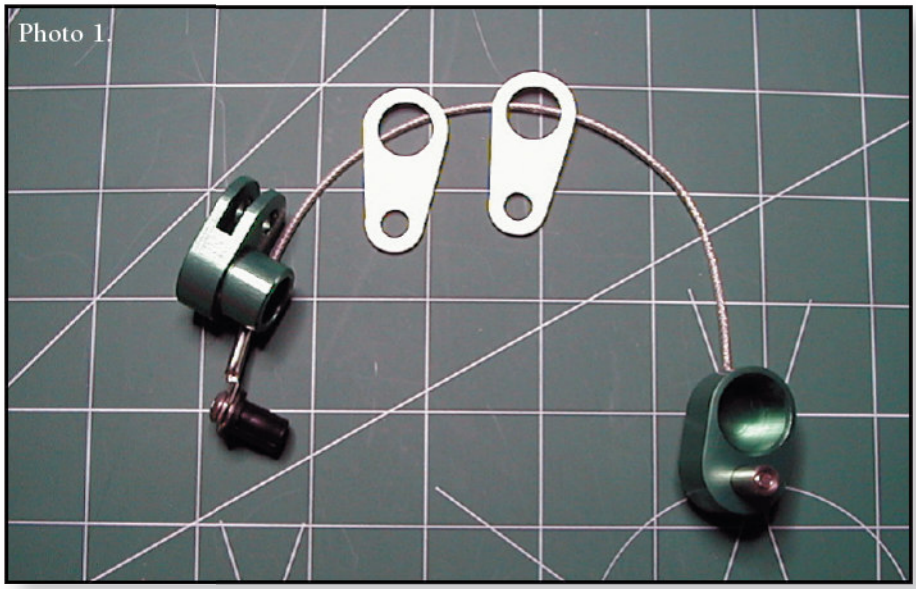

Dual-deployment recovery using the

Defy Gravity Tether

by Will Marchant, NAR 13356

Above: These are the basic pieces of the Tether. The grid squares are one inch on a side. The rubber stopper seals the charge compartment in one half of the locking mechanism. The wire harness for the e-match exits the charge compartment alongside the rubber stopper. The steel retention cable is run through one of the tabs and keeps both halves of the locking mechanism from being lost.

I had built a BSD Horizon 4" kit (http://www.bsdrocketry.com/4%20Horizon.htm) to use for my level 2 high power certification. The stock Horizon uses a motor-initiated ejection charge for recovery. After seeking council, I decided that deploying a 36" parachute at 4000 feet on a 4-pound rocket was likely to result in a very long walk! I'd already built the kit, so what was I to do?

The obvious answer was to use some form of dual-deployment recovery. The typical system uses an altimeter to first deploy a small drogue parachute at apogee with the main parachute deployed at a much lower altitude. That system requires compartments for the drogue and main parachutes, as well as an avionics bay compartment for the altimeter. The stock Horizon has a compartment for the main recovery system and a payload bay.

I thought about replacing or rebuilding the payload compartment to contain both the altimeter and main parachute. But an easier option presented itself in the form of the Defy Gravity Tether (http://defyg.com).

The Tether has lots of possible uses, but in my case I have it holding the main parachute furled until the low deployment altitude is reached. At apogee an ejection charge separates the payload bay from the engine portion of the airframe and also ejects the furled parachute from the airframe. The rocket then "tumbles" at a low speed until the altimeter activates the Tether to unfurl the main parachute.

The Tether is a small device (see photo 1) consisting of a locking body that retains two metal tabs until the e-match initiated pyrotechnic charge is activated. The Tether can use Black Powder or Pyrodex.

For my application the tabs are connected by a small length of parachute cord (see photo 2) that wraps around, and confines, the main parachute. A piece of Nomex cloth from Pratt Hobbies wrapped around the parachute, shroud lines, and shock cord gives the Tether a good grip (see photo 3.) Note that the Nomex is securely attached to the Tether tabs. The steel cable connecting the lock halves goes through one of the tabs to keep them from being lost. Finally, one of the tabs is clipped into the carabiner at the base of the payload bay (see photo 4).

I've flown the Horizon seven times in this configuration. Five times the main parachute fully deployed and the rocket was recovered successfully. The two failures were due to mistakes on my part. In the first I was working too fast and didn't have the Tether's retention cable in the correct location. When the Tether mechanism separated, the retention cable trapped the

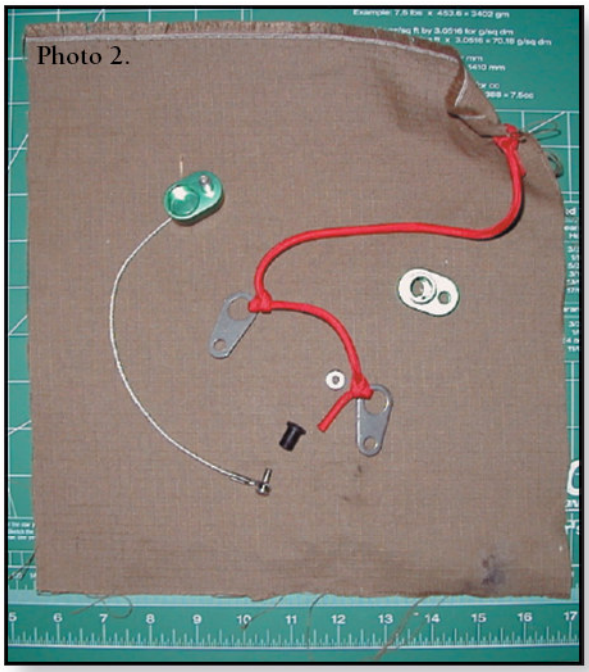
Photo 2.

The user supplies a piece of cloth (a Pratt Hobbies Nomex parachute protector in this case) to wrap the parachute and shock cord. The red parachute cord and the two metal tabs hold the parachute inside the cloth until the locking mechanism releases.

The Tether has lots of possible uses ... I have it holding the main parachute furled until the low deployment altitude is reached.

parachute. The second failure was a result of my wrapping the shroud lines too tightly around the parachute. I now layer the shroud lines inside the parachute and then loosely roll the parachute. The BSD Horizon flew again after these two mishaps.

I like the Tether and plan to continue using it. You'll need to be very careful to keep the e-match wire for your apogee ejection charge from tangling the Tethered main parachute. Trim all e-match wires to the appropriate length and minimize excess that might tangle. Also, pay attention to the routing of all harnesses as it is easy to load a configuration that will foul the parachute.


Photo 3.

The parachute is securely wrapped inside the cloth and held in place by the parachute cord and tabs. The green locking mechanism is then held together with a small piece of masking tape. The tape will yield when the pyrotechnic charge is initiated and the locking mechanism will fly apart.

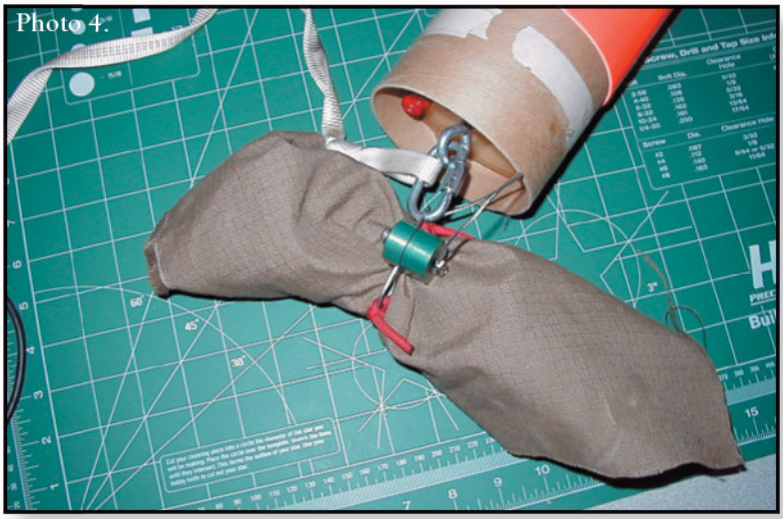
Photo 4.

The completed assembly is then securely attached to the payload bay eyebolt with a carabiner through one of the large holes in the metal tab. The e-match wires are not shown in this photo. They would be attached to the two red screw-terminals. Note that only a short length of e-match cable is required.