



## November 14th LUNAR Meeting:

### Rack Rocket Build Session

Come to the November 14<sup>th</sup> meeting - we're going to build 18mm 4-motor rack rockets! See Tom Desmarais' article starting on page 7 in this issue, and the plans on page 10. Rack Rockets go high and spit out hot motors, so are most suitable for launching at Snow Ranch on a green, quiet day.

The meeting starts at 7:30 PM with a short business agenda. This LUNAR meeting will be held at the Carnegie Building, 2155 Third Street in Livermore. See the LUNAR website for detailed driving directions.

### Next LUNAR Launch

At press time, details of the next LUNAR launch were unresolved. We foresee very slight chance for launching at Snow Ranch in November; most likely the first launch of the Snow Ranch season will be December 1<sup>st</sup> (December 8<sup>th</sup> alternate).

Stay tuned! Check the website (<http://www.lunar.org>) for updates. Subscribe to the LUNAR Announce email list to get information about launches and other LUNAR club business. More information about LUNAR email lists at: <http://www.lunar.org/docs/lists/lists.shtml>

## In This Issue

November 14 <sup>th</sup> Meeting .....	1
Next LUNAR Launch .....	1
In This Issue .....	1
Range Head .....	2
Launch Site Report .....	2
September 19 <sup>th</sup> LUNAR Members' Meeting Report.....	3
October 17 <sup>th</sup> LUNAR Board Meeting Report.....	4
Note From The Editor .....	4
NAR Annual Meeting .....	4
Patterson Sports Park Demonstration Launch Report .....	6
Rack Rocket .....	7
Rack Rocket Plans.....	10
Who we are.....	11
LUNAR Calendar.....	12

## In This Issue



LUNAR Members' meeting



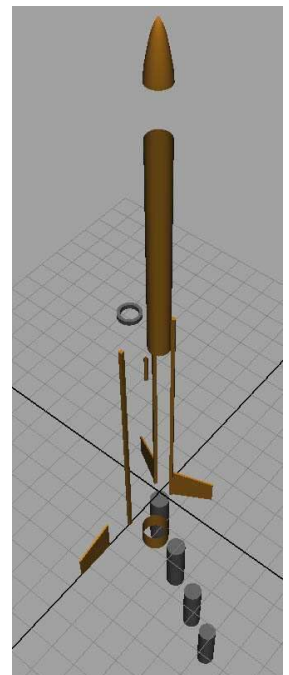
Who is that man and how is he going to launch that big old thing?!???

(see page 4)

What do you get when you assemble all these parts?

(see page 7)

All this and more ... Inside!





## Range Head

Craig Saunders, President, LUNAR #890, NAR #76743

I've really felt a change of season this month. After the last Robertson Park Launch blow-out, it seems like everyone took a little time off to recover. Some members went to Hawaii, others took the Pyro3 tests and/or applied for LEUPs (including Tony Cooper, Kimball Tucker, Martin Hall, Gene Engelgau), Jack Hagerty went to NARAM (as usual) and picked up our trophy for winning the newsletter of the year (not so usual), and a bunch of folks hit the Aeronaut, ROC, TCC & XPRS launches. (Yeah, I got blown out a couple of times up at Black Rock.)

But with school starting, our thoughts turn back to LUNAR activities. I've personally gotten a lot of inquiries from parents at my daughters' school about flying rockets. I'm not sure why except maybe it's the "Rocket Geek" t-shirt that I often wear. And there are the usual queries from members about finding another low-power field (more on that later). And now that TARC registration is open, we're getting lots of interest in participating after Newark HS won last year's national finals.

So it seems that we've turned a corner and it's time to knuckle down and get to the serious business of building and flying rockets... Don't wait – even if the next LUNAR launch ends up being Snow Ranch, that's still really soon.

As mentioned above, this year NAR recognized LUNAR 'Clips as the best section newsletter. We've been a runner-up many times but it's nice to see the judges confirm what we've always known – that 'Clips is awesome.

Cliff Sojourner has done a great job editing, publishing, writing, nudging 'Clips for the last couple of years and you ought to clap him on the back the next time you see him. But there are lots of other folks who have contributed to 'Clips success. We should remember Geoff Canham, who set the stage for this year's success with the many years of work that he put into 'Clips before Cliff. Then there are the many contributions from members - something that the judges look for. But more than that, getting contributions from lots of folks also makes 'Clips more interesting to all of us. So, if you've contributed, clap yourself on the back! And if you haven't written an article yet, then do so soon! And you'll be able to clap yourself on the back when 'Clips wins next year!

## TARC 2008 Underway

TARC 2008 has started with team registration opening on September 5<sup>th</sup> and continuing until November 30<sup>th</sup>. This year, the goal is to fly a payload with two eggs to an altitude of 750 feet and 45 seconds total flight time.

If you're listed as a mentor, you should have already gotten various TARC materials from Trip. Be sure to check out the changes in rules and that Trip has the right contact info for you. If you're not a TARC mentor, then go to the TARC website ([www.rocketcontest.org](http://www.rocketcontest.org)) and sign up.

Teams can fly with LUNAR at the Snow Ranch launches. We're working on securing a local field for the January-April period when teams will want to fly multiple times as they refine their designs. So don't let the lack of a launch site deter you from promoting TARC to local schools and youth groups.

## Education Director

We're still looking for someone to co-ordinate meetings and speakers. It's not a huge commitment compared to some of the other positions in LUNAR. But you get a chance to meet lots of great folks and learn about things you are interested in. So if you're interested, please drop me an email ([president@lunar.org](mailto:president@lunar.org)) or call me (at 925-324-2400). LUNAR could really use the help!

## Coming Soon...

We're considering having a RockSim class on a Saturday in November, if there's enough interest. We figure that's a good time to educate new TARC participants on how to use RockSim. But I was reminded how useful it is by Mike Sunseri during his presentation at the October meeting – he used RockSim to create lots of low and mid-power models, including many using clusters. So everyone is welcome to join in.

Snow Ranch season is coming soon! But remember that it's dependent on enough wet weather to turn the grass green. So don't be surprised if the November launch doesn't happen.

Suggestions, comments and offers of assistance are always welcome. ☺ Just email me at [president@lunar.org](mailto:president@lunar.org) or give me a call at 925-324-2400.

## Launch Site Report

Craig Saunders, President, LUNAR #890, NAR #76743

With TARC 2008 starting up, the pressure is increasing to find a new year-round field. Unfortunately, we continue to strike out in securing a new field.

We had a trail launch at the Patterson Sports Complex Park on 10/27. While that launch was a success with a couple dozen flyers and 91 flights, it did identify some issues that need to be worked on before we try to hold another launch there. (Especially, dealing with the construction that just started!)



There continues to be some interest in finding a field between Davis and Sacramento. Mike Sunseri is investigating a couple of possibilities. But he needs help and support, so if you live or work up that way, please give Mike a helping hand.

In Livermore, we're still working on a number of private properties both north of 580 and south-east of Livermore. But there's no news yet worth reporting on them.

On a less active track, we haven't given up either on NASA-Ames and a couple of locations in Newark...

That's it for now. When there's more concrete news, I'll be sure to post it on the website and the email lists...

Suggestions, comments and offers of assistance are always welcome. ☺ Just email me at [president@lunar.org](mailto:president@lunar.org) or give me a call at 925-324-2400.

## LUNAR Members' Meeting Report

Dave Raimondi, Secretary, LUNAR #1221, NAR #82676

### Minutes From 19 September 2007 LUNAR Members' Meeting

Newark Memorial HS, 2007 TARC First Place Winner, has been invited to participate in Student Launch Initiative (SLI). This is a NASA-sponsored event which is open to the top 25 TARC teams every year. Congratulations again to Newark Memorial HS and their mentor Alan Thym. In addition to the SLI competition, Newark Memorial HS is also going to have three TARC teams participating in the 2008 challenge. This year's contest is to launch 2 raw eggs to 750 feet and flight duration of 45 seconds.

Mike Sunseri, the guest speaker for the meeting, presented finishing techniques. Mike does an absolutely beautiful job finishing his rockets. He spent a good part of his presentation going over paint supplies and how to make you



own decals. Mike is using a freeware program for designing his decals. Serif DrawPlus 4.0 can found at Download.com. Mike had lots of good building tips as well. Look for Mike at the next LUNAR launch, he will be the guy carrying around the super looking rockets.

Mike gave away a bunch of goodies: home made decals and completed rockets.



Smiling faces – thanks for the loot, Mike!



After Mike's talk, Past President and NAR Representative Jack Hagerty presented the LAC Trophy to LUNAR and newsletter editor. With stealth and cunning, we opened the secret box of stuff that goes with the trophy. You'd never believe, the box was full of )@#\$\$% & NO CARRIER

*The last thing at the meeting was opening the box – this was nearly as dramatic as the scene in Raiders Of The Lost Ark, when they open the Ark...*

If we get lots of rain between now and November, the next scheduled launch is November 3rd at Snow Ranch. Everyone should start doing a rain-dance at least once a week. (And wash your cars, because we know it agitates the Rain Gods – ed.)

Hope to see you at a meeting or launch soon.



## LUNAR Board Meeting Report

Dave Raimondi, Secretary, LUNAR #1221, NAR #82676

### **Minutes From 17 October 2007 LUNAR Board Of Directors Meeting**

The LUNAR BoD held a planning meeting for the coming year. The launch schedule for Snow Ranch was determined so that we can get the FAA Waiver filed for next year. We also talked about and planned the logistics for the up-coming Snow Ranch launches.

The TARC launch schedule was also discussed. We will make a presentation to the LARPD requesting permission to hold the TARC qualification launches at Robertson Park in February, March and the first weekend in April. We will publish the TARC launch schedule when we receive permission from the LARPD BoD. The TARC teams are welcome to fly at any of the club launches. Please come out and have a great time at Snow Ranch.

The longest running topic as of late was kicked around again... Where is the new launch site?? The answer... possibly in Patterson for the moment. We are actively looking and hoping to secure a new launch site near Livermore. If you have any leads, please let the BoD know so that we can approach the property owners.

I have noticed that I must be the only one doing rain dances. Obviously I am not very good since we have not had enough rain (at this time) to hold the November HP launch at Snow Ranch. Everyone should start doing a rain-dance at least twice a week. Don't forget to wash your cars, the Rain Gods hate it.

## Note From the Editor

Cliff Sojourner, LUNAR #1212, NAR #82864

Even without regular monthly launches, the last three months have been busy for LUNAR.

First, we LUNARtics were honored and thrilled to receive the NAR LAC Newsletter Award. I had prepared a little speech for the LUNAR members' meeting, but Jack did all the talking so I didn't have to say much. Fortunately, I did have a chance to mention by name everyone who contributed to LUNAR'clips since I've been editor – nearly 50 different people! My sincerest thanks to everyone for all your excellent contributions: articles, photos, meeting minutes, technical tips, pre-release reviews, jokes. The only thing missing is poetry, ha ha.

LUNAR does what we do because it works for us, and we're going to keep on doing it the same way. Still, it's flattering to have our good work recognized, thanks NAR!

Second, The LUNAR Board of Directors has been busy with launch site search, calendar, waivers, demonstration launches, TARC support, and more. You can read all about it right here.

Third, thanks again to this issue's contributors. Hope you enjoy this issue as much as I've enjoyed putting it together. Meanwhile, I've washed all the cars at least twice.

## NARAM 49 – NAR Annual Meeting

Jack Hagerty, NAR Representative, LUNAR #2, NAR #55105

### **LUNAR'clips wins LAC Newsletter Award!**

As you know, LUNAR doesn't compete much in official NAR contests. Despite LUNAR Contest Director Tom Desmarais' best efforts, we only had two contests this year. We try to compensate by joining in on two peripheral competitions, the Section of the Year (SoY) and the LAC newsletter award.

For the past 10 years we have been coming in second or third on both of these. SoY measures the amount of outreach that clubs do and recording the events has always been hit or miss. For the '04-'05 contest I decided to take care of that and created a spreadsheet to track all of our events. Wow! Huge number! I sent it in to the Section Event chairman who was likewise impressed. He was less impressed that I mailed it three days late, and had to tell me that we had technically won, but he couldn't award us first place because I missed the deadline. As a sort of consolation prize, he made my spreadsheet (with upgrades by our own Craig Saunders) the official recording form for the contest. Of course, that means that all of the clubs now can track their events equally well, so last year we wound up placing second to NARHAMS (the section that hosts TARC every year). This year we wound up placing second again...to NARHAMS, the section that hosts TARC every year.

So, on to the newsletter award. Here's the official NAR page on the contest: <http://www.nar.org/LAC.html>. Another site that explains the contest (including what LAC stands for) is: <http://www.nar.org/pdf/Section6.pdf>. Our 'Clips editors over the years have poured their heart into every issue, and I know the membership appreciates it. The perpetual Rockwell Trophy (the official award of the contest) goes to the newsletter with the greatest variety and on-time production. We've always had a good variety of writers (including the under 15 set) which works well with the judges, but the lack of contests and build plans (plus publishing only every other month instead of every month)



# LUNAR'clips 2007

Livermore Unit of the National Association of Rocketry

Volume 14, Number 5

August-October 2007

has held us back to second or third place every year. This year, as Tom Beach (the editor of the national Sport Rocketry magazine and head of this contest) got up to the microphone, I was holding my breath. He doesn't give 3rd-2nd-1st places, but starts with the two runners up, in no particular order, followed by the winner. As he read the names of the runners-up (and I honestly don't remember who they were) all could think was, "Damn, we didn't even make the finals this year!" I was only half listening as he said, "The winner of this year's LAC Newsletter award goes to the Livermore Unit of the National Association of Rocketry's 'LUNAR Clips!'"

I just sat there at my table near the back of the room, a little stunned. I always thought I'd let out a whoop or something when we won, but I just sat quietly for a second before standing up. As I threaded my way through the tables to the front of the room I was thinking, "I'm going to have to say something" as a flash of performance anxiety washed over me. I considered a line similar to the subject of this note, but I toned it down to something like, "Hey, we're from the west coast. We're not supposed to win a national award!"

Take a look at this photo of me with the trophy and Tom Beach with "The Box."



Thomas Beach (left), editor of Sport Rocketry magazine and Head Judge for LAC newsletter award, presents the North American Rockwell Trophy and "The Box" to LUNAR Past President Jack Hagerty (right)

Figuring out a way to get both of those home when all I could transport was checkable luggage (a story for another time) was bad enough, but more interesting is "The Box." The trophy was first awarded

in 1969, and it wasn't long before the winning clubs started putting little memorabilia inside the hollow spaces of the base. It rapidly ran out of room so the items started being stored in a box that goes with the trophy. Even the original box ran out of room so I'm pleased to announce that LUNAR is the first club to win the use of the brand new box donated by last year's winning club (Pittsburgh Space Command).

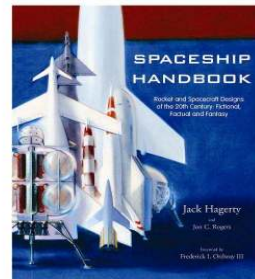
What's in the box? Ahh, you're going to have to come to the next meeting to find out. Only members of the winning section can look inside the box, and they are forbidden (by an official curse and everything) to discuss it in any manner that can be read by outsiders, like in the newsletter or on e-mail lists. I can tell you that I think our contribution to the box should be some sort of shipping container that will allow it, and the trophy, to be checked on board an airplane or shipped by a package service. After all, I've got to bring it to NARAM next year for the awards ceremony. With any luck, and you guys continuing to contribute great articles to the newsletter, I'll be bringing it back again!

## Back In Print!

By popular demand, **Spaceship Handbook** is once again available. We have done a limited reprint of this precedent setting volume for those of you that missed the original printing. Don't miss out again!



ARA Press  
785 Jefferson Ave.  
Livermore, CA 94550  
(925) 455-1143  
www.arapress.com



## Spaceship Handbook

by Jack Hagerty and  
Jon C. Rogers

- 75 Fictional, Theoretical and Real Subjects.
- 534 Pages.
- Data Drawings.
- Over 500 photographs and illustrations, most in color.

• **Only \$59.95!**  
(plus shipping)

15% off for LUNAR members!



## Launch Reports

Cliff Sojourner, LUNAR #1212, NAR #82864

*Editor's note: many folks post photos to the picture gallery. You can find the gallery by clicking "Gallery" on the left side of the LUNAR website main page (<http://www.lunar.org>), or directly from <http://lunar.mtrd.com/gallery>. Some of my favorites are printed here, but many more are available online – maybe even a picture of your rocket. Or maybe you could post a picture of someone's rocket?*

### October 27, Patterson Sports Park

LUNAR made the trek out to Patterson, to Patterson Sports Park. This was a demonstration launch to show the folks in Patterson how much fun a launch like this can be. The launch parameters were like an old Robertson Park launch, up to G motors and 1400 foot ceiling.

Weather conditions at the launch were mild, comfortable temperature and 5-10 knot breeze. LUNAR shared the Patterson Sports Park area with the Patterson RC fliers club, and a BMX track. We set up six launch pads.

Statistics for the day:

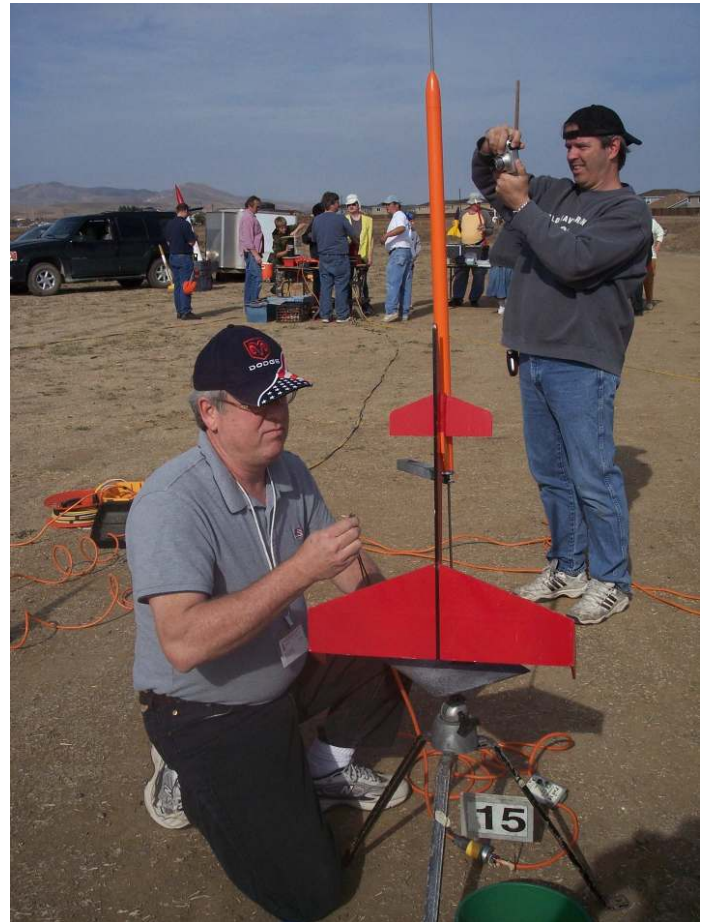
- We had at least one first-time-flier
- Clusters: two A8-3s, two B6-4, two C6-5s
- Staged: one C to A
- 1 Motor CATO
- 4 recovery failures
- 94 Flights, 97 motors burned

Breakdown by motor size:

1/2A	A	B	C	D	E	F	G
3	12	25	31	8	5	2	4



*Looks like a Quest Full Moon.*



*Gus Robinson preps his big Edmunds rocket boosted glider.*



*Estes camera rocket.*

All photos here by Gus Robinson, LUNAR #604 – thanks, Gus!

## Rack Rocket

Tom Desmarais, LUNAR #1387, NAR #85755

### Four Stages And Beyond

While browsing the web for interesting rockets, I came across this link:

[http://members.tripod.com/tripoli\\_rocketry\\_pgh/rackrocket.html](http://members.tripod.com/tripoli_rocketry_pgh/rackrocket.html)

Here was the first description of a rack rocket that I came across. I certainly encourage you to visit this site as well as do your own searches for rack rockets, but to whet your appetite, I'll give you a brief description of a rack rocket.

A rack rocket is a multistage rocket that holds a "rack" of engines and spits each engine out when that engine is done. The rocket itself doesn't have any stages or extra fins. The fins are at the back of the rack, so the rocket is one solid entity.

One of the advantages of this configuration is that the staging is very reliable. The engines are taped together outside the rocket and slid in to the rack. The rocket is not relying on the taped engines to keep the rocket solid (though they help), rather the rocket is one piece.

Another advantage of this configuration is aerodynamic stability. There is only one set of fins, and they are at the back, so the center of pressure (CP) is near the fins. The engines, which



are most of the mass of the rocket, extend ahead of the fins, so the center of gravity (CG) will be in front of the CP. As each engine finishes and is ejected out the back of the rack, the CG moves forward, increasing stability. Moving the CG too much forward can cause the rocket to weathercock (turn into the wind) more, but as each stage is ejected, the rocket should be moving faster and faster, so the weathercocking would be minimized.

Yet another advantage of rack rockets is aerodynamic cleanliness. Since there is only one set of fins that are shared for all stages, the drag from the fins is minimized across all stages. Now I won't pretend to understand the implications for drag of the rails making the rack, I suspect they don't contribute much to the drag. This would make a good research project, since by the time the sustainer is going, the fins are quite a ways back from the vacuum drag at the tail of the rocket, which could be good or bad.

The first rack rocket I built was an 18mm 4-stage flavor. Rack rockets are like Estes Mosquitoes, you often don't see them again, since they fly so high. I flew it at Snow Ranch in December 2007 with a B6-0/B6-0/B6-0/A8-5. That day, the weather at Snow Ranch was perfect. I could tell there was some doubt in people's minds when they heard the rocket had four stages. Three stage rockets often fail to get all stages to go. The rocket took off straight and true, spitting motors and going, going, gone, out of sight. Shortly, the streamer was sighted, and on this perfect windless day, it landed about a 100 yards from the pads. When I built this first rack rocket, I mismeasured something, since the tail extended a half inch past the first stage. As a result, the small piece of BT-50 I used at the tail to stabilize the rails was burnt away by the engine. Amazingly, the flight path was seemingly unaffected. I would have flown it again with some bigger engines, but I didn't really have what I needed to repair it on the field.

At this same launch, I made an attempt for a mile using black powder motors in a conventional three-stage configuration. This was my second attempt (my first weathercocked severely and was lost way down range). I had made the rocket significantly lighter, and I was using a piston launch to try to prevent excessive weathercocking. The rocket got to about 50 feet and went unstable, landing near the pads with the delayed second stage waiting to start the third stage. Fortunately the third stage didn't start. I'm still not sure what made it go unstable (I suspect the engines slid back, possibly due to the piston?), but the flight was scary enough that I was ready to go back to the drawing board.

After all that, the rack rocket concept seemed like an improvement over the conventional three-stage.

I wanted to simulate the rack rocket using RockSim, but RockSim only supports up to three stages. My solution is to put two engines together as one custom engine, and use that in the



first stage. This requires making a custom engine file, which is fortunately not too hard. RockSim comes with an engine editor called EngEdit. You can load the database for supported manufacturers' engines in EngEdit, and modify or add to the engines in the database. I was pretty sure the configuration I would want to use would be D12-0/D12-0/D12-0/E9-8, so I wanted to make a new engine that would be the equivalent of two D12-0's in series to use as a mock first stage. The first step was to create a new engine in the Estes database. I had to set the burn time and the peak thrust, so I doubled the burn time of a D12 and set the same peak thrust.

## Making a D12-D12 Engine File

I tried using EngEdit but found editing the combined thrust curves too cumbersome. I discovered a better way to create a model of the D12D12, by editing the data in text (RASP and ENG) format.

1. From the EngEdit application, open the Estes engine data file, then "save as" and select filetype RASP or ENG. Use Notepad to open the file. Find the D12 engine specification:

```
;Estes D12 RASP.ENG file made from NAR published data
;File produced October 3, 2000
;The total impulse, peak thrust, average thrust ..
;the same as the averaged static test data on the ...
;the certification file. The curve drawn with these ...
;close to the certification curve as can be with ...
;number of points (32) ...
D12 24 70 0-3-5-7 0.0211
0.0426 Estes
0.049 2.569
0.116 9.369
0.184 17.275
...
```

Copy the D12 specification and save in a separate file, D12D12.ENG.

2. Now, we need to double the thrust curve data to make it represent two D12s. It's easiest to use Excel to calculate the time offsets. Open Excel and use Data->Get External Data->Import Text Data, to get the D12 thrust curve from D12D12.ENG. Skip the first 10 rows (starting with semicolons), and select "space" as the delimiter.

	A	B	C	D
6	0.297	27.01		
7	0.311	22.589		
8	0.322	17.99		
9	0.348	14.126		
10	0.386	12.099		
11	0.442	10.808		
12	0.546	9.876		
13	0.718	9.306		
14	0.879	9.105		
15	1.066	8.901		
16	1.257	8.698		
17	1.436	8.31		
18	1.59	8.294		
19	1.612	4.613		
20	1.65	0		
21	1.699	2.569		
22	1.766	9.369		
23	1.834	17.275		
24	1.887	24.258		
25	1.932	29.73		
26	1.947	27.01		
27	1.961	22.589		
28	1.972	17.99		
29	1.998	14.126		
30	2.036	12.099		
31	2.092	10.808		
32	2.196	9.876		
33	2.368	9.306		
34	2.529	9.105		
35	2.716	8.901		
36	2.907	8.698		
37	3.086	8.31		
38	3.24	8.294		
39	3.262	4.613		
40	3.3	0		
41				
42				

The left column is the time in seconds and the second is the thrust. Put an expression in the first column that looks like =A1+1.65, to add the time for burning the first engine to the

time for each sample point that we will use in the second engine. In the second column, enter =B1 to copy the thrust matching a given time during the first engine's burn. Now select the row with those two entries and hit ctrl-c to copy them. Now select the appropriate number of rows with the two columns (down to column 40 in this case) and use ctrl-p to paste the formulas in place. You should end up with something like this.

Now, select "file" -> "save as" to save this as text.

3. Next, we must fix up the engine summary information for our D12D12. In RASP format, the data elements following the engine name are: diameter, length, initial mass, propellant mass, and manufacturer. The D12D12 has double the length, double the initial mass, and double the propellant mass.

Using Notepad, open D12D12.ENG, and change the comments and first data line to create a new engine: change the name to D12D12, change the date just for fun. Change the numbers of the length, initial mass, and propellant mass, to their doubled values. Last, copy the thrust curve data points from Excel, and insert into the RASP file after the header field.

One thing to note is that the RASP format assumes a 0 thrust is the end of the motor burn, so you need to set the end of the first engine's burn at 1.65 seconds to a small non-zero number like 0.01.

The completed D12D12.ENG file should look like:

```
;Estes D12D12 RASP.ENG file made from NAR published
...
;File produced October 31, 2007
...
D12D12 24 140 0-3-5-7 0.0422 0.0852 Estes
0.049 2.569
0.116 9.369
0.184 17.275
0.237 24.258
0.282 29.73
0.297 27.01
0.311 22.589
0.322 17.99
0.348 14.126
0.386 12.099
0.442 10.808
0.546 9.876
0.718 9.306
0.879 9.105
1.066 8.901
1.257 8.698
1.436 8.31
1.59 8.294
1.612 4.613
1.65 0.01
1.699 2.569
```





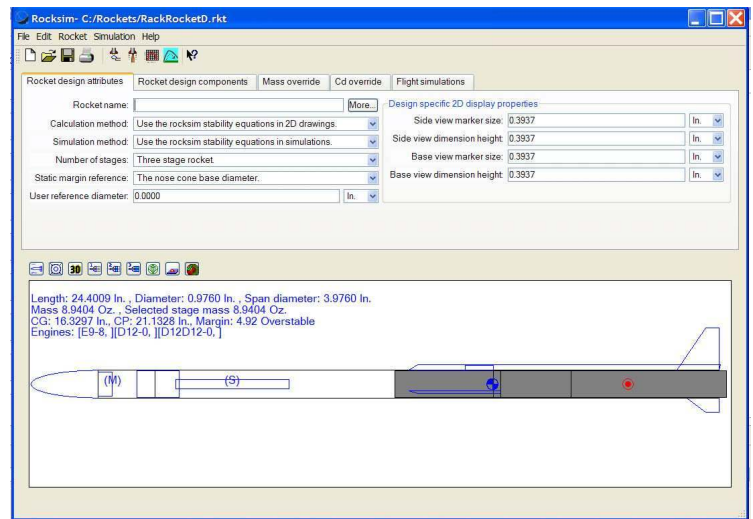
# LUNAR'clips 2007

Livermore Unit of the National Association of Rocketry

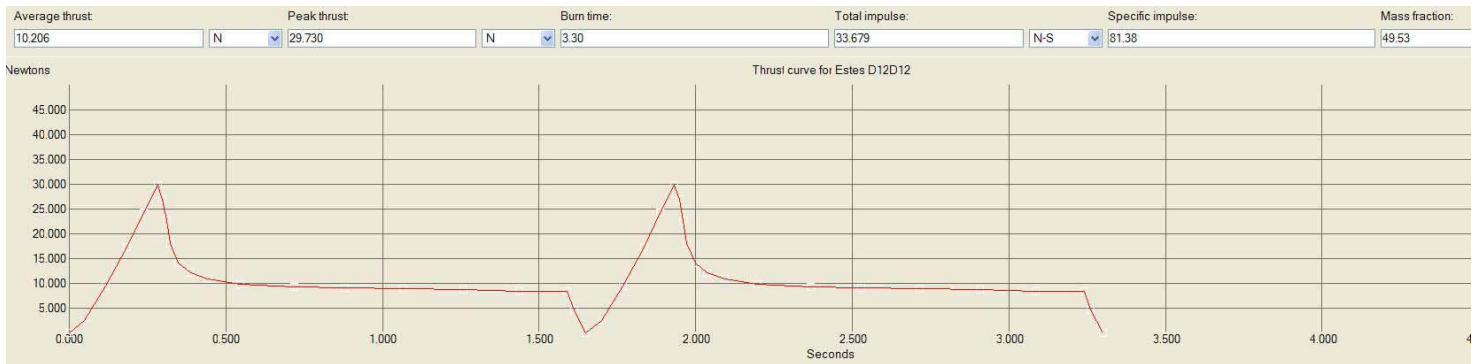
Volume 14, Number 5

August-October 2007

1.766	9.369
1.834	17.275
1.887	24.258
1.932	29.73
1.947	27.01
1.961	22.589
1.972	17.99
1.998	14.126
2.036	12.099
2.092	10.808
2.196	9.876
2.368	9.306
2.529	9.105
2.716	8.901
2.907	8.698
3.086	8.31
3.24	8.294
3.262	4.613
3.3	0



4. Now save D12D12.ENG, and open it in EngEdit to admire your work:



Save this file as a RockSim engine file: use “file” -> “save as” and select “RockSim (rse)”. This step is most important because the D12D12.ENG file has more data points (40) than are supported by RASP/ENG format (30), and only RockSim RSE engine files can support it. For more information about the formats of the engine file, check out Apogee Rockets’ “Peak Of Flight” newsletter #139, “What is in a Rocket Engine Data File”, <http://www.apogeerockets.com/education/downloads/newsletter139.pdf>.

5. Last, follow the method for your version of RockSim (methods vary, please consult the manual) to import the engine in to RockSim’s database. Now you can select D12D12 for first stage of your rack rocket!

Now, in RockSim, you can make a three stage rocket and use the D12D12 engine for the first stage to simulate four stages.

That’s it!

**Now Available!**

**LUNAR logo items**

<http://www.cafepress.com/lunarorg>



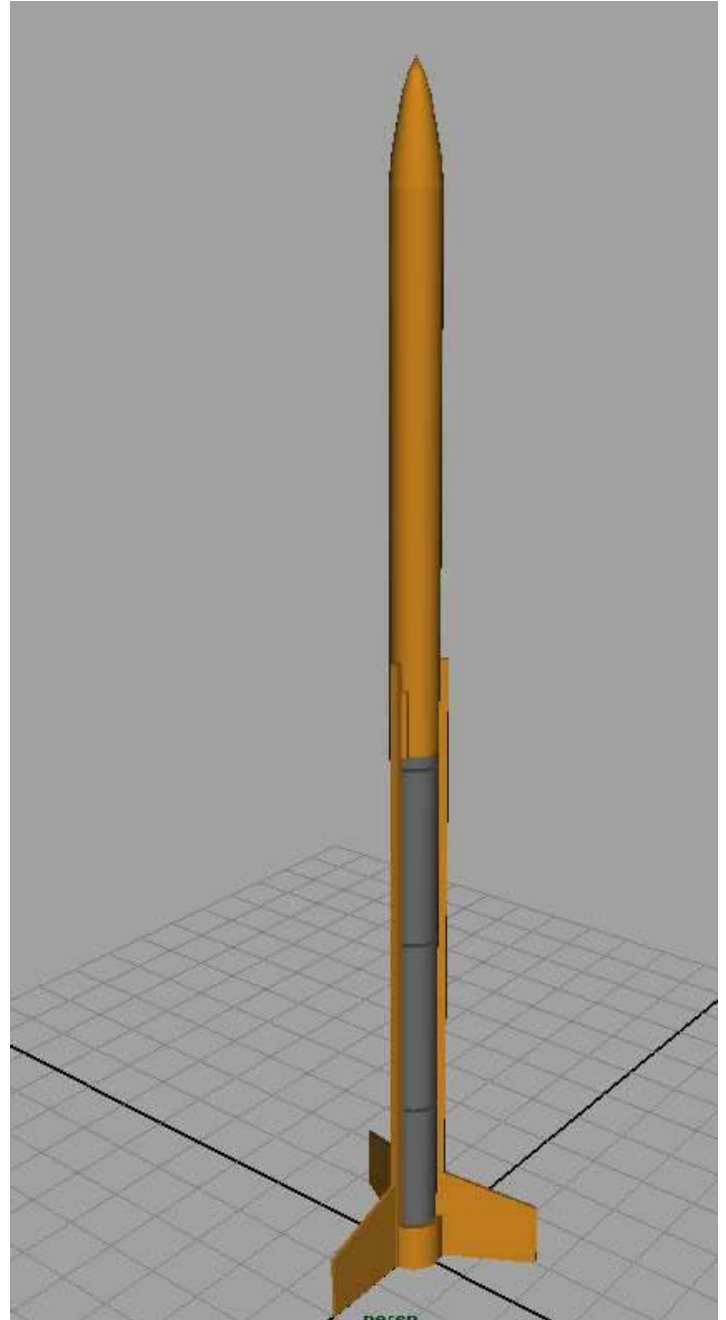
## Four-18mm Motor Rack Rocket

### Parts List

- 3x 1/8"x1/8"x10" basswood rails
- 3x 1/16"x1.5"x1.5" balsa fins
- 1x 8" BT-20 body tube
- 1x 3/4" BT-50 body tube for support ring
- 1x BT-20 nose cone
- 1x 1/8"x1" launch lug
- 1x BT-20 engine ring
- 1x 36" streamer
- 1x 24" 40lb Kevlar cord
- 3x 1/8"x8.5" aluminum tape strip
- 3x 3/4"x3/4" aluminum tape pieces for support ring

### Instructions

1. Tie Kevlar cord around engine ring.
2. Glue engine ring 2.5" into BT-20 body tube
3. Mark body tube for 3 fins/racks. Mark these lines 1.5" from the bottom end.
4. Glue 3 racks to right side of fin marks, up to the marks 1.5" from the bottom end.
5. Use spare BT-20 with engine in it to space rear of racks, then sand bottom 3/4" so BT-50 can fit over racks with BT-20 in place. Then glue the BT-50 support to racks.
6. Sand fins 3/4" from back to front for good fit on racks and BT-50 support.
7. Glue fins to rack and support. Ensure straight and perpendicular to body.
8. Fillet the rack to body joint, fin to rack joint, and rack to support joint.
9. Glue launch lug to one of the racks at the BT-20 joint. The launch rod will go through the lug and between the BT-50 support and the motors.
10. Tie the Kevlar cord to the nose cone and attach the streamer to the Kevlar cord.
11. Paint if desired (something bright is desirable).
12. Apply the aluminum tape strip to the inside of the rack to protect it somewhat from the exhaust. Apply the aluminum tape pieces to the inside of the BT-50 support to protect it.
13. For first flight, it's recommended to use B6-0/B6-0/B6-0/B6-6. Cellophane-tape all of the engines together (with ejection to nozzle!) with the B6-6's ejection at the top end. Add tape to the outside of the B6-6 to make it very snug in the BT-20, and slide the stack into the rack until only 1/4" of the B6-6 is sticking out.
14. Fly on a windless day and watch the engines kick out the back.





## Who you gonna call?

- LUNAR HOTLINE (925) 443-8705  
 PRESIDENT  
 Craig Saunders, [president@lunar.org](mailto:president@lunar.org) (925) 324-2400  
 VICE PRESIDENT  
 Tony Cooper, [vp@lunar.org](mailto:vp@lunar.org) (510) 471-3648  
 SECRETARY  
 David Raimondi, [secretary@lunar.org](mailto:secretary@lunar.org)  
 TREASURER  
 Sheryl Cooper, [treasurer@lunar.org](mailto:treasurer@lunar.org)  
 MEMBERS AT LARGE  
 Lee Teicheira, [bmal1@lunar.org](mailto:bmal1@lunar.org)  
 Richard Hagen, [bmal2@lunar.org](mailto:bmal2@lunar.org)  
 EQUIPMENT  
 Bill Orvis, [equipment@lunar.org](mailto:equipment@lunar.org)  
 MEMBERSHIP  
 Tony Cooper, [membership@lunar.org](mailto:membership@lunar.org)  
 NEWSLETTER  
 Cliff Sojourner, [newsletter@lunar.org](mailto:newsletter@lunar.org)  
 CALPYRO III  
 Rob Tashjian, [calpyro@lunar.org](mailto:calpyro@lunar.org)  
 CONTEST DIRECTOR  
 Tom Desmarais, [tdesmarais@acm.org](mailto:tdesmarais@acm.org)

## Who We Are...

### LUNAR is the Livermore Unit of the National Association of Rocketry, Section #534

LUNAR is located in Livermore, California, about fifty miles southeast of San Francisco. We are organized to supply a safe, educational and legal means of furthering the hobby of model and high-powered rocketry in northern California, to aid and encourage the development of all club members' knowledge and expertise in the area of rocketry, to promote youth education and community involvement, and to engage in scientific, educational and related activities. LUNAR is open to rocketry hobbyists of all ages to further the sport and science of hobby rocketry within the NAR (National Association of Rocketry) and Tripoli safety codes. These codes have allowed hundreds of millions of model rocket launches by hobbyists since the late 1950s without serious injuries.

LUNAR also supports assorted rocketry activities of community youth groups. We have hosted launches (and in some case building sessions) for the Boy Scouts, Girl Scouts, 4H, YMCA Adventure Guides, the GATE program, and LARPD Science Camp.

### Launches

Section launches are usually held from 9:00 a.m. to 1:00 p.m. on the **third Saturday of the month**. Generally these are *sport*

*launches*, although we occasionally hold sanctioned *contest launches* for points in the NAR national contest standings, *theme launches* where we focus on a particular class of rocket, and *night launches*.

LUNAR's Snow Ranch launch site accommodates all rockets from 1/4-A to M motors, with a 15,000 foot maximum altitude. The LUNAR Board requests notification of L and M flights a week before the launch date. Contact the LUNAR Members At Large directly, or post a message on [general@lunar.org](mailto:general@lunar.org).

### The LUNAR Hotline - (925) 443-8705

The Hotline is available to provide up-to-date event information. It's a good idea to call our Hotline to verify the date of the next launch or meeting.

On launch days, the Hotline recording is updated by 7:00 AM to reflect the Go/No-Go status of the launch. On launch days with questionable weather, it is especially important to call the Hotline to get the latest information. You can also leave messages on the Hotline.

### Meetings

Section meetings are currently held on a bi-monthly basis. These meetings cover section business, and typically include presentations by club members or other experts on some aspect of the hobby, ranging from simple building tips to advanced science and engineering principles.

The LUNAR annual meeting is held during the first quarter of the calendar year at a time and place announced to the membership. At this meeting, officers are elected and other club business is conducted.

### World Wide Web site!

LUNAR maintains a Web site at <http://www.lunar.org>

You will find a lot of stuff to see on the web site, and it always has the latest information about LUNAR and our activities. For example, you'll find our latest launch and meeting calendar, directions to our launch site, a gallery of photos from past launches, the on-line issues of the LUNAR'clips (the section newsletter), our section bylaws, pointers to member rocket pages, pointers to other rocket and space related information on the Internet, ... and lots more!

### Membership

Your membership fees support the costs of launch operations, equipment maintenance, meetings, newsletter, outreach events, and other public services. Join LUNAR now! Yearly fees: Youth (to age 11) is \$6; Junior (ages 12-17) is \$6; Adult (over 18) is \$25. Become a Contributing Member for an extra \$20 (\$26 Youth & Junior; \$45 Adult), and your flight cards are free.

# LUNAR Calendar

Launches at new location or Snow Ranch (see website [www.lunar.org](http://www.lunar.org) for directions)  
 Meetings at Robert Livermore Community Center, 4444 East Avenue, in Livermore.

WARNING! Times and dates are subject to change with little notice. Setup starts an hour before the listed time and teardown and packing up usually takes an hour after the listed time. For launch confirmation call the LUNAR Hotline (925) 443-8705 after 7 AM on launch day. Visit the LUNAR web site at [www.lunar.org](http://www.lunar.org) for the latest information.

<b>January 17, 2007</b> Meeting 7:30 to 9:30 PM Elections Presentation: Bill Orvis: Odd-Rockets	<b>May 16, 2007</b> Meeting 7:30 to 9:30 PM Presentation: Eric Kleinschmidt: Hybrid Rocketry	<b>September 19, 2007</b> Meeting 7:30 to 9:30 PM Presentation: Mike Sunseri: Build, Decal, and Paint Rockets
<b>January 2007 launches</b> Jan 6: 9 AM - 3 PM, Snow Ranch Jan 20: 9 AM - 1 PM, Robertson Park	<b>May 2007 launches</b> May 5: 9 AM - 3 PM, Snow Ranch May 12: <b>4 PM - 10 PM</b> , Robertson Park <b>Night Launch</b>	<b>September 2007 launch</b> Sept 22: 9 AM - 1 PM, <i>TBD cancelled</i> <b>NAR Contest</b>
<b>February 2007 launches</b> Feb 3: 9 AM - 3 PM, Snow Ranch Feb 17: 9 AM - 1 PM, Robertson Park	<b>June 2007 launch</b> June 30: 9 AM - 1 PM, Robertson Park	<b>October 2007 launch</b> Oct 27: <b>4 PM - 10 PM</b> , <i>cancelled</i> <b>Night Launch</b>
<b>March 14, 2007</b> Meeting 7:30 to 9:30 PM Presentation: Jamie Clay: Video Rocketry	<b>July 18, 2007</b> Meeting 7:30 to 9:30 PM Presentation: various: Altimeters	<b>November 14, 2007</b> Meeting 7:30 to 9:30 PM Build Session: 18mm Rack Rockets
<b>March 2007 launches</b> March 3: 9 AM - 3 PM, Snow Ranch March 17: 9 AM - 1 PM, Robertson Park	<b>July 2007 launch</b> July 21: <i>Cancelled</i>	<b>November 2007 launches</b> Nov 3: 9 AM - 3 PM, <i>Snow Ranch cancelled</i> Nov 17: 9 AM - 1 PM, <i>TBD cancelled</i>
<b>April 2007 launches</b> April 7: 9 AM - 3 PM, Snow Ranch April 22: 9 AM - 1 PM, Robertson Park <b>NAR Contest</b>	<b>August 2007 launch</b> Aug 18: 9 AM - 1 PM, location TBD	<b>December 2007 launches</b> Dec 1: 9 AM - 3 PM, Snow Ranch Dec 15: 9 AM - 1 PM, <i>TBD cancelled</i>



## LUNAR

c/o Membership Chair  
 31120 Chicoine Ave.  
 Hayward, CA 94544-7432