

# Aeronaut

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Tripoli Rocketry Association, Inc Prefecture no. 23



## Presidents Pad

Tony Alcocer

With XPRS just around the corner this flying season sure came and went by fast. There were some new changes that made obtaining motors easier because the ATF lost the court case. Some new changes with the FAA rules that made it harder to fly rockets with bigger than O power. I believe our own 99K group was one of the first to apply for and get approval for a Class 3 rocket. They hope to send it up on Monday during XPRS Research day. ARLISS got bigger and we are working with some other groups for some interesting projects next year. We seemed to have more volunteer help with set up and tear down at the last couple of launches, which is always appreciated. AeroPac is doing well financially. So as a club we seem to be doing very good. That's all I have. If anyone has any questions or complaints feel free to drop me an email. [Tfish38@aol.com](mailto:Tfish38@aol.com)

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Banner Photo By Ken Adams

## 2009 Launch Schedule

ARLISS September 13th-18th

XPRS September 17th-21st

**ARLISS Fall** setup day Sunday September 13 with ARLISS activities thru Thursday the 17th and the student presentation banquet on Friday the 18th.

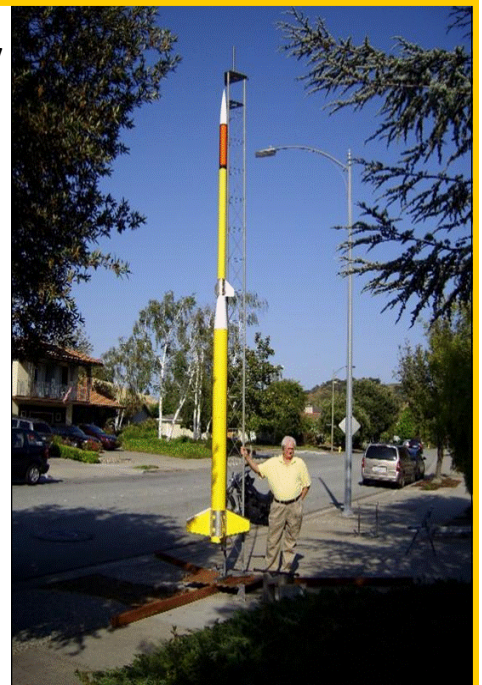
**XPRS Setup Day** Thursday the September 17th XPRS flight operation beginning on Friday the 18th with a Research Day on Monday the 21st.

### Agent 99k Project Story

**"The project started so easily."**

We were fortunate, in that a) we had a great deal of rocketry experience, and b) we had different, but complementary, interests in the project. For instance, one member was very interested in making rocket motors, another interested in doing computer analysis of the design, and another was interested in tracking and recovering the parts of the rocket. The synergy was remarkable.

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## **AERO-PAC Officers**

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Photo by Steve Wigfield



Photo by Ken Adams

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## Contests



\* **LOC Precision's "Dude Where's My Rocket"** - Parachute time duration for A, B, C, D, and E motor powered rockets. This contest is for juniors (under 18 years). In 2008 each division's top prize was a LOC Aura kit! In 2007 the prize was a D-Region Tomahawk kit. Very generous and thank you Barry & LOC Precision.

\* **What's Up Hobbies' Extreme Altitude** - best altitude for the motor class, from H to O motors. This one is the most competitive, with heavy action in I, J, and M motor classes. We'll accept barometric altitude from any production altimeter.

\* **AEROTECH Need For Speed** - top velocity for the motor class, from H to O motors. This one requires an altimeter with an integrating accelerometer, the differentiated barometric readings are not reliable enough. Download the altimeter and show us your Mach!

\* **Aerocon Systems' EconoMax** - best altitude for the cost of the motor. Show us the barometric altitude and manufacturer's suggest retail price of the motor, we'll do the math. Best feet-per-dollar wins!

## Rules for all events:

1. Rockets must be entered in contest prior to flight.
2. Flyers must designate the specific event on their *flight card* to be an official entry.
3. Only one event per flight.
4. Official flights are from 8:00 am Friday to 6:00 pm Saturday.
5. Awards presented at Saturday night's gathering.
6. There will be awards for 1st, 2nd, and 3rd place in all motor classes, in all contests.
7. Certified motors only.
8. Motor classes: H, I, J, K, L, M, N, O
9. Kids Class, A through E.
10. All rockets must be recovered in good condition to be considered a successful flight.
11. The class of Clusters and Staged flights will be based on total installed impulse.
12. TRA or NAR Certified Motors Only. Please observe the TRA 40K Ns limit.
13. Any disputes or ties will be handled by the contest directors.
14. No contest flights during the night launch.





*(Agent 99k continued from page 1)*

Additionally, many of us have a love of rocketry, and an intense, overarching interest in the whole project – integrated with a burning desire to succeed. Here are the Team Members, and area of interest:

James Marino – Motors

Dave Cummings – Analysis and modeling

Dave Raimondi – Electronics and integration

Charlie Wittman – Tracking and integration

Steve Kendall – Machining and integration

Ross Ohmen – Planning, finance, and integration

Cliff Sojourner – Voice of Reason, and Master Trailer Fabricator

Mike Pettipiece – Launch Support

Craig Saunders – Webmaster

We started out with a philosophy and set of standards that has sustained us: We wanted to fly high, have fun, stay married (if appropriate), and not go broke.

Given that, we set out to procure all the components as cheaply as possible, and do much of the work ourselves. We all donated components and countless hours of labor to the project. After much discussion and analysis, we settled on a 2-stage design – a booster with a 7 1/2" airframe, and a 6-inch "P" motor, staging to a 4-inch, minimum-diameter upper stage with a 98mm motor.

In 2006, we budgeted \$3600 for the whole project, and got a deal on components from Performance Rocketry. Soon, boxes of fiberglass tubing, couplers, and a nosecone arrived, to the delight of all.

One of our first issues: the aluminum fin can used in the sustainer would not fit around our heavy-duty airframe. We solved this problem using shims next to the fins, making an extremely rigid and tight fin section.

Another issue: How to track the rocket, back from 99,000 feet? Discussions lead to GPS-based tracking components,

to be installed in the nosecone. We also agreed that we should use Walston tone trackers, as backups.

About this time (July 2006), we decided to test one of the sustainer motors at the Aeronaut launch with AeroPac. We loaded the N2600 Wimpy Red motor into a test stand. At 2.5 seconds, the motor burst out of the stand, and started to thrash around! The case had failed just in front of the forward bulkhead – the hottest part. James went off to redesign the forward closure, so this didn't happen again.

Also at this time, Charlie started testing the tracking equipment, seeing if this equipment was going to work. He started seeing odd results: dropouts, incomplete tracks, and completely disabled systems that didn't work after test flights. This confusing and haphazard behavior was to plague us for years.

In October of 2006, we tried another "N" motor test, and were again disappointed to find the case burned through – in almost the same spot. Paper/cardboard liners just weren't going to work for us with that big, hot, motor. James switched to fiberglass liners.

In March of 2007, we tested the newest "N" motor. At 2.5 seconds, the aft closure ring let go, and blew the nozzle and a grain several hundred feet into the air! We investigated and found that there were voids in the motor grains, which greatly increased the surface area of the burn, and over-pressurized the case. Additionally, the liner had cracked in many spots, and the motor might have burned through, had the nozzle not blown!

Clearly, the Wimpy Red propellant was difficult to handle in the 4" motor, and we opted for "Swamp Gas", instead. While having a lower ISP, perhaps we wouldn't blow up our motor. We were able to borrow a Loki 6" casing suitable for the "P" motor from Wedge Oldham, and cast a motor to test. At Mudrock 2007 (June 16th,) we put the motor on a stand and fired it. Even from 1500 feet away, the motor was loud and impressive! And it held together.

Our design and fabrication work continued, and by Dairy Aire (May, 18th) 2008, we were ready to fly the sustainer.

*(Continued on page 5)*





*(Agent 99k continued from page 4)*

In May of 2008, we purchased a “coffee-can-K”, a K458, which we flew in a one-grain 98mm case. The flight was perfect, and we recovered without error.

We tried the sustainer again at Mudrock 2008 (June 20th). This time, we used a 2-grain JPS L663. While the flight looked good initially, we had several issues. First, the motor was not adequately restrained, and fell out. Next, the high winds, and low rocket weight meant that the rocket was dragged across the playa. The result was that the main coupler was sanded heavily on one side, and would need to be replaced.

We decided to replace the fiberglass coupler with a machined aluminum one instead. As the old coupler was held in with a few bolts, this was easily done. We tried the sustainer a third time at the TCC launch in July of 2008, on a K1499 Warp 9. The rocket tore off the pad and coasted to apogee, where the drogue came out. The main parachute came out as expected at 700 feet, and the rocket settled into a muddy field. Thankfully, we had no structural or water damage. We were still working on some GPS tracking issues but were happy with the flight performance.

While all this was happening, several members were working on the booster, and fabricating the four big fins. Careful machining by Charlie, Steve, Steve’s brother-in-law Chris at Erwin Manufacturing, and Richard Hagen at HSD Engineering, produced the four fins, and a fin-can structure that would keep them steady at Mach plus. The booster was finished, and painted yellow, with the fin edges kept as polished aluminum.

The completed rocket was now 19 ½ feet tall - impressive by most people’s standards.

We decided to fly the entire stack at XPRS – September 22, 2008. We selected an M2500T, staging to another L663 Swamp Gas. While the preparation took forever, the rocket was finally ready to fly around 10am on Monday – Research Day.

The M2500 lit beautifully, and heaved that 100 lb rocket into the sky. Burnout and separation happened quickly. The sus-

*(Continued on page 6)*

## Frequency Allocations and Tracking

Charlie Wittman



Hi Flyers

The following link will take you to a Google hosted spreadsheet for XPRS. If you are attending and using tracking radios, GPS or other electronic or RF emitting device make sure you on the list. I have placed **former** entries in **red** and if you are using this device on that or any day then change to **black** and add in any other data in black. Spreadsheet located [here](#). Account Required to modify.

### History for those inquiring minds;

I am the keeper of the list for now as I originally brought the issue to AeroPac due to problems experienced at Dairy Air, TCC this year. I was testing the recovery GPS for the 99k project which will fly at Aeronaut or XPRS and the GPS Flight unit I was using all of a sudden lost tracking and I saw a NEMA device on my map on the laptop. I reset the system and got mine back in the SWARM protocol and it then changed back to another NEMA location. I walked over to see who had a unit on and it was James Dougherty and his ARTS2 GPS A GPS Flight unit can track 10 SWARM units per channel but only one NEMA. That is when I realized we has a problem is someone fired up their ARTS unit when I was tracking 99k. Richard Hagen then suggested and started a list of the frequencies and channels of all tracking as the Big Red Bees on the same ham channel with no slotting would have the same problem on 70 cm and 2 meter bands. Richard started circulating the email about the frequency list and then Eric put it on Google docs. I volunteered to carry on the list for the future. Very important if you want to find your rocket.





*(Agent 99k continued from page 5)*

tainer lit as planned and continued to push the sustainer higher. Then, the sustainer jumped all over the sky, and rained down parts.

At least the booster worked as expected, though a few of us ran out of air, as the booster 'chute took forever to inflate.

The sustainer aft end came straight down, trailing 20' of Kevlar, and hit hard. The sustainer upper section came down much slower, on a severely damaged Sky Angle 'chute. The sustainer airframe tubes needed to be replaced from the hard impact with the ground.

Post flight analysis indicated that the head-end-ignition wires which were not potted correctly, resulting in a plasma burn-through in the lower body tube, causing the chaotic flight.

Lots of things went well, so we couldn't be completely glum. And much of it was salvageable. But, there were two serious beefs: The on-board video failed and the on-board GPS tracking failed.

Charlie went to work on the tracking issue while we procured additional tubing for the sustainer. When the new tubes arrived, we found, as expected, that the outer diameter was different from the previous stuff. We needed to machine it to get it to fit in our interstage coupler, and fit our fin can. Careful lathe work turned down this tube to the exact diameter we needed.

During this time, our tests with video showed that our Aiptek DV camera wasn't built to handle the G's and harsh handling of flight – indeed, turning the camera to “record”, and throwing it in the air recorded nothing! We bought another camera.

We decided that we were ready to fly the big flight – 99,000 feet, or almost 19 miles. We started preparing.

Tripoli and the FAA asked us for a document describing our flight, along with analyses of the dispersion landing patterns. Our aerodynamicist generated the data, and along with other documentation from other team members we assembled an 80-page document describing our rocket and proposed flight. We submitted the package in April of 2009.

What followed next was a series of requests from Tripoli for more data, better dispersion modeling, and analysis, analysis, analysis. We were finally granted permission to fly in late June 2009.

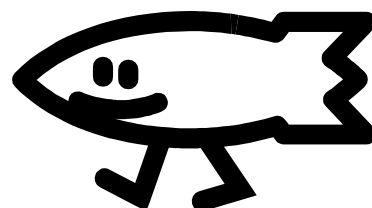
We almost flew the rocket at Aeronaut, but we kept running into GPS problems again. However we quickly diagnosed the problem to be heat. The GPS unit sitting inside a black nose cone was being subjected to 140+ degree heat. We did extensive before and after heat testing with a newly painted (white!) nose cone and are now ready to fly at XPRS. *-Submitted by the Agent 99k Team-*



***A note from AEROTECH***

We will be there to support the launch...I have demo's in 38mm,54mm, 75 and 98. So bring some light minimum diameter stuff and what ever else your stables include. As always first come first serve. I will be bringing all the hardware for these motors...the 38mm is a long one (In Length,approx.23") burns about 2.37 seconds, 1,211 N-sec.....

***-Karl Baumann AEROTECH***





## ARLISS LAUNCH INFO

Notes from the ARLISS TEAM



Looks like the ARLISS folks are going to be busy this year with a very active schedule. Just a friendly reminder to watch out for student projects on the playa if you are speeding around looking for your rocket. If you do happen on a project or airframe please do not disturb it rather, note it's physical description and location preferably with GPS coordinates, landmark line of sight or mileage and heading from center camp. If you do come across a rocket air frame that is being drug across the playa by the wind, roll up the chute so it stays put and note the location.

### Launch Calendar:

Sunday 9/13 – ARLISS setup

Monday - Thursday 9/14 - 9/17 - ARLISS Flights 8 am. - 6 pm.

Friday 9/18 9 am. – Banquet at Bruno's, Team presentations. There might be ARLISS flights early am if required. This will be announced on Thursday before the launch ends. Currently there are 41 M flights and 4 K flights scheduled for the launch.

17 Japanese teams - 15 are open class and 2 are cansat - all have 2 flights scheduled

Hawaii - 2 open class flights

South Korea- 2 open class flights

Stanford - 4 open class flights

San Jose State 1 open class flight

New Hampshire 1 open class flight

Georgia Tech 1 open class flight



The Virtual Classroom volunteers from AeroPac have been developing with funding from the California Space Authority based on the idea of Professor Bob Twiggs will go live at ARLISS/XPRSS 2009.

Summary of what capabilities will be provided:

1. Streaming video to the Internet. We will have three network video cameras in operation - one on an RC controlled rover for watching rocket prep, the infamous "perp" walk to the pad .. and launch, one stationed at the remote target to catch those rovers making to the goal, and one on a webcam notebook for doing interviews with teams during prep and launch.

2. Tracking services. We will have trackers on the video cameras, on rockets and payloads. These will be streamed to the Internet for display on Google Maps in (almost) real time. We will be supporting APRS compatible trackers at 144.390, 441.000 and 441.025 MHz.

It appears that four payload teams will be participating - with GPS trackers on board for display to the Internet in (almost) real time.

3. Chat and wiki. Each project team will have its own chat room and wiki for Internet wide collaboration and documentation of the project.

4. General Internet access via WiFi around camp.

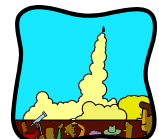
The VC 1,2, and services will be accessed from a web page on the [arlistt.org](http://arlistt.org) web site. Watch for that announcement.

Internet services will be available to members when capacity available.

Tracking services are available to members with coordination with the Virtual Classroom team.

Thanks for your support and we look forward to success.

We would LOVE a member to volunteer to be a web host to interview project teams!







## ROCKET FEVER

Adapted from "Sea-Fever" [Masefield \(1902\)](#)

I must go down to the arid seas again, to the lonely sea and the sky  
And all I ask is a tall ship and a star to sail her by  
And the rocket's kick and calm wind's song, the smoke trail shaking  
And a good day at Black Rock, and a clear, cool dawn breaking.

I must go out to the launch pad again, for the call of soaring pride  
Is a wild call and clear call that may not be denied,  
And all I ask is a ten count for high-power reload flying,  
And flung payloads and billowing chutes, and no CATO crying.

I must go out to desert-seas again, for the vagrant Black Rock life  
To the Mudrock way and the Aerohot way where playa dust is rife.  
And all I ask is a few 'nauts who volunteer, to set up, not just fly,  
And Vincent's starry, starry night with a sleepy restful sigh.

I must go out on the playa flat, for solitude of a cone road drive  
With radios, cameras and shovel, and spring water to stay alive  
And all I ask is sunshine and blue sky, and the highest FAA waiver,  
And crunched ice for the cooler, and evening BBQ to savor.

I must boldly go out to the playa again, to the desert and deep sky  
And all I ask is a tall ship and a rail to soar her by  
From ignition's kick and liftoff roar to the mach diamonds blazing  
And a good day at Black Rock, and galactic midnight gazing.

D Mathes





## Tripoli Research Launches - FAQ

The purpose of this document is to summarize and highlight the special rules that govern the operation and participation of Tripoli members at a Tripoli Research Launch (TRL). This document does not replace the actual Tripoli Research Safety Code, it is only provided as a guide.

It is the purpose of this code to provide a means to introduce new technology or to include currently prohibited technology into Tripoli Research activities as the ability and expertise of TRA to include these technologies becomes available. Tripoli members in good standing and 18 years or older may fly rockets with commercial motors at a TRL.

**1. What is a Tripoli Research Launch (TRL)?** *The Tripoli Research Program's purpose is to foster the research and development of payloads, electronics, recovery devices, air frame design, construction materials and to provide members of TRA with a venue in which they can static test and use their own composite or hybrid motors.*

**2. How is a TRL approved/authorized?** *[http://tripoli.org/documents/rsrch\\_launch\\_form.shtml](http://tripoli.org/documents/rsrch_launch_form.shtml)*

**3. What are the constraints for scheduling a TRL?** *All Tripoli Research launches shall take place at a time which is to be separated from any other Tripoli Regular or Certified launch at that same site by no less than 8 hours and a date change. Operating separate range heads at separate locations on the same or adjacent property shall not meet this requirement unless launch/firing times for Tripoli Regular or Certified and Tripoli Research flights are separated by at least 8 hour and a date change. The separation shall be from any other launch of an organized club or group, including, but not limited to TRA and NAR. This rule shall apply to all operations conducted at the launch.*

**4. What is a Tripoli Research flight?** *Simply put, all flights that occur at a sanctioned/insured TRL are research flights.*

**5. Who may participate in a Tripoli Research Launch?** *All flyers at a Tripoli Research Launch shall be members of Tripoli in good standing and 18 years or older*

**6. Can non-members fly rockets at a TRL?** *No.*

**7. Can children fly rockets at a TRL?** *No, Only Tripoli members 18 years of age or older shall be allowed to participate in Tripoli Research Launches.*

**8. Are Research motors required in order to fly at a TRL?** *No, commercial motors can be flown at TRLs.*

**9. Can all fliers fly rockets with research motor at a TRL?** *No, all flights and static tests that use research motors shall be conducted by Tripoli members who are Tripoli certified level 2 or 3.*

**10. Are there any limits on flying commercial motors at a TRL?** *Yes, all flights and static tests conducted by the member shall be within the member's certification level.*

*(Continued on page 10)*



**11. Are there restrictions on spectators and/or invited guests?** *Non-Tripoli members are either invited guests or spectators. Tripoli members shall be responsible for the conduct of their invited guests. An invited guest may be permitted in the motor/rocket preparation areas upon approval of the RSO but may not be present at the launch site (pad area).*

*Spectators, who are neither TRA members nor invited guests, are confined to the spectator areas as designated by the RSO and shall not be present in the motor/rocket preparation areas nor at the pad areas or flying range site.*

*Invited guests or spectators who meet all the other requirements of this code may have access to these restricted areas if they join TRA and have the permission of the RSO and the person or group personnel involved in a project.*

**12. What is the 75% rule and how can it be waived?** *The 75% rule limits flights that use research motors to 75% of the FAA waiver in force at the time of the flight. This is done to be conservative with flights that may overperform their expected flight profile. The maximum launch altitude of a research flight shall be 75% of the waiver altitude established for the launch.*

*The BOD may waive this requirement when it can be demonstrated (by past performance, actual thrust curves, etc.) that the performance of the motor(s) to be used shall not exceed the limits of the waiver.*

*Computer simulations without actual thrust data derived from one or more actual test stand firings shall not be considered for waiver.*

*You can apply for a waiver of this rule if you have consistent history of making motors that performed as predicted. A commercial manufacturer also has a consistent history of motors performing as predicted, and is therefore granted the waiver.*

**13. I want to 'kit-bash' some commercial motor parts to create a 'custom' motor is this allowed at a TRL?** *Yes, this is considered a Research motor. However, this is not allowed at non-TRLs since the motor is not certified.*

**14. My buddy is not a member of Tripoli but wants to fly his rocket at a TRL. Can I 'sponsor' his flight so his rocket can fly?** *No, a flier has to be a Tripoli member, in good standing 18 years of age or older. This rule also prohibits children from flying at a TRL under any circumstances.*

**15. Is a motor with a PVC casing allowed at a TRL?** *No. PVC is frangible and thus not allowed.*

**16. Can I fly a motor with a steel nozzle or steel case or closures?** *No steel cases or nozzles or closures are allowed. Steel snap rings, screws, and washers are minor parts and are permitted.*

**17. Can I buy or sell a research motor at a TRL?** *No, a TRL is not a venue for sales of research motors. Research motors cannot be sold for profit at a TRL.*





## DID YOU KNOW?

AEROPAC's own Ken Biba has put together a excellent paper titled:

### High Altitude Wind Speed, Direction and Air Temperature at Black Rock, Nevada for Amateur Rocketry Application

This paper analyzes the NOAA radiosonde data to provide a reference for the historical behavior of wind direction, speed and air temperature between 10k' and 100k' MSL at Reno Nevada the nearest reporting site to the amateur rocketry launch site at Black Rock Desert in Northwestern Nevada.

Ken's paper can be down loaded [here as a PDF](#) from the AeroPac website.

Well done Ken. I am positive many class 3 flyers and others will find this a valuable reference for flight documentation and preparation.

#### *What is a Radiosonde?*

For over six decades, upper air observations have been made by the National Weather Service (NWS) with radiosondes. A radiosonde is a expendable instrument package in a box that is suspended below a 6 foot wide balloon filled with helium gas. As the radiosonde is carried aloft, sensors on the radiosonde measure location, altitude, pressure, temperature, and relative humidity. These sensors are tied to a battery powered, 300 MW radio transmitter that sends the sensor measurements to a sensitive ground receiver. By tracking the position of the radiosonde in flight, information on wind speed and direction aloft is recorded. The radiosonde flight can last more than two hours; can achieve max altitudes of around 115,000 feet and it can drift as much as 125 miles from the release point. During the flight, the radiosonde is exposed to temperatures as cold as -130 ° F and an air pressure only few thousandths of what is found on the Earth's surface. When the balloon has expanded beyond its elastic limit from six feet to 20 feet in circumference it bursts, a small parachute slows the descent of the radiosonde, minimizing the danger to lives and property.



Photo Steve Wigfield, EX Day Aeronaut

## Launch Duty Reminder

There are still plenty of holes in the Launch Duty roster. Many of the main shifts are empty and none of the assistant slots have been filled in. We have heard from the powers above that no launch will begin until all the slots for that day have been filled. Get your spot today at the [launch sign up page](#).

