



# UPDRAFT

Newsletter of EAA106  
Greater Boston Chapter

We Build  
Airplanes!

**February 2004**  
**Volume 32 Issue 2**

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## EAA 106 February 2004 Meeting

**Friday, February 6<sup>th</sup>, 7:30pm**  
**At the BEDFORD VA HOSPITAL**

### Meeting Program

Chapter member Joe Ryan will lead us through the design and construction of a new sign for the Chapter 106 Hanger. Joe has put together the basics, but we need your creative thoughts to finish the project!

### **DUES ARE DUE!**

Mail Your Dues to the Chapter Treasurer, Ed Dokus,  
Or better yet, bring them to the meeting!

\$20.00 for E-mail Newsletter  
\$23.00 for the Snail-Mail Version

*Failure to pay your dues means:*

1. You won't receive this fine newsletter anymore
2. You won't be covered by chapter insurance
3. You won't be able to vote in chapter matters

Alert: March meeting will be on the 5<sup>th</sup> at the unusual time of 6:30 pm, at an unusual location, and with a very special program – See next page for more!

### Dues Are Due

Please note that Chapter 106 Dues for 2004 are now over due. You can pay your dues to the chapter Treasurer, Ed Dokus. The dues remain \$20/year for email membership, and \$23/year for snail mail membership. Those former members who have not paid their dues will be dropped from the roster and mailing list. Send your dues to Ed at 7 Fairmount Street, Winchester MA 01890.

**March meeting** -- A visit to Avidyne Corporation next to Hanscom Field. Sales Manager Jamie Luster will show us many of their line of integrated avionics products and tell us how they are revolutionizing the future of general aviation. Date is Friday, 5 March at the unusual time of 6:30pm. Depending on what aircraft are in the Avidyne shop on that day, we'll get to see them too! We'll provide further information at the February meeting and in the March Newsletter.

Membership Means More With EAA...

Ever wonder what comes along with your EAA membership? On the EAA website, [www.eaa.org](http://www.eaa.org), click on the button labeled "member benefits" along the left side. The member benefit page lists numerous great deals available only to EAA members. Recently one area member found just what a great deal could be obtained through the EAA Partner Recognition program with Ford Motor Company.



Seems this local EAA member, who edits the newsletter for another area chapter, went to several Ford dealers and offered to pay \$500 over invoice for a new truck. The dealers all wanted \$1500 to \$2000 over invoice. He later returned with the appropriate information from the EAA website and was given a firm price on a F-150 truck of \$100 below invoice with no haggling! Check it out for yourself.

Editors Note: It was a year ago February First that the Space Shuttle Columbia broke up on reentry taking the lives of 7 astronauts and grounding the remaining fleet. Chapter member Joel Ventura provides some interesting information on what happened.

### COLUMBIA SHUTTLE FOAM STRIKE

On one of the mail lists I belong to a member found it hard to understand how a piece of foam could accelerate to 500 mph in such a short distance before it struck the shuttle wing. He also asked how fast the shuttle was going and what was its acceleration. This was a response I sent in. --Joel

The shuttle's main engines are rated at 4.3 million pounds of thrust, and the solid boosters add 2.6 million pounds to that for a total of 6.9 million. The weight of the entire vehicle ready for launch is about 4.4 million pounds.

The solid boosters are either on or off, so once they are ignited you are committed to some kind of launch. The liquid fuel main engines are variable from 65% to 109% of their rated power. They come up to about 90% of rated power for the initial part of the launch, but soon

after that, the main engines are throttled back. I believe this is done to limit the dynamic pressures on the vehicle in the dense atmosphere. They then throttle up to 103%. As the ascent continues the solid boosters lose thrust, and the main engines are throttled back to keep the acceleration rate below 3 gs as the vehicle is getting lighter as it burns its fuel.

At T+ 50 seconds, the shuttle is going about Mach 1. About 132 seconds into the launch the boosters burn out, and the shuttle is going

about Mach 4.5. Between 50 seconds and 130 seconds the shuttle has gained about 2,450 MPH. That works out to an average acceleration of about 1.38 gs. Using that acceleration rate for 32 seconds, and adding this increase in speed to Mach 1 at T+50 seconds, you get a shuttle speed of about 1,650 MPH at 82 seconds into the launch when the foam block came loose.

That foam block had a flat plate area of over 1 square foot, and it weighed about 2 lbs. You can imagine that putting an object like that in a 1,600 MPH air stream would result in a very large acceleration rate. Keep in mind that this was not a streamlined object, and placing it in a supersonic air stream would generate a very large shock wave, with the associated tremendous increase in drag. I do not know how to calculate supersonic drag, but a 500 MPH difference in speed does not seem unreasonable in these conditions. I assume they got that speed by looking at how far the block traveled between TV frames.

Note also that the most recent test NASA conducted on the leading edge of the wing was not nearly as nasty as what the shuttle actually had to endure, since it did not include the above mentioned shock wave and the dynamic pressure the shuttle experienced. They just shot a block of foam at the wing at 500 MPH, and it blew a 2 foot large hole in the leading edge.

That leading edge, and the nose of the shuttle, are made from a reinforced carbon-carbon (RCC) material that can take up to 3000 degrees F. You need those high temperature properties for the re-entry thermal stress, but you have to

give up something in the strength department. There have been foam strikes on every shuttle launch, though most have been on the underside of the wing tile surface. Engineers had considered the possibility of a foam strike on the leading edge, but concluded that, in the launch conditions, that was impossible. Apparently the complex supersonic airflow around that complex vehicle is not well understood.

The basic numbers I gave above came from Andrew Chaikin's new book "Space", and from the "Space Shuttle Operator's Manual" by Joels and Kennedy, published in 1982. The 1982 numbers may be a little out of date, but they should be in the ballpark.

I leave you with the Aero-News Quote of the Day on 7/2/03 from "Steve" Stich, NASA, in an email to the Columbia crew, putting to rest any concern the astronauts may have had about possible damage caused by the foam strike during launch.

"Experts have reviewed the high speed photography and there is no concern for RCC or tile damage. We have seen the same phenomenon on several other flights and there is absolutely no concern for entry."

PS: One thing I forgot to mention is that I heard NASA had done some testing on foam strikes before this event, and found them not to pose a serious problem. That is why they felt so confident in reassuring the astronauts. Unfortunately the largest piece they tested was about 1/20<sup>th</sup> the size of the piece that broke off and struck the wing of the Columbia.

### **DIRECTIONS TO THE BEDFORD VA HOSPITAL MEETING ROOM**

From Route 128 aka Rte I 95 take Route 4/225 West towards Bedford. Go approximately 2.2 miles on Rte 4/225, passing the Great Pond Shopping Center (on left) and Marshall's (on right). Turn right onto Hillside Road (gift shop just beyond this turn) and stay on Hillside past merge into Springs Road. Go straight at the four-way stop sign, and about 0.6 miles beyond into the VA Hospital grounds.

Turn **LEFT** at the sign for Parking Lot #2. Proceed past the **Receiving & Warehouse**, past the buildings on the left, around the turn past the **large water tower** on the **LEFT** and enter the parking lot on your left. Park as close to the water tower as you can. Proceed on the side walk towards the long low building that ends at the road. Walk towards the connecting hallway between buildings and enter the door. Take two quick right turns and go down the hall to the classroom.

|                    |               |                    |               |       |                |
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**EAA 106 Hangar (978) 683-8751**

This **NEWSLETTER** is for **COMMUNICATION** and **ENLIGHTENMENT**, but should **not** be relied upon as absolutely correct in content.

**DUES ARE DUE THIS JANUARY**

**If you haven't paid, you will be dropped**

**Mail your dues to Chapter Treasurer:**

**Ed Dokus (address Above)**

**\$20.00 for the E-Mail Newsletter**

**\$23.00 for the Snail-Mail version**

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