This ATM documents Task 2 of the Operational Contingency Study defined in ATM-396.

Diagnostic procedures have been described for the Operational Contingencies defined in ATM-529. Purpose of the diagnostic procedures is to provide preliminary data, to the project engineers and principal investigators, relating to the cause of the operating difficulty and to the optimum employment of the remaining capabilities.

The diagnostic procedures utilize the current command access and telemetry potential of the Central Station and of the experiments. Cognizant project engineers are requested to bring to the attention of System Design additional procedures which might prove advantageous, whether they are within the capability of the present design or not.

Prepared by _____
O. T. Neau

Approved by _____
L. W. Helmreich

A. CENTRAL STATION CONTINGENCIES

Contingency	Procedure
1. No Power from RTG	None
2. Low Power from RTG	a. Check telemetry Channels 1 and 5 for converter input voltage and current respectively, and determine power input.
	b. Check telemetry Channels 12 and 14 for ON-OFF status of experiments and channel 8 (or 13) for shunt regulator current, and determine nominal power load on RTG.
	c. Check RTG temperatures, Channels 6, 7, 37, 52, 62 and 87 and compare against nominal.
	d. Gradually increase load by adding experiments (Commands PD-13 through PD-25) or power dissipation resistors (Commands PD-5 and PD-7) and determine maximum available power.
3. Loss of regulation in PCU	a. Gradually reduce load by dropping experiments from ON to STANDBY (Commands PD-14 through PD-26) and removing power dissipation resistors (Commands PD-6 and PD-8) until regulation is restored.
	b. Switch PCU's by use of Command PC-1 (or PC-2) and check performance of second unit as in a, above.
	c. Determine maximum power available from PCU without loss of regulation as in Step 2 d. above.
4. No response to PCU Set Command (PC-1)	a. Exercise Command PC-2 (PCU Reset), then repeat PC-1.
	b. If no response, check up link by exercising Command DP-4 (Slow data rate).
	c. If up link is OK check decoding of octal 60 Commands by exercising PS-1 (change gain, Passive Seismic LP Horizontal) noting before and after status on telemetry Channel 23.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. | NO. ATM 541 | REV.NO.

10/17/66 | Operational Contingency Diagnostic Procedures

PAGE 3 OF 48 PAGES

Contingency	Procedure
5. No response to PCU Reset Command (PC-2)	Proceed as in 4 above.
6. Loss of Command Receiver Primary Local Oscillator.	a. Switchover is indicated by loss of LO Crystal Temperature data in Channel 16. b. Check back-up crystal temperature in channel 17. c. Check LO output level on Channel 36.
7. Loss of up link.	a. With ground station transmitting carrier modulated by subcarrier, check telemetry channel 21 for pre-limiting level of receiver. b. If no carrier is indicated in a, above, check receiver LO per Step 6, above and check +12v on channel 50. c. If tests indicate no LO output, receiver circuit breaker may have tripped. Check again after internal timer has reset breaker. d. If carrier is OK, check Channel 9 for presence of subcarrier. e. If no subcarrier is indicated check Command Demodulator VCO Temperature on channel 61. f. If subcarrier is OK, check +5v to Command Decoder on Channel 65. g. Check Command Decoder Temperatures on Channels 48 and 49. h. If voltage and temperature are OK, sequentially transmit unique Commands, noting which, if any, are properly decoded, to determine available command control.
8. Malfunction of Signal Conditioner.	a. Check 90 housekeeping channels, telemetry word 33, and identify which, if any, are usable.

Contingency	Procedure
9. Loss of Back-up Timer	None
10. Loss of Transmitter	a. With back-up transmitter functioning, check 12v and 29v supplies on Channels 50 and 20, respectively.
	b. Check RF output and IPA level, Channels 66 and 22 (or 51 and 81) respectively.
	c. Check crystal and heat sink temperatures, Channels 31 and 32 (or 18 and 19), respectively.
	d. Switch in defective transmitter using Command PD-1 (or PD-4) if signal level is at all usable and repeat Steps a through c.
	e. If trouble appears to be in modulation, switch in back-up Data Processor, Command PD-12 (or PD-11) and check performance.
11. Loss of Data Processor	a. Switch in back-up Data Processor, using Command PD-12 (or PD-11).
	b. Check +15v, +5v, +12v and -12v supplies on Channels 35, 65, 50 and 79, respectively.
	c. Check Data Processor temperatures on Channels 33, 34, 46 and 47.
	d. If voltages and temperatures are OK, switch malfunctioning Data Processor back in, Command PD-11 (or PD-12). Then switch to Slow Data Rate, Command DP-4, and check for usability.
	e. For Array B only, switch to Active Seismic ON, Command DP-1 with experiment ON and check for usability.
	f. Switch Active Seismic OFF Command DP-2 and select Normal Data Rate, Command DP-3. Check usability.
	g. Reset Processor, Command DP-5 and check usability.

Contingency	Procedure
12. Complete loss of down link.	None
13. No response to Normal Data Rate Command, DP-3.	Verify command and, a. Check clock rate of data for Array B only. b. If 10,600, switch Active Seismic OFF, Command DP-2, and then recheck. c. If 530, or if no data are being received, transmit Normal Data Rate, Command DP-3 again. d. Check voltages and temperatures as in 11 above. e. Reset Data Processor, Command DP-5. f. If condition has not been corrected, select back-up Data Processor, Command PD-12 (or PD-11) and reset as in d above.
14. No response to Slow Data Rate Command, DP-4.	a. Proceed as in 13 above, substituting DP-4 for DP-3 and 1060 for 530.
15. No response to Reset x and y Processor, Command DP-5.	Verify command and, a. Check similar octal commands to ascertain proper decoding of command. b. Select Back-up Processor Command PD-12 (or PD-11) and recheck response.
16. No response to Transmitter A Select, Command PD-1.	a. Verify command b. Transmit similar octal commands to verify proper decoding.
17. No response to Transmitter ON, Command PD-2.	a. Select other transmitter (Command PD-1 or PD-4) and repeat Command PD-2.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. | NO. ATM 541 | REV. NO.

10/17/66 | Operational Contingency Diagnostic Procedures | PAGE 6 OF 48 PAGES

Contingency	Procedure
18. No response to Transmitter OFF, Command PD-3.	a. Proceed as in 16 above.
19. No response to Transmitter B Select, Command PD-4.	a. Proceed as in 16 above.
20. No response to PDM Load #1 ON, Command PD-5.	a. Proceed as in 16 above. b. Try Command PD-6, Load #1 OFF, then repeat PD-5. c. Switch in PDM Load #2, Command PD-7, and check response.
21. No response to PDM Load #1 OFF, Command PD-6.	a. Proceed as in 16 above. b. Switch PDM Load #2 OFF (Command PD-8) if it is ON. Note response. c. Check capability to Command Off low-priority experiment, if required, to preserve regulation.
22. No response to PDM Load #2 ON, Command PD-7.	a. Proceed as in 16 above. b. Command Load #2 OFF (PD-8) and then repeat PD-7. c. Switch in PDM Load #1 (Command PD-5) and note response.
23. No response to PDM Load #2 OFF, Command PD-8.	a. Proceed as in 16 above. b. Command Load #1 OFF (PD-6) if it is ON. Note response. c. Check capability to Command OFF low-priority experiments to preserve regulation.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

10/17/66

Operational Contingency
Diagnostic Procedures

NO.
ATM 541

REV.NO.

PAGE ___7___ OF ___48___ PAGES

Contingency	Procedure
24. No response to Back-up Heater ON, Command PD-9.	a. Proceed as in 16 above. b. Command Back-up Heater OFF, (PD-10). Then repeat PD-9. c. Carefully monitor Central Station temperatures, Channels 27, 42, 4, 28, 43, 58, 71, 59, 87, 15, 88, 60, and 72 and note any abnormally low indications.
25. No response to Back-up Heater OFF, Command PD-10.	a. Command Back-up Heater ON (PD-9) and then repeat PD-10. b. Proceed as in 16 above. c. Carefully monitor temperatures as in 24 above for excessively high indications.
26. No response to Data Processor X ON, Command PD-11.	a. Command Data Processor Y ON (PD-12) and then repeat PD-11. b. Proceed as in 16 above. c. Check +5v supply, Channel 65.
27. No response to Data Processor Y ON, Command PD-12.	a. Command Data Processor X ON (PD-11) and then repeat PD-12. b. Proceed as in 16 above. c. Check + 5v supply, Channel 65.
28. No response to Experiment 1 Power ON, Command PD-13.	a. Check available power per 2, above. b. Check 29 volt supply, Channel 20. c. Execute following Command sequence: PD-14 (Exp. 1 STANDBY) PD-15 (Exp. 1 OFF) PD-13 (Exp. 1 ON) noting changes in telemetry of a, above, and power status of Experiment 1 (Channel 12).

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. | NO. ATM 541 | REV.NO.

10/17/66 | Operational Contingency Diagnostic Procedures | PAGE 8 OF 48 PAGES

Contingency	Procedure

29. No response to Experiment 1 Power STANDBY, Command PD-14.	a. Check 29 volt supply, Channel 20.
	
	b. Execute following Command sequence:
	    PD-15 (Exp. 1 OFF)
	    PD-13 (Exp. 1 ON)
	    PD-14 (Exp. 1 STANDBY)
	noting any changes in status of experiment scientific data and power status (Channel 12).
	
	c. During lunar night, carefully monitor experiment temperature (ALSEP word 37, odd frames), maintaining power ON status if feasible.

30. No response to Experiment 1 Power OFF, Command PD-15.	a. Execute following Command sequence:
	    PD-13 (Exp. 1 ON)
	    PD-14 (Exp. 1 STANDBY)
	    PD-15 (Exp. 1 OFF)
	noting any changes in experiment telemetry and power status (Channel 12).

31. No response to Experiment 2 Power ON, Command PD-16.	a. Proceed as in 28 above, using Command sequence: PD-17, PD-18, PD-16.
32. No response to Experiment 2 Power STANDBY, Command PD-17.	a. Proceed as in 29 a and b, above, using Command sequence: PD-18, PD-16, PD-17. b. Monitor experiment temperature, especially during lunar night, maintaing power ON if feasible.
33. No response to Experiment 2 Power OFF, Command PD-18.	a. Proceed as in 30 above, using Command sequence: PD-16, PD-17, PD-18.

34. No response to Experiment 3 Power ON, Command PD-19.	a. Check available power per 2, above.
	
	b. Check 29 volt supply, Channel 20.
	
	c. Execute following Command sequence:
	    PD-20 (Exp. 3 STANDBY)
	    PD-21 (Exp. 3 OFF)
	    PD-19 (Exp. 3 ON)
	noting changes in telemetry of a, above and power status of experiment (Channel 14).

Contingency	Procedure

35. No response to Experiment 3 Power STANDBY, Command PD-20.	a. Check 29 volt supply, Channel 20.
	
	b. Execute following Command sequence:
	  PD-21 (Exp. 3 OFF)
	  PD-19 (Exp. 3 ON)
	  PD-20 (Exp. 3 STANDBY)
	  noting any changes in experiment telemetry, including power status (Channel 14).
	
	c. During lunar night monitor experiment temperature, maintaining power ON if feasible.

36. No response to Experiment 3 Power OFF, Command PD-21.	a. Execute following Command sequence:
	  PD-19 (Exp. 3 ON)
	  PD-20 (Exp. 3 STANDBY)
	  PD-21 (Exp. 3 OFF)
	  noting any changes in experiment telemetry and power status (Channel 14).

37. No response to Experiment 4 Power ON, Command PD-22.	a. Proceed as in 34 above, using Command sequence: PD-23, PD-24, PD-22.
38. No response to Experiment 4 Power STANDBY, Command PD-23.	a. Proceed as in 35 above, using Command sequence: PD-24, PD-22, PD-23.
39. No response to Experiment 4 Power OFF, Command PD-24.	a. Proceed as in 36 above, using Command sequence: PD-22, PD-23, PD-24.
40. No response to Experiment 5 Power ON, Command PD-25.	a. Proceed as in 34 above, using Command sequence: PD-26, PD-27, PD-25.
41. No response to Experiment 5 Power STANDBY, Command PD-26.	a. Proceed as in 35 above, using Command sequence: PD-27, PD-25, PD-26.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. NO. ATM 541   REV.NO.

10/17/66   Operational Contingency
Diagnostic Procedures

PAGE —— 10 —— OF —— 48 —— PAGES

Contingency	Procedure
42. No response to Experiment 5 Power OFF, Command PD-27.	a. Proceed as in 36 above, using Command sequence: PD-25, PD-26, PD-27.

43. No telemetry of Command verification (word 46 of Array A or word 5 of Array B).	a. Check adjacent words in frame for correct formatting.
	
	b. Check Command link by transmitting following sequence:
	    DP-4 (Slow Data Rate)
	    DP-3 (Normal Data Rate)
	and verifying execution of each Command by change of bit rate.
	
	c. Check power supply voltages, Channels 50, 65, 79 and 80.
	
	d. Check Command Decoder and Data Processor temperatures, Channels 46-49.

44. Loss of one sunshield temperature (STT-1 or STT-2).	a. Check remaining sunshield temperature (Channel 27 or 42) for abnormal temperature indication and possible cable or connector damage. b. Check dust detector temperature and cell outputs (Channels 83, 84, 26, and 41) for possible cable or connector damage. c. Check adjacent analog channels for correct formatting.
45. Loss of one thermal plate temperature (STT-3 through STT-7).	a. Check remaining thermal plate temperatures for abnormal range (Channels 4, 28, 43, 58, 71). b. Check adjacent analog channels for correct formatting.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. NO. ATM 541 REV.NO.

10/17/66   Operational Contingency
           Diagnostic Procedures

PAGE 11 OF 48 PAGES

Contingency	Procedure
46. Loss of one primary structure temperature (STT-8 through STT-11)	a. Check remaining primary structure temperatures for abnormal indication (Channels 59, 87, 15 and 88). b. Check adjacent channels for correct formatting.
47. No telemetry of inner temperature of multi-layer insulation (STT-12) (Channel 60).	a. Check external temperature (Channel 72) for integrity of cable and supply voltage. b. Check Channels 59 and 61 to verify proper functioning of analog multiplexer.
48. No telemetry of outer temperature of multi-layer insulation (STT-13) Channel 72).	a. Check inner temperature (Channel 60) for integrity of cable and power supply. b. Check Channels 71 and 73 for proper functioning of analog multiplexer.
49. Loss of LO crystal temperature (ET-1 or ET-2) (Channel 16 or 17).	a. Check level of LO output (Channel 36) for degradation of performance. b. Check Channels 15 and 18 for proper analog multiplexing.
50. Loss of transmitter crystal temperature (ET-3 or ET-5, Channel 18 or 31).	a. Check adjacent analog channels. b. Check RF levels and heat sink temperature for transmitter in use (Channels 51, 81 and 19 or 66, 22, and 32). c. If necessary to ensure continued operation, switch in back-up transmitter (Command PD-4 or PD-1) and check pertinent telemetry.
51. Loss of transmitter heat sink temperature (ET-4 or ET-61, Channel 19 or 32).	a. Check adjacent channels for proper formatting. b. Check RF levels and crystal temperatures for transmitter in use (Channels 51, 81 and 18 or 66, 22 and 31). c. If necessary, switch in back-up transmitter (Command PD-4 or PD-1) and check pertinent telemetry.

Contingency	Procedure
52. Loss of analog multiplexer base temperature (ET-7, Channel 33).	a. Check multiplexer internal temperature (Channel 34).
53. Loss of analog multiplexer internal temperature (ET-8) (Channel 34)	a. Check multiplexer base temperature (Channel 33).
54. Loss of Data Processor base temperature (ET-9, Channel 46)	a. Check D. P. internal temperature (Channel 47).
55. Loss of Data Processor internal temperature (ET-10, Channel 47).	a. Check D. P. base temperature (Channel 46).
56. Loss of Command Decoder internal temperature (ET-12, Channel 49).	a. Check C. D. internal temperature (Channel 49).
57. Loss of Command Decoder internal temperature (ET-12, Channel 49).	a. Check C. D. base temperature (Channel 48).
58. Loss of Command Demodulator VCO temperature (ET-13, Channel 61).	a. Check CD base and internal temperatures (Channels 48 and 49). b. Check analog Channels 60 and 62 for proper sequencing.
59. Loss of PDU base temperature (ET-14, Channel 62).	a. Check PDU internal temperature (Channel 63).
60. Loss of PDU internal temperature (ET-15, Channel 63).	a. Check PDU base temperature (Channel 62).

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

NO. ATM 541

REV.NO.

10/17/66

Operational Contingency
Diagnostic Procedures

PAGE 13 OF 48 PAGES

Contingency	Procedure
61. Loss of PCU Power Oscillator temperature (ET-16 or ET-17, Channel 64 or 76).	a. Monitor output voltages (Channels 20, 35, 50, 65, 79 and 80). b. If necessary, switch in Back-up PCU (Command PC-1 or PC-2) and recheck voltages and oscillator temperature.
62. Loss of PCU Regulator temperature (ET-18 or ET-19, Channel 77 or 78).	a. Proceed as in 61 above, rechecking regulator temperature if PCU is switched.
63. No telemetry of one analog calibration voltage (CE-1 or CE-2, Channel 2 or 3).	a. Check remaining channel for deviation from normal.
64. No telemetry of converter input voltage (CE-3, Channel 1).	a. Monitor experiment status, output voltages per 61. a. above, input current (Channel 5), RTG temperatures (Channels 6, 37, 52, 7, 67 and 82) and shunt regulator current for PCU in use (Channel 8 or 13). b. Adjust load if necessary for conservative operation.
65. No telemetry of input current (CE-4, Channel 5).	a. Monitor parameters of 64. a. above plus input voltage (Channel 1). b. Adjust load if necessary for conservative operation.
66. No telemetry of shunt regulator current (CE-5 or CE-6, Channel 8 or 13).	a. Check adjacent housekeeping channels for proper multiplexing. b. Check + 12v supply (Channel 50) c. Switch PCU's (Command PC-1 or PC-2) and recheck regulator current.
67. No telemetry of one PCU output voltage (CE-7 through CE-12, Channels 20, 35, 50, 65, 79 or 80).	a. Check remaining channels for abnormal indications. b. Switch PCU's (Command PC-1 or PC-2) and recheck missing voltage.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. NO. ATM 541   REV. NO.

10/17/66   Operational Contingency
Diagnostic Procedures

PAGE ___14___ OF ___48___ PAGES

Contingency	Procedure

	c. Check at least one user function of the missing voltage, to verify that trouble is only in telemetry, per following list:
	   1. 29v - experiments, transmitter
	   2. 15v - A/D Converter
	   3. +12v - receiver, transmitter, Command decoder
	   4. 5v - A/D Converter, Data Processor, Command decoder
	   5. -12v - A/D Converter.

68. No telemetry of prelimiting level of receiver (CE-13, Channel 21).	a. Check adjacent channels for correct multiplexing. b. Check up-link performance by switching data rate (Commands DP-4 and DP-3) noting change in bit rate. c. Determine threshold margin by reducing transmitted power at ground station until up-link performance becomes marginal.
69. No telemetry of Receiver LO level (CE-14, Channel 36).	a. Check adjacent channels for correct multiplexing. b. Check LO crystal temperature (Channel 16 or 17) for indication of abnormality. c. Check up-link performance as in 68.b above.
70. No telemetry of RF Output of one transmitter (CE-15 or CE-16, Channel 51 or 66).	a. Check adjacent telemetry channels for correct multiplexing. b. Check level of RF signal received at MSFN station. c. Switch in Back-up transmitter (PD-4 or PD-1) and check RF output. d. Recheck level at MSFN and compare with b above.

Contingency	Procedure
71. No telemetry of RF level of one transmitter's second PA (CE-17 or CE-18, Channel 81 or 22).	a. Check output level of transmitter (Channel 51 or 66). b. Switch in back-up transmitter (Command PD-4 or PD-1) and check output level. c. Check intermediate RF level (Channel 81 or 22).
72. No telemetry of 1 kHz subcarrier status (CB-1, Channel 9).	a. Check up-link performance as in 68. b. above. b. Check adjacent channels for correct multiplexing.
73. Erroneous telemetry of Experiment OFF status (CB-4 or CB-5, Channel 12 or 14).	a. Check adjacent channels for correct multiplexing. b. Check A/D calibration voltages (Channels 2 and 3). c. Command all experiments off (PD-15, PD-18, PD-21, PD-24 and, for Array B, PD-27). d. Note telemetry indication of Channels 12 and 14. e. Command Exp. 1 Power STANDBY (PD-14) and note responce of Channel 12. f. Command Exp. 2 Power STANDBY (PD-17) and note response of Channel 12. g. Command Exp. 3 Power STANDBY (PD-20) and note response of Channel 14. h. Command Exp. 4 Power STANDBY and note response of Channel 14. i. For Array B, Command Exp. 5 Power STANDBY and note response of Channel 14.
74. No telemetry of one RTG temperature (RT-1 through RT-6) Channel 6, 32, 52, 7, 67 or 82.	a. Check remaining RTG temperatures to verify integrity of cable and power source. b. Check adjacent channels for proper multiplexing. c. Check TRG output voltage and current (Channels 1 and 5).

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

THE Bendix CORPORATION

10/17/66

Operational Contingency
Diagnostic Procedures

NO. ATM 541

REV.NO.

PAGE 16 OF 48 PAGES

Contingency	Procedure
75. No telemetry of Dust Accretion Unit temperature (DA-1, Channel 83).	a. Check adjacent channels for proper multiplexing. b. Check cell voltages to verify cable integrity and attempt temperature synthesis from voltage response (Channels 84, 26, and 41). c. Check sunshield temperatures for gross confirmation (Channels 27 and 42).
76. No telemetry of one Dust Accretion Unit Cell Voltage (DA-2 through DA-4, Channel 84, 26 or 41).	a. Check remaining channels to verify integrity of cable and power source. b. Check adjacent channels for proper multiplexing. c. Check unit temperature (Channel 83) for abnormal indication.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

10/17/66

Passive Seismic
Experiment Contingencies

NO.
ATM 541

REV.NO.

PAGE 17 OF 49 PAGES

B. PASSIVE SEISMIC EXPERIMENT CONTINGENCIES

Contingency	Procedure
1. No response to Change Gain LP Horizontal, Command PS-1.	a. Check command decoding by execution of following sequence: 1. PS-3, Cal. SP ON 2. PS-3, Cal. SP OFF 3. PS-4, Cal. LP ON 4. PS-4, Cal. LP OFF noting mode response in scientific data change for each Command. b. Repeat PS-1 noting telemetry Channel 23 for indication of gain change. c. Execute Command PS-4 twice noting scientific data results and comparing with a. above. d. Check experiment temperature.
2. No response to Change Gain LP Vertical Command PS-2.	a. Check Command (word 37) decoding by execution of Command PS-4, Cal. LP ON/OFF twice noting mode response in LP acientific data. b. Note gain indication in Channel 38. Repeat PS-2 and check Channel 38 for indication of change. c. Execute Command PS-4 twice noting scientific data and comparing with results of a. above.
3. No response to Calibration SP Command (P5-3).	a. Check command decoding by executing following sequence: 1. PS-1 Change Gain LP Horizontal 2. PS-2 Change Gain LP Vertical verifying execution on telemetry Channels 23 and 38, respectively. b. Check Cal. Status (Channel 9) and repeat PS-3. c. Check experiment power load by switching power OFF (PD-15) and noting PCU input voltage and current (Channels 1 and 5), then switching power ON (PD-13) and noting increase of EI product, compare against theoretical. d. Check Exp. temperature (word 37).

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

THE Bendix CORPORATION

10/17/66

Passive Seismic
Experiment Contingencies

NO. ATM 541

REV. NO.

PAGE __18__ OF __48__ PAGES

Contingency	Procedure
4. No response to Calibration LP Command (PS-4).	a. Proceed as in 3 above.
5. No response to Change Gain SP, Command PS-5.	a. Check command decoding as in 3.a. above. b. Note gain indication in Channel 68. Repeat PS-5 and note any change in Channel 68. c. Check Exp. temperature (word 37).

6. No response to X Level Power Command PS-6.	a. Check command decoding by execution of following sequence:
	
	  1. Level Direction (PS-10)
	  2. PCU Set (PC-1)
	
	noting appropriate response.
	
	b. Check experiment power load as in 3.c. above.
	
	c. Check Exp. temperature (word 37).

7. No response to Y Level Power Command, PS-7.	a. Check command decoding by execution of following sequence:
	
	  1. Level Direction (PS-10)
	  2. Filter IN/OUT (PS-13)
	
	noting appropriate response.
	
	b. Check experiment power load as in 3.c. above.
	
	c. Check Exp. temperature (word 37).

8. No response to Z Level Power Command, PS-8+	a. Check command decoding by execution of following sequence:
	
	  1. Level Direction (PS-10)
	  2. Coarse Level IN/OUT (PS-14)
	
	noting appropriate response.
	
	b. Check experiment power load as in 3.c. above.
	
	c. Check Exp. temperature (word 37).

Contingency	Procedure
9. No response to Uncage, Command PS-9.	a. Check command decoding by execution of following sequence: 1. Level Direction (PS-10) 2. Change Gain LP Horizontal (PS-1) noting appropriate response. b. Check experiment power load as in 3. c. above. c. Check exp. temp. (word 37)
10. No response to Level Direction, Command PS-10	a. Check command decoding by execution of following sequence: 1. Level Speed (PS-11) 2. Change Gain LP Vertical (PS-2) noting appropriate response. b. Check experiment power load as in 3. c. above. c. Check exp. temp. (word 37).
11. No response to Level Speed, Command PS-11.	a. Check command decoding by execution of following sequence: 1. Level Direction (PS-10) 2. Calibration SP ON/OFF (PS-3). noting appropriate response. b. Check experiment power load as in 3. c. above. c. Check exp. temp. (word 37).
12. No response to Heater Control Command PS-12.	a. Check command decoding by execution of following sequence: 1. Level Direction (PS-10) 2. Calibration LP ON/OFF (PS-4) noting appropriate response. b. Monitor experiment temperature (ALSEP word 37) and note whether temperature is being controlled.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

10/17/66

Passive Seismic
Experiment Contingencies

NO.
ATM 541

REV.NO.

PAGE 20 OF 48 PAGES

Contingency	Procedure
13. No response to Filter IN/OUT Command (PS-13)	a. Check command decoding by executing following sequence: 1. Coarse Level IN/OUT (PS-14) 2. Exp. 1 Power OFF (PD-15) 3. Exp. 1 Power ON (PD-13) noting appropriate responses. b. Check experiment power load as in 3. c. above. c. Check exp. temp. (word 37).
14. No response to Coarse Level, Command PS-14.	a. Check command decoding by execution of following sequence: 1. Filter IN/OUT (PS-13) 2. PCU Reset (PC-2) 3. PCU Set (PC-1) and observe appropriate response. NOTE: order of 2 and 3 above may be interchanged to comply with initial conditions. b. Check experiment power load as in 3. c. above. c. Check exp. temp (word 37).
15. No response to Level Mode, Command PS-15	a. Check command decoding by eexecution of following sequence: 1. Filter IN/OUT (PS-13) 2. Change Gain LP Horizontal (PS-1) noting appropriate response. b. Check experiment power laod as in 3. c. above. c. Check exp. temp. (word 37).
16. No telemetry of LP Gain Status X & Y, PS-1 (Channel 23).	a. Check adjacent channels for proper multiplexing. b. Command Gain Change (PS-1) and recheck Channel 23.

Contingency	Procedure
17. No telemetry of LP Gain Z axis (PS-2 Channel 38).	a. Proceed as in 16 a. above. b. Using Command PS-2 change gain and recheck Channel 38.
18. No telemetry of SP Gain (PS-B Channel 68)	a. Proceed as in 16. a above. b. Using Command PS-5 change gain and recheck Channel 68.
19. No telemetry of Level Mode and Coarse Level Status (PS-4 Channel 24)	a. Proceed as in 16. a. above. b. Change Level Mode, using Command PS-15, and Coarse Level Status (PS-14) and recheck Channel 24.
20. No telemetry of Level Speed and Direction (PS-5 Channel 53).	a. Proceed as in 16. a. above. b. Change Level Speed, using Command PS-11, and Level Direction (PS-10) and recheck Channel 53.
21. No telemetry of Thermal Control Mode and Heater Status (PS-6 Channel 39).	a. Proceed as in 16. a. above. b. Change Thermal Control Mode (PS-12) and recheck Channel 39). c. Check exp. temp. (word 37).
22. No telemetry of LP and SP Calibrate Mode Status (PS-7, Channel 54).	a. Proceed as in 16. a. above. b. Change calibration status of both LP and SP (PS-4 and PS-3, respectively and recheck Channel 54.
23. No telemetry of Uncage Status (PS-8, Channel 69).	a. Check scientific data to determine whether instruments are uncaged.
24. Loss of scientific data from one LP axis.	a. Check other axes for abnormal indication. b. Check experiment temperature (word 37). c. Check experiment power load per 3. c. above.

Contingency	Procedure
25. Loss of LP Tidal data from one axis.	a. Proceed as in 24 above.
26. No telemetry of temperature data.	a. Check scientific data, using calibration modes (PS-3 and PS-4) for abnormal indications. b. Ensure that system is in automatic Thermal Control Mode (Channel 39).
27. Loss of SP scientific data.	a. Proceed as in 24 above.

C. LUNAR SURFACE MAGNETOMETER CONTINGENCIES

Contingency	Procedure
1. No response to Range Selection Command (MG-1)	a. Check command decoding by twice executing the following command. Flip/cal. Inhibit (MG-4) noting telemetry indication of inhibit status after each execution (Bit 10 of 15th commutation of engineering data word (ALSEP word 5)
	b. Note telemetry indication of measurement range status (Bits 9 and 10 of 7th commutation of word 5) and repeat command MG-1.
	c. Check internal electronics temperature (5th commutation of word 5).
2. No response to Steady Field Offset Command (MG-2)	a. Proceed as in 1.a above.
	b. Note telemetry indication of offsets (Bits 9 and 10 of commutations 9-13 of word 5) for all 3 axes.
	c. Execute alternately commands MG-3 (Steady-Field Hold) and MG-2 while noting telemetered offset status.
	d. Check temperature as in 1.c.
3. No response to Steady Field Hold Command (MG-3)	a. Proceed as in 1.a above.
	b. Observe telemetry indication of offset address (Bits 9 and 10 of 14th commutation of word 5) and repeat command.
	c. Check temperature as in 1.c above.
4. No response to Flip/cal Inhibit Command (MG-4)	a. Determine initial status as in 1.a above and repeat command.
	b. Check command decoding by executing commands MG-1 and MG-2 and noting telemetry confirmation of execution.
	c. Check temperature as in 1.c above.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. | NO. ATM 541 | REV. NO.

10/17/66 | Operational Contingency Diagnostic Procedures | PAGE 24 OF 48 PAGES

Contingency	Procedure
5. No response to Flip/cal Initiate Command (MG-5)	a. Check inhibit status as in 1.a above, execute command MG-4 and then repeat MG-5. b. Check command decoding by executing command MG-6 (Filter Failure Bypass) noting change of status by telemetry (Bit 9 of 15th commutation of word 5). c. Check temperature as in 1.c above.
6. No response to Filter Failure Bypass Command (MG-6)	a. Check command decoding by executing the following sequence: 1. Flip/cal Inhibit (MG-4) 2. Thermal Control Select (MG-8) noting response in telemetry (Bit 10 of 15th and 5th commutation of word 5, respectively). b. Check temperature as in 1.c above.
7. No response to Site Survey Command (MG-7)	a. Check command decoding by executing the following sequence: 1. Filter Failure Bypass (MG-6) 2. Range Selection (MG-1) noting response in telemetry (Bit 9 of 15th and Bits 9 and 10 of 7th commutation of word 5, respectively). b. Check status of calibration inhibit as in 1.a; execute command MG-4, (once or twice) leaving subsystem in "not inhibited state". Execute Flip/cal Initiate (MG-5): After Flip/cal sequence, repeat MG-7. c. Check temperature of lease and internal electronics (4th and 5th commutation of word 5).

Contingency	Procedure
8. No response to Thermal Control Select Command (MG-8)	a. Check command decoding by executing the following sequence: 1. Filter Failure Bypass (MG-6) 2. Flip/cal Inhibit (MG-4) confirming execution by telemetry (Bit 9 and Bit 10 of 15th commutation of word 5, respectively. b. Check temperatures as in 7. c above. c. Check temperatures of X-axis and Y-axis sensors (first and second commutation of word 5, respectively).
9. No telemetry of sub-frame marker bit (Bit 1 of first commutation of word 5)	a. Check balance of first commutation of word 5 for correct format and reasonable data. b. Check sequencing of scientific data (words 17, 19, 21, 49, 51, 53) c. Check sequencing of engineering data (word 5) d. Check temperature as in 1. c above.
10. No telemetry of temperature data from any one magnetic field sensor (first, second or third commutation of word 5)	a. Check the status Bits 9 and 10 in the deficient telemetry word for correct representation of the flip position. b. Check scientific data from the applicable sensor to confirm integrity of wiring harness. c. Examine other temperature words to confirm status of power supply.
11. No telemetry of base temperature data (4th commutation of word 5)	a. Check status Bits 9 and 10 for correct representation of gimbal position. b. Check temperature as in 1. c above.

Contingency	Procedure
12. No telemetry of Internal Electronics Temperature (5th commutation of word 5)	a. Proceed as in 11.a above. b. Check base temperature (4th commutation of word 5) to confirm status of power supply.
13. No telemetry of supply voltage (8th commutation of word 5)	a. Check 29 volt output of PCU (Channel 20). b. Check other engineering data (word 5) for correct format and reasonable level.
14. No telemetry of flip position of any one sensor (Status bits both zero, commutation 1, 2 or 3 of word 5)	a. Check scientific data for applicable axis to confirm integrity of wiring: compare against history, if available, to deduce present position. b. Check flip position of other axes. c. Check temperature data of applicable sensor for correct format and reasonable level.
15. No telemetry of gimbal position of one sensor. (Status bit remains zero)	a. Check gimbal position of other sensors. b. Check temperature data in same word for correct format and reasonable level. c. Check scientific data for applicable axis and compare with other axes and with its own history, if available.
16. No telemetry of Thermal Control Address (Status bit remains zero)	a. Check temperature as in 1.c for correct formatting and reasonable level. b. Execute Thermal Control Select Command (MG-8) at appropriate time intervals, observe sensor temperature telemetry and verify switching of control. Identify axis of control element at each switching. c. Check other status bits for correct indication.

Contingency	Procedure
17. No telemetry of measurement range data (Bits 9 and 10 of 7th commutation of word 5)	a. Check level data in same word for correct format and reasonable value. b. Cycle through selectable ranges, by execution of command MG-1 three times, while observing level of scientific data, to establish that switching does occur and to identify current state.
18. No telemetry of offset field status of any one sensor.	a. Check temperature data in same words for correct format and reasonable level. b. Step through selectable offsets, by execution of command MG-2 (after selection of correct axis by command MG-3, if necessary) to verify that offset action does occur and to identify current position.
19. No telemetry of mode status (Bit 10 of 13th commutation of word 5)	a. Check base temperature data in same word for correct format and reasonable level. b. Check Z-axis offset data bit in same word, offsetting as in 18 b above. c. Execute Flip/cal Initiate Command (MG-5) noting status of mode bit and flip position bits before and after sequence.
20. No telemetry of offset ratachet, address data (Bits 9 and 10 of 14th commutation of word 5)	a. Check level data in same word for correct format and reasonable value. b. Observe offset position telemetry and execute Steady Field Offset Command (MG-2) to identify current address. Return sensor to original position by repeating command, as required. c. Verify switching of address by executing Steady Field Hold Command (MG-3) and repeating step b above.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

10/17/66

Operational Contingency
Diagnostic Procedures

NO. ATM 541

REV.NO.

PAGE 28 OF 48 PAGES

Contingency	Procedure
21. No telemetry of filter status data (Bit 9 of 15th commutation of word 5)	a. Proceed as in 20. a above. b. Observe scientific data and verify switching of filter by execution of command MG-6 (Filter Failure Bypass) noting change in data. c. Check temperature as in 1. c.
22. No telemetry of calibrate Inhibit Status (Bit 10 of 15th commutation of word 5)	a. Proceed as in 20 above. b. Verify that calibration is not inhibited by execution of command MG-5 (Flip/cal Initiate) noting changes in flip position telemetry during cycle. c. Check temperature as in 1. c.
23. No scientific data from one sensor.	a. Check data from other sensors. b. Check temperature data from applicable sensor. c. Check all engineering data for format and level.

D. SOLAR WIND EXPERIMENT CONTINGENCIES

Contingency	Procedure
1. No response to Dust Cover Removal Command (SW-1).	a. Check experiment power load by executing following sequence: 1. Command PD-21 (Exp. 3 Power OFF). 2. Record PCU input voltage and current (Channels 1 and 5). 3. Command PD-19 (Exp. 3 Power ON). 4. Repeat Step 2 and compute power load, comparing to nominal . b. Check command decoding by execution of command MG-1 (magnetometer range selection) noting appropriate response.
2. No telemetry of A/D converter calibration (SWE words 112-119, odd sequences).	a. Check data on both sides of A/D converter calibration data in format (plasma magnitude, protons and electrometer calibration, words 0. 111 and 120-127, respectively). b. Check temperature data in even sequences.
3. No telemetry of electrometer calibration (SWE words 120-127).	a. Check data in odd and even sequences. b. Check data on both sides of electrometer calibration in format (A/D converter cal or temperatures and plasma magnitude, electrons, words 112-119 and 128-1832.
4. No telemetry of instrument temperatures (SWE words 112-119, even sequences.	a. Proceed as in 2 above. b. Check Central Station telemetry for determination of surface temperature. c. Check same words in odd sequences.
5. No telemetry of DC component of High Voltage (SWE words 0, 8, 16---104 and 128, 136, 144---176 of 15th sequence).	a. Check same words in 14th and 16th sequences for appropriate data (plasma count and AC component, respectively).

Contingency	Procedure
6. No telemetry of AC component of High Voltage (SWE words 0, 8, 16 --- 104 and 128, 136, 144---176 of 16th sequence).	a. Check same words in 15th and 1st sequences for approximate data (DC component and plasma count respectively)
7. No telemetry of cycle count (SWE words 184 and 185).	a. Try to identify sequence 15 and 16 from voltage data interleaved with plasma count.
	b. Determine whether any data are being correctly sequenced and identify missing data.
8. No telemetry of plasma magnitude electrons, (SWE words 128-183)	a. Check formatting of other data.
	b. Check DC component of high voltage as in 5 above.
	c. Check instrument temperatures as in 4 above.
	d. Check A/D converter calibration as in 2 above.
9. No telemetry of plasma magnitude, protons (SWE words 10-111)	a. Proceed as in 8 above.
10. No telemetry of output of one (or more) sensor.	a. Examine telemetry of outputs of remaining sensors for consistent response.
	b. Check instrument temperatures as in 4 above.
11. No telemetry of output of sensors at one (or more) energy level.	a. Check DC component of High Voltage for applicable level(s) per 5 above.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

10/17/66

Operational Contingency
Diagnostic Procedures

NO.
ATM 541

REV.NO.

PAGE ___31___ OF ___48___ PAGES

E.   SIDE CONTINGENCIES

Contingencies		Procedure
1.	No response to Ground Plane Step Programmer ON/OFF Command (ST-1).	a. Check command decoding by executing command ST-3 (reset frame counter at 39) noting appropriate response in SIDE word 1.
		b. Check instrument temperatures and supply voltages (SIDE word 2).
		c. Execute Master Reset command ST-8 and then repeat non-responsive command.
2.	No response to Reset Frame Counter at 10 command (ST-2).	a. Proceed as in 1 above.
3.	No response to Reset Frame Counter at 39 command (ST-3).	a. Check command decoding by executing command ST-7 (X10 accumulation Interval ON/OFF) noting change of reading in SIDE words 4 and 5 (HE) and 9 and 10 (LE).
		b. Check temperatures and voltages then execute master reset as in 1 b and c above.
4.	No response to Reset Velocity Filter Counter at command (ST-4).	a. Check command decoding by executing command ST-5 (Reset SIDE frame counter at 79) noting appropriate response in SIDE word 1.
		b. Check temperatures, voltages and master reset as in 1. b and c above.
5.	No response to Reset SIDE Frame Counter at 79 Command (ST-5).	a. Proceed as in 3 above.
6.	No response to Reset SIDE Frame Counter at 79 and Velocity Filter Counter at 9 command (ST-6).	a. Proceed as in 3 above.

Contingencies	Procedure
7. No response to X10 Accumulation Interval ON/OFF command (ST-6).	a. Check command decoding by executing ST-15 (Reset Command Register) noting appropriate response in SIDE word 6, SIDE frames 1, 5, 13, 17 ---. b. Check temperatures, voltages and master reset as in 1. b and c above.
8. No response to Master Reset Command (ST-8).	a. Proceed as in 7. a above. b. Check temperatures and voltages as in 1. b above if format permits.
9. No response to Velocity Filter Voltage ON/OFF Command (ST-9).	a. Proceed as in 8 above.
10. No response to LE CPA High Voltage ON/OFF Command (ST-10).	a. Proceed as in 8 above.
11. No response to HE CPA High Voltage ON/OFF Command (ST-11).	a. Proceed as in 8 above.
12. No response to Force Continuous Calibration Command (ST-12).	a. Proceed as in 7 above.
13. No response to CCIG ON/OFF ON/OFF (ST-13).	a. Proceed as in 8 above.
14. No response to Channeltron High Voltage ON/OFF Command (ST-14).	a. Proceed as in 8 above.

Contingency	Procedure
15. No response to Reset Command Register Command (ST-15)	a. Check command decoding by executing following sequence: 1. ST-12 (x 10 accumulation interval ON/OFF). 2. ST-13 (master reset) noting appropriate response. b. Proceed as in 1.b and 1.c above.
15.a No response to Dust Cover Removal Command	
15.b No response to CCIG Seal Break	
16. No telemetry of LE Detector Count Rate (Channel 70 ALSEP word 33)	a. Check redundant data (SIDE words 9 and 10). b. Check telemetry channel 71 for presence of data and correct formatting. c. Proceed as in 1.b above.
17. No telemetry of HE Detector Count Rate (Channel 85)	a. Check redundant data (SIDE words 4 and 5). b. Check telemetry channel 84 for presence of data and correct formatting (NOTE: Dust detector power must be ON). c. Proceed as in 1.b above.
18. No telemetry of Dust Cover Status (WIDE word 6, SIDE frames 7.39---)	a. Check redundant data (word 2, frames 27, 59..) b. Verify removal of dust cover by presence of of data in HE and LE channels as in 16 and 17 above. c. Check telemetry of Ground Plane Step (SIDE word 6, frames 6 and 8) for correct format and reasonable data. d. Proceed as in 1.b above.

Contingency	Procedure
19. No telemetry of CCIG Seal Status (SIDE word 6, SIDE frames 7, 39 - - -)	a. Check redundant data is in 18. a above. b. Verify breaking of seal by presence of CCIG data in SIDE word 2, SIDE frames 1, 3, 5, 7 and 9. c. Proceed as in 18. c and d above.
20. No telemetry of Ground Plane Voltage (SIDE word 2, frames 13, 15, 29, 31 - - -)	a. Check telemetry of Step count (SIDE word 6, frames 0, 2, 4 - - -). b. Check other data of word 2 for format and level.
21. No telemetry of Ground Plane Step count (SIDE word 6, SIDE frames 0, 2, 4 - - -)	a. Check ground plane voltage as in 20 above. b. Check other data of word 6 for format and level. c. Check temperatures and supply voltages (SIDE word 2).
22. No telemetry of one (or more) experiment temperature (SIDE word 2, SIDE frames 2, 34 - - -, 4, 36 - - -, 6, 38 - - -, 11, 43 - - -, or 12, 44 - - -)	a. Check remaining temperatures for marginal level. b. Check other data in word 2 for format and level. c. Check functional data associated with site of applicable temperature.
23. No telemetry of one (or more) supply voltage (SIDE word 2, SIDE frames 0, 32 - - -, 8, 40 - - -, 16, 48 - - -, 17, 49 - - -, 18, 50 - - -, 20, 52 - - -, 21, 53 - - - or 23, 55 - - -).	a. Check remaining voltages for correct level. b. Check other data in word 2 for format and level. c. Check functional data associated with missing voltage.
24. No telemetry of one (or more) calibration voltage (SIDE word 2, frames 24, 56 - - -, 25, 57 - - -, 26, 58 - - -, 28, 60 - - -, 30, 62 - - -,	a. Proceed as in 23 above.

Contingency	Procedure
25. No telemetry of Command Input Register contents (SIDE word 6, SIDE frames 1, 5, 13, 17, ---)	a. Check proper functioning of Command Input Register by Executing Master Reset (ST-8). b. Check remaining data in word 6 for format and level. c. Proceed as in 1. b above.
26. No telemetry of Mode Register contents (SIDE word 6, SIDE frames 3, 11, 19, 27---)	a. Confirm the instrument mode changes by executing several of the optional commands and noting appropriate response. b. Check remaining data in word 6 for format and level. c. Proceed as in 1. b above.
27. No telemetry of Velocity Filter Voltage step (SIDE word 7)	a. Execute command ST-9 (Velocity Filter Voltage ON/OFF), noting any response. b. Proceed as in 1. b above. c. Check SIDE word 8 for format and level.
28. No telemetry of SIDE frame count (SIDE word 1)	a. Execute Master Reset (ST-8) noting response. b. Check formatting of SIDE data. c. If possible proceed as in 1. b above.
29. No telemetry of Calibration Rates (SIDE word 6, SIDE frames 120-124, 126, 127).	a. Check other data in word 6 for format and level. b. Execute command ST-12 (Force continuous calibration) noting effect on word 6 and scientific data in words 4 and 5 and 9 and 10. c. Execute Master Reset (ST-8). d. Proceed as in 1. b above.
30. No telemetry of CCIG data (SIDE word 2)	a. Check other data in word 2 for level and format. b. Execute command ST-13 (CCIG ON/OFF) noting response.

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH. | NO. ATM 541 | REV.NO.

10/17/66 | Operational Contingency Diagnostic Procedures

PAGE 36 OF 48 PAGES

Contingency	Procedure
31. No telemetry of LE CPA Voltage (SIDE word 8)	a. Check SIDE word 7 for format and level. b. Check LE count (SIDE words 9 and 10) for change as voltage is programmed. c. Proceed as in 1. b above.
32. No telemetry of HE CPA Voltage (SIDE word 3)	a. Check HE count (SIDE words 4 and 5) for change as voltage is programmed. b. Proceed as in 1. b above.
33. No telemetry of LE count (SIDE words 9 and 10)	a. Check analog channel for redundant data (70). b. Check LE CPA voltage, per 31 above, for level. c. Execute command ST-7 (x 10 accumulation Interval ON/OFF) noting response. d. Check velocity filter voltage per 27 above, for level. e. Execute command ST-9 (Velocity Filter Voltage ON/OFF) noting response. f. Proceed as in 1. b above.
34. No telemetry of HE count (SIDE words 4 and 5)	a. Check analog channel for redundant data (85). b. Check HE CPA voltage per 32 above for level. c. Proceed as in 33. c above. d. Proceed as in 1. b above.

F. ACTIVE SEISMIC EXPERIMENT CONTINGENCIES

Contingency	Procedure
1. No response to Active Seismic ON Command (DR-1)	a. Verify command reception (word 5) b. Switch in Back-up Data Processor (Command PD-11 or PD-12) and repeat DP-1
2. No response to Active Seismic OFF Command (DP-2)	a. Proceed as in 1 above
3. No response to Geophone Calibrate Command (AS-1)	a. Verify command reception (word 5) b. Check mode indication in telemetry control word, and if necessary execute command AS-9 (Set Engineering Data Mode); repeat AS-1. c. Check all engineering data for abnormal indication.
4. No response to Set Seismic Data Mode Command (AS-2)	a. Verify command reception (word 5) b. Execute Command AS-9 (Set Engineering Data Mode) and repeat AS-2 while monitoring control word for mode indication. c. Check all engineering data for abnormal indications.
5. No response to Sequential Fire Command (AS-3)	a. Verify command reception (word 5) b. Check control word for Seismic mode indication. c. Execute Command AS-8 (Arm Grenades) and repeat AS-3. d. Execute AS-4 (Fire Grenade 1) and observe results e. Execute Command AS-9 (Set Engineering Data Mode) and observe all engineering data for abnormal indication.

Contingency	Procedure
6. No response to Fire Grenade Command (AS-4 through AS-7)	a. Proceed as in 5.a and b above. b. Execute Command AS-8 (Arm Grenades) and repeat AS-4, 5, 6, or 7. c. If no response, execute AS-3 (Sequential Fire). d. Proceed as in 5.e above.
7. No response to Arm Grenades Command (AS-8)	a. Proceed as in 5.a. and b. above. b. Proceed as in 5.e. above.

8. No response to Set Engineering Data Mode Command (AS-9)	a. Proceed as in 5.a. and b. above
	
	b. Execute Command AS-1 (Geophone Calibrate) and observe response.
	
	c. Execute sequence
	
	  1. AS-8
	  2. AS-4 (or AS-3)
	
	noting response.

9. No response to Geophone Sequence Command (AS-10).	a. Proceed as in 3 above.
10. Failure of Thumper Arm Switch (or Arm Grenades Command) to Set Seismic Data Mode	a. Execute Command AS-2 (Set Seismic b. If no response, proceed as in 4 above.
11. Failure of one thumper squib to fire	a. Proceed as in 5.e. above. b. Have astronaut repeat thumper arm and fire sequence, noting switchover to Seismic Mode when armed.
12. Failure of all squibs to fire	a. Proceed as in 11 above.
13. Failure of system to return to Engineering Data Mode after firing of squib or grenade.	a. Proceed as in 5.e. above.

Contingency	Procedure
14. Failure of any one grenade to fire	a. Proceed as in 5. e. above. b. Proceed as in 6. b. and c. above.
15. Failure of all grenades to fire	a. Proceed as in 14 above.
16. No telemetry of Mortar Box or Geophone temperature. (Channel 44 or 73)	a. Check other A. S. E. temperatures (Channels 29 and 55). b. Check analog Channels 43 and 45 for (or 72 and 74) for format and level
17. No telemetry of Central Station Package or Grenade Launcher Assembly Temperature (Channel 29 or 55)	a. Check other A. S. E. temperatures (Channels 44 or 73) b. Execute Command DP-1 (Active Seismic ON). c. Examine control word for Engineering Data Mode indication. d. Check Channel 1 (CS Package Temperature) or Channel 3 (GLA Temperature)
18. No telemetry of Calibration Pulse Voltage.	a. Check all ASE engineering data for abnormal indication.
19. No telemetry of 5-volt reference	a. Proceed as in 18 above.
20. No telemetry of A/D calibration voltage	a. Proceed as in 18 above.
21. No telemetry of either angle voltage	a. Proceed as in 18 above.
22. No telemetry of any one geophone output	a. Check both Seismic and Engineering Data Modes for missing geophone data. b. Identify geophone whose output is missing c. Execute Command AS-10 (Geophone Sequence) and recheck. d. Check all engineering data

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

THE Bendix CORPORATION

10/17/66

Operational Contingency
Diagnostic Procedures

NO. ATM 541

REV.NO.

PAGE 40 OF 48 PAGES

Contingency	Procedure
23. No telemetry of any geophone output	a. Proceed as in 22 above.
24. No telemetry of Central Station measurements in ASE format.	a. Check all other engineering data. b. Execute Command DP-2 (Active Seismic OFF) and check data in housekeeping Channels 1, 5, 6, 7 and 8.
25. No telemetry of thumper real time event	a. Observe control word for switchover to Seismic mode. b. Check all engineering data.
26. No telemetry of Grenade Launch or 20-foot Range real time event.	a. Proceed as in 25 above. b. Repeat Grenade Launch Sequence and recheck for real time events.
27. No telemetry of Grenade Explosion Real Time Event	a. Proceed as in 26 above.

G. HEAT FLOW EXPERIMENT CONTINGENCIES

Contingency	Procedure

1. No response to Gradient Mode Select Command (HF-1)	a. Verify Command reception (word 5)
	
	b. Check experiment mode telemetry (Bits 3 and 4 of HFE word 3)
	
	c. Execute following sequence.
	   1. HF-3 (Heat Pulse Conductivity Mode Select)
	   2. HF-2 (Ring Source Conductivity Mode Select)
	   3. HF-1
	
	noting any change in mode telemetry
	
	d. Check supply voltages (Channels 30, 45, 56, 74, 86, 57 and 75).

2. No response to Ring Source Conductivity Mode Select Command (HF-2)	a. Proceed as in 1.a. and b. above.
	
	b. Execute following sequence:
	   1. HF-3
	   2. HF-1
	   3. HF-2
	
	noting any change in mode telemetry.
	
	c. Check supply voltages as in 1.d. above.

3. No response to Heat Pulse Conductivity Mode Select Command	a. Proceed as in 1.a. and b. above.
	
	b. Execute following sequence
	   1. HF-2
	   2. HF-1
	   3. HF-3
	
	noting any change in mode telemetry.
	
	c. Check voltages as in 1.d. above.

4. No response to Probe Select Command (HF-5 or HF-6)	a. Check both commands for non-responsiveness, verifying, command reception. b. Check voltages as in 1.d. above. c. Check reference temperature (HFE word 49)

Contingency	Procedure
5. No response to one of Measurement Select Commands (HF-7 through HF-10)	a. Check all Measurement Select Commands, verifying reception and noting response. b. Check voltages as in 1. d. above. c. Check temperature as in 4. c. above.
6. No response to full Sequence Command (HF-4)	a. Proceed as in 5 above. b. Repeat HF-4
7. No response to Heater Advance Command (HF-11)	a. Proceed as in 5 above. b. Repeat HF-11
8. No telemetry of +5 volt supply (Channel 30)	a. Check other voltages as in 1. d. above. b. Check Channels 29 and 31 for format and level. c. Check temperature as in 4. c. above.
9. No telemetry of -5 volt supply (Channel 45)	a. Proceed as in 8. a. above. b. Check Channels 44 and 46 for format and level. c. Check temperature as in 4. c. above.
10. No telemetry of +15 volt supply (Channel 56)	a. Proceed as in 8. a. above. b. Check Channel 55 for format and level. c. Check temperature as in 4. c. above.
11. No telemetry of -15 volt supply (Channel 74)	a. Proceed as in 8. a. above. b. Check Channel 73 for format and level. c. Check temperature as in 4. c. above.
12. No telemetry of 29 volt input (Channel 86)	a. Proceed as in 8. a. above. b. Check Channels 85 and 87 for format and level. c. Check temperature as in 4. c. above. d. Check PCU output (Channel 20).

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

NO. ATM 541

REV.NO.

10/17/66

Operational Contingency
Diagnostic Procedures

PAGE 43 OF 48 PAGES

Contingency	Procedure
13. No telemetry of High Conductivity Heater Voltage (Channel 57)	a. Proceed as in 8.a. above b. Check Channel 58 for format and level. c. Check selected heater function to verify that voltage is applied.
14. No telemetry of Low Conductivity Heater Voltage (Channel 75)	a. Proceed as in 8.a. above. b. Check Channel 76 for format and level. c. Proceed as in 13.c. above
15. No telemetry of one probe bridge output.	a. Check other bridge outputs of some probe.
16. No telemetry of one bridge excitation.	a. Check bridge excitation of other blocks.
17. No telemetry of one probe thermocouple output.	a. Check other thermocouples associated with same probe. b. Identify the location of thermocouple with deficiency
18. No telemetry of reference bridge output.	a. Proceed as in 1.d. above. b. Check reference bridge excitation
19. No telemetry of reference bridge excitation	a. Proceed as in 1.d. above. b. Check reference bridge output. c. Check excitation of other bridges.
20. No telemetry of amplifier offset (or amplifier gain)	a. Check both offset and gain. b. Proceed as in 1.d. agove. c. Check temperature as in 4.c. above. d. Check other HF data near calibration block for format and level.

Contingency	Procedure
21. No telemetry of subsequence register 1D bits	a. Check HFE data for correct formatting. b. Proceed as in 1.d. above. c. Check temperature as in 4.c. above.
22. No telemetry of Program Sequence Register 1D bits.	a. Proceed as in 21 above.
23. No telemetry of mode identification	a. Switch modes as in 1.c. above and recheck. b. Proceed as in 1.d. above c. Proceed as in 4.c. above.
24. No telemetry of heater identification	a. Execute command HF-11 (Heater Advance) a total of eight times checking heater 1D bits after each. b. Proceed as in 23 above.
25. Loss of one to four heaters	a. Identify defective heater circuits by proceeding as in 24.a. above while operating in Ring Source Conductivity Mode (Command HF-2), checking heater voltage on Channel 57 for each heater.
26. Loss of five or more heaters	a. Identify remaining heaters as in 25 above. b. Proceed to complete HF experiments as permitted by equipment.
27. Loss of automatic sequence	a. Proceed as in 1.d. above.
28. Loss of amplifier or A/D converter.	a. Proceed as in 1.d. above.

H. CPLEE CONTINGENCIES

Contingency	Procedure

1. No response to Thermal Control Bypass ON Command (CP-1)	a. Verify command reception (word 5)
	
	b. Verify command execution by exercising following sequence:
	
	  1. Auto. Voltage Sequencer ON (CP-4)
	  2. Auto. Voltage Sequencer OFF (CP-6)
	
	noting appropriate response.
	
	c. Monitor instrument temperatures (Channels 69 and 90) for marginal condition.

2. No response to Thermal Control Bypass OFF Command (CP-2)	a. Proceed as in 1 above.
3. No response to Dust Cover Removal Command (CP-3).	a. Proceed as in 1 above. b. Check supply voltage (Channel 54)
4. No response to Automatic Voltage Sequencer ON Command (CP-4).	a. Verify command reception. b. Verify command execution by exercising: CP-5 (Step Voltage Level) c. Check Supply Voltage (Channel 54) d. Check temperature (Channel 69 and 90).
5. No response to Step Voltage Level Command (CP-5)	a. Proceed as in 1 above. b. Exercise Command CP-4 (automatic Voltage Sequencer ON) and note response.
6. No response to Automatic Voltage Sequencer OFF Command (CP-6)	a. Verify command reception (word 5) b. Check voltages (Channels 25 and 54) c. Execute Command CP-4. (Automatic Voltage Sequencer ON) and then repeate CP-6 and note response.

Contingency	Procedure
7. No response to Channeltron Voltage Increase ON Command (CP-7)	a. Verify command reception b. Check converter voltage (Channel 54) c. Check temperatures (Channels 69 and 90). d. Monitor Channeltron power supply voltages (Channels 40 and 89) while executing CP-8 (Channeltron Voltage Increase OFF); then repeat CP-7 and note results.
8. No response to Channeltron Voltage Increase OFF Command (CP-8)	a. Proceed as in 7.a. - 7.c. above. b. Execute CP-7 while monitoring Channeltron voltage as in 7.d. above; then repeat CP-8.
9. No telemetry of Switchable Power Supply Voltage (Channel 25)	a. Check Deflection Plate Voltage Step 1D bits (3 and 4) b. Proceed as in 7.a. - 7.c. above. c. Execute: CP-4 (Auto. Volt. Seq. ON) CP-6 (Auto. Volt. Seq. OFF) CP-5 Step Voltage Level noting response after each command
10. No telemetry of Analyzer A Channeltron Power Supply Voltage (Channel 89)	a. Check Analyzer B Voltage (Channel 40). b. Note any difference between scientific data output of the two analyzers. c. Check supply voltage (Channel 54) d. Execute: CP-7 (Channeltron Voltage Increase ON) CP-8 (Channeltron Voltage Increase OFF) noting response after each command. e. Check temperatures (Channels 69 and 90)
11. No telemetry of Analyzer B Channeltron Power Supply Voltage (Channel 40)	a. Check analyzer A Voltage (Channel 89) b. Proceed as in 10.b. through 10.e. above.

Contingency	Procedure
12. No telemetry of DC-DC Converter Voltage (Channel 54)	a. Check switchable Power Supply Voltage (Channel 25) and compare against nominal b. Check Channeltron Voltages (Channels 40 and 89) and compare against nominal. c. Check temperatures (Channels 69 and 90).
13. No telemetry of one instrument temperature (Channel 69 or 90)	a. Check other temperature channel. b. Check supply voltage (Channel 54)
14. No telemetry of Analyzer Identification (10 Bits No. 1)	a. Check Channeltron Voltages (Channels 40 and 89); examine data and note any possible correlation between voltage differences and scientific data differences of the two analyzers. b. Check supply voltage (Channel 54) c. Check temperatures (Channels 69 and 90)
15. No telemetry of Voltage Polarity (1D Bit No. 2)	a. Check scientific data at both levels of Channeltron High Voltage and note trend of results. b. Check voltage and temp per 14. b. and c. above.
16. No telemetry of Deflection Plate Voltage Step (1D Bits 3 and 4)	a. Check Switchable Power Supply Voltage (Channel 25) and correlate with scientific data b. Check voltage and temperatures per 14. b. and c. above.
17. No telemetry of one channel count	a. Note whether missing count is associated with both or only one analyzer.
18. No telemetry of one analyzer output	a. Check Channeltron Power Supply Voltages (Channels 40 and 89) noting any difference b. Check remaining scientific data for abnormality. c. Check Analyzer 1D bit for proper switching d. Check instrument temperatures (Channels 69 and 90).

BENDIX SYSTEMS DIVISION ANN ARBOR, MICH.

10/17/66

Operational Contingency
Diagnostic Procedures

NO. ATM 541

REV.NO.

PAGE 48 OF 48 PAGES

Contingency	Procedure

19. Loss of program sequencer	a. Check all housekeeping Channels (25, 40, 54, 69, 89, 90) for abnormal indications.
	
	b. Check experiment power load by executing following sequence:
	
	  1. PD-26 Exp 5 Power Standby
	  2. PD-27 Exp 5 Power Standby OFF
	  3. PD-25 Exp 5 Power
	
	noting effect on PCU input voltage and current (Channels 1 and 5 respectively) after each command.