Fabric Streamer Optimization
R&D Summary

In this research project I built and tested the performance of a pleated fabric streamer. The streamer was made from 1.3 ounce rip-stop nylon and pleated like a mylar streamer. I used a high quality clear coat spray paint to coat the nylon fabric. It was used to stiffen the fabric and set the pleats so they would behave and preform like a pleated mylar streamer. I tested the streamers performance against a non-pleated rip-stop nylon streamer and a pleated nylon streamer.

All streamers were the same dimensions and all tested for duration and launched in the same rocket three times with a A-8-3 impulse motors. Each launch was timed for duration and an altimeter was used to record the altitude for each launch.

The pleated fabric streamer out preformed the others in both duration and altitude. I expected the mylar streamer to do better. I will be competing with a 12 inch by 120 inch fabric streamer with 2 inch pleats in the G streamer duration event at NARAM 58!

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Research and Development

Fabric Streamer Optimization

By Thomas Estrada

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NARAM 58

RESEARCH AND DEVELOPMENT

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I joined the NAR in November 2015. My son Ryan and his grandfather Vern Richardson have been competing for a few years now, but about a little over a year ago Vern changed jobs and took an IT job in Arizona. So I decided to get into this rocket craze to help Ryan. It is July 2016 and here comes NARAM 58. WOW! What a ride it has been.

The Objectives of the work:

After competing in the FLARE winter regional in November 2015 I decided I was going to try using a fabric streamer instead of the mylar one for the G streamer event. The mylar streamer I was using for that competition was tearing and sticking together Just about everyone uses some type of pleated mylar, paper or fabric streamer, but I have never seen anyone using a pleated fabric streamer. I knew I could pleat a fabric streamer by ironing it, but how could I get the pleats to set. I decided a coating of some type would be needed to set the pleats. I started researching the NAR website and the internet. I found many papers on methods for pleating mylar and paper streamers. There were also papers written on various streamer materials and how those materials preformed but nothing on pleating fabric streamers. I decided to see if I could pleat a fabric streamer and have those pleats preform like a pleated mylar streamer. I am also going to test this pleated fabric streamer against a non-pleated fabric streamer and a pleated mylar streamer to see which one preforms the best.

The approach taken:

I am going to use a altimeter in small 14.75 inch BT-50 rocket with a 18 millimeter motor mount, two fiber centering rings, three 1/16 air-foiled balsa fins and an ogive balsa nose cone. A-8-3 motor will be friction fitted to the body tube and also taped to the tube. The nose cone will be attached with a 50 pound Kevlar shock cord which is attached around the motor and taped to the rocket body at the center of mass. I will use a spent engine to determine the center of mass. The streamer will be attached to the shock cord with 1 inch Mylar tape. All the streamers will be 1.75 inches wide by 25 inches long. I chose these dimensions for each streamer because the mylar streamer material was precut to those dimensions. Each of the streamers will be flown in the same rocket three times.

After much deliberation I decided to make the pleated fabric streamer from 1.3 ounce rip-stop nylon. The nylon fabric is very flexible so I am going to coat the fabric to stiffen it up considerably. I had considered using spray starch to do this, after having a flashback and remembering my brother starching his slacks so heavy they could stand up on all by themselves.

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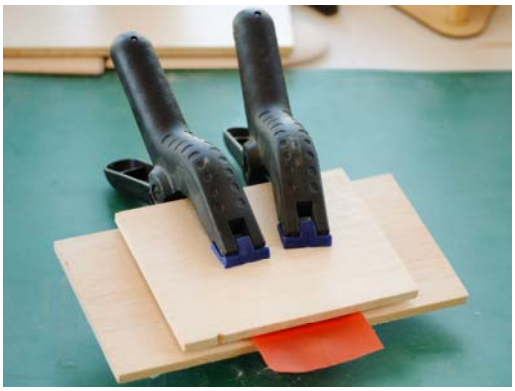
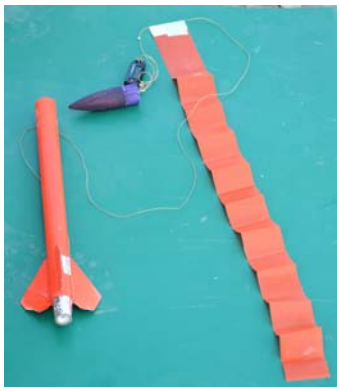
Instead I decided on a high quality fast drying clear coat spray paint since it will dry harder and last longer than the starch. The pleats on the fabric streamer will be one inch apart starting from the top and there will be no pleats on the last three inches. I am going to use a hot iron to start the pleats then clamp the streamer between two scraps of balsa to set the pleats in the rip-stop nylon. After a couple of days I removed the streamer from the clamps and sprayed both sides with two coats of clear coat, letting each coat dry toughly before the next is applied. After the clear coat dries the streamer was clamped up for another day. The non-pleated fabric streamer is the same 1.3 ounce rip-stop fabric cut to the same dimensions. The mylar streamer is made from a 1 mil rippled mylar that was left over from a previous project. It was cut to the same dimensions.





The equipment used:

1 BT-50 tube.
1 BT-20 tube.
2 Fiber centering rings BT-20 to BT-50.
1 scrap piece of 1/16 balsa for fins.
9 A-8-3 engines, igniter's, and plugs.
1 Small launch tower.
1 Launch controller.
2 feet of 50 pound Kevlar shock cord.
80 square inches of 1.3 ounce rip-stop nylon.
1 can of clear coat spray paint.
Paper wadding.
2 plastic spring clamps.
2 small pieces of scrap ¼ balsa.
1 small scale to calculate streamer and rocket weight.

Common tools-hobby knife, super glue, ruler, rotary cutter, cutting mat, Mylar tape and white glue.

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The facilities used:

We launched all rockets in my front yard, about thirty acres of New Mexico desert in Cotton City. All the rockets were built in our sun room.

The budget:

The only things I had to purchase were as follows.

A-8-3 engines $38.
Kevlar shock cord 80¢.
Rip-stop nylon 40¢.
Total: $39.20

The data:

Elevation: 4236'
Temperature: 99°
Humidity: 16%
Pressure: 30 in.
Wind: WNW 12 Mph
Sunny and clear.
Rocket weight without streamer: 19.84 grams
Non-pleated Fabric Streamer:
- Weight-2.83 grams
- Launch #1-14.25 seconds, 65 meters.
- Launch #2-14.75 seconds, 66 meters.
- Launch #3-14.16 seconds, 62 meters.

Pleated Fabric Streamer:
- Weight: 5.14 grams
- Launch #1-15.7 seconds, 69 meters.
- Launch #2-15.41 seconds, 67 meters.
- Launch #3-15.16 seconds, 65 meters.

Pleated Mylar Streamer:
- Weight: 0.79 grams
- Launch #1-14.51 seconds, 67 meters.
- Launch #2-14.86 seconds, 66 meters.
- Launch #3-13.13 seconds, 64 meters. Wind gust at launch moved the tower.

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The results obtained:

The average time for the non-pleated fabric streamer was 14.38 seconds. The pleated fabric streamer averaged 15.42 seconds. The average time for the pleated mylar streamer is 14.16 seconds. And the winner is the pleated fabric streamer!

The conclusions drawn:

It is possible to pleat a fabric streamer. The pleats do set very well into the nylon fabric using the clear coat paint and the clamping system. I am not an engineer but I think other coating methods need to be investigated. The clear coat almost doubled the weight of the streamer. Other lightweight fabrics need to be researched also.

The pleated mylar streamer seemed to flatten out in flight with the weight of the rocket. I know my test rocket was a little on the heavy side but I didn't want to spend too much time chasing rockets since I need to launch nine of them. After seeing Ryan's streamer research data, I am going to try ripples between larger pleat spacing of a mylar streamer. I am also going to try to produce ripples in a fabric streamer. Maybe even try pleating some silk or parachute fabric.

I will be competing with a 12 inch by 120 inch fabric streamer with 2 inch pleats in the G streamer duration event at NARAM 58!

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