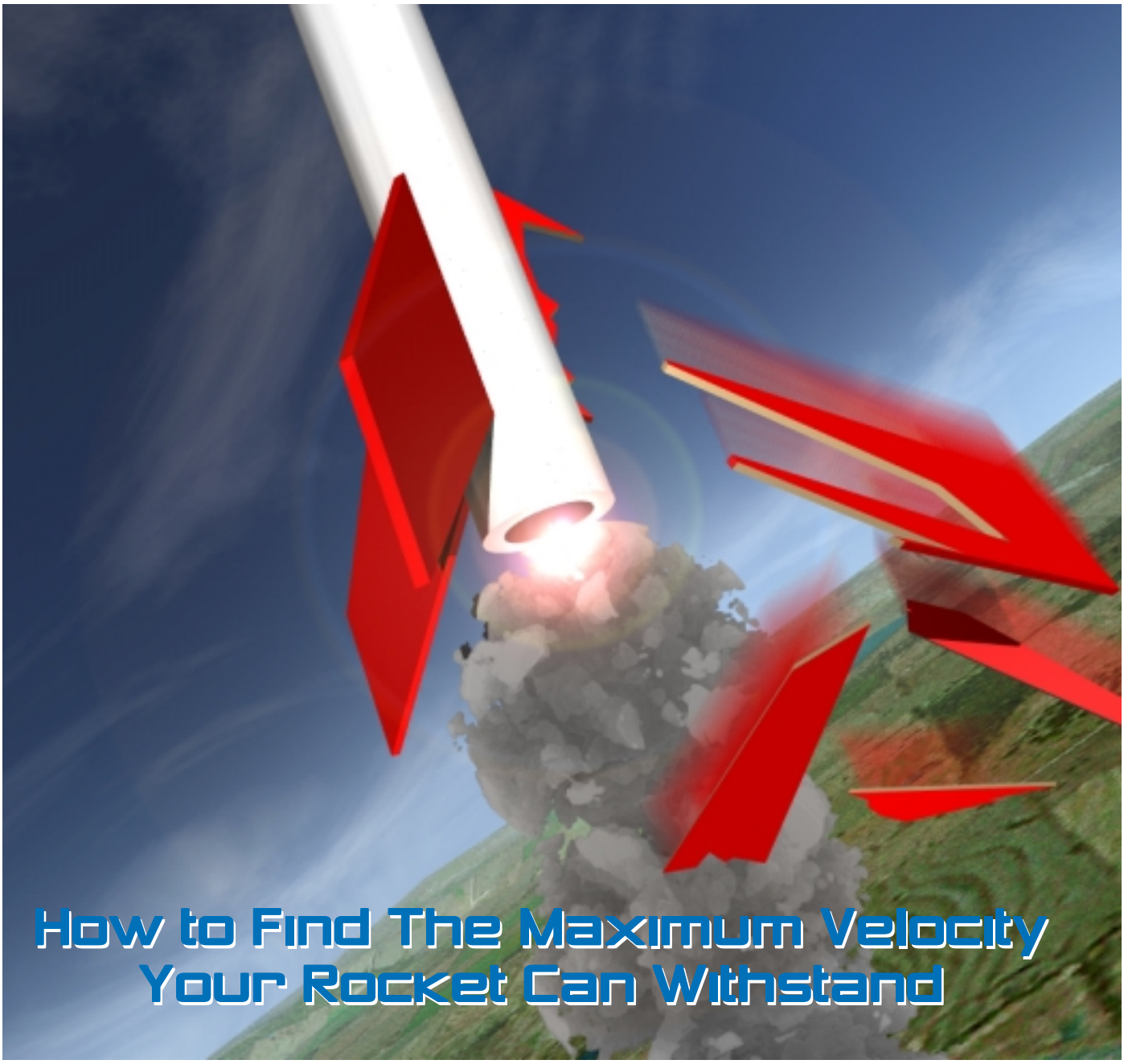
ISSUE 88 - SEPT 16, 2002

APOGEE PEAK OF FLIGHT NEWSLETTER



How to Find The Maximum Velocity Your Rocket Can Withstand

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APOGEE

PEAK OF FLIGHT

Steal $23.95 in FREE Rocketry Reports By Ordering The Money-Saving Book - *Model Rocket Design & Construction*

Here's the deal: Buy one a copy of "Model Rocket Design & Construction" at the regular price of $23.95 before September 30, 2002, I'll throw in a NEW e-book called "RockSim In depth" worth $10.00. In addition, you'll also receive a $10 video booklet "Understanding Stability Using RockSim." Plus, I'll throw in a set of the famous "Apogee Data Sheets" worth another $3.95. That's a total of $23.95 in FREE merchandise just for ordering the book today!

This book saves you money!

Even without the FREE bonus items, the book is a bargain at just $23.95. Here's why...

Consider the average price of most Estes, LOC and PML kits these days. You know how expensive they are: $20, $40, $60 or more. It isn't like the good-old-days, when a $20 was the most expensive kit in the entire catalog.

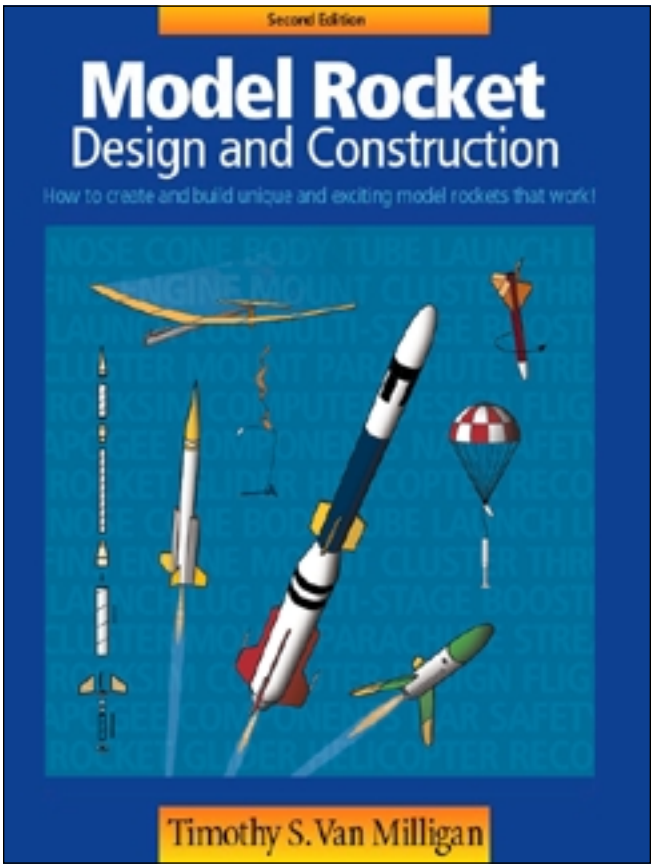
To combat these higher prices, you should be designing and building your own rocket kits. For less than the price of most any medium size rocket kit, you can own this book. Once you do, you'll have the all guidance you need to make your own rockets. Most of the time, you can make them from inexpensive household items.

Imagine getting three or four new rockets added to your fleet for the price of just one "kit" rocket you bought from the store. And then do this month after month. In a year, you'll have a huge rocket fleet. By the end of the year, think of the money you would have saved! It could easily be in the hundreds of dollars in savings!

I know you want to save money on rocketry. With the economy the way it is, you've got to scrape by on a limited budget for your hobby. That is why it is important to make every rocket count. Can you afford to have an expensive kit rocket go squirley at lift-off and smash itself into thousands of bits and pieces?

That is why you need this book. It will give you the guidance to design and build low-cost rockets that fly straight-and-true every time.

But more importantly, after the cheers and the applause die down when you launch your rocket, people will come up



to you and ask where you got that cool looking kit. You may have a hard time convincing them that you designed and built it yourself (I know this feeling -- its often happened to me).

This huge 160 page reference book is the definitive "how-to" design manual for model rockets. With over 453 photographs and illustrations, this easy-to-read and publication gives you concise information that makes it easy to build your own rockets.

Here is a list of the 20 chapters in the book:

1. Getting Started - what do you need to know?

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2. Stability: Getting Rockets To Fly Straight
3. Drag Reduction and Aerodynamics - Make them fly higher
4. Construction Tools - You DON'T need expensive tools - see why in the book.
5. Basic Raw Materials and Which Ones To Choose
6. Construction Techniques - Build strong, but lightweight.
7. Building Higher Powered Rockets - Special tips and tricks
8. Painting and Decorating - You want them to look good too?
9. Repair Techniques - How to make them "show-room new" again.
10. Streamer and Parachute Recovery System Design
11. Designing for Glider Recovery
12. Helicopter Recovery Design
13. Scale Models
14. Payload Rockets - What can rockets be used for?
15. Multi-stage Rockets - How to get the highest flights.
16. Clustered Engine Rockets - Big burly rockets with lots of smoke.
17. Rocket Engines - Which ones should you use?
18. Flight Testing - Things to look for during the first launch.
19. Displaying Your Completed Model
20. Starting a Rocketry Club

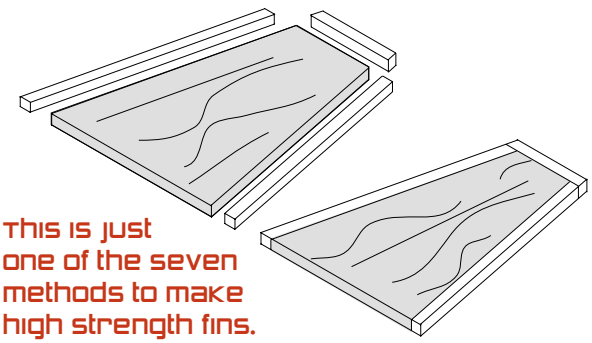
Appendix: Other Design Resources - where to get more information...

Glossary

Index

"If you own no other book on model rocketry, get this one. It's $23.95 list price is modest for this type of book today, and it is well worth it. Tim covers all the bases in model rocket design and lays out a general how-to-do framework that future model rocketry activity can be placed upon. It is not just thorough; it is thoroughly enjoyable for the advanced rocketeer or the beginner alike. It refreshingly up-to-date, revised, and ready for takeoff in your mind and rocket workshop."

Francis Graham (the founder of the Tripoli Rocketry Association)



This is just one of the seven methods to make high strength fins.

Tom Kizner writes: -- *"This book really does offer a solid understanding of basic component rocket construction and design, for both the novice and veteran modeler! From chute compartments, to stabilization, to clustering, to gussets, to fin types, to airfoils, to safety, etc., this book is packed with tons of info for even the beginning modeler. The writing style was easy to comprehend, and the illustrations/pictures gave strong support to the narrative. If someone wants a step-by-step understanding of rocket component design and construction, whether a kit or a do-it-yourself job, I fully recommend the book!"*

I have RockSim, why do I need the design book?

Model Rocket Design and Construction is where you start before entering the rocket dimensions into the RockSim software. It gives you ideas. Such as what fin shape or nose cone might look cool on your rocket. It will also tell you the strongest construction method for putting your design together - sorta like a step-by-step instruction sheet; but for your own designs.

I think it is the perfect companion to RockSim. It gives you the techniques and construction methods you'll need to

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Steal $23.95 in FREE Rocketry Reports By Ordering The Money-Saving Book - *Model Rocket Design & Construction*

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assemble them after you've simulated them in RockSim.

"I wrote the book on rocket design, and now you too can learn my secret construction techniques" - *Tim van Milligan*

If you've ever talked with someone that has a copy of the book, they'll tell you that it is stuffed-to-the-gills with all sorts of tips and tricks. There are a lot of secret techniques I learned when I was a designer with Estes Industries, and now I want to share these with you.

It includes things like how to get that perfect paint finish, and how to repair rockets that had some landing damage. You'll also find tips on how to build for maximum strength without sacrificing performance by making the rocket too heavy. These are real aeronautical principles that most modelers don't seem to know about.

On top of the great book, if you buy it before September 30, 2002, you'll also receive a FREE CD-ROM with these bonus items:

FREE BONUS #1. NEW E-Book: "RockSim In depth" Value: $10.00 This 52 page booklet shows you how to get the most use out of your copy of the RockSim software. I took all the articles that I've written over the years about RockSim, and put them into a easy-to-read book. It has never been released to the general public in booklet form. You'll be among the first to see it.

FREE BONUS #2. Video Book: "Understanding Stability Using RockSim." Value: $10.00. This new video book shows how you can use RockSim to teach others what "stability" is, and why it is important. I guarantee that you'll learn something new too!

FREE BONUS #3. Data Sheet Collection. Value: $3.95. The data sheet collection has given numerous modelers a way to finally track their progress in making their rockets fly higher, straighter, and faster. As the saying goes, what gets measured, gets improved. When you actually record information about your rocket and its flight, you will become a better modeler, and save money in the process.

100% Risk-Free Guarantee:

You'll love this book. If you aren't 100% satisfied, let me know and I'll issue you an immediate, no-hassle refund right on the spot. Plus, the free bonus gifts are yours to keep regardless, just for your trouble. Is that fair or what?

Why am I giving such a great deal?

I'm overstocked on my book "Model Rocket Design & Construction." I've got over 1000 copies in boxes, and due to my inadequate marketing skills, they've been collecting dust for 1-1/2 years. That has tied up a lot of money, which I'd like to use to create some new rocket kits.

And by blowing them out the door with this special offer, I also think that it will help you see how great our world-famous service really is. I am taking the first small step to gain your confidence and trust. I hope to convince you that Apogee Components should always be your first choice when you order rocket supplies.

How to order:

Visit our special web page to order this special offer.

http://www.ApogeeRockets.com/design_book.asp

You can also order by phone, fax, or by mailing in a money order.

Look at it this way, the for the price of just $23.95, you not only get a terrific book that will save you hundreds of dollars, you get $23.95 in free reports!

Don't delay. I urge you to take advantage of this offer right now. Why not take 2 1/2 minutes now to order this money-saving book, and at the same time add all the free bonus publications.

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APOGEE

PEAK OF FLIGHT

How to Find The Maximum Velocity Your Rocket Can Withstand

By Tim Van Milligan

I found this question on r.m.r. a while back, and I thought I would answer it here in the e-zine.

"I am currently designing a high power rocket using RockSim and I need some help understanding Max. Velocity and Max. Acceleration.

The rocket is 7.5 inches in diameter and length will be about 45 inches. I have set it up with a cluster of (5) 29mm motor mounts. Weight should be under 10 pounds.

I have run RockSim with a variety of F and G motors (single use and RMS). I have noticed that the max. velocity will range from 192 ft/sec. up to 312 ft/sec. and acceleration from 185 ft/sec/sec. to 1258 ft/sec/sec.

My question is, what should the upper end for velocity and acceleration be to keep the thing together? Should I be more worried about one or the other? Aren't velocity and acceleration almost the same thing when it comes to rocket flight? Is there any reference data on this?

Another question is how thick should the fins be if made of G10? This will be the first time I have ever used G10 on any rocket."

This is a good question. Up until a few weeks ago, I didn't have a tool to help you determine the answer. That new tool is called "FinSim."

Let's start with a little background. There is a difference between velocity and acceleration. I can probably see why there is some confusion, since the units of both seem pretty close. For example, the units of velocity are feet/sec or meters/sec. And the units of acceleration are feet/sec/sec or meters/sec/sec.

In actuality, acceleration is the change in velocity of the rocket. If the rocket maintains a constant speed, then the acceleration is zero. To keep from getting confused, I recommend changing the units of acceleration to Gee's. This is a little easier to comprehend anyway. Most people know what you're talking about when you say it reaches an acceleration of 9 Gees.

The first question is a good one. "What is the upper end for velocity and acceleration to keep the thing together?" In other words, we don't want the rocket to shred when it comes off the launch rod; so how fast is too fast?

The answer depends on a host of factors. The first is the strength of the rocket. As we all know, a strong rocket will take more abuse than a whimpy one. But on the other had, usually a stronger rocket is heavier, and won't travel as high or as fast as the lighter weight rocket. Ideally, we want a rocket

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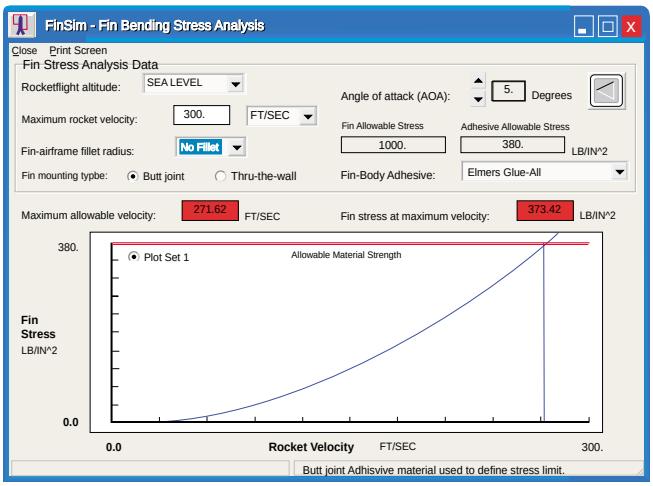

Archives of this Newsletter

All the articles that have appeared in this newsletter are archived at http://www.apogeerockets.com/education/newsletter_archive.asp

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How to Find The Maximum Velocity Your Rocket Can Withstand

cont. from pg. 5

that is "just strong enough" for the flight.

What does that mean to us, and how do we figure it out? First, it means that the rocket is light enough to maximize the altitude or the speed we want to achieve. We have to know this in advance. I always tell people to decide: "Do you want to fly high, or do you want to fly fast? There is a difference." (see the article at: http://www.apogeerockets.com/education/newsletter01.asp)

Assuming we want to maximize the speed of the flight (such as breaking Mach), then we want to keep the weight of the rocket to a minimum. That means we want to use as little epoxy as possible and keep things small and thin. At the same time, this is going to make the rocket weaker. So we want to find "how small" can we make the fins on the rocket.

We can use RockSim to find the smallest fin planform size. But it doesn't tell us how thin we can make the fins. If we make them too thin, they are going to be too weak. They also could flutter and cause excess drag. But if they are too thick, they'll add weight and drag to the model. We seek the optimum thickness that will allow the fastest flight without stripping the fins off the model.

The stiffness of the fin material, and how the fins are attached to the rocket will tell us how thin we can make the fins. A fin made out of G10 Fiberglass will be much stronger than a fin of the same dimensions made out of balsa wood.

That is where the new FinSim program comes in. It will tell us how thick to make the fins; based on the planform size, and how they'll be attached to the rocket.

And FinSim is easy to use too. If you have RockSim v6, you can just save the design in RockSim, and then open it up again in FinSim. It will immediately tell you a bunch of information about the fins. First, it will tell you the speeds at which the fins will flutter, and where the fins will start to twist (the divergence speed). But more importantly, it will tell you the conditions — speed and angle-of-attack — where the fins will actually break. This is based on:

1. Fin material
2. Fin Area and planform shape
3. Fin thickness
4. Type of glue used to attach to the rocket
5. Whether or not the fin is attached through-the-wall, or a butt joint.
6. Glue fillet radius

FinSim then will compute the flight forces on the rocket using the angle-of-attack and the speed of the rocket. From the forces, it then calculates the stress forces on the fins. Finally, it will tell you the at what speed the forces on the fins will exceed the strength of the fins. These are the conditions you have to watch out for.

Once you know the conditions where the fins will break, you can go back into RockSim and look at the graph of speed and angle-of-attack. If the conditions of the flight will exceed those where the fins will break off, you need to beef up the thickness of the fins.

On the other hand, if the fins are strong, you can either leave them alone, or make them thinner to save weight. If you want to make them thinner, you can go back to FinSim and directly edit the fin thickness.

This is a procedure you need repeat a couple of times. But it goes quickly, since FinSim gives instant results. In the end, you'll be able to optimize your rocket for the best performance and minimum weight.

About the Author:

Tim Van Milligan is the owner of Apogee Components (http://www.apogeerockets.com) and the new rocketry education web site: http://www.apogeerockets.com/education. He is also the author of the books: *Model Rocket Design and Construction, 69 Simple Science Fair Projects with Model Rockets: Aeronautics* and publisher of the FREE e-zine newsletter about model rockets. You can subscribe to this e-zine at the Apogee Components web site, or sending any message to: ezine@apogeerockets.com with "SUBSCRIBE" as the subject of the message. This article may be reprinted as long as this paragraph is included.

Enhance Your Apogee SATURN 'SUPER-SCALE' Modeling Expirience With High–Quality Reference Photos, Drawings, and Documentation.

Original Apogee SATURN V prototype under construction

Saturn V displayed at Kennedy Space Center

Adding accurate additional detailing to any scale model is always challenging. Even more challenging can be the often frustrating search for the technical information needed to construct those details.

Mike Dorffler Replicas helps end those long searches by offering scale model rocketeers a single sourse for documentation for many subjects on easy to use CDs. These CDs contain large collections of photos, videos, drawings, and documentation selected to provide the highest degree of detail for the various vehicle components.

The two new Saturn V and Saturn 1B CD collections cantain an in-depth quantity of reference data and documentation every Apogee Saturn modeler should have. The five-disk History Series set contain hundreds of photgraphs, official NASA vehicle drawings, and NASA documentation *.pdf format, including the actual Saturn Flight manuals. Price for this set is $70 plus $3.50 Priority Mail shipping.

The eight-disk John Pursley CD Set contains one of the finest collections of high-resolution, highly detailed photgraphs of both the Saturn V and Saturn 1B found Anywhere. The set also contains a great series of photos of the earlier Saturn 1 assembly and launches, and the Saturn V on display at the Johnson Space Center. One of the CDs offers a photographic historical look at the Apollo 11 launch and lunar landing. The price for this superb collections is $90 plus $3.50 Priority Mail shipping.

Email Mike Dorffler at mkdorffler@earthlink.net for further details. Special pricing is available for those Modelers who have purchased either the Apogee Saturn V or Saturn 1B kits. Ask for a full email * .pdf catalog of all the Mike Dorffler Replicas scale subjects on CDs.

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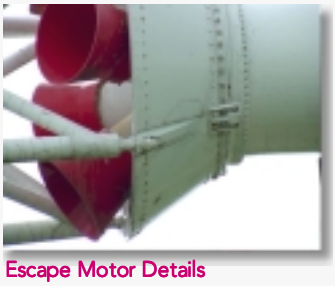
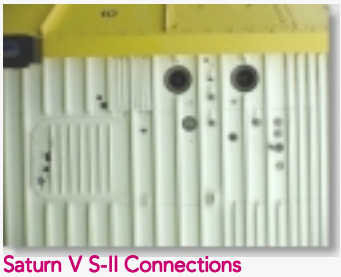


Escape Motor Details

S-IVB APU Details

H-1 Engine Installation In Saturn 1B



Saturn V S-II Connections

Super Saturn V F-1 Engine Details