



Invocon, Inc.

Application Spotlight – TMS

Tension Measurement System for Parachutes

During the development of its X-38 Crew Return Vehicle (CRV), NASA contracted with Invocon to develop a Tension Measurement System (TMS) for measuring loads on the risers of its parafoil. The data provided by TMS enabled NASA to save money by significantly reducing the number of drop tests that were originally planned during development of the CRV.



NASA's X-38 Lifting Body with Parafoil

The TMS sensor units were installed on the risers of the parafoil before packing and remained in a low-power state until the test. Data acquisition was triggered as the parafoil was deployed but before a load was applied to the risers.

Therefore, TMS recorded the initial deployment and all subsequent events throughout the flight including the multiple de-reefing events that were designed to gradually slow down the vehicle. This approach ensured that the final configuration would not damage the parafoil or the vehicle.

The system acquired data at two sample rates in order to capture the initial highly-dynamic parafoil deployment as well as the near-static final glide. This approach minimized memory usage which influenced size, weight, and power (SWaP).



Tension Measurement System Sensor

In addition to its requirements for small size and weight, TMS units had to withstand significant packing loads for the parafoil. This was a significant factor in the mechanical design of the system. The robust nature of TMS allowed NASA to use it for multiple test programs over several years. The flexibility of its design has enabled it to be used by private industry for other parachute test programs.