MASTER
NTO-R-0113

ETS-1

TEST REPORT

DATA ACQUISITION

SYSTEM ACCURACY TESTS

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NERVA TEST OPERATIONS
Jackass Flats, Nevada

X 12826

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MASTER

TEST REPORT

ETS-1 DATA ACQUISITION SYSTEM ACCURACY

TESTS

NTO-R-0113

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ETS-1 Instrumentation & Controls

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W. D. Wayne, Manager
ETS-1

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TEST REPORT
ETS-1 DATA ACQUISITION SYSTEM ACCURACY
TESTS

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I. Introduction

Tests were conducted from 5 May 1967 to 23 May 1967 at ETS-1 to obtain data necessary to assess the accuracy of the ETS-1 Data Acquisition System as specified in NRO Specification RN-S-0304, entitled "ETS-1 Data Acquisition System Final Accuracy Test Specification." The tests were conducted in accordance with the approved test procedure NTO-I-0270 Revision A (Ref. Appendix D). All tests specified in RN-S-0308A were conducted except the Analog Zero Suppressed System tests and the LVDT System tests. These tests will be conducted when the systems have been installed and checked out at ETS-1. All test data was sent to NRO in Sacramento for analysis. Compliance with the test procedure and the calibration status of all test equipment and system components requiring calibration (i.e., mode cards and amplifiers) was certified by NTO Quality Control (Ref. Appendix A).

II. Summary

All tests were completed satisfactorily with no major system malfunctions or deviations from the test procedure. All deviations and data abnormalities are listed in the comments column of Table I. All changes to the procedure or patchlist were documented on an ETS-1 Channel Change Request form and approved by the NRO representative. These changes were incorporated in Revision A of the Test Procedure (Appendix D).

III. Test Procedure

The accuracy tests were conducted in accordance with the normal procedures used for ETS-1 facility activation tests as follows:

- A. A test procedure was written and approved by the NRO representative, Manager of ETS-1, and Manager of NERVA Test Operations (Ref. Appendix D).
- B. A channel data log and a patchlist were generated by the Channel Engineering Group (Ref. Appendices B and C).
- C. The data acquisition system was patched per the patchlist and setup per the channel data log.
- D. The tests were then conducted in accordance with the test procedure (Ref. Appendix D).
- E. A chronology of the recorder on-off times for each test and log of all abnormal test conditions was kept and is shown in this report as Table I.

- F. All test data was given to the ETS-1 I&C Engineering Group for reduction and transmittal to NRO.

IV. Data Reduction

ETS-1 Data Reduction for the Accuracy Tests used the methods that will be used on XE-1. The data were converted from digital counts to engineering units using the following standard ETS-1 data equation:

$$\text{E.U.} = \frac{\text{Transducer Range} \times \text{Calibration Slope}}{\text{System Constant}} (\text{Counts} - \text{Zero Offset}) + \text{E.U. Constant}$$

Where:

- Transducer Range = 1000.0 for Test Modes 1A, 1B-1, 1B-2, and 3; 20 KC and 500 cps in Test Mode 7. (Thermocouple data, being non-linear, is converted to engineering units by using an appropriate polynomial. Therefore, the transducer ranges for Test Modes 2, 4, and 5 are dummy valves.)
- System Constant = 10,000 counts (D.D.S. full scale).
- Calibration Slope = Ratio of Ideal to Observed counts at the 75% calibration step.
- Counts = Count value to be converted to engineering units.
- E.U. Constant = Engineering Unit Adjustment (not used on Accuracy Tests).

TABLE I - ACCURACY TEST CHRONOLOGY

Date	Test Mode	Recorders Utilized	Event	Record Start	Time Stop	Comments
5/15/67	1A	DDS	System Pre-Calibration	49169	49215	(1) The data amplifier for channel SG16 was found to be non-linear at 25% F.S. Data should, therefore, be voided.
			Simulator Zero	49330	49395	
			Simulator 25%	49465	49530	
			Simulator 50%	49590	49655	
			Simulator 75%	49890	49955	
			System Post Calibration	50020	50030	
5/15/67	1B (Part 1)	DDS	System Pre-Calibration	80943	80998	(1) DDS started twice pre-maturely.
	Analog Tape		Simulator Zero	81032	81039	(2) Last 64 frames of simulator initial zero on DDS-2 are void.
	Oscillograph		Simulator 25%	81124	81131	
	Strip Chart		Simulator 50%	81142	81149	
			Simulator 75%	81161	81167	
			Simulator Zero	81209	81216	
			System Post Calibration	81265	81311	
5/16/67	1B (Part 2)	DDS	System Pre-Calibration	38192	38237	(1) Channels SG-53 & 54 on DDS-2 and SG-31 & 32 on DDS-1 not calibrate during the system pre-calibration because rack 40R008 was not in Remote. Test data is OK. Use post cal. for data reduction.
	Analog Tape		Simulator Zero	38341	38348	
	Oscillograph		Simulator 25%	38381	38388	
	Strip Chart		Simulator 50%	38441	38448	
			Simulator 75%	38471	38478	
			System Post Calibration	38653	38698	
						(2) Two post calibrations were taken with first voided.
5/17/67	2 (CC01)	DDS	System Pre-Calibration	49765	49810	(1) Range 1, -425°F to -400°F
			Simulator 90%, Range 1	49890	49955	(2) See Note 2 for Mode 2
			System Post Calibration	50030	50075	(RT10).
5/18/67	2 (RT10)	DDS	System Pre-Calibration	34169	34220	(1) Range 2, -425°F to + 75°F.
			Simulator 90%, Range 2	34325	34390	(2) Due to instrumentation system differences between AGC - Sacto and ETS-1, only the simulator 90% of F.S. step was considered valid
			System Post Calibration	34409	34454	

TABLE I - ACCURACY TEST CHRONOLOGY

Date	Test Mode	Recorders Utilized	Event	Record Time		Comments
				Start	Stop	
5/18/67	3	DDS	System Pre-Calibration	46720	46764	(1) Due to DDS tape transfer, two post calibrations were run.
			Simulator Zero	46790	46855	
			Simulator 25%	46890	46955	
			Simulator 50%	47000	47065	
			Simulator 75%	47090	47155	
			Simulator 100%	47190	47255	
			System Post Calibration	47310	47355	
			System Post Calibration	47396	47441	
5/19/67	4 & 5	DDS	Ice Bath Thermometer Reading	11:25 AM		(1) All ice bath thermometer readings were 0°C.
			System Pre-Calibration	41093	41136	(2) Void calibration data taken between 70495 and 70630. (75% cal step was intermittant)
			Ice Bath & Reference Oven	41220	41280	
			System Post Calibration	41317	41362	
			Ice Bath Thermometer Reading		(Post Test)	
			Ice Bath Thermometer Reading		1:25 PM (Post Test)	
			System Pre-Calibration	48353	48396	
			Reference Oven Data	48445	48510	
			System Post Calibration	48528	48572	
			Ice Bath Thermometer Reading		(Post Test)	
			Ice Bath Thermometer Reading		3:25 PM (Pre-test)	
			System Pre-Calibration	55330	55375	
			Reference Oven Data	55415	55480	
			System Post Calibration	55519	55564	
			Ice Bath Thermometer Reading		(Post Test)	
			Ice Bath Thermometer Reading		7:25 PM (Pretest)	
			System Pre-Calibration	70190	70272	
			Reference Oven Data	70350	70415	
			System Post Calibration	70682	70884	

TABLE I - ACCURACY TEST CHRONOLOGY

Date	Test Mode	Recorders Utilized	Event	Record Time		Comments
				Start	Stop	
5/19/67	4 & 5	DDS	Ice Bath Thermometer			
			Reading			(Post Test)
			Ice Bath Thermometer			
			Reading	11:00	PM (Pretest)	
			System Pre-Calibration	82479	82524	
			Reference Oven Data	82570	82635	
			System Post Calibration	82697	82742	
			Ice Bath Thermometer			
			Reading			(Post Test)

TABLE I - ACCURACY TEST CHRONOLOGY

Date	Test Mode	Recorders Utilized	Event	TCB Osc. Frame No.	Record Start	Time Stop	Comments
5/23/67	6 (Analog)	Analog Tape Oscillograph in TCB	System Precalibration Simulator steps 0, 25, 50, 75	0027	31960	-	(1) The 350 ohm resistors were removed from the TCB patchboard and inserted in the 42 area (North Terminal Room)
			10 cps @ 3 mv peak	0028	32050	-	
			10 cps @ 6 mv peak	0029	32165	32215	
			10 cps @ 15 mv peak	0030	32300	32360	
			10 cps @ 30 mv peak	0031	32790	32850	
			500 cps @ 3 mv peak	0032	32900	32960	
			500 cps @ 6 mv peak	0033	33085	33145	
			500 cps @ 15 mv peak	0034	33185	33245	
			500 cps @ 30 mv peak	0037	34490	34550	
			2000 cps @ 3 mv peak	0038	34605	34665	
			2000 cps @ 6 mv peak	0039	34820	34880	
			2000 cps @ 15 mv peak	0040	35020	35080	
			2000 cps @ 30 mv peak	0043	35210	35270	
			System Post Calibration	0044	35360	35420	
					(unknown)		(2) In order to keep the wide band amplifier input balanced, it was necessary to insert the oscillator across the simulator output leads. This changes Figure 7.
5/23/67	6 (Phase Shift)	Analog Tape Oscillograph in TCB	System Precalibration	0049	38475	-	(1) TCB oscillograph speeds were as follows:
			10 cps @ 15 mv peak	0050	38672	38682	10 ips for 10 & 50 cps,
			50 cps @ 15 mv peak	0051	38776	38786	100 ips for 100 & 500 cps.
			100 cps @ 15 mv peak	0052	38835	38845	
			500 cps @ 15 mv peak	0053	38915	38925	
5/23/67	6 (Drift)	Analog Tape	System Precalibration		39240	39290	
			Simulator Zero		39325	39335	
			Simulator 75%		39385	39395	
			Simulator Zero		43000	43010	
			Simulator 75%		43020	43030	
			Simulator Zero		46200	46210	
			Simulator 75%		46230	46240	
			Simulator Zero		49860	49870	
			Simulator 75%		49885	49895	
			Simulator Zero		53325	53335	
			Simulator 75%		53350	53360	
			Simulator Zero		60638	60648	

TABLE I - ACCURACY TEST CHRONOLOGY

Date	Test Mode	Recorders Utilized	Event	Record Start	Time Stop	Comments
5/23/67	6 (Drift)	Analog Tape	Simulator 75%	60675	60685	
			Simulator Zero	64220	64230	
			Simulator 75%	64260	64270	
			Simulator Zero	67825	67835	
			Simulator 75%	67855	67865	
			Simulator Zero	71410	71420	
			Simulator 75%	71435	71445	
			Simulator Zero	75625	75635	
			Simulator 75%	75645	75655	
			Simulator Zero	78960	78970	
			Simulator 75%	78985	78995	
			Simulator Zero	82275	82285	
			Simulator 75%	82300	82310	
			System Post Calibration	82822	82866	
5/23/67	6 (Common Mode Rejection) CM #1	Analog Tape	System Precalibration	46380	46450	(1) Passive channel used to provide a grounded shield for wide band amplifiers
			54 cps @ 1v RMS	46600	46610	
			54 cps @ 5v RMS	47020	47040	
			54 cps @ 5v RMS	47090	47100	
			54 cps @ 22v peak to peak	47355	47365	
			54 cps @ 10v RMS	47430	47440	
			System Post Calibration	47490	47550	
5/23/67	6 (Common Mode Rejection) CM #2	Analog Tape	System Pre-calibration	47960	48020	(1) See note 1 above (CM #1)
			54 cps @ 1v RMS	48210	48220	
			54 cps @ 5v RMS	48275	48285	
			54 cps @ 10v RMS	48350	48360	
			54 cps @ 30v peak to peak	48430	48440	
			System Post Calibration	48480	48540	
5/19/67	7	DDS	System Zero Calibration	36975	-	(1) A 5 cps variation noted from oscillator during 401 cps @ 100
		Analog Tape	System 10KC Calibration	37045	-	
			4KC @ 100 mv peak	37170	37235	
			8KC @ 100 mv peak	37375	37440	
			12 KC @ 100 mv peak	37560	37625	
			16KC @ 100 mv peak	37755	37820	
			20KC @ 100 mv peak	37885	37950	

TABLE I - ACCURACY TEST CHRONOLOGY

Date	Test Mode	Recorders Utilized	Event	Record Start	Time Stop	Comments
5/29/67	7	DDS Analog Tape	4 KC @ 1v peak	39325	39390	
			8 KC @ 1v peak	45875	45940	
			12 KC @ 1v peak	45970	46035	
			16 KC @ 1v peak	46090	46155	
			20 KC @ 1v peak	46200	46265	
			Vidar set to 500 cps			
			System Zero Calibration	47090	-	
			System 200 cps Calibration	47170	-	
			Step Function 100 cps @ 100 mv peak	47385	47460	
			Step function 201 cps @ 100 mv peak	47535	47600	
			Step function 302 cps @ 100 mv peak	47635	47705	
			Step function 401 cps @ 100 mv peak	47765	47835	
			Step function 501 cps @ 100 mv peak	47880	47955	

TABLE II
TEST EQUIPMENT

Description	Make	Model	Ser. No.
Oscillator	Hewlett-Packard	200CD	335-5120
Strain Gage Simulator	Aerojet-General Corp.	514330	7
Strain Gage Simulator	Aerojet-General Corp.	514330	1
RTT Simulator	Aerojet-General Corp.	514320	3
Digital Voltmeter	Dymec	2401B	350-01332

APPENDIX A

Q.C. CERTIFICATION

NERVA TEST OPERATIONS

Nuclear Rocket Development Station

TO: ✓ D. E. Bridenstine, I & C Data
FROM: J. L. Meredith, Jr., Product Assurance
SUBJECT: Data System Accuracy Test

DATE: June 20, 1967
NTO-M-13971
JLM/bsp

DISTRIBUTION:

Product Assurance personnel were present during all phases of the subject Data System Accuracy Test.

All phases were verified as being per the Operating Procedure. All equipment was verified as per the recorded data and information.

All deviations from the original plan were verified as being duly and correctly recorded.

J. L. Meredith, Jr.
Product Assurance

APPENDIX B
CHANNEL DATA LOG

ETS-1 DATALOG

PAGE 1
DATA SYSTEM ACCURACY TEST-ISSUE 3-AS RUN
29 MAY 67

* CHANNEL * NO	** ** **	CHANNEL TITLE REMARKS	* TRANSDUCER * TYPE * + MFG	*SIG CNDTNER *SET PNG MODE *SEQ NO	* AMP* DIGITAL SYSTEM *SENS*WRD MPX SPS *CHNO* NO JSS	* RECORDERS C* TYPE FREQ H* CH NO	* METER C * RANGE H *	*CONSOL* *TITLE *TAG NUMBER* * NHBT *
DT01		MODE 3	POT		SP01 034 1B1004 010			VA
				0655				VA
								VA
DT02		MODE 3	POT		SP01 975 1B1116 010			VA
				0656				VA
								VA
DT03		MODE 3	POT		SP01 850 1B1091 010			VA
				0657				VA
								VA
DT04		MODE 3	POT		SP01 274 1B1028 010			NA
				0658				NA
								VA
DT05		MODE 3	POT		SP01 554 1B1056 010			NA
				0654				VA
								NA
DT06		MODE 3	POT		SP01 434 2B1044 010			VA
				0660				NA
								NA
DT07		MODE 3	POT		SP01 134 2B1014 010			VA
				0661				NA
								NA
DT08		MODE 3	POT		SP01 955 2B1112 010			VA
				0662				NA
								VA
DT09		MODE 3	POT		SP01 664 2B1067 010			VA
				0663				NA

ETS-1 DATALOG

DATA SYSTEM ACCURACY TEST-ISSUE 3-AS RUN
29 MAY 67

* CHANNEL *	** CHANNEL TITLE **	* TRANSDUCER *	* SIG CONDTRN *	* AMP *	* DIGITAL SYSTEM *	* RECORDERS *	* METER *	* CONSOL *
* NO *	** REMARKS **	* TYPE RRG/SN *	* SET RRG MODE *	* SENS * WRD *	MPX SPS C * TYPE FREQ C * RANGE * TITLE * TAG NUMBER *	H * CH NO *	H *	* NHBT *
DT10	MODE 3	POT		SP01	815 281084 010			VA
			0664					VA
FT01	MODE 7			VR	764 181077 010 1	F309	1	NA
FT01-AC			0671			CTR2	2	NA
								VA
FT02	MODE 7			VR	314 181032 010 1	F302	1	VA
FT02-AC			0672			CTR3	2	NA
								NA
FT03	MODE 7			VR	444 181045 010 1	F305	1	VA
FT03-AC			0673			CTR1	2	NA
								NA
FT04	MODE 7			VR	044 281005 010 1	F328	1	NA
FT04-AC			0674			CTR2	2	NA
								NA
FT05	MODE 7			VR	990 281119 010 1	F317	1	NA
FT05-AC			0675			CTR1	2	NA
								VA
GG01	MODE 1A	SG		SG05	030 589 182059 010			VA
			0654		V129			NA
								NA
GG02	MODE 1A	SG		SG05	030 789 182079 010			VA
			4F15		V149			VA
								NA
GG03	MODE 1A	SG		SG05	030 984 182117 010			VA
			0133		V187			VA

* CHANNEL *	** CHAVNEL TITLE **	* TRANSDUCER *	*SIG CNDTNER *	* AMP* DIGITAL SYSTEM *	RECORDERS	* METER *	*CONSOL*	*TAG NUMBER*
* NO *	** REMARKS **	*TYPE RNG/SN *	*SET RNG MODE *	*SENS*WRD MPX SPS C* TYPE FREQ C * RANGE	* H* CH NO	* H *	* NHBT *	*
UG04	MODE 1A	SG		SG05 030 884 1H2097 010				VA
			0163	N167				VA
								NA
UG05	MODE 1A	SG		SG05 030 729 1H2073 010				VA
			0043	143				NA
								NA
UG06	MODE 1A	SG		SG05 030 519 1H2042 010				NA
			0185	N102				VA
								VA
UG07	MODE 1A	SG		SG05 030 379 1H2048 010				NA
			6J6	N108				VA
								VA
UG08	MODE 1A	SG		SG05 030 934 1H2107 010				VA
			7D4	N177				VA
								NA
UG09	MODE 1A	SG		SG05 030 874 1H2095 010				VA
			7H2	N165				NA
								NA
UG10	MODE 1A	SG		SG05 030 439 1H2044 010				VA
			7K5	N114				NA
								NA
UG11	MODE 1A	SG		SG05 030 509 2H2051 010				NA
			8B1	N221				VA
								VA
UG12	MODE 1A	SG		SG05 030 409 2H2041 010				NA
			8F5	N211				VA

ETS-1 DATALOG

 DATA SYSTEM ACCURACY TEST-ISSUE 3-A5 RUN
 29 MAY 67

PAGE 4

* CHANNEL	** CHANNEL TITLE	* TRANSDUCER	*SIG CNDTNER	* AMP*	DIGITAL SYSTEM	* RECORDERS	* METER	*CONSOL*
* NO	** REMARKS	*TYPE RNG/SN	*SET RNG MODE	*SENS*WRD	MPX SPS	C* TYPE FREQ	C * RANGE	*TITLE *TAG NUMBER*
		* * MFG	*SEQ NO CARD	*CHND* NO	3SS	H* CH NO	H *	* NHBT *
GG13	MODE 1A	SG		SG05	030 679 2H2068 010			NA
			8G6		N238			NA
GG14	MODE 1A	SG		SG05	030 884 2H2097 010			NA
			9J5		N257			NA
GG15	MODE 1A	SG		SG05	030 749 2H2075 010			NA
			9F3		N245			NA
GG16	MODE 1A	SG		SG05	030 709 2H2071 010			NA
			10C1		N241			NA
GG17	MODE 1A	SG		SG05	030 854 2H2091 010			NA
			10G4		N261			NA
GG18	MODE 1A	SG		SG05	030 339 2H2034 010			NA
			11D6		N204			NA
GG19	MODE 1A	SG		SG05	030 824 2H2085 010			NA
			11F1		N255			NA
GG20	MODE 1A	SG		SG05	030 309 2H2031 010			NA
			11F6		N201			NA
GG21	MODE 1B	SG		SG05	030 023 1E1005 100	RA2		NA
			3B1		N120	0206		NA

* CHANNEL	**	CHANNEL TITLE	* TRANSDUCER	*SIG CNDTNER	* AMP*	DIGITAL SYSTEM	* RECORDE	* METER	*CONSOL*		
* NO	**	REMARKS	*TYPE RNG/SN	*SET RNG MODE	*SENS*WRD	MPX SPS C	* TYPE	FREQ C	* RANGE	*TITLE	*TAG NUMBER*
			* * MFG	*SEQ NO CARD	*CHNO*	NO 3SS	H* CH NO	H *	* NHBT *		
							F108			NA	
G022		MODE 1B	SG		SG05	030 007 1D1002 100	RD1			NA	
				3H2		W108	0239			NA	
							F109			NA	
G023		MODE 1B	SG		SG05	030 087 1D1018 100	RB1			NA	
				4B4		W130	0227			NA	
							F110			NA	
G024		MODE 1B	SG		SG05	030 018 1E1004 100	RCB			NA	
				5D3		W140	0218			NA	
							F111			NA	
G025		MODE 1B	SG		SG05	030 033 1E1007 100	RF7			NA	
				5J1		W115	0214			NA	
							F112			NA	
G026		MODE 1B	SG		SG05	030 072 1D1015 100				NA	
				6B2		W122				NA	
										NA	
G027		MODE 1B	SG 0		SG05	030 017 1D1004 100				NA	
				6G2		W109				NA	
										NA	
G028		MODE 1B	SG		SG05	030 032 1D1007 100				NA	
				7D1		W101				NA	
										NA	
G029		MODE 1B	SG		SG05	030 012 1D1003 100				NA	
				7F6		W104				NA	
										NA	
G030		MODE 1B	SG		SG05	030 003 1E1001 100				NA	
				7 3		W139				NA	

* CHANNEL	** CHANNEL TITLE	* TRANSDUCER	*SIG CNDTNER	* AMP*	DIGITAL SYSTEM	* RECONDERS	* METER	*CONSOL*
* NO	** REMARKS	* TYPE RNG/SN	*SET RNG MODE	*SENS*WRD	MPX SPS	C* TYPE FREQ	C * RANGE	*TITLE *TAG NUMBER*
		* * MFG	*SEQ NO CARD	*CHNO*	NO 3SS	H* CH NO	H *	* NHBT *
GG31	MODE 1B	SG		SG05	030 037 1D1008 100			NA
			8C5		W150			NA
GG32	MODE 1B	SG		SG05	030 088 1E1018 100			NA
			8F2		W147			NA
GG33	MODE 1B	SG		SG05	030 078 1E1016 100			NA
			983		W113			NA
GG34	MODE 1B	SG		SG05	030 062 1D1013 100			NA
			9G4		W124			NA
GG35	MODE 1B	SG		SG05	030 097 1D1020 100			NA
			9J1		W138			NA
GG36	MODE 1B	SG		SG05	030 048 1E1010 100			NA
			10B2		W110			NA
GG37	MODE 1B	SG		SG05	030 093 1E1019 100			NA
			10D5		W107			NA
GG38	MODE 1B	SG		SG05	030 057 1D1012 100			NA
			10H4		W135			NA
GG39	MODE 1B	SG		SG05	030 013 1E1003 100			NA
			11B3		W152			NA

* CHANNEL	** CHANNEL TITLE	* TRANSDUCER	*SIG CNDTNER	* AMP*	DIGITAL SYSTEM	* RECORDERS	* METER	*CONSOL*
* NO	** REMARKS	*TYPE RNG/SN	*SET RNG MODE	*SENS*WRD	MPX SPS	C* TYPE	FREQ	C * RANGE
		* * MFG	*SEQ NO	CARD	*CHNO*	NO	3SS	H* CH NO
GG40	MODE 1B	SG	SG05	030	042	1D1009	100	NA
			11F5			W126		NA
GG41	MODE 1B	SG	SG05	030	017	2D1004	100	NA
			3F1			W220		NA
						F103		NA
GG42	MODE 1B	SG	SG05	030	077	2D1016	100	NA
			3J4			W208		NA
						F104		NA
GG43	MODE 1B	SG	SG05	030	043	2E1009	100	NA
			4B2			W230		NA
						F105		NA
GG44	MODE 1B	SG	SG05	030	032	2D1007	100	NA
			4D4			W240		NA
						F106		NA
GG45	MODE 1B	SG	SG05	030	057	2D1012	100	NA
			4G6			W215		NA
						F107		NA
GG46	MODE 1B	SG	SG05	030	063	2E1013	100	NA
			5B6			W222		NA
								NA
GG47	MODE 1B	SG	SG05	030	093	2E1019	100	NA
			5F2			W209		NA
								NA
GG48	MODE 1B	SG	SG05	030	092	2D1019	100	NA
			5K1			W201		NA

ETS-1 DATALOG

DATA SYSTEM ACCURACY TEST-15508 3-AS RUN
29 MAY 67

* CHANNEL * NO	** **	CHANNEL TITLE REMARKS	* TRANSDUCER * TYPE RRG/SN * MFG	* SIG CNDTNER * SET RRG MODE * SEQ NO CARD	* AMP * SENS*WRD * CHNO* NO	* DIGITAL SYSTEM MPX SPS 3SS	* RECORDERS C* TYPE FREQ H* CH NO	* METER C * RANGE H *	* CONSOL* * TITLE *TAG NUMBER* * NHBT *
									NA
0049		MODE 10	SG			SG05 030 000 2E1002 100			NA
				6F3		W204			NA
									NA
0050		MODE 10	SG			SG05 030 053 2E1011 100			NA
				6K1		W239			NA
									NA
0051		MODE 10	SG			SG05 030 070 2E1016 100			NA
				705		W250			NA
									NA
0052		MODE 10	SG			SG05 030 040 2E1010 100			NA
				7F2		W247			NA
									NA
0053		MODE 10	SG			SG05 030 067 2D1014 100			NA
				805		W213			NA
									NA
0054		MODE 10	SG			SG05 030 052 2D1011 100			NA
				8H3		W224			NA
									NA
0055		MODE 10	SG			SG05 030 042 2D1009 100			NA
				9Q1		W230			NA
									NA
0056		MODE 10	SG			SG05 030 022 2D1005 100			NA
				9H2		W210			NA
									NA
0057		MODE 10	SG			SG05 030 027 2D1006 100			NA
				9K4		W207			NA

ETS-1 DATALOG

DATA SYSTEM ACCURACY TEST-ISSUE 3-AS RUN
29 MAY 67

* CHANNEL *	** CHANNEL TITLE **	* TRANSDUCER *	*SIG CNDTNER *	* AMP* DIGITAL SYSTEM *	* RECORDERS *	* METER *	*CONSOL*
* NO *	** REMARKS **	*TYPE RNG/SN *	*SET RNG MODE *	*SENS*WRD MPX SPS *	C* TYPE FREQ C *	* RANGE *	*TITLE *TAG NUMBER*
		* MFG *	*SEQ NO CARD *	*CHNO* NO 3SS *	H* CH NO *	H *	* NMST *
							NA
0049	MODE 1B	SG		SG05 030 008 2E1002 100			NA
			6F3	W204			NA
							NA
0050	MODE 1B	SG		SG05 030 053 2E1011 100			NA
			6K1	W239			NA
							NA
0051	MODE 1B	SG		SG05 030 078 2E1016 100			NA
			7B5	W250			NA
							NA
0052	MODE 1B	SG		SG05 030 048 2E1010 100			NA
			7F2	W247			NA
							NA
0053	MODE 1B	SG		SG05 030 067 2D1014 100			NA
			8B5	W213			NA
							NA
0054	MODE 1B	SG		SG05 030 052 2D1011 100			NA
			8H3	W224			NA
							NA
0055	MODE 1B	SG		SG05 030 042 2D1009 100			NA
			9Q1	W238			NA
							NA
0056	MODE 1B	SG		SG05 030 022 2D1005 100			NA
			9H2	W210			NA
							NA
0057	MODE 1B	SG		SG05 030 027 2D1006 100			NA
			9K4	W207			NA

ETS-1 DATALOG

DATA SYSTEM ACCURACY TEST-ISSUE 3-AS RUN
29 MAY 67

* CHANNEL *	CHANNEL TITLE	* TRANSDUCER *	* SIG CNDTNER *	* AMP * DIGITAL SYSTEM *	* RECORDERS *	* METER *	* CONSOL *
* NO *	REMARKS	* TYPE RNG/SN *	* SET RNG MODE *	* SENS * WRD MPX SPS *	* TYPE FREQ *	* RANGE *	* TITLE * TAG NUMBER *
		* MFG *	* SEQ NO CARD *	* CHNO * NO 3SS *	* CH NO *		
GG58	MODE 1B	SG		SG05 030 013 2E1003 100			NA
			10F3	#235			NA
GG59	MODE 1B	SG		SG05 030 082 2D1017 100			NA
			10K4	#252			NA
GG60	MODE 1B	SG		SG05 030 072 2D1015 100			NA
			11D2	#226			NA
GG61	MODE 6	SG		SG05 030	F229		NA
			0161	#102			NA
GG61A	MODE 6	SG		SG05 030	F203		NA
				#112			NA
GG61B	MODE 6	SG		SG05 030	F227		NA
				#121			NA
GG61C	MODE 6	SG		SG05 030	F205		NA
				#114			NA
GG61D	MODE 6	SG		SG05 030	F225		NA
				#133			NA
GG61E	MODE 6	SG		SG05 030	F207		NA
				#103			NA

* CHANNEL **	CHANNEL TITLE	* TRANSDUCER	*SIG CNDTNER	* AMP	DIGITAL SYSTEM	* RECORDERS	* METER	*CONSOL*			
* NO **	REMARKS	*TYPE RNG/SN	*SET RNG MODE	*SENS*WRD	MPX	SPS	C* TYPE	FREQ	C * RANGE	*TITLE	*TAG NUMBER*
		* * MFG	*SEQ NO	CARD	*CHNO*	NO	3SS	H* CH NO	H *	* NHBT *	
GG61F	MODE 6	SG	SG05	030				F223			NA
				W119							NA
											NA
GG61G	MODE 6	SG	SG05	030				F214			NA
				W111							NA
											NA
GG61H	MODE 6	SG	SG05	030				F213			NA
				W105							NA
											NA
GG61J	MODE 6	SG	SG05	030				F215			NA
				W137							NA
											NA
GG61AA	MODE 6	SG	SG05	030				F230			NA
				W216							NA
											NA
GG61BB	MODE 6	SG	SG05	030				F224			NA
				W233							NA
											NA
GG61CC	MODE 6	SG	SG05	030				F228			NA
				W228							NA
											NA
GG61DD	MODE 6	SG	SG05	030				F216			NA
				W205							NA
											NA
GG61EE	MODE 6	SG	SG05	030				F209			NA
				W218							NA

ETS-1 DATALOG

DATA SYSTEM ACCURACY TEST-ISSUE 3-AS RUN
29 MAY 67

* CHANNEL * NO	** **	CHANNEL TITLE REMARKS	* TRANSDUCER * TYPE RNO/SN * * MPQ	* SIG CNDTNER * SET RNO MODE * SEQ NO CARD	* AMP * SENS*WRD * CHNO* NO	DIGITAL SYSTEM MPX SPS	* RECORDERS C* TYPE FREQ M* CH NO	* METER C * RANGE M *	* CONSOL* * TITLE *TAG NUMBER* * NMB* *
0001FF		MODE 6	SG		S005 030		F206		NA
					W231				NA
000100		MODE 6	SG		S005 030		F200		NA
					W221				NA
0001HH		MODE 6	SG		S005 030		F226		NA
					W211				NA
0001JJ		MODE 6	SG		S005 030		F212		NA
					W212				NA
0001KK		MODE 6	SG		S005 030		F219		NA
					W232				NA
TE01		MODE 4	CC		TH06 010 760 1A1077 010				NA
				0462					NA
TE02		MODE 4	CC		TH06 010 535 1A2094 010				NA
				0477					NA
TE03		MODE 4	CC		TH06 010 270 1A1020 010				NA
				0473					NA
TE04		MODE 4	CC		TH06 010 335 1A2034 010				NA
				0465					NA

* CHANNEL	**	CHANNEL TITLE	* TRANSDUCER	*SIG CNDYNER	* AMP*	DIGITAL SYSTEM	* RECORDERS	* METER	*CONSOL*
* NO	**	REMARKS	*TYPE RNG/SN	*SET RNG MODE	*SENS*HRD	MPX SPS	C* TYPE FREQ	C * RANGE	*TITLE *FAL NUMBER*
			* * MFG	*SEQ NO CARD	*CHNO*	NO 3SS	H* CH NO	H *	* NMBV *
TE05		MODE 4	CC		TH06	010 165 1A2017 010			NA
				0479					NA
TE06		MODE 4	CC		TH06	010 640 1A1065 010			NA
				0465					NA
TE07		MODE 4	CC		TH06	010 635 1A2064 010			NA
				0469					NA
TE08		MODE 4	CC		TH06	010 770 1A1078 010			NA
				0488					NA
TE09		MODE 4	CC		TH06	010 370 1A1038 010			NA
				0494					NA
TE10		MODE 4	CC		TH06	010 430 1A1044 010			NA
				0481					NA
TE21		MODE 5	CA		TH07	010 349 2H2035 010			NA
				0435		N205			NA
TE22		MODE 5	CA		TH07	010 449 2H2045 010			NA
				0574		N215			NA
TE23		MODE 5	CA		TH07	010 649 2H2065 010			NA
				0547		N235			NA

ETS-1 DATALOG

DATA SYSTEM ACCURACY TEST-ISSUE 3-AS RUN
29 MAY 67

* CHANNEL *	** CHANNEL TITLE **	* TRANSducer *	*SIG CNDTNER *	* AMP* DIGITAL SYSTEM *	* RECORDERS *	* METER *	*CONSOL*	*TAG NUMBER*
* NO *	REMARKS	*TYPE RNG/SN *	*SET RNG MODE *	*SENS*WRD MPX SPS C* TYPE FREQ C *	*RANGE *	*TITLE *	* NMBT *	
		* MFG *	*SEQ NO CARD *	*CHNO* NO 3SS	H* CH NO	H *		
TE24	MODE 5	CA		TH07 010 874 282095 010				NA
			0568	N265				NA
TE25	MODE 5	CA		TH07 010 799 282088 010				NA
			0440	N258				NA
TE26	MODE 5	CA		TH07 010 579 282058 010				NA
			0459	N228				NA
TE27	MODE 5	CA		TH07 010 389 282039 010				NA
			0578	N209				NA
TE28	MODE 5	CA		TH07 010 469 282047 010				NA
			0431	N217				NA
TE29	MODE 5	CA		TH07 010 904 282181 010				NA
			0444	N271				NA
TE30	MODE 5	CA		TH07 010 949 282110 010				NA
			0570	N280				NA
TY01	MODE 2	RTT		RMK 100 429 182043 010				NA
	1ST TEST-RT10,2ND TEST-		0130	V113				NA
	CC01,3RD TEST-CC03							NA
TY02	MODE 2	RTT		RMK 100 954 182111 010				NA
	1ST TEST-RT10,2ND TEST-		782	N181				NA

* CHANNEL *	** CHANNEL TITLE **	* TRANSDUCER *	* SIG CNDTNER *	* AMP *	* DIGITAL SYSTEM *	* RECORDERS *	* METER *	* CONSOL *
* NO *	** REMARKS **	* TYPE RNG/SN *	* SET RNG MODE *	* SENS * WMD MPX SPS *	* CHNO * NO JSS *	* TYPE FREQ C * RANGE H *	* CH NO *	* TITLE * TAG NUMBER *
	CC01,3RD TEST-CC03							NA
TT03	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0184		N158			NA
	CC01,3RD TEST-CC03							NA
TT04	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0198		N171			NA
	CC01,3RD TEST-CC03							NA
TT05	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0226		N106			NA
	CC01,3RD TEST-CC03							NA
TT06	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0255		N123			NA
	CC01,3RD TEST-CC03							NA
TT07	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0289		N154			NA
	CC01,3RD TEST-CC03							NA
TT08	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0360		N119			NA
	CC01,3RD TEST-CC03							NA
TT09	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0357		N161			NA
	CC01,3RD TEST-CC03							NA
TT10	MODE 2	RTT						NA
	1ST TEST-RT10,2ND TEST-		0150		N186			NA
	CC01,3RD TEST-CC03							NA
TT11	42J1 REF OVEN-1							NA
			0227		N124			NA

ETS-1 DATALOG

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DATA SYSTEM ACCURACY TEST-ISSUE 3-AS RUN
29 MAY 67

* CHANNEL **	CHANNEL TITLE	* TRANSDUCER	*SIG CNDTNER	* AMP*	DIGITAL SYSTEM *	RECORDERS	* METER	*CONSOL*
* NO	**	* TYPE RNO/SN	*SET RNO MODE	*SENS*HRD	MPX SPS	C* TYPE	FREQ	C * RANGE
* NO	**	REMARKS	* * MFG	*SEQ NO	CARD	*CHNO*	NO	JSS
						H* CH NO	H *	* NHBT *

NA

TT12	42J1 REF OVEN-2		RT05	010	570	1A105B	010	
------	-----------------	--	------	-----	-----	--------	-----	--

0228	N125
------	------

TT13	42J7 REF OVEN-1		RT05	010	395	1A2040	010	
------	-----------------	--	------	-----	-----	--------	-----	--

0239	N126
------	------

TT14	42J7 REF OVEN-2		RT05	010	140	1A1015	010	
------	-----------------	--	------	-----	-----	--------	-----	--

0240	N127
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NUMBER OF CHANNELS LISTED IS 129,
THE END

APPENDIX C

TEST PATCH LIST

INSTRUMENTATION DATA AND PATCHING LIST

BY ML DATE 5/13/67 SUBJECT Mode Ia Accuracy Test (Strain Gage)

SHEET 1 OF 1

TAG NO	FUNCTION TERM.	ONLY RANGE BOX	XDCR RANGE	TYPE	MODE CARD				DC AMPL	FULL SCALE	AMP S/N		TCB PATCH		FCR PATCH		R R PATCH			
					SERIAL NO.	SEQ NO.	DDS WORD	SIGNAL COND			MODE CARD	IN	OUT	IN	OUT	IN	OUT			
SG-01	57/58	42B010	Sim a/4A-1		214	064	589		SG05	30		N203	LI1-64	DS1-5	LI1-5	NB1-29				
SG-02	107/108	42B004	1-2		250	4E1	789					N424	LI1-103	DS1-6	LI1-6	1-49				
SG-03	229/230	42B004	1-3		232	133	984					N257	LI1-133	DS1-7	LI1-7	1-87				
SG-04	299/300	42B004	1-4		278	043	884					N194	LI1-163	DS1-8	LI1-8	1-67				
SG-05	15/16	42B010	1-5		71	043	729					N538	LI1-43	DS1-9	LI1-9	1-43				
SG-06	353/354	42B004	1-6		201	185	319					N543	LI1-185	DS1-10	LI1-10	1-42				
SG-07	299/300	42B002	1-7		75	6J6	379					N459	LI1-210	DS1-11	LI1-11	1-8				
SG-08	353/354	42B002	1-8		178	7D4	934					N356	LI1-232	DS1-12	LI1-12	1-77				
SG-09	207/208	42B002	1-9		19	7H2	874					N232	LI1-248	DS1-13	LI1-13	1-65				
SG-10	247/248	42B002	1-10		225	7K5	439					N425	LI1-263	DS1-14	LI1-14	NB1-14				
SG-11	369/370	42B004	1-11		193	8B1	509					N179	LI2-1	DS2-15	NB-1	NB2-21				
SG-12	41/42	42B005	1-12		47	8F5	409					N266	LI2-23	DS2-16	2	11				
SG-13	55/56	52B005	7-1		70	8G6	679					N265	LI2-30	DS2-17	3	38				
SG-14	131/132	42B005	7-2		235	9J5	834					N488	LI2-78	DS2-18	4	57				
SG-15	92/94	42B005	7-3		44	9F3	749					N304	LI2-57	DS2-19	5	45				
SG-16	169/170	42B005	7-4		277	10C1	709					N359	LI2-91	DS2-20	6	41				
SG-17	253/254	42B005	7-5		76	10G4	854					N325	LI2-112	DS2-21	7	61				
SG-18	329/330	42B005	7-6		231	11D1	339					N305	LI2-145	DS2-22	8	4				
SG-19	333/334	42B005	7-7		227	11D3	824					N443	LI2-147	DS2-23	9	55				
SG-20	351/352	42B005	Sim a/n7-8		2	11F6	309		SG05	30		N311	LI2-156	DS2-24	NB-10	NB2-1				

INSTRUMENTATION DATA AND PATCHING LIST

BY M. Levine DATE 5/13/67 SUBJECT Mode 1B Accuracy Test (Strain Gage)

TAG NO.	TERM	BOX	XDCR RANGE SIM.	TYPE	SER. NO. MODE CARD	SEQ. NO.	DDS WORD	SIG. COND.	MODE CARD	DC AMPL	FULL SCALE	READ OUT WB S/N	TCB PATCH		FCR PATCH		R R PATCH		MAG. TAPE PATCH	
													IN	OUT	LLDP	HLDP	IN	OUT		
SG 21	27/28	42B010	S/N 1-1		251	3B1	023		SG05	30		W13654	LL1-49	DS1-15	LL1-15	WB20	WB20-40cf25	DS1-1	RAZ/OSC2-6	WB20 TRI-8
SG 22	65/66	42B010	2		253	3H2	007					W13572	LL1-68	16	16	WB8	WB8-40cf2	DS1-2	RD1/OSC2-39	WB8 TRI-9
SG 23	115/116	42B010	3		224	4B4	087					W13613	LL1-88	17	17	WB 30	WB30-40CF18	DS1-3	RB1/OSC2-29	WB30 TRI-10
SG 24	267/268	42B004	4		239	5D3	018					W13648	LL1-147	18	18	WB 40	WB4.-40CF24	DS1-4	RC8/OSC2-18	WB40 TRI-11
SG 25	321/322	42B004	5		181	5J1	033					W13630	LL1-169	19	19	WB 15	WB15-40CF27	DS1-5	RF7/OSC2-14	WB15 TRI-12
SG 26	347/348	42B004	6		248	6B2	072					W13662	LL1-182	20	20	WB 22	WB22-40CF15			
SG 27	253/254	42B002	7		274	6G2	017					W13589	LL1-194	21	21	WB 9	WB9 4			
SG 28	323/324	42B002	8		69	7D1	032					W13577	LL1-217	22	22	WB 1	1 7			
SG 29	369/370	42B002	9		261	7F6	012					W13587	LL1-240	23	23	WB 4	4 3			
SG 30	221/222	42B002	S/N 1-10		252	7J3	003					W13598	LL1-255	24	24	WB 39	39 21			
SG 31	17/18	42B005	S/N 1-1		257	8C5	037					W13680	LL2-11	1	179	WB 50	50 8			
SG 32	35/36	42B005	2		258	8F2	088					W13588	LL2-21	2	180	WB 47	47 38			
SG 33	69/70	42B005	3		270	9B3	078					W13616	LL2-51	3	181	WB 13	13 36			
SG 34	105/106	42B005	4		241	9G4	062					W13627	LL2-64	4	182	WB 24	24 13			
SG 35	123/124	42B005	5		262	9J1	097					W13662	LL2-73	5	183	WB 38	38 20			
SG 36	149/150	42B005	6		245	10B2	048					W13657	LL2-86	6	184	WB 10	10 30			
SG 37	221/222	42B005	7		271	10D5	093					W13685	LL2-101	7	185	WB 7	7 39			
SG 38	265/266	42B005	8		265	10H4	057					W13625	LL2-118	8	186	WB 35	35 12			
SG 39	299/300	42B005	9		272	11B3	013					W13650	LL2-115	9	187	WB 35	52 23			
SG 40	349/350	42B005	S/N 1-10		256	11F5	042		SG05	30		W13608	LL2-115	DS1-10	LL1188	WB 26	WB26-40CF 9			

INSTRUMENTATION DATA AND PATCHING LIST

Y M. Levine DATE 5/13/67 SUBJECT Mode 1b Accuracy Test (Strain Gage)

TAG NO.	TERM	BOX	XDCR RANGE SIM.	TYPE	SER. NO. MODE CARD	SEQ. NO.	DDS WORD	SIG. COND	MODE CARD	DC AMPL	FULL SCALE	READ OUT WB S/N	TCB PATCH IN	TCB PATCH OUT	FCR PATCH LLDP	FCR PATCH WB20	HLDP	HLDP	R R PATCH IN	R R PATCH OUT	MAG. TAPE PATCH
SG 41	39/40	42B010	S/N 7-1		238	3F1	017		SG05	30		W13681	LL1-55	DS2-25	LLZ-25	WB20	WB20	40cf4	DS2-1	RA1/OSC1-A	WB60 TR1-3
SG 42	91/92	42B010	2		244	3J4	077					W13666	76	26	26	8	8	40cf16	DS2-2	RB2/OSC1-36	48 TR1-4
SG 43	111/112	42B010	3		268	4B2	043					W13686	86	27	27	30	30	40cf29	DS2-3	RC3/OSC1-4	70 TR1-5
SG 44	101/102	42B004	4		247	4D4	032					W13632	100	28	28	40	40	40cf7	DS2-25	RE4/OSC1-41	80 TR1-6
SG 45	129/130	42B004	5		249	4G6	057					W13663	114	29	29	15	15	40cf12	DS2-26	RD5/OSC1-7	WB55 TR1-7
SG 46	249/250	42B004	6		10	5B6	063					W13569	138	30	30	6	6	40cf33			
SG 47	277/278	42B004	7		11	5F2	093					W13668	152	31	31	9	19	39			
SG 48	333/334	42B004	8		7	5K1	092					W13655	175	32	32	1	1	19			
SG 49	361/362	42B004	9		53	6F3	008					W13561	189	33	33	4	4	22			
SG 50	301/302	42B002	S/N 7-10		266	6K1	053					W13617	211	34	34	39	39	31			
SG 51	331/332	42B002	S/N 7-1		237	7B5	078					W13665	221	35	35	50	50	36			
SG 52	361/362	42B002	2		269	7F2	048					W13576	LL1-236	36	LL2-36	47	47	30			
SG 53	5/6	42B005	3		240	8B5	067					W13573	LL2-5	25	NB	11	13	14			
SG 54	61/62	42B005	4		260	8H3	052					W13682	33	26	NB	12	24	11			
SG 55	99/100	42B005	5		263	9G1	042					W13677	61	27	NB	13	38	9			
SG 56	113/114	42B005	6		254	9H2	022					W13669	68	28	NB	14	10	5			
SG 57	141/142	42B005	7		243	9K4	027					W13679	82	29	NB	15	7	6			
SG 58	229/230	42B005	8		242	10F3	013					W13620	105	30	NB	16	35	23			
SG 59	289/290	42B005	9		246	10K4	082					W13585	130	31	NB	17	52	17			
SG 60	331/332	42B005	S/N 7-10		259	11D2	072		SG05	30		W13579	LL2-146	DS2-32	NB	18	WB26	NB26	40cf15		

INSTRUMENTATION DATA AND PATCHING LIST

BY ML DATE 5/13/67 SUBJECT Mode 3 Accuracy Test (Swept Pot)

SHEET 1 OF 1

[illegible]

INSTRUMENTATION DATA AND PATCHING LIST

BY M. L. DATE 5/13/67 SUBJECT Modes 4-5 (Accuracy Test)

~~SET~~ FULL
MEX MUX

SHEET ____ OF ____

[illegible]

INSTRUMENTATION DATA AND PATCHING LIST

BY M. Levine DATE 5/13/67 SUBJECT Mode 6 - Accuracy Test (Phase Shift - Drift - Common Mode)

SHEET **OF**

TAG NO.	FUNCTION TERM	CAL RANGE BOX	XDCR RANGE	TYPE	SERIAL NO. MODE CARD	SEQ NO.	DDS WORD	SIGNAL COND	MODE CARD	DC AMPL	FULL SCALE	READ OUT	TCB PATCH		FCR PATCH		TAPES REEL PATCH		W/B	
													IN	OUT	IN	OUT	IN	OUT	SER.	NO.
SG 61	295-296	42B004			269	161		5G5	SG05	30			LL1-161	DS1-60	DS1-60	WR - 2	WR - 2	TR2-29	136	9
SG 61-a														DS1-61	61	WR - 12	WR - 12	TR2-3	135	2
SG 61-b	a													DS1-62	62	WR - 21	WR - 21	TR2-27	136	7
SG 61-c														DS1-63	63	WR - 14	WR - 14	TR2-5	136	0
SG 61-e														DS1-64	64	WR - 33	WR - 33	TR2-25	136	2
SG 61-e														DS1-65	65	WR - 3	WR - 3	TR2-7	136	3
SG 61-f														DS1-66	66	WR - 19	WR - 19	TR2-23	136	8
SG 61-g														DS1-67	67	WR - 11	WR - 11	TR2-18	136	1
SG 61-h														DS1-68	68	WR - 5	WR - 5	TR2-13	136	1
SG 61-j														DS1-69	DS1-69	WR - 37	WR - 37	TR2-15	136	0
SG 61-k																				
SG 61-aa														DS2-50	DS2-50	WR - 16	WR - 56	TR2-30	136	1
SG 61-bb														DS2-51	51	WR - 33	WR - 73	TR2-24	136	8
SG 61-cc														DS2-52	52	WR - 28	WR - 68	TR2-28	136	0
SG 61-dd														DS2-53	53	WR - 5	WR - 45	TR2-16	136	6
SG 61-ee														DS2-54	54	WR - 18	WR - 58	TR2-9	136	3
SG 61-ff														DS2-55	55	WR - 31	WR - 71	TR2-6	136	7
SG 61-gg														DS2-56	56	WR - 21	WR - 61	TR2-8	136	1
SG 61-hh														DS2-57	57	WR - 11	WR - 51	TR2-26	136	8
SG 61-ii														DS2-58	58	WR - 12	WR - 52	TR2-12	135	8
SG 61-kk										30				DS2-59	DS2-59	WR - 32	WR - 72	TR2-19	136	2
X350-1	107/108	42B004			250		4F1		SG05	30			LL1-103	DS1-71	DS1-71	WR - 17	WR - 17	TR2-22	136	4
X350-2	353/354	42B002			178		7D4			30			232	72	72	36	36	11	136	1
X350-3	207/208	42B002			75		7H2			30			248	73	73	31	31	18	135	9
X350-4	299/300	42B002			201		6J6			30			210	74	74	26	26	1	135	8
X350-5	353/354	42B004					185			30			185	75	75	23	23	10	136	8
X350-6	229/230	42B004					133			30			133	76	76	6	6	21	135	6
X350-7	57/58	42B0010					064			30			064	77	77	29	29	20	136	7
X350-8	299/300	42B004					043		SG05	30			163	78	78	16	16	4	136	2
X350-9	15/16	42B010											LL1-043	DS1-79	79	* 25	25	17	135	1

INSTRUMENTATION DATA AND PATCHING LIST

BY M. Levin DATE 5/23/67 SUBJECT Mode 6 (Common Mode Rejection)

SHEET ____ OF ____

[illegible]

INSTRUMENTATION DATA AND PATCHING LIST

BY M. Levine DATE 5/13/67 SUBJECT Node 7 (Speed and Flow)

SHEET ____ OF ____

TAG NO.	FUNCTION TERM	CAL RANGE BOX	XOCR RANGE	TYPE	SERIAL NO.	SEQ NO.	DOS WORD	SIGNAL COND	MODE CARD	DC AMPL	FULL SCALE	READ OUT	TCB PATCH IN OUT		FCR PATCH IN OUT		R R PATCH IN OUT			
FT 1	115	42B 15				671	764		VR				HI 2 DA 25	DS1- 5	TS1-137	4cf-77	DS-1-6	TR3-9		
FT 1ac													30	DS1- 6	TS1-138	ARP-1-6 CTR 2	DS-1-9	TR3-12		
FT 2	116	42B 15				672	774		VR				26	DS1- 7	TS1-139	ARP-1-9 4cf-78 ARP1-7	DS1-7	TR3-2		
FT 2ac													31	DS1- 8	TS1-140	CTR 3 ARP-1-10 ARP1-7	DS1-10	TR3-25		
FT 3	117	42B 15				673	784		VR				27	DS1- 9	TS1-141	4cf-79 ARP 1-8	DS1-8	TR3-5		
FT 3ac													32	DS1-10	TS1-142	CTR 1 ARP-1-11	DS1-11	TR3-22		
FT 4	118	42B 15				674	044		VR				28	DS2-6	TS2-138	4cf-5 ARP 2-27	DS2-27	TR3-28		
FT 4ac													33	DS2-7	TS2-139	CTR 2 ARP 2-29	DS2-29	TR3-10		
FT 5	119	42B 15				675	990		VR				29	DS2-8	TS2-140	4cf-119 ARP 2-28	DS2-28	TR3-17		
FT 5ac													HI 2 DA 34	DS2-9	TS2-141	CTR 1 ARP 2-30	DS2-30	TR3-14		

INSTRUMENTATION DATA AND PATCHING LIST

BY M. Levine DATE 5/13/67 Subject: Mode 2 Accuracy Test (RTT)

TAG NO.	TERM	BOX	XDCR RANGE	TYPE	SERIAL NO.			SEQ. NO.	DDS WORD	SIG. COND	MODE CARD	DC AMPL	FULL SCALE	READ OUT	TCB PATCH		FCR PATCH	
					CC01	RT 10	CC03								IN	OUT	IN	OUT
RTT 01	223-224	42B4	Sim	3-1(range 1)	7	12		130	429	4K4	*	100		N 475	LL1-130	DS1-35	LL1-35	NB-13
				3-1(range 2)														
RTT 02	325-326	42B2	Sim	3-2(range 1)	12	9		7B2	954	7B2				N 563	LL1-218	36	36	8
				3-2(range 2)														
RTT 03	351-352	42B5	Sim	3-3(range 1)	14	5		184	839	6B4				N 443	LL1-184	37	1L1-37	58
				3-3(range 2)														
RTT 04	7-8	42B5		3-4(range 1)	8	4		198	904	8B6				N 356	LL2-6	33	NB 19	71
				3-4(range 2)														
RTT 05	63-64	42B5		3-5(range 1)	18	14		226	359	8H4				N 424	LL2-34	34	NB 20	6
				305(range 2)														
RTT 06	103-104	42B5		3-6(range 1)	9	11		255	529	9G3				N 459	LL2-63	35	NB 21	23
				3-6(range 2)														
RTT 07	213-214	42B5		3-7(range 1)	3	1		289	819	10D1				N 194	LL2-97	36	NB 22	54
				3-7 (range 2)														
RTT 08	191-192	42B14		3-8(range 1)	5	100		360	489	11H6				N 425	LL2-168	37	NB 23	19
				3-8(range 2)														
RTT 09	167-168	42B14		3-9(range 1)	16	3		357	854	11H3				N 203	LL2-165	38	NB 24	61
				3-9(range 2)														
RTT 10	273-274	42B14	Sim	3-10(range 1)	6	101		150	979	5D6	*	100		N 232	LL1-150	DS1-44	LL1-44	NB 86
				3-10(range 2)														

* use RT 10 mode cards for 2nd test

CC 01 mode cards for 1st test

APPENDIX D

NTO-I-0270, REVISION A

ETS-1 DATA ACQUISITION SYSTEM FINAL ACCURACY STUDY

NTO-I-0270A

ETS-1 Data Acquisition System

Final Accuracy Study

Approvals:

R. Cooper, NRO

W. D. Wayne, Manager ETS-1

N. E. Erickson, Manager
NERVA Test Operations

ETS-1 DATA ACQUISITION
SYSTEM FINAL ACCURACY
TEST PROCEDURE

I. PURPOSE

The purpose of this procedure is to provide a step by step method of performing the tests specified in the ETS-1 Data Acquisition System Final Accuracy Test Specification.

II. SCOPE

This procedure will cover the system set-up, checkout, calibration, and data recording required to accomplish the objectives of the Test Specification.

III. REFERENCES

- A. NTO-SOP-0081, Active Signal Conditioners
- B. NTO-SOP-0075, Passive Signal Conditioners
- C. NRO RN-S-0308A, ETS-1 Data Acquisition System Final Accuracy Test Specification.

IV. TEST EQUIPMENT REQUIRED

- A. Two (2) twelve (12) Channel Strain Gage Simulators
- B. One (1) twelve (12) Channel RTT Simulator
- C. Two (2) five (5) Channel Swept Pot Simulators
- D. Ten (10) Copper Constantan Thermocouple Probes
- E. Ten (10) Chromel Alumel Thermocouple Probes
- F. One (1) Dewar for Thermocouple Ice Bath
- G. One (1) Oscilloscope
- H. One (1) Oscillator - Freq. Range: 0-20 KC; Output Voltage Range: 0-1 Volt (capable of adjusting output voltage to 1, 2, 5, 10, 100, and 1000 mv)

- I. One (1) oscillograph (CEC) equipped with one (1) 0-10 KC response galvanometer and one (1) galvo for timing.
- J. One (1) laboratory quality mercury in glass thermometer.

V. TEST PROCEDURES

A. Test Mode 1a - Strain Gage

1. _____ Connect 20 randomly selected channels as shown in Figure 1. Patch ten (10) of these channels to DDS Subsystem 1 and the other ten (10) channels to DDS Subsystem 2.
2. _____ Switch all Strain Gage Simulator Channel Switches to the Zero or Operate position.
3. _____ Set-up the signal conditioners and amplifiers per NTO-SOP-0075 (Ref. Para. III-B) and Table II.
4. _____ Range the DDS for 7500 counts at the 75% electrical calibration step.
5. _____ Perform and record a normal system electrical calibration.
6. _____ With the simulator channel switches set to Zero, record 64 seconds of data.
7. _____ Switch all simulator channel switches to the 25% position and record 64 seconds of data.
8. _____ Repeat part A-7 for the 50% and 75% simulator channel switch positions.
9. _____ Perform and record a normal system electrical calibration.
10. _____ Record the test date, recording start/stop times (range time), any abnormal test conditions, and obtain Quality Control approval on the Test Data Sheet.

11. _____ Record the serial number and calibration date of all test equipment (i.e., oscillators, meters, signal conditioner mode cards, amplifiers, etc.) on the Test Equipment Data Sheet. Also, record the simulator channel number and its corresponding system channel number on the Test Equipment Data Sheet.

B. Test Mode 1b - Strain Gage

1. _____ Connect 40 channels from the 42 area junction box to the DDS per Figure 2. Patch twenty (20) of these channels to DDS-1 and twenty (20) channels to DDS-2. Patch five (5) of the DDS-1 channels and five (5) of the DDS-2 channels to the magnetic tape, oscillograph, and strip chart recorders per Figure 2.
2. _____ Connect ten (10) of the DDS-1 channels (including the five (5) channels patched to the analog recorders) to one (1) strain gage simulator and ten (10) of the DDS-2 channels (including the five (5) channels patched to the analog recorders) to the other strain gage simulator.
3. _____ Repeat parts A-2 through A-8 with the following exceptions:
 - 3.1 _____ Record each simulator channel switch position for 6.4 seconds.
 - 3.2 _____ Record only the zero and 75% steps for 6.4 seconds on the analog tape, oscillograph, and strip chart recorders.
4. _____ Connect the remaining ten (10) DDS-1 channels to one (1) strain gage simulator and the remaining ten (10) DDS-2 channels to the other strain gage simulator.

5. _____ Repeat parts A-2 through A-11, except record each step for only 6.4 seconds.

C. Test Mode 2 - RTT

1. _____ Connect 10 randomly selected channels per Figure 3. Patch all ten (10) of these channels to DDS-1.
2. _____ Install RT10 mode cards in the ten (10) signal conditioners.
3. _____ Set-up the channels per NTO-SOP-0075 (Ref. Part III-B) and Table II (RT10 mode card).
4. _____ Perform and record a normal system electrical calibration.
5. _____ Switch all simulator channel switches to the 90% position.
6. _____ Record 64 seconds of test data.
7. _____ Repeat part C-4.
8. _____ Replace the RT10 mode cards with CCO1 mode cards.
9. _____ Repeat parts C-3 through C-9 using simulator switch settings of 90%.
10. _____ Repeat parts A-10 and A-11.

D. Test Mode 3 - Swept Pot

1. _____ Connect 10 randomly selected channels to DDS-1 per Figure 4.
2. _____ Set-up the ten (10) channels per NTO-SOP-0075 (Ref. Part III-B) and Table II.
3. _____ Perform and record a normal system electrical calibration.
4. _____ Switch all simulator channel switches to the 0% position and record 64 seconds of test data.

5. _____ Repeat part D-4 for the 25%, 50%, 75%, and 100% simulator channel switch settings.
6. _____ Repeat part D-3.
7. _____ Repeat parts A-10 and A-11.

E. Test Mode 4 and 5 - Thermocouples

1. _____ Connect 10 copper constantan thermocouple channels per Figure 5 to DDS-1 channels and ten (1) chromel alumel thermocouples per Figure 6 to DDS-2 channels.
2. _____ Set-up the twenty (20) channels per NTO-SOP-0081 (Ref. Part III-A) and Table II.
3. _____ Patch the two (2) reference oven internal temperature monitoring RTT's from each reference oven (4 total) to the A multiplexer in one of the DDS subsystems.
4. _____ Insert the twenty (20) thermocouple probes into a distilled water ice bath along with a laboratory quality mercury in glass thermometer.
5. _____ Allow the thermocouples to stabilize for a minimum of 30 minutes or until they are stable as indicated by the short term drift of the signal conditioner output voltage.
6. _____ Perform and record a normal system electrical calibration.
7. _____ Record the reading of the mercury thermometer on the Test Data Sheet (remarks column).
8. _____ Record 64 seconds of test data.
9. _____ Repeat parts E-6, E-7, A-10, and A-11.

10. _____ Record 64 seconds of data from the four (4) (two (2) from each reference oven) reference oven RTT's at 2, 4, 8, and 12 hours after completion of part E-9.

F. Test Mode 6 - Analog

1. _____ Connect 1 channel of a strain gage simulator, an oscillator, an oscilloscope, and an oscillograph recorder to a passive signal conditioner as shown in Figure 7. Patch the output of this signal conditioner to twenty (20) analog channels as shown in Figure 7.
2. _____ Terminate nine (9) other channels with a 350 ohm resistor at the signal conditioner output patch and patch these channels to the remainder of the channels on the magnetic tape recorder per Figure 7 using the W/B amplifier outputs that are connected directly to the magnetic tape recorder patch.
3. _____ Set-up the strain gage signal conditioner per NTO-SOP-0075 (Ref. Part III-B) and the W/B amplifier gains per Table II.
4. _____ With the oscillator turned off and the strain gage simulator channel switch turned to the zero position, perform and record a normal system electrical calibration.
5. _____ With the oscillator off and the strain gage simulator channel switch in the zero position, record 10 seconds of test data.
6. _____ Repeat part F-5 for simulator channel switch settings of 25, 50, and 75% of full scale.
7. _____ Switch the strain gage simulator channel switch to the zero position.

8. _____ Turn on the oscillator and adjust the output to produce a 3 mv peak, 10 cps, sine wave.
9. _____ Set the chart speed of the CEC oscillograph to 10 ips and the gain of the Neff amp to produce a 2" deflection.
10. _____ Record 60 seconds of test data on magnetic tape.
11. _____ Repeat parts F-8, F-9, and F-10 for peak voltages of 6 mv, 15 mv, and 30 mv at 10 cps. Record 10 seconds of data on the CEC oscillograph for the 3, 6, 15, and 30 mv signal levels.
12. _____ Repeat parts F-8 through F-11 for test frequencies of 500 cps and 2000 cps. Change the oscillograph chart speed to 100 ips for the 500 and 2000 cps frequencies.
13. _____ Turn off the oscillator.
14. _____ Perform and record a normal system electrical calibration.
15. _____ Repeat parts A-10 and A-11.

G. Test Mode 6 - Phase Shift

1. _____ Using the test set-up of Figure 7, perform the following operations:
 - 1.1 _____ Set the chart speed of the CEC oscillograph in the Test Cell Building to 10 ips.
 - 1.2 _____ Set the gain of the Neff galvanometer driver amplifier for a 2" galvo deflection.
 - 1.3 _____ Switch the strain gage simulator channel switch to the zero position.
 - 1.4 _____ Manually set the 100% calibration step.
 - 1.5 _____ Adjust the CEC galvanometer for maximum on scale deflection.

- 1.6 _____ Perform a normal system electrical calibration.
Record this calibration on both the CEC oscillograph
and magnetic tape.
 - 1.7 _____ Turn the oscillator on and adjust the amplitude and
frequency of the Sine wave output signal to 15 mv
peak and 10 cps respectively.
 - 1.8 _____ Record (CEC and Analog Tape) 10 seconds of test data.
 - 1.9 _____ Repeat parts G-1.7 and G-1.8 for oscillator frequencies
of 50, 100, and 500 cps and a signal amplitude of
15 mv. Set the CEC oscillograph chart speed to 100
ips for the 100 and 500 cps frequencies.
2. _____ Repeat parts A-10 and A-11.

H. Test Mode 6 - Drift

1. _____ Using the test set-up of Figure 7, perform the following operations:
 - 1.1 _____ Turn the oscillator off.
 - 1.2 _____ Switch the strain gage simulator channel switch to
zero.
 - 1.3 _____ Perform and record a normal system electrical cali-
bration.
 - 1.4 _____ Switch the strain gage simulator channel switch to
zero.
 - 1.5 _____ Record 10 seconds of test data.
 - 1.6 _____ Switch the strain gage simulator channel switch to 75%.
 - 1.7 _____ Record 10 seconds of test data.

- 1.8 _____ Repeat parts H-1.4 through H-1.7 once per hour for 12 consecutive hours.
- 1.9 _____ At the end of the 12 hour period, repeat parts H-1.2 and H-1.3
- 2. _____ Repeat parts A-10 and A-11.

I. Test Mode 6 - Common Mode Rejection

- 1. _____ Patch two (2) channels per Figure 9.
- 2. _____ Connect an oscillator to one (1) channel per Figure 9.
- 3. _____ Set-up the signal conditioner per NTO-SOP-0081 and Table II.
- 4. _____ Perform and record a normal system electrical calibration.
- 5. _____ Adjust the oscillator output to 5⁴ cps and 1 volt RMS.
- 6. _____ Remove the oscillator monitoring device (oscilloscope, etc.).
- 7. _____ Record 10 seconds of test data.
- 8. _____ Repeat parts I-5 through I-7 for signal amplitudes of 5, 10, and 25 V.
- 9. _____ Turn off the oscillator and repeat part I-4.
- 10. _____ Record all recorder On/Off times and any abnormal test conditions on the Test Data Sheet.

J. Test Mode 7 - Speed and Flow

- 1. _____ Connect six (6) channels (3 per DDS subsystem) per Figure 8.
- 2. _____ Set the frequency to DC converter range switch to 20 KC.
- 3. _____ Perform and record a normal system electrical calibration using a calibration frequency of 10 KC.
- 4. _____ With the oscillator off, record 6⁴ seconds of test data.

5. _____ Turn the oscillator on and adjust the output signal to 4 KC and 100 mv peak.
6. _____ Record 64 seconds of test data.
7. _____ Repeat parts J-5 and J-6 for signal frequencies of 8 KC, 12 KC, 16 KC, and 20 KC.
8. _____ Repeat parts J-5 through J-7 for a signal amplitude of 1 volt.
9. _____ Switch the frequency to DC converter range switch to 500 cps.
10. _____ Perform and record a normal system electrical calibration with a calibration frequency of 200 cps.
11. _____ Repeat parts J-4 through J-7 for test frequencies of 100, 200, 300, 400, and 500 cps at a signal amplitude of 100 mv. Apply the frequencies as step functions by connecting the oscillator to the channel input after the recorder has been turned on for each different frequency. Record 64 seconds of data after each step.
- . 12. _____ Repeat parts A-10 and A-11.

TABLE I
DATA SYSTEM ACCURACY TEST SET-UP

[illegible]

TABLE II

DATA SYSTEM ACCURACY SIGNAL CONDITIONING

Mode	Block Diagram	Simulation	Source Monitoring	Signal Conditioner			Amplifier	
				Type	Mode Card	F.S. Output	Type	Sensitivity
1a	Fig. 1	Strain Gage Sim.	None	Pass.	SG05	30mv	N.B.	30
1b	Fig. 2	Strain Gage Sim.	None	Pass.	SG05	30mv	W.B.	30
2	Fig. 3	RTT Simulator	None	Pass.	RT 10 CC01 CC03	100 mv 100 mv 100 mv	N.B. N.B. N.B.	100 100 100
3	Fig. 4	Swept Pot Sim.	None	Pass.	SP01	5 V	---	---
4	Fig. 5	Thermocouple C/C	None	Active	TH06	10 mv	L.L. Mux.	10
5	Fig. 6	Thermocouple C/A	None	Active	TH07	10 mv	N.B.	10
6	Fig. 7	Strain Gage Sim. Oscillator	Oscilloscope Oscillograph	Pass.	SG05	30 mv	W.B.	30
7	Fig. 8	Oscillator	Oscilloscope	---	---	---	---	---
6	Fig. 9	Oscillator (Common Mode Rejection)	Oscilloscope	Passive	SG05	30	W.B.	100

TEST DATA SHEET

Date	Test Mode	Input Signal	Record	Times	Remarks	Q.C. Approval
			START	STOP

MODE 1a - STRAIN GAGE

NARROW BAND

FIGURE 1

TEST CELL BUILDING

FORWARD CONTROL ROOM

C. P. RECORDER ROOM

MODE 1b - STRAIN GAGE - WIDE BAND

FIGURE 2

TEST CELL BUILDING

FORWARD CONTROL

MODE 2 - RTT

FIGURE 3

FORWARD CONTROL ROOM

MODE 3 - SWEEP POT

FIGURE 4

MODE 1 - COPPER CONSTANTAN

FIGURE 5

MODE 5 - CHROMEL ALUMEL

THERMOCOUPLE

FIGURE 6

MODE 6 - ANALOG

FIGURE 7

MODE 7 - SPEED AND FLOW

FIGURE 8

MODE 6 - COMMON MODE REJECTION

FIGURE 9