

# Design and Development of the LV3 Recovery System

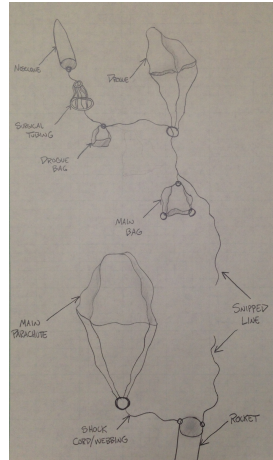


Figure 1: Figure 1

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## Abstract

This document details the design and development of the two-stage recovery system used in the third launch vehicle (LV3) of the Portland State Aerospace Society. The recovery system consists of a five foot, MACH II high speed drogue parachute and an 18 foot standard main parachute, made of low-porosity 1.1 rip-stop nylon. The parachutes were purchased for payloads between 60 and 100 pounds, with impact velocities ranging from 15 to 25 feet per second. The total system fits into the six-inch diameter, 36 inch long Van Karman nosecone (CONFIRM/REWORD) and weighs approximately (FILL IN).

## Background

The old system utilized a PVC cap, wooden ring, and surgical tubing to act as a compressive spring, effectively pushing the nosecone away from the body of the rocket. It also included an aluminum bar attachment to secure the main 'chute. In order to cut the lines to the drogue 'chute, gun powder line cutters

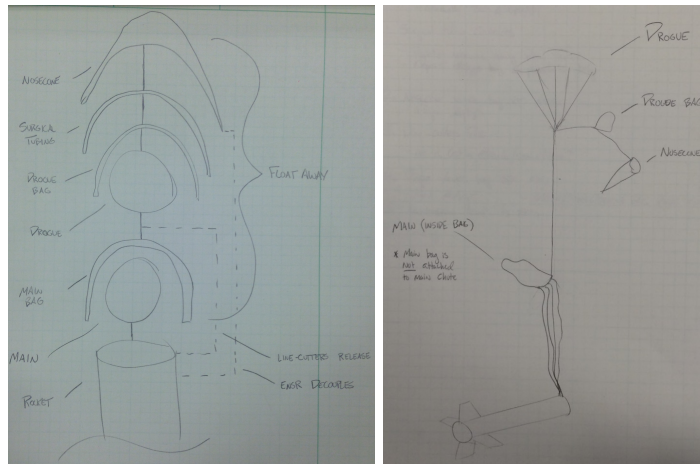
were used - multiple for redundancy. Both the drogue and main parachutes were cross-shaped. The system was housed in the body of the rocket.

The need for development of a new recovery system came primarily from the fact that a new launch vehicle was built. The new vehicle is both lighter and larger, but will mostly likely increase in weight as more components are added to the payload. The old recovery parachutes were also becoming dilapidated, and therefore needed replacing. But, since they were made in-house by a retired member, a new source needed to be found. New rings must be designed and manufactured as well, since the diameter of the new system is larger. This provides an opportunity to improve on the old method too.

## Design

The new recovery design remains a two-stage system, incorporating a new five foot drogue and 18 foot main parachute. The most difficult challenge during the design was fitting all components into the nosecone of the rocket, rather than the body.

A rough sketch of the overall design is shown below in Figures 2 and 3.



Where the order of operations are as follows:

1. ENSR (electronic nosecone separation ring) activates
2. Surgical tubing contracts
3. Nosecone pulls the bag off of drogue 'chute
4. Line-cutters fire, releasing drogue 'chute
5. Drogue parachute pulls the bag off of the main 'chute
6. Accelerations tends to zero
7. Landing