

Harding University Flying Bison USLI 2009 Rocket Team

Final Report

June 12, 2009

The Harding University Flying Bison USLI 2009 Rocket Team was composed of eight Harding University Students, two faculty members and one external expert:

Gregory Lyons, Team Leader	Shane O'Connor	Jonathan Langford
Paul Elliott	Megan Bush	Steven Barber
Nathan Smeal	Shailer Bowen	Edmond Wilson, Team Mentor
James Mackey, Faculty Advisor	David Stair, Expert Model Maker	

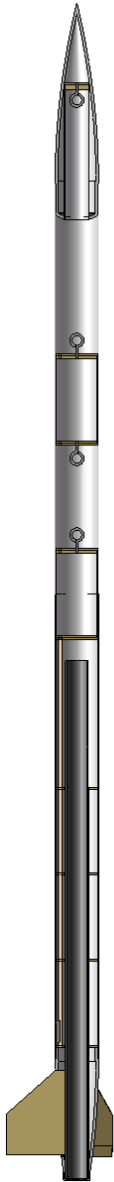
Summary The team prepared and submitted a proposal (PR), a preliminary design (PDR), a critical design (CDR), a flight readiness report (FFR) and this final report (FR). These documents may be found on the team's website, www.harding.edu/wilson/usli.html. The team engaged in the reviews of the PR, PDR, CDR, FFR and FR conducted by personnel at Marshall Space Flight Center. The team conducted outreach activities with a third grade class at Westside Elementary, Searcy, Arkansas. The Flying Bison participated in the USLI Annual Rocket Competition at Marshall Space Flight Center, Huntsville, Alabama during April 15 – 19, 2009. The Flying Bison Hybrid Rocket flew successfully to an altitude of 4902 feet and was recovered in excellent condition. The Science Payload failed to record the exhaust plume spectra as planned because of a design error. The official altimeter did not perform but the flight data was recorded successfully by the backup flight computer.

Launch Vehicle Summary

Size:	4.00 inches, o.d. by 9.5 feet high
Weight:	5810 grams minus motor
Motor Choice:	K-234HP Contrail Rockets Hybrid, 54mm
Recovery System:	Drogue - 24" Classic II Sky Angle Parachute Main - 60" Classic II Sky Angle Parachute
Ignition:	Standard Electric Match Ejection Charges
Rail Size:	80/20 1 in square x 8 feet launch rail
Avionics:	PerfectFlite MAWD flight computer and a G-Wiz LCX flight computer Both flight computers were powered by standard 9V batteries.

Payload Summary

Name:	REMSPEC (<u>R</u> ocket <u>E</u> mission <u>S</u> pectrometer)
REMSPEC:	Designed to fit into a 3.75 in. i.d. by 11.50 in. phenolic coupler tube.
Purpose:	To collect emission spectra from the exhaust plume of the hybrid rocket motor, in order to study changes in the burn profile due to airflow and forward motion.



Flying Bison 2009 Competition Rocket

REMSPEC Science Payload

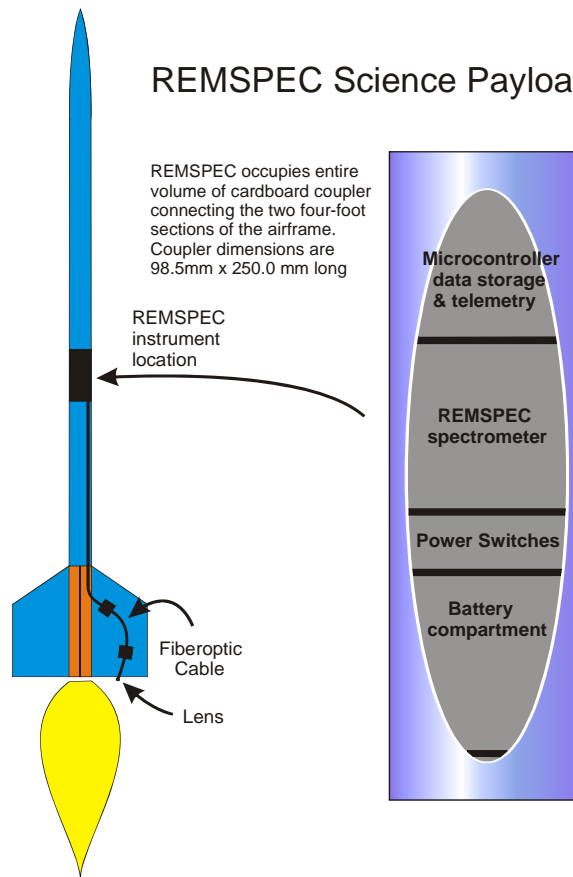


Figure 4.1 Schematic showing REMSPEC location and fiber optic cable placement.

Figure 4.2 Schematic of coupler tube showing arrangement of sub systems.

Testing Three flight tests with equivalent air frames, including the competition frame were flight tested prior to the competition in April at MSFC. All tests, using smaller hybrid motors were successful. In addition, Megan Bush conducted static tests of the hybrid motors and recorded their spectra.

Reporting of Project at Science/Engineering Meetings Flying Bison Team members reported the results of their research and design at several science/engineering meetings in the State of Arkansas, including six presentations at the INBRE Conference in November 2008 at the University of Arkansas at Fayetteville, five presentations at Southwestern Regional Meeting of the American Chemical Society in Little Rock, Arkansas on October 1-4, 2008, two presentations at the Arkansas Association of Public Universities in Little Rock on October 6, Four posters at the Capitol at the State Capitol in Little Rock, Arkansas, six presentations at the Arkansas Space Grant Symposium on April 24, 2009 at the Winthrop Rockefeller Institute on Petit Jean Mountain and four presentations at the Sigma Xi Annual Banquet and Poster Competition in Little Rock, on April 24, 2009.

Funding A proposal was submitted by Team Mentor Wilson to the Arkansas Space Grant Consortium (ASGC) requesting \$5000 for the Flying Bison Team to compete in the 2009 USLI competition. ASGC funded the Harding team, in the amount requested, for the third consecutive year. In addition, ATK, awarded Harding University a check in the amount of \$600 help with the expense of the competition.

Outreach and Publicity Outreach activities consisted of two visits to the third grade classroom of Ms. Sherry Wilson at Westside Elementary in Searcy. The students were given information about building water-bottle rockets and some of NASA's research areas during the first visit. During the second visit, the students launch their rockets and flight times, height and quality of construction were recorded. Parents of some of the children helped during launch day. Several parents were present as onlookers. The team also planned to give a demonstration on how to build a high powered hobby rocket and then fly two or three rockets for the Civil Air Patrol in Little Rock. However, the proposed launch site of Camp Robinson, the Army Reserve training base in Little Rock was denied the team by the officer in charge of the firing range. We are looking for a suitable area near Searcy and Little Rock that can be used for public exhibition, training and research in the field of high powered hobby rockets. Contact was never made with any of the local Girl Scout troops in the area because the contact information was not available after extensive web and phone book searching. The team's activities were published by the local media.

Safety and safe procedures were followed in each step of the entire, year-long process. There were absolutely no injuries of any kind to the participants, nor to the environment.