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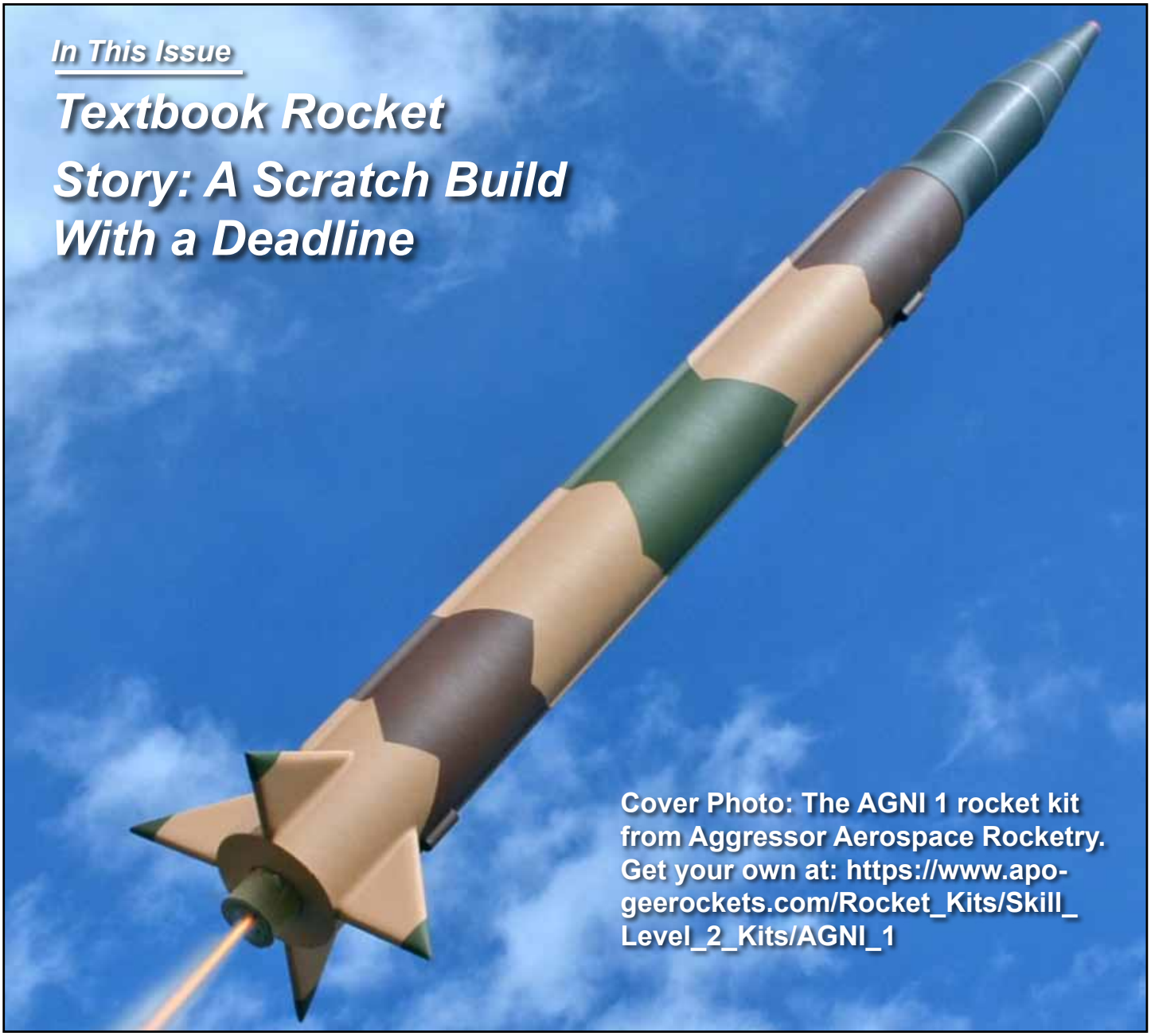
NEWSLETTER



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Textbook Rocket Story: A Scratch Build With a Deadline

Cover Photo: The AGNI 1 rocket kit from Aggressor Aerospace Rocketry. Get your own at: https://www.apogeerockets.com/Rocket_Kits/Skill_Level_2_Kits/AGNI_1

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Textbook Rocket Story: A Scratch Build With a Deadline!

By Chris Michielssen

Upcycling Books contacted me by email on March 31 to make a flying model rocket out of outdated physics and math textbooks.

As explained on the upcyclingtextbooks.org website:

> *"We are a movement encouraging people to use their creativity to inspire change . . . to move us beyond textbooks. Grab an old textbook, possibly one collecting dust on your shelf right now.*
>
> *Look at it. Don't think about what it is. Think about what it could be. Could it be a hat? Origami? A planter? A work of fine art? A rocket?"*

The idea fascinated me! This would be a good challenge or a possible disaster. A true scratch built rocket.

By the end of the project I learned to appreciate commercially available body tubes, engine mounts and nose cones!

I phoned Craig Joiner, Upcycling Books director, and asked about building a scale model. This might be one of the rockets on display at the Space Center Houston. I agreed to do the project.

The build guidelines:

1. The rocket was to be built from the supplied hardcover textbooks.

The only non-textbook parts were a dowel, shock cord and parachute.

2. This was to be a rocket others would see and be inspired to build themselves.

I was most concerned about the time window for the build. The textbook launch was to be at the Johnson Space Center Earth Day Celebration on April 18. Mr. Joiner assured me the books would be sent out the next day on Wednesday, April 1.

UH, OH!

On Friday, April 3 I received a flat envelope with two different address labels. One label had my address, the second label was addressed to Nevada!

Figure 1: The books from which to make the rocket.

Inside was a scarf and a letter thanking Grandma for taking care of the grand kids! No textbooks!

I emailed Craig and let him know I got the wrong package, no books to make a rocket.

Four more textbooks were sent out and arrived at my door on April 8.

With only a few precious days left, I was running out of time.

By now there was no time to make a complicated scale model and not enough time for a flight test before the public demonstration in Houston.

With four days lost, there were some simpler design compromises:

The new build:

1. The rocket is now a sport demonstration style model that could easily be seen during boost. A slower "Big Bertha" style launch is sometimes best for a demonstration.

2. All visible surfaces should be obvious book pages. The bulk of the model will clearly be printed pages.

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You can subscribe to receive this e-zine FREE at the Apogee Components web site (www.ApogeeRockets.com), or by sending an e-mail to: ezine@apogeeRockets.com with "SUBSCRIBE" as the subject line of the message.

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3. I needed a clever name that reflected the textbook and rocket theme. The name “SPEED READER” fit the project very well.

The body tube would be rolled around a tube form. I settled for a 1 ½” diameter PVC pipe from a hardware store. The 1 ½” diameter is a little smaller than a BT–60 sized model.

To laminate the body tube pages and nose cone, Mod-Podge glue was used. ModPodge is almost a thinned white glue and can be applied with a cheap foam brush.

Figure 2: Making the spiral wound tube using Mod-Podge on a foam brush.

Pages were torn out of the textbooks. I purposely picked pages with large copy blocks. The trick will be not to glue the paper to the PVC pipe.

There is a good reason why body tubes are rolled diagonally in a spiral - it’s easier to make long tubes!

The edge of the first interior pages were rolled dry, with no glue.

The pages were set down at an angle. No glue was applied until the start of the first overlap. It doesn’t take much glue, a thinner coat is actually better and the thin paper will wrinkle less.

Brush an inch of glue, roll the page and smooth to surface. Repeat glue brushing and rolling, just an inch at a time.

Figure 3: The first attempt at the nose cone didn’t turn out well. It warped when the glue dried.

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When you get the first page glued down, turn the paper around the pipe to make sure it isn't glued to the PVC form. If it turns on the pipe you can start gluing down a second page.

Eight layers of pages were wrapped! The tube felt as strong as a commercially available body tube.

Next up was the nose cone. The first attempt wasn't useable.

Figure 4: The internal structure of the nose cone used a wood dowel and rings cut from a book cover.

Figure 5: Layers of paper were wrapped around the skeleton to give it shape.

I tried to wrap 1" wide strips down a dowel to make a LONG Goblin style nose cone (see Figure 3).

After it dried it warped! It ended up looking like a big pickle.

A BIG HEAVY pickle. Four hours of build time lost!

For the second try I went with a simple conical shape.

A 1/4" diameter dowel went down the center and some "centering ring" supports were cut from a book cover (see Figure 4).

Layer upon layer of page strips were glued down from the tip to the shoulder (see Figure 5).

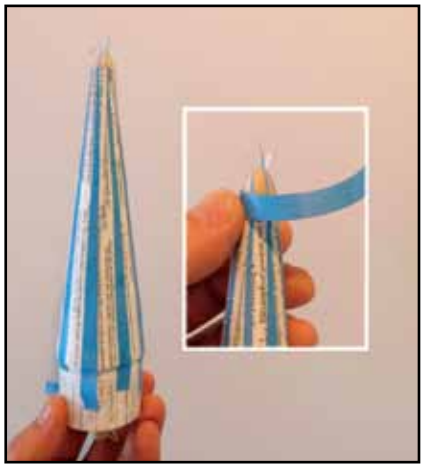

Figure 6: Vertical stripes were added to make it look taller than it really was.

The nose cone ended up shorter than I would have liked.

Tapered, vertical blue stripes were glued down the cone to give it a forced perspective, making it look taller than it really was (see Figure 6).

The second nose cone was smoother, lighter and useable.

The engine mount parts were also made from the textbooks.

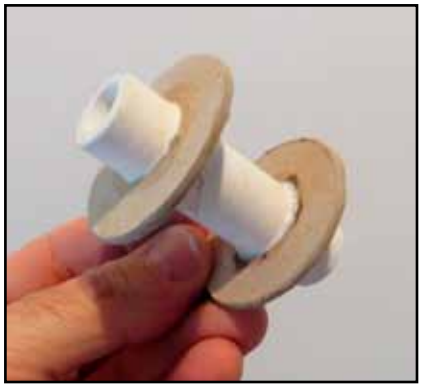

Figure 7: The completed engine mount.

The motor mount tube was made of page wraps formed around a 24mm engine casing.

The centering rings were cut from the book cover, the

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outside glossy cover skin was peeled off.

No engine hook could be fashioned from the books so the engine will be a friction fit or held in place with a single wrap of masking tape around the motor tube and the engine extending out the back of the mount.

The launch lug was made from another single page. It was wrapped around a 3/16" rod and glued together with a glue stick.

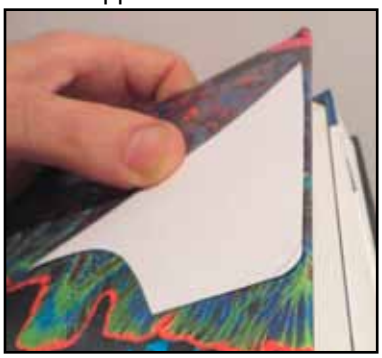

Figure 8: The fins were made from thick book covers.

The fins turned out to be the easiest part of the build. A template was made from cardstock and traced over the most colorful print area I could find on the book covers.

The rounded cover sides would end up as a rounded leading edge of the fin. The outside and trailing edges would be square.

To cover the unprinted back side of the fin, some of the cover print was scored and peeled off. The skin was set in place with a glue stick.

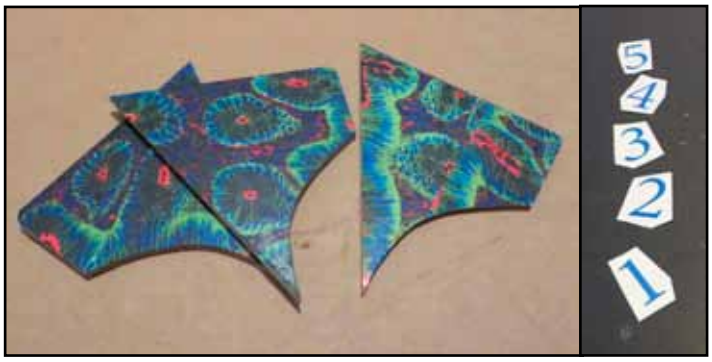

Figure 9: The finished fins (left), and the trim lettering cut from chapter pages (right).

The only trim on the rocket was some blue stripes cut from chapter pages. To add a bit of interest and whimsey, a vertical countdown of 5 to 1 was cut from the same chapter pages and set down the rocket side.

Figure 10: The completed model.

An 18" parachute and shock cord were installed, and the rocket was done (see Figure 10).

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Figure 11: The Speed Reader takes flight.

The Speed Reader textbook rocket flew with a D12-5 engine to 700' at the Space Center Houston Earth Day Celebration on April 18, 2015.

It was stable - Whew!

The Speed Reader rocket even got a write up and video! (see: http://upcyclingtextbooks.org/?p=1317)

Lessons learned -

You can make a rocket out of nearly anything. But it's not much fun making a scratch rocket while working against the clock!

It did remind me of the early Estes Scout kits, where Gleda Estes rolled body tubes by hand on the kitchen floor.

A project like this makes you appreciate commercially available body tubes, nose cones and ready to build kits.

This turned out to be one of the most interesting rocketry challenges so far!

Would I make another textbook rocket? Maybe!

About the author:

Chris Michielssen is an avid builder and flyer of low power model rockets. He produces Odd'l Rockets and accessories, available from Apogee Rockets.

His building blog: www.modelrocketbuilding.blogspot.com is followed by 1,500 people each day worldwide.

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