APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
84-08001	5487	A	INC PER ECN 45071	[illegible]	DG [illegible]

1. PREPARED IN ACCORDANCE WITH MIL-STD-100.
2. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

AUG [illegible]

FACTORY
TEST PROCEDURE
INDIVIDUAL TEST
FOR THE
FBIS ANTENNA CONTROL SYSTEM
ESI PART NUMBER 84-08001

REV	A	A	A	A	A	A	A														
SHEET	19	20	21	22	23	24	25														

REV STATUS OF SHEETS	REV	A	A	A			A		A	A		A	A	A	A	A	A	A	A
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

CONTRACT NO.

ELECTROSPACE SYSTEMS, INC.
RICHARDSON, TEXAS 75080

APVD		84-06-19
ENGR		-------
ENGR		84-06-19
CHECK		84-06-19
DRAWN		84-06-19

PROJECT DRAFTSMAN:

DRAWING TITLE

FACTORY TEST PROCEDURE
FBIS ANTENNA CONTROL SYSTEM

SIZE	FSCM NO.	DRAWING NO.
A	33875	84-08007-000

SCALE | A | SHEET 1 OF 25

STAT

STAT

77ASC026A

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 3

77CS028B (VERTICAL)

1.0 SCOPE

This test procedure details checks, tests and measurements for an integrated factory test of the FBIS Antenna Control System. The testing consists of connecting the antenna control unit, drive cabinet, drive motors, remote control box, antenna simulator and test panels together to verify correct logic and control loop operation. All data and notes recorded during the test performance are to be considered a portion of the test procedure and should be attached hereto. The following procedure details the tests to be performed on each axis individually due to the single axis limitations of the antenna simulator and motor test stand. Procedure is performed in factory ambient environment with normal line voltage (±10 percent).

2.0 APPLICABLE DOCUMENTS

a. ESI System Interface Specification 84-08002-000.

2.1 DRAWINGS

ESI 77-17026-000	Schematic, Signal Processor Board
ESI 77-17031-000	Schematic, SDC Board
ESI 83-38026-000	Schematic, Auto Control Board
ESI 84-08051-000	Schematic, ACU
ESI 84-08045-000	Schematic, Motor Controller AZ
ESI 84-08046-000	Schematic, Motor Controller EL
ESI 84-08043-000	Schematic, SCR Logic PWB, AZ
ESI 84-08044-000	Schematic, SCR Logic PWB, EL
ESI 84-08005-000	Schematic, System
ESI 80-28017-000	Schematic, Manual Control Board
ESI 84-08026-000	Schematic, Servo Drive Cabinet
ESI 78-14039-000	Schematic, Remote Control Box
ESI 84-08032-000	Schematic, Interface Board, AZ
ESI 84-08034-000	Schematic, Interface Board, EL

3.0 REQUIREMENTS

3.1 GENERAL

3.1.1 Power shall be applied to all commercial test equipment at least five minutes prior to conducting tests.

3.1.2 All test equipment shall be properly grounded and shall be in current calibration.

3.2 REQUIRED TEST EQUIPMENT

a. Antenna mechanism simulator and wire harness

b. Test panel of antenna mounted switches

c. Drive motor test stand

d. Volt - ohm meter

e. Oscilloscope

f. Function generator

g. Triple power supply

3.3 TEST CONDITIONS

3.3.1 All tests will be performed under room ambient conditions of temperature, atmospheric pressure and humidity. Temperature will be in the range of 20° to 40°C and relative humidity from 0 to 95 percent.

3.4 ACCEPT/REJECT CRITERIA

3.4.1 The basis for acceptance of the production assembly is twofold:

a. all test measurements shall be within tolerance limits; and,

b. all test actions or observations shall be successfully completed.

3.4.2 Each individual test measurement has associated tolerance limits. Tolerance values of measurements are identified in the detailed procedure.

3.5 VERIFICATION OF TEST DATA

3.5.1 Test data (measurements or actions) shall be recorded on the data sheets by the technician performing the tests.

3.6 NOTES

3.6.1 Test steps followed by the word "RECORD" require a measurable value to be recorded. Test steps followed by the word "CHECK" require a mark (✓) to be made in the space provided.

4.0 FUNCTIONAL TEST

4.1 PREPARATION

4.1.1 Verify that the test equipment is in current calibration. _____(CHECK)

4.1.2 Verify that all test equipment is properly grounded. _____(CHECK)

4.2 TEST SET-UP

4.2.1 Refer to the following block diagram Figure 1 for the preliminary test setup.

4.2.2 In the 93C-15 ACU, disconnect J3 on the SDC card of the unused axis. Load loop parameters into the ACU. Section 4.3 is repeated for elevation. Elevation notations are in parenthesis.

4.2.3 Set the following parameters at the 93S-1A Antenna Simulator:

Velocity	0.15 degrees/second
Data Gearbox Ratio	64:1
3 dB Beamwidth	0.42 degrees
Tracking Signal Slope	1.0 volt/dB

_____(CHECK)

4.3 DETAILED TEST

4.3.1 Fault and Status Reporting

Set all circuit breakers on and close all interlock switches on the test panel. Apply power to the ACU.

Unit powers on in STANDBY mode. _____(CHECK)

Disable MONITOR if it is on. _____(CHECK)

4.3.1.1 System and Axis Fault Status

Open each circuit breaker and interlock switch individually, i.e., operate, observe fault and reclose. Note that the status message and axis disable displayed on the ACU agrees with Table I. Those with an X in the alarm column should cause the alarm lamp on the ACU to flash red. Place ACU in manual mode, zero command, for all checks. Items denoted with a * require re-enabling thru axis disable switches.

4.3.1.2 Motor Fault Status

Open each circuit breaker and interlock switch individually, i.e., operate, observe fault or faults, and reclose. Note that the status message displayed on the ACU agrees with Table II. No axis disables should occur on the Azimuth axis. The ACU alarm should sound in all cases. Note that the faulted motor controller assembly is disabled by observing DS1 on the SCR Logic PWB's.

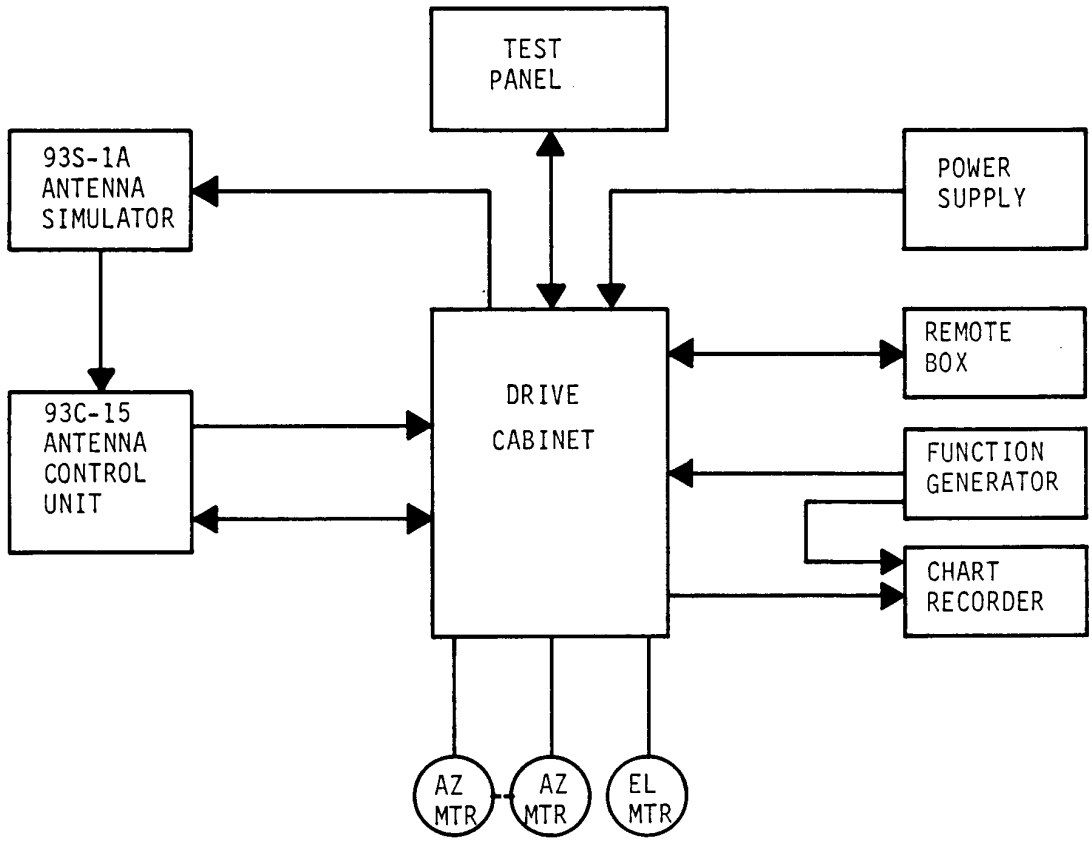

FIGURE 1
TEST SET-UP

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
	SCALE		SHEET 7

77CS028A

TABLE I: SYSTEM AND AXIS FAULT STATUS

	SWITCH	MESSAGE	ALARM	AXIS DISABLED AZ	AXIS DISABLED EL	CHECK
	AZ 1 EMERGENCY	AZ1 EMERGENCY	X	X	X	
	AZ 2 EMERGENCY	AZ2 EMERGENCY	X	X	X	
	EL EMERGENCY	EL EMERGENCY	X	X	X	
	DISH DOOR EMERGENCY	DISH DOOR EMER	X	X	X	
	3Ø POWER LOSS	3 PHASE PWR LOSS	X	X	X	
	AZ HANDCRANK	AZ HANDCRANK	X	X		
	AZ BRAKE INTERLOCK	AZ BRAKE INTERLK	X	X		
	AZ CW PRELIMIT	AZ CW PRELIMIT	X	X		
	AZ CW LIMIT	AZ CW LIMIT	X	X		
	AZ CCW PRELIMIT	AZ CCW PRELIMIT	X	X		
	AZ CCW LIMIT	AZ CCW LIMIT	X	X		
*	AZ BRAKE FAULT	AZ BRAKE FAULT	X	X		
	LOW ANGLE	LOW ANGLE	X			
	EL HANDCRANK	EL HANDCRANK	X		X	
	EL BRAKE INTERLOCK	EL BRAKE INTERLK	X		X	
	EL UP PRELIMIT	EL UP PRELIMIT	X		X	
	EL UP LIMIT	EL UP LIMIT	X		X	
	EL DOWN PRELIMIT	EL DOWN PRELIMIT	X		X	
	EL DOWN LIMIT	EL DOWN LIMIT	X		X	
*	EL BRAKE FAULT	EL BRAKE FAULT	X		X	

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 8

77CS028B (VERTICAL)

TABLE II: MOTOR FAULT STATUS

SWITCH	MESSAGE	ALARM	CHECK
AZ # 1 FIELD CURRENT OR CB	AZ1 FIELD FAULT	X	_____
AZ # 2 FIELD CURRENT OR CB	AZ2 FIELD FAULT	X	_____
AZ # 1 ARMATURE CB	AZ1 MTR CONTROL	X	_____
AZ # 2 ARMATURE CB	AZ2 MTR CONTROL	X	_____
AZ # 1 ELECTRONICS CB	AZ1 MTR CONTROL	X	_____
AZ # 2 ELECTRONICS CB	AZ2 MTR CONTROL	X	_____
AZ # 1 MOTOR THERMOSTAT	AZ1 MTR OVERTEMP	X	_____
AZ # 2 MOTOR THERMOSTAT	AZ2 MTR OVERTEMP	X	_____
AZ # 1 BLOWER CB	AZ BLOWER CB	X	_____
AZ # 2 BLOWER CB	AZ BLOWER CB	X	_____
EL FIELD CURRENT OR CB	EL FIELD FAULT	X	_____
EL ARMATURE CB	EL MTR CONTROL	X	_____
EL ELECTRONICS CB	EL MTR CONTROL	X	_____
EL MOTOR THERMOSTAT	EL MTR OVERTEMP	X	_____
EL BLOWER CB	EL BLOWER CB	X	_____

4.3.1.3 Current Fault Status

4.3.1.3.1 Disable AZ Motor# 2 assembly using Armature CB. With ACU in Manual mode zero rate command inject a 5.3 volt signal at A1 (A6) BJ2-24. (Open BJ2-24 and inject 5.3 volt at C20-4). Note within 10 seconds an axis shut down with a current fault being reported for AZ(EL)# 1 Motor. Message should read AZ 1 CURRENT FAULT (EL CURRENT FAULT).

AZ _____ (EL) _____(CHECK)

4.3.1.3.2 Clear the current fault by depressing the axis disable switch on the ACU and re-enable Motor# 2 Armature CB. Disable Motor# 1 assembly and repeat 4.3.1.3.1 for AZ #2 Motor looking for an AZ 2 Current Fault. (Open BJ2-25 and inject 5.3 volt at C28-3.) Re-enable Motor# 1 assembly and clear the current fault by depressing the axis disable switch on the ACU.

_____(CHECK)

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 9

77CS028B (VERTICAL)

4.3.1.4 Multiple Status

4.3.1.4.1 Activate any alarm condition. Summary alarm lamp ON. _____(CHECK)

4.3.1.4.2 Press the ALARM switch on the ACU.

ALARM switch changes to solid yellow. _____(CHECK)

Summary alarm lamp OFF. _____(CHECK)

4.3.1.4.3 Activate another alarm condition.

ALARM switch reverts to flashing red. _____(CHECK)

Summary alarm lamp ON. _____(CHECK)

Asterisk in message display and messages alternate. _____(CHECK)

4.3.1.4.4 Press the ALARM switch.

ALARM switch is yellow. _____(CHECK)

Messages alternate. _____(CHECK)

4.3.1.4.5 Remove one alarm.

ALARM switch is yellow. _____(CHECK)

Asterisk not present. _____(CHECK)

4.3.1.4.6 Remove last alarm.

ALARM switch is off. _____(CHECK)

Data section of display is blank. _____(CHECK)

4.3.2 Manual Modes

This section checks the logic modes and the back-up modes.

4.3.2.1 Manual

4.3.2.1.1 Select the MANUAL ENABLE mode of operation and verify that the direction and speed of the motor rotation may be controlled using the ACU manual control. Brake release lamp should be ON.

AZ _____ (EL) _____(CHECK)

4.3.2.1.2 Verify that as the manual control is rotated CW (UP) the digital position display is incremented. With a CCW (DN) command the display is decremented.

AZ _____ (EL) _____(CHECK)

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE		SHEET 10

77CS028B (VERTICAL)

4.3.2.1.3 Command a maximum CW (UP) rate command. Using a DVM measure the tach feedback voltage at B17-7. It should measure 1V ± .15 (1/10 full velocity). Repeat for CCW (DOWN) direction.

CW_____(UP)_____(RECORD)

CCW_____(DOWN)_____(RECORD)

4.3.2.2 Slew

4.3.2.2.1 Select the SLEW ENABLE mode of operation and verify that the direction and speed of motor rotation may be controlled using the ACU manual control. Brake release lamp should be ON.

4.3.2.2.2 Using the tachometer, measure the maximum motor speed in each direction. It should be 1750 ± 175 rpm.

CW_____(UP)_____(RECORD)

CCW_____(DOWN)_____(RECORD)

4.3.2.3 Monitor

4.3.2.3.1 Select SLEW ENABLE mode and place command at zero. Enable the monitor by pressing MONITOR.

AZ _____ (EL) _____(CHECK)

4.3.2.3.2 Give a full CW (UP) command. The monitor circuit should cause the mode to revert to STANDBY within 1.0 seconds.

Reverts within limit. AZ _____ (EL) _____(CHECK)

Monitor is red. AZ _____ (EL) _____(CHECK)

Message MONITOR TRIPPED appears in ACU status window AZ _____ (EL) _____(CHECK)

NOTE: Monitor time constant switch must be in position 4.

4.3.2.3.3 Return command to zero and reset monitor. Repeat for CCW (DN) command.

Reverts within limit. AZ _____ (EL) _____(CHECK)

Monitor is red. AZ _____ (EL) _____(CHECK)

Message MONITOR TRIPPED appears in ACU status window AZ _____ (EL) _____(CHECK)

4.3.2.3.4 Disable monitor by depressing front panel MONITOR switch. Red lamp extinguishes.

AZ _____ (EL) _____(CHECK)

4.3.2.4 Remote

4.3.2.4.1 Connect the remote control box to the drive cabinet. Note that it cannot be enabled.

Not enabled. AZ _____ (EL) _____(CHECK)

4.3.2.4.2 Place the ACU in REMOTE mode. The remote control box may now be enabled. ACU should display REMOTE ENABLED upon activating the remote box.

Remote enables. AZ _____ (EL) _____(CHECK)

4.3.2.4.3 Verify that MANUAL mode may be controlled with the remote box.

Manual controlled. AZ _____ (EL) _____(CHECK)

Remove remote box and restore ACU to MANUAL mode.

4.3.3 Travel Limit Test

4.3.3.1 Prelimits

4.3.3.1.1 Enter MANUAL mode and command AZ(EL) CW (UP) rate. Activate the AZ(EL) CW (UP) prelimit switch on the test panel. The brakes are set and AZ(EL) CW (UP) PRELIMIT is displayed.

AZ _____ (EL) _____(CHECK)

4.3.3.1.2 Using the MANUAL rate knob and while depressing MANUAL ENABLE, command AZ(EL) CCW(DN) and note that it is possible to drive the system away from the prelimit.

AZ _____ (EL) _____(CHECK)

4.3.3.1.3 Using the MANUAL rate knob and while depressing MANUAL ENABLE, command AZ(EL) CW(UP) and note that it is not possible to drive the system further into a prelimit.

AZ _____ (EL) _____(CHECK)

4.3.3.1.4 Clear the prelimit and repeat paragraphs 4.3.3.1.1 through 4.3.3.1.3 for the CCW(DN) direction.

4.3.3.1.1 AZ _____ (EL) _____(CHECK)

4.3.3.1.2 AZ _____ (EL) _____(CHECK)

4.3.3.1.3 AZ _____ (EL) _____(CHECK)

4.3.3.2 Limits

4.3.3.2.1 Select MANUAL mode. Command movement in either directions. Open the CW(UP) limit switch. Motors should stop.

Motors stop. AZ _____ (EL) _____(CHECK)

4.3.3.2.2 Close the CW(UP) limit switch. Repeat 4.3.3.2.1 using the CCW(DN) limit switch.

Motors stop. AZ _____ (EL) _____(CHECK)

4.3.3.2.3 Repeat 4.3.3.2.1 and 4.3.3.2.2 for the CCW (DOWN) direction.

4.3.3.2.1 AZ _____ (EL) _____(CHECK)

4.3.3.2.2 AZ _____ (EL) _____(CHECK)

4.3.4 Auto Modes

4.3.4.1 Manual Position Mode

4.3.4.1.1 Set mode to MAN POS. Verify that manual control of the motors is possible.

AZ _____ (EL) _____(CHECK)

4.3.4.1.2 Set command to zero and verify that there is no drift in position.

AZ _____ (EL) _____(CHECK)

4.3.4.1.3 Record position. AZ _____ degrees (RECORD)

(EL) _____ degrees (RECORD)

4.3.4.1.4 Disable axis from ACU (axis disable switch should be yellow) and manually rotate motor or use antenna simulator until position has changed 0.1 degrees or more. Enable axis. System should return to previous position, ±0.01 degrees.

System returns. AZ _____ (EL) _____(CHECK)

4.3.4.2 20 Satellite Positions

4.3.4.2.1 Put DATA section of display into DISPLAY KEYBOARD mode. Store a command position for Position 1 Azimuth and Position 1 Elevation and record below.

P01 AZ _____degrees (NMT 359.99) (RECORD)

P01 EL _____degrees (NMT 99.99) (RECORD)

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 13

77CS028B (VERTICAL)

4.3.4.2.2 Place the ACU in Position 1 mode. The system should drive to the stored command position. Record position after system settles. Actual position should equal command position ±0.01 degrees.

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.3 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 2.

P02 AZ _____degrees (NMT 359.99) (RECORD)

P02 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.4 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 3.

P03 AZ _____degrees (NMT 359.99) (RECORD)

P03 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.5 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 4.

P04 AZ _____degrees (NMT 359.99) (RECORD)

P04 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.6 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 5.

P05 AZ _____degrees (NMT 359.99) (RECORD)

P05 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

4.3.4.2.7 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 6.

P06 AZ _____degrees (NMT 359.99) (RECORD)

P06 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

4.3.4.2.8 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 7.

P07 AZ _____degrees (NMT 359.99) (RECORD)

P07 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

4.3.4.2.9 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 8.

P08 AZ _____degrees (NMT 359.99) (RECORD)

P08 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

4.3.4.2.9 (CONT.)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.10 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 9.

P09 AZ _____degrees (NMT 359.99) (RECORD)

P09 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.11 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 10.

P10 AZ _____degrees (NMT 359.99) (RECORD)

P10 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.12 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 11.

P11 AZ _____degrees (NMT 359.99) (RECORD)

P11 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.13 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 12.

P12 AZ _____degrees (NMT 359.99) (RECORD)

P12 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.14 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 13.

P13 AZ _____degrees (NMT 359.99) (RECORD)

P13 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.15 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 14.

P14 AZ _____degrees (NMT 359.99) (RECORD)

P14 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.16 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 15.

P15 AZ _____degrees (NMT 359.99) (RECORD)

P15 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

5.3.4.2.16 (CONT.)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.17 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 16.

P16 AZ _____degrees (NMT 359.99) (RECORD)

P16 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.18 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 17.

P17 AZ _____degrees (NMT 359.99) (RECORD)

P17 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.19 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 18.

P18 AZ _____degrees (NMT 359.99) (RECORD)

P18 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] ≤ 0.01 deg_____ (CHECK)

4.3.4.2.20 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 19.

P19 AZ _____degrees (NMT 359.99) (RECORD)

P19 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

4.3.4.2.21 Repeat paragraphs 4.3.4.2.1 and 4.3.4.2.2 for Position 20.

P20 AZ _____degrees (NMT 359.99) (RECORD)

P20 EL _____degrees (NMT 99.99) (RECORD)

Azimuth Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

Elevation Actual_____degrees (RECORD)

[Actual - Command] $\leq$ 0.01 deg_____ (CHECK)

4.3.4.2.22 Command STANDBY mode at the ACU. _____(CHECK)

4.3.5 Rate Loop Tests

4.3.5.1 Set-Up

4.3.5.1.1 Remove the rate command from the input to the rate loop and replace with a function generator.

AZ _____ (EL) _____(CHECK)

4.3.5.1.2 Monitor the output of the function generator with one channel of the chart recorder and the TACH voltage with the other.

AZ _____ (EL) _____(CHECK)

4.3.5.1.3 Place system in MANUAL ENABLE.

AZ _____ (EL) _____(CHECK)

4.3.5.2 Minimum Smooth Velocity

4.3.5.2.1 Calibrate chart recorder so that .01 deg/sec equals full scale on both channels.

AZ _____ (EL) _____(CHECK)

4.3.5.2.2 Set function generator to generate a .1 Hz triangular wave with zero DC offset.

AZ _____ (EL) _____(CHECK)

4.3.5.2.3 Adjust amplitude of triangular wave for a peak of .01 deg/sec.

AZ _____ (EL) _____(CHECK)

4.3.5.2.4 Record several cycles of the COMMAND and TACH voltages on the chart recorder.

AZ _____ (EL) _____(CHECK)

4.3.5.2.5 Note point at which antenna velocity drops to zero as seen by the recorded TACH voltage. Record below.

Azimuth CW_____degrees/second (RECORD)

Azimuth CCW_____degrees/second (RECORD)

(Elevation UP)_____degrees/second (RECORD)

(Elevation DN)_____degrees/second (RECORD)

4.3.5.3 Transient Response

4.3.5.3.1 Place system in SLEW ENABLE.

4.3.5.3.2 Select the square wave output of the function generator and adjust the amplitude for 1 volt peak to peak at .2 Hz.

AZ _____ (EL) _____(CHECK)

4.3.5.3.3 Record several cycles of the COMMAND and TACH voltages on the chart recorder.

AZ _____ (EL) _____(CHECK)

4.3.5.3.4 Record overshoot.

AZ_____ $\leq$ 20 percent (RECORD)

(EL)_____ $\leq$ 20 percent (RECORD)

4.3.5.4 Acceleration

4.3.5.4.1 Adjust the output of the function generator for 10 volts peak to peak at .2 Hz. (Note: 10 volts command is $\pm$1/2 speed).

AZ _____ (EL) _____(CHECK)

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 20

77CS0288 (VERTICAL)

4.3.5.4.2 Record several cycles of the COMMAND and TACH voltages on the chart recorder. Measure the maximum slope of the TACH feedback and calculate acceleration.

AZ_____ $\geq$ 1 degree/sec^2(RECORD)

(EL)_____ $\geq$ 1 degree/sec^2(RECORD)

4.3.5.5 Rate Loop Bandwidth

4.3.5.5.1 Set the sine wave output of the function generator to 1 volt peak to peak. With the chart recorder running, slowly sweep the frequency of the function generator upward (making sure the output of the function generator remains constant) until the system no longer responds as indicated by the chart recording.

4.3.5.5.2 From the above recording, determine the frequency at which the output voltage from the TACH has decreased 3 dB.

Azimuth Rate Loop Bandwidth_____ Hz (RECORD)

Elevation Rate Loop Bandwidth_____ Hz (RECORD)

4.3.5.5.3 Restore the rate command connection. _____(CHECK)

4.3.6 Parameter Record

Configure the system for normal operation. Record the following parameters.

AES_____	BA3_____	ESF_____
AOS_____	BO3_____	ESR_____
ASF_____	CO1_____	ETA_____
ASR_____	CA1_____	ETO_____
ATO_____	CO2_____	PSA_____
ATA_____	CA2_____	PSO_____
BA1_____	CO3_____	STC_____
BO1_____	CA3_____	
BA2_____	EES_____	
BO2_____	EOS_____	

NOTE: ASF (ESF) must be entered before AOS (EOS).

TABLE III: PARAMETERS AND ABBREVIATIONS

MNEMONIC	RANGE	NAME	FUNCTION
POSITION LOOP CONTROL PARAMETERS			
AES	0-255	Azimuth Error Slope	Set gain of digital loop used to hold azimuth position.
AOS	0-359.99°	Azimuth OffSet	Used to align azimuth data gearbox.
ASF	0-99,999	Azimuth Scale Factor	Sets full scale reading of azimuth position.
ASR	0-255	Azimuth Square Root Gain	Determines amount of azimuth position error required to obtain full velocity command.
EES	0-255	Elevation Error Slope	Sets gain of digital loop used to hold elevation position.
EOS	0-359.99°	Elevation OffSet	Used to align elevation data gearbox.
ESF	0-99,999	Elevation Scale Factor	Sets full scale reading of elevation position.
ESR	0-255	Elevation Square Root Gain	Determines amount of elevation position error required to obtain full velocity command.
STC	0-255	Settling Time Constant	Determines rate of integration to reduce LSB oscillation.

TABLE III: PARAMETERS AND ABBREVIATIONS (Continued)

MNEMONIC	RANGE	NAME	FUNCTION
INPUT NORMALIZING PARAMETERS			
BA1	1-31 (1)	#1 Beacon Amplitude 1	Sets gain of 1 Beacon channel (not used).
BO1	0-255 (2)	#1 Beacon Offset 1	Sets offset of 1 Beacon channel (not used).
BA2	1-31 (1)	#2 Beacon Amplitude 2	Sets gain of 2 Beacon channel (not used).
BO2	0-255 (2)	#2 Beacon Offset 2	Sets offset of 2 Beacon channel (not used).
BA3	1-31 (1)	#3 Beacon Amplitude 3	Sets gain of 3 Beacon channel (not used).
BO3	0-255 (2)	#3 Beacon Offset 3	Sets offset of 3 Beacon channel (not used).
CA1	1-31 (1)	Comm Channel Amplitude 1	Sets gain of EL Error signal (not used).
CO1	0-255 (2)	Comm Channel Offset 1	Sets offset of EL Error signal (not used).
CA2	1-31 (1)	Comm Channel Amplitude 2	Sets gain of Cross EL Error signal (not used).
CO2	0-255 (2)	Comm Channel Offset 2	Sets offset of Cross El Error signal (not used).
CA3	1-31 (1)	Comm Channel Amplitude 3	Sets gain of Sum signal (not used).
CO3	0-255 (2)	Comm Channel Offset 3	Sets offset of Sum signal (not used).
PSA	1-31 (1)	Power Supply Amplitude	Sets gain of power supply and control loop self-check. (PSA=15, sets scale multiplier of 4V).
PSO	0-255 (2)	Power Supply Offset	Sets offset of power supply and control loop self-check. (PSA=117, zeroes meter).

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 23

77CS028B (VERTICAL)

TABLE III: PARAMETERS AND ABBREVIATIONS (Continued)

MNEMONIC	RANGE	NAME	FUNCTION
INPUT NORMALIZING PARAMETERS (Continued)			
ATA	1-31 (1)	Azimuth Torque Ampl.	Sets gain of azimuth torque feedback for meter display (ATA=17 sets scale multiplier to 4A).
ATO	0-255 (2)	Azimuth Torque Offset	Sets offset of azimuth torque feedback for meter display.
ETA	1-31 (1)	Elevation Torque Ampl.	Sets gain of elevation torque feedback for meter display (ETA=17 sets scale multiplier to 4A).
ETO	0-255 (2)	Elevation Torque Offset	Sets offset of elevation torque feedback for meter display.

(1) The higher the number, the lower the gain.
(2) Increasing numbers move meter to the left (zero offset = 128).

ABBREVIATIONS

ACU = Antenna Control Unit
NMT = Not More Than

	SIZE	FSCM NO.	DRAWING NO.
	A	33875	84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 24

77CS028B (VERTICAL)

WITNESS _____ DATE _____

FOR _____

WITNESS _____ DATE _____

FOR _____

WITNESS _____ DATE _____

FOR ELECTROSPACE SYSTEMS, INC.

NOTES

	SIZE A	FSCM NO. 33875	DRAWING NO. 84-08007-000
WANG ID. NO. 0115D	SCALE	A	SHEET 25

77CS028B (VERTICAL)

ACCURACY

.016°

18 bit

1.37×10^{-3}