

# Design and Development of a Small Universal Sounding Rocket Recovery System

Randy Thomas

*Paratech Parachutes, Fairbanks, Alaska*

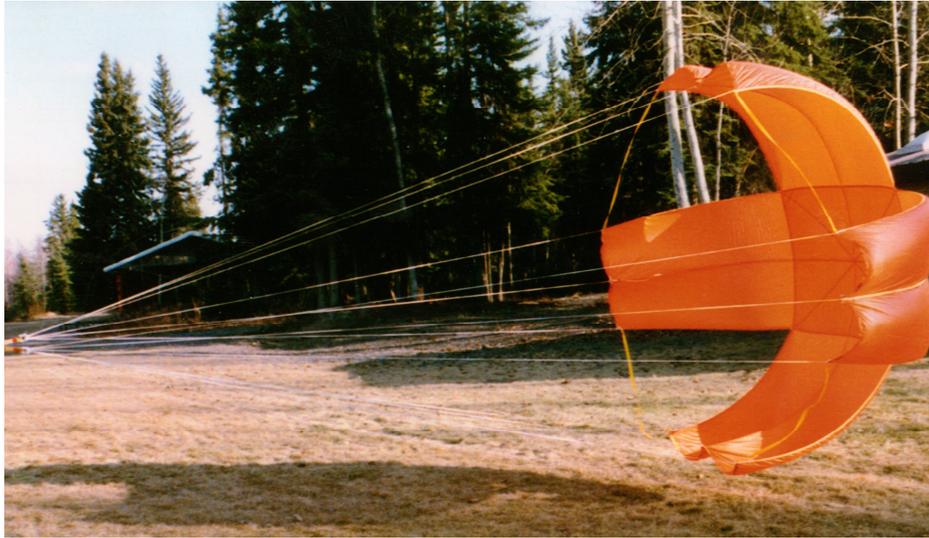


Figure 1: Inflated view of small universal sounding rocket main cross parachute.

## **Abstract:**

This paper presents a preliminary 3-phase design, in which hardware was developed to fully test a flight qualified and operational sounding rocket parachute recovery system. This recovery system consists of a 3 feet diameter ribless guide surface drogue, and a 14 feet diameter main cross parachute with a cross arm (W/L) ratio of 3.8:1 (0.263), packed into a 6 inch diameter parachute canister. Construction with nylon, Kevlar and Spectra provide low weight and packing bulk. The complete recovery system weighs 4.5 pounds and packs into a length of 8 inches. System is designed for 25 pound minimum payloads with impact velocities of 20 feet per second, and can be used up to 80 pounds at 35 feet per second. Design heritage from a large cross parachute recovery system developed by the author (AIAA-97-1531), led to development of this recovery system, which further addresses performance issues and parameters contributing to parachute wake recontact.

## **Introduction**

The need to develop a “generic” lightweight parachute recovery system for small sounding rocket payloads with different flight configurations is desirable, as no readily available off the shelf systems are available for small sounding rockets. This recovery system concept was developed to configure several small sounding rocket payload parachute recovery systems. Universal application of this recovery system concept is adaptable payload recovery configurations over a wide weight range on different launch vehicles.

A 3-phase preliminary design was fully developed and flight tested using small hybrid sounding rockets. Further testing fully developed this recovery system concept for operational use on sounding rocket applications by private sector companies engaged in sub-orbital space flights and science applications. This small universal recovery system concept recovers small rocket payloads and motors for reusable hybrid sounding rocket special applications and operations. Application of this compact system is reuse of hybrid rocket flight vehicle hardware, significantly reducing operational costs in conjunction with modular payload recovery system described in this paper