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PCM TELEMETRY FOR EARTH RESOURCES AIRCRAFT

END ITEM TEST REPORT

CONTRACT ITEM NUMBERS 2, 3 & 7

NAS9-8146

July 1969

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I INTRODUCTION

Martin Marietta Corporation has designed and produced the PCM Telemetry System for Earth Resources Aircraft, for the Manned Space Center of the National Aeronautics and Space Administration at Houston, Texas. This report describes the results of the electrical and environmental acceptance testing for the system elements procured by NASA-MSC from MMC as contract items numbers 2, 3 and 7 of Contract NAS9-8146. Item number 2 is comprized of 2 MEU's, 1 CCU exclusive of programmer formater boards, and spares for one MEU and one CCU exclusive of programmer formater board spares. Item number 3 consists of one set of programmer formater boards. Item number 7 consists of one CCU and one MEU.

The PCM Telemetry System consists of two basic units, the Control/Combiner Unit (CCU) and the Multiplexer Encoder Unit (MEU). A complete system is comprised of one CCU and up to four MEU's. The CCU provides the system timing signals and provides a flexible telemetry formatting capability via plug-in cards. Each MEU can accept 60 differential 0-5 volt analog signals which it converts to 10 bit binary words, and 60 differential bilevel signals grouped as six 10 bit words. The A/C conversion accuracy is $\pm 0.1\%$. The system was electrically tested to verify all specification requirements of the contract, including such tests as accuracy, input and output impedance, and frequency stability. The system was also subjected to vibration, temperature/altitude, and electromagnetic interference environments as specified in the contract to meet the requirements of MSD/IESD 28-52. The detailed test procedure is described in the Martin Marietta document MCR-68-10 (Rev. B), PCM Telemetry System for Earth Resources Aircraft End Item Test and Inspection Procedure, October 1968.

One complete set of data will be sent to the NASA-MSC technical monitor, Mr. William Mallary, and the originals will remain in Quality Control's Log. This document summarizes the results, describes in detail any failures to meet specifications and any rework required to make the system conform to specifications.

II PRE-ENVIRONMENTAL TESTS

Following assembly, the system was functionally tested. Some modifications were incorporated in the phase locked loop and MEU/CCU data interface circuitry in an effort to alleviate some of the aircraft system integration problems encountered at NASA-MSC. Following modification, a formal set of pre-environmental tests were performed according to the test procedure. One A/D converter made by Pastoriza Electronics failed during the pre-environmental tests. This unit was a spare board for item number 2, which was to be delivered concurrent with item number 7. The same A/D converter had been previously returned to Pastoriza for rework, as was presented in the End Item Test Report for end item number 1 (MCR-69-286) Section IV 2, post environmental acceptance tests. This unit is presently at Pastoriza for failure analysis and repair. The cause for failure will be reported in the contract final report. There were no other failures during pre-environmental testing.

The data sheets are in the Quality File, with one copy to the NASA Technical Monitor, W. E. Mallary.

III ACCEPTANCE TESTS

III.1 Environmental Tests

Three MEU's (part number 1100-1-009) serial number 0000003, 0000004, and 0000005 and the spare P.C. boards and power supply, and two CCU's (part number 1200-1-009) serial numbers 0000002 and 0000003 and spare P.C. boards were subjected to the vibration tests at the levels required for acceptance testing for the Earth Resources Aircraft.

Vibration

- 1) Four Multiplexer/Encoder Units (MEU) and 3 Control/Combiner Units (CCU), while operational, were individually subjected to a 2 minute $\pm 1/2$ g sine sweep from 5 to 2000 Hz in each of three areas. Resonant frequencies and levels were recorded on a data sheet included herein.
- 2) The MEU's and CCU's, while operational, were individually subjected to a 2 g sine sweep from 5 to 500 to 5 Hz in a total duration of 5 minutes. This sweep was performed in each of three axes.
- 3) No performance degradations of either CCU's or MEU's were noted during these vibration tests. The performance data is in the form of a strip chart. One set of these charts will be sent to the technical monitor.

III.2 Post Environmental Acceptance Tests

Three MEU's (part number 1100-1-009) serial numbers 0000003, 0000004, and 0000005 and the spare P. C. boards and power supply and two CCU's (part number 1200-1-009) serial numbers 0000002 and 0000003 and spare P.C. boards were tested to the acceptance test performance levels per MCR-68-10 (Rev. B). There were no failures during the post environmental acceptance tests.

VIBRATION TEST LOG

Test Unit MEU and CCUDate 12/12/68Test Engineer CloughTechnician Siemruch

TABULATION OF ITEM RESONANCES AND W's

AXIS	4 MEU's 5-500-5Hz	5 MIN	3 CCU's 5-500-5Hz	5 MIN
	FREQ.	Q.	FREQ.	Q.
X	None		100	4
			171	3.5
			271	3.5
			343	3
			500	3
x	None		139	7
			289	9
			459	7
X	None		163	10
			289	15

VIBRATION TEST EQUIPMENT AND INSTRUMENTATION

<u>Item</u>	<u>Mfr.</u>	<u>Model</u>	<u>S/N</u>	<u>Date Cal. Due</u>
Shaker	Ling	L-200	AF001146	N/A
Amplifier	Ling	90/200	AF001146	N/A
Sweep Oscillator	Spectral Dynamics	SD104A-5	AF006409	06/21/69
Accelerometer	Endevco Corp	2272	MA06	07/23/69
Accelerometer	Endevco Corp	2272	MB60	09/20/69
Accel. Amp.	Unholtz-Dickie	D11	EQ525739	07/14/69
Accel. Amp.	Unholtz-Dickie	D11	EQ526968	10/10/69
VIVM	Ballestine	320	EQ504947	10/11/69
Frequency Counter	Computer Measure- ments Corporation	200A	AF031523	08/17/69
Stop Watch	Gallet	300	#3	N/A

FUNCTIONAL TEST EQUIPMENT LIST

ITEM	MANUFACTURER	MODEL
1. Power Supply *	Hewlett Packard	6255A
2. Digital Voltmeter*	Dana	5400
3. Sensitive D.C. Meter*	Boonton Elec. Corporation	95A
4. Pulse Generator*	Data Pulse	200M
5. Oscilloscope*	Tektronix	555
6. Power Supply*	Power Designs Inc.	TW-4005
7. Voltage/Current Calibrator*	Fluke Mfg. Company	382A
8. Oscillator, Audio*	Hewlett Packard	202A
9. Counter*	Hewlett Packard	5245L
10. Ammeter*	Simpson	260
11. MEU Interface Test Tool	Martin-Marietta	---
12. CCU Interface Test Tool	Martin-Marietta	---
13. Stimulus Control Test Tool Switch	Martin-Marietta	---
14. Universal PCM * Demodulation System	EMR	285

* Equipment was within the dates of normal calibration cycles. Dates are not given since total time span of usage encompasses several calibration cycles.