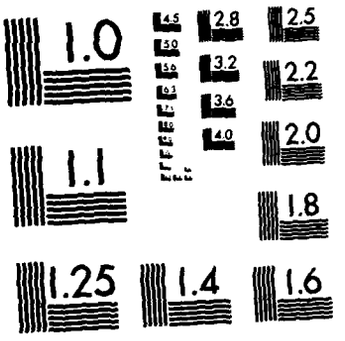
AD-A123 735 DESIGN AND FABRICATE ROCKET ATTITUDE CONTROL SYSTEM (ACS) FOR ACCURATE PA.. (U) SPACE VECTOR CORP NORTHRIDGE CA R E SCARBORO 14 MAY 82 AFGL-TR-82-0289 1/1

UNCLASSIFIED F19628-77-C-0251 F/G 22/2 NL



AFGL-TR-82-0289

DESIGN AND FABRICATE ROCKET ATTITUDE CONTROL SYSTEM (ACS) FOR ACCURATE PAYLOAD ORIENTATION AND CONTROL FUNCTIONS

Robert E. Scarboro

Space Vector Corporation
19631 Prairie Street
Northridge, CA 91324

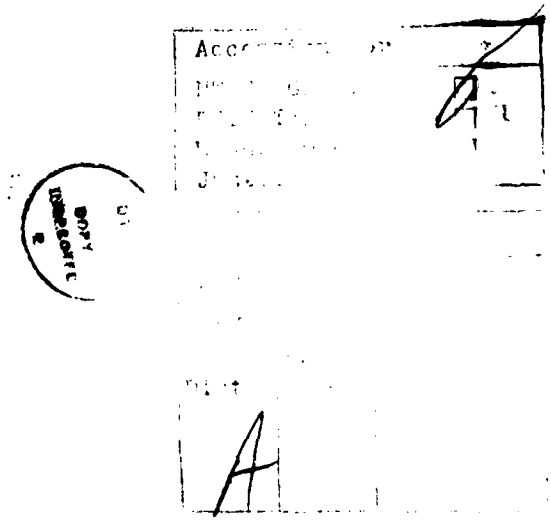
Final Report
10 August 1977 - 30 April 1982

14 May 1982

Approved for public release; distribution unlimited

AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
HANSCOM AFB, MASSACHUSETTS 01731

Qualified requestors may obtain additional copies from the Defense Technical Information Center. All others should apply to the National Technical Information Service.



Unclassified

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFGL-TR-82-0289	2. GOVT ACCESSION NO. AD-A123 735	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* DESIGN AND FABRICATE ROCKET ATTITUDE CONTROL SYSTEM (ACS) FOR ACCURATE PAYLOAD ORIENTATION AND CONTROL FUNCTIONS		5. TYPE OF REPORT & PERIOD COVERED Final Report 10 August 1977 - 30 Apr 1982 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Robert E. Scarboro		8. CONTRACT OR GRANT NUMBER(s) F19628-77-C-0251
9. PERFORMING ORGANIZATION NAME AND ADDRESS Space Vector Corporation 19631 Prairie Street Northridge, CA 91324		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 63428F 76700605
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory Hanscom AFB, Massachusetts Monitor/Charles Howard/LCR		12. REPORT DATE 14 May 1982 13. NUMBER OF PAGES 6
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Attitude control
MIDAS
Inertial reference unit (IRU)
Microprocessor and star tracker

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Three (3) Attitude Control Systems (ACS) were designed and built for SPICE, IRBS, ZIP, and FIRSSE (Background Measurements) programs. They utilized star tracker, IRU, and MIDAS platforms. The IRU system gives state-of-the-art accuracy.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

INTRODUCTION

This is the final report for Contract F19628-77-C-0251 and is submitted in compliance with Item 002. This report reflects the contract task as described in the revision issued on 5 August 1981.

OBJECTIVES

The purpose of this contract was to develop, fabricate, and test attitude control systems with field systems; provide integration for rocket payloads; and provide engineering support services in accordance with the following:

1. Design, fabricate, calibrate, and test three (3) attitude control systems.

2. Inspect, refurbish, test, calibrate, and return to a flight worthy condition one (1) recovered attitude control system.

3. Provide the necessary support for overall systems integration for four (4) attitude control systems.

4. Provide the necessary support for the launch of four (4) rockets with ACS at WSMR.

5. Provide engineering, analytical, and field support services for the attitude control systems, sounding rocket vehicles, and ancillary equipment.

6. Data in accordance with Contract Data Requirements List dated May 1976.

PERFORMANCE

During the period of performance for this contract, Space Vector Corporation accomplished the following tasks in conforming with the requirements of each line item as described above.

DESIGN, FABRICATE, CALIBRATE, AND TEST THREE (3)ACSs

The three (3) Attitude Control Systems which were designed, fabricated, and tested under this line item were as follows:

1. The first system was scheduled for use on a vehicle designa- SPICE I. The Attitude Control System was designed using Space Vector's standard MIDAS platform for the main control element until the star tracker, located in the payload, was locked onto a polar star. The remaining vehicle maneuvers were accomplished using this star to control pointing accuracy. This system wa flown in January 1979.

2. The second system designed and fabricated was very similar to the first but with more complex maneuvers. In addition, this system was being used as an engineering test flight for a newly designed gyro platform which was an Inertial Reference Unit (IRU). The development and incorporation of the IRU was a major engineering effort. This system was incorporated into a vehicle designated IRBS and flown in early 1981.

3. The final system designed and fabricated under this contract was for a vehicle called FIRSSE. This system was very similar to the SPICE in maneuver requirements and also used the Space Vector MIDAS platform as the main control element. This system was recovered and is in storage at Space Vector.

INSPECT, REFURBISH, TEST AND CALIBRATE ONE ATTITUDE CONTROL SYSTEM

One (1) Attitude Control System was scheduled for refurbishment.

A vehicle which was called ZIP I was designed, fabricated and flown under another contract, and scheduled for refurbishment under this line item. The refurbishment and testing was completed and the vehicle was successfully launched in July 1981.

PROVIDE SYSTEM INTEGRATION SUPPORT

Four (4) Attitude Control System Integrations were scheduled. These integrations were completed as scheduled. The four (4) vehicles supported were:

SPICE I - November 1979
IRBS I - December 1981
ZIP II - May 1981
FIRSSE I - November 1982

All integrations were conducted at AFGL, Space Vector provided engineers at that location to support the effort.

LAUNCH SUPPORT

Launch Support for four (4) vehicles were scheduled. Three (3) launches were completed. Funds for the fourth launch were deobligated by AFGL in June 1981. The three (3) launches which were completed are as follows:

SPICE I (1-27-79)
IRBS I (2-23-81)
FIRSSE I (1-23-82)

All launches were conducted at White Sands Missile Range in New Mexico. The Space Vector field crew, which supports these activities, consisted of five people: one (1) mechanical engineer and one (1) mechanical technician. Field operations lasted approximately five (5) weeks and were divided into four phases: pre-launch validation test, practice countdown, launch operations, and recovery.

ENGINEERING SERVICES

This item authorized engineering support on a task assignment basis. There were a total of twenty-two (22) tasks assigned. A brief description of the more significant tasks is as follows.

Task No.	Description
1.	Design and fabricate a launch console for Attitude Control Systems.
2.	Reprogram the IRBS ACS to facilatate a change in mission requirements.
3.	Redesign and test the SPICE ACS because of mission changes.
4.	Design and fabricate a 10-inch extender module for the IRBS Interstage assembly.
5.	IRBS reprogramming.
6.	Perform separation testing of the IRBS extender.
7.	Design, fabricate and test a Booster Tumble jet for IRBS.
8.	Feasibility Study for the FIRSSE ACS.
9.	Accomplish environmental testing of the pneumatic separation system.
10.	Environmental testing of Attitude Control Systems.
11.	Accomplish payload reentry study for IRBS.
12.	Perform recovery assembly testing for the BCS/ACS module.
13.	Install thermistors into the ACS/BCS module.
14.	Modify the IRBS extender module.
15.	Attend and support interface meetings with Aerospace.

Task No.	Description
16.	Redesign the FIRSSE ACS to meet changes in mission requirements.
17.	Conduct a Gas Budget analysis for IRBS.
18.	Develop a microprocessor for use in Attitude Control Systems. This effort resulted in obtaining better pointing accuracy and more complex programs for future Attitude Control Systems.
19.	Design and fabricate a 40 FPS Separation System for ZIP II. This task resulted in a separation system that, when actuated, propels the Payload far enough away from the burned out booster to prevent contamination.
20.	Cancelled.
21.	This task covered several different efforts associated with the redesign of systems to include redundant mods. A brief description of these efforts are: - Test of FIRSSE Redundant Separation System - Fabricate test hardware - Test Redundant Recovery System - Incorporate Redundant mods into FIRSSE BCS System - Modify and test Booster Roll Jet System - Attend CDR for FIRSSE - Perform Hot and Cold testing of guidance components for FIRSSE I and ZIP II
22.	Purchase 15 each high pressure 10 cubic inch bottles for testing Separation and Recovery Systems.

CONCLUSION

All contract activities were completed successfully and within the scope and price of the contract.