



## AEROPAC Fall 2017 Newsletter Volume 2

Photo by Phoenix 4, courtesy of Curt Von Delius

### AEROPAC Year End Party

This year's AeroPac year-end party is going to be held at a different location due to Pizza Organismica closing. It will be held this year on December 3rd from 11-3pm at Round Table Pizza at 2200 4th Street in San Rafael. There will be a BOD meeting from 11 to 12 and everyone is welcome to join that as well. If not, start showing up at noon and the food will probably start coming around 12:30. Come share good times with friends, lots of pizza, salads and sodas and just have a great afternoon.

However, if you want beer (which I'm sure many of you will) you will have to order and pay for those yourself.

I look forward to seeing many of you at the party.

Please email Becky Green off line at [ap-fueled@yahoo.com](mailto:ap-fueled@yahoo.com) to RSVP.

### What's Inside

Page 2 - Airspace, Rockets and You

Page 7 - Bill Lewis

Page 6 - ARLISS 2017 Costa Rica Team Experience

Page 9 - Costa Rica Team Wins Micro-Sat Competition

Page 10 - Becky Green Flies High

Page 12 - So You Want To Go To A Launch On The Other Side Of The Country

Page 18 - 2017 Flight Count Totals

Page 20 - It all Starts Somewhere

Page 21 - The Last of the Kosdons

Page 22 - Paris Family Celebrates 10 years

Page 23—Oregon State Flies High at BR

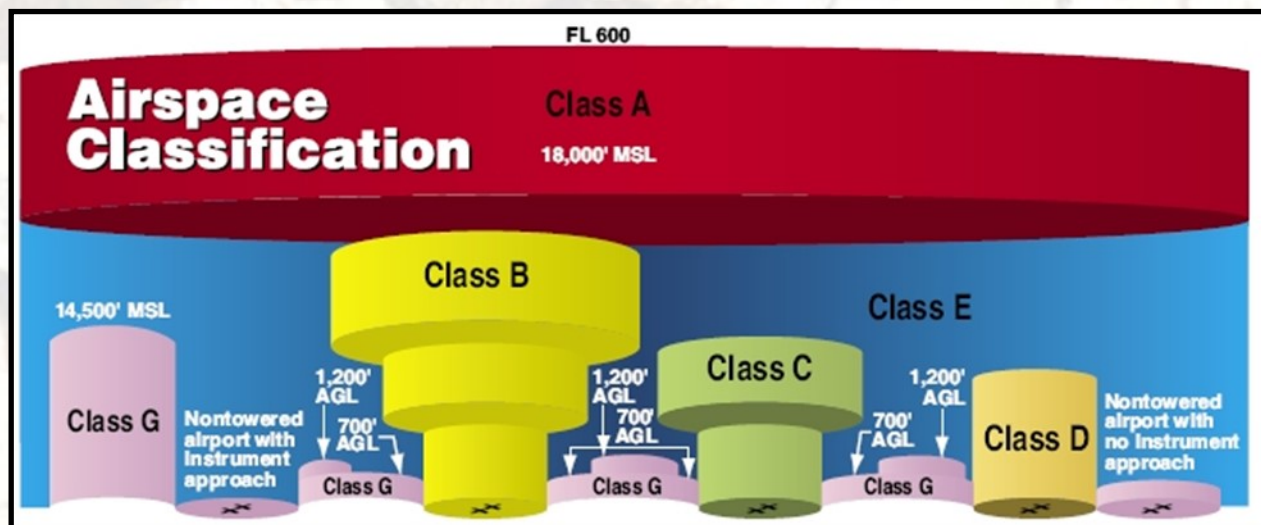


## Airspace, Rockets, and You

Matt Sikking

Although the Black Rock Desert is an amazing and beautiful remnant of pre-historic Lake Lahontan, most of us make the trek out to the playa for the medium right above the hard-packed ground. In this article, I'll cover some of the basics of the U.S. National Airspace System (NAS) and how it affects our launches in the Black Rock Desert. First, we'll briefly cover the different types of airspace.

The NAS is broken into different classes indicated by a letter from A through G (there is no F). Class A-E are controlled airspace and Class G is uncontrolled. Class A airspace is at or above 18,000' Mean Sea Level (MSL) up to Flight Level (FL) 600 (60K ft at standard atmospheric day altimeter setting of 29.92). Class B airspace varies in shape but generally resembles an upside wedding cake. This type of airspace is generally found above the largest international airports (such as San Francisco). The shape and size of Class C airspace varies as well and is found at medium size airports (such as Sacramento). Class D airspace is generally reserved for towered airports that have heavy enough traffic to warrant controlled airspace (such as Travis Air Force Base). Class E airspace is everything else that is under positive control from an air traffic control facility. Class G is uncontrolled airspace that has different rules and is usually found under Class E airspace closer to the ground. Without going in to too many details, each class of airspace has different rules and regulations that govern who can fly in it and what equipment they must have. The chart below is a great visual depiction of the different types of airspace. So, for the average rocketeer, what does all the airspace mean and why does it matter?



Simple! We share the airspace around Black Rock with many different users and everyone wants to remain safe. Generally speaking, the Federal Aviation Administration (FAA) will not approve rocket operations in active Class B, C, or D airspace because it is difficult for them to provide positive separation from the heavy amounts of traffic that transit in and out of those airports and rocket activity. Therefore, you generally won't see FAA waivers in those types of controlled airspace, and as such most rocket operations



will occur in Class E and G airspace. While I am not an expert on how the FAA builds airspace waivers, they generally assume that rocket clubs operate on a see and avoid basis and that the local airspace control authority will keep positive separation with participating traffic.

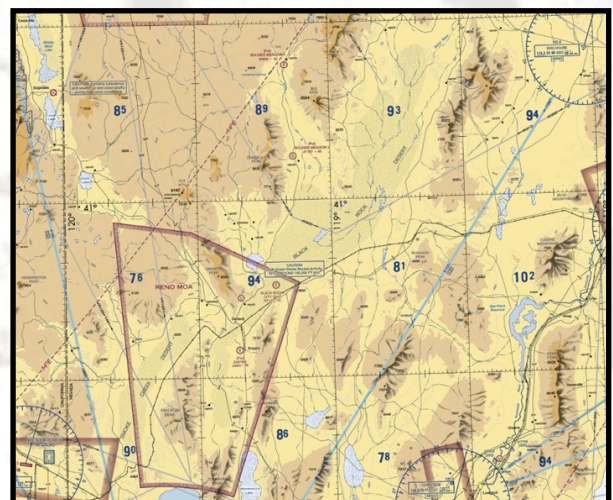
Participating traffic is key for most launches, because it does not restrict or prohibit aircraft flying under visual flight rules (VFR, see and avoid) from transiting over a rocket launch. They share responsibility with the club to separate themselves from the rocket activity. Normally, a Notice to Airmen (NOTAM) is published which outlines the area, altitude, and duration of rocket activity as a warning to VFR pilots. Traffic flying under instrument flight rules (IFR), is considered participating traffic, is under positive control from a controlling agency, and will receive positive separation from the rocket activity. Therefore, rocket clubs generally only need to worry about making sure the FAA publishes a NOTAM and visually clears the airspace before conducting launch operations to keep clear of VFR traffic. AEROPAC, though, operates a little differently and issues a Temporary Flight Restriction (TFR) to keep all traffic out of the waived airspace.

A TFR is just that, a temporary restriction that prohibits any aircraft activity that is not part of the event that generating the restriction. In the case of AEROPAC, our TFR is based on one of two points, Black Rock 7 (BR7) and Black Rock 15 (BR15). Both points were determined by the FAA in coordination with the Tripoli Rocketry Association (TRA) and serve as a base point for the waiver. From the BR7 center point, the FAA may allow flights up to 100,000' within a 7-mile diameter cylinder. Because the AEROPAC site is offset from BR7, our waiver is subsequently reduced so that all recovery operations still occur within the defined center point of the waiver. It's important to note that even though the launch site may not be at waiver center, the FAA expects all rocket activity to stay within the boundaries of the center point. At our current launch site, we have been given a 60,000' waiver. But what about those folks that can't seem to keep their rockets under 60K? That's why we have the BR15!

The BR15 center point allows higher altitudes and launch and recovery must occur within a 15-mile cylinder. Generally speaking, BR15 is normally available for specified time periods only in order to lessen the impact on other users of the airspace around Black Rock.

Who are those other users you ask? And why would we sometimes not receive permission to use the BR15 waiver? This chart below shows some of the types of Special Use Airspace (SUA) that may impact AEROPAC operations.

The U.S. Military is the primary user of special use airspace, and you will see various Military Operating Areas (MOA) on the chart. MOAs are built to give the military a place to conduct training activities within set boundaries to lessen the impact on other airspace users. For instance, the Reno MOA, as listed on the chart, is carved out to allow military operations from certain times on





Mon-Fri from certain altitudes. During those times, airspace users can expect that the MOA may be active. Users can call the controlling agency (listed on the chart) to confirm. If the MOA is in use, IFR traffic will be routed around that particular area, but it does not limit VFR traffic. Aircraft operating under VFR can still transit a MOA, but must take extreme caution. Most military controlling agencies will halt operations when VFR aircraft enter a MOA just to be safe. For our purposes in AEROPAC, the Reno MOA is normally not active on the weekends and usually isn't a factor. If it is in use, the BR15 cylinder comes very close to the edge of the Reno MOA and the FAA may deny waiver requests to ensure there is no interference. There are other types of SUA that also may interfere with our launch operations, but it is beyond the scope of this article to cover them all. The Federal Aviation Regulations cover SUA in depth and is a great place to find more information.

Bottom line, the FAA, in conjunction with all the users of the airspace, are jointly responsible for everyone's safety. We felt some of the effects of that joint responsibility at the 2017 XPRS launch, where AEROPAC did not receive a BR15 waiver. Because of previously scheduled military operations, the FAA could not ensure that launches from BR15 would not interfere, subsequently denying the waiver request. While this is not an optimal scenario, from the lens of the FAA, it was the only way to keep everyone safe, but not necessarily everyone happy!

I hope you enjoyed a very brief introduction to the NAS and the different types of airspace and how they affect rocket operations.

While this article is in no way inclusive of every part of the Federal Aviation Regulations, it does serve as a quick introduction to the complexities of managing the air above our heads.

Happy flying!



The author preparing to launch an ARLISS project in 2016



## AEROPAC Founding Member Bill Lewis Has Passed Away

One of the earliest AEROPAC members died during ARLISS / XPRS this year. Bill's activities in AEROPAC seem to pre-date all of our current active members. Bill was clearly a central figure early on and our earliest AEROPAC newsletters, January and April of 1992, seem to be almost exclusively written by Bill. Interesting reading these early newsletters. One can get a real feel for the history of the club and the foundations that were laid that helped make AEROPAC a great rocketry club.

For the January, 1992 newsletter Bill wrote "Fun in the Sun" covering the July, 1991 "Black Rock III" launch. Apparently, this was the last launch before TRIPOLI required that only certified motors be used. The official "EX" designation must have come later. "It was two days of near-perfect-weather rocketry: warm and sunny with clear blue skies."

118 flights were made at Black Rock III.



Also in the January 1992 newsletter was Bill's article "AERONAUT 2— Snow and Cold Weather Rocketry" where snow flurries and a buried to the axles porta-pottie trailer (took the 3 mile entrance) did not deter AEROPACer's from launching.

Apparently Bill was still active in 1993 but by the time of our next archived newsletter in 1996 he seems gone from the scene.

According to his family he continued to educate young people in rocketry and supported STEM activities.

You can read Bill's full obituary from the San Jose Mercury News and view a video made by his family by following the links from the posting on the AEROPAC Facebook page.

So long Bill! We owe a lot to you and our other founding members!





## ARLISS 2017 COSTA RICA Team Experience Costa Rica ARLISS Team

Our experience began 8th September, when the first member of the team took the plane to Nevada. We all met on Sunday at Legends, one of the famous outlet malls of the region, then we moved to the hotel to get ready because we had to leave at 4am in the morning. We rented a big car, for 8 persons, but we had an issue, 8 big persons with 8 big luggage was not easy to fit in a car!

So, we got to the desert, but we got lost, we were looking for the place, and in that moment where everything was quiet and empty we realized that to the right there were 3 cars racing to get to the launch, so we did the same. We followed them until the camping part, where we met Becky and Jim for the first time, and we all together had breakfast, and there was something really interesting, for most of the members it was not common to have oatmeal for breakfast, but we tried anndddddd OMG, it was so good!



Photo by Becky Green

**Our rented car with Costa Rican flag**

After the breakfast, we started with the rocket building, the temperature was good and the weather was perfect, but, wait for it, during the night the most amazing things just happened, I will talk about it later! And, so after



Photo by Becky Green



Photo by Becky Green

**Intense rocket assembly on the playa.**

a hard day of work, it was time to set up the camping tents and then we had fun with the motorbikes.

During the night, we were all set at the camping tents, sleeping, very nice and comfortable, but around 1am the wind started blowing, so, we ignored it and continued sleeping, half hour after that, the rain started, we said: ahhhh it doesn't matter, we are not going to get wet, we are inside the camping tent,



but at 2am the combination of the rain and the strong wind made us to call Jim and Becky, because the tents got broken, the water started to get in the tent and we freaked out. As a consequence, we had to leave the tents and got it into the RV.

The second day, the fuselage was on the way, the resin took some time to dry, but also, the test to get the Tripoli certification was near, so during the rest times we studied, as we were really scared about the test.

Lastly, the big day arrived, the launch to get the L1 Certification was on us, the stress level was on the limit, the most scary part was folding the parachute, maybe we tried around 10 times just to make sure that it worked good, and thank God the Aerotech Experts helped us, and we learned about the chain method to fold the parachute, and the results were amazing, a 100% effectiveness.

We filled out the flight cards, and then we got to the launching point, totally excited and worried about the idea of having a successful launching or a failure, supporting each other to be confident about our work.

Lastly, the L2 certification flight arrive, with an amazing hurry because there was an storm coming to us, all the flights were successful, it was hard to find the rockets with all the mud due to the storm, but we did it!

Of course, we developed a new kind of shoes specially to be used at the playa.

For the last day, we changed the view a little bit, from the playa to the



Very special flight card!



Waking up in the Green's RV



Studying for L2 Test while the epoxy dries



Karl showed us how to drill the proper delay



snow, from being melted to getting almost frozen!  
But, when we were talking about the experience, we realized that there was a common opinion: THIS WAS THE BEST TRIP IN OUR LIFE!



Photo by Becky Green



Photo by Becky Green

**Dan Michaels of Aerotech helped us prep**



Photo by Becky Green



Photo by Becky Green

**Ready for our L2 cert flights!**



Photo by Becky Green

**We had some time for motorcycling riding!**



Photo by Ricardo Campos

**We are out of here!**





# Costa Rica Team Wins UN Sponsored Micro-Sat Competition!

(all photos (courtesy of authors))

After the time at ARLISS in the USA, half of the team went to Guadalajara Mexico, as they were selected as one of the six finalists on the Pre-Mission Idea Contest. The competition, consisted on the design of a Micro Satellite to help on the 17 United Nations Sustainable Development Goal, with the limitation of 50kg weight. The team satellite is call "Reti-Sat", because its mission is to monitor the red tide blooming at the Central American Coast.

The team arrived in Mexico on Sept 30th and started to work on the final issues to present to the project to experts in the Aerospace field, as can be seen on the next image, where the team was working at the hotel room.



The competition was in the first week of October, the Reti-Sat project was the first to be presented, and in this case the professor was selected to make the presentation.

The team won the competition! That means it was selected as the Latin American Team to represent the region at the International Competition in Italy, during the first week of December.



After winning the competition, the group celebrated in Guadalajara, and they visited "Tlaquepaque," which is one of the most famous tourist places in Guadalajara.





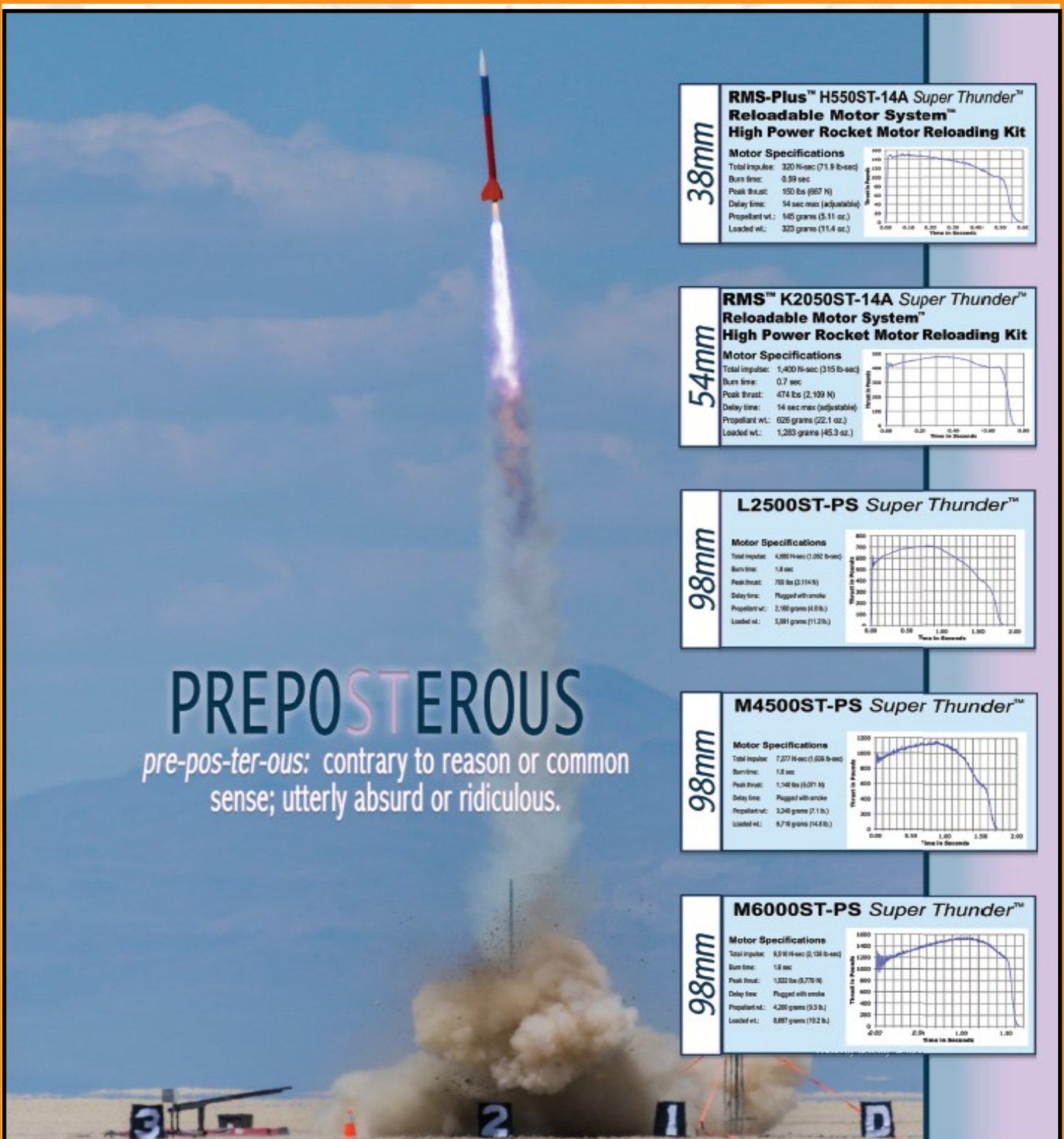
**Becky Green flies high on an Aerotech M685W**



You guys go get it, okay?

Becky's rocket flew to 27k+ and recovered about 3 miles away





**PREPOSTEROUS**  
pre-pos-ter-ous: contrary to reason or common sense; utterly absurd or ridiculous.

**38mm**

**RMS-Plus™ H550ST-14A Super Thunder™ Reloadable Motor System™ High Power Rocket Motor Reloading Kit**

**Motor Specifications**

- Total impulse: 320 N-sec (71.9 lb-sec)
- Burn time: 0.59 sec
- Peak thrust: 150 lbs (667 N)
- Delay time: 14 sec max (adjustable)
- Propellant wt.: 545 grams (5.11 oz.)
- Loaded wt.: 323 grams (11.4 oz.)

**54mm**

**RMS™ K2050ST-14A Super Thunder™ Reloadable Motor System™ High Power Rocket Motor Reloading Kit**

**Motor Specifications**

- Total impulse: 1,400 N-sec (315 lb-sec)
- Burn time: 0.7 sec
- Peak thrust: 474 lbs (2,109 N)
- Delay time: 14 sec max (adjustable)
- Propellant wt.: 626 grams (22.1 oz.)
- Loaded wt.: 1,283 grams (45.3 oz.)

**98mm**

**L2500ST-PS Super Thunder™**

**Motor Specifications**

- Total impulse: 4,880 N-sec (1,092 lb-sec)
- Burn time: 1.8 sec
- Peak thrust: 700 lbs (3,114 N)
- Delay time: Plugged with anode
- Propellant wt.: 2,766 grams (9.8 lb)
- Loaded wt.: 5,881 grams (13.0 lb)

**98mm**

**M4500ST-PS Super Thunder™**

**Motor Specifications**

- Total impulse: 7,277 N-sec (1,626 lb-sec)
- Burn time: 1.8 sec
- Peak thrust: 1,146 lbs (5,071 N)
- Delay time: Plugged with anode
- Propellant wt.: 3,246 grams (11.4 lb)
- Loaded wt.: 8,716 grams (19.2 lb)

**98mm**

**M6000ST-PS Super Thunder™**

**Motor Specifications**

- Total impulse: 8,516 N-sec (1,911 lb-sec)
- Burn time: 1.8 sec
- Peak thrust: 1,532 lbs (6,776 N)
- Delay time: Plugged with anode
- Propellant wt.: 4,265 grams (15.3 lb)
- Loaded wt.: 8,887 grams (19.6 lb)



**Technical by Design.**

[www.aerotech-rocketry.com](http://www.aerotech-rocketry.com)

©2016 PCS Rocket Motor Components, Inc. 2113 W 850 N, Cedar City, UT 84721 [www.aerotech-rocketry.com](http://www.aerotech-rocketry.com)





## So You Want To Go To A Launch On The Other Side Of The Country

### A Guide to Surviving the Pitfalls of Long Distance Rocketry Trips

Ross Ohmen

#### Introduction

A few years ago, I took a job a long way from my beloved Black Rock Desert. I thought my days of flying there were over, but I figured out a way to get back for the occasional launch: I ship a crate of rocket parts, and fly to the West Coast.

#### The Quandary: How to Get There – Drive vs. Fly

If you live more than two states from the launch site (West Coast states, that is) the options for getting there are time-consuming and expensive. You can drive an RV, a car, or you can fly.

#### Driving an RV – Pro's and Con's

1. If you own or have access to an RV (camper or fifth-wheel), you can cover the distance in style. There are lots of RVs available for rent in Reno (except during Burning Man).
2. You will need other drivers, if you're going to drive more than twelve hours a day.

#### Pro's:

1. You could have an absolute ball, if you team up with other, like-minded folks.
2. You might see some cool things on the way.
3. You'll have a solid structure in the event of bad weather.
4. You'll be able to carry more stuff (weight), but space may be limited.
5. You can bring your motors with you, instead of relying on a vendor.
6. You might have a vehicle to retrieve rockets. (Example: Truck & fifth wheel, towed-car behind a motorhome.)
7. "RV Share," a service that rents personal RVs, could save you lots of money over "El Monte RVs".



Con's:

1. It's going to take a while. Both ways. Count on about 50 miles/hour, with stops. That's 50+ hours of travel to cover the 2600 miles between DC and Gerlach.
2. It's going to take a lot of gas money. At 10 miles/gallon, that's 520 gallons of gas for the round trip, costing about \$1300, at \$2.50/gallon.
3. You could have a breakdown and get stranded. It happens, and it's expensive, and you probably won't make the launch, or your expected return date.
4. You'll probably need some kind of small vehicle to retrieve your rocket. That's more hassle, space, and complexity.

**Driving a Car – Pro's and Con's**

Pro's:

1. You could have fun, if you team up with other, like-minded folks.
2. You might see some cool things on the way.
3. You'll be able to carry some stuff (weight), but space will be limited.
4. You can bring (some of) your motors with you, instead of relying on a vendor.
5. You have a vehicle to retrieve rockets.

Con's:

1. As before, it's going to take a while to make that drive. Both ways.
2. You'll probably be stuck in a small, uncomfortable space with others, for that long travel time.
3. It's going to take some gas money.
4. You might have a breakdown and get stranded.
5. You won't have much of a hard structure in the event of bad weather.
6. You might need a hotel room for a multi-day drive, and that could be expensive and a hassle.



**Ross's Dead Pool came cross country and rocked the on Sunday of XPRS**



### **Flying – Pro’s and Con’s**

#### **Pro’s:**

1. You can cross thousands of miles in a few hours. Saves on vacation time and the discomforts of driving.
2. You can arrive refreshed instead of tired and smelly from driving. Some people even sleep on a planes.

#### **Con’s:**

1. You’ll need another vehicle to get you from the airport to the launch site.
2. Plane tickets can be expensive.
3. Airports add hours to your travel time.
4. Shipping goods costs about \$2/lb, each way, for cheap, slow shipping. The round-trip cost for that 100-pound crate will be about \$400.
5. Shipping takes about a week to get across the country.
6. Shipping crates usually take damage, even with “Fragile” stickers on them. And the rockets inside take damage too.
7. Accidentally take the wrong thing into an airport, and you could have an unpleasant visit with security.
8. You’ll use a tent and airbed, which may be uncomfortable. (Unless you have a friend with space in an RV.)
9. You’ll need to arrange for lots of things at the launch site – things too heavy or hazardous to ship. Examples: Camp stove, shade structure, rocket engine reloads, tables, camp chairs, water, ice, and food.
10. You’ll have to ship many of the liquids and spray cans you use at the launch site, because they can’t go on the plane. (Epoxy, CA, cleaning fluid, TFE Dry Lube, etc.) You’ll also have to ship your igniters.
11. You’re not supposed to ship engines or BP.
12. Having lots of gear in a shipping crate makes for lots of packing/unpacking to find what you need, and put away what you don’t.

### **Shipping Crate**

This crate is useful for shipping with UPS, or putting it in your friend’s RV or pickup truck. Note that you can ship to a business, a friend’s house, or to a UPS store, to be held for pickup.



## Construction Materials

I was tempted to try to make a crate out of space-age materials like fiberglass and carbon-fiber, to save weight. I'm now much happier I made it out of wood, (pine and 3/16" ply), as it's much easier to repair and modify, and still pretty light.

The individual sides are made with staples and wood glue. It's held together with 1 1/2" (outdoor) drywall screws, for quick assembly and repair.

## Overall Design

The key dimensions are the inner length of 48", and the end width / height or 15 1/2". That doesn't fit the biggest rockets I could fly, but keeps the crate from being too big, bulky, and heavy. Still holds lots of 29, 38, and 54mm minimum diameter rockets.

Empty weight is about 28 pounds.

## Wheels

As I knew the crate was going to be big and heavy, I opted to put wheels on one end, so it can be rolled like a hand-truck. They touch the ground only after the end is lifted 12", to prevent unwanted rolling. Despite reinforcements, the wheels have taken damage nearly every trip.



Crate showing rolling instructions and hasps

## Handles

Reinforced handles on both ends allow two strong people to lift it.

## Securing

I wanted to discourage theft and tampering, so I put on simple hasps and (luggage) locks, in addition to dry-wall screws in the lid. After the first trip, I discovered that normal shipping usually bends up the hasps and locks, so I added a screw-on plywood cover, to protect this part.



Hasps closed with small luggage locks. Not for real strength, just to discourage tampering.

Simple plywood covers protect the hasps and locks.



## Lid Hinge

A simple piano hinge holds the door on, and a sturdy chain prevents the lid from opening too far.

## Shipping Crate Lessons Learned

1. To save money on shipping, ship ONLY the items that cannot be carried through the airport, because of space, weight, crushing, or HAZMAT concerns.
2. Figure out what you can borrow from others, and send them a request list.
3. Place protective wood over the locks and hasps to keep them from being bent and broken off in shipping.
4. When the UPS store clerk says "What are the contents?" I answer "Tools and camping equipment." This reply keeps the clerk from getting concerned about "Rocket parts". And it's technically correct.
5. When they ask you "Any hazardous materials", make sure you can answer "No".
6. Ziploc bag and seal all liquids. (And don't put CA in the same bag as Accelerator.) When epoxy spills in the crate, it's a real mess.
7. Don't even bother to ship fragile (Estes) rockets in the crate – they'll be smashed to splinters. They can be carried onto a plane, as long as there are no motors. (I've thought about putting a protected area inside the crate, but it would add weight, and take space.)
8. Safe the electronics before shipping. Remove/disconnect batteries. On two occasions, my sealed shipping crate started beeping out Perfectflite's "altitude and velocity" codes, which was disconcerting and irritating to all who had to be around it.
9. Be careful packing batteries, especially 9V batteries. The terminals can short out, and even cause fires.
10. Put on lots of "Fragile" and "This Side Up" stickers. Some handlers will ignore them, but some won't.
11. Use tent, airbed, and sleeping bag as packing materials. Also, use cold weather clothing and towels.
12. Ensure the crate is completely filled, and things won't flop around if it's stored on its end, or turned upside-down. Bubble-wrap and balloon-packs work great. Avoid packing peanuts, as they tend to blow all over the place.
13. Give your crate 9 days to get across the country. Get the tracking number, and use it. (It should take a week, but if something goes wrong, you'll need that time. And if it can't get where it needs to be, your trip is ruined.)
14. "Indestructible" things go on the very bottom of the crate – motor cases, pusher sticks, Yagi antennas, and some (very tough) rockets.
15. Use a packing list. Remember - a missing piece of rocket hardware could mean hours of work-arounds, or no flight at all.
16. Have the rockets as prepped as possible. Test all electronics. This cuts down on launch site prep, and reduces missing parts.





### Personal Travel Lessons Learned

1. When carrying lots of (safe!) rocket parts and tools onto a plane, use clear gallon Ziplock bags. Take them out of the suitcase at X-Ray, and run them through the machine individually. Otherwise, you'll be forced to take your suitcase apart with a TSA agent, and that's a hassle. (I actually had a TSA agent compliment me on my trip through Security, when I did this.)
2. And be prepared to answer a question or two. They're doing a job, and they might be curious.
3. Tired of airlines charging \$50 to check a bag? Most airlines will check your bag for free if you're among the last on the plane, and the bins are full. You'll usually have to wait at baggage claim, but that's pretty quick these days.
4. If you hold your Garmin Nuvi GPS up to the airplane's window, it looks like you're going down Colorado's roads at 540 mph!

Perhaps the most important lesson I've learned: Rocket folks are incredibly generous when asked for help. I've often needed help out on the Playa, and there's almost always someone there who not only has the tool or part I need, but has a (humbly offered) insight that will take me much further towards a solution, than I thought possible. For that, I'm most humbly grateful.

### Conclusion

If you're going to fly a rocket above 25,000 feet, then the west is the only place to do it.

But flying at Black Rock is the best for so many other reasons:

- No trees to hide your rocket, or capture it 70 feet up.
- No (nearby) hills to hide your rocket or disguise the tracking signal.
- No crops, crop stubble, tilled fields, bushes, dirt clods, or even grass to hide your rocket or twist your ankle.
- You can fly a 30-pound rocket, have it land a mile away, and drive right to it.
- The night sky is usually amazing.

If you live on the East Coast, you can get there with your stuff, but you need to plan and prepare ahead of time.

I thought my adventures in Black Rock were over when I moved across the country to the East Coast. On the contrary – I've had the privilege of flying with AeroPac at Black Rock four times since 2011, and have loved it.

Thanks to Tim and the rest of AeroPac for all the help you've given me, so I can fly rockets in the best place on earth.



## AERONAUT Flight Count

Complied by Peter Hackett

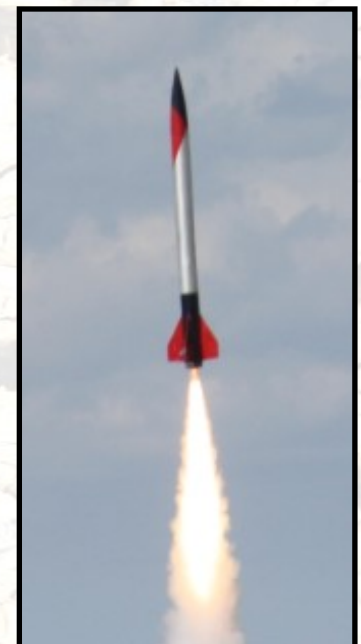
Motor Class	Max Impulse	Model Count	Normal Count	Cert Count	Research Count	Bad Flights	Grand Total
½ A up to 1.25NS	1.25						
A up to 2.5 NS	2.5	4				1	
B up to 5 NS	5	4				1	
C up to 10 NS	10	6				1	
D up to 20 NS	20	1					
E up to 40 NS	40	7				1	
F up to 80 NS	80	8					
G up to 160 NS	160	6					
H up to 320 NS	320			9			
I up to 640 NS	640			4			
J up to 1280 NS	1280			3		1	
K up to 2560 NS	2560			5		3	
L up to 5120 NS	5120			3		2	
M up to 10240 NS	10240			1			
N up to 20480 NS	20480					1	1
O up to 40960 NS	40960						
P up to 81920 NS	81920						
<b>Total Flights</b>		<b>36</b>	<b>25</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>73</b>
<b>Approximate NS's</b>		<b>995</b>	<b>23840</b>	<b>0</b>	<b>19200</b>	<b>10908.75</b>	<b>54,944</b>
Other Static Tests							



Two layer cornflake  
playa effect at  
**AERONAUT**

## ARLISS / XPRS Flight Count

Motor Class	Max Impulse	Model Count	Normal Count	Cert Count	Research Count	Bad Flights	ARLISS	Grand Total
½ A up to 1.25NS	1.25	3						
A up to 2.5 NS	2.5	9				3		
B up to 5 NS	5	18				3		
C up to 10 NS	10	40				5		
D up to 20 NS	20	8				4		
E up to 40 NS	40	20				4		
F up to 80 NS	80	20				1		
G up to 160 NS	160	26				1		
H up to 320 NS	320		25	2	3	2		
I up to 640 NS	640		20		2	4		
J up to 1280 NS	1280		25	3	4	4		
K up to 2560 NS	2560		15		4	4		
L up to 5120 NS	5120		8			1		
M up to 10240 NS	10240		6	7	1		35	
N up to 20480 NS	20480							
O up to 40960 NS	40960		1		3			
P up to 81920 NS	81920							
<b>Total Flights</b>		<b>144</b>	<b>100</b>	<b>12</b>	<b>17</b>	<b>32</b>	<b>35</b>	<b>340</b>
<b>Approximate NS's</b>		<b>3618.125</b>	<b>117280</b>	<b>38080</b>	<b>75360</b>	<b>9556.25</b>	<b>264425</b>	<b>508,319</b>



**Matt Sikkink's ARLISS on  
an AT M1340 DMS motor**



# Fruity Chutes



## Custom Parachutes

### Aerospace Recovery Solutions

Chutes for low power - mid power - high power - uav



**Fruity Chutes feature:**

- Lightweight 1.1oz Mil-spec Ripstop
- Sizes from 12" up to 16'
- Low, Mid and Hi Power Designs
- Heavy duty bridle and swivel
- Your choice of colors and pattern
- All seams are double stitched
- Hi Power feature 550lb shroud lines
- In Ultra with a Cd of 2.2
- Choose the options you want

**Fluorescent Colors**

Lemon	Tangerine	Lime	Fuchsia

**Standard Colors**

Cassini	Midnight	Liberty	Midnight



Reviewed Nov, 2008 Issue!

[www.fruitychutes.com](http://www.fruitychutes.com) - [fruitysales@fruitychutes.com](mailto:fruitysales@fruitychutes.com)  
408-499-9050

**Parachutes for UAV, Rockets, Rescue, Manufacturer, Research**

We are a manufacturer of premium quality parachutes for Aerospace, Consumers, Institutional, University and Corporate customers who demand exceptional quality, have exacting requirements and expect exceptional service. Our parachutes are used for all types of Rocketry, Rescue chutes for UAV, Multirotor, Multicopter, Drones and RC Control Aircraft Recovery, and Balloon Research. They have been featured on major motion pictures and on science TV programming. Most of our products are made to order - you choose the size, colors as well as many other options.

**"As a former member of the US Parachute Team, and as a FAA Licensed Senior Parachute Rigger, I am exceptionally picky about parachutes. The Fruity Chutes are not only made to manned parachute quality, but offer amazing efficiency - which is why they're the only parachutes in my rockets!"**

**February 9, 2015 - James Flenner, FAA licensed Senior Parachute Rigger, former member US Parachute Team, TRA L3**



MADE IN

U. S. A.

SUPPORT OUR COUNTRY

OVER 95% US MATERIALS

100% US LABOR



**It All Starts Somewhere!**

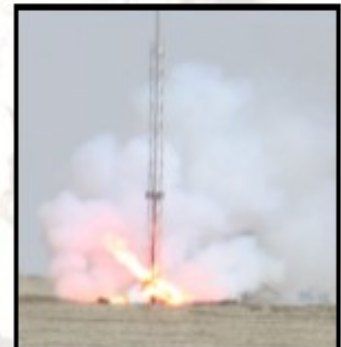
**Cliff Sojourner**

Dolores is a 5th grade teacher in Livermore, CA. She had never seen a model rocket launch, and had never been to Black Rock dry lake. I said "OK, let's go, but you are jumping in the deep end of the pool!" She quickly learned to prep and fly mid-power rockets. She shared some photos, the Estes Skeeter rocket, and burned motors with her class, the kids went nuts! Looking forward to the next rocket launch, and returning to Black Rock next year.



**Kurt Gugisberg's first place 2 stage**

**Peter Hackett with his Level 3 Certification rocket.**



**Kurt Gugisberg won a couple of Extreme Altitude trophies but not everything went so well. Here his research O burns to the ground**

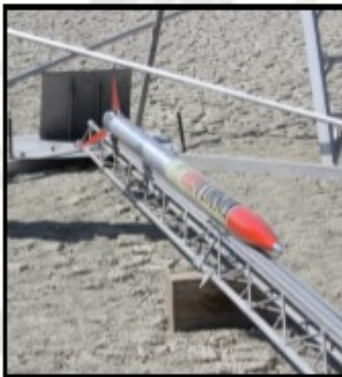
## The Last of the Kosdon's

Those present the Monday of ARLISS got a special treat. Ted and Scott Sobieralski from Visalia flew what is believed to be the last Kosdon O 6000. Ted and Scott had built a beautiful upper section and fin can for this "flying motor".

Like most Kosdon motors, no instructions were included, so a little reverse engineering was required to assemble this beast.

While it was a nice straight flight and nominal recovery, the motor seemed to chuff during the flight, probably egesting some propellant.

Nonetheless, it was a spectacular tribute to one of rocketry's master spirits and esteemed motor man.





## Paris Family Celebrates 10 years at AEROPAC!

The Paris family celebrated ten years of launching rockets on the playa by launching a 10'-10" tall rocket. The 42 pound rocket was launched with an Aerotech M1075DM in a borrowed motor case that happened to be a old ARLISS ten year anniversary case! We had a nice flight with a bit of weather cocking due to the baby M low thrust but we won't wait ten more years to launch with a bigger motor!

Special thanks to Becky Green for the borrowed motor case!





## OSU Student Fly High at Black Rock

Nancy Squires

(All photos courtesy of author)

Flight of an OSU high altitude rocket in Blackrock Nevada

The Oregon State University team successfully launched a 2-stage rocket to an altitude of 80,000 ft above the Blackrock desert in Nevada at BALLS 2017. This is a truly amazing feat for a team of engineering undergraduates! Rocketry at OSU began in 2013, with the formation of a student chapter of the American Institute of Aeronautics and Astronautics (AIAA) organization and formation of the first team competing in the Experimental Sounding Rocket Association (ESRA) competition in Green River. A first place win with an altitude of 10,000 ft made history in the engineering program.



The high altitude project began with a discussion in Green River Utah at ESRA rocket engineering competition with SpaceX recruiters in June 2016, who wondered what university engineering students could do with a 'sky's the limit' rocket challenge. So began a Senior engineering capstone design project at Oregon State with one goal: build a rocket to reach as high an altitude as possible. The students had only one constraint: the rocket motor could not exceed a Class 3 FAA waiver, which meant they could not exceed a total impulse of 41,000 N·s. A team of 12 mechanical engineering students, 3 electrical and 3 computer science students started the design of a 2-stage rocket in September 2016. The team added another 6 mechanical engineering students to design and build a tower that would be required to launch a high altitude rocket.

The team faced several a number of new technical challenges in the design of the 2-stage rocket. The propulsion system was comprised of two solid propellant motors that required a very specific burn rate at lift-off in the booster stage and a faster burning motor for the upper stage. The electronics that would fire black powder charges were designed to separate the rocket stages and deploy 2 parachutes for each stage. Extensive testing was required to characterize the properties and performance of black powder at very high altitudes. The upper stage ignition sequence was another challenge and a very common failure mode. It required an innovative front-end ignition system that was integrated into the rocket airframe. With several HAM radio operators as part of the electrical engineering telemetry team, a system was designed to track and recover both stages of the rocket at all phases of the trajectories. The structures team



designed a unique carbon-fiber and fiberglass airframe combination with the assistance of Hood River based Innovative Composites Engineering (ICE). A new composite fin design was needed to withstand the Mach 2.2 speed of the rocket.

Early subscale motor propellant testing was conducted in the OSU Propulsion Lab and full-scale motor test fires at the local Corvallis Airport took place throughout the Winter quarter. The rocket was tested in separate stages in May and early June 2017 in Brothers Oregon due to a limit on the FAA flight waiver of 38,000 ft.

The day after graduation, the team embarked on the 2-day drive to Spaceport America in Las Cruces New Mexico, with the launch rail trailer and 21 members of the team, comprised of both seniors and underclassman. In the first full-range flight in June, the rocket, named 'Probatum' encountered an upper stage motor failure. However, the flight did confirm that the designs of the more challenging components of the rocket and recovery were successful. In spite of a very disappointing outcome at Spaceport, the team was determined to launch the rocket again. There are very few places in the United States to launch a rocket to these altitudes. When the team had the opportunity to participate in the Gerlach Tripoli Balls launch in Blackrock Nevada later in the summer, the team began a redesign of the upper stage nozzle, and manufacturing of new booster and upper stage motors. Ready to go by September!

When the team arrived at Blackrock, they finalized flight logistics with the leadership of Tripoli, a high power research rocketry organization that served as the launch and range safety authority. The day started with a very early morning rocket assembly and preparation, ideal weather conditions and the push of a button. The day ended with a lot of cheering after a great success overall with perfect motor and airframe performance. A small glitch in the firmware deployed the upper stage drogue parachute early, but both the booster and upper stage were recovered successfully. Both GPS data and on-board altimeters measured an altitude of 79,800 ft.

Why is high altitude rocketry important to students at Oregon State University? The benefits of this program to students are easy to quantify: most all of the students on this team are now employed in the aerospace industry or enrolled in graduate







programs. Team members are working professionally at companies, including SpaceX, Blue Origin, Orbital ATK, United Launch Alliance, Aerojet-Rocketdyne, Raytheon and the Naval Weapons Facility China Lake. They have demonstrated the skills required to solve challenging technical problems, and have shown exceptional dedication, leadership as a team, and passion for aerospace. Recognition of student success in rocketry over the past three years played an important role in the administration of the College of Engineering moving forward with the development of a new Aerospace Engineering minor at Oregon State University, the only program in Oregon.

What is next for Oregon State University high altitude rocketry? A new team of mechanical and electrical engineering and computer science senior capstone students is already underway for the design and manufacturing of a new 2-stage rocket. Ultimate goal? To exceed the current university record of 144,000 ft at Spaceport America in June 2018. Go BEAVS!

On behalf of the team and myself, we would like to thank the Gerlach Tripoli community for giving us the opportunity to launch Probatum...appreciated beyond words! We also would like to thank the Oregon Rocketry (OROC) organization for their incredible support. Special thanks to Oregon Tripoli members Steve Cutonilli and Joe Bevier for their unwavering encouragement and technical mentorship for the Oregon State University rocketry teams, both in our many design reviews and in the field. Would not have lift-off without you. A special shout out to John Lyngdal and John Hockheimer for such great support for my Level 3! And last but not least, thank you to Becky, who serves as an inspiration in service to students in all things ARLISS and beyond...you are the best!





## Largest rocketry inventory west of the Mississippi!



All AeroTech new released motor are in stock.  
Check out the new "Witches Sale" on the new website on 10/31!  
Remember to make BAR your one stop shop this build season.  
We now have BAR gift cards just in time for Christmas!

Wishing you clear skies and a safe & Happy Holiday Season!

**SERVICE - EXPERIENCE - SAVINGS**

**Raising the BAR**

*"We treat our customers as we would like to be treated."*