



AEROPAC Fall 2017 Newsletter

Photo by Phoenix 4, courtesy of Curt Von Delius

President's Pad

Greetings, fellow AEROPAC members!

This is the first year that we have ever had to cancel MUDROCK. With the playa under 5 feet of water, launching rockets was going to be a problem. At least Tony got some fishing in. By Aeronaut it was dry enough to launch. We saw some more of that Black Rock wild weather during ARLISS with high winds, rain and hail. That was the first time I'd seen hail out there. I hope next year is not as eventful.

The BLM has laid down some new rules regarding their Leave No Trace requirements. Gas cans must be on a tarp or other secondary surface so that they are not in direct contact with the ground. If it rains while you are parked on the playa and that creates a rut, you have to fill it in so that it is smooth again. The other thing is, don't drive on the playa when it is wet,

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because your vehicle will leave ruts. They will be checking for these things next year.

The Satellite Van is being retired this year. If you know of anybody who is interested in it please let me or Ken Biba know.

The sat van has been costing the club way too much money so the BOD has decided not to keep it. Plus there is some data coverage now that the Sulfur Mine is in operation. It served us well for the years it was needed. Thank you to Ken for all his years of keeping it up and running during the launches.



Photo courtesy of Jim Green

Yeah, I see the gas can on the ground but that was before the BLM rule.

Jim Green



XPRS Extreme Altitude trophies waiting to be awarded to winners



Trip to SpaceX

Monica Daniels, Curt Von Delius

Note: All photos, unless otherwise noted, are from the “Gallery” on the official SpaceX website. No photography is allowed inside the plant.

On June 20, 2017 Jonathan DuBose arranged a tour of the SpaceX facility in Hawthorne, California. Our group included Jonathan, Dick Jackson, Juniper Slouber, Curt von Delius and Monica Daniels. We met for dinner near the complex before the tour began at 7:00pm. We all felt fortunate to be there.

We met our host, Jason who is young, bright and embodies the culture of SpaceX. He is an aeronautical engineer and works in SpaceX Mission Control, is a Dragon Operator and also establishes operating procedures. His team has responsibility throughout a mission to the International Space Station (ISS), including berthing, monitoring, and spacecraft re-entry.

'SpaceX designs, manufactures and launches advanced rockets and spacecraft. The company was founded in 2002 to revolutionize space technology, with the ultimate goal of enabling people to live on other planets.' Go big or go home!

We started by discussing the large pictures on display in the entry hall. We passed the office floor used by all the facilities engineers. Everyone has a cube, there is no big office for management. The ethic at SpaceX is that every position is equally important.

The next area of this massive building is the Mission Control room and back up control room. These rooms are what you might envision, rows of tables with three monitors per engineer. Walls of glass and a huge projection wall allow the SpaceX teams to view the control room and experience each launch.



Examining A Dragon 2 Weldment Unit



Dragon Spacecraft in Orbit



First Re-flight of Falcon booster, launch complex 39A



Suspended overhead is the first Dragon reusable spacecraft that flew to the ISS and back. This spacecraft “berths” with the ISS to deliver supplies. The heat shields show erosion and blackening from the extreme forces of re-entry.

Ring sail chutes are deployed for the spacecraft’s final recovery.

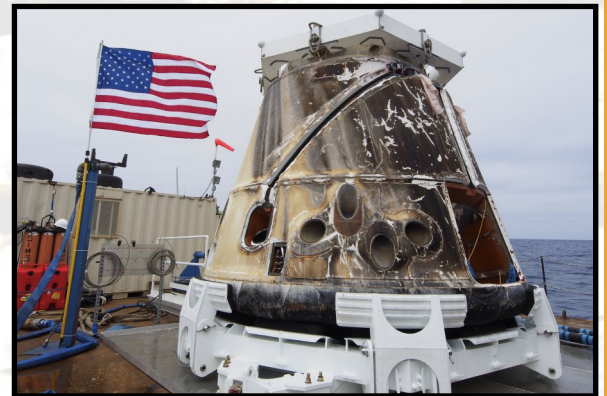
Also on display, is a vacuum version of the Merlin 1D engine developed for the Falcon 9/Falcon Heavy second stage with a thrust on the second stage of the launcher at 934 kN or 210,000 lbf. The Merlin 1D engine has the highest specific impulse ever achieved for a gas-generator cycle kerosene rocket engine. By June 2015, SpaceX was producing Merlin engines at the rate of four Merlin 1D engines per week.

It is well after 7:00pm and the place is bustling with engineers. All involved are definitely “on board” with the goal of building rockets. This is a team effort of epic proportions.

We watched as a team of engineers were assembling the nine Merlin engines into a Falcon 9 Octoweb assembly. A Falcon 9 first stage produces 1.7 million pounds of thrust.



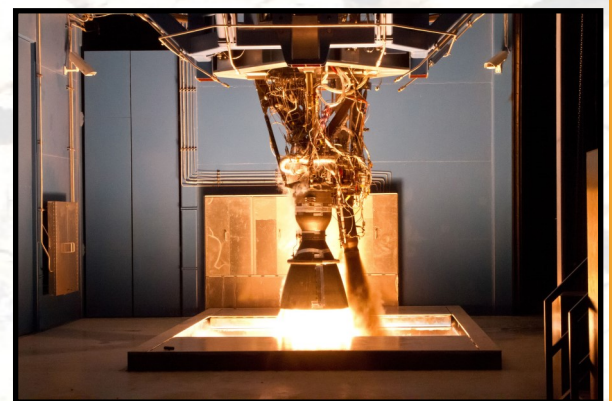
Employees Watching a SpaceX launch



Dragon Recovered after Splashing



Assembling Merlin Engines



Merlin 1D Test Firing at McGregor



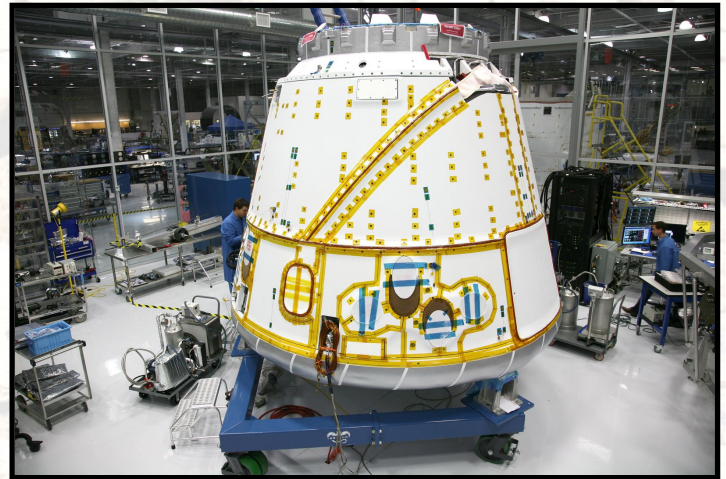
In the massive clean room there were three Dragon spacecraft, each in a different stage of completion. One was just the pressure vessel and one was almost complete and already scheduled for flight. When components are complete they are shipped by truck to Florida or Vandenberg. The nearly completed Dragon successfully completed its re-supply mission to the ISS in August— “Commercial Resupply Services” (CRS-12).

In the expansive composites facility, construction was underway building the fairings for satellite launches. Pre-preg spread-tow carbon fiber is spooled out onto long work surfaces. CNC machines cut the individual plies to shape with great accuracy.

Layups were being performed on giant molds with lasers projecting outlines for the exact placement of each lamination. The composite assemblies are then vacuum bagged and cured. Robotic X-ray surveys are conducted to reveal and correct any potential flaws.

Being right on the production floor, we were able to closely inspect a nearly complete inter-stage. Falcon 9 uses an all-pneumatic stage separation system for low-shock, highly reliable separation that can be tested on the ground, unlike pyrotechnic systems used on most launch vehicles.

It was incredible to view thruster controls and airframe bearings for the giant grid fins so close up. Large high-strength aluminum-lithium alloy first stage sections were being worked on and a Falcon Heavy nose cone was nearly finished, complete with cork phenolic ablative.



Dragon in the Clean Room



Lighting a Fairing Half for Inspection



Falcon 9 Inter-stage on shop floor



Several previously flown Falcon stages could be seen in the facility while being refurbished for their next missions.

All the hydraulic and fuel lines used by SpaceX are manufactured within the facility. Another area houses the 3-D laser metal printing equipment used to manufacture Draco thrusters and other components. Various samples were on display showing the strength and accuracy of this technology.

As we strolled along from where they were building reusable spacecraft, stages, Merlin engines to pre-preg carbon air frames, it became clear that SpaceX is not using much subcontracting for their rockets. In fact, 80% of what goes up with a Falcon 9, in either satellite or ISS CRS configuration, is manufactured at the Hawthorne facility.

By building systems in house, SpaceX has cut the cost of sending a rocket to the ISS by a third. It's all about "reusability" with SpaceX being the first to successfully achieve re-flight of an orbital class rocket.

The engineers who design and build motors and other systems draw from their diverse backgrounds of experience.

The facility is open 24/7 and one thing is obvious, there is a lot of work to be done. The company has booked over 70 launches and also reservations for a trip around the moon.

We finished the tour by leaving the facility to visit the Falcon 9 on display outside. Another veteran of space flight towers hundreds of feet in the air revealing its huge Grid Fins, Merlin engines and standing on composite landing legs.



Previously Flown Falcon 9 Awaiting Refurbishment



Falcon 9 First Stage



Photo by Dick Jackson

AEROPAC crew with our host with first landed Falcon 9 Booster in front of SpaceX HQ, Hawthorne, CA (Dick Jackson is behind the camera)



Ryan Sebastian 1988-2017

Tony Alcocer

I first met Ryan in the forums on Rocketry Planet. He went by the name of RyanS. Ryan was not your typical snotty nosed kid that flew Estes rockets at the local park. Ryan got involved in rocketry at the age of 8 thanks to his uncle and Dad. He flew back east and was very knowledgeable in Experimental Rocketry. Ryan graduated from college with a degree in Mechanical Engineering/ Aerospace. Shortly after gradating Ryan got a job with AeroJet and moved to Sacramento. Shortly after his move to Sacramento I got an email. "Hey Tony where do you get all your Ex chems?" It wasn't too long after that, that he began having drums of "stuff" sent to my house. It was easier for him to have it sent to my place and I did get in on the buy. I'd be at work and get a call from my wife telling me there was another drum on our driveway.

In 2012 Ryan and his long time friend David Hailey began work on a series of rockets named Honey Badger. It was very interesting to see what some good high power rocket guys, with college degrees in Aerospace and working in the biz, could come up with.

2012 - Honey Badger1 40K 42G Mach 2.5 <http://www.rocketryforum.com/showthread.php?42436-4-quot-Min-Diameter-Rocket&highlight=honey+badger>

2013 - Honey Badger2 53K 51G Mach 3.1 <http://www.rocketryforum.com/showthread.php?58793-Honey-Badger-2-Build-Thread-and-Flight-to-57k>

2014 - Honey Badger 2.1 63K 69G Mach 3.9 Mass Fraction 0.53 [http://www.rocketryforum.com/showthread.php?66948-MLP-\(HB2-1\)-Rocket-Flight-to-63k-ft-M3-9&highlight=honey+badger](http://www.rocketryforum.com/showthread.php?66948-MLP-(HB2-1)-Rocket-Flight-to-63k-ft-M3-9&highlight=honey+badger)

Ryan wrote an article for the FALL 2014 AEROPAC Newsletter on the Honey Badger 2.1 flight at MUDROCK 2014.

In 2014 Ryan joined SpaceX. Got married to his long time girlfriend Caitlin and was diagnosed with cancer. When we would talk on the phone it was mostly about rockets, research motors and what other people were up to. Ryan and Caitlin added a new member to their family on June 6th 2017. Little Charlie was born premature. 9 days later Ryan passed away with family and friends at his side.



I always try to make the best out of things when life sucks. I'm still trying to figure out the "good" on this!

"These photos of Ryan were flown to space and returned aboard the first flight of booster serial number 1036 on June 25th, 2017. Ryan was a loved member of the SpaceX community and he will be profoundly missed," Kaitlyn Sebastian



XPRS Contest Winners

Darryl Paris

The XPRS competition heated up once again in the Extreme Altitude contest with new records being broken and some very amazing flights!

17 year old Juniper Slouber, flying in the Tripoli Mentoring Program (TMP) flew his “Snakes Are No More” 54mm rocket to an eye popping 26, 989’ on a CTI K300! Not only did “Juni” take the “K” class trophy but has also applied for the TRA records list (4th best ever).

Tim Robinson and Chris Attebery set new contest records in the “L” and “M” classes.

Dan Michaels from Aerotech offered two completely assembled and professionally painted special rockets for mid power winners. Both rockets specifically built by Aerotech.

All first place winners received trophyies provided by Paris Construction. Loft duration winners received rocket kits provided by Bay Area Rocketry. Extreme Altitude records are compiled since 2015 and are specific to AeroPac’s XPRS launch.

Loft Duration:

A motor class— 1st. Noah Anderson; 2nd. Will Swenson; 3rd. Zoe Paris

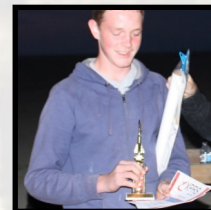


Noah



Zoe

B motor class— 1st. Zoe Paris; 2nd. Max Nobrega; 3rd. Luke Nobrega



Will



Luke

C motor class— 1st. Jack Renny; 2nd. Zoe Paris; 3rd. Will Swenson

D motor class - 1st. Will Swenson

E motor class— 1st. Michael Paris

F motor class— 1st. Luke Nobrega; 2nd Jake Nobrega

G motor class— 1st Michael Paris; 2nd Luke Nobrega; 3rd. Luke Nobrega



Michael Paris with Dan Michaels of Aerotech



XPRS Extreme Altitude Contest Winners

H motor class— 1st. Mike Riss 9387', 2nd. Katelynn Wilson 5127', 3rd. Curt Von Delius 4681'

Record - Joe Bevier 10,538'

I motor class— 1st. Kurt Gugisberg 8219', 2nd. Mike Riss 463',

Record Kurt Gugisberg 8352'

J motor class — 1st. Steve Kendal 9805',

Record - Kurt Gugisberg 12,103

K motor class — 1st. Juniper Slouber 26,989' *, 2nd. Matt Sikkink 21,129'

Old record John Sifling 19,953'

* New record - Juniper Slouber 26,989'

L motor class — 1st. Tim Robinson 19,369' *, 2nd. Chris Wilson 15,665'

Old record Greg Clark 16,229'

* New record - Tim Robinson 19,369'

M motor class — 1st Chris Attebery 37,789' *, 2nd. Matt Sikkink 27,697', 3rd. Gene Engलगau 23,500'

Old record Gene Engलगau 32,011'

* New record - Chris Attebery 37,789'

N motor class — no entries

O motor class — 1st. Mike Ostby 16,377' *

* New record, no previous entry

Two Stage class — 1st. Kurt Gugisberg 24,261'

Record Curt VonDelius 95,786'



Mike



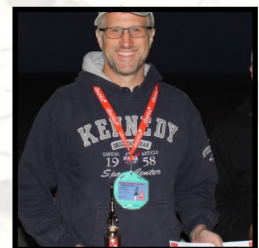
Steve



Juniper



Mike



Tim



Chris



Kurt



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 lbf (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 lbf (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 lbf (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 (1,628 lb-sec)
- Burn time: 1.8 sec
- Peak thrust: 1,740 lbf (7,871 N)
- Delay time: Plugged with anode
- Propellant wt.: 3,246 grams (11.4 lb)
- Loaded wt.: 8,776 grams (19.4 lb)

98mm

M6000ST-PS Super Thunder™

Motor Specifications

- Total impulse: 8,576 N-sec (1,918 lb-sec)
- Burn time: 1.8 sec
- Peak thrust: 1,532 lbf (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

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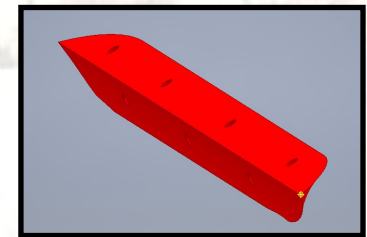
Snakes Are No More

Jonathan DuBose

This is a follow up article on the “54mm-MD-1” project by Juniper Slouber in the Spring 2017 newsletter. As a high school senior Juniper is extremely busy and since I am his TMP mentor and quite familiar with his rocket I offered write up a “results” article especially since Juniper was successful in meeting his goals for the project.

Picking up where the original article left off—Juniper was successful in setting up his high school’s CNC router to create the tenons for fitting into the previously created mortises for fin attachment.

At some point the idea of using 3D printed fillets was generated and Juni created a design in Autodesk Inventor and printed them using Raptor PLA. Some custom fitting was required to get them to properly conform to the airframe and the dual airfoil geometry of the APE fins. The fillets were secured to the airframe and fins using 1/4” and 1/8” 4-40 cup point set screws.



Fillet design

A carbon fiber tip to tip layup of two layers of 1K, Plain Weave Ultralight Carbon Fiber Fabric (“When Strength, Stiffness, Minimum Weight are Key”) was applied giving strength and rigidity to the fin can.

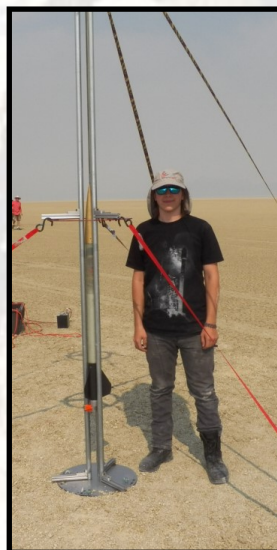
An interesting side note here: Up to this point, the rocket had only a technical designation—not a real name. When Juni removed the layup compression material and ply peel there were some tiny “squiggly” ripples...”snakes” we called them, on the airframe section. We were quite perplexed by the cause of this phenomenon but they did easily sand out and provided an eventual name for the vehicle.

Changes in summer vacation plans afforded an opportunity to attend Aeronaut and get this project in the air.

Early Saturday the winds aloft showed < 5 mph all the way to 30k’ so it was a definite “Go” for launch.

Being Juni’s mentor I installed the deployment charges and the Aerotech K250 while Juni set-up the telemetry system.

Ross Ohmen provided a an awesome LCO and our anticipation grew as the countdown reached zero.



Juniper with “Snakes” prior to, and at recovery of the Aeronaut launch



Snakes leapt out of the APE tower like a cobra fighting a mongoose for its life.

Straight as an arrow and quickly reaching mach 1.875 we watched as AltosUI indicated an apogee of over 22, 500ft and then that the rocket was on drogue (although Grandpa couldn't see or hear the readouts from the AltosUI interface).

Juni's mom (my daughter Rachel) recorded the entire sequence on her iPhone including what turned out to be a quite humorous ending to the whole affair. Juni edited the footage by adding "Replay Flight" from AltosUI.

Here is the first flight of "Snakes Are No More": <https://www.youtube.com/watch?v=ZnKBTTfsZXc&t=2s>

You can skip forward to about 8:35 to see the funny scene unfold. Apparently, just about everyone at the launch knew the rocket landed 66 meters behind us—except us. We got too focused on technology.

Other than a somewhat less than hoped for altitude this was a spectacularly perfect flight. Big smiles and fist bumps were definitely in order.

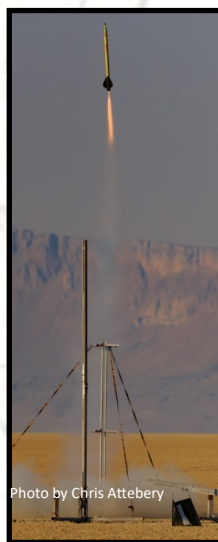
Next up was XPRS . I was able to secure a CTI K300 for this flight. This is the motor that Curt Von Delius and Jim Jarvis used to record flights over 30k' (at the top of TRA "K" records list) so we were looking forward to this flight.

As with the first flight, "Snakes" jumped eagerly out of the tower on it's way to 26,989ft and a recovery about 2.1 miles away. Another amazingly perfect flight.

Juni was pretty confident that he had locked up the XPRS "K" contest and was eager to fly the CTI L265 and take the "L" trophy as well. The rocket was prepped exactly as before using charges made at the same time as the ones from the 2 previous flights. Telemetry indicated an apogee over 27k' but then also a very rapid descent i.e. coming in ballistic. A search of the last known coordinates yielded no results and our faint hopes that someone would find Snakes were in vain.

Juni has filed an application for the TRA records list—26,989' puts him at # 4. He is busy finishing HS, planning for college and also planning his next rocket.

And in a very bold, confident manner was heard to say "Look out Curt, I'm coming for your record." Curt's response? "Bring it on, Juni!"



Snakes flying out of the tower and "in situ" 2.1 miles away on the playa



My 75mm minimum diameter project for XPRS **Chris Attebery** (All photos by author)

I'm weak. I admit it.

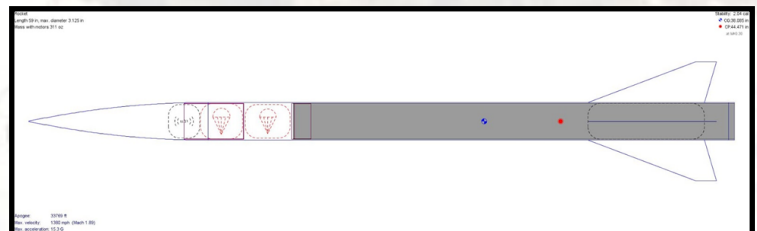
On Black Friday last year I saw that Wildman Rocketry had their Blackhawk 75 kit on sale for a great price and I pressed the "Add to cart" button. I had been looking for a 3" minimum diameter kit with a carbon fiber airframe and the price was just too good to pass up.

To meet that goal I set some objectives for the build:

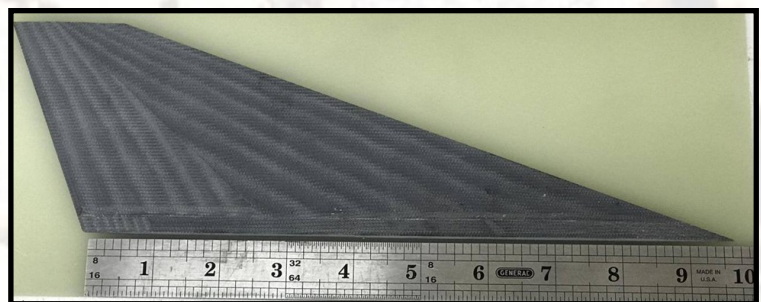
1. Custom design and machine much of the rocket.
2. Build as light as possible.
3. Maintain 2 calibers of stability throughout the flight.
4. Set a personal altitude record.

The Blackhawk 75 is a 3" minimum diameter kit consisting of a filament wound fiberglass nose cone made with high temperature epoxy, a 60" convolute wound carbon fiber airframe and 3 large 3/16" G10 fins. Barely a week had passed before I started simulating and optimizing the rocket in OpenRocket and RAS Aero II. From the beginning I had one goal, fly as high as possible on an Aerotech M685. I realized early on that the airframe was too long and the fins were too big and heavy to be truly optimal.

I decided to use 4 smaller fins to reduce drag and minimize the possibility of coning. I came up with a fin shape that was very efficient and yielded 2 calibers of stability throughout the flight. Both simulators estimated the flight would hit around 34,000'.



I took the 2D fin shape from the simulators and turned it into a 3D modeled swept delta fin with a double wedge airfoil in Fusion 360. The fins were then machined from 3/16" G10 fiberglass. They taper from 3/16" at the base to 1/8" at the tip.

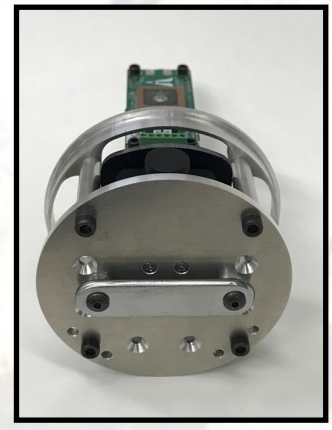
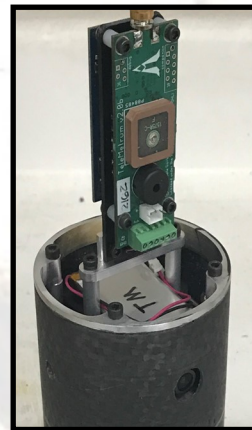
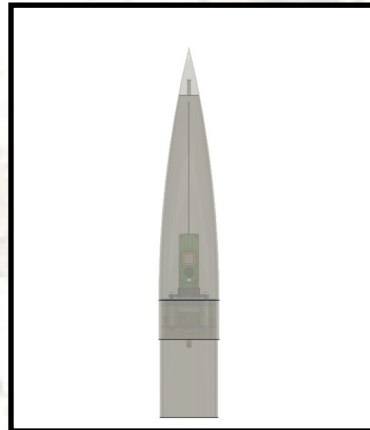


To keep the weight low and maintain the clean aerodynamic shape of the fins I mounted the fins with a 1/2" radius fillet of Rocket-poxy without any other reinforcement.

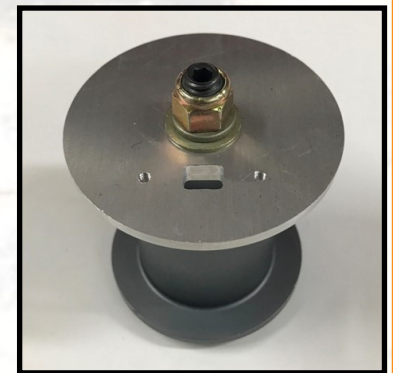
My 75mm minimum diameter project for XPRS

Chris Attebery

The altimeter bay contains my Telemetrum V2, a Missile Works RRC2+ altimeter as a backup, a Mobius Mini camera, three LiPo batteries, and three screw switches. The altimeters are mounted above the shoulder of the nose cone so that the GPS and downlink antennas were not blocked by the carbon fiber airframe. I moved back into Fusion 360 to design the altimeter bay and camera mount. The mounting ring is epoxied into the top of the nose cone coupler. The bay is removed from the bottom and is held in place with 4x 6-32 screws. There are four equally spaced holes around the base of the nose cone for the camera lens and to access the screw switches. The nose cone is attached with a pair of countersunk 4-40 screws with matching pem nuts in the coupler. I able to prep the parachutes and ejection charges in the days before the launch. Then at the launch all I had to do was remove the nose cone to attach the ejection charges to the altimeters. It was very stress free.



To keep the airframe as clean as possible I planned to use a single break to deploy both parachutes. I decided to mount the main parachute in the base of the nose cone coupler and use a pinned bulkhead to keep it in place. The recovery harnesses pass between the coupler wall and bulkhead. The drogue was placed in the top of the airframe. I used a Fruity Chutes 48" Iris Ultra Light parachute for the main and a 12" elliptical for the drogue. The entire recovery system weighs just over 10 ounces. The two parachute compartments take up just 7" of the airframe.



I also designed the combined motor retainer and recovery hardpoint in Fusion. There is a ring of coupler epoxied into the booster ahead of the forward closure. The retainer plate fits on top of this ring and is



bolted to the front of the closure. The recovery harness is inserted through the plate and then a hardened steel dowel pin passes through the harness loop. The pin sits in a slot on the back side of the plate.

On Saturday morning I hooked up the charges and turned on the Telemetry to get a GPS fix. After I got the fix I shut it down and loaded the rocket into my tower. I turned the altimeters back on and saw that the TM was waiting for a lock. My experience in the past was that it had trouble getting lock in the tower but would get a lock once it went into coast phase. Unfortunately this time around it never got a GPS lock. I'm not sure what happened there.

The launch was clean and the boost straight. It turned to the West and AltOS announced the apogee as 37,789'. That was higher than I had simmed by a fair margin. I got altitude data until the rocket was 200' off the ground but I never did get a GPS location.

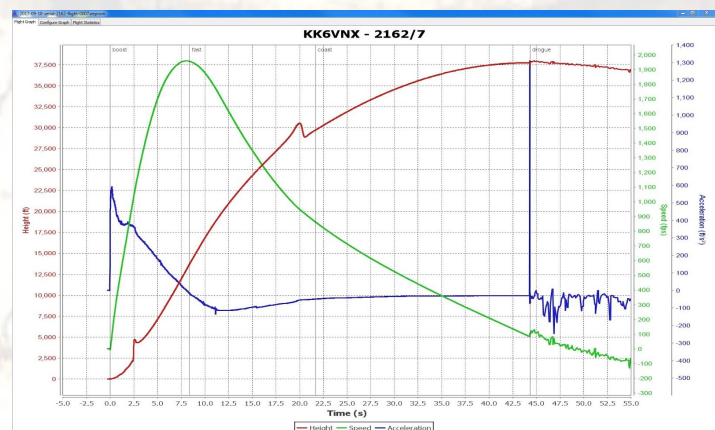
On the ground the wind was blowing from the ENE so I headed WSW and drove until I hit the edge of the playa 5 miles away. I never saw it or got a blip on the radio. I drove back to camp and explained what had happened to Kevin McGrath. He volunteered to bring his RDF gear and we headed back out again. Again we never saw it or got a hint of a signal. We decided to head back to camp. As soon as we arrived a couple people let me know that the rocket had been found 1.5 miles East. Apparently the upper level winds were coming from the West.

Tony Alcocer let me know that he found the rocket and told me congratulations on my L3. We picked up the rocket and headed back to camp. Later that afternoon as I was cleaning the rocket up I found that one fin had cracked both fillets about 50% from the bottom and it was flexible.

Sunday morning we finally got together and agreed that the rocket was not flyable without a repair. So, I didn't get my L3. I had never intended for this rocket to be my L3 project so I wasn't too disappointed. My L3 attempts are a story for another day.

The good news was that I won the AeroPAC Extreme Altitude M Class Competition. I broke the existing AeroPAC M record by 5,778'. It's still a ways off the 45,554' that Nic Lottering got with his TRA record but that was on a full M.

It was a beautiful weekend and I had a great time. Maybe next year I'll try a full M.





Aeropac Launch Director Report – 2017

Gene Engelgau
(All courtesy of author)

MUDROCK

Launch Canceled! – So the big story this year was our season being cut short by one launch, and we almost lost two launches. With the huge rains we had over the winter, Black Rock Desert became Black Rock Lake. The area where we fly was covered by an estimated 40” of water. There was perhaps several feet at our site when Mudrock was supposed to start.



Tony even had a tee-shirt made that said “Black Rock Yacht Club”!

Aeronaut 2017

Thursday Setup – Markus Krauss and I and a few others arrived at the launch site around 5PM. It was dry and the bed was covered by the sort of crumbly “cake” stuff and was otherwise dry. There was pretty much no dust at all at Aeronaut. Setup was mostly just dumping off the equipment and waiting for Friday and more people to show up for setup.



Thursday sunset with Peter Hackett modeling the sun.

Friday morning we had to complete setup. We were finally ready by about 10AM. Here is the Friday flyers meeting. Aeronaut was lightly attended, I think due to some peoples concern that it might still be wet, which it was not. But we had a nice group of hard core flyers. As I recall, Friday was overall a pretty good day of flying.



Friday morning flyer's meeting



Saturday morning's flyer's meeting



Black Rock icon Laura Blaylock with BLM rangers. Laura flew a few rockets.



Wind indicator says "Very Windy"

Saturday started off pretty good, and we had more flyers. Around 4PM the wind came up and was blowing pretty hard for a while. We were also getting little sprinkles.

By Saturday at sunset the winds had calmed down more or less. But it was also clouding up! After I went to bed Saturday about 10PM it started raining – uh-oh!



Sunset soiree



Rain from the previous evening



Jim decided to play in the mud!

Sunday I woke up to wet playa and my flat top shade was sagging in the middle with gallons of water. I dumped it out which made another mess! Because the playa was wet, load out was delayed some until it dried out some. Later in the morning we had some pretty good flying conditions.



Thursday started out pretty good but...

ARLISS / XPRS

Thursday around 4PM it started to look a bit wicked and the wind started to pick up. Within 15 minutes it was raining like crazy with thunder and lightning! I hid out in Mike's BAR trailer during the rain, running over periodically to my camp to secure stuff.



This storm had been forecast since Monday

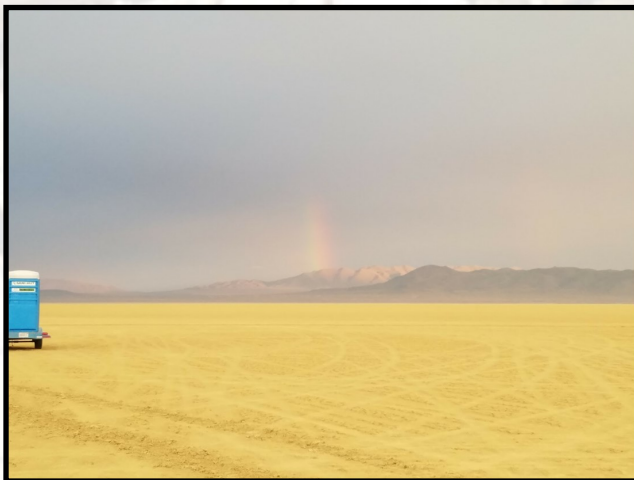


Merrels in the mud



Drowned out camp

After about an hour the rain stopped and the Playa was a mucky mess. A small lake had moved into my camp, which was not really that welcome. I spent the rest of Thursday dealing with the mud and water! By 7PM the Rain moved off to well the east and we had a few rainbows.



Post storm rainbow



Desperately needed porta-potties

After the rain stopped I ventured out to survey the camp. During the rain Markus Kraus showed up at Mike's trailer. He said he barely made it out with the trailer. I see why that was!



Beautiful, clear sunrise on the playa



Friday's flyer's meeting



Saturday's Flyer's meeting



Dark Energy after its flight on a M650 at 2.4 mi out.

We woke up Friday to some nice weather but a wet playa. We had to wait till about 10AM till the playa had dried some to start the launch.

Like Friday, Saturday started out good but it was a bit hazy up high. We later had a somewhat persistent layer of clouds most of the day.

Sunday – For me no flights Sunday and I focused on getting things packed up and then helped with club load out done.

The End until 2018 Season!



Oregon State Engineering Prof Nancy Squires Certifies Level 3, and Then Flies ARLISS Nancy Squires

Nancy Squires on Nancy Squires: After a BS degree from UCSD in Mechanical and Aerospace Engineering, I started my career at General Dynamics with the Titan-Centaur Voyager and II trajectory group. Ended up getting a PhD along the way in Applied Mechanics, doing combustion modeling and propulsion-induced vibration analysis...fun! My husband, Ed, was leader of a number of programs at Lockheed, including Atlas and THAAD. I had the opportunity to teach at a number of universities including Colorado School of Mines, Stanford and University of Texas. We retired (supposedly) to Corvallis Oregon in 2005. I teach at OSU and serve as faculty advisor for OSU AIAA. I am honored to serve on the Experimental Sounding Rocket Association (ESRA) Board of Directors and am Affiliate Director of Oregon NASA Space Grant. Being involved with students doing rocketry is the most fun though!

It does not seem that long ago that a group of students had the idea, or rather the inspiration, to take on building a high power rocket as part of the mechanical engineering program here at Oregon State University. In 2013, we approached Oregon Rocketry for mentorship. Joe Bevier, John Lyngdahl and Steve Cutonilli answered the call to help students design, build and launch the first OSU competition rocket in the International Rocket Engineering Competition (IREC) at Green River Utah. What followed that first year was an intense interest among students in rocketry, and the opportunity for OSU graduates to be a part of the professional aerospace engineering community. My mission as their faculty advisor, was to not only inspire and technically challenge students in the classroom, but figure out a way to insure a culture of safety and mission assurance. Which meant, of course, that I had to obtain Level 1, 2 and 3 HPR certifications before any of my students did! What started out as a student interest project, has evolved into a passion that has led me to participate in rocket launches at Brothers Oregon, Blackrock Nevada, the Mohave desert in California and Spaceport America.

My L3 certification challenges were met with the amazing assistance of NAR and Tripoli members John Lyngdal, Joe Bevier and Gary Lech. Many thanks to all of them for their support in this great adventure. This was my second year at the ARLISS event, and seeing what Becky and the students are doing there was truly inspirational. I was very happy that my L3 flight on a 6' fiberglass airframe and Aerotech M1780 motor at ARLISS performed well.



**Nancy with her L3 /
ARLISS nose cone**



Naturally I was nervous at the countdown, but significantly more nervous when the same rocket flew an amazing rover payload for the Technical University of Tokyo. It is one thing to lawn dart my own rocket, but a year's worth of student robotics efforts is quite another. When these brave students asked me how long I had been an L3, I had to tell them about 3 hours...at least I had a smile on my face to reassure them that the rocket had successfully certified.

When I first considered an L3 attempt a year ago, I knew it would be a challenge, and that if successful, I would join a unique group of individuals that inspire and mentor others. It is an honor and privilege to be part of the rocketry organizations like Tripoli and NAR that do so much to promote the science and safety of high power rocketry. I cannot quantify what this has done for my students here at OSU in the challenges we face in university rocket engineering competitions and the skills they take with them to jobs in aerospace companies.

Once again, many thanks to everyone at the ARLISS and BALLS events for their help and support. I am fortunate indeed to have the unwavering support of my husband Ed...now as an L3, we begin serious discussions on how we can spend our discretionary income.



Nancy's ARLISS rocket lifts off with a student payload

See you at Blackrock 2018!

Nancy Squires, Ph.D.
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NAR President John Hochheimer preps his ARLISS rocket



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





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ARLISS 2017

Becky Green

I can't believe another ARLISS has just ended. ARLISS 2017 was our 19th ARLISS. Where has the time gone? Next year is the 20th year. Who would have thought it would have gone on so long?

ARLISS 2017 began on Sunday, September 10th at Bruno's when the students had their meet and greet meeting that ended around 3:00 pm. By about 3:30 the cars all started arriving to help set up camp. We had a slight delay setting up due to the fact that our ARLISS trailer was missing for a few hours. During those hours, we were making plans to call AeroPac members who lived in Sparks to go buy tables, chairs and shade tents and we were busy emptying trucks so we could drive to Sparks to pick everything up and bring back to set up Monday morning.



Photo by Becky Green

Sunday afternoon: Here they come! Student teams arriving on the playa

However, Jonathan and Matt were bound and determined to find it. They found it stuffed between the storage units in the wrong storage lot. It was really strange it was even missing because Jim and I saw it Saturday around 5:00 pm in its normal spot. It took a while to get it out because Jonathan's truck was too big to fit in the spot they put it in. Once Sunny's son moved it out....they hooked it up and got to the launch site.

While we waited for the trailer to arrive....teams set up the goal flag. Just as they finished setting that up....Jonathan and Matt arrived with the ARLISS trailer. Thanks to you two for working with Sunny to figure out where the trailer was



Photo by Becky Green

Setting up the goal/flag



and delivering it out there.

Luckily we had lots of students who helped unpack and set up the entire ARLISS camp in record time.

Also, while the students were waiting to set up camp Mike and Marla Parker along with Paul Forrester arrived with the equipment trailer. Wow.....that's one heavy trailer.....thank you for getting it out there. We gathered a team of volunteers who started setting up the launch site.....but basically I think they just dropped it off since we were all tired. I helped a bit....but had to go help with ARLISS set up. Thank you to all who helped....you know who you are.

Monday morning they were all back for our welcome meeting at 8 am. There were 16 teams from Japan, (2) from South Korea, University of Hawaii-Windward Community College, University of Louisiana @ Lafayette and Peru who joined us at ARLISS this year. Costa Rica was there again as well....but this year like last year they didn't send ARLISS students... they sent another team of seven students and 1 professor to get their Level 1 and Level 2 certifications. Now that last year's students have been members of Tripoli for a year they are going to start their own Prefecture. Even though last year's students wanted to join ARLISS this year....they and some of this year's team joined a different satellite competition in Mexico about a week after ARLISS. I just received word they won the competition. CONGRATULATIONS to the entire team!!!! Let's hope they join ARLISS next year. The team this year was also able to observe the entire ARLISS event like the students last year.....so hopefully they have lots of good ideas for next year.



Photo by Nancy Squires

Setting up the ARLISS infrastructure went quickly



Photo by Becky Green

Monday morning orientation meeting



By the time the meeting and registration was completed, couple of hours later due to some confusion and having to re-write receipts several times.... the teams were ready to start flying so I started assigning flights.

Also....in addition to ARLISS that morning, I had the rocket building class on the playa going on. Costa Rica's seven students and one professor arrived Monday morning about 7 am. After breakfast, the ARLISS meeting and registration....we went to my camp and started the class. The kits we used were the same S4 rocket kits on steroids....LOL....just like the ones we used last year.

Since they had to leave Thursday evening, we once again were on a tight schedule and had to get the rockets finished by Tuesday night or Wednesday early so they could fly L1 on Wednesday take their tests, and fly L2 on Thursday.



Sorry....back to ARLISS.....A few weeks before ARLISS....I had 5 flyers contact me and let me know they were unable to attend so it was looking like we'd have a very low volume of ARLISS flyers. I started to panic but with one email I was able to find someone who recruited 4 new fliers and I heard from 1 of our L2 fliers that he was doing his L3 on his ARLISS bird. YAY....back up to my original numbers.

Last year Nancy Squires from Oregon State was hoping to bring an ARLISS team this year. However, the team was so busy with ESRA competition that there was no time for an ARLISS team. So Nancy did one better. She got her L3 on an ARLISS rocket and flew several ARLISS teams during the week. There were two other ARLISS flyers (Paul Forrester and John Hocheimer (NAR President)) who got their L3's on ARLISS rockets and flew several ARLISS teams during the week. We also had two other OROC flyers join us this year: Gary Lech and Joe Bevier. Joe used John's rocket when he left and Gary flew the Gumby rocket. Everything worked perfectly until the parachute stripped and parts of Gumby fell to the ground. However, Gumby survived to fly again, but I think the booster and payload section needs to be repaired.

We managed to have 7 flights on Monday....which was really low....due to the fact it was an absolute perfect day to fly. No "W" at all.

Tuesday again was a beautiful day to fly but we only had 9 flights ready and Wednesday another beautiful day had only 12. We were scheduled to have 44 flights and we knew Thursday was supposed to have some bad weather come in. Well....as expected Thursday had some ugly weather off and on during the



day. We did however manage to get enough lulls in the “W” that 6 flights were flown. Well short of the scheduled 44 flights. We did manage to get 35 flights total. Better than last year but still short. Let’s hope next year (our 20th year) that the teams are ready early and fly often.

Once again it was so slow that our Motor Wrangler volunteer Peter Hackett didn’t have to clean any cases. Of course, I’m sure he appreciated it since he was very busy with his own awesome projects.



Photo by J. DuBose

A couple of flights were made using the Aerotech M1340W DMS motor. These motors use the same grains as the M1419W and are simple to build. However they require a 12hr minimum cure time for the epoxy. Matt Sikkink built and flew one—very nice. Jonathan and Matt built 4 more but due to the bad weather on Thursday they were not flown.

The lull did however give me time to help Costa Rica with any questions they might have had during the build. They really didn’t need me much since they had experience building kits in last year’s Costa Rica rocket camp. I did, however, get to show them some techniques that are hard to describe in writing, so everything went really smoothly.



Photo by Becky Green



Photo by Becky Green



Photo by Becky Green

Costa Rican students studied while epoxy was drying, ready to fly and celebrating L1s afterward

As I mentioned earlier in the article.....the weather was supposed to be bad on Thursday. Yes, there were some lulls....but the students were still taking their tests. No one wanted to fly until everyone was finished so it became late in the afternoon before everyone was ready. While waiting they took time to paint their rockets before the second flights.

I would like to give a big thank you shout out to Peter Hackett and John Hocheimer for their help on Thursday. OMG....they were soooooo awesome. Peter drove John to the airport to rent a car and the two of them did all the Costco shopping for the banquet food. Peter schlepped all the food and drinks into the Gerlach Community Center by himself and that was a huge task. So for that....thank you so much



for doing that....it was such a huge help to me. I know I could have probably found someone else to assign the ARLISS projects and keep registration going and go shopping myself....but I was sure glad I was able to stay there to work and also make sure the Costa Rican students got their level 2 certification flights in the air.

Finally everyone was ready to put their L2 motor in. They packed their parachutes again just as Dan showed them but had to reef them since the storm was approaching and the "W" was getting stronger. There was no time to mess around. We had broken clouds and blue skies above us but coming from the south was a huge cell about to hit us. They all ran out....hooked up their igniters and ran back to start launching. Jim was there watching each one and I was barely able to say their names and 5..4..3..2..1 launch....next one, next one until they were all gone. I think that was the fastest a rack has ever been cleared. Just as we launched the last one.....I felt a couple of rain drops. I took off on my motorcycle to disable the chute on one rocket....Tony did the other one and they went off and got the other 6. By the time I was riding back the hail started. I was getting pelted but found them just as they picked up the last one and I had them follow my track to the other two.

When they got back to camp it was just about to get really bad. We all jumped in the RV and just sat around eating dinner, packing all their stuff and talking about all of the wonderful/funny stories that they experienced while at Black Rock. Before we knew it several hours had passed and the playa had dried enough to get them off of it safely so they could make their flights the next day.

Unfortunately with the bad weather Thursday night....I totally forgot to arrange a ride for myself to the banquet. I also now needed a ride for the helpers I managed to scrounge up Friday morning while I was begging for eggs. Thanks to all who were able to lend me some eggs. Oh yes....in addition to forgetting to arrange a ride and find folks to help....I realized I didn't give the correct egg count for the Costco run. Luckily with the help of others.....I managed to get enough eggs to feed everyone at the banquet. Since this happened.....we were all a little late arriving to the banquet. But....by the time we arrived.....there were so many hands to help set up the tables and chairs that we just ran in the kitchen and started with all the food. Plus we even had the University of Louisiana @ Lafayette help in the kitchen. No one stopped until everything was cut up and placed on the tables. We only started eating about 20 minutes



Got to look good for your L2 cert flight!



Post storm the new L2s pack up as night falls



late.....not too bad.

While the presentations were going on.....I had to go to Brunos's to buy 3 dozen replacement eggs and thanks to Peter and Evan who were able to get 2 dozen more on their way in. I was able to replace them all without having to borrow Joe's truck and drive all the way to Fernley.

I don't have the final results of which team won....but I do know that there were two teams who actually touched the cone and stopped this year. This is just amazing to see how incredible the team projects have progressed over the years. I was really impressed last year that there were three teams within 17 meters (I think it was 2, 5 and 17) from the flag. Now there were two teams that actually touched the flag/cone and stopped. WOW THAT'S IMPRESSIVE!!!!!!!!!!



Photo by Gary Lech

Students' group photo outside of Gerlach Community Center

I just want to say a BIG THANK YOU to everyone who made this a spectacular ARLISS. If I missed your name please don't be mad....I'm probably having another senior moment....LOL.

Jim Green, Paul Forrester, Mike and Marla Parker, Dave Raimondi, James Marino, Matt Sikkink, Jonathan DuBose, Erik Ebert, Jake Hudson, John Lyngdal, Joe Bevier, Nancy Squires, John Hocheimer, Gary Lech, Peter Hackett, UNISEC, all the students and of course Aero-Tech's very own Karl Baumann for delivering the motors. Without all of you ARLISS wouldn't be possible.

NAR President John Hochheimer congratulated the students and the AEROPAC organizers at the closing.



Photo by Gary Lech



8 years to Recover

Tony Alcocer

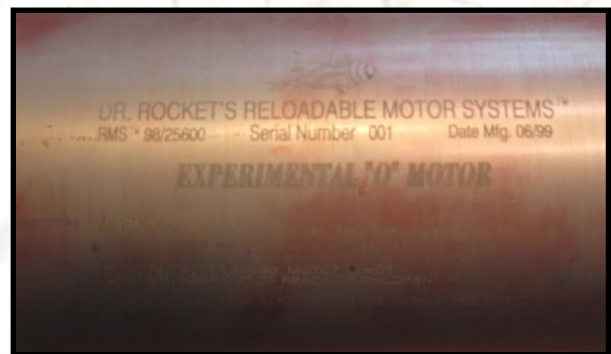
(All photos courtesy of author)

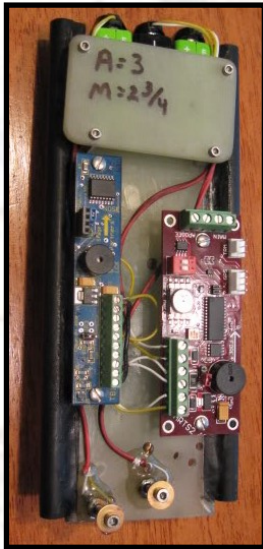
Luckily, this is not a story about me trying to recover from an injury or a health issue. Instead, is mostly a story about a motor case. Yep, a motor case. A very rare, one of a kind motor case, to be exact. Most of us have been around long enough to know about Dr. Rocket motor cases.

Dr. Rocket was a nickname given to Michael Reiner TRA# 831. Mike had obtained his L3 flying an all metal N2000 powered rocket for a successful Level III Certification at Balls 8 (1998 Utah). I believe it contained a modular aluminum fin can. After his certification flight Mike was looking for a project that was a bit more challenging. He had a few "special" items made for himself by the company making the motor cases. One of the items was a RMS 98/25600 Serial # 001 Date 06/99 Experimental "O" Motor.

Mike never got around to flying this project. The case was sold and passed hands several times. One of the sightings of this case was by Ken Finwall. In 2004, it was spotted at CTRA/Narconn Invitational XI, where 13 year old Steven Heller wanted to buy it. Instead, the case was sold to Eric Stackpole. Eric had the case for a few years. He had been "using" the case, as a mandrel to layup body tubes. I entered the picture in 2009 when I purchase the case from Eric. I may have had to promise to fly it as part of the purchase agreement!

When I got the case the anodizing was already faded. I never did hear how it got that way. I like long motor cases and have had pretty good luck making research loads for them. I ran some BurnSim numbers using Swamp Gas. SG is a very forgiving formula and it works very well for very long motors. This case takes 59 inches of propellant. The 98/15360 case takes 36 inches. My BurnSim numbers looked pretty good. Now I needed a rocket to put it in. I decided to go with a fin can and enough "rocket" to hold the chutes and electronics.





I met AJ, his wife Ali and Woody at Balls 18 in 2009. The case was actually going to get to fly finally! The morning of the launch the temperature was down in the teens. It was freezing cold. We got the rocket on the pad and pointed in the right direction. We're hearing all the right beeps and flashes and are getting signals from the beeline GPS and Tx. So we let her fly!

Everything was going great! For about the first 20 seconds! First, we lost GPS lock. No biggie this thing is screaming. Then we lost Tx. Then we began to wonder what the heck happened. Woody thought he heard it come in hot out to the east of us. Then we began to think with the cold temps, did our batteries give up? We looked and we looked, then we looked some more. No sign of it anywhere. I began to look at the bright side of things. The motor didn't CATO. The rocket stayed together and didn't rain fins down on us. So it kind of worked and we go home.

End of Story

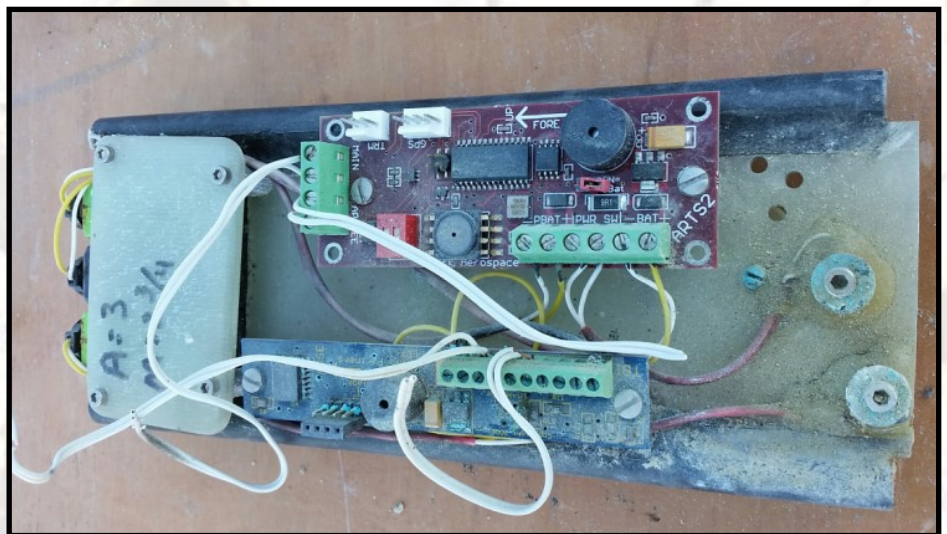


And Now....the Rest of the Story.... 8 Years to Recover

Don't you hate stories that end this way? I sure do. I have too many rocket stories that end with "Rocket Misplaced @ Black Rock"

Fast forward to Balls 2017. I'm not having the best of luck with a couple of my flights. I'm just getting back from recovering one of them and Becky yells over "Hey Tony I think they found one of your rockets." I've always felt that if I misplaced enough rockets out at Black Rock, someday I might start finding some of them. Anyway, I go strolling over to the LCO table and as I approach I see it!

My first thought was- It worked! It was fully intact. I carried it back to camp and looked it over. The chutes and shock cords are now garbage after laying out in the elements for 8 years. I had to use a hacksaw to open up the electronics bay. It looked pretty good. The Beeline GPS is still wrapped in its foam padding. I realized Greg with Big Red Bee was just a few camps down from me. I took it to him and told him the story. He was amazed that it was in such great shape. He kept it to tinker with it at home. I put the rocket back together and I was a happy camper.





Once back at home I turned my attention to the motor case. The closures came right off as did the fin can. The 2 piece liner slides right out. Status of motor case - usable! The fin can looked great. Status - minor sanding = usable! Body tubes and nose cone - may be usable. Next up were the electronics. What's the chance of them working? I started with the ARTS 2. I got it hooked up and had issues with the program seeing the ARTS (which is a very normal issue with them). With just the right turn this on, plug that in and open this up, it connects and downloads the flight data. Next was the G-WiZ LCX. It had some corrosion issues that I cleaned up with electrical parts cleaner and then some denatured alcohol. Plugged in a battery and....nothing. Not a single beep, no sparks or even that magic smoke that's normally inside these kinds of things. It's dead.

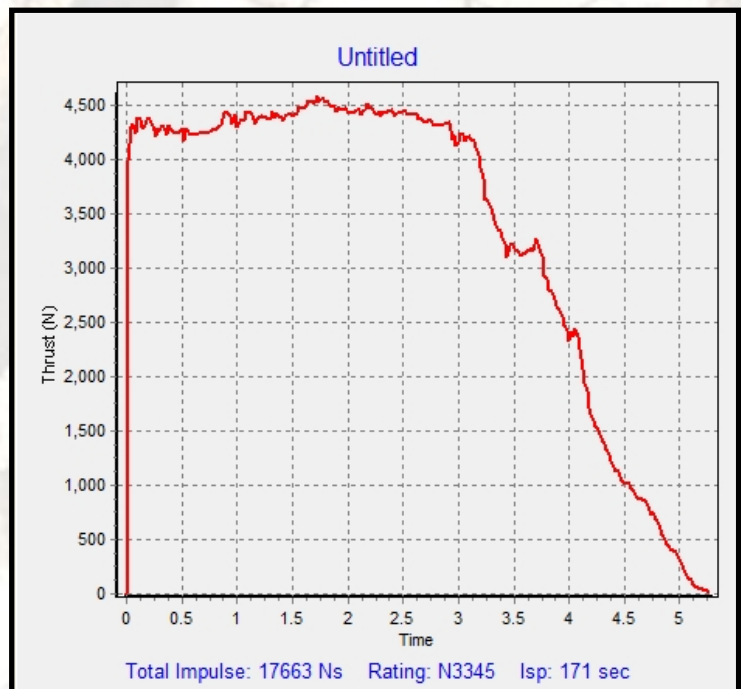
I got an email from Greg with the GPS file. It shows that the Beeline lost signal a few seconds into the flight. It re-acquired at 14,000 on its way down. It landed 6 miles to the North-east from where it was launched. The ARTS data was just under 41,000 feet mach 2.3 and 20G's with a nice burn profile.

So, what did I learn? #1. Don't give up so fast on the tracking. We may have been preoccupied with 'poor us', and should have continued tracking for several minutes longer than we did. #2. Things are not always lost! Sometimes they are just misplaced!

I want to thank the Alaska Crew for finding it and especially Nick, for not thinking it was "Playa Junk" the second time he walked over it!

PS...Look for the second flight of this Rocket at Balls 27?

Video of flight... <https://www.youtube.com/watch?v=ngiqZPfVSJO>





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