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NEWSLETTER

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Cover Photo: DFR Technology's Altlas V AV551 rocket kit. Get your own at: www.ApogeeRockets.com/Rocket_Kits/Skill_Level_4_Kits/AtlasV_AV551_New_Horizons

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Adapting the Aerotech Universal Delay Drilling Tool for Regular RMS Delays

By Scott Tyrrell

The new Aerotech Disposable Motor System (DMS) and EZ reload motors use a delay tool called the Universal Delay Drilling Tool (www.ApogeeRockets.com/Rocket_Motors/AeroTech_Accessories/Universal_Delay_Drilling_Tool). However, it isn't really universal, as it doesn't work on the regular RMS delays. The purpose of this article is to show you how you can add the capability to drill the RMS delays too.

Figure 1: Aerotech's Universal Delay Drilling Tool

It should be noted that since Aerotech wants customers to use the new DMS motors, they have an initial deal to push it into the marketplace. Essentially, this tool is available FREE through 2014 (with a purchase of two DMS motors). Apogee sells DMS motors and also offers the tool free with the purchase of two DMS motors through the end of the year. To take advantage of this special, you just use the combo discount to add the drilling tool to the order.

The tool worked great in the field; it was used on an H195-14A, (Figure 2) at the Radical Rocketeers Launch in Great Meadows NJ, drilling 4 seconds off the delay (Figure 3). The tool is marked at each end with the delay in seconds to be removed, that end is placed next to the motor forward bulkhead and the delay is drilled out by rotating the knob while gently pushing. The tool takes off 4 or 8 seconds from the delay or use the included spacer to take off 2 or 6 seconds.

Figure 2: A disposable motor (right), and the Universal Delay Drilling tool (left).

Figure 3: Using the Universal Delay Drilling Tool.

The tool is called "universal' because it is designed to drill the delays of the 29, 38 and 54 mm DMS motors and the new RMS-EZ versions of the popular I161, I357, and I211 motors. From what we understand, eventually all the RMS motors will be switched over to the 'EZ' configuration, but it may take years to get them all converted and re-certified).

Aerotech has authorized its delays to be drilled, and at that same launch I had a delay element from an RMS motor that needed to be six seconds shorter. Aerotech has had directions on its website since 2005 about how to shorten delay elements by drilling. http://www.aerotech-rocketry.com/customersite/resource_library/Instructions/RDK_Instructions/rms_delay_mod_inst.pdf

Aerotech specified drilling 1/32" per second in its instructions, so 6/32" (converted to: 3/16") was measured on the end of the Universal Delay Drilling Tool bit, and masking tape was wrapped around the bit at that point, then the delay was hand drilled to the tape mark. This was a pain at a launch where the time is short.

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Looking at the spent DMS motor, it occurred to me the plastic bulkhead should be able to be used as a spacer to drill the loose delay elements that come in most Aerotech reload kits. All the parts that come in reload kits are sold by RCS, Aerotech's parent company at http://www.rocketmotorparts.com. I took a look there and was very happy when they appeared to also sell the same yellow plastic delay bulkhead used in the H195 DMS motor. I might just have found the perfect adapter to use to drill any Aerotech delay (except the 54 mm delays that are too big to fit in the delay cavity).

This is what was ordered (Figure 4):

(1) Spacer, Fiber Washer, .865" dia, 1/32" thick, Product Code: 05400

(2) Plastic Delay bulkhead, Product Code: 01917-1

Optional:

(3) Delay Insulator 13/16" O.D., 5/8" I.D., 0.719" Long, Product Code: 03302

Figure 4: Parts ordered from Aerotech to allow RMS motors to be easily drilled with the Universal Delay Drilling Tool.

Figure 5: The plastic delay bulkhead (bottom) is what is used in the DMS motors (top).

The order arrived in a few days and the upper end of the bulkhead seemed identical to the DMS motor, (Figure 5) except the touchhole was tiny compared to the DMS motor. (Figure 6) The other dimensions were confirmed

Figure 6: The size of the 'touch' holes is different.

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Figure 7: Enlarging the 'touch' hole.

by inserting a thin dowel inside the DMS motor and finding the thickness of the touchhole bulkhead. The delay insulator was a perfect slip fit in the new bulkhead to keep delays centered.

The Universal Delay Drilling Tool bit is ¼", so on my drill press I carefully drilled the small touch hole out in the new bulkhead to accept the ¼" delay tool bit. (Figure 7) The hole should be kept centered as much as possible but this step could also be done by hand just using the Delay Drilling Tool.

The bulkhead was then placed at the eight-second end of the Universal Delay Drilling Tool just as if it was the DMS motor, and I measured how far the bit came through. (Figure 8) It was a little longer than 8/32" (1/4"), the desired length for 8 seconds according to the Aerotech delay drilling instructions.

Figure 8: Measure how far the bit protudes into the cavity.

What was needed was another thin spacer between the bulkhead and the tool. In the RMS motors, Aerotech has a very thin neoprene washer in the forward delay cavity, so it is possible there was something like that in the DMS motor. The fiber washer is exactly the thickness needed to work perfectly as a spacer, the washer was placed over the bit, then the bulkhead goes over the bit, and the bit protruded

Figure 9: The fiber spacer cuts down the delay time exactly to 8 seconds.

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Figure 10 (above) and 11 (below): An RDK delay element used with the Universal Delay Drilling Tool.

¼" into the cavity, perfect for removing eight seconds. Figure 9 shows the drill tool, black fiber washer spacer, and drilled bulkhead, ready to drill.

I put a test RDK delay element into the delay insulator and both into the bulkhead to test drill (Figure 10). The delay was pushed to the bottom of the well and held there with finger pressure on it (Figure 11).

Figure 12: The hole in the delay grain. Note the fiber spacer inside the drill tool to the left side of the photo.

Then the knob is rotated, and when the knob bottomed out the delay was removed and it measured at the expected depth. Success! (Figure 12) The tool is now more nearly universal, able to securely drill any delay from an Aerotech 38mm motor and smaller.

For folks wanting to also drill 54mm RMS delays, the walls of the delay cavity would need to be trimmed off, just leaving a flat disc to press the delay on.