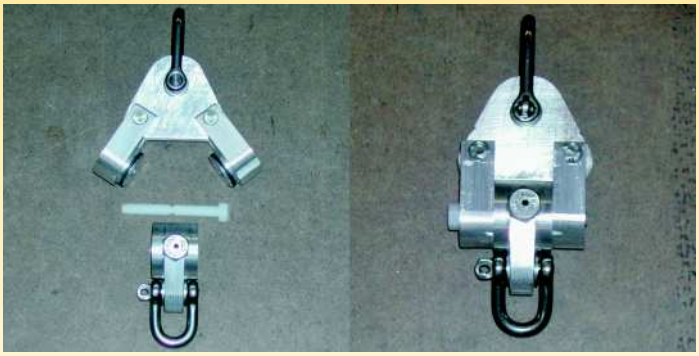
The nose cone required many steps to construct. First, a plug was machined from mdf wood on a CNC machine. The dimensions were programmed in and the machine cut out the two halves of the nose cone plug.

Then several coats of sealer were painted on and it was highly polished to prevent any possible glue from adhering to it.

A two piece mold was made from special fiberglass using the plugs. The actual nose cone was constructed from pre-preg fiberglass using the two piece mold. Like with the mold, for each layer of material laid down, a vacuum was drawn to eliminate any gap between the layers of material.

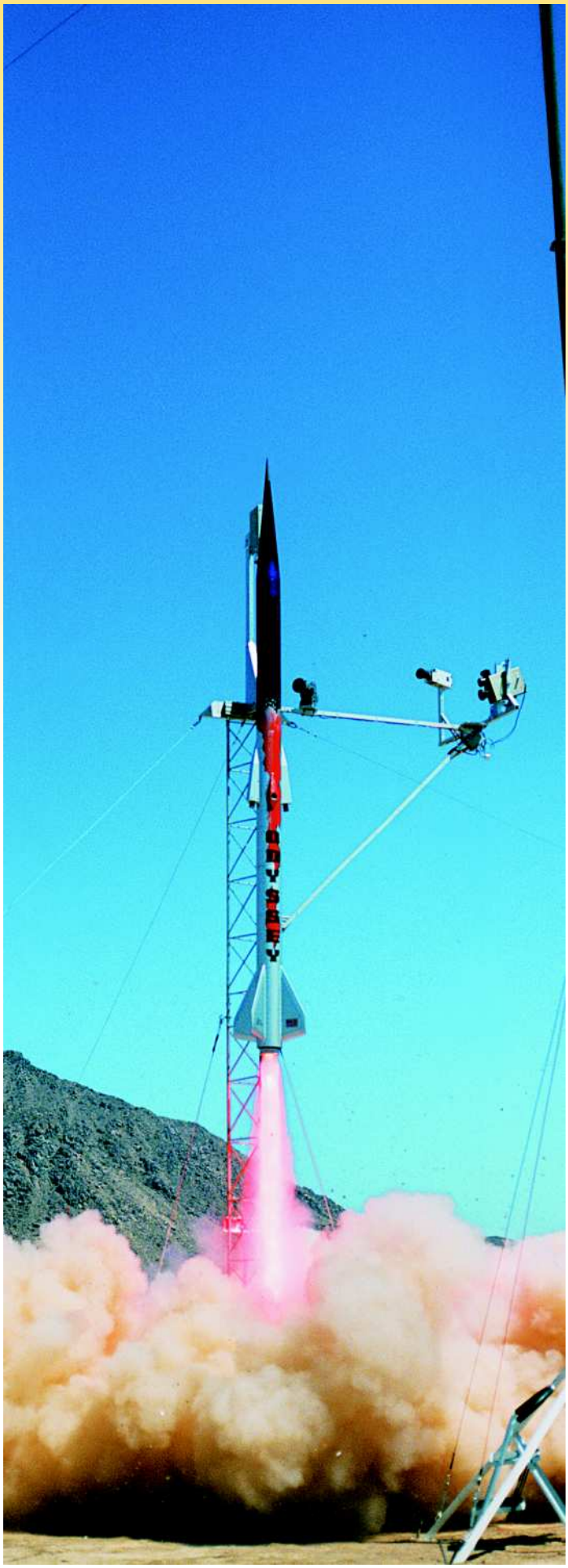
A plug was molded into the nose cone to install the aluminum tip and the nose cone was cured under high temperature and pressure in the autoclave. The result was the strongest and lightest weight nose cone for this size rocket.

The final feature that makes Odyssey different is the development of a reliable Parachute Release Mechanism. Upon landing half of the parachute lines are released preventing the rocket from being dragged along the ground damaging the rocket, camera, or lens. This is accomplished by my own design that positively holds the lines until a small charge shears a 1/4-20 Nylon bolt releasing the pieces.



Unlike other release mechanisms that don't release if there is side pressure, or are not very strong, this device can probably handle thousands of pounds of load although the actual value has not been determined. Just as importantly, the PRM can release those forces when necessary. Anyone who has tried to stop a 200 pound rocket from being dragged across the ground can attest to how dangerous it is and how damaging it can be to the rocket.

Odyssey has had two flights, the latest one in 2010 at LDRS 29 at Lucerne, CA. After we planned on flying at LDRS 29 it was announced that the Science Channel would film the launch and Kari Byron would host the show. They interviewed all of us and they even chose Odyssey to be filmed as a promo for the research rocketry part of the show. But in the end they decided not to use Odyssey in the program despite it being one of the largest, most successful flights at the launch.



It took days to set up the launch pad and equipment but it was worth it. The liftoff was beautiful and the ground cameras captured some spectacular images was also perfect. The snap ring style motor has a total impulse of nearly 41,000 Ns with an average thrust of 6,900 Ns and moved the 230 pound rocket to just reach Mach. Odyssey flew over 16,000 feet and landed within sight of the flightline. Best of all the parachute release mechanism worked flawlessly and we could actually see half the lines fall away after landing.

So as I was pondering the question asked to me before the meeting, it occurred to me the differences that members of rocketry who do research have with many of their fellow rocketeers and nearly everyone else in the world. I thought of how many times I was invited to join my friends for their Friday Night ritual of going to the local Pub having dinner and then watching their favorite TV show and how my Friday night routine was to go and vacuum bag parts for a project. I reflected about the Monday mornings when one of the technicians would tell me their adventures over the weekend in rock hunting or seeing the latest movie that had been recently released when all I got accomplished was building another camera mount or soldering a circuit board I had designed. I never could figure out how hard it was to hunt for a rock but aligning a fin or a camera cowling onto the side of an airframe and not induce roll was the challenge I like to pursue.

I thought of just a few months earlier when we were down to crunch time and the deadline for its first launch seemed imminent and I was invited to lunch by a coworker but I had to decline because I already had plans. I had to run home and epoxy another glue joint. You know when you have a complex project with dozens of glue joints that have to be made but it takes hours for them to cure. So you start doing them around the clock; 6:00 a.m. before work, 12:00 noon

run home during lunchtime, 6:00 p.m. after dinner and then finally stay up until midnight to do one more glue joint only to get up the next day and repeat the process until it was finished.

I reflected about all the sacrifices not being able to spend time with family and friends and the expense of such a project but also the dedication it required to take a project like Odyssey from concept to completion. I thought of the countless hours of planning, designing, building, and documenting the project. I remembered all the risks that are involved with such a project. On board Odyssey there are three cameras, seven altimeters and circuit boards, a large research motor, plus various transmitters and GPS devices. I recalled the worry, almost panicking feeling I felt trying to anticipate every possibly thing that could go wrong and figure out a way to prevent it from happening.

A spectator once commented to me "you must have too much time on your hands". I politely pointed out that we all have the same 24 hours in a day and 365 days in a year. And for the most part the same amount of time on this earth, relatively speaking. How one chooses to spend out valuable time is a decision made every moment. Most dedicate their time to their family, others to their careers, and still others to their lifelong passions like research and rocketry. Each of us chooses everyday what we spend our time doing. The skills and capabilities to complete a project like Odyssey is not that far above what many rocketeers do all year long. But it takes the will, dedication, and sacrifice to see a project like Odyssey through to its completion.

So as I visualize all the effort that went into this research project like your life flashing before your eyes, I give my co-worker a little smile and reply "I had had good weekend, how was yours?"

Visit Doug's Web Site and view all of his projects, interests and some really great videos.

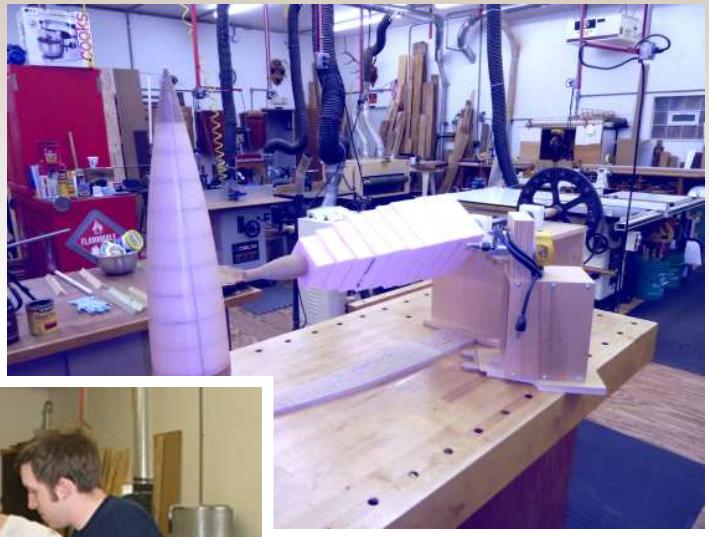
WWW.ROCKETRYPHOTOGRAPHY.COM

LET'S VISIT JOE PSCOLKA

Tripoli Gerlach member Joe Pscolka lives in Cokeburg, Pennsylvania and owns *Pscolka Wood Working*. His specialty is Antique Furniture and Taxidermy Mounts and Fixtures. Running a full time wood shop leaves little room for his rocketry hobby but he manages to find space.

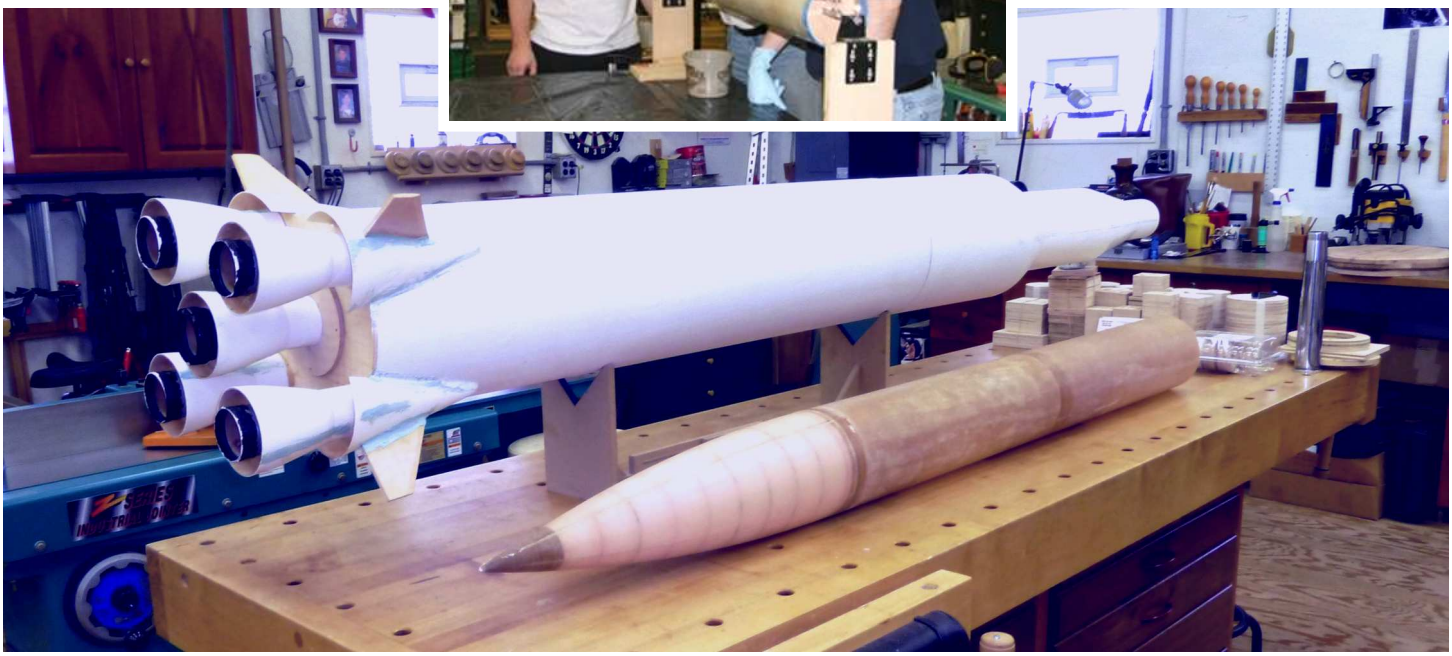
Luckily Joe is organized with some rocket stuff out in the open but most stored away until needed. He is completely equipped with everything required to make and test motors, and is a craftsman at that as well

He prefers to scratch build all of his own components such as Tubes, Nose Cones and Centering Rings; and has made all of the jigs and tools required for expert fiberglass & carbonfiber fabrications.



Even though it's a working Wood Shop you will always find Joe with interesting projects on the table.

Joe also opens his shop to Tripoli Pittsburgh members to conduct various Work Shops and Mixing Parties



OUR SAFETY CODE

Conceived in Tripoli's early years as a National Organization this was a fore-runner to the existing High Power Safety Code(?). Originally credited to AHPRA is was also adopted by Tripoli Vegas and Tripoli Pittsburgh - and maybe some others!

1. Materials: My rocket will be made of lightweight materials in order that they can be destroyed if the police show up.

2. Motors/Engines: I will use only non commercially made, uncertified rocket motors in the manner recommended by the manufacturer. I will to the best of my ability, alter the rocket motor, it's parts, and ingredients in any way possible for maximum effect.

3. Recovery: I will spend at least twelve hours recovering, after a heavy night of drinking, before firing any explosive-filled rockets.

4. Weight and Power Limits: I recognize there is no weight limit on rocket motors or vehicles. There shall be a 24v 90 amps limit on launch equipment. No AC permitted.

5. Stability: If, at any time, I discover I am becoming mentally stable, I will resign.

6. Payloads: I will launch only interesting, though be they dangerous, payloads, but never live animals. I will kill them first.

7. Launch Site: I will ensure that the launch site is free from police surveillance before firing.

8. Launcher: I understand that launching modified rockets can be dangerous. Therefore, in order to protect my eyesight, I will get someone else to press the button.

9. Launch System: The system I use to launch my rocket will be remotely and electrically operated. (Hood open on car, apply pressure on wires to the Positive/Negative posts of battery.) All persons will remain at least 15 feet from my rocket when I am igniting rocket motors. (50 feet for 'O' motors and above.) I will use whatever it takes to ignite my rocket on the first try, so I don't look stupid.

10. Launch Safety: I will wait until an unsuspecting person approaches before launching. In the absence of a person, I will try to takeout model aircraft or large dogs.

11. Flying Conditions: I will launch my rocket whenever I feel like it. For maximum effect I will launch my rocket so it flies into clouds, near aircraft in flight and so as to scare people and endanger property for maximum humor/enjoyment.

12. Pre Launch Test: When conducting research activities with unproven designs, especially if explosive materials are involved, I will not tell anyone. I will verbally announce "Watch This" and then I will launch my rocket.

13. Recovery Hazards: If my rocket becomes entangled in a power line, or any other dangerous place, I will score 5 extra points. I will never try to recover rockets from power lines without first using a cat, or other small animal, to check for current. Rubber gloves and boots must be worn. If the cat won't put them on, I will shoot it.