Best Available Copy

REPORT NO. [illegible]

RELIABILITY ANALYSIS OF LARGE COMMERCIAL VESSEL ENGINE ROOM AUTOMATION SYSTEMS

VOLUME III
Appendices D— G

C.E. Davis
W.C. Graham

DONAP & ASSOCIATES
427 Manchester Avenue
Playa del Rey, CA 90291

NOVEMBER 1982

AD-A134 849

Document is available to the U.S. Public through the National Technical Information Service, Springfield, Virginia 22161

DTIC FILE COPY

PREPARED FOR

US DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD
OFFICE OF RESEARCH AND DEVELOPMENT
WASHINGTON, D.C. 20590

DTIC ELECTE NOV 21 1983 S A

83 11 21 003

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The contents of this report do not necessarily reflect the official view or policy of the Coast Guard; and they do not constitute a standard, specification, or regulation.

This report, or portions thereof may not be used for advertising or sales promotion purposes. Citation of trade names and manufacturers does not constitute endorsement or approval of such products.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
CG-D-47-82		

4. Title and Subtitle	5. Report Date
Reliability Analysis of Large Commercial Vessel Engine Room Automation Systems Volume III - Appendices D-G	November 1982
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
9. Performing Organization Name and Address DOVAP & ASSOCIATES 427 Manchester Avenue Playa del Rey, CA 90291	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. DTCG23-81-20005
12. Sponsoring Agency Name and Address U.S. Department of Transportation United States Coast Guard Office of Research and Development Washington, D.C. 20590	13. Type of Report and Period Covered Final Report July 1981 - Nov. 1982
	14. Sponsoring Agency Code G-DMT-1

15. Supplementary Notes

16. Abstract

This Volume III presents Appendices D through G. Appendix D contains the system failure effects summary and detailed failure modes and effects analysis for Ship C.

Appendix E contains the Fault Tree diagrams for Ships A, B and C. Appendix F contains the individual criticality analysis summary sheets.

Appendix G contains the computer printouts which were generated during the quantitative criticality analysis.

17. Key Words	18. Distribution Statement
Reliability Vessels (commercial) Automation Systems Engine Room FMEA'S	Document is available to the U.S. public through the National Technical Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

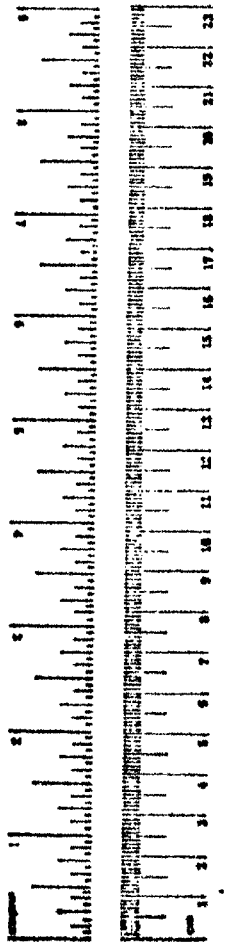
Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

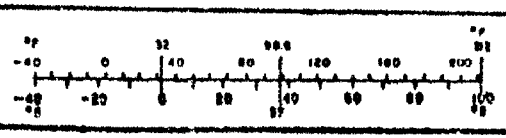
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in. = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



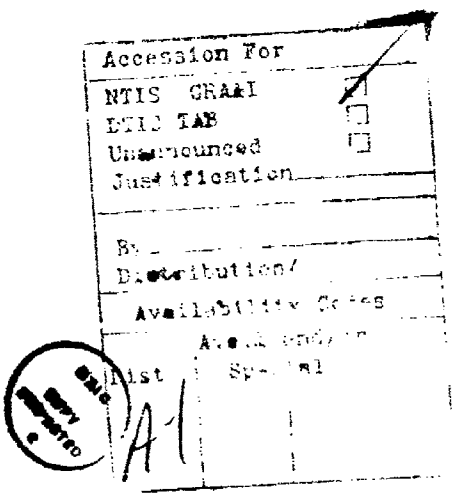
Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	36	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



APPENDIX D

SHIP C FAILURE MODE SUMMARIES AND DETAILED FMEA



INDEX

SUBSYSTEM NO.	TITLE	SYSTEM FAILURE EFFECTS SUMMARY PAGE	FAILURE MODES AND EFFECTS ANALYSIS (FMEA) PAGE
1.1			D-23
to	Control Transfer		D-33
1.3	Logic	D-1	D-34
2.1	Engine and		D-35
to	Clutch		D-41
2.3	Control	D-4	D-51
3.1			D-54
to			D-60
3.3	Mode Control	D-11	D-63
4.1	Pitch Controller	D-20	D-71
4.2	Pitch Controller	D-20	D-75
4.3	Pitch Controller	D-20	D-77
4.4	Pitch Cutback	D-20	D-78
4.5	Pitch Cutback	D-20	D-80

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
1.1 to 1.3 Control Transfer Logic

P.X	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P. 1	Propulsion system goes to idle; lose way on vessel.	1.1: 1B
P.2	Lose all control capability from bridge and control transfers to bridge not possible.	1.1: 10B, 13B, 30A, 41A, 42A 1.2: 1B, 2A, 3B, 4B, 5A, 6
P.3	Lose all control capability from ER and control transfers to ER not possible.	1.1: 11B, 14B, 33B, 40A 1.2: 9A, 10
P.4	Lose all control capability from ER and local stations; control transfers to these stations not possible.	1.1: 10A, 42B 1.2: 3A, 4A
P.5	Lose all control capability from bridge and ER; control transfers to these stations not possible.	1.1: 39A, 43B, 44B
P.6	Lose all control capability from bridge and local stations; control transfers to these stations not possible.	1.1: 11A
P.7	Control could not be transferred to local station.	1.1: 38A, 43A, 44A 1.2: 7B
P.8	Control erroneously transferred to bridge.	1.1: 34B

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
1.1 to 1.3 Control Transfer Logic

P.X	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.9	Two or more stations simultaneously in control.	1.1: 12, 13A, 14A
P.10	No station in control transfers possible.	1.1: 35, 36, 37B, 38B, 39B, 40B, 41B 1.2: 5B, 7A, 8, 9B
P.11	System comes up in indeterminant state at system start-up.	1.1: 29
P.12	Lose bridge or ER transfer buzzer.	1.1: 2A, 3A, 20A, 31B, 32A 1.3: 1B, 2B
P.13	False bridge or ER transfer buzzer.	1.1: 2B, 3B, 31A, 32B, 33A 1.3: 1A, 2A
P.14	Lose station in control lamp at 1 or more locations.	1.1: 4A, 5A, 6A, 7A, 8A, 23A, 24B, 28A 1.3: 3B, 4B, 5B, 6B, 7B
P.15	False station in control lamp at 1 or more locations.	1.1: 4B, 5B, 6B, 7B, 8B, 20B, 21A, 22B, 24A, 25A, 26B, 27A 1.3: 3A, 4A, 5A, 6A, 7A
P.16	Lose station in control transfer acknowledge lamp indication.	1.1: 9A 1.3: 8B
P.17	False station in control transfer acknowledge lamp indication.	1.1: 9B 1.3: 8A
P.18	Lose control transfer in process lamp indication at 1 or more stations.	1.1: 15A, 16B, 17B, 18B, 19B, 21B, 22A, 25B, 26A

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
1.1 to 1.3 Control Transfer Logic

P.X	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.19	Premature lamp indication that control transfer process has been completed.	1.1: 15B, 16A, 17A, 18A, 19A
P. J	No effect.	1.1: 1A, 27B, 28B, 30B, 34A, 37A 1.2: 1A, 2B

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
2.1 to 2.3 Engine and Clutch Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.1	Propulsion system goes to idle; lose way on vessel.	2.1: 1B
P.2	One engine would shutdown.	2.1: 8A, 9A, 11B, 12A, 22B, 32A 2.2: 1, 52B, 55, 56B, 64, 65B 2.3: 4A, 5B, 6A, 7A, 8B
P.3	One engine would de-clutch.	2.1: 13B, 14B, 15B, 16A, 17A, 18B, 30B, 33A 2.3: 10B, 11A, 15B
P.4	One engine would shutdown when shutdown override not in effect.	2.1: 10A 2.2: 9, 10, 12B, 13B, 14B, 15, 16, 18B, 19B, 20B, 21, 22B, 23B, 24, 25B, 26B, 30B, 31B, 32B, 33, 34B, 35B, 39B, 40B, 41B, 42, 43B, 44A
P.5	One engine would de-clutch when bridge in control.	2.2: 69A
P.6	One engine would de-clutch when ER in control.	2.2: 67A
P.7	One engine would not shutdown if auto shutdown condition occurred. (Reduction gear L.O. pressure low, engine overspeed, etc.)	2.1: 10B, 11A, 12B, 22A 2.2: 56A 2.3: 7B, 8A
P.8	One engine could not be shutdown via emergency stop or engine stop P.B. switch.	2.1: 8B, 9B 2.2: 51, 52A, 65A 2.3: 4B, 5A, 6B
P.9	One engine could not be started.	2.1: 2A, 3B, 4B, 7A, 7B, 31B 2.2: 7A, 49, 50A, 53, 54B, 62, 63B, 60, 61A 2.3: 1B, 2B, 3B

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
2.1 to 2.3 Engine and Clutch Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.10	One engine could be started when one or more permissives not met (J.W. pressure low, L.O. pressure low, etc.).	2.1: 2B, 3A 2.2: 12A, 13A, 14A, 18A, 19A, 20A, 22A, 23A, 25A, 26A, 27, 28, 30A, 31A, 32A, 34A, 35A, 36, 37, 39A, 40A, 41A, 43A, 44B
P.11	One engine could be started with its clutch engaged.	2.1: 31A 2.2: 61B
P.12	One engine could be started when an engine shutdown condition exists.	2.2: 50B
P.13	One engine could be started when its barring gear is engaged.	2.2: 54A
P.14	One engine could not be clutched in.	2.1: 21A, 23B, 24A 2.2: 8B, 48A, 58, 59B
P.15	One engine could not be clutched in from ER.	2.1: 19B 2.2: 70, 71B
P.16	One engine could not be clutched in from bridge.	2.1: 20B 2.2: 72, 73B
P.17	One engine could not be clutched in unless other engine is clutched in.	2.1: 28B
P.18	One engine could not be clutched in when the other engine is running.	2.1: 26B, 27A, 29B

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
2.1 to 2.3 Engine and Clutch Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.19	One engine could not be declutched.	2.1: 14A, 15A, 18A, 28A, 29A, 30A, 33B 2.3: 10A, 11B, 15A
P.20	One engine could not be declutched from ER.	2.1: 17B 2.2: 66, 67B
P.21	One engine could not be declutched from bridge.	2.1: 16B 2.2: 68, 69B
P.22	One engine could be clutched in when one or more permissives not met.	2.1: 24B 2.2: 47, 48B
P.23	One engine could be clutched in without regard for engine speed.	2.1: 26A 2.2: 8A
P.24	One engine could be clutched in when reduction gear barring gear engaged.	2.2: 59A
P.25	One engine would stay clutched in following emergency stop.	2.1: 13A
P.26	One engine stays clutched in whenever the two engines are in sync.	2.1: 27B
P.27	One engine stays clutched in when ER in control.	2.2: 71A
P.28	One engine stays clutched in when bridge in control.	2.2: 73A

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
2.1 to 2.3 Engine and Clutch Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.29	One engine starts spontaneously.	2.1: 4A 2.2: 7B, 63A 2.3: 1A, 2A, 3A
P.30	Lose manual override of auto engine shutdown.	2.2: 45, 46A
P.31	Lose split mode operation capability.	2.1: 32B
P.32	Lose engine barring gear engaged annunciator.	2.1: 5B, 6B 2.3: 16B
P.33	False engine barring gear engine annunciator.	2.1: 5A, 6A 2.3: 16A
P.34	Lose reduction gear barring gear engaged annunciator.	2.1: 23B 2.3: 13B, 14B
P.35	False reduction gear barring gear engaged annunciator.	2.1: 23A 2.3: 13A, 14A
P.36	Lose engine RPM meter.	2.2: 2
P.37	Lose engine stop annunciator.	2.2: 3B, 4B
P.38	False engine stop annunciator.	2.2: 3A, 4A
P.39	Lose engine start annunciator.	2.2: 5B, 6B
P.40	False engine stop annunciator.	2.2: 5A, 6A
P.41	Lose P.G. pressure gauge.	2.2: 11

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
2.1 to 2.3 Engine and Clutch Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.42	Lose F.O. pressure annunciator.	2.2: 13D
P.43	False F.O. pressure annunciator.	2.2: 13C
P.44	Lose engine L.O. pressure gauge.	2.2: 17
P.45	Lose engine L.O. pressure annunciator.	2.2: 19D
P.46	False engine L.O. pressure annunciator.	2.2: 19C
P.47	Lose rocker L.O. pressure annunciator.	2.2: 22D
P.48	False rocker L.O. pressure annunciator.	2.2: 22C
P.49	Lose J.W. pressure annunciator.	2.2: 25D
P.50	False J.W. pressure annunciator.	2.2: 25C
P.51	Lose J.W. temperature gauge.	2.2: 29
P.52	Lose J.W. temperature annunciator.	2.2: 31D
P.53	False J.W. temperature annunciator.	2.2: 31C
P.54	Lose inj. coolant pressure annunciator.	2.2: 34D

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
2.1 to 2.3 Engine and Clutch Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.55	False inj. coolant pressure annunciator.	2.2: 34C
P.56	Lose inj. coolant temperature gauge.	2.2: 38
P.57	Lose inj. coolant temperature annunciator.	2.2: 40D
P.58	False inj. coolant temperature annunciator.	2.2: 40C
P.59	Lose reduction gear L.O. pressure annunciator.	2.2: 43D
P.60	False reduction gear L.O. pressure annunciator.	2.2: 43C
P.61	Lose CPP hydraulic pressure annunciator.	2.2: 48D
P.62	False CPP hydraulic pressure annunciator.	2.2: 48C
P.63	Lose engine overspeed annunciator.	2.2: 57B
P.64	False engine overspeed annunciator.	2.2: 57A
P.65	Lose engine shutdown annunciator.	2.3: 9B
P.66	False engine shutdown annunciator.	2.3: 9A

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
2.1 to 2.3 Engine and Clutch Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.67	Lose shutdown reset indication.	2.3: 12B
P.68	False shutdown reset indication.	2.3: 12A
P.69	Lose clutch engaged indication.	2.3: 17B
P.70	False clutch engaged indication.	2.3: 17A
P.71	No effect.	2.1: 1A 2.2: 46B
P.72	One engine stays clutched in whenever permissives are met (flat pitch, thrust control at zero, etc.).	2.1: 19A, 20A, 21B, 25A

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.1	Propulsion system goes to idle; lose way on vessel.	3.1: 1B, 4A, 12A, 13B, 15A 3.2: 15B, 16B 3.3: 12B, 14B, 16B, 18B, 20B, 29B, 29C
P.2	Same as #1 above except auto cruise mode only.	3.1: 18B
P.3	Same as #1 above except split mode only.	3.1: 19 3.2: 23 3.3: 24A, 24D
P.4	Same as #1 above except only when ER in control in maneuver mode.	3.1: 30, 32B 3.2: 21 3.3: 22C
P.5	Same as #1 above except only when bridge in control in maneuver mode.	3.1: 31, 34B 3.2: 20 3.3: 22A
P.6	Same as #1 above except only in maneuver mode.	3.3: 13B, 23B, 23C
P.7	Same as #1 above except only in cruise and maneuver mode.	3.3: 24B, 24C, 28C
P.8	Same as #1 above except only in 2-engine cruise mode.	3.3: 25A, 25D
P.9	Same as #1 above except only in 1-engine cruise mode.	3.3: 25E, 25H
P.10	Same as #1 above except only in 2-engine maneuver mode.	3.3: 25B, 25C

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.11	Same as #1 above except only in 1-engine maneuver mode.	3.3: 25F, 25G
P.12	Same as #1 above except only in 1-engine cruise and maneuver mode.	3.3: 28A
P.13	Lose auto pitch control when going AH.	3.2: 15A
P.14	Lose auto pitch control when going AS.	3.2: 16A
P.15	Lose auto pitch control when going AH and ER in control.	3.2: 17A, 19A
P.16	Same as #15 except when bridge in control.	3.2: 18A, 19C
P.17	Lose auto pitch control when going AS and ER in control.	3.2: 17B, 19B
P.18	Lose auto pitch control when going AS and bridge in control.	3.2: 18B, 19D
P.19	False full speed commands in auto-cruise mode.	3.1: 18A
P.20	False full speed commands in maneuver mode.	3.3: 13A
P.21	False full AH commands in 2-engine cruise mode.	3.3: 15A

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.22	Same as #21 except in 2-engine maneuver mode.	3.3: 17A
P.23	Same as #21 except in 1-engine cruise mode.	3.3: 19A
P.24	Same as #21 except in 1-engine maneuver mode.	3.3: 21A
P.25	False full AS commands in 2-engine cruise mode.	3.3: 15B
P.26	Same as #25 except in 2-engine maneuver mode.	3.3: 17B
P.27	Same as #25 except in 1-engine cruise mode.	3.3: 19B
P.28	Same as #25 except in 1-engine maneuver mode.	3.3: 21B
P.29	Lower speed than commanded, 1-engine modes.	3.1: 17A
P.30	Lower speed than commanded, cruise mode.	3.1: 20 3.2: 22 3.3: 23A
P.31	Higher speed than commanded, 2-engine modes.	3.1: 17B
P.32	Uncommanded speed increases when ER in control.	3.1: 32A

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.33	Uncommanded speed increases when bridge in control.	3.1: 34A
P.34A	Speed higher and/or lower than commanded--maneuver mode.	3.3: 13C
P.34B	Speed higher and/or lower than commanded--cruise mode.	3.3: 23D
P.35	Speed higher and/or lower than commanded when bridge in control	3.3: 22D
P.36	Speed higher and/or lower than commanded when ER in control.	3.3: 22B
P.37	Higher AH speed than commanded, 1-engine manevuer mode.	3.3: 21C
P.38	Higher AS speed than commanded, 1-engine maneuver mode.	3.3: 21D
P.39	Higher AH speed than commanded, 2-engine maneuver mode.	3.3: 17C
P.40	Higher AS speed than commanded, 2-engine maneuver mode.	3.3: 17D
P.41	Higher AH speed than commaned, 1-engine cruise mode.	3.3: 19C
P.42	Higher AS speed than commanded, 1-engine cruise mode.	3.3: 19D

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.43	Higher AH speed than commanded, 2-engine cruise mode.	3.3: 15C
P.44	Higher AS speed than commanded, 2-engine cruise mode.	3.3: 15D
P.45	Incorrect response to direction change commands--all 2-engine modes.	3.3: 28B
P.46	Same as #45 except 1-engine modes.	3.3: 28D
P.47	Lose all modes except auto-cruise mode; lose control if in any other mode at time of failure (vessel could speed-up or slow down).	3.1: 4B, 5B 3.2: 6B, 11, 12B
P.48	Same as #47 except lose all modes except split mode.	3.1: 6B, 8A 3.2: 10A
P.49	Lose split mode; lose control if split mode at time of failure (vessel could speed up or slow down).	3.1: 2A, 6A, 7B, 8B, 29 3.2: 9, 10B
P.50	Same as #49 except maneuver mode.	3.1: 2B, 3B, 7A 3.2: 7, 8A, 8B
P.51	Same as #49 except cruise mode.	3.1: 3A, 5A 3.2: 5, 6A

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FAEA ITEM NO.		
P.52	Same as #49 except auto and and maneuver mode.			
P.53	One engine goes to idle.	Port Engine:	3.3:	26A, 26C
		Stbd Engine:	3.3:	27A, 27C
P.54	One engine slows down.	Port Engine:	3.1:	24B
		Stbd Engine:	3.1:	25B
P.55	One engine could not be controlled via auto system.	Port Engine:	3.1:	23B
			3.3:	27B
		Stbd Engine:	3.1:	22B
			3.3:	26B
P.56	One engine speeds up.	Port Engine:	3.1:	24A
		Stbd Engine:	3.1:	25A
P.57	One engine speeds up when engine not in use.	Port Engine:	3.1:	23A
		Stbd Engine:	3.1:	22A
P.58	Small, false speed commands occur when vessel not underway.	3.3:	29A, 29D	
P.59	Pitch commands not inhibited when vessel not underway.	3.1:	15B	
P.60	Port idle cannot be commanded from bridge and/or ER.	3.1:	12B, 13A, 14B	
		3.2:	1, 2A, 3, 4A	
P.61	High change rates on all pitch commands.	3.1:	10A	

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.62	Slow change rates for manual mode AH pitch changes.	3.1: 10B
P.63	One engine could be clutched in without regard for engine speed.	3.1: 16B
P.64	One engine could not be clutched in when the other engine is running.	3.1: 16A
P.65	False port idle commands when vessel stopped.	3.1: 14A 3.2: 2B, 4B
P.66	Lose inhibit against applying thrust if SDG on-line.	3.2: 12A
P.67	Lose SDG Not on Line lamp indication.	3.1: 9D 3.2: 13, 14A 3.3: 6B, 7B, 8B, 9B
P.68	False SDG Not on Line lamp indication.	3.1: 9A, 9B, 9C 3.2: 14B 3.3: 6A, 7A, 8A, 9A
P.69	Lose cruise mode indicator at one or more locations.	3.1: 11A 3.3: 3B
P.70	False cruise mode indication at one or more locations.	3.1: 11B 3.3: 3A

SUMMARY OF SKIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.71	Lose speed fail alarm.	3.1: 21B, 27A 3.2: 25A, 26A 3.3: 1B
P.72	False speed fail alarm.	3.1: 21A, 26, 27B 3.2: 24, 25B, 26B 3.3: 1A
P.73	Lose control fail alarm.	3.1: 28A 3.3: 2B
P.74	False control fail alarm.	3.1: 28B 3.3: 2A
P.75	ER throttle position indicator incorrect.	3.1: 33 3.3: 10
P.76	Bridge throttle position indicator incorrect.	3.1: 35 3.3: 11
P.77	Lose maneuver mode indicator at one or more locations.	3.3: 4B
P.78	False maneuver mode indicator at one or more locations.	3.3: 4A
P.79	Lose split mode indicator at one or more locations.	3.3: 5B
P.80	False split mode indicator at one or more locations.	3.3: 5A
P.81	Lose port idle indication.	3.3: 26E, 26H, 27E, 27H

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
3.1 to 3.3 Mode Control

	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.82	False port idle indication.	3.3: 26F, 27F
P.83	No effect.	3.1: 1A 3.3: 1C, 2C, 8C, 12A, 14A, 16A, 15E, 17E, 18A, 19E, 20A, 21E, 26D, 26G, 27D, 27G

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
4.1 TO 4.5 Pitch Control

P.X	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.1	Propulsion system goes to idle; lose way on vessel.	4.1: 1B, 21A, 22B, 23A
P.2	Same as #1 except in cruise and maneuver modes only.	4.1: 12A, 13A
P.3	Same as #1 except in split mode only.	4.1: 11B, 24 4.2: 3
P.4	Vessel slowdown.	4.4: 2A, 3B, 4B, 6A, 7A 4.5: 1A, 2A, 3A, 4A
P.5	False full AH command.	4.1: 2A, 4A, 7A, 9A, 10A, 17A 4.4: 5C
P.6	False full AS command.	4.1: 2B, 4B, 7B, 9B, 10B, 16B 4.4: 5A
P.7	Same as #5 except in split mode only.	4.1: 8A
P.8	Same as #6 except in split mode only.	4.1: 9B
P.9	Lose ability to go AH.	4.4: 5D
P.10	Lose ability to go AS.	4.4: 5B
P.11	Lose automatic pitch control in split mode.	4.1: 8C
P.12	Crash astern rates too slow.	4.1: 2D, 6A, 14A 4.2: 4B

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
4.1 TO 4.5 Pitch Control

P.X	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.13	Uncommanded pitch changes in non-split mode if split pot not left at zero position.	4.1: 11A
P.14	Uncommanded pitch changes in split mode if any throttle lever not left at zero position.	4.1: 12B, 13B
P.15	Pitch changes not inhibited if vessel not underway.	4.1: 21B, 22A, 23B
P.16	Clutch could be engaged when pitch not flat.	4.1: 18A 4.2: 5B
P.17	Clutch could not be engaged.	4.1: 18B 4.2: 5A
P.18	No auto pitch cutback if overload occurrred on one or both engine(s).	4.4: 2B, 3A, 4A, 6B, 7B 4.5: 1B, 2B, 3B, 4B
P.19	Pitch changes occur at high rates.	4.1: 2C, 3A, 5A, 6B, 14B 4.2: 4A 4.3: 1A, 2B
P.20	Slow pitch change rates in manual.	4.1: 3B, 5B
P.21	Lose pitch position indicator at one or more locations.	4.1: 15 4.3: 4

SUMMARY OF SHIP C SYSTEM FAILURE EFFECTS
4.1 TO 4.5 Pitch Control

P.X	SYSTEM FAILURE EFFECT	FMEA ITEM NO.
P.22	Lose pitch fail alarm at one or more locations.	4.1: 19B, 20A 4.2: 1B, 2B 4.3: 3B
P.23	False pitch fail alarm at one or more locations.	4.1: 19A, 20B 4.2: 1A, 2A 4.3: 3A
P.24	Lose AH or AS indication on bridge wings.	4.2: 6B, 7B
P.25	False AH or AS indication on bridge wings.	4.2: 6A, 7A
P.26	Lose wrong direction pitch alarm at one or more locations.	4.2: 8, 9B, 9D
P.27	False wrong direction pitch alarm at one or more locations.	4.2: 9A, 9C
P.28	No effect.	4.1: 1A, 16, 17B 4.3: 3C, 1B, [illegible] 4.4: 1A

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10^6 HRS.	COMMENTS INDEX
1A	Filer Capacitors	Fail open.	No effect (some EMI filtering capability would be lost).	No effect.	0.1705	
1B	Filter Capacitors	Fail short.	+5 volt power supply to all cards shorted to ground; lose all logic circuitry.	Engines would be forced to idle state and prop would go to neutral. Vessel would coast to a stop.	0.3279	
2A	Bridge Transfer Buzzer* Output Circuit	Stays high.	Lose bridge transfer buzzer.	Buzzer would not alert bridge to control transfer request.	0.1004	
2B	Bridge Transfer Buzzer* Output Circuit	Stays low.	Bridge transfer buzzer would sound continuously.	No effect unless bridge took wrong action which would create confusion as to who was in control and possibly result in no one being in control.	0.1004	
3A	ER Transfer Buzzer* Output Circuit	Stays high.	Lose ER transfer buzzer.	Buzzer would not alert ER to control transfer request.	0.1004	
3B	ER Transfer Buzzer* Output Circuit	Stays low.	ER transfer buzzer sounds continuously.	No effect unless ER took wrong action, which would create confusion as to who was in control and possibly result in no one being in control.	0.1004	
4A	Bridge Control Lamp* Output Circuit	Stays high.	Bridge and ER "Bridge in Control" would not light steady nor flash.	Bridge and ER would lose lamp indicator that bridge had received control and that a control transfer was in process.	0.1004	
4B	Bridge Control Lamp* Output Circuit	Stays low.	Bridge and ER "Bridge in Control" lamp would stay lit steady.	Bridge and ER would think bridge was in control; could create confusion and result in nobody exercising control.	0.1004	
5A	ER in Control Lamp* Output Circuit	Stays high.	Bridge to ER "ER in Control" lamp would not light steady nor flash.	Bridge and ER would lose lamp indication that ER had received control and that a control transfer was in process.	0.1004	
5B	ER in Control Lamp* Output Circuit	Stays low.	Bridge and ER "ER in Control" lamp would stay lit steady.	Bridge to ER would think ER was in control; could create confusion and result in nobody exercising control.	0.1004	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
6A	Local in Control Lamp* on Bridge Output Circuit	Stays high.	"Local in Control" lamp on bridge would not light steady nor flash.	Bridge would lose lamp indication that local had received control and that a control transfer was in process.	0.1004	
6B	Local in Control Lamp* on Bridge Output Circuit	Stays low.	"Local in Control" lamp on bridge would stay lit steady.	Bridge would think that local was in control; could create confusion and result in nobdy exercising control.	0.1004	
7A	Local in Control Lamp* in ER Output Circuit	Stays high.	"Local in Control" lamp in ER would not light steady nor flash.	ER would lose lamp indication that local had received control and that a control transfer was in process.	0.1004	
7B	Local in Control Lamp* in ER Output Circuit	Stays low.	"Local in Control" lamp in ER would stay lit steady.	ER would think that local was in control; could create confusion and result in nobody exercising control.	0.1004	
8A	Local in Control Lamp* Output to Local Panel	Stays high.	"Local in Control" lamp on local panel would not light steady nor flash.	Local station would lose lamp indication that it had received control and that a control transfer was in process.	0.1004	
8B	Local in Control Lamp* Output to Local Panel	Stays low.	"Local in Control" lamp on local panel would stay lit steady.	Local would think that it was in control; could create confusion and result in nobody exercising control.	0.1004	
9A	Bridge Transfer Acknowledge P.B.* Output Circuit	Output stays high.	Transfer acknowledge P.B. lamp on bridge would never light nor flash.	Bridge would lose the lamp indication that it should depress the transfer acknowledge P.B. to complete the control transfer to the bridge cannot be accomplished until this P.B. is depressed.	0.1673	
9B	Bridge Transfer Acknowledge P.B.* Output Circuit	Output stays low.	Transfer acknowledge P.B. lamp on bridge stays lit steady.	Bridge might think it was supposed to depress the control transfer acknowledge P.B. although since the lamp would not be flashing bridge would probably recognize this as an incorrect indication.	0.1673	

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
10A	Bit 0 Flip Flop	Stays reset.	Bit 0 would stay low.	Control not possible from ER or local panel; would not effect control from bridge.	0.6507	
10B	Bit 0 Flip Flop	Stays set.	Bit 0 would stay high.	Control not possible from bridge; would not effect control from ER or local panel.	0.6507	
11A	Bit 1 Flip Flop	Stays reset.	Bit 1 would stay low.	Control not possible from bridge or local panel; would not effect control from ER.	0.1004	
11B	Bit 1 Flip Flop	Stays set.	Bit 1 would stay high.	Control not possible from ER; would not effect control from bridge or local panel.	0.1004	
12	U21 BCD to Decimal Decoder	Any.	Depending on nature of failure (internal to IC chip); would cause either 1) loss of bridge in control, ER in control, and/or local in control signals or 2) any one of the 3 station-in-control signals remains erroneously active.	Depending on nature of failure, either 1) control would not be possible from 1 or more of the 3 stations, or 2) any 2 of the 3 stations could simultaneously exercise control.	1.0345	
13A	Bridge in Control Outlet Circuit	Stays high.	Bridge in control circuits stay enabled and bridge in control lamps at bridge and ER stay lit steady.	Bridge and either of the other 2 stations could be in control simultaneously.	0.1062	
13B	Bridge in Control Outlet Circuit	Stays low.	Bridge in control circuits stay inhibited and bridge in control lamps at bridge and ER never light steady (they would flash.	Same as #10B.	0.4075	
14A	ER in Control Output Circuit	Stays high.	ER in control circuits stay enabled and ER in control lamps at bridge and ER stay lit steady.	ER and either of the other 2 stations could be in control simultaneously.	0.1062	
14B	ER in Control Output Circuit	Stays low.	ER in control circuits stay inhibited and ER in control lamps at bridge and ER never light steady (they would flash).	Same as #11B.	0.1062	

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
15A	Blink Circuit	Output stays high.	None of the station-in-control lamps would illuminate in the flashing mode to indicate that a control transfer was in process; lamps would stay dark during the transfer process.	Loss of control transfer in process indication via flashing lamp at all control stations.	0.1073	
15B	Blink Circuit	Output stays low.	All of the station-in-control lamps womuld illuminate steady when they should be flashing.	Control transfer process would appear to have been completed prematurely.	0.1073	
16A	Bridge in Control Blink Gate	Stays high.	Bridge in control lamps will illuminate steady when they should be flashing.	Control transfers involving bridge station would appear to have been completed prematurely.	0.1004	
16B	Bridge in Control Blink Gate	Stays low.	Bride in control lamps will stay dark when they should be flashing.	Lose control transfer in process indication via flashing lamps at all control stations for transfers involving the bridge.	0.1004	
17A	ER in Control Gate	Stays high.	ER in control lamps will illuminate steady when they should be flashing.	Control transfers involving ER station would appear to have been completed prematurely.	0.1004	
17B	ER in Control Gate	Stays low.	ER in control lamps will stay dark when they should be flashing.	Lose control transfer in process indication via flashing lamps at all control stations for transfers involving ER.	0.1004	
18A	Local Control Blink Gate, Bridge Indication	Stays high.	Local in control lamp on bridge will illuminate steady when it should be flashing.	Control transfers involving local station would appear to the bridge to have been completed prematurely.	0.1004	
18B	Local Control Blink Gate, Bridge Indication	Stays low.	Local control loop on bridge will stay dark when it should be flashing.	Lose control transfer in process indication via flashing lamp on bridge for transfers involving local station.	0.1004	
19A	Local Control Blink Gate, ER Indication	Stays high.	Local in control lamp in ER will illuminate steady when it should be flashing.	Control transfers involving local station would appear to ER to have been complete prematurely.	0.1004	

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC PAGE: 5

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE,'S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10^6 HRS.	COMMENTS INDEX
19A	Local Control Blink Gate, ER Indication	Stays low.	Local control lamp in ER and local station will stay dark when they should be flashing.	Lose control transfer in-process indications via flashing lamps in ER and at local panel for transfers involving local station.	0.1004	
20A	ER Transfer Flash and Buzzer Gate	Stays high.	Lose blink and buzz signals for transfers involving ER.	Lose flashing lamps and buzzer indications at bridge and ER for control transfers involving ER.	0.1004	
20B	ER Transfer Flash and Buzzer Gate	Stays low.	Blink signal for ER in control would occur when ER not in control.	ER in control lamp at bridge and ER would flash when ER not in control; could create confusion.	0.1004	
21A	Bridge "Local in Control" Lamp Input Logic	Stays high.	Local in control lamp signal to bridge stays low.	Local in control lamp on bridge would stay lit steady.	0.0669	
21B	Bridge "Local in Control" Lamp Input Logic	Stays low.	Local in control lamp signal to bridge would stay high when it should blink.	Same as #18B.	0.0669	
22A	Local in Control Lamp Gating	Stays high.	Same as #21B; also, lose blink signal to local in control lamp at local panel.	Same as #18B; also, local in control lamp at local panel would not flash.	0.1004	
22B	Local in Control Lamp Gating	Stays low.	Same as #21A and #8B.	Same as #21A and #8B.	0.1004	
23A	Local in Control Lamp Gating	Stays high.	Lose local in control signal to lamps at bridge and ER.	Local in control lamp at bridge and ER would stay dark when local panel had control.	0.0727	
23B	Local in Control Lamp Gating	Stays low.	Local in control signal to lamps at bridge and ER would stay active.	Local in control lamps at bridge and ER would stay lit steady.	0.0727	
24A	Bridge "Local in Control" Lamp Gating	Stays high.	Same as #21A.	Same as #21A.	0.1004	
24B	Bridge "Local in Control" Lamp	Stays low.	Lose local in control lamp signal to bridge when local in control.	Local in control lamp at bridge would stay dark when local panel had control.	0.1004	
25A	ER "Local in Control" Lamp Gating	Stays high.	Same as #7B.	Same as #7B.	0.0669	

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
25B	ER "Local in Control" Lamp Gating	Stays low.	Local control lamp at ER will stay dark when it should be flashing.	Lose control transfer in process indication via flashing lamp at ER for transfer involving local station.	0.0669	
26A	ER and "Local in Control" Lamp Gating	Stays high.	Same as #25B.	Same as #25B.	0.1004	
26B	ER and "Local in Control" Lamp Gating	Stays low.	Same as #8B and #7B.	Same as #8B and #7B.	0.1004	
27A	ER "Local in Control" Lamp Gating	Stays high.	Same as #7B.	Same as #7B.	0.1004	
27B	ER "Local in Control" Lamp Gating	Stays low.	No effect.	No effect.	0.1004	
28A	Local Selected Inverter	Stays high.	Same as #24B.	Same as #24B.	0.0669	
28B	Local Selected Inverter	Stays low.	No effect.	No effect.	0.0669	
29	Power On Reset Circuit	Any.	Flip flop for Bits 1 and 0 would not reset properly at power turn on; also, initialize signal to other cards would be incorrect.	System state could come up initially in auto mode with associated auto mode circuitry enabled. Also, could come up initially with some undesired station incorrectly selected as the station in control.	2.7280	
30A	System in Manual Power Fail Gate	Stays high.	Gate output would continuously indicate that the system was in manual or power had failed; would inhibit bridge control.	Bridge could not take control.	0.1004	
30B	System in Manual Power Fail Gate	Stays low.	Gate output would continuously indicate that the system was not in manual and that power had not failed.	Bridge could take control when the system was in manual or when power had failed.	0.1004	

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
31A	Flash Bridge Input Gate	Stays high.	Flash bridge signal would stay active.	Bridge in control lamp at bridge and ER would flash anytime bridge not in control; transfer buzzer on bridge would also sound.	0.1004	
31B	Flash Bridge Input Gate	Stays low.	Lose flash bridge signal for bridge initiated transfers.	Bridge in control lamp at bridge and ER would not flash and bridge and ER buzzers would not sound for transfers initiated from bridge.	0.1004	
32A	Flash Bridge Gate	Stays high.	Lose bridge transfer buzzer and flash bridge signal.	Bridge in control lamp at bridge and ER would not flash and bridge buzzer would not sound for transfers initiated by bridge or ER.	0.1004	
32B	Flash Bridge Gate	Stays low.	Bridge transfer buzzer and flash bridge signal stays active.	Bridge in control lamp at bridge and ER would continuously flash and bridge buzzer would continuously sound.	0.1004	
33A	Bridge Request Input Gating	Stays high.	ER request for control would always appear active.	ER request for control continuously transmitted to bridge. Nuisance only unless bridge acknowledged request and allowed ER to take control when ER did not want control (e.g., ER unattended).	0.2003	
33B	Bridge Request Input Gating	Stays low.	Lose ER request for control signal.	If ER not in control, control could not be transferred to ER.	0.2008	
34A	Transfer to Bridge Back-Up Gate	Stays high.	Transfer to bridge back-up signal could not switch flip flops to bridge in control positions.	Lose back-up signal for transferring control to bridge.	0.1004	
34B	Transfer to Bridge Back-Up Gate	Stays low.	Transfer to bridge back-up signal would stay active.	Bridge would erroneously be placed in control at the time of failure; attempts to shift control back to ER could result in local station immediately having control. No flashing lamps or buzzing would accompany these erroneous transfers.	0.1004	

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 1086 HRS.	COMMENTS INDEX
35	U20 Decoder-DeMux	Any.	Depends on nature of failure (interval to IC chip); could cause either or both 1) apon-tamepis requests for forbidden and non-forbidden transfer requests, 2) loss of 1 or more non-forbidden transfer requests.	Depending on nature of failure, would cause some type of erroneous transfer request or loss of legiti-mate transfer requests. Except in 1 case, lamps and buzzers would not be effected so there would some warning that something was wrong. The exception is that failure could also cause same effect as #34B.	1.0345	
36	Flip Flop's Trigger Gate	Any.	Lose trigger pulse to flip flops; flip flops could not change states.	No control transfers possible.	0.2008	
37A	Flip Flop's Trigger Circuit for Back-Up Signal	Output stays high.	Lose flip flop's trigger pulse for back-up transfer to bridge signal; flip flops would not change state.	Same as #34A.	0.2505	
37B	Flip Flop's Trigger Circuit for Back-Up Signal	Output stays low.	Same as #36.	Same as #36.	0.2505	
38A	Flip Flop's Trigger Circuit for Local Station Transfers	Output stays high.	Lose flip flops' trigger pulse for transfers involving local station.	No transfer possible to local station.	0.4896	
38B	Flip Flop's Trigger Circuit for Local Station Transfers	Stays low.	Same as #36.	Same as #36.	0.4896	
39A	ER and Bridge Transfer Acknowledge Gate	Stays high.	Lose flip flops' trigger pulse for transfers involving ER and bridge.	No transfer possible to ER or bridge.	0.1004	
39B	ER and Bridge Transfer Acknowledge Gate	Stays low.	Same as #36.	Same as #36.	0.1004	
40A	ER Transfer Acknowledge Gate	Stays high.	Lose flip flop's trigger pulse for ER transfers.	No transfer possible to ER.	0.1109	
40B	ER Transfer Acknowledge Gate	Stays low.	Same as #36.	Same as #36.	0.1109	

FAILURE MODES AND EFFECTS ANAYLSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 1.1 CONTROL TRANSFER LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
41A	Bridge Transfer Acknowledge Gate	Stays high.	Lose flip flops' trigger pulse for bridge transfers.	No transfer possible to bridge.	0.1109	
41B	Bridge Transfer Acknowledge Gate	Stays low.	Same as #36.	Same as #36.	0.1109	
42A	Transfer to Bridge Inputs to Flip Flops	Output stays high.	Lose flip flop J/K inputs for bridge transfers.	Same as #41A.	0.5131	
42B	Transfer to Bridge Inputs to Flip Flops	Output stays low.	Bridge transfer J/K inputs to flip flops always active; on non-bridge transfers. Flip flop would receive a J and K input simultaneously and not change states.	Same as #10A.	0.5131	
43A	Transfer to Local Inputs to Flip Flops	Output stays high.	Lose flip flop J/K inputs for Local Transfers.	Same as #38A.	0.5471	
43B	Transfer to Local Inputs to Flip Flops	Output stays low.	Same as #42B except for local transfer J/K inputs.	Control not possible from ER or bridge.	0.5471	
44A	U19 BCD to Decimal Decoder and Input	Lose local select outputs.	Same as #43A.	Same as #38A.	0.5168	
44B	U19 BCD to Decimal Decoder and input	Local select outputs stay active.	Same as #43B.	Same as #43B.	0.5168	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 1.1.1 PURGE CONTROL

REF. NO.	ITEM NOMENCLATURE & FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1	Console Power Supply #1 (redundant to unit #2 below)	Any.	Loss of or incorrect power output from unit.	No effect unless redundant unit failed. If both failed, control system would shut down and vessel would come to a stop.	9.2609	
2	Console Power Supply #2 (redundant to unit #1 above)	Any.	Same as #1.	Same as #1.	9.2600	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 1.2 CONTROL TRANSFER INPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Power Fail* LR	Stays high.	Same as 1.1 item #30B.	Same as 1.1 item #30B.	0.4591	
1B	Power Fail* LR	Stays low.	Same as 1.1 item #30A.	Same as 1.1 item #30A.	0.4591	
2A	Power Fail Relay	Sticks open.	Same as 1.1 item #30A.	Same as 1.1 item #30A.	0.8768	
2B	Power Fail Relay	Sticks closed.	Same as 1.1 item #30B.	Same as 1.1 item #30B.	0.8768	
3A	Br EOT in Br Pos LR	Stays high.	Same as 1.1 item #42B.	Same as 1.1 item #10A.	0.4591	
3B	Br EOT in Br Pos LR	Stays low.	Same as 1.1 item #42A.	Same as 1.1 item #41A.	0.4591	
4A	ER EOT in Br Pos LR	Stays high.	Same as 1.1 item #42B.	Same as 1.1 item #10A.	0.4591	
4B	ER EOT in Br Pos LR	Stays low.	Same as 1.1 item #42A.	Same as 1.1 item #41A.	0.4591	
5A	Br Xfer Ack PB* LR	Stays high.	Same as 1.1 item #41A.	Same as 1.1 item #41A.	0.4591	
5B	Br Xfer Ack PB* LR	Stays low.	Same as 1.1 item #36.	Same as 1.1 item #36.	0.4591	
6	Br Xfer Ack PB	Fails open.	Same as 1.1 item #41A.	Same as 1.1 item #41A.	0.4600	
7A	Local Selected LR	Stays high.	Same as 1.1 item #36.	Same as 1.1 item #36.	0.4591	
7B	Local Selected LR	Stays low.	Same as 1.1 item 38A.	Same as 1.1 item 38A.	0.4591	
8	Local Selected Switch	Fails open.	Same as 1.1 item #36.	Same as 1.1 item #36.	7.0800	
9A	ER Xfer Ack PB* LR	Stays high.	Same as 1.1 item #40A.	Same as 1.1 item #40A.	0.4591	
9B	ER Xfer Ack PB* LR	Stays low.	Same as 1.1 item #36.	Same as 1.1 item #36.	0.4591	
10	ER Xfer Ack PB	Fails open.	Same as 1.1 item #40A.	Same as 1.1 item #40A.	0.4600	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 1.3 CONTROL TRANSFER OUTPUT INTERFACE

REF. NO	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 1086 HRS.	COMMENTS INDEX
1A	Bridge Bell/Alarm Relay Drv	Stays on.	Same as 1.1 item #2B.	Same as 1.1 item #2B.	0.5822	
1B	Bridge Bell/Alarm Relay Drv	Stays off.	Same as 1.1 item #2A.	Same as 1.1 item #2A.	0.5822	
2A	ER Bell/Buzz Relay Drv	Stays on.	Same as 1.1 item #3B.	Same as 1.1 item #3B.	1.1644	
2B	ER Bell/Buzz Relay Drv	Stays off.	Same as 1.1 item #3A.	Same as 1.1 item #3A.	1.1644	
3A	Br in Cntl Lamp Drv	Stays on.	Same as 1.1 item #4B.	Same as 1.1 item #4B.	0.5822	
3B	Br in Cntl Lamp Drv	Stays off.	Same as 1.1 item #4A.	Same as 1.1 item #4A.	0.5822	
4A	ER in Cntl Lamp Relay Drv	Stays on.	Same as 1.1 item #5B.	Same as 1.1 item #5B.	0.5822	
4B	ER in Cntl Lamp Relay Drv	Stays off.	Same as 1.1 item #5A.	Same as 1.1 item #5A.	0.5822	
5A	Local Cntl Lamp (Br) Relay Drv	Stays on.	Same as 1.1 #6B.	Same as 1.1 #6B.	0.5822	
5B	Local Cntl Lamp (Bz) Relay Drv	Stays off.	Same as 1.1 #6A.	Same as 1.1 #6A.	0.5822	
6A	Local Cntl Lamp (ER) Relay Drv	Stays on.	Same as 1.1 #7B.	Same as 1.1 #7B.	0.5822	
6B	Local Cntl Lamp (ER) Relay Drv	Stays off.	Same as 1.1 #7A.	Same as 1.1 #7A.	0.5822	
7A	Local Cntl Lamp (LCL) Relay Drv	Stays on.	Same as 1.1 #8B.	Same as 1.1 #8B.	0.5822	
7B	Local Cntl Lamp (LCL) Relay Drv	Stays off.	Same as 1.1 #8A.	Same as 1.1 #8A.	0.5822	
8A	Br Xfer Ack PB Relay Drv	Stays on.	Same as 1.1 #9B.	Same as 1.1 #9B.	0.5822	
8B	Br Xfer Ack PB Relay Drv	Stays off.	Same as 1.1 #9A.	Same as 1.1 #9A.	0.5822	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.1 ENGINE AND CLUTCH CONTROL LOGIC PAGE: 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Power Filtering	Capacitors open.	Lose some EMI filtering.	No effect	0.3797	
1B	Power Filtering	Capacitors short.	5 volt power to system shorted to ground.	Same as FMEA 1.1 item #1B.	0.641:	
2A	Engine Start Permissive Gate	Stays high.	Signal to engine start solenoid valve never active.	Enigne could not be started.	0.4017	
2B	Engine Start Permissive Gate	Stays low.	Start signal could be enabled when start permissives not met.	Engine could be started when permissives not met (e.g., lo pres not normal, barring gear engaged, etc.).	0.4017	
3A	Start Permissives NOR Gate	Stays high.	Same as #2B.	Same as #2B.	0.1052	
3B	Start Permissives NOR Gate	Stays low.	Same as #2A.	Same as #2A.	0.1052	
4A	Engine Start Solenoid Valve Output	Output stays low.	Signal to engine start solenoid valve always active.	Erroneous engine start continuously attempted; interlocks are provided on the engine to prevent an erroneous start if the engine is already running.	0.1766	
4B	Engine Start Solenoid Valve Output	Output stays high.	Same as #2A.	Same as #2A.	0.1766	
5A	Engine Barring Gear Engaged Input	Stays high.	Engine Barring Gear Engaged Annunciator signal would occur whenever engine start PB depressed.	Engine barring gear engaged annunciator would occur at all starts; crew would probably abort start attempt.	0.0714	
5B	Engine Barring Gear Engaged Input	Stays low.	Engine Barring Gear Engaged Annunciator signal never active.	Lose engine barring gear engaged annunciator.	0.0714	
6A	Engine Barring Gear Engaged Output	Stays high.	Signal to engine barring gear engaged annunciator always active.	False engine barring gear engaged annunciator.	0.1052	
6B	Engine Barring Gear Engaged Output	Stays low.	Same as #5B.	Same as #5B.	0.1052	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.1 ENGINE AND CLUTCH CONTROL LOGIC PAGE: 2

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
7A	Shutdown Reset Latch	Stays set.	Shutdown reset output stays high; lose shutdown reset signal to engine start permissive gate.	Engine could not be restarted following an auto shutdown.	0.3365	
7B	Shutdown Reset Latch	Stays reset.	Shutdown reset output stays low; engine start permissives gates would stay high--same as 2A.	Same as #2A.	0.3365	
8A	Emergency Stop Latch	Stays set.	Emergency stop PB function always appears active; engine start would stay inhibited and emergency stop solenoid valve signal would stay active.	Engine would shutdown and could not be started.	0.4079	
8B	Emergency Stop Latch	Stays reset.	Emergency stop PB signal never active.	Lose emergency stop capability.	0.4079	
9A	Remote Stop Solenoid Valve Latch	Stays set.	Signal to remote stop solenoid valve would stay active (high); solenoid would stay energized.	Engine would stop.	0.2883	
9B	Remote Stop Solenoid Valve Latch	Stays reset.	Signal to remote stop solenoid valve never active; solenoid valve never energized.	Engine could not be stopped via stop PB.	0.2883	
10A	Engine Shutdown Gate	Stays high.	Energize emergency stop solenoid valve signal would stay active whenever shutdown override not in effect.	Engine would stop whenever shutdown override not in effect.	0.4017	
10B	Engine Shutdown Gate	Stays low.	Shutdown signal would not go active if shutdown condition occurred.	Engine would not shutdown if shutdown condition occurred (e.g., JW pressure not normal, Inj coolant temp not normal, etc.).	0.4017	
11A	Shutdown Override Gate	Stays high.	Same as #10B.	Same as #10B.	0.1052	
11B	Shutdown Override Gate	Stays low.	Energize Emergency Stop Solenoid Valve signal would stay active.	Same as #9A.	0.1052	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.1 ENGINE AND CLUTCH CONTROL LOGIC PAGE: 3

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
12A	Energize Emergency Stop Solenoid Valve Output Gate	Stays high.	Same as #11B.	Same as #9A.	0.1052	
12B	Energize Emergency Stop Solenoid Valve Output Gate	Stays low.	Same as #10B and #8B.	Engine would not shutdown if shutdown condition occurred (same as #10B) or if emergency stop PB depressed (same as #8B).	0.1052	
13A	Emergency Stop Inverter	Stays high.	Emergency stop signal never resets clutch engage latch.	Clutch would remain engaged following an emergency stop.	0.0714	
13B	Emergency Stop Inverter	Stays low.	Emergency stop signal to clutch engage latch reset stays active; clutch engage latch stays reset.	Clutch would disengage.	0.0714	
14A	Clutch Engage Latch Reset Circuit	Output stays high.	Clutch Engage Latch Reset signal never active; clutch engage latch stays set.	Clutch would stay engaged.	0.2122	2
14B	Clutch Engage Latch Reset Circuit	Output stays low.	Clutch engage latch reset signal always active; clutch engage latch stays reset.	Same as #13B.	0.2122	
15A	Clutch Engage Latch	Stays set.	Clutch engage latch cannot be reset.	Same as #14A.	0.4717	
15B	Clutch Engage Latch	Stays reset.	Clutch engage latch cannot be set.	Same as #13B.	0.4717	
16A	Br Clutch Disengage Cmd Input	Stays high.	Clutch disengage command from bridge always active; clutch engage latch would stay reset.	Same as #13B.	0.1004	
16B	Br Clutch Disengage Cmd Input	Stays low.	Clutch disengage command from bridge never active; clutch engage latch would stay set when bridge in control.	Bridge could not disengage clutch.	0.1004	
17A	ER Clutch Disengage Cmd Input	Stays high.	Clutch disengage command from ER always active; clutch engage latch would stay reset.	Same as #13B.	0.1004	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.1 ENGINE AND CLUTCH CONTROL LOGIC PAGE: 4

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
17B	ER Clutch Disengage Cmd Input	Stays low.	Clutch disengage command from ER never active; clutch engage latch would stay set when ER in control.	ER could not disengage clutch.	0.1004	
18A	Clutch Disengage Command Gate	Stays high.	Clutch disengage commands from bridge and ER never active; clutch engage latch would stay set.	Clutch could not be disengaged by bridge nor ER.	0.1004	
18B	Clutch Disengage Command Gate	Stays low.	Same as #14B.	Same as #13B.	0.1004	
19A	ER Clutch Engage Command Input	Stays high.	Clutch engage command from ER always active; clutch engage latch would stay set whenever clutch engage permissives met.	Clutch would stay engaged whenever clutch engage permissives met (prop pitch flat, thrust control at zero, etc.).	0.1004	
19B	ER Clutch Engage Command Input	Stays low.	Clutch engage command from ER never active.	ER could not engage clutch.	0.1004	
20A	Bridge Clutch Engage Command Input	Stays high.	Clutch engage command from bridge always active; clutch engage latch would stay set whenever clutch engage permissives met.	Same as #19A.	0.1004	
20B	Bridge Clutch Engage Command Input	Stays low.	Clutch engage command from bridge never active.	Bridge could not engage clutch.	0.1004	
21A	Clutch Engage Command Gate	Stays high.	Clutch engage commands from bridge and ER never active.	Clutch could not be engaged by bridge nor ER.	0.1004	
21B	Clutch Engage Command Gate	Stays low.	Clutch engage command always active; clutch engage latch would stay set whenever clutch engage permissives met.	Same as #19A.	0.1004	
22A	Reduction Gear L.O. Pressure Adq* Input	Stays high.	Reduction gear L.O. pressure always appears adequate.	Engine would not shutdown if reduction gear L.O. pressure not adequate.	0.0714	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.1 ENGINE AND CLUTCH CONTROL LOGIC PAGE: 5

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
22B	Reduction Gear L.O. Pressure Acq* Input	Stays low.	Reduction gear L.O. pressure never looks adequate.	Same as #9A.	0.0714	
23A	Reduction Gear Barring Gear Engaged Output	Stays high.	Signal to reduction gear barring gear engaged annunciator stays active.	False reduction gear barring gear engaged annunciator.	0.1052	
23B	Reduction Gear Barring Gear Engaged Output	Stays low.	Lose signal to reduction gear barring gear engaged annunciator.	Lose reduction gear barring gear engaged annunciator.	0.1052	
24A	Clutch Engaged Permissives Gate	Stays high.	Clutch engage permissives never appears met.	Same as #21A.	0.2051	
24B	Clutch Engaged Permissives Gate	Stays low.	Clutch engage permissives always appears met.	Clutch could be engaged when permissives not met (e.g., CRP hyd pressure not adequate, engine speed less than Hl speed, etc.).	0.2051	
25A	Clutch Engaged Permissives/ Command Gate	Stays high.	Same as #21B.	Same as #19A.	0.1052	
25B	Clutch Engaged Permissives/ Command Gate	Stays low.	Same as #21A.	Same as #21A.	0.1052	
26A	Other Clutch Engaged* Input	Stays high.	Other clutch always appears engaged.	Clutch could be engaged when other engine running but the two engines not synchronized.	0.0714	
26B	Other Clutch Engaged* Input	Stays low.	Other clutch never appears engaged.	Clutch could not be engaged when other engine running.	0.0714	
27A	Clutch Engaged/ Command Gate	Stays high.	Lose clutch engage command for situation where other clutch already engaged.	Same as #26B.	0.1026	
27B	Clutch Engaged/ Command Gate	Stays low.	Clutch engage command always active for situation where other clutch already engaged.	Clutch would erroneously engage whenever the speed of the two engines matched.	0.1026	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.1 ENGINE AND CLUTCH CONTROL LOGIC PAGE: 6

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
28A	Clutch Engaged Command Check Circuit	Output stays high.	Clutch engage command always active.	Same as #14A.	0.2765	
28B	Clutch Engaged Command Check Circuit	Output stays low.	Lose clutch engage command for situation where other clutch is not already engaged.	Clutch could not be engaged unless other clutch already engaged.	0.2765	
29A	Speed Match Circuit	Stays high.	Same as #28A.	Same as #14A.	0.1052	
29B	Speed Match Circuit	Stays low.	Same as #27A.	Same as #26B.	0.1052	
30A	Clutch Engaged Latch Set Circuit	Output stays high.	Clutch engage command always active.	Same as #14A.	0.1766	
30B	Clutch Engaged Latch Set Circuit	Output stays low.	Same as #21A.	Same as #13B.	0.1766	
31A	Clutch Engaged Inverter	Stays high.	Lose start inhibit if clutch is engaged.	Engine could be started with clutch engaged.	0.0714	
31B	Clutch Engaged Inverter	Stays low.	Clutch engaged start inhibit always active.	Same as #2A.	0.0714	
32A	Energize E/P Relay* Output	Stays high.	Lose Energize E/P Relay signal.	Engine could not be operated in auto mode. Also, E/P would "see" idle signal and take the the engine off-line.	0.1052	
32B	Energize E/P Relay* Output	Stays low.	Energize E/P Relay signal always active.	Split mode operation not possible.	0.1052	
33A	Energize Clutch Fill Solenoid* Output	Stays high.	Lose signal to energize clutch fill solenoid.	Same as #13B.	0.1052	
33B	Energize Clutch Fill Solenoid* Output	Stays low.	Clutch Fill Solenoid Energized signal always active.	Same as #14A.	0.1052	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE PAGE: 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1	Engine Tach-Gen	Lose output.	Lose Engine Speed signal.	Lose auto engine control.	19.4800	
2	Engine RPM Indication	Meter fails.	Engine RPM indicator reading wrong.	Lose manual-visual engine RPM indication.	10	
3A	Engine Stop Annunciator Setpoint Channel	Stays on.	Engine stop annunciator signal stays active.	False engine stop annunciator.	3.1692	
3B	Engine Stop Annunciator Setpoint Channel	Stay off.	Engine Stop Annunciator signal never active.	Lose engine stop annunciator.	3.1692	
4A	Engine Stop Annunciator Relay Driver Channel	Stays on.	Same as #3A.	Same as #3A.	0.5822	
4B	Engine Stop Annunciator Relay Driver Channel	Stays off.	Same as #3B.	Same as #3B.	0.5822	
5A	Engine Start Annunciator Setpoint Channel	Stays on.	Engine Start Annunciator signal stays active.	False engine start annunciator.	3.1692	
5B	Engine Start Annunciator Setpoint Channel	Stays off.	Engine Start Annunciator signal never active.	Lose engine start annunciator.	3.1692	
6A	Engine Start Annunciator Relay Driver Channel	Stays on.	Same as #5A.	Same as #5A.	0.5822	
6B	Engine Start Annunciator Relay Driver Channel	Stays off.	Same as #5b.	Same as #5B.	0.5822	
7A	Engine Speed Greater than Start Signal	Stays high.	Same as 2.1 item #2A.	Same as 2.1 item #2A.	3.1692	
7B	Engine Speed Greater than Start Signal	Stays low.	Same as 2.1. item #4A.	Same as 2.1 item #4A.	3.1692	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE PAGE: 2

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
8A	M1 Speed Signal	Stays high.	Engine speed always appears greater than or equal M1 speed.	Clutch could be engaged without regard to engine speed.	3.1692	
8B	M1 Speed Signal	Stays low.	Same as 2.1 item #24A.	Same as 2.1 item #21A.	3.1692	
9	F.O. Pressure Sensor	Lose output.	Lose F.O. Pressure signal.	Same as 2.1 item #10A.	8.6600	
10	F.O. Pressure Signal Conditioner	Lose output.	Same as #9.	Same as 2.1 item #10A.	7.6176	
11	Fuel Oil Pressure Gauge	Meter fails.	Fuel oil pressure gauge reading wrong.	Lose manual-visual F.O. pressure indication.	10	
12A	F.O. Pressure Setpoint Channel	Stays on.	F.O. pressure always appears normal.	Lose engine start inhibit if F.O. pressure not normal.	3.1692	
12B	F.O. Pressure Setpoint Channel	Stays off.	Same as #9.	Same as 2.1 item #10A.	3.1692	
13A	F.O. Pressure Alarm Channel	Stays on.	Same as #12A.	Same as #12A.	1.3012	
13B	F.O. Pressure Alarm Channel	Stays off.	Same as #9.	Same as 2.1 item #10A.	1.3012	
13C	F.O. Pressure Alarm Channel	Alarm signal stays on.	F.O. Pressure Annunciator signal always active.	False F.O. pressure annunciator.	0.8675	
13D	F.O. Pressure Alarm Channel	Alarm signal stays off.	F.O. Pressure Annunciator signal never active.	Lose F.O. pressure annunciator.	0.8675	
14A	F.O. Pressure Line Receiver Channel	Stays high.	Same as #12A.	Same as #12A.	0.3292	
14B	F.O. Pressure Line Receiver Channel	Stays low.	Same as #9.	Same as 2.1 item #10A.	0.3292	
15	Engine L.O. Pressure Sensor	Lose output.	Lose Engine L.O. Pressure Signal.	Same as 2.1 item #10A.	8.6600	
16	Engine L.O. Pressure Signal Conditioner	Lose output.	Same as #15.	Same as 2.1 item #10A.	7.6176	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM. 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
17	Engine L.O. Pressure Gauge	Meter fails.	Engine L.O. pressure gauge reading wrong.	Lose manual-visual engine L.O. pressure indication.	10	
18A	Engine L.O. Pressure Setpoint Channel	Stays on.	Engine L.O. pressure always normal.	Lose engine start inhibit if L.O. pressure not normal.	3.1692	
18B	Engine L.O. Pressure Setpoint Channel	Stays off.	Same as #15.	Same as 2.1 item #10A.	3.1692	
19A	Engine L.O. Pressure Alarm Channel	Stays on.	Same as #18A.	Same as #18A.	1.3012	
19B	Engine L.O. Pressure Alarm Channel	Stays off.	Same as #15.	Same as 2.1 item #10A.	1.3012	
19C	Engine L.O. Pressure Alarm Channel	Alarm signal stays on.	Engine L.O. Pressure Annunciator signal always active.	False engine L.O. pressure annunciator.	0.8675	
19D	Engine L.O. Pressure Alarm Channel	Alarm signal stays off.	Engine L.O. Pressure Annunciator signal never active.	Lose engine L.O. pressure annunciator.	0.8675	
20A	Engine L.O. Pressure LR Channel	Stays high.	Same as #18A.	Same as #18A.	0.3292	
20B	Engine L.O. Pressure Lr Channel	Stays low.	Same as #15.	Same as 2.1 item #10A.	0.3292	
21	Rocker L.O. Pressure Switch	Lose output.	Lose Rocker L.O. Pressure signal.	Same as 2.1 item #10A.	2.9000	
22A	Rocker L.O. Pressure Alarm Channel	Stays on.	Rocker L.O. pressure always appears normal.	Lose engine start inhibit if rocker L.O. pressure not normal.	1.3012	
22B	Rocker L.O. Pressure Alarm Channel	Stays off.	Same as #21.	Same as 2.1 item #10A.	1.3012	
22C	Rocker L.O. Pressure Alarm Channel	Alarm signal stays on.	Rocker L.O. Pressure Annunciator signal stays active.	False rocker L.O. pressure annunciator.	0.8675	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE PAGE: 4

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
22D	Rocker L.O. Pressure Alarm Channel	Alarm signal stays off.	Rocker L.O. Pressure Annunciator signal never active.	Lose rocker L.O. pressure annunciator.	0.8675	
23A	Rocker L.O. Pressure L.R.	Stays high.	Same as #22A.	Same as #22A	0.3292	
23B	Rocker L.O. Pressure L.R.	Stays low.	Same as #21.	Same as 2.1 item #10A.		0.3292
24	J.W. Pressure Sensor	Lose output.	Lose J.W. Pressure signal.	Same as 2.1 item #10A.	8.6600	
25A	J.W. Pressure Alarm Channel	Stays on.	J.W. pressure always appears normal.	Lose engine start inhibit if J.W. pressure not normal.	1.3012	
25B	J.W. Pressure Alarm Channel	Stays off.	Same as #24.	Same as 2.1 item #10A.	1.3012	
25C	J.W. Pressure Alarm Channel	Alarm signal stays on.	J.W. Pressure Annunciator signal stays active.	False J.W. pressure annunciator.	0.8675	
25D	J.W. Pressure Alarm Channel	Alarm signal stays off.	J.W. Pressure Annunciator never active.	Lose J.W. pressure annunciator.	0.8675	
26A	J.W. Pressure L.R.	Stays high.	Same as #25A.	Same as #25A.	0.3292	
26B	J.W. Pressure L.R.	Stays low.	Same as #24.	Same as 2.1 item #10A.	0.3292	
27	J.W. Temperature Sensor	Lose output.	Lose J.W. Temperature signal.	Same as 2.1 item #10A.	75.98	
28	J.W. Temperature Signal Conditioner	Lose output.	Same as #27.	Same as 2.1 item #10A.	7.6176	
29	J.W. Temperature Gauge	Meter fails.	J.W. temperature gauge reading wrong.	Lose manual visual J.W. temperature indication.	10	
30A	J.W. Temperature Setpoint Channal	Stays on.	J.W. temperature always appears normal.	Lose engine start inhibit if J.W. temperature not normal.	3.1692	
30B	J.W. Temperature Setpoint Channal	Stays off.	Same as #27.	Same as 2.1 item #10A.	3.1692	
31A	J.W. Temperature Alarm Channel	Stays on.	Same as #30A.	Same as #30A.	1.3012	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE PAGE: 5

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
31B	J.W. Temperature Alarm Channel	Stays off.	Same as #27.	Same as 2.1 item #10A.	1.3012	
31C	J.W. Temperature Alarm Channel	Alarm signal stays on.	J.W. Temperature Annunciator signal always active.	False J.W. temperature annunciator.	0.8675	
31D	J.W. Temperature Alarm Channel	Alarm signal stays off.	J.W. Temperature Annunciator signal never active.	Lose J.W. temperature annunciator.	0.8675	
32A	J.W. Temperature L.R.	Stays high.	Same as #30A.	Same as #30A.	0.3292	
32B	J.W. Temperature L.R.	Stays low.	Same as #27.	Same as 2.1 item #10A.	0.3292	
33	Inj. Coolant Pressure Sensor	Lose output.	Lose Inj. Coolant Pressure signal.	Same as 2.1 item #10A.	2.9000	
34A	Inj. Coolant Pressure Alarm Channel	Stays on.	Inj. coolant pressure always appears normal.	Lose engine start inhibit if inj. coolant pressure not normal.	1.3012	
34B	Inj. Coolant Pressure Alarm Channel	Stays off.	Same as #33.	Same as 2.1 item #10A.	1.3012	
34C	Inj. Coolant Pressure Alarm	Alarm signal stays on.	Inj. Coolant Pressure Annunciator signal always active.	False inj. coolant pressure annunciator.	0.8675	
34D	Inj. Coolant Pressure Alarm	Alarm signal stays off.	Inj. Coolant Pressure Annunciator signal never active.	Lose inj. coolant pressure annunciator.	0.8675	
35A	Inj. Coolant Pressure L.R.	Stays high.	Same as #34A.	Same as #34A.	0.3292	
35B	Inj. Coolant Pressure L.R.	Stays low.	Same as #33.	Same as 2.1 item #10A.	0.3292	
36	Inj. Coolant Temperature Sensor	Lose output.	Lose Inj. Coolant Temperature signal.	Same as #39A below.	75.98	
37	Inj. Coolant Temperature Signal Conditioning	Lose output.	Same as #36.	Same as #39A below.	7.6176	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10^6 HRS.	COMMENTS INDEX
38	Inj. Coolant Temperature Gauge	Meter fails.	Inj. coolant temperature gauge reading wrong.	Lose manual-visual inj. coolant temperature indicator.	10	
39A	Inj. Coolant Temperature Setpoint Channel	Stays on.	Inj. coolant temperature always appears normal	Lose engine start inhibit if inj. coolant temperature not normal.	3.1692	
39B	Inj. Coolant Temperature Setpoint Channel	Stays off.	Same as #36.	Same as 2.1 item #10A.	3.1692	
40A	Inj. Coolant Temperature Alarm Channel	Stays on.	Same as #39A.	Same as #39A.	1.3012	
40B	Inj. Coolant Temperature Alarm Channel	Stays off.	Same as #36.	Same as 2.1 item #10A.	1.3012	
40C	Inj. Coolant Temperature Alarm Channel	Alarm signal stays on.	Inj. Coolant Temperature Annunciator signal stays active.	False inj. coolant temperature annunciator.	0.8675	
40D	Inj. Coolant Temperature Alarm Channel	Alarm signal stays off.	Inj. Coolant Temperature Annunciator signal never active.	Lose inj. coolant temperature annunciator.	0.8675	
41A	Inj. Coolant Temperature L.R.	Stays high.	Same as #39A.	Same as #39A.	0.3292	
41B	Inj. Coolant Temperature L.R.	Stays low.	Same as #36.	Same as 2.1 item #10A.	0.3292	
42	Reduction Gear L.O. Pressure Sensor	Lose output.	Lose Reduction Gear L.O. Pressure signal.	Same as 2.1 item #10A.	4.9000	
43A	Reduction Gear L.O. Pressure Alarm Channel	Stays on.	Reduction gear L.O. pressure always appears normal.	Lose engine start inhibit if reduction gear L.O. pressure not normal.	1.3012	
43B	Reduction Gear L.O. Pressure Alarm Channel	Stays off.	Same as #42.	Same as 2.1 item #10A.	1.3012	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
43C	Reduction Gear L.O. Pressure Alarm Channel	Alarm signal stays on.	Reduction gear L.O. pressure annunciator signal always active.	False reduction gear L.O. pressure annunciator.	0.8675	
43D	Reduction Gear L.O. Pressure Alarm Channel	Alarm signal stays off.	Reduction gear L.O. pressure annunciator never active.	Lose reduction gear L.O. annunciator.	0.8675	
44A	Reduction Gear L.O. Pressure L.R.	Stays high.	Same as #42.	Same as 2.1 item #10A.	0.3292	
44B	Reduction Gear L.O. Pressure L.R.	Stays low.	Same as #43A.	Same as #43A.	0.3292	
45	Shutdown Override PB	Fails open.	Shutdown override signal never active.	Lose capability for manually overriding an auto engine shutdown.	0.4600	
46A	Shutdown Override L.R.	Stays high.	Same as #45.	Same as #45.	0.3292	
46B	Shutdown Override L.R.	Stays low.	Shutdown override signal always active.	No effect--normal operation.	0.3292	
47	Propeller Hydraulic Pressure Signal Pressure Sensor	Fails open.	Propeller hydraulic pressure always appears adequate.	Lose inhibit against engaging clutch if propeller hydraulic pressure not adequate.	8.6603	
48A	Propeller Hydraulic Pressure Signal Pressure Sensor	Stays on.	Propeller hydraulic pressure never appears adequate.	Same as 2.1 item #21A.	1.3012	
48B	Propeller Hydraulic Pressure Signal Pressure Sensor	Stays off.	Same as #47.	Same as #47.	1.3012	
48C	Propeller Hydraulic Pressure Signal Pressure	Alarm signal stays on.	Propeller hydraulic pressure not adequate annunciator signal stays active.	False propeller hydraulic pressurh not adequte annunciator.	0.8675	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE PAGE: 8

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10^6 HRS.	COMMENTS INDEX
48D	Propeller Hydraulic Pressure Signal Pressure	Alarm signal stays off.	Propeller hydraulic pressure not adequate annunciator signal never active.	Lose propeller hydraulic pressure not adequate annunciator.	0.8675	
49	Shutdown Reset PB	Fails open.	Shutdown reset latch would stay reset following an engine shutdown.	Same as 2.1 item #7A.	0.4600	
50A	Shutdown Reset L.R.	Stays high.	Lose shutdown reset PB function.	Same as 2.1 item #7A.	0.3292	
50B	Shutdown Reset L.R.	Stays low.	Shutdown reset P.B. always appears depressed.	Lose inhibit against starting engine if shutdown condition exists.	0.3292	
51	Emergency Stop P.B.	Fails open.	Lose emergency stop P.B. switch function.	Engine could not be stopped via emergency stop P.B. switch.	0.4600	
52A	Emergency Stop P.B. L.R.	Stays high.	Same as #51.	Same as #51.	0.3292	
52B	Emergency Stop P.B. L.R.	Stays high.	Emergency stop P.B. always appears depressed.	Same as 2.1 item #8A.	0.3292	
53	Engine Brg. Gear Engaged Sensor	Fails open.	Engine brg. gear appears engaged.	Same as 2.1 item #2A.	2.9000	
54A	Engine Brg. Gear Engaged L.R.	Stays high.	Engine brg. gear never appears engaged.	Lose inhibit against starting engine when engine brg. gear engaged.	0.3292	
54B	Engine Brg. Gear Engaged L.R.	Stays low.	Same as #53.	Same as 2.1 item #2A.	0.3292	
55	Engine Overspeed Sensor	Fails open.	Overspeed condition appears to exist.	Same as 2.1 item #9A.	2.9000	
56A	Engine Overspeed L.R.	Stays high.	Engine overspeed signal never active.	Lose engine shutdown on overspeed.	0.3292	
56B	Engine Overspeed L.R.	Stays low.	Same as #55.	Same as 2.1 item #9A.	0.3292	
57A	Engine Overspeed Alarm Channel	Alarm signal stays on.	Engine Overspeed Annunciator signal stays active.	False engine overspeed annunciator.	4.3374	
57B	Engine Overspeed Alarm Channel	Alarm signal stays off.	Engine Overspeed Annunciator signal never active.	Lose engine overspeed annunciator.	4.3374	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE PAGE: 9

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
58	Reduction Gear Barring Gear Engaged Sensor	Faile open.	Reduction gear barring gear appears engaged.	Same as 2.1 item #21A.	2.9000	
59A	Reduction Gear Barring Gear L.R.	Stays high.	Reduction gear barring gear never appears engaged.	Lose inhibit against engaging clutch if reduction gear barring gear is engaged.	0.3292	
59B	Reduction Gear Barring Gear L.R.	Stays low.	Same as #58.	Same as 2.1 item #21A.	0.3292	
60	Clutch Engaged Sensor	Fails open.	Clutch always appear engaged.	Engine could not be started; also lose inhibit against energizing E/P relay if clutch is not engaged.	2.9000	
61A	Clutch Engaged L.R.	Stays high.	Same as #60.	Same as #60.	0.3292	
61B	Clutch Engaged L.R.	Stays low.	Clutch never appears engaged.	Same as 2.1 item #31A.	0.3292	
62	Engine Start P.B.	Fails open.	Engine start P.B. never appears depressed.	Same as 2.1 item #2A.	0.4600	
63A	Engine Start P.B. L.R.	Stays high.	Engine start P.B. always appears depressed.	Engine would start erroneously whenever start permissives met (e.g., L.O. pressure normal, clutch not engaged, et	0.3292	
63B	Engine Start P.B. L.R.	Stays low.	Same as #62.	Same as 2.1 item #2A.	0.3292	
64	Engine Stop P.B.	Fails open.	Engine stop P.B. always appears depressed.	Same as 2.1 item #9A.	0.4600	
65A	Engine Stop P.B. L. R.	Stays high.	Engine stop P.B. never appears depressed.	Same as 2.1 item #9A	0.3292	
65B	Engine Stop P.B. L.R.	Stays low.	Same as #64.	Same as 2.1 item #9A.	0.3292	
66	ER Clutch Disengage PB	Fails open.	ER clutch disengage PB never appears depressed.	Same as 2.1 item #17B.	0.4600	
67A	ER Clutch Disengage PB L.R.	Stays high.	ER clutch disengage PB always appears depressed.	Clutch would disengage whenever ER in control.	0.3292	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.2 ENGINE AND CLUTCH CONTROL INPUT INTERFACE PAGE: 10

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
67B	ER Clutch Disengage PB L.R.	Stays low.	Same as #66.	Same as 2.1 item #17B.	0.3292	
68	Bridge Clutch Disengage PB	Fails open.	Bridge clutch disengage PB never appears depressed.	Same as 2.1 item #16B.	0.4600	
69A	Bridge Clutch Disengage PB L.R.	Stays high.	Bridge clutch disengage PB always appears depressed.	Clutch would disengage whenever bridge in control.	0.3292	
69B	Bridge Clutch Disengage PB L.R.	Stays low.	Same as #68.	Same as 2.1 item #16B.	0.3292	
70	ER Clutch Engage PB	Fails open.	ER clutch engage PB never appears depressed.	Same as 2.1 item #19B.	0.4600	
71A	ER Clutch Engage PB LR	Stays high.	ER clutch engage PB always appears depressed.	Clutch would engage whenever ER in control.	0.3292	
71B	ER Clutch Engage PB LR	Stays low.	Same as #70.	Same as 2.1 item #19B.	0.3292	
72	Bridge Clutch Engage PB	Fails open.	Bridge clutch engage PB never appears depressed.	Same as 2.1 item #20B.	0.4600	
73A	Bridge Clutch Engage PB L.R.	Stays high.	Bridge clutch engage PB always appears depressed.	Clutch would engage whenever bridge in control.	0.3292	
73B	Bridge Clutch Engage PB L.R.	Stays low.	Same as #72.	Same as 2.1 item #20B.	0.3292	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.3 ENGINE AND CLUTCH CONTROL OUTPUT INTERFACE PAGE: 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Engine Start Relay Driver	Stays on.	Same as 2.1 item #4A.	Same as 2.1 item #4A	0.4400	
1B	Engine Start Relay Driver	Stays off.	Same as 2.1 item #2A.	Same as 2.1 item #2A.	0.4400	
2A	Engine Start Relay	Contact Sticks open.	Same as 2.1 item #4A.	Same as 2.1 item #4A.	0.5300	
2B	Engine Start Relay	Contact Sticks closed.	Same as 2.1 item #2A.	Same as 2.1 item #2A.	0.5300	
3A	Engine Start Solenoid	Fails open.	Same as 2.1 item #4A.	Same as 2.1 item #4A.	19.2050	
3B	Engine Start Solenoid	Fails closed.	Same as 2.1 item #2A.	Same as 2.1 item #2A.	19.2050	
4A	Engine Stop Relay Driver	Stays on.	Same as 2.1 item #9A.	Same as 2.1 item #9A.	0.4400	
4B	Engine Stop Relay Driver	Stays off.	Same as 2.1 item #9B.	Same as 2.1 item #9B.	0.4400	
5A	Engine Stop Relay	Contact Sticks open.	Same as 2.1 item #9B.	Same as 2.1 item #9B.	0.5300	
5B	Engine Stop Relay	Contact Sticks closed.	Same as 2.1 item #9A.	Same as 2.1 item #9A.	0.5300	
6A	Engine Stop Solenoid	Fails open.	Same as 2.1 item #9A.	Same as 2.1 item #9A.	19.2050	
6B	Engine Stop Solenoid	Fails closed.	Same as 2.1 item #9B.	Same as 2.1 item #9B.	19.2050	
7A	Emergency Stop Relay Driver	Stays on.	Same as 2.1 item #11B.	Same as 2.1 item #9A.	0.4400	
7B	Emergency Stop Relay Driver	Stays off.	Same as 2.1 items #8B and #10B.	Same as 2.1 item #12B.	0.4400	
8A	Emergency Stop Relay	Contact Sticks open.	Same as 2.1 items #8B and #10B.	Same as 2.1 item #12B.	0.5300	
8B	Emergency Stop Relay	Contact Sticks closed.	Same as 2.1 item #11B.	Same as 2.1 item #9A.	0.5300	
			Engine shutdown alarm signal	False engine shutdown alarm.	1.6535	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 2.3 ENGINE AND CLUTCH CONTROL OUTPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
9B	Engine Shutdown Alarm	Stays off.	Engine shutdown alarm signal never active.	Lose engine shutdown alarm.	1.6535	
10A	Clutch Relay Driver	Stays on.	Same as 2.1 item #33B.	Same as 2.1 item #14A.	1.6535	
10B	Clutch Relay Driver	Stays off.	Same as 2.1 item #33A.	Same as 2.1 item #13B.	1.6535	
11A	Clutch Relay	Contact Sticks open.	Same as 2.1 item #33A.	Same as 2.1 item #13B.	0.5300	
11B	Clutch Relay	Contact Sticks closed.	Same as 2.1 item #33B.	Same as 2.1 item #14A.	0.5300	
12A	Shutdown Reset Relay Driver	Stays on.	Shutdown reset lamp signal stays active.	Shutdown reset lamp stays lit.	0.4400	
12B	Shutdown Reset Relay Driver	Stays off.	Shutdown reset lamp signal never active.	Shutdown reset lamp never lights.	0.4400	
13A	Reduction Gear Brg. Gear Engaged Relay Driver	Stays on.	Reduction gear brg. gear engaged lamp signal stays active.	Reduction gear brg. gear engaged lamp stays lit.	0.4400	
13B	Reduction Gear Brg. Gear Engaged Relay Driver	Stay off.	Reduction gear brg. gear engaged lamp signal never active.	Reduction gear brg. gear engaged lamp never lights.	0.4400	
14A	Reduction Gear Brg. Gear Engaged Alarm	Stays on.	Reduction gear brg. gear engaged alarm signal stays active.	False reduction gear brg. gear engaged alarm.	1.6535	
14B	Reduction Gear Brg. Gear Engaged Alarm	Stays off.	Reduction gear brg. gear engaged alarm signal never active.	Lose reduction gear brg. gear engaged alarm.	1.6535	
15A	Clutch Fill Solenoid	Stays open.	Same as 2.1 item #33B.	Same as 2.1 item #14A.	19.2050	
15B	Clutch Fill Solenoid	Stays closed.	Same as 2.1 item #33A.	Same as 2.1 item #13B.	19.2050	
16A	Engine Brg. Gear Engaged Alarm	Stays on.	Engine Brg. Gear Engaged Lamp signal stays active.	Engine brg. gear engaged lamp stays lit.	1.6535	
16B	Engine Brg. Gear Engaged Alarm	Stays off.	Engine Brg. Gear Engaged Lamp signal never active.	Engine brg. gear engaged lamp never lights.	1.6535	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 2.3 ENGINE AND CLUTCH CONTROL OUTPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
17A	Clutch Engaged Relay Driver	Stays on.	Clutch Engaged Lamp signal stays active.	Clutch engaged lamp stays lit.	0.4400	
17B	Clutch Engaged Relay Driver	Stays off.	Clutch Engaged Lamp signal never active.	Clutch engageed lamp never lights.	0.4400	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.1 MODE CONTROL LOGIC PAGE: 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Filter Capacitors	Fail open.	No effect (some EMI filtering capability would be lost).	No effect.	0.1988	
1B	Filter Capacitors	Fail short.	Power supply to all cards shorted to ground.	Same as FMEA 1.1 item #1B.	0.8630	
2A	Maneuver IPB Gate	Stays high.	Auto/split mode latch stays/ reset; also, cruise/maneuver latch stays set whenever SDG not on.	Split mode (manual) operation not possible. Lose all speed control at time of failure if split mode had been in effect. (Vessel could speed up or slow down.) .	0.1052	
2B	Maneuver IPB Gate	Stays low.	Lose maneuver mode select signal.	Maneuver mode could not be selected.	0.1052	
3A	Cruise/Maneuver Latch	Stay set.	Maneuver mode always selected.	Lose auto and manual cruise mode. Lose all speed control at time of failure if cruise mode had been in effect (vessel could speed up or slow down).	0.3935	
3B	Cruise/Maneuver Latch	Stays reset.	Cruise mode always selected.	Lose auto and manual maneuver mode. Lose all speed control at time of failure if maneuver mode had been in effect (vessel could speed up or slow down).	0.3935	
4A	SDG CB Input Circuit	Output stays high.	Cruise/maneuver latch would not be reset at initialize when SDG on line.	At ERC power turn-on, the system could come up in either the cruise or maneuver mode randomly. Loss of speed control could occur at time of failure (vessel could speed up or slow down).	0.1766	
4B	SDG CB Input Circuit	Output stays low.	Cruise/maneuver latch and auto/ split mode latch would stay reset.	Auto cruise mode always selected. Lose all speed control at time of failure if non-auto cruise mode had been in effect (vessel could speed up or slowdown).	0.1766	
5A	Latch Reset Circuit	Output stays high.	Latches could not be reset to auto cruise mode.	Lose ability to select auto cruise mode. Lose speed control if this mode selected (vessel could slow down or speed up).	0.1916	
5B	Latch Reset Circuit	Output stays low.	Same as #4B.	Same as #4B.	0.1916	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.1 MODE CONTROL LOGIC PAGE: 2

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
6A	Split IPB Input Circuit	Stays high.	Lose split IPB function.	Split mode (manual) could not be selected. Lose speed control if this mode selected (vessel could slowdown or speed up).	0.1052	
6B	Split IPB Input Circuit	Stays low.	Split IPB always appears depressed.	Split mode (manual) always selected. Lose all speed control at time of failure if non-split mode had been selected. (Vessel could slowdown or speed up.)	0.1052	
7A	Maneuver PB Reset Signal	Stays high.	Auto/split mode latch could not be reset by maneuver IPB.	Auto maneuver mode could not be selected. Lose speed control if this mode selected (vessel could slowdown or speed up).	0.0714	
7B	Maneuver PB Reset Signal	Stays low.	Auto/split mode latch stays reset.	Same as #2A.	0.0714	
8A	Auto/Split Mode Latch	Stays set.	Split mode always selected.	Same as #6B.	0.2883	
8B	Auto/Split Mode Latch	Stays reset.	Auto mode always selected.	Auto mode always selected. Lose all speed control at time of failure if non-auto mode had been in effect (vessel could slowdown or speed up).	0.2883	
9A	SDG On-Line Lamp Circuit	Blink enable stays active.	SDG not-on-line blink gate stays enabled.	False SDG not-on-line blinking lamp.	0.2945	
9B	SDG On-Line Lamp Circuit	Blink signal never active.	SDG not-on-line blink signal inhibited.	SDG not-on-line lamp lights steady when it should blink.	0.2209	
9C	SDG On-Line Lamp Circuit	Lamp signal stays active.	SDG not-on-line lamp signal stays active.	False SDG not-on-line steady lamp.	0.2209	
9D	SDG On-Line Lamp Circuit	Lamp signal never active.	SDG not-on-line lamp signal never active.	Lose SDG not-on-line lamp.	0.7362	
10A	Manual* Output	Stays high.	Auto-manual signal to pitch controller never active.	Same as 4.1 (Pitch Controller) FMEA item #3A.	0.1004	
10B	Manual* Output	Stays low.	Auto-manual signal to pitch controller always active.	Same as 4.1 (Pitch Controller) FMEA item #3B.	0.1004	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 3.1 MODE CONTROL LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
11A	Cruise* Output	Stays high.	Lose signal to bridge and ER cruise mode lamps.	Bridge and ER cruise mode lamps would not light.	0.1004	
11B	Cruise* Output	Stays low.	Bridge and ER cruise mode lamp signal stays active.	False bridge and ER cruise mode lamp indications.	0.1004	
12A	Port Idle Latch	Stays set.	E/P relay signals always inhibited.	E/P relays could not be energized--lose vessel propulsion.	0.2883	
12B	Port Idle Latch	Stays reset.	Port idle always inhibited.	Lose port idle function.	0.2883	
13A	Port Idle Latch Input	Stays high.	Port idle latch could not be set.	Same as #12B.	0.1004	
13B	Port Idle Latch Input	Stays low.	Port idle latch stays set--same as #12A.	Same as #12A.	0.1004	
14A	Port Idle IPB Gate Input	Stays high.	Port idle latch would set whenever SDG CB out and thrust lever at 0	Unselected port idle mode would occur when vessel stopped.	0.1004	
14B	Port Idle IPB Gate Input	Stays low.	Same as #13A.	Same as #12B.	0.1004	
15A	Detent* Output	Stays high.	Thrust control lever never appears at zero.	Same as Pitch Controller FMEA (4.1) item #21A.	0.1004	
15B	Detent* Output	Stays low.	Thrust control lever always appears at zero.	Same as Pitch Controller FMEA (4.1) item #21B.	0.1004	
16A	Speed Match Output	Stays high.	Same as Engine and Clutch Control FMEA (2.1) item #27A.	Same as Engine and Clutch Control FMEA (2.1) item #25B.	0.1004	
16B	Speed Match Output	Stays low.	Lose speed match enable for clutch engage when other clutch already engage.	If other clutch engaged, clutch could be engaged when speed did not match--major damage possible.		
17A	Two Engine On-Line Output	Stays high.	Both clutches always appear engaged (Relay 9 stays energized); 2-engine function gen would be switched in when only 1 engine on-line.	No effect if both engines on line. If only one engine on-line, propeller pitch control would be incorrect. Vessel speed would be lower than commanded.	0.1004	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 5.1 MODE CONTROL LOGIC PAGE: 4

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10^6 HRS.	COMMENTS INDEX
17B	Two Engine On-Line Output	Stays low.	Only 1 clutch always appears engaged (Relay 9 stays de-energized). 1-engine function gen. would be switched in when both engines on line.	No effect if 1 engine on line. If 2 engines on line, propeller pitch control would be incorrect. Vessel speed would be higher than commanded.	0.1004	
18A	Cruise Speed Summing Amp	Output too high.	In auto-cruise mode, P. SRC input too high.	In auto cruise mode, false full speed commands would occur.	1.4728	
18B	Cruise Speed Summing Amp	Output too low.	In auto-cruise mode, P. SRC input too low.	In auto cruise mode, false engine idle commands would occur.	1.4728	
19	Split PRM Resistor	Fails open.	Lose input signal from split RPM pot (signal opens). In split mode, P. SRC input stays too low.	In split mode, vessel would stop and speed changes via split RPM pot not possible. Other speed control modes not effected.	0.0058	
20	Trim RPM Resistor	Fails open.	Lose input signal from cruise trim RPM pot (signal opens). In cruise mode, cruise speed trim input incorrect.	In cruise mode, vessel would go slower than commanded (shaft RPM would drop).	0.0126	
21A	Speed Fail Enable	Output stays high.	Speed fail circuit always enabled.	Nuisance speed fail alarms when propulsion system not in use.	0.2008	
21B	Speed Fail Enable	Output stays low.	Speed fail circuit never enabled.	Lose speed fail alarm.	0.2008	
22A	Energize S. E/P Relay Output	Stays high.	Starboard E/P relay stays energized.	Starboard engine governor stays activated; no effect if starboard engine in use. If not in use, engine "speed-up" command would occur erroneously.	0.1004	
22B	Energize S. E/P Relay Output	Stays low.	Starboard E/P relay stays de-energized.	Starboard engine governor never activated; lose starboard engine control via automation. Engine load-sharing system would control governer.	0.1004	
23A	Energize P. E/P Relay Output	Stays high.	Port E/P relay stays energized.	Same as #22A except for port engine.	0.1004	
23B	Energize P. E/P Relay Output	Stays low.	Port E/P relay stays de-energize.	Same as #22B except for port engine.	0.1004	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA

SHIP: SHIP C

SUBSYSTEM: 3.1 MODE CONTROL LOGIC

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
24A	Port SRC Circuit	Output too high.	Slow rate controller signal to port engine governor and to speed fail comparator too high.	Uncommanded speed increase of Port Engine. If non-failed, speed fail alarm would occur.	3.2083	
24B	Port SRC Circuit	Output too low.	Slow rate controller signal to port engine governor and to speed fail comparator too low.	Uncommanded speed decrease of Port Engine.	3.2083	
25A	Starboard SRC Circuit	Output too high.	Same as #24A except for starboard engine.	Same as #24A except for starboard engine.	3.2083	
25B	Starboard SRC Circuit	Output too low.	Same as #24B except for starboard engine.	Same as #24B except for starboard engine.	3.2083	
26	Scaled E/P Circuit	Any.	Commanded shaft speed signal to speed fail comparator circuit would be incorrect.	False speed fail alarms in ER and control fial alarms on bridge.	2.8560	
27A	Speed Fail Circuit	Output stays high.	Lose speed fail signal.	Lose speed fail alarm in ER and control fail alarm on bridge.	1.7232	
27B	Speed Fail Circuit	Output stays low.	Speed fail signal always appears active.	Same as #26.	1.7232	
28A	Control Fail* Output	Output stays high.	Control Fail signal to bridge alarm never active.	Lose control fail bridge alarm.	0.1673	
28B	Control Fail* Output	Output stays low.	Control Fail signal to bridge always active.	False control fail alarm on bridge.	0.1673	
29	Split Pot Buffer	Any.	Incorrect slow rate controller input in split mode.	In split mode, speed changes via split pot not possible and speed would be different than commanded. Other modes not effected.	2.8519	
30	ER Thrust Lever Pot Resistors	Fail open.	Lose signal from ER thrust lever (signal opens).	Thrust during maneuvering could not be controlled from the ER. If ER in control of maneuvering thrust at time of failure, all control would be lost, and pitch command would go to zero, causing vessel to stop.	0.0234	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP 1 SUBSYSTEM: 3.1 MODE CONTROL LOGIC PAGE: 6

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
31	Bridge Thrust Lever Pot Resistors	Fail open.	Lose signal from bridge thrust lever (signal opens).	Thrust during maneuvering could not be controlled from bridge. If bridge in control of maneuvering thrust at time of failure, all control would be lost, and pitch command would go to zero, causing vessel to stop.	0.0234	
32A	ER Throttle Control Pot Buffer	Output too high.	Signal from ER throttle lever too high (maneuvering mode).	Uncommand vessel speed increases when ER in control.	1.9147	
32B	ER Throttle Control Pot Buffer	Output too low.	Signal from ER throttle lever too low (maneuvering mode).	Uncommanded vessel speed decreases when ER in control; vessel would coast to a stop.	1.9147	
33	ER Throttle Position Meter Output	Any.	Signal to ER throttle position meter incorrect.	ER throttle position meter incorrect.	1.7892	
34A	Bridge Throttle Control Pot Buffer	Output too high.	Same as #32A except for bridge throttle lever.	Same as #32A except for bridge throttle lever.	1.9147	
34B	Bridge Throttle Control Pot Buffer	Output too low.	Same as #32B except for bridge throttle lever.	Same as #32B except for bridge throttle lever.	1.9147	
35	Bridge Throttle Position Meter Output	Any.	Signal to bridge throttle position meter incorrect	Bridge throttle position meter incorrect.	1.7892	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.2 MODE CONTROL INPUT INTERFACE PAGE: 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1	Bridge Port Idle IPB	Fail open.	Lose Bridge Port Idle PB function.	Port Idle could not be commanded from the bridge.	0.4600	
2A	Bridge Port Idle L.R.	Stays high.	Same as #1.	Same as #1.	0.4591	
2B	Bridge Port Idle L.R.	Stays low.	Same as Mode Control Logic FMEA (3.1) item #14A.	Same as Mode Control Logic FMEA (311) item #14A.	0.4591	
3	ER Port Idle PB	Fail open.	Lose ER Port Idle PB function.	Port Idle could not be commanded from ER.	0.4600	
4A	ER Port Idle L.R.	Stays high.	Same as #3.	Same as #3.	0.4591	
4B	ER Port Idle L.R.	Stays low.	Same as Mode Control Logic FMEA (3.1) item #14A.	Same as Mode Control Logic FMEA (3.1) item #14A.	0.4591	
5	Cruise Mode IPB	Fails open.	Lose cruise mode PB function-- same as Mode Control Logic FMEA (3.1) item #5A.	Same as Mode Control Logic FMEA (3.1) item #5A.	0.4600	
6A	Cruise Mode L.R.	Stays high.	Same as #5.	Same as Mode Control Logic FMEA (3.1) item #5A.	0.4591	
6B	Cruise Mode L.R.	Stays low.	Same as Mode Control Logic FMEA (3.1) item #4B.	Same as Mode Control Logic FMEA (3.1) item #4B.	0.4591	
7	Maneuver Mode IPB	Fails open.	Same as Mode Control Logic FMEA (3.1) item #2B.	Same as Mode Control Logic FMEA (3.1) item #2B.	0.4600	
8A	Maneuver Mode L.R.	Stays high.	Same as Mode Control Logic FMEA (3.1) item #2B.	Same as Mode Control Logic FMEA (3.1) item #2B.	0.4591	
8B	Maneuver Mode L.R.	Stays low.	Same as Mode Control Logic FMEA (3.1) item #2A.	Same as Mode Control Logic FMEA (3.1) item #2A.	0.4591	
9	Split Mode IPB	Fails open.	Same as Mode Control Logic FMEA (3.1) item #6A.	Same as Mode Control Logic FMEA (3.1) item #6A.	0.4600	
10A	Split Mode L.R.	Stays high.	Same as Mode Control Logic FMEA (3.1) item #6B.	Same as Mode Control Logic FMEA (3.1) item #6B.	0.4591	
10B	Split Mode L.R.	Stays low.	Same as Mode Control Logic FMEA (3.1) item #6A.	Same as Mode Control Logic FMEA (3.1) item #6A.	0.4591	
11	SDG CB Cls Signal	Fails open.	Same as #12B.	Same as #12B.	0.4600	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.2 MODE CONTROL INPUT INTERFACE PAGE: 2

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE'S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
12A	SDG CB LR	Stays high.	SDG never appears on-line.	Loss inhibit against applying propulsive thrust if shaft driven generator is on-line.	0.4591	
12B	SDG CB LR	Stays low.	SDG always appears on-line.	Only cruise mode could be selected loss all other modes.	0.4591	
13	SDG Clutch Engage Signal	Fails open.	SDG clutch never appears disengaged--same as Mode Control Logic (3.1) FMEA item #9D.	Same as Mode Control Logic FMEA (3.1) item #9D.	0.4600	
14A	SDG Clutch L.R.	Stays low.	Same as #13.	Same as Mode Control Logic FMEA (3.1) item #9D.	0.4591	
14B	SDG Clutch L.R.	Stays high.	SDG clutch never appears engaged--same as Mode Control Logic FMEA (3.1) item #9C.	Same as Mode Control Logic FMEA (3.1) item #9C.	0.4591	
15A	Ahead L.R.	Stays high.	Thrust levers never appear set to ahead. Detent signal would go active when thrust control not at zero.	Auto pitch control would be disabled when Thrust Lever at astern.	0.4591	
15B	Ahead L.R.	Stays low.	Thrust level always appears set to ahead; detent signal never active (Detent* stays high). Same as Mode Control Logic FMEA (3.1) item #15A.	Same as Mode Control Logic FMEA (3.1) item #15A.	0.4591	
16A	Astern L.R.	Stays high.	Thrust levers never appear set to astern; detent signal would go active when thrust control not at zero.	Auto pitch control would be disabled when thrust level set to astern.	0.4591	
16B	Astern L.R.	Stays low.	Same as #15B except thrust lever always appears set to astern.	Same as Mode Control Logic FMEA (3.1) item #15A.	0.4591	
17A	ER Throttle Lever AH/AS Contacts	AH contact stays open.	Same as #15A when ER in control; no effect when bridge in control.	Same as #15A when ER in control; no effect when bridge in control.	1.4500	
17B	ER Throttle Lever AH/AS Contacts	AS contact stays open.	Same as #16A when ER in control; no effect when bridge in control.	Same as #16A when ER in control; no effect when bridge in control.	1.4500	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 3.2 MODE CONTROL INPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 1086 HRS.	COMMENTS INDEX
18A	Bridge Throttle Lever, AH/AS Contacts	AH contact stays open.	Same as #15A when bridge in control; no effect when ER in control.	Same as #15A when bridge in control; no effect when ER in control.	1.4500	
18B	Bridge Throttle Lever, AH/AS Contacts	AS contact stays open.	Same as #16A when bridge in control; no effect when ER in control.	Same as #16A when bridge in control; no effect when ER in control.	1.4500	
19A	AH/AS Relay	ER AH contact stays open.	Same as #17A.	Same as #17A.	0.2650	
19B	AH/AS Relay	ER AS contact stays open.	Same as #17B.	Same as #17B.	0.2650	
19C	AH/AS Relay	Bridge AH contact stays open.	Same as #18A.	Same as #18A.	0.2650	
19D	AH/AS Relay	Bridge AS contact stays open.	Same as #18B.	Same as #18B.	0.2650	
20	Bridge Throttle Lever	Any.	Same as Mode Control Logic FMEA (3.1) item #31.	Same as Mode Control Logic FMEA (3.1) item #31.	0.9650	
21	ER Throttle Lever	Any.	Same as Mode Control Logic FMEA (3.1) item #30.	Same as Mode Control Logic FMEA (3.1) item #30.	0.9660	
22	ER Trim RPM Lever	Any.	Same as Mode Control Logic FMEA (3.1) item #20.	Same as Mode Control Logic FMEA (3.1) item #20.	0.9660	
23	ER Split RPM Lever	Any.	Same as Mode Control Logic FMEA (3.1) item #19.	Same as Mode Control Logic FMEA (3.1) item #19.	0.9660	
24	Prop Shaft RPM Tach-Generator	Lose output.	Same as Mode Control Logic FMEA (3.1) item #27B.	Same as Mode Control Logic FMEA (3.1) item #26.	19.4800	
25A	Speed Fail #1 Setpoint	Output stays high.	Same as Mode Control Logic FMEA (3.1) item #27A.	Same as Mode Control Logic FMEA (3.1) item #27A.	3.0628	
25B	Speed Fail #1 Setpoint	Output stays low.	Same as Mode Control Logic FMEA (3.1) item #27B.	Same as Mode Control Logic FMEA (3.1) item #27B.	3.0628	
26A	Speed Fail #2 Setpoint	Output stays high.	Same as Mode Control Logic FMEA (3.1) item #27A.	Same as Mode Control Logic FMEA (3.1) item #27A.	3.0628	
26B	Speed Fail #2 Setpoint	Output stays low.	Same as Mode Control Logic FMEA (3.1) item #27B.	Same as Mode Control Logic FMEA (3.1) item #27B.	3.0628	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE PAGE 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Speed Fail Alarm	Alarm signal stays on.	ERC speed fail alarm signal stays active.	False ERC speed fail alarm.	0.5609	
1B	Speed Fail Alarm	Alarm signal stays off.	ERC speed fail alarm signal never active.	Lose ERC speed fail alarm	0.6609	
1C	Speed Fail Alarm	Non-alarm portion fails.	No effect.	No effect.	1.9827	
2A	Control Fail Alarm	Alarm signal stays on.	Bridge control fail alarm signal stays active.	False bridge control fail alarm	0.6609	
2B	Control Fail Alarm	Alarm signal stays off.	Bridge control fail alarm signal never active.	Lose bridge control fail alarm.	0.6609	
2C	Control Fail Alarm	Non-alarm portion fails.	No effect.	No effect.	1.9827	
3A	Cruise Mode Lamp Relay Driver	Stays on.	Bridge and ERC cruise mode lamp signal stays active.	False bridge and ERC cruise mode lamp indications; could create confusion.	0.4400	
3B	Cruise Mode Lamp Relay Driver	Stays off.	Bridge and ERC cruise mode lamp signal never active.	Lose bridge and ERC cruise mode lamp indications; could create confusion.	0.4400	
4A	Maneuver Mode Lamp Relay Driver	Stays on.	Bridge and ERC maneuver mode lamp signal stays active.	False bridge and ERC maneuver mode lamp indications; could create confusion.	0.4400	
4B	Maneuver Mode Lamp Relay Driver	Stays off.	Bridge and ERC maneuver mode lamp signal never active.	Lose bridge and ERC maneuver mode lamp indications; could create confusion.	0.4400	
5A	Split Mode Lamp Relay Driver	Stays on.	Bridge and ERC split mode lamp signal stays active.	False bridge and ERC split mode lamp indications; could create confusion.	0.4400	
5B	Split Mode Lamp Relay Driver	Stays off.	Bridge and ERC split mode lamp signal never active	Lose bridge and ERC split mode lamp indications; could create confusion.	0.4400	
6A	SDC Status Relay Driver	Stays on.	Same as Mode Control Logic (3.1) FMEA item #9C.	Same as Mode Control Logic (3.1) FMEA item #9c.	0.4400	
6B	SDC Status Relay Driver	Stays off.	Same as Mode Control Logic (3.1) FMEA item #9D.	Same as Mode Control Logic (3.1) FMEA item #9D.	0.4400	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE PAGE 2

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
7A	SDG Status Timer	Output stays high.	Same as Mode Control Logic (3.1) FMEA item #9C.	Same as Mode Control Logic (3.1) FMEA item #9C.	1.5	
7B	SDG Status Timer	Output stays low.	Same as Mode Control Logic (3.1) FMEA item #9D.	Same as Mode Control Logic (3.1) FMEA item #9D.	1.5	
8A	SDG On-Line Alarm	Alarm signal stays on.	Same as Mode Control Logic (3.1) FMEA item #9C.	Same as Mode Control Logic (3.1) FMEA item #9C.	0.6609	
8B	SDG On-Line Alarm	Alarm signal stays off.	Same as Mode Control Logic (3.1) FMEA item #9D.	Same as Mode Control Logic (3.1) FMEA item #9D.	0.6609	
8C	SDG On-Line Alarm	Non-alarm portion fails.	No effect.	No effect.	1.9827	
9A	SDG On-Line Lamp Relay Driver	Stays on.	Same as Mode Control Logic (3.1) FMEA item #9C.	Same as Mode Control Logic (3.1) FMEA item #9C.	0.4400	
9B	SDG On-Line Lamp Relay Driver	Stays off.	Same as Mode Control Logic (3.1) FMEA item #9D.	Same as Mode Control Logic (3.1) FMEA item #9D.	0.4400	
10	ER Throttle Position Indicator	Any.	ER throttle position indicator reading wrong.	Lose visual ER throttle position indication.	10	
11	Bridge Throttle Position Indicator	Any.	Bridge throttle position indicator reading wrong.	Lose visual bridge throttle position indication.	10	
12A	Engine Speed Function Generator Filter Capacitors	Fail open.	No effect; some EMI filtering would be lost.	No effect.	0.1710	
12B	Engine Speed Function Generator Filter Capacitors	Fail short.	Positive or negative 15 volt supply shorted to ground.	All speed direction control signals would be incorrect but in some indeterminant fashion. Engines would probably go to idle.	0.3286	
13A	Engine Speed Function Generator	Output fails high.	High E/P signal in maneuver mode when either bridge or ER in control.	Both engines would receive max. speed commands in maneuver mode when either bridge or ER in control.	5.8754	
13B	Engine Speed Function Generator	Output fails low.	Lose E/P signal in maneuver mode when either bridge or ER in control.	Both engines would slow down to idle when either bridge or ER in maneuver mode.	5.8754	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
13C	Engine Speed Function Generator	Incorrect function	Incorrect E/P/ signal in maneuver mode when either bridge or ER in control.	Incorrect engine speed commands maneuver mode when either bridge or ER in control. Speed will be somewhat higher and/or lower than commanded.	27.4186	
14A	Cruise Mode/2 Engine Gen Filter Capacitors	Fail open.	No effect; some EMI filtering would be lost.	No effect.	0.1760	
14B	Cruise Mode/2 Engine Gen Filter Capacitors	Fail short.	Same as #12B.	Same as #12B.	0.3286	
15A	Cruise Mode/2 Engine Function Generator	Ahead circuits fail "on."	In two-engine cruise mode, erroneous full ahead command generated.	In two-engine cruis mode, vessel would erroneously go full ahead..	5.8754	
15B	Cruise Mode/2 Engine Function Generator	Astern circuits fail "on."	In two-engine cruise mode, erroneous full astern command generated.	In two engine cruise mode, vessel would erroneously go full astern.	5.8754	
15C	Cruise Mode/2 Engine Function Generator	Ahead circuits incompletely activated.	In two-engine cruise mode, ahead signals would be larger than commanded.	In two-engine cruise mode, ahead speed would be greater than commanded.	5.8754	
15D	Cruise Mode/2 Engine Function Generator	Astern circuits incompletely activated.	In two-engine cruise mode, astern signals would be larger than commanded.	In two-engine cruise mode, astern speed would be greater than commanded.	5.8754	
15E	Cruise Mode/2 Engine Function Generator	Slope of function incorrect.	In two-engine cruise mode, pitch change rates would differ from design rates.	In two-engine cruise mode, pitch changes would occur at a "bumpy" rate.	15.6678	
16A	Maneuver Mode/2 Engine Function Generator Filter Capacitors	Fail open.	No effect; some EMI filtering would be lost.	No effect.	0.1760	
16B	Maneuver Mode/2 Enginge Function Generator Filter Capacitors	Fail short.	Positive or negative 15 volt supply shorted to ground.	All speed/direction control signals would be incrorrect but in some indeterminant fashion. Engines would probably go to idle.	0.3286	
17A	Maneuver Mode/2 Engine Function Generator	Ahead circuits fail "on."	In two-engine maneuver mode, erroneous full ahead command generated.	In two-engine maneuver mode, vessel would erroneously go full ahead.	5.8754	

SHIP: SHIP C

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
17B	Maneuver Mode/2 Engine Function Generator	Astern circuits fail "on."	In two-engine maneuver mode, erroneous full astern command generated.	In two-engine maneuver mode, vessel would erroneously go full astern.	5.8754	
17C	Maneuver Mode/2 Engine Function Generator	Ahead circuits incompletely activated.	In two-engine maneuver mode, ahead signals would be larger than commanded.	In two-engine maneuver mode, ahead speed would be greater than commanded.	5.8754	
17D	Maneuver Mode/2 Engine Function Generator	Astern circuits incompletely activated.	In two-engine maneuver mode, astern signals would be larger than commanded.	In two engine maneuver mode, astern speed would be greater than commanded.	5.8754	
17E	Maneuver Mode/2 Engine Function Generator	Slope of function incorrect.	In two-engine maneuver mode, pitch change rates would differ from design rates.	In two-engine maneuver mode, pitech changes would occur at a "bumpy" rate.	15.6678	
18A	Cruise Mode/1 Engine Function Generator Filter Capacitors	Fail open.	No effect; some EMI filtering would be lost.	No effect.	0.1760	
18B	Cruise Mode/1 Engine Function Generator Filter Capacitors	Fail short.	Same as #12B.	Same as #12B.	0.3286	
19A	Cruise Mode/1 Engine Function Generator	Ahead circuits fail "on."	In one-engine cruise mode, erroneous full ahead command generated.	In one-engine cruise mode, vessel would erroneously go full ahead.	5.8754	
19B	Cruise Mode/1 Engine Function Generator	Astern circuits fail "on."	In one-engine cruise mode, erroneous full astern command generated.	In one-engine cruise mode, vessel would erroneously go full astern.	5.8754	
19C	Cruise Mode/1 Engine Function Generator	Ahead circuits incompletely activated.	In one-engine cruise mode, ahead signals would be larger than commanded.	In one-engine cruise mode, ahead speed would be greater than commanded.	5.8754	
19D	Cruise Mode/1 Engine Function Generator	Astern circuits incompletely activated.	In one-engine cruise mode, astern signals would be larger than commanded.	In one-engine cruise mode, astern speed would be greater than commanded.	5.8754	
19E	Cruise Mode/1 Engine Function Generator	Slope of function incorrect.	In one-engine cruise mode, pitch change rates would differ from design rates.	In one-engine cruise mode, pitch changes would occur at a "bumpy" rate.	15.6678	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
20A	Maneuver Mode/1 Engine Function Generator Filter Capacitors	Fail open.	No effect; some EMI filtering would be lost.	No effect.	0.1760	
20B	Maneuver Mode/1 Engine Function Generator Filter Capacitors	Fail short.	Same as #12B.	Same as #12B.	0.3286	
21A	Maneuver Mode/2 Engine Function Generator	Ahead circuits fail "on."	In one-engine maneuver mode, erroneous full ahead command generated.	In stet-engine maneuver mode, vessel would erroneously go full ahead.	5.8754	
21B	Maneuver Mode/2 Engine Function Generator	Astern circuits fail "on."	In one-engine maneuver mode, erroneous full astern command generated.	In two-engine maneuver mode, vessel would erroneously go full astern.	5.8754	
21C	Maneuver Mode/2 Engine Function Generator	Ahead circuits incompletely activated.	In one-engine maneuver mode, ahead signals would be larger than commanded.	In two-engine maneuver mode, ahead speed would be greater than commanded.	5.8754	
21D	Maneuver Mode/2 Engine Function Generator	Astern circuits incompletely activated.	In one-engine maneuver mode, astern signals would be larger than commanded.	In two engine maneuver mode, astern speed would be greater than commanded.	5.8754	
21E	Maneuver Mode/2 Engine Function Generator	Slope of function incorrect.	In one-engine maneuver mode, pitch change rates would differ from design rates.	In two-engine maneuver mode, pitch changes would occur at a "bumpy" rate.	15.6678	
22A	Throttle Control Pot Relay	NO contact sticks open.	Lose signal from bridge throttle lever to engine speed function generator.	Same as FMEA 3.1 item #34B.	0.2650	
22B	Throttle Control Pot Relay	NO contact sticks closed.	Signal from bridge throttle lever always connected to engine speed function generator.	No effect when control is via bridge throttle lever. When control is via ER throttle lever, speed would be higher and/or lower than commanded.	0.2650	
22C	Throttle Control Pot Relay	NC contact sticks open.	Lose signal from ER throttle lever to engine speed function generator.	Same as FMEA 3.1 item #32B.	0.2650	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE PAGE 6

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
22D	Throttle Control Pot Relay	NC contact sticks closed.	Signal from ER throttle lever always connected to engine speed function generator.	No effect when control is via ER throttle lever. When control is via bridge throttle lever, speed would be higher and/or lower than commanded.	0.2650	
23A	Cruise Pot Relay	NO contact sticks open.	Lose signal from ER trim RPM pot (cruise) to E/P input--same as Mode Control FMEA 3.1 item #20.	Same as FMEA 3.1 item #20.	0.2650	
23B	Cruise Pot Relay	NO contact sticks closed.	Signal from ER trim PRM pot always connected; lose signal from engine speed function generator.	No effect in cruise mode. In maneuver mode, same as FMEA 3.3 item #13B.	0.2650	
23C	Cruise Pot Relay	NC contact sticks open.	Lose signal from engine speed function generator.	Same as FMEA 3.1 item #13B.	0.2650	
23D	Cruise Pot Relay	NC contact sticks closed.	Signal from engine speed function generator always connected; lose signal from ER trim RPM (cruise) pot.	No effect in maneuver mode. In cruise mode, speed would be higher and/or lower than commanded.	0.2650	
24A	Split Mode Relay	NO contact sticks open.	Lose signal from ER split RPM pot to E/P input #20.	Same as FMEA 3.1 item #19.	0.2650	
24B	Split Mode Relay	NO contact sticks closed.	Signal from ER split RPM pot always connected; lose signals from ER trim RPM (cruise) pot and engine speed function generator.	No effect in split mode. In cruise and maneuver modes, both engines would slow down to idle.	0.2650	
24C	Split Mode Relay	NC contact sticks open.	Lose signals from ER trim RPM (cruise) pot and engine speed function generator.	Same as #24B.	0.2650	
24D	Split Mode Relay	NC contact sticks closed.	Signal from ER trim RPM (cruise) pot or engine speed function generator always connected; lose signal from ER split RPM pot.	Same as Mode Control FMEA 3.1 item #19.	0.2650	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
25A	Function Generator Relay #4	#1 NC contact sticks open.	Lose output signal from two engine-cruise mode function generator.	In two-engine cruise mode, vessel would coast to a stop and later (over a long time period) small, uncommanded speed changes would occur.	0.1325	
25B	Function Generator Relay #4	#1 NC contact sticks closed.	Signal from two engine-cruise mode function generator always connected; lose signal from two engine-maneuver mode.	In two-engine maneuver mode, vessel would coast to a stop and later (over a long time period) small, uncommanded speed changes would occur.	0.1325	
25C	Function Generator Relay #4	#1 NO contact sticks open.	Lose signal from two engine-maneuver mode function generator.	Same as #25B.	0.1325	
25D	Function Generator Relay #4	#1 NO contact sticks closed.	Signal from two engine-maneuver mode function generator always connected; lose signal from two engine-cruise mode function generator.	Same as #25A.	0.1325	
25E	Function Generator Relay #4	#2 NC contact sticks open.	Lose signal from one engine-cruise mode function generator.	In one-engine cruise mode, vessel would coast to a stop and later (over a long time period) small, uncommanded speed changes would occur.	0.1325	
25F	Function Generator Relay #4	#2 NC contact sticks closed.	Signal from one engine-cruise mode function generator always connected; lose signal from one engine/maneuver mode function generator.	In one-engine maneuver mode, vessel would coast to a stop and later (over a long time period) small, uncommanded speed changes would occur.	0.1325	
25G	Function Generator Relay #4	#2 NO contact sticks open.	Lose signal from one engine-maneuver mode function generator.	Same as #25F.	0.1325	
25H	Function Generator Relay #4	#2 NO contact sticks closed.	Signal from one engine-maneuver mode function generator always connected; lose signal from one engine-cruise mode function generator.	Same as #25E.	0.1325	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
26A	Port E/P Relay	#1 NC contact sticks open.	Port E/P input would not be grounded when port E/P relay should be de-energized.	Port engine would go to idle.	0.1325	
26B	Port E/P Relay	#1 NC contact sticks closed.	Port E/P input stays grounded.	Same as Mode Control FMEA 3.1 item #22B.	0.1325	
26C	Port E/P Relay	#1 NO contact sticks open.	Lose SRC signal to port E/P input.	Same as #26A.	0.1325	
26D	Port E/P Relay	#1 NO contact sticks closed.	SRC signal always connected to port E/P input	No effect--normal position when when vessel underway.	0.1325	
26E	Port E/P Relay	#2 NC contact sticks open.	Lose signal to bridge port idle lamp.	Lose bridge port idle lamp indication.	0.1325	
26F	Port E/P Relay	#2 NC contact sticks closed.	Signal to bridge port idle lamp stays active.	False bridge port idle lamp indication.	0.1325	
26G	Port E/P Relay	#2 NO contact sticks open.	No effect.	No effect.	0.1325	
26H	Port E/P Relay	#2 NO contact sticks closed.	Same as #26E.	Same as #26E.	0.1325	
27A	Stbd E/P Relay	#1 NC contact sticks open.	Stbd E/P input would not be grounded when stbd E/P relay should be de-energized.	Stbd engine would go to idle.	1.0600	
27B	Stbd E/P Relay	#1 NC contact sticks closed.	Stbd E/P input stays grounded.	Same as Mode Control FMEA 3.1 item #22B.	1.0600	
27C	Stbd E/P Relay	#1 NO contact sticks open.	Lose SRC signal to stbd E/P input.	Same as #26A.	1.0600	
27D	Stbd E/P Relay	#1 NO contact sticks closed.	SRC signal always connected to stbd E/P input	No effect--normal position when when vessel underway.	1.0600	
27E	Stbd E/P Relay	#2 NC contact sticks open.	Lose signal to bridge port idle lamp.	Lose bridge port idle lamp indication.	1.0600	
27F	Stbd E/P Relay	#2 NC contact sticks closed.	Signal to bridge port idle lamp stays active.	False bridge port idle lamp indication.	1.0600	
27G	Stbd E/P Relay	#2 NO contact sticks open.	No effect.	No effect.	1.0600	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 3.3 MODE CONTROL OUTPUT INTERFACE

REP. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
27H	Stbd E/P Relay	#2 NO contact sticks closed.	Same as #26E.	Same as #26E.	1.0600	
28A	Function Generator Relay #9	NC contact sticks open.	Lose signals from one engine-cruise mode and one engine-maneuver mode function generators.	In one-engine cruise and maneuver modes, vessel would coast to a stop and later (over a long time period) small, uncommanded speed changes would occur.	0.2650	
28B	Function Generator Relay #9	NC contact sticks closed.	Signal from one engine-cruise mode or one engine-maneuver mode function generator always connected; lose signals from two engine-cruise mode and two engine-maneuver mode function generators.	In two-engine cruise and maneuver modes, incorrect response would occur on direction change commands.	0.2650	
28C	Function Generator Relay #9	NO contact sticks open.	Lose signals from two engine-cruise mode and two engine-maneuver mode function generators.	In two-engine cruise and maneuver modes, vessel would coast to a stop and later (over a long time period) small, uncommanded speed changes would occur.	0.2650	
28D	Function Generator Relay #9	NO contact sticks closed.	Signal from two engine-cruise mode or two engine-maneuver mode function generators always connected; lose signals from one engine-cruise mode and one engine-maneuver mode function generators.	In one-engine cruise and maneuver modes, incorrect response would occur on direction change commands.	0.2650	
29A	Auto Pitch Relay	NC contact sticks open.	Auto pitch signal not grounded when pitch not enabled.	When vessel not underway, small erroneous speed commands would occur.	0.2650	
29B	Auto Pitch Relay	NC contact sticks closed.	Auto pitch signal always grounded.	Prop would go to flat pitch and vessel womuld coast to a stop.	0.2650	
29C	Auto Pitch Relay	NO contact sticks open.	Lose signals from all cruise/ maneuver mode function generators.	In any mode, vessel would coast to a stop and later (over a long time period) small, uncommanded changes would occur.	0.2650	
29D	Auto Pitch Relay	NO contact sticks closed.	Cruise/maneuver mode function generators would remain connected when pitch not enabled.	Same as #29A.	0.2650	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 4.1 PITCH CONTROLLER

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Filter Capacitors	Fail open.	No effect; lose some EMI filtering capability.	No effect.	0.4453	
1B	Filter Capacitors	Fail short.	+5 volt or +15 or -15 volt power to all cards shorted to ground.	Same as FMEA 1.1 item #1B.	0.4040	
2A	Rate Ltd Pitch Command	Ahead signal stays max.	Full ahead command continuously generated.	Vessel would go full ahead regardless of what had been commanded.	0.9091	
2B	Rate Ltd Pitch Command	Astern signal stays max.	Full astern command continuously generated.	Vessel would go full astern regardless of what had been commanded.	0.9091	
2C	Rate Ltd Pitch Command	Slew rate incorrect.	Pitch change commands would occur at rate higher than designed for.	High change rate on pitch change commands. Limits would still be imposed by propeller system itself.	0.2218	
2D	Rate Ltd Pitch Command	Crash astern rates stay inhibited.	Rate limiting would be imposed on crash astern commands.	Crash astern commands would be carried out too slow.	0.1330	
3A	Pitch Command Summing Gate	Stays on.	Manual increased slew rate ahead circuit would stay active.	Same as #2C.	0.6769	
3B	Pitch Command Summing Gate	Stays off.	Lose manual increased slew rate ahead circuit.	In manual mode, ahead pitch changes would not occur at increased rate.	0.6769	
4A	Slew Rate Controller	Fails high.	Same as #2A.	Same as #2A.	0.9892	
4B	Slew Rate Controller	Fails low.	Same as #2B.	Same as #2B.	0.9892	
5A	Actual Pitch AH Input Circuit	Output stays high.	FET Q3 stays off; same as #3A.	Same as #3A.	0.2139	
5B	Actual Pitch AH Input Circuit	Output stays low.	FET Q3 stays on; same as #3B.	Same as #3B.	0.2139	
6A	Command/Actual Pitch Input Circuit	Output stays high.	FET Q4 stays off; same as #2D.	Same as #2D.	0.2931	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 4.1 PITCH CONTROLLER

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
6B	Command/Actual Pitch Input Circuit	Output stays low.	FET Q4 stays on; crash astern rates would be imposed on all commanded pitch changes.	Same as #2C.	0.2931	
7A	Pitch Pos Feedback Buff	Ahead signal stays max.	Actual pitch position signal to pitch error circuit fails to limits in ahead direction.	Vessel would immediately go full ahead; thereafter, lose auto pitch control capability (all operating modes).	1.4675	
7B	Pitch Pos Feedback Buff	Astern signal stays max.	Actual pitch position signal to pitch error circuit fails to limits in astern direction.	Vessel would immediately go full astern; thereafter, lose auto pitch control capability (all operating modes.	1.4675	
8A	Split Pitch Command Circuit	Ahead signal stays max.	In split mode, full ahead command always active.	In split mode, vessel would immediately go full ahead.	1.7147	
8B	Split Pitch Command Circuit	Astern signal stays max.	In split mode, full astern command always active.	In split mode, vessel would immediatly go full astern.	1.7147	
8C	Split Pitch Command Circuit	Lose output.	Split mode commands never active.	No pitch control possible in split mode.	0.3855	
9A	Pitch Error Output	Ahead signal stays max.	Signal to pitch servo amplifier always at full ahead.	Vessel would immediately go full ahead (any operating mode).	0.9130	
9B	Pitch Error Output	Astern signal stays max.	Signal to pitch servo amplifier always at full astern.	Vessel would immediately go full astern (any operating mode).	0.9130	
10A	Split Pitch Command Inverter	Ahead signal stays max.	Same as #9A.	Same as #9A.	1.4145	
10B	Split Pitch Command Inverter	Astern signal stays max.	Same as #9B.	Same as #9B.	1.4145	
11A	Split Pitch/Auto Gate	Stays on.	Split pitch command always active; could be added to auto command in auto mode.	No effect in split mode. In auto mode, if split pot not set to zero position, uncommanded pitch changes would occur, with the direction and magnitude depending on the position of the split mode pot.	0.3255	
11B	Split Pitch/Auto Gate	Stays off.	Lose split pitch commands; in split mode, all pitch commands would stay at zero.	In split mode, vessel would go into "neutral" and stop; no further split mode control possible.	0.3255	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 4.1 PITCH CONTROLLER

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10P6 HRS.	COMMENTS INDEX
12A	Auto Input Circuit	Fails high.	Auto mode never appears selected; commanded pitch/auto gate stays off.	Same as #13A.	0.0772	
12B	Auto Input Circuit	Fails low.	Auto mode always appears selected; commanded pitch/auto gate stays on.	Same as #13B.	0.0772	
13A	Commanded Pitch/ Auto Gate	Stays off.	Commanded pitch signal never selected.	In auto and maneuver modes, vessel would go into neutral and stop. No further auto and maneuver modes control possible.	0.1097	
13B	Commanded Pitch/ Auto Gate	Stays on.	Commanded pitch signal always selected.	In split mode, if throttle levers not set to zero position, uncommanded pitch changes would occur with the direction and magnitude depending on the positions of the throttle levers.	0.1097	
14A	Actual Pitch Circuit	Actual pitch signal fails high	Same as #6A.	Same as #2D.	0.9362	
14B	Actual Pitch Circuit	Actual pitch signal fails low.	Same as #6B.	Same as #2C.	0.9362	
15	Pitch Meter Output	Any.	Signals to bridge and ERC pitch indicators incorrect.	Lose bridge and ERC visual pitch position indicators.	1.7892	
16A	Feedback Pot Supply, Pos	Fails high.	Lose calibration throttle levers.	"Bumpy" pitch changes.	1.4154	
16B	Feedback Pot Supply, Pos	Fails low.	Lose postive voltage to pitch control op-amps.	If vessel going ahead, failure will cause it to go full astern.	1.4154	
17A	Feedback Pot Supply, Pos	Fails high.	Lose negative voltage to pitch control op-amps.	If vessel going astern, failure will cause it to go full ahead.	1.4154	
17B	Feedback Pot Supply, Pos	Fails low.	Same as #16A.	Same as #16A.	1.4154	
18A	Plat Pitch Output	Stays high.	Pitch always appears flat.	Lose inhibit against engaging clutch if propeller pitch not flat.	0.1052	
18B	Plat Pitch Output	Stays low.	Pitch never appears flat.	Clutch could not be engaged.	0.1052	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 4.1 PITCH CONTROLLER

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
19A	Pitch Fail Timer	Output stays high.	Pitch fail signal stays active.	False bridge and ERC pitch fail alarms.	1.4647	
19B	Pitch Fail Timer	Output stays low.	Pitch fail signal never active.	Lose bridge and ERC pitch fail alarms.	1.4647	
20A	Pitch Error Input	Stays high.	Same as #19B.	Same as #19B	0.1052	
20B	Pitch Error Input	Stays low.	Same as #19A.	Same as #19A.	0.1052	
21A	Detent* Input	Stays high.	Enable pitch signal stays inhibited; auto pitch command signal would stay at ground.	Same as FMEA 3.3 item #29B.	0.1445	
21B	Detent* Input	Stays low.	Auto pitch command signal could be enabled when engines below proper speed.	Pitch commands would not be inhibited if vessel not underway.	0.1445	
22A	Enable Pitch Output	Stays high.	Auto pitch relay stays energized; cruise/maneuver mode function generator outputs would be applied to Rate Limited Pitch Command circuit continuously.	Same as #21B.	0.1052	
22B	Enable Pitch Output	Stays low.	Auto pitch relay stays de-energized; auto pitch command to Rate Limited Pitch command circuit stays at ground.	Same as FMEA 3.3 item #29B.	0.1052	
23A	Engine Below N.I.* Input	Stays high.	Same as #22B.	Same as FMEA 3.3 item #29B.	0.1052	
23B	Engine Below N.I.* Input	Stays low.	Engine speed always appears above N.I.; auto pitch command signal could be enabled when engine speed not above N.I.	Same as #21B.	0.1052	
24	Split Pitch Pot Resistors	Fail open.	Lose split pitch command from split pitch pot.	In split mode, vessel would coast to a stop and no further pitch control possible. Other modes not effected.	0.0504	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 4.2 PITCH CONTROLLER INPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Pitch Error #1 Setpoint Channel	Stays on.	Same as Pitch Controller (4.1) FMEA item #19A.	Same as Pitch Controller (4.1) FMEA item #19A.	3.0630	
1B	Pitch Error #1 Setpoint Channel	Stays off.	Lose pitch fail alarm signal for low pitch error.	Lose bridge and ERC pitch fail alarm for low pitch error.	3.0630	
2A	Pitch Error #2 Setpoint Channel	Stays on.	Same as Pitch Controller (4.1) FMEA item #19A.	Same as Pitch Controller (4.1) FMEA item #19A.	3.0630	
2B	Pitch Error #2 Setpoint Channel	Stays off.	Lose pitch fail alarm signal for high pitch error.	Lose bridge and ERC pitch fail alarm for high pitch error.	3.0630	
3	Split Pitch Pot	Any.	Same as Pitch Controller (4.1) FMEA item #24.	Same as Pitch Controller (84.1) FMEA item #24.	0.9660	
4A	Actual Pitch Pos. Setpoint Channel	Stays on.	Crash astern rates would be enabled during any astern commands.	All astern commands would be carried out at crash astern rates.	3.0630	
4B	Actual Pitch Pos. Setpoint Channel	Stays off.	Crash astern gate stays inhibited.	Same as FMEA 4.1 item #2D.	3.0630	
5A	Actual Pitch Neg. Setpoint Channel	Stays on.	Same as Pitch Controller (4.1) FMEA item #18B.	Same as Pitch Controller (4.1) FMEA item #18B.	3.0630	
5B	Actual Pitch Neg. Setpoint Channel	Stays off.	Actual pitch never appears astern.	Lose inhibit against engaging clutch if propeller pitch astern.	3.0630	
6A	Bridge Wings AS Ind. Signal Relay Driver	Stays on.	Bridge wings AS indicator signal always active.	False AS indication on bridge wings.	0.4380	
6B	Bridge Wings AS Ind. Signal Relay Driver	Stays off.	Bridge wigns AS indicator signal never active.a	Lose AS indication on bridge wings.	0.4380	
7A	Bridge Wings AH Ind. Signal Relay Driver	Stays on.	Bridge wings AH indicator signal always active.	False AH indication on bridge wings.	0.4380	
7B	Bridge Wings AH Ind. Signal Relay Driver	Stays off.	Bridge wings AH indicator signal never active.	Lose AH indication on bridge wings.	0.4380	
8	BR EOT AH/AS Limit Switch	Any.	Lose wrong direction pitch alarm signal.	Lose ERC and bridge wrong direction pitch alarm.	0.9200	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 4.2 PITCH CONTROLLER INPUT INTERFACE PAGE: 2

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
9A	Wrong Direction Pitch Alarm	Stays on.	ERC wrong direction pitch alarm signal stays active.	False ERC wrong direction pitch alarm.	1.0310	
9B	Wrong Direction Pitch Alarm	Stays off.	Lose ERC wrong direction pitch alarm signal.	Lose ERC wrong direction pitch alarm signal.	1.0310	
9C	Wrong Direction Pitch Alarm	Alarm signal stays on.	Bridge wrong direction pitch alarma signal stays active.	False bridge wrong direction pitch alarm.	0.6873	
9D	Wrong Direction Pitch Alarm	Alarm signal stays off.	Lose bridge wrong direction pitch alarm signal.	Lose bridge wrong direction pitch alarm.	0.6873	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 4.3 PITCH CONTROLLER OUTPUT INTERFACE PAGE: 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Pitch Fail Relay Driver	Stays on.	Pitch fail relay stays energized; circuit to skinner valve stays made.	Pitch changes would occur at higher than normal change rates.	0.4400	
1B	Pitch Fail Relay Driver	Stays off.	Pitch fail relay cannot be energized; circuit to skinner valve stays open.	No effect.	0.4400	
2A	Pitch Fail Relay	Contact sticks open.	Circuit to skinner valve stays open.	No effect.	0.5300	
2B	Pitch Fail Relay	Contact sticks closed.	Circuit to skinner valve stays closed.	Same as #1A.	0.5300	
3A	Pitch Fail Alarm	Alarm signal stays on.	Pitch fail alarm signal stays active.	False ERC pitch fail alarm.	0.9881	
3B	Pitch Fail Alarm	Alarm signal stays off.	Pitch fail alarm signal never active.	Lose ERC pitch fail alarm.	0.9041	
3C	Pitch Fail Alarm	Non-alarm portion fails.	No effect.	No effect.	2.9643	
4	Pitch Indicator	Any.	Bridge and ERC pitch indicators incorrect.	Bridge and ERC pitch indicators incorrect.	10	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 4.4 PITCH CUTBACK

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Filter Capacitors	Fail open.	No effect; lose some EMI filtering.	No effect.	0.3926	
1B	Filter Capacitors	Fail short.	Plus or minus 15v or 24v supply shorted to ground.	Same as FMEA 1.1 item #1B.	0.7332	
2A	Pitch Limit Circuit	Fails high.	System will "think" there is too much fuel rack and cutback on pitch.	Vessel will slowdown.	3.5630	
2B	Pitch Limit Circuit	Fails low.	Lose ability to sense the load on the engines.	If an engine overload condition occurred, the automation system would not command a pitch cutback to reduce the load. Non-automation system overload protection provided on engines.	3.5630	
3A	Pitch Cutback Circuit	Fails high.	Same as #2B.	Same as #2B.	1.9525	
3B	Pitch Cutback Circuit	Fails low.	Same as #2A.	Same as #2A.	1.9525	
4A	Shaft RPM Circuit	Fails high.	Same as #2B.	Same as #2B.	0.9352	
4B	Shaft RPM Circuit	Fails low.	Same as #2A.	Same as #2A.	0.9352	
5A	Pitch Servo Output	Positive output stays low.	Astern command stays active.	Erroneous full astern command continuously.	0.7918	
5B	Pitch Servo Output	Positive output stays high.	Astern command never active.	Lose ability to go astern.	0.3391	
5C	Pitch Servo Output	Negative output stays low.	Ahead command stays active.	Erroneous full ahead command continuously.	0.7918	
5D	Pitch Servo Output	Negative output stays high.	Ahead command never active.	Lose ability to go ahead.	0.3391	
6A	Port LVDT Circuit	Output stays high.	Same as #2A.	Same as #2A.	0.9388	
6B	Port LVDT Circuit	Output stays low.	Same as #2B except for port engine only.	Same as #2B except for port engine only.	0.9388	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C SUBSYSTEM: 4.4 PITCH CUTBACK PAGE: 2

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
7A	Stbd LVDT Circuit	Output stays high.	Same as #2A.	Same as #2A.	0.9388	
7B	Stbd LVDT Circuit	Output stays low.	Same as 32B except for stbd engine only.	Same as #2B except for stbd engine only.	0.9388	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

SHIP: SHIP C

SUBSYSTEM: 4.5 PITCH CUTBACK INPUT INTERFACE

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE/S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1A	Port LVDT	Output too high.	Same as FMEA #4.4 item #2A.	Same as FMEA #4.4 item #2A.	10.3500	
1B	Port LVDT	Output too low.	Same as FMEA #4.4 item #6B.	Same as FMEA #4.4 item #6B.	10.3500	
2A	Stbd LVDT	Output too high.	Same as FMEA #4.4 item #2A.	Same as FMEA #4.4 item #2A.	10.3500	
2B	Stbd LVDT	Output too low.	Same as FMEA #4.4 item #7B.	Same as FMEA #4.4 item #7B.	10.3500	
3A	LVDT Pos. Setpoint	Stays on.	Same as FMEA #4.4 item #2A.	Same as FMEA #4.4 item 32A.	3.4198	
3B	LVDT Pos. Setpoint	Stays off.	Same as FMEA #4.4 item #2B.	Same as FMEA #4.4 item #2B.	3.4198	
4A	LVDT Pos. Relay Driver	Stays on.	Same as FMEA #4.4 item #2A.	Same as FMEA #4.4 item #2A.	0.2415	
4B	LVDT Pos. Relay Driver	Stays off.	Same as FMEA #4.4 item #2B.	Same AS FMEA #4.4 item #2B.	0.2415	

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

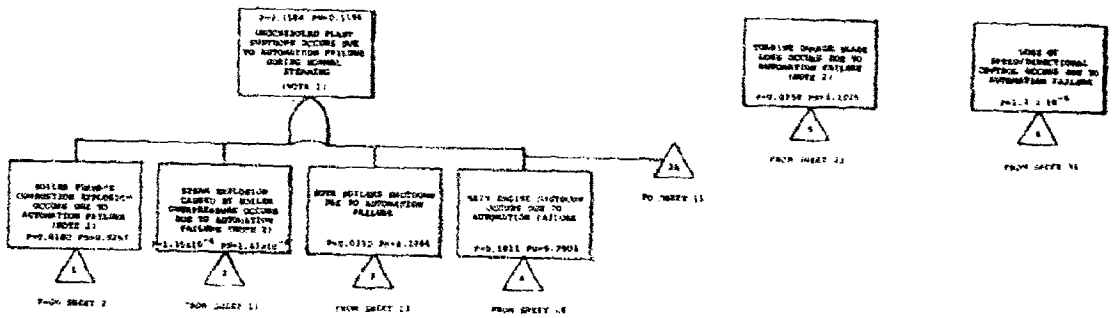
SHIP: SHIP C SUBSYSTEM: 1.3 CONTROL POWER SUPPLY PAGE: 1

REF. NO.	ITEM NOMENCLATURE FUNCTION	FAILURE MODE, S	FAILURE MODES SUBSYSTEM	FAILURE MODES SYSTEM	FAILURES/ 10E6 HRS.	COMMENTS INDEX
1	Console Power Supply #1 (redundant to unit #2 below)	Any.	Loss of or incorrect power output from unit.	No effect unless redundant unit failed. If both failed, control system would shut down and vessel would come to a stop.	9.2600	
2	Console Power Supply #2 (redundant to unit #1 above.)	Any.	Same as #1.	Same as #1.	9.2600	

APPENDIX E

FAULT TREES

SHIP	PAGE
A	E-1
B	E-35
C	E-63



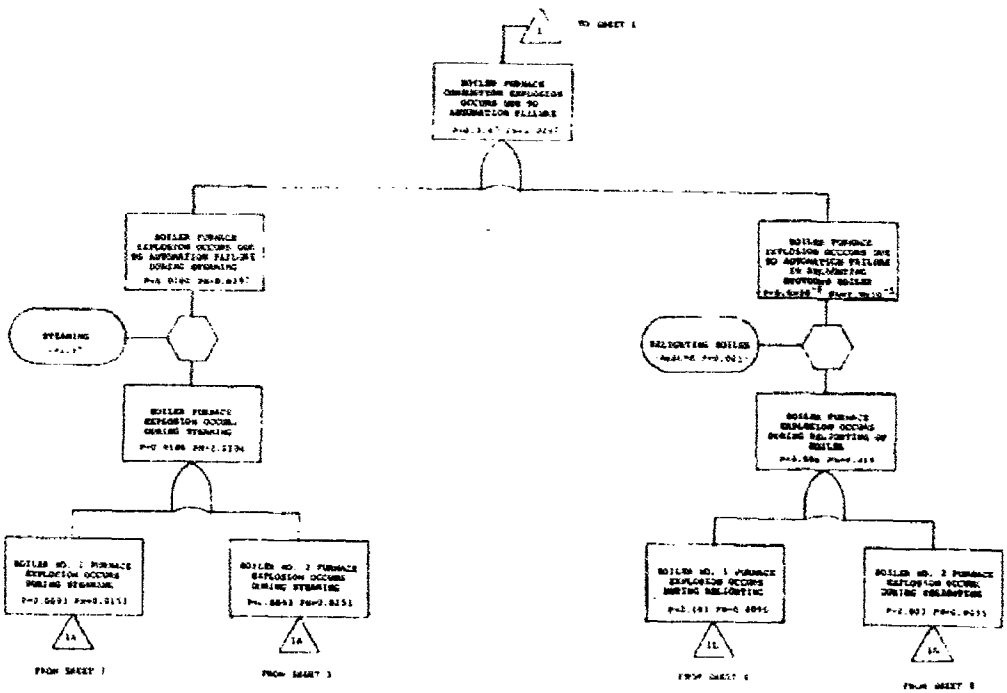
NOTES:

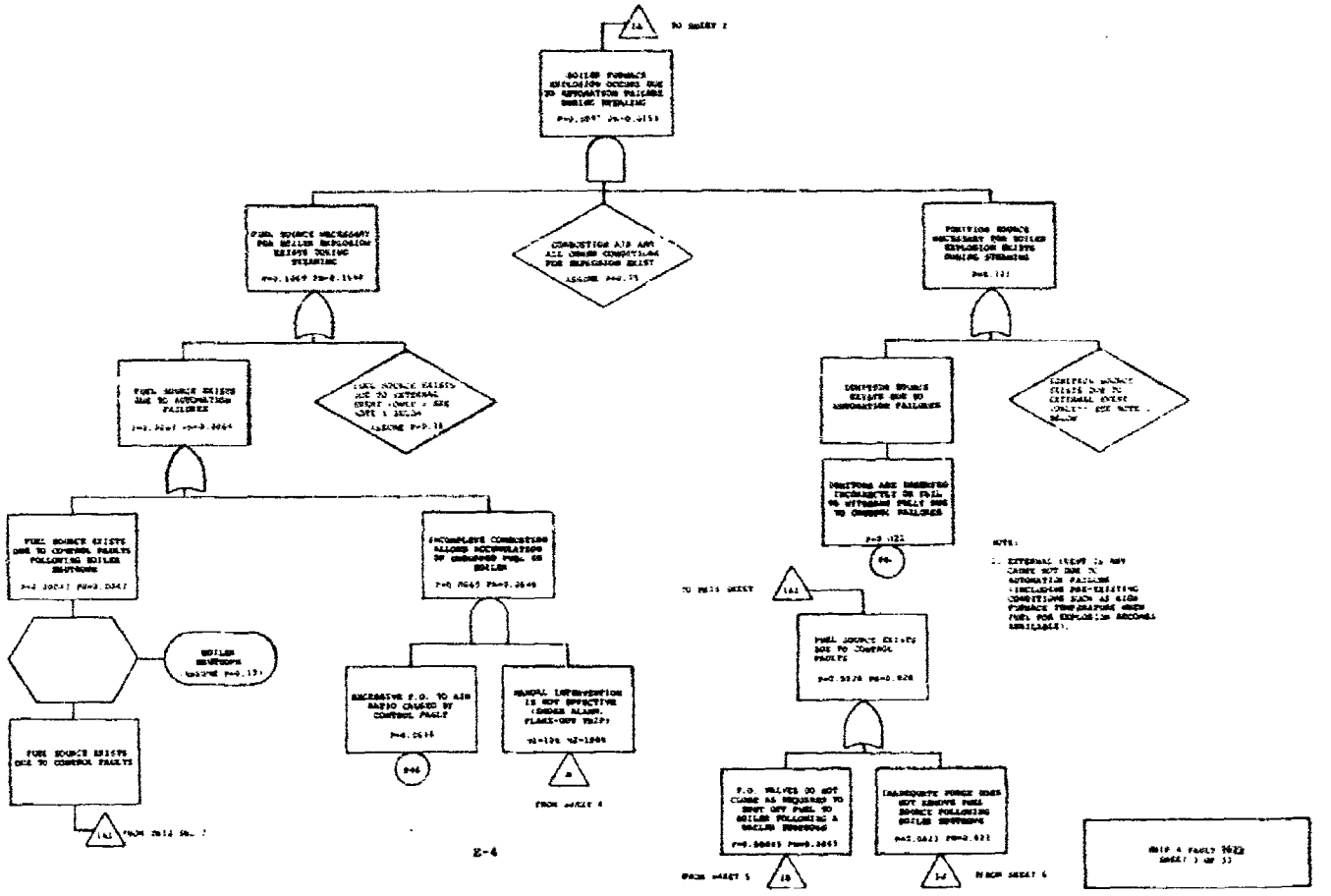
1. UNSCHEDULED PLANT SHUTDOWN CAN OCCUR DUE TO SIGNIFICANT DAMAGE AS WELL AS DUE TO SHUTDOWN OF STEAM SUPPLY MAIN ENGINE.

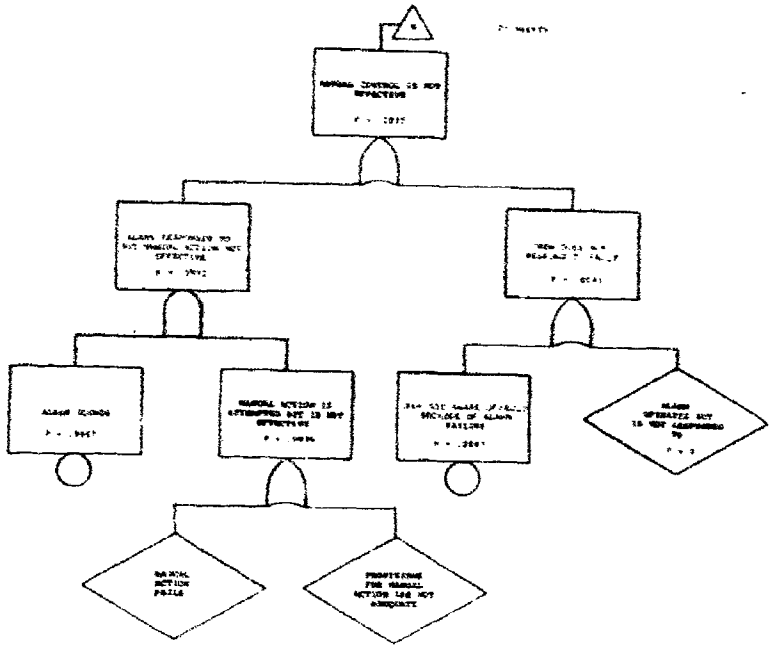
2. POTENTIAL EXISTS FOR CREW INJURY, CONDITIONAL ON LOCATIONS OF CREW MEMBERS.

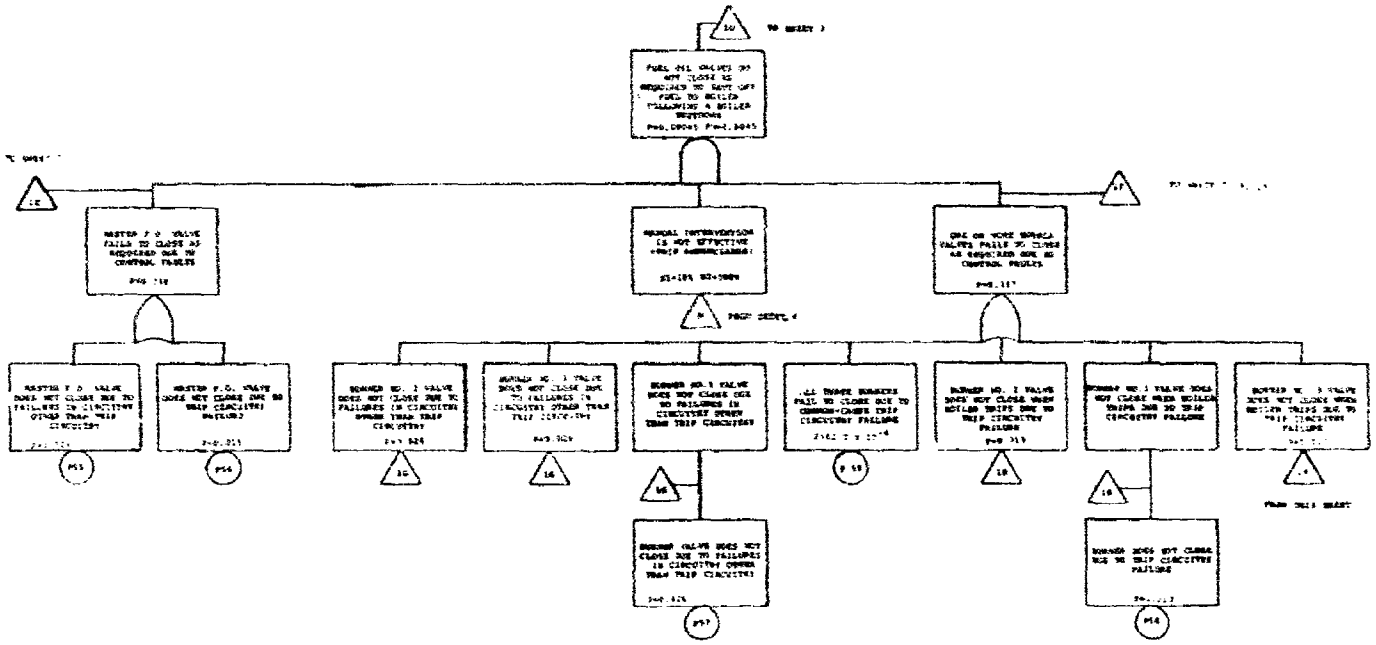
3. THE "FAIL" UNDER THE SITUATION HEADS MANUAL INTERVENTION IS EFFECTIVE 99% OF THE TIME; THE "FAIL" UNDER THE SITUATION HEADS MANUAL INTERVENTION IS NEVER EFFECTIVE

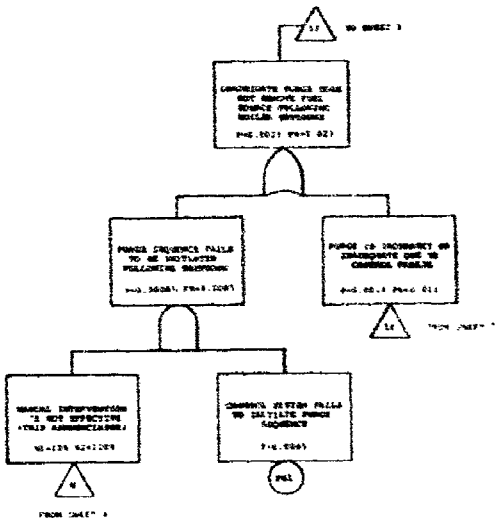
SHIP A FAULT TREE
SHEET 1 OF 11

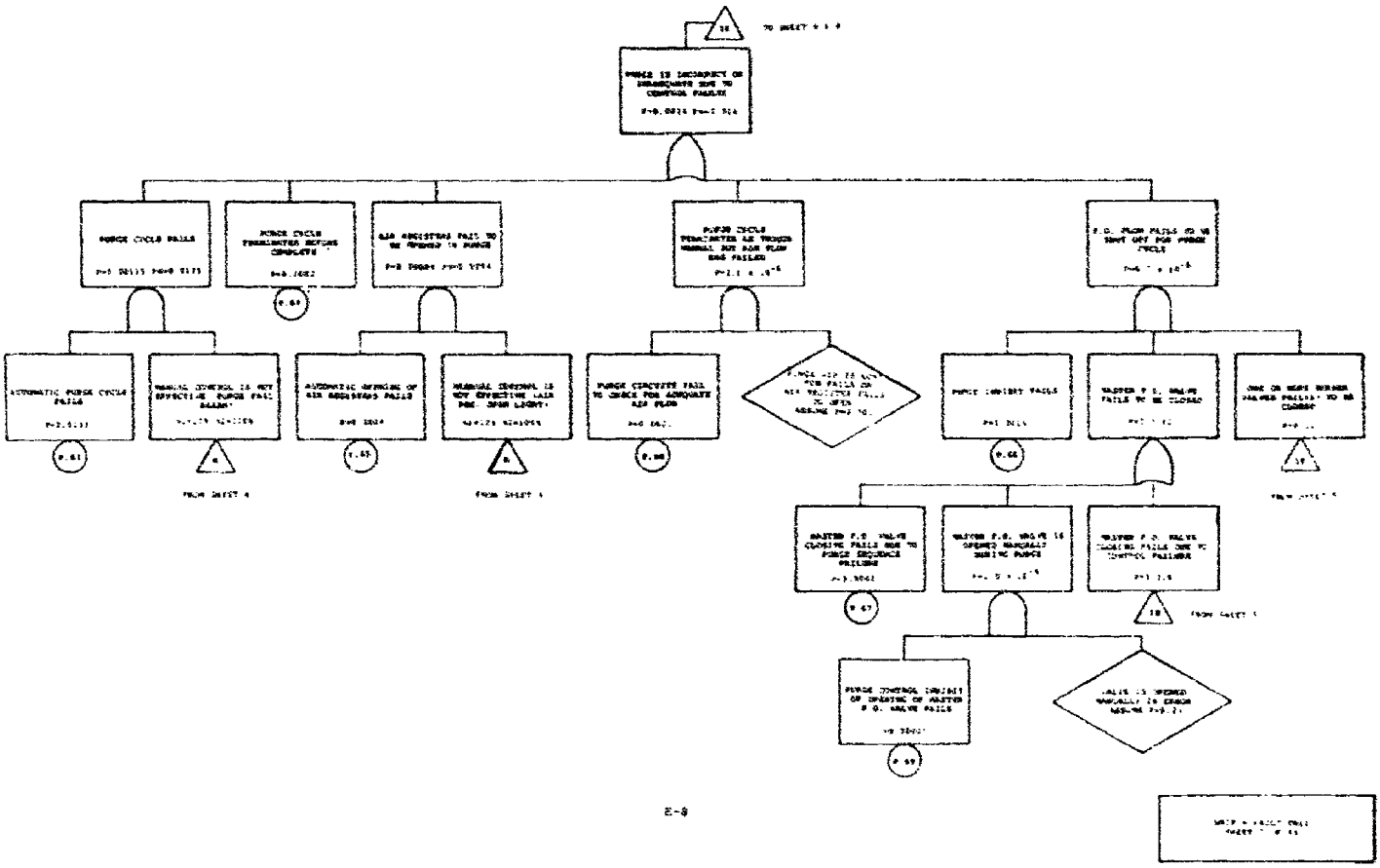


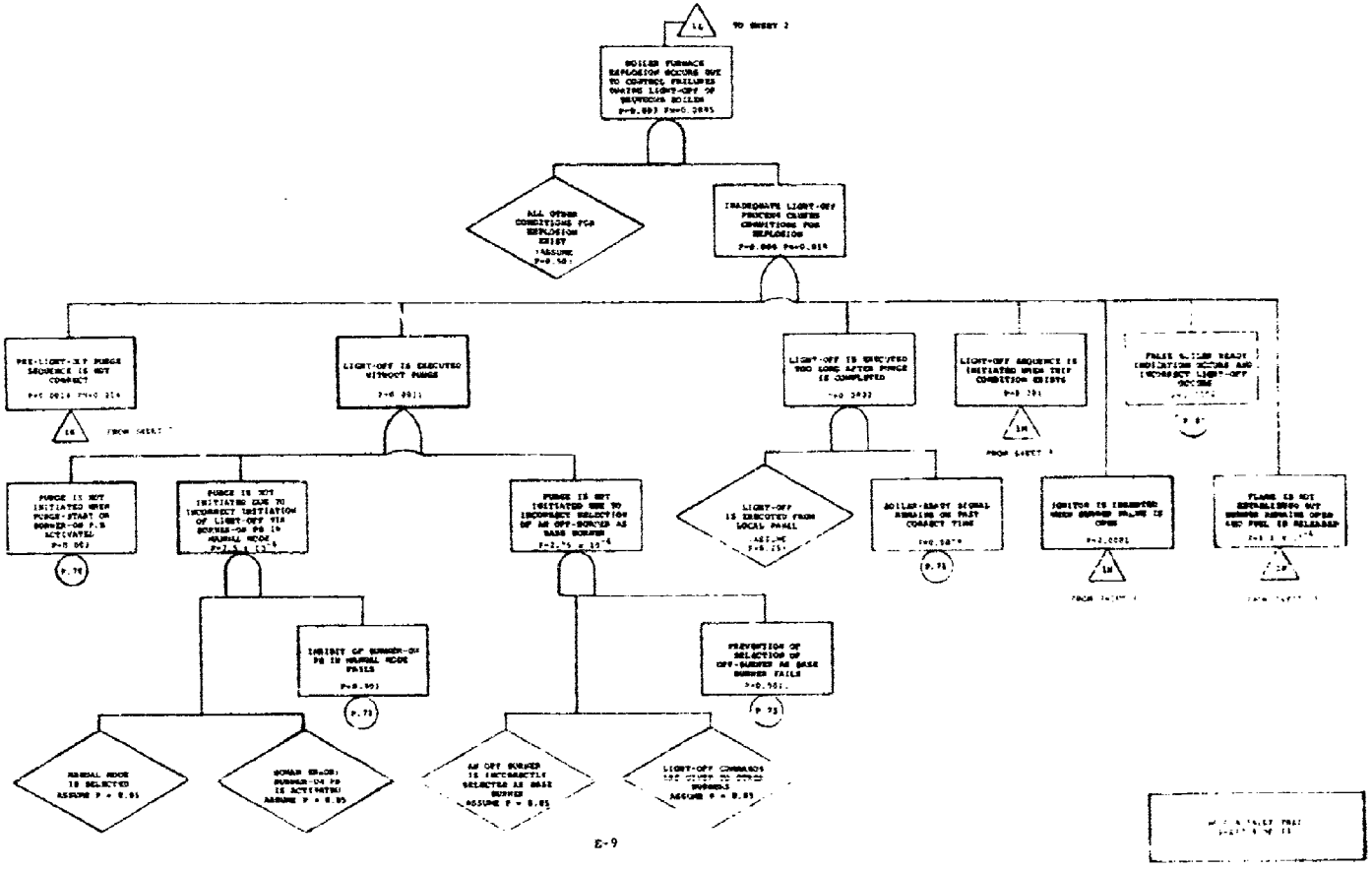


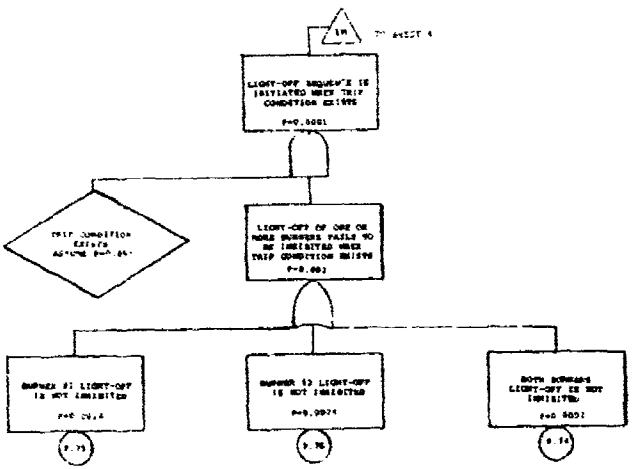


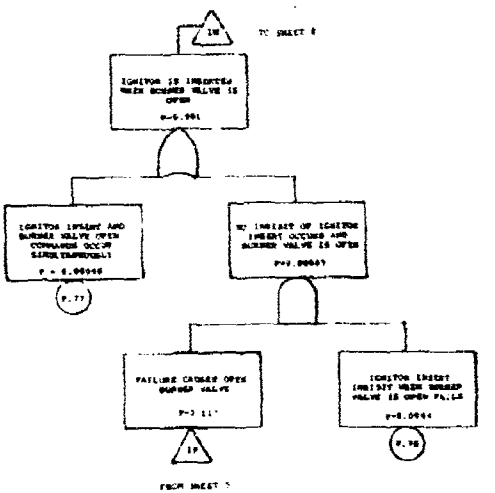


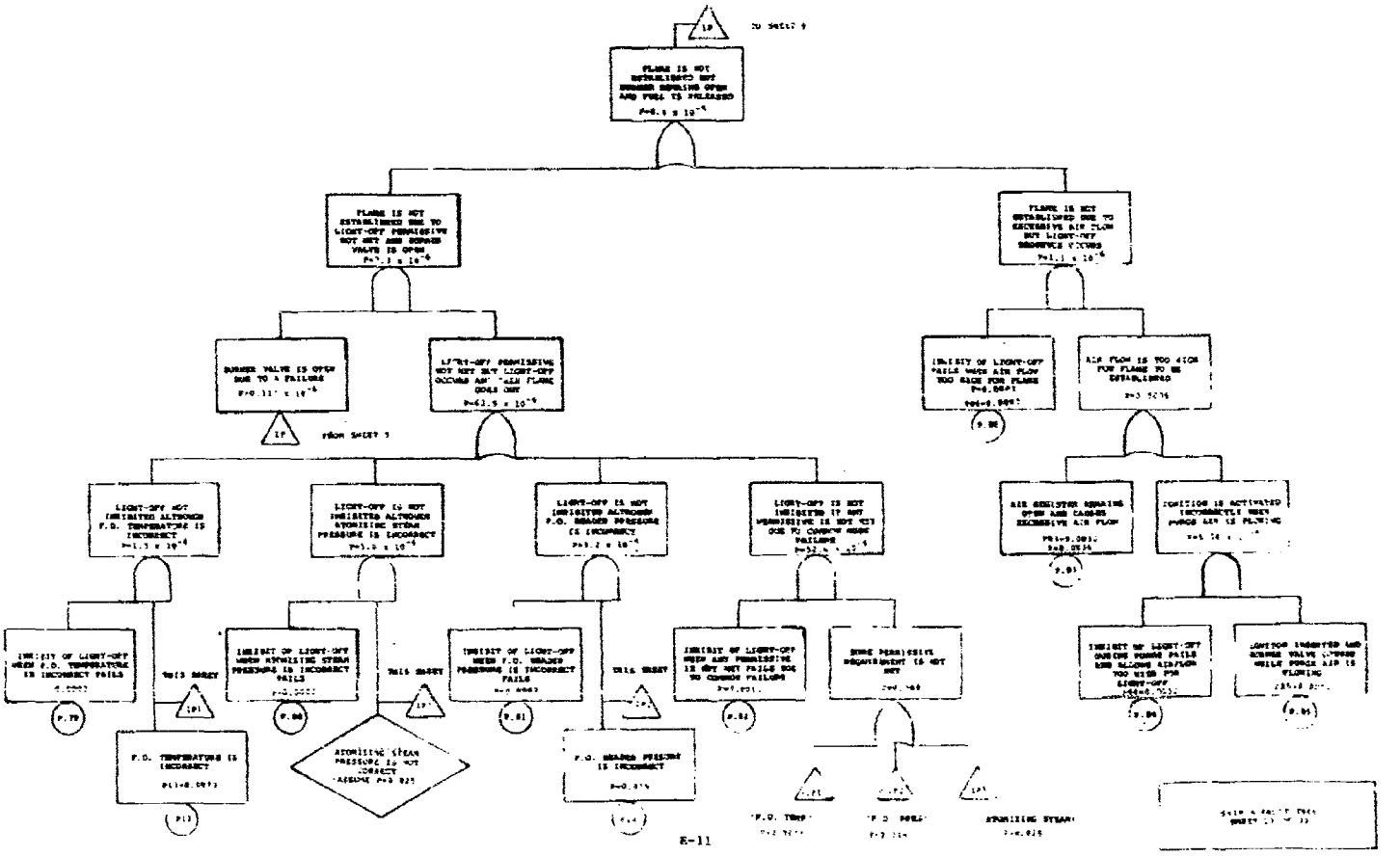


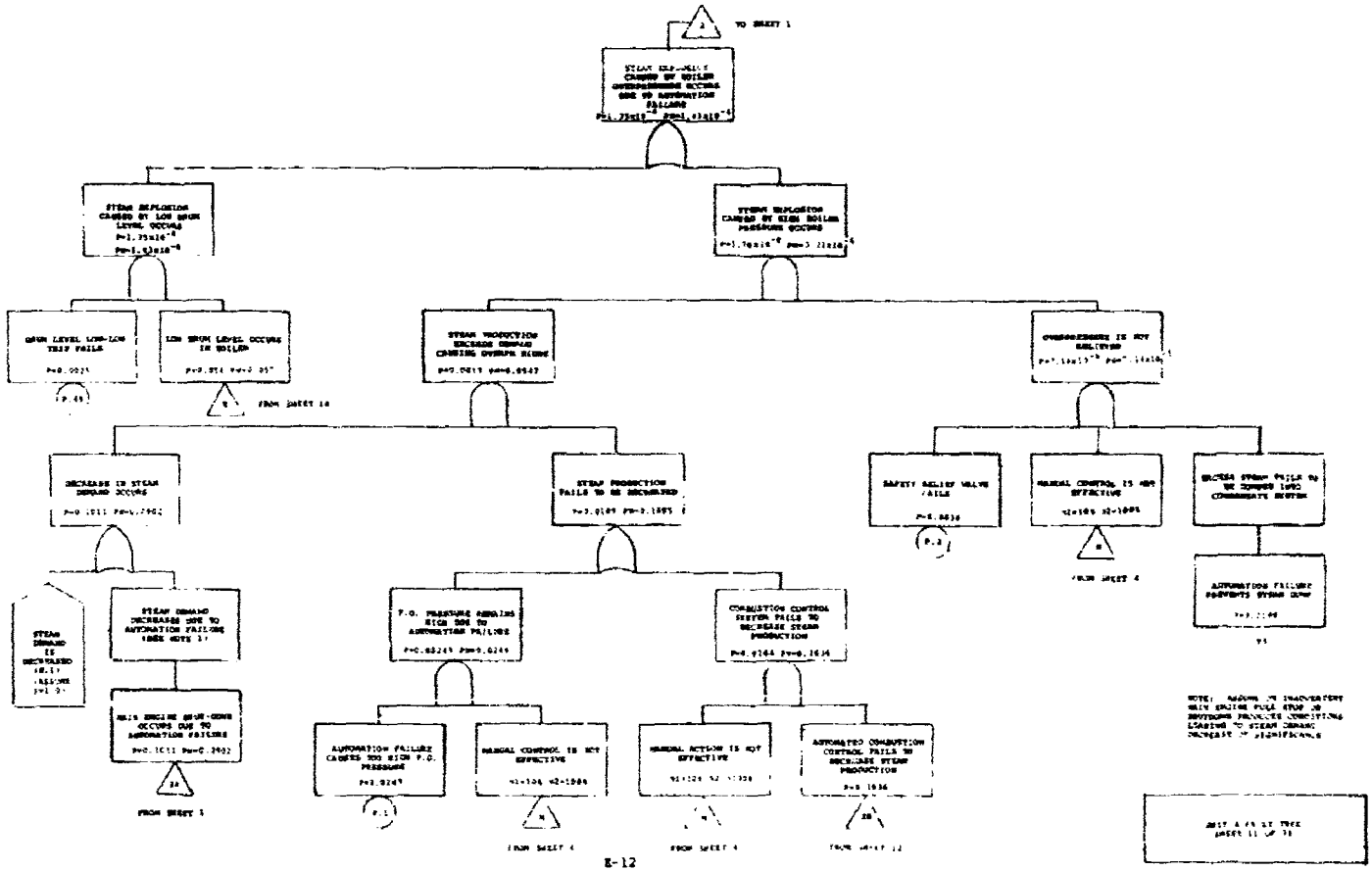


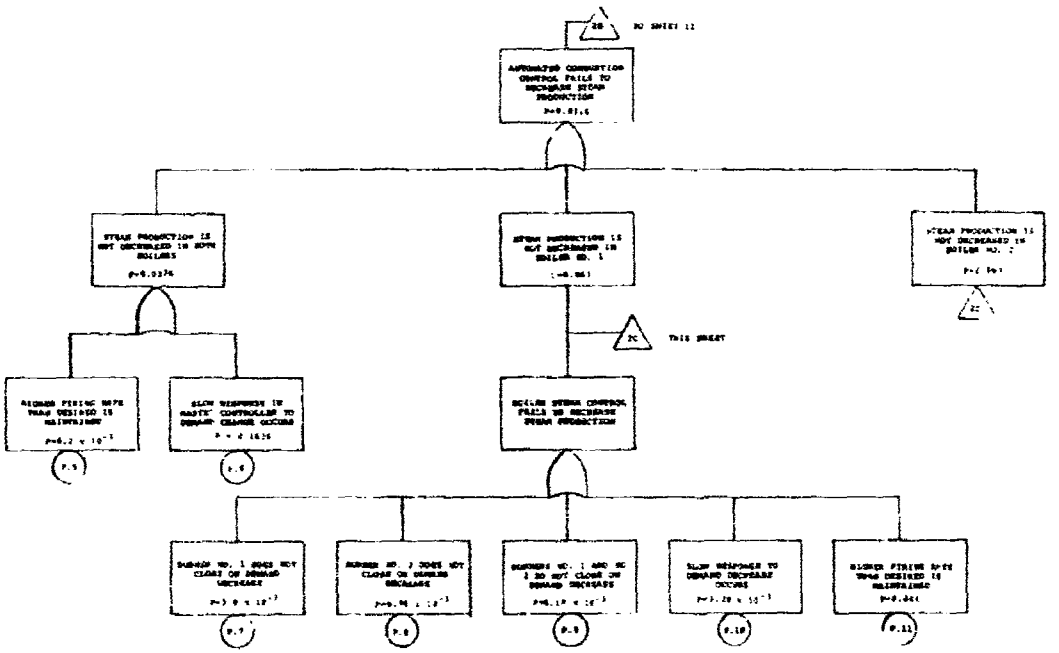


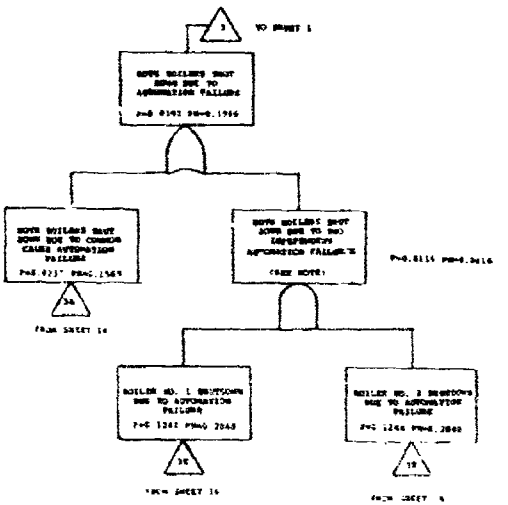


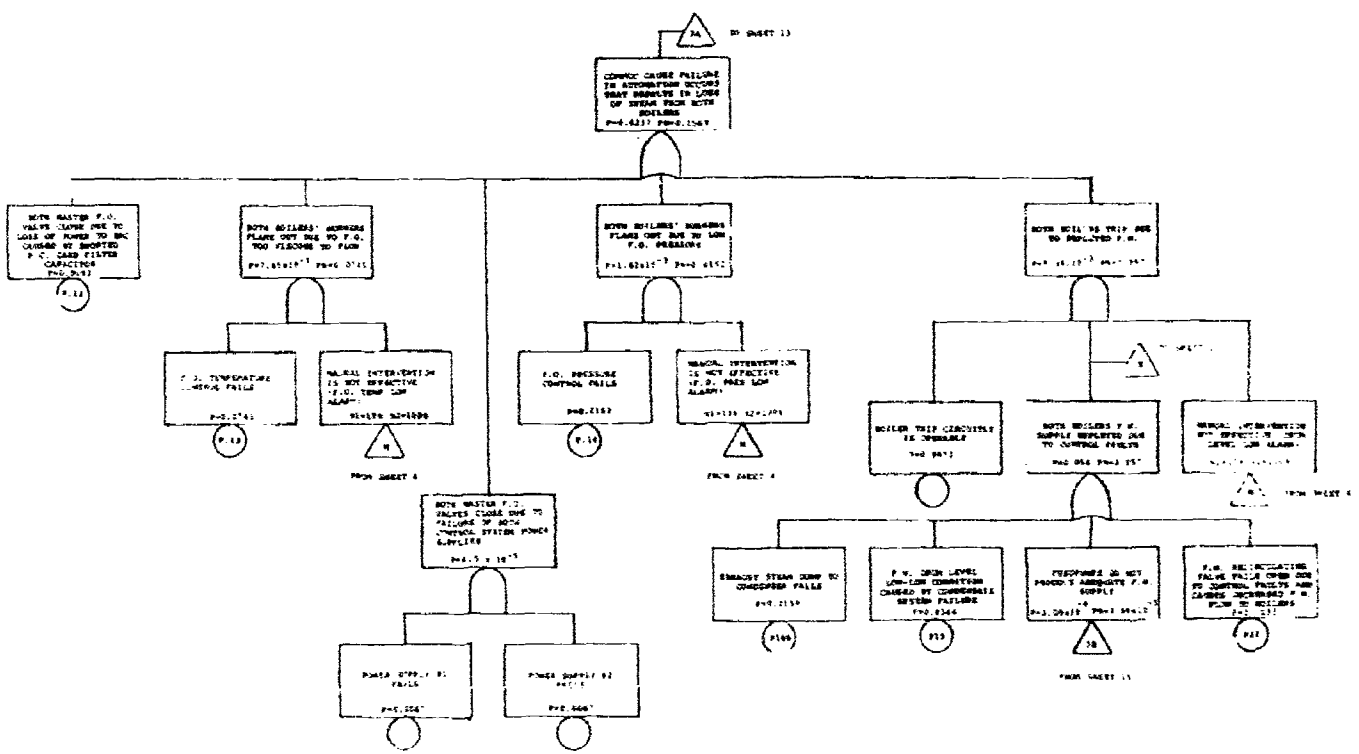


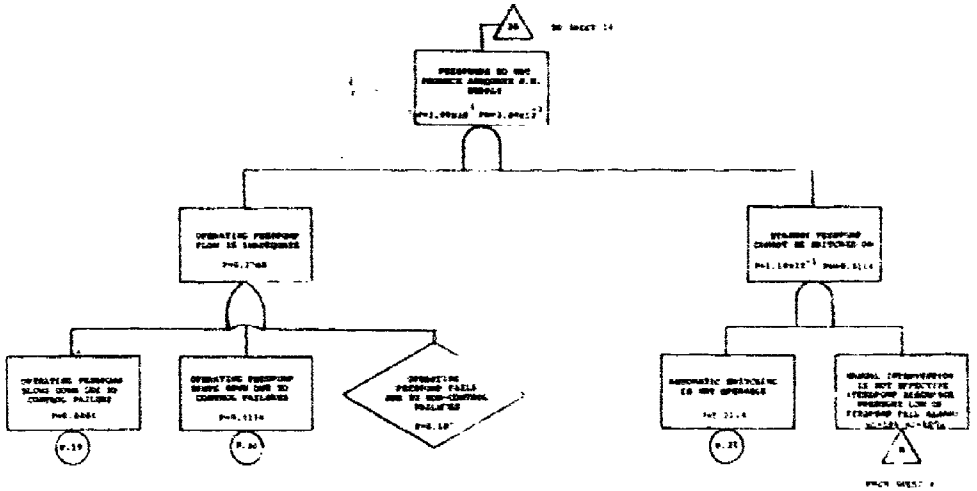


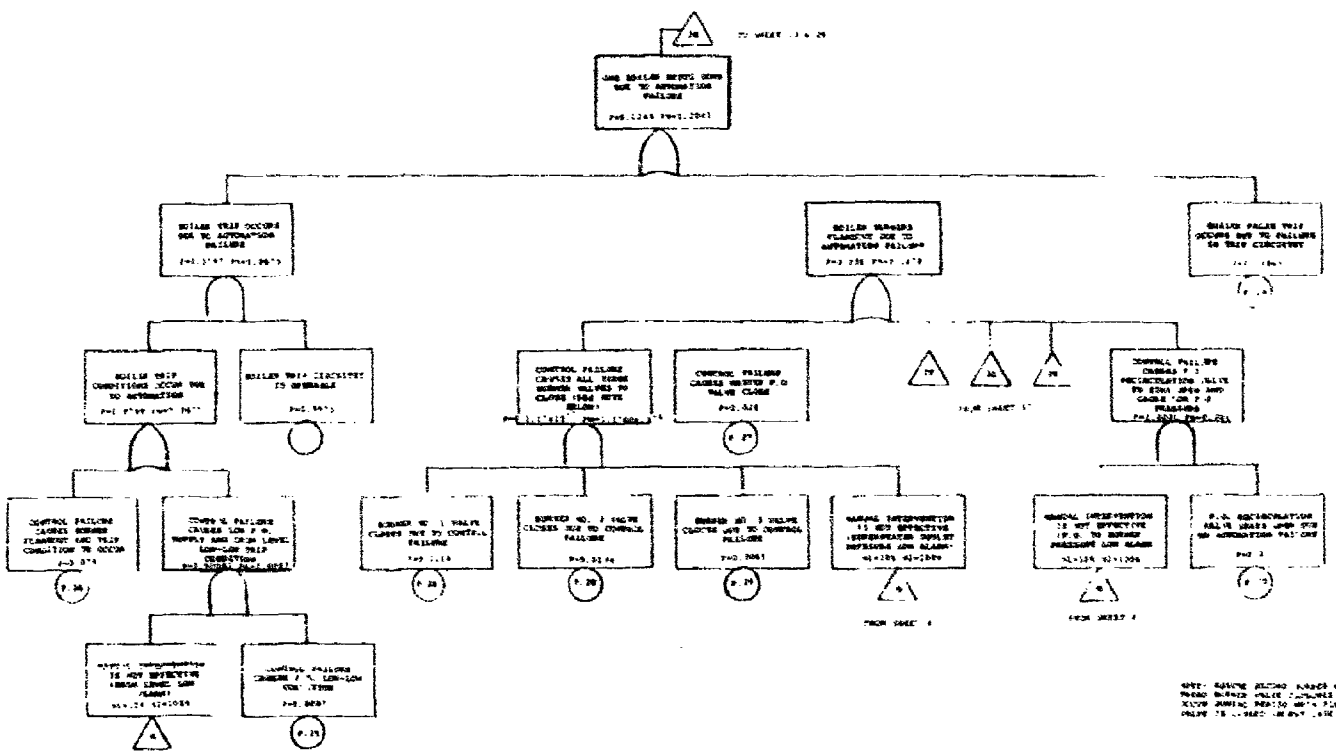


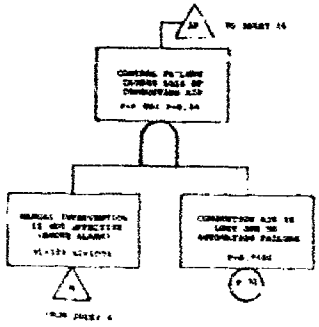

TO SHEET 12
THIS SHEET

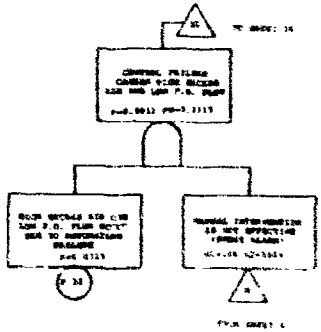


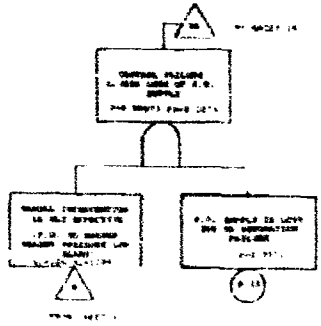


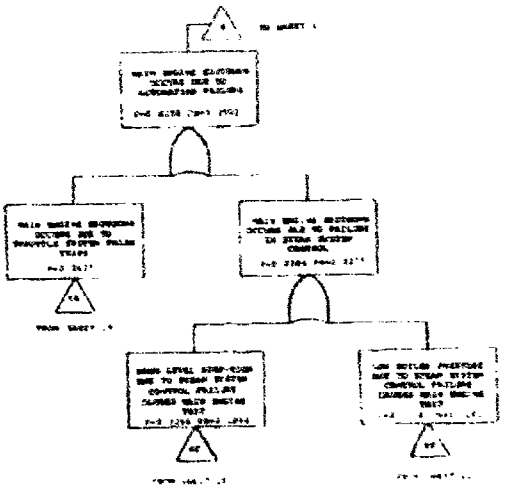


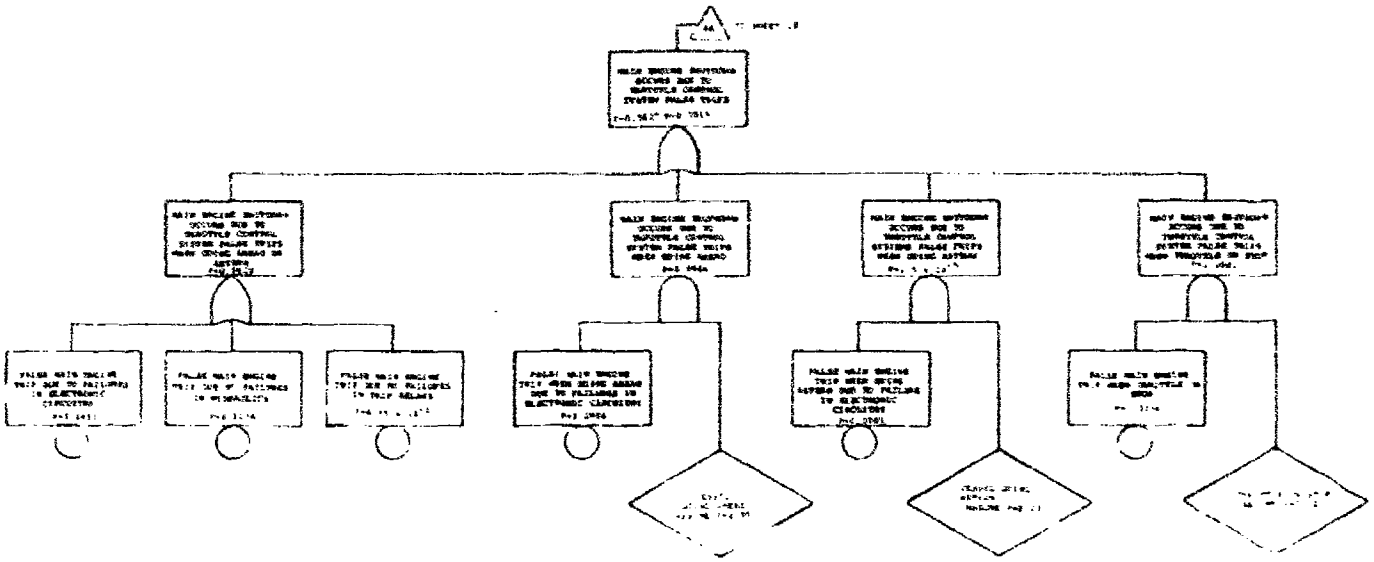


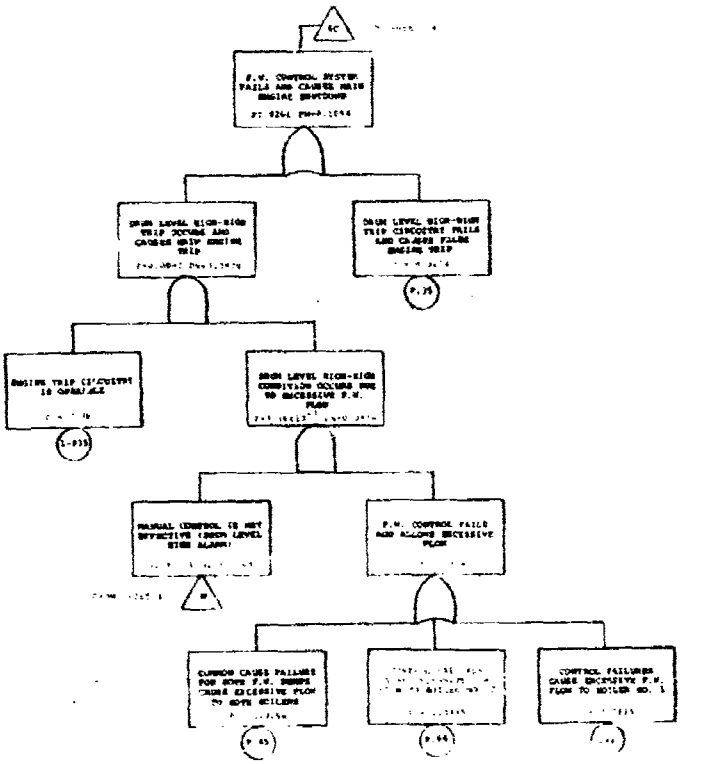


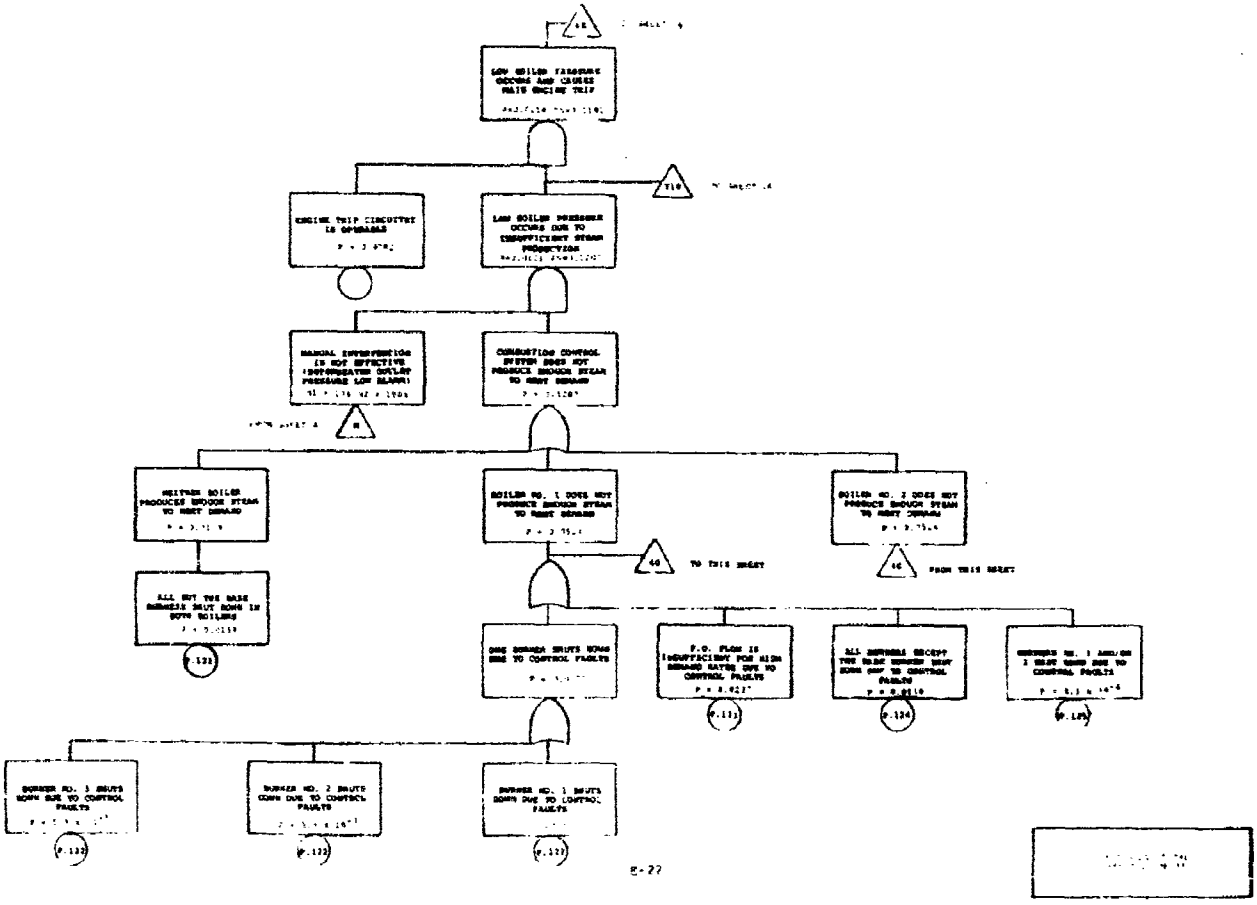


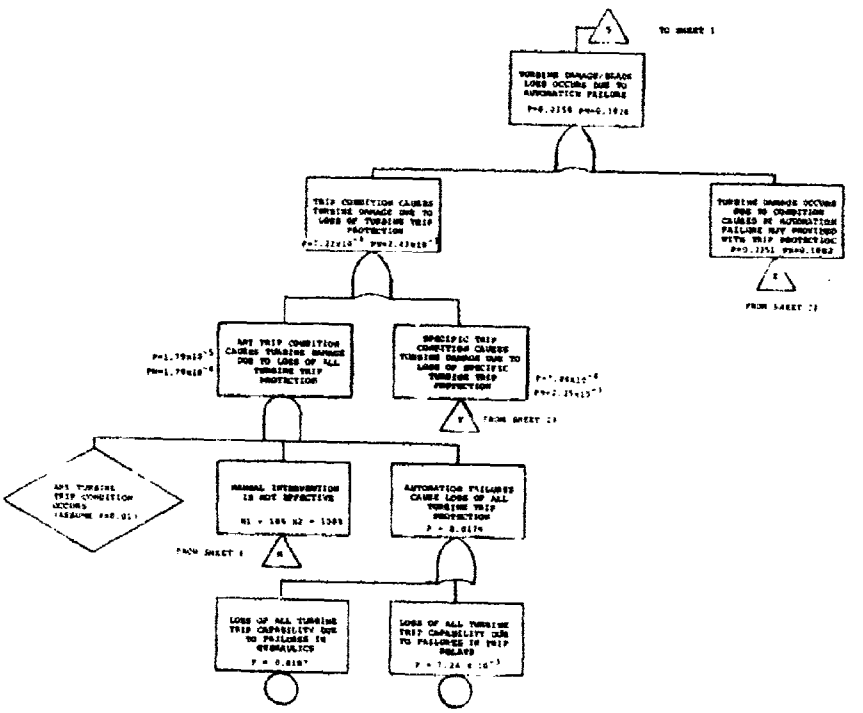


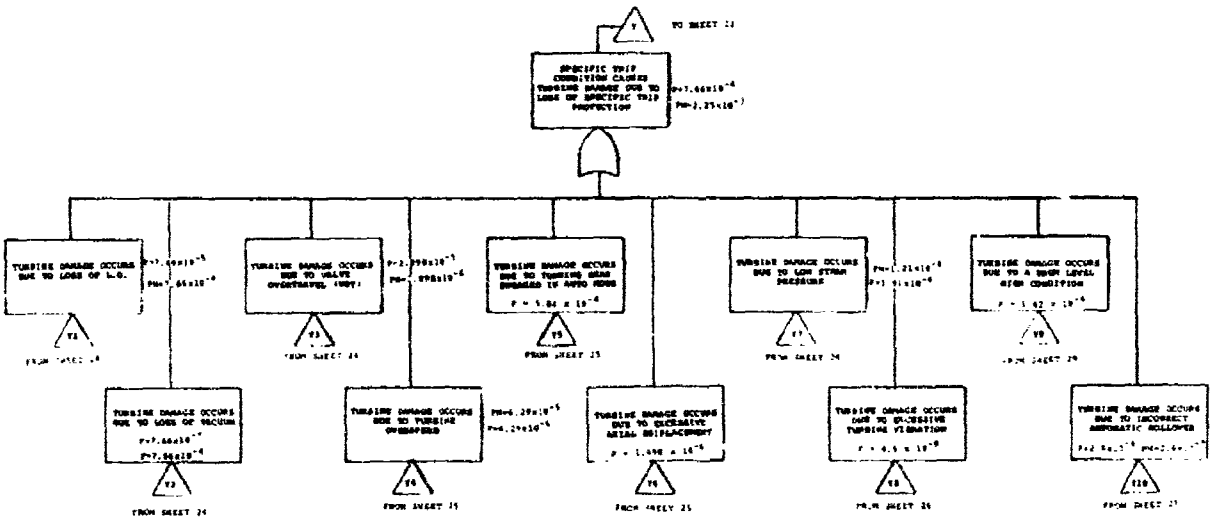


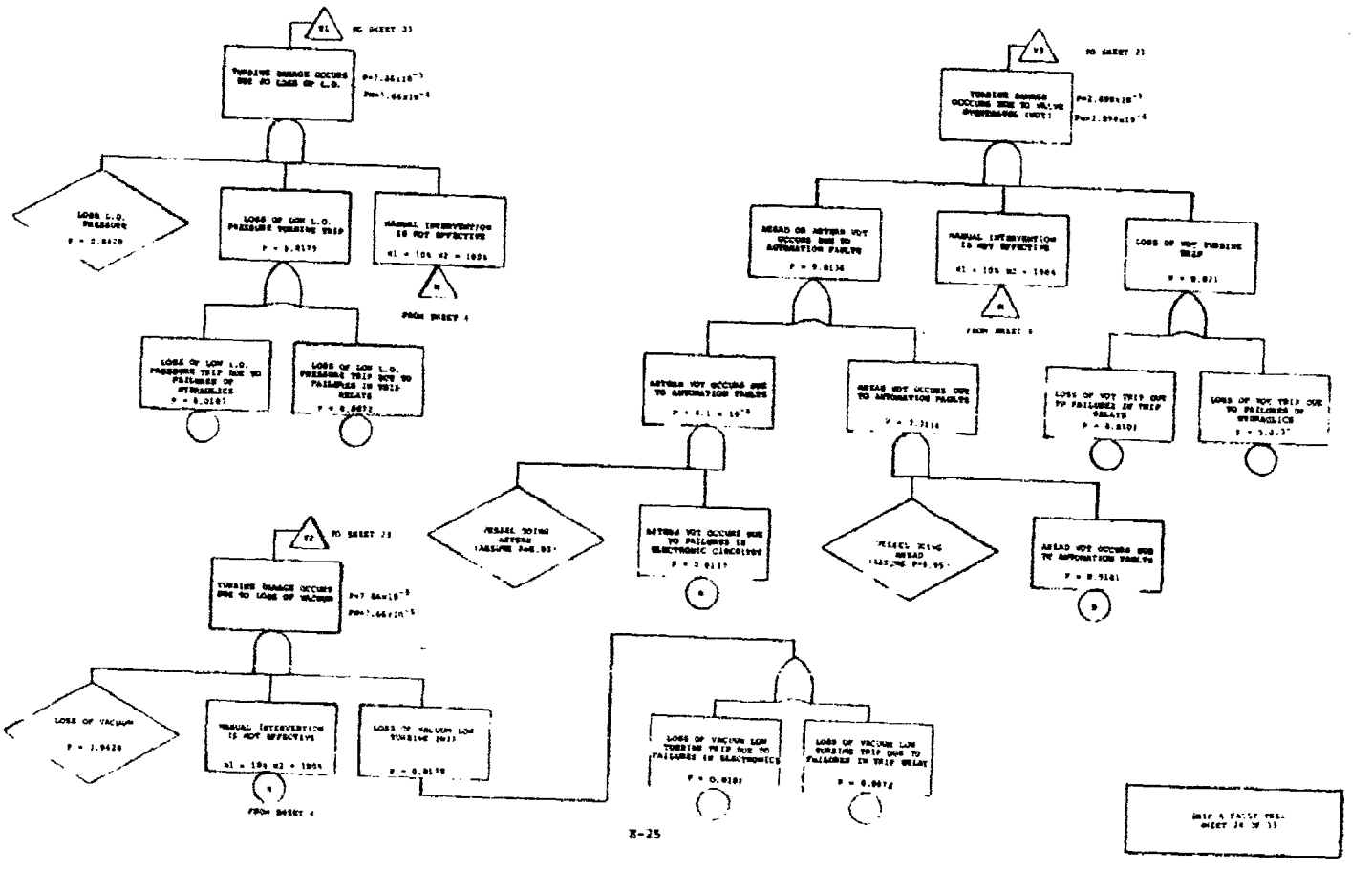


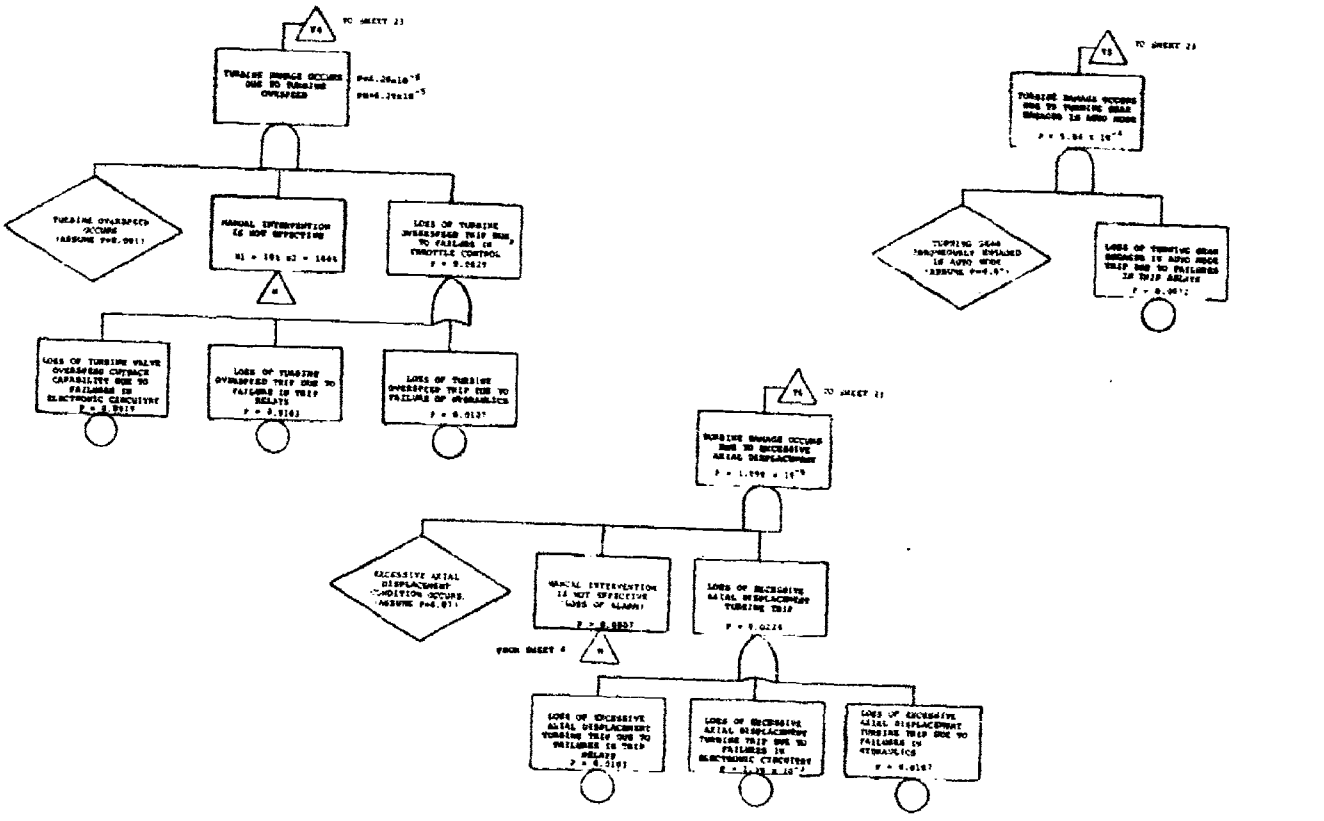


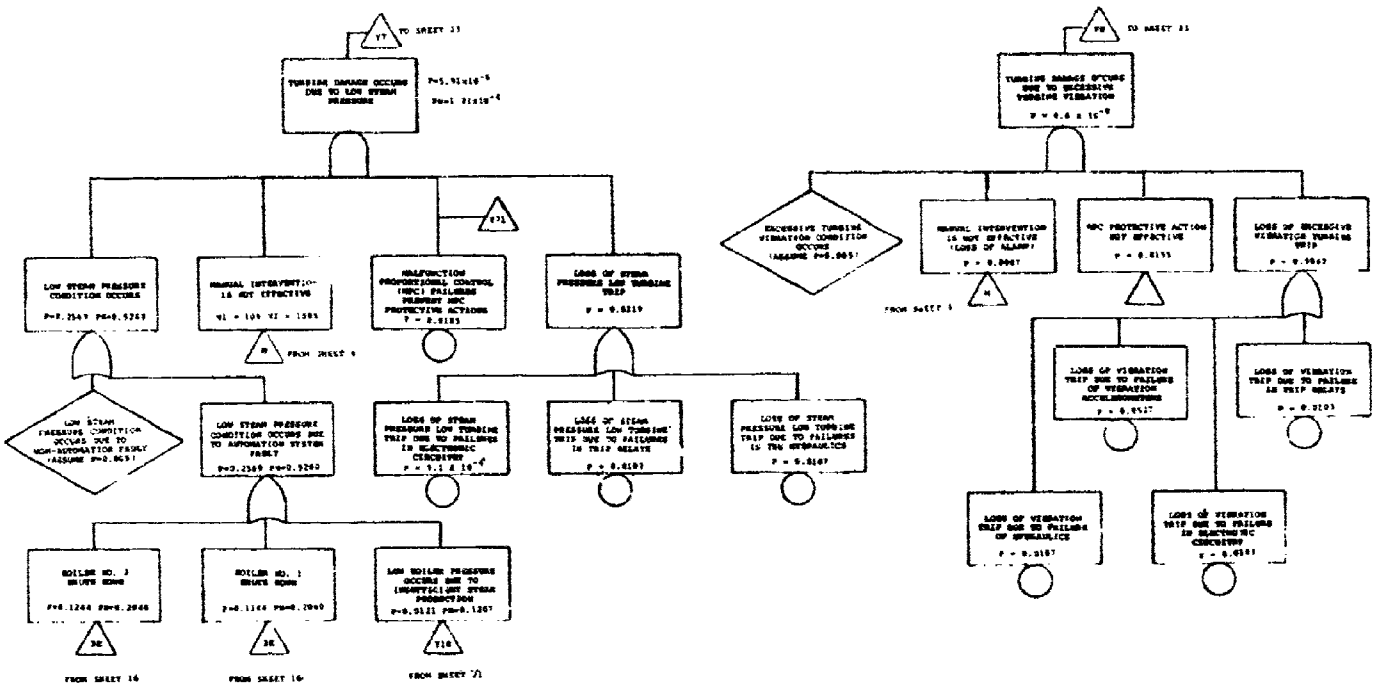


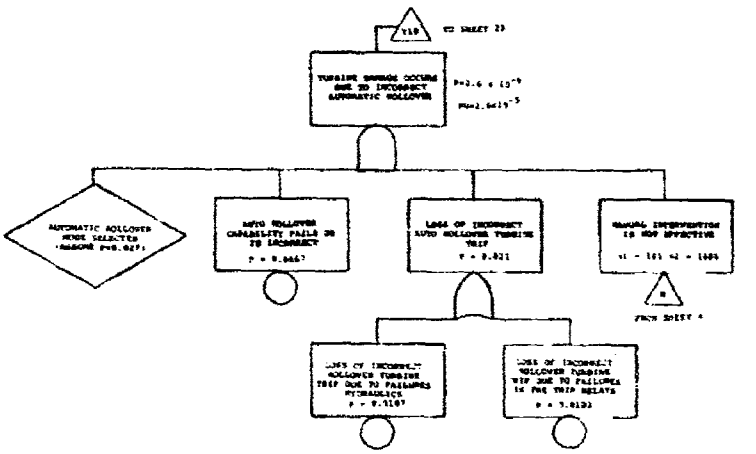

TO SHEET 1
TURBINE DAMAGE/BRAKE LOSS OCCURS DUE TO AUTOMATICH FAILURE
P=0.2358 P#=0.1826
TRIP CONDITION CAUSES TURBINE DAMAGE DUE TO LOSS OF TURBINE TRIP PROTECTION
P=7.22x10^-5 P#=2.43x10^-5
TURBINE DAMAGE OCCURS DUE TO CONDITION CAUSED BY AUTOMATION FAILURE MAY PROVIDED WITH TRIP PROTECTION
P=0.2351 P#=0.1862
FROM SHEET 2
ANT TRIP CONDITION CAUSES TURBINE DAMAGE DUE TO LOSS OF ALL TURBINE TRIP PROTECTION
P=1.79x10^-5
P#=1.79x10^-6
SPECIFIC TRIP CONDITION CAUSES TURBINE DAMAGE DUE TO LOSS OF SPECIFIC TURBINE TRIP PROTECTION
P=7.99x10^-6
P#=2.25x10^-3
FROM SHEET 2
ANT TURBINE TRIP CONDITION OCCURS
(ASSUME P=0.01)
MANUAL INTERVENTION IS NOT EFFECTIVE
H1 = 10% H2 = 100%
AUTOMATION FAILURES CAUSE LOSS OF ALL TURBINE TRIP PROTECTION
P = 8.017%
FROM SHEET 1
LOSS OF ALL TURBINE TRIP CAPABILITY DUE TO FAILURES IN HYDRAULICS
P = 0.018%
LOSS OF ALL TURBINE TRIP CAPABILITY DUE TO FAILURES IN TRIP POLARS
P = 7.2A x 10^-3

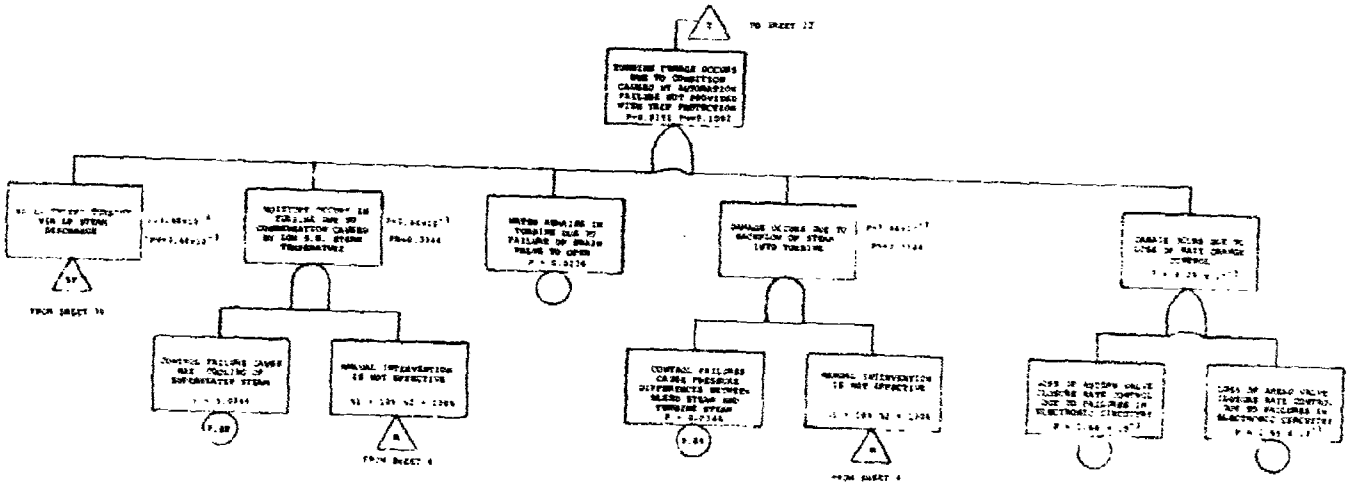

TO SHEET 23
OVERSPEED TRIP CONDITION CAUSES TURBINE DAMAGE DUE TO LOSS OF OVERSPEED TRIP PROTECTION
P=7.66x10⁻⁴
PM=2.27x10⁻³
TURBINE DAMAGE OCCURS DUE TO LOSS OF L.O.
P=7.66x10⁻⁵
PM=7.66x10⁻⁶
T1
FROM SHEET 24
TURBINE DAMAGE OCCURS DUE TO LOSS OF VACUUM
P=7.66x10⁻⁴
P=7.66x10⁻⁶
T2
FROM SHEET 24
TURBINE DAMAGE OCCURS DUE TO VALVE OVERTRAVEL (MOT)
P=2.298x10⁻³
PM=2.298x10⁻⁶
T3
FROM SHEET 24
TURBINE DAMAGE OCCURS DUE TO TURBINE OVERSPEED
PM=6.29x10⁻⁵
P=6.29x10⁻⁶
T4
FROM SHEET 25
TURBINE DAMAGE OCCURS DUE TO TURBINE GEARS DAMAGED IN AUTO MODE
P = 5.84 x 10⁻⁴
T5
FROM SHEET 25
TURBINE DAMAGE OCCURS DUE TO EXCESSIVE AXIAL DISPLACEMENT
P = 1.498 x 10⁻⁴
T6
FROM SHEET 25
TURBINE DAMAGE OCCURS DUE TO LOW STEAM PRESSURE
P=2.21x10⁻⁴
P=2.21x10⁻⁶
T7
FROM SHEET 26
TURBINE DAMAGE OCCURS DUE TO EXCESSIVE TURBINE VIBRATION
P = 6.9 x 10⁻⁸
T8
FROM SHEET 26
TURBINE DAMAGE OCCURS DUE TO A HIGH LEVEL HFW CONDITION
P = 1.02 x 10⁻⁴
T9
FROM SHEET 29
TURBINE DAMAGE OCCURS DUE TO INCORRECT AUTOMATIC ROLLOVER
T10
FROM SHEET 27

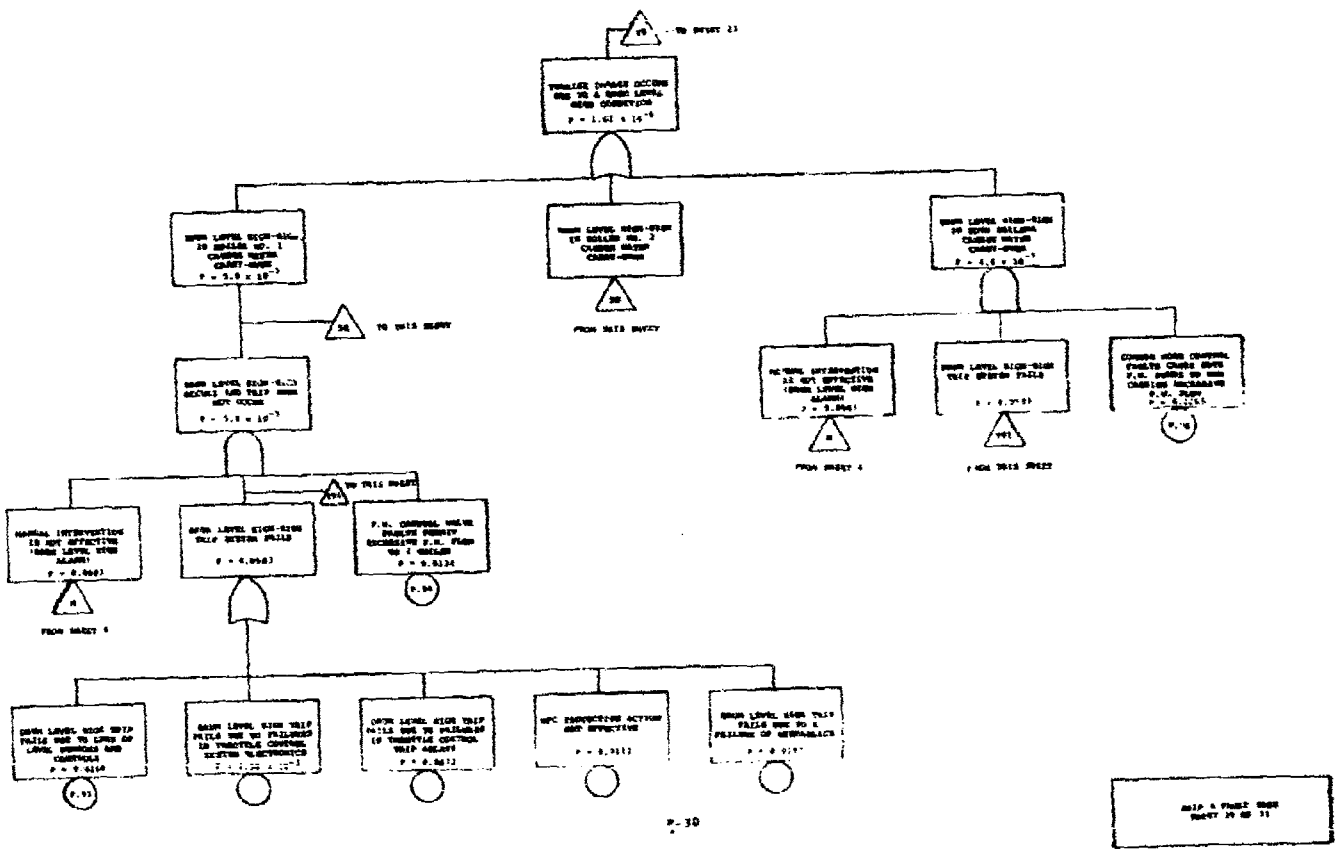

TURBINE DAMAGE OCCURS DUE TO LOSS OF L.O.
LOSS L.O. PRESSURE
LOSS OF LOW L.O. PRESSURE TURBINE TRIP
MANUAL INTERVENTION IS NOT EFFECTIVE
LOSS OF LOW L.O. PRESSURE TRIP DUE TO FAILURES OF HYDRAULICS
LOSS OF LOW L.O. PRESSURE TRIP DUE TO FAILURES IN TRIP RELAYS
TURBINE DAMAGE OCCURS DUE TO LOSS OF VACUUM
LOSS OF VACUUM
MANUAL INTERVENTION IS NOT EFFECTIVE
LOSS OF VACUUM LOW TURBINE TRIP
LOSS OF VACUUM LOW TURBINE TRIP DUE TO FAILURES IN ELECTRONICS
LOSS OF VACUUM LOW TURBINE TRIP DUE TO FAILURES IN TRIP RELAY
TURBINE DAMAGE OCCURS DUE TO VALVE SYNDROME (VOT)
ASEAD OR ASTERN VOT OCCURS DUE TO AUTOMATION FAILUR
MANUAL INTERVENTION IS NOT EFFECTIVE
LOSS OF VOT TURBINE TRIP
ASTERN VOT OCCURS DUE TO AUTOMATION FAILURE
ASEAD VOT OCCURS DUE TO AUTOMATION FAILURE
LOSS OF VOT TRIP DUE TO FAILURES OF TRIP RELAYS
LOSS OF VOT TRIP DUE TO FAILURES OF HYDRAULICS
ASTERN VOT OCCURS DUE TO FAILURES IN ELECTRONIC CIRCUITRY
ASEAD VOT OCCURS DUE TO AUTOMATION FAILURE
FROM SHEET 4
TO SHEET 21

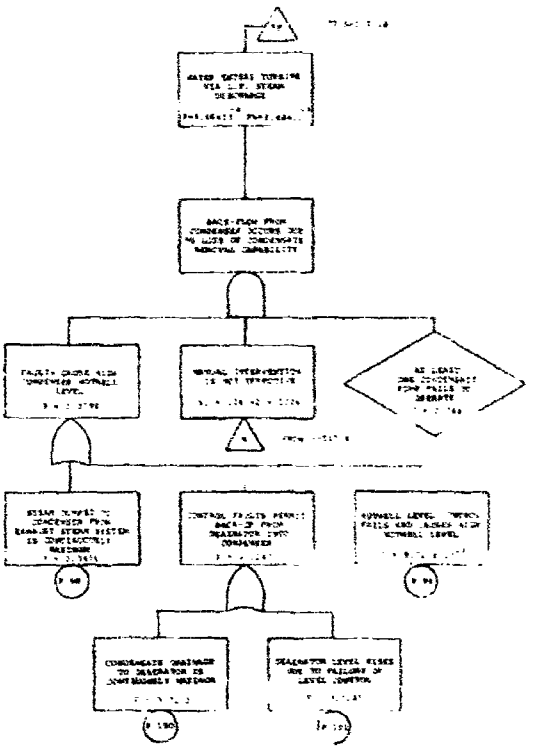

TO SHEET 23
TURBINE DAMAGE OCCURS DUE TO TURBINE OVERSPEED
TURBINE OVERSPEED OCCURS (ASSUME P=0.001)
MANUAL INTERVENTION IS NOT EFFECTIVE
LOSS OF TURBINE OVERSPEED TRIP DUE TO FAILURE OF THROTTLE CONTROL
P = 0.0429
LOSS OF TURBINE VALVE OVERSPEED CUTBACK CAPABILITY DUE TO FAILURES IN ELECTRONIC CIRCUITRY
P = 0.0017
LOSS OF TURBINE OVERSPEED TRIP DUE TO FAILURES IN TRIP RELAYS
P = 0.0161
LOSS OF TURBINE OVERSPEED TRIP DUE TO FAILURE OF HYDRAULICS
P = 0.0137
TO SHEET 23
TURBINE DAMAGE OCCURS DUE TO TURBINE GEAR BREAKER IN AUTO MODE
TURNING GEAR INADVERTENTLY ENGAGED IN AUTO MODE (ASSUME P=0.1)
LOSS OF TURNING GEAR BREAKER IN AUTO MODE TRIP DUE TO FAILURES IN TRIP RELAYS
P = 0.001
TO SHEET 23
TURBINE DAMAGE OCCURS DUE TO EXCESSIVE AXIAL DISPLACEMENT
P = 1.998 x 10^-5
EXCESSIVE AXIAL DISPLACEMENT CONDITION OCCURS. (ASSUME P=0.01)
MANUAL INTERVENTION IS NOT EFFECTIVE (LOSS OF ALARM)
P = 0.0037
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP DUE TO FAILURES IN TRIP RELAYS
P = 0.0226
FROM SHEET 4
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP DUE TO FAILURES IN TRIP RELAYS
P = 0.0161
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP DUE TO FAILURES IN ELECTRONIC CIRCUITRY
P = 1.15 x 10^-7
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP DUE TO FAILURES IN HYDRAULICS
P = 0.0167
SHIP A FAULT TREE INSERT 23 OF 23

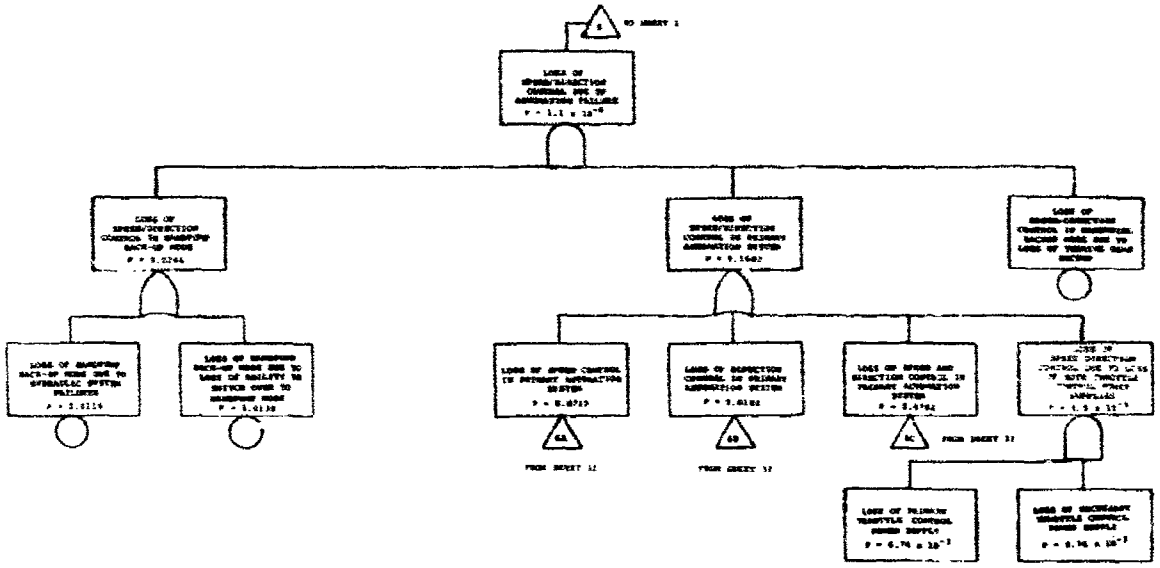


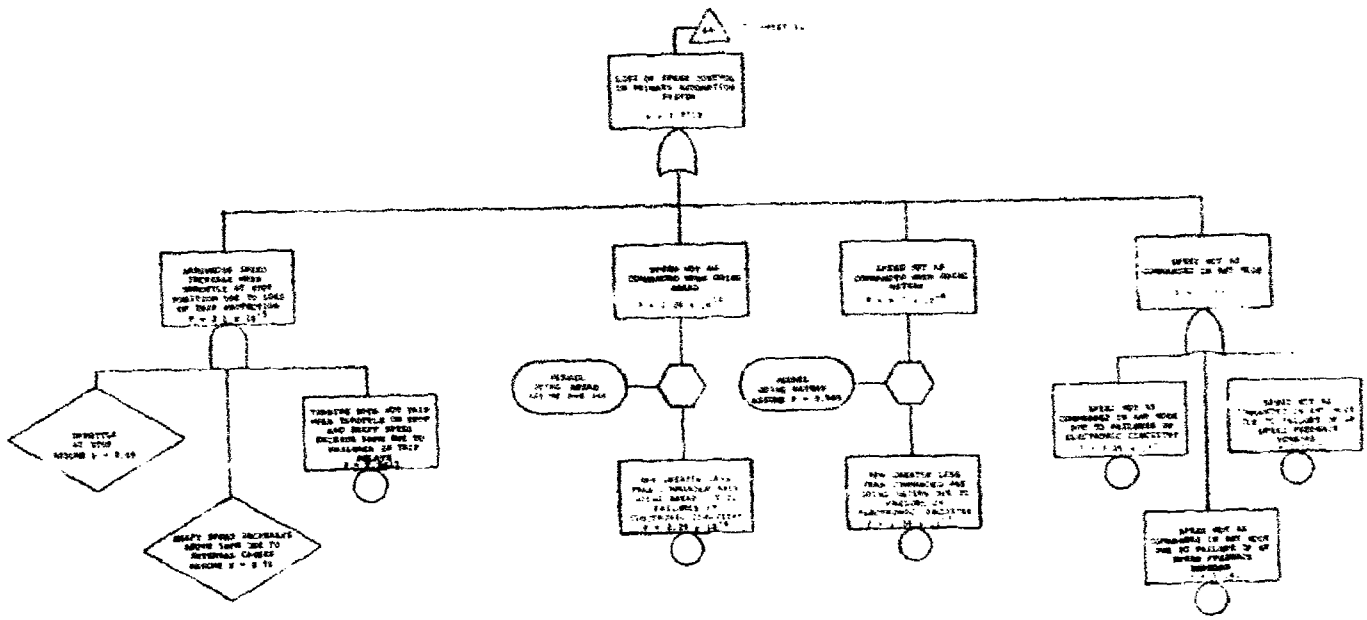

Y10
TURBINE DRIVEN OCCURS DUE TO INCORRECT AUTOMATIC ROLLOVER
AUTOMATIC ROLLOVER MODE SELECTED
AUTO ROLLOVER CAPABILITY FAILS TO INCORRECT
LOSS OF INCORRECT AUTO ROLLOVER TURBINE TRIP
MANUAL INTERVENTION IS NOT EFFECTIVE
LOSS OF INCORRECT ROLLOVER TURBINE TRIP DUE TO FAILURES HYDRAULICS
LOSS OF INCORRECT ROLLOVER TURBINE TRIP DUE TO FAILURES IN THE TRIP RELAYS

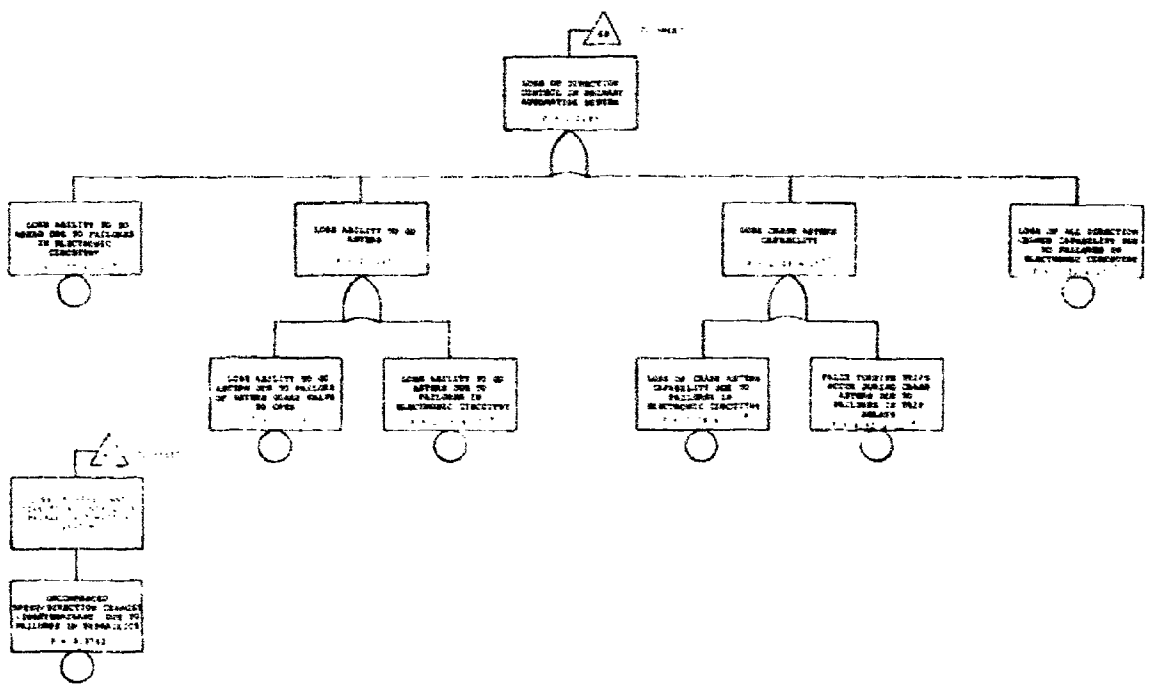


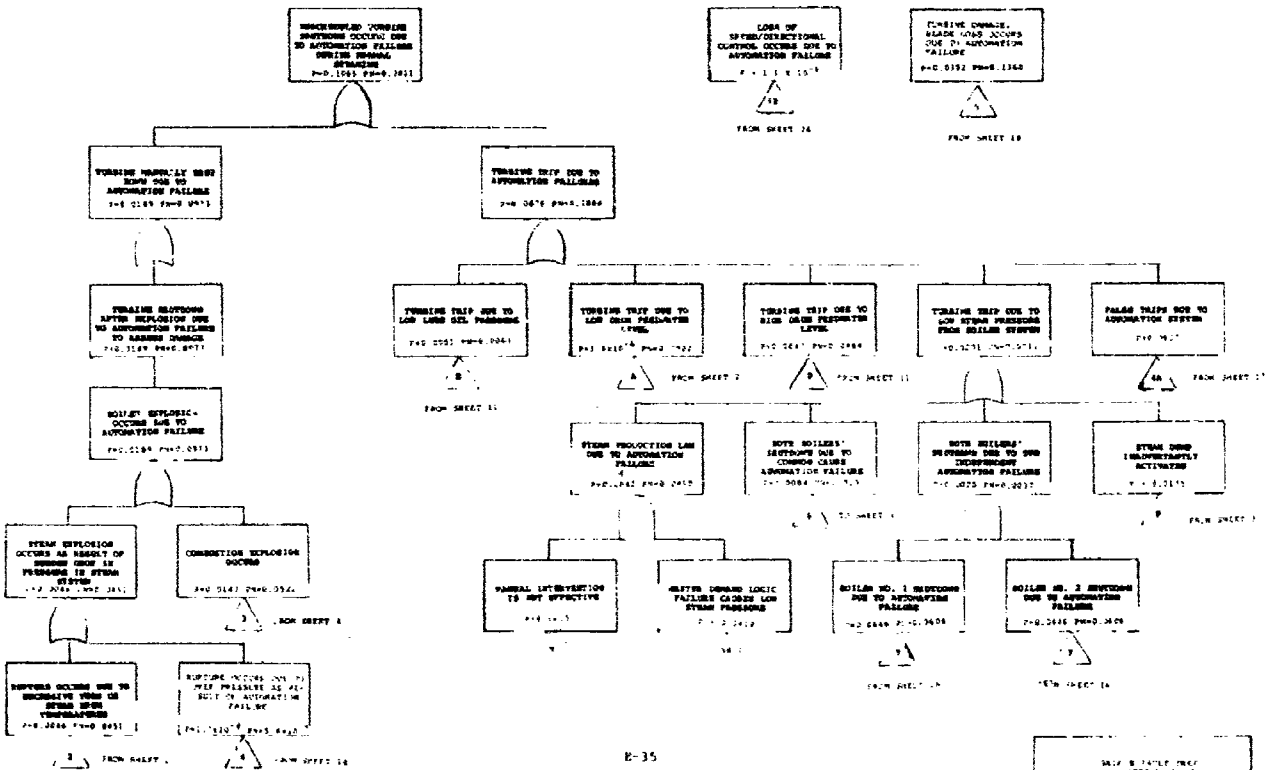


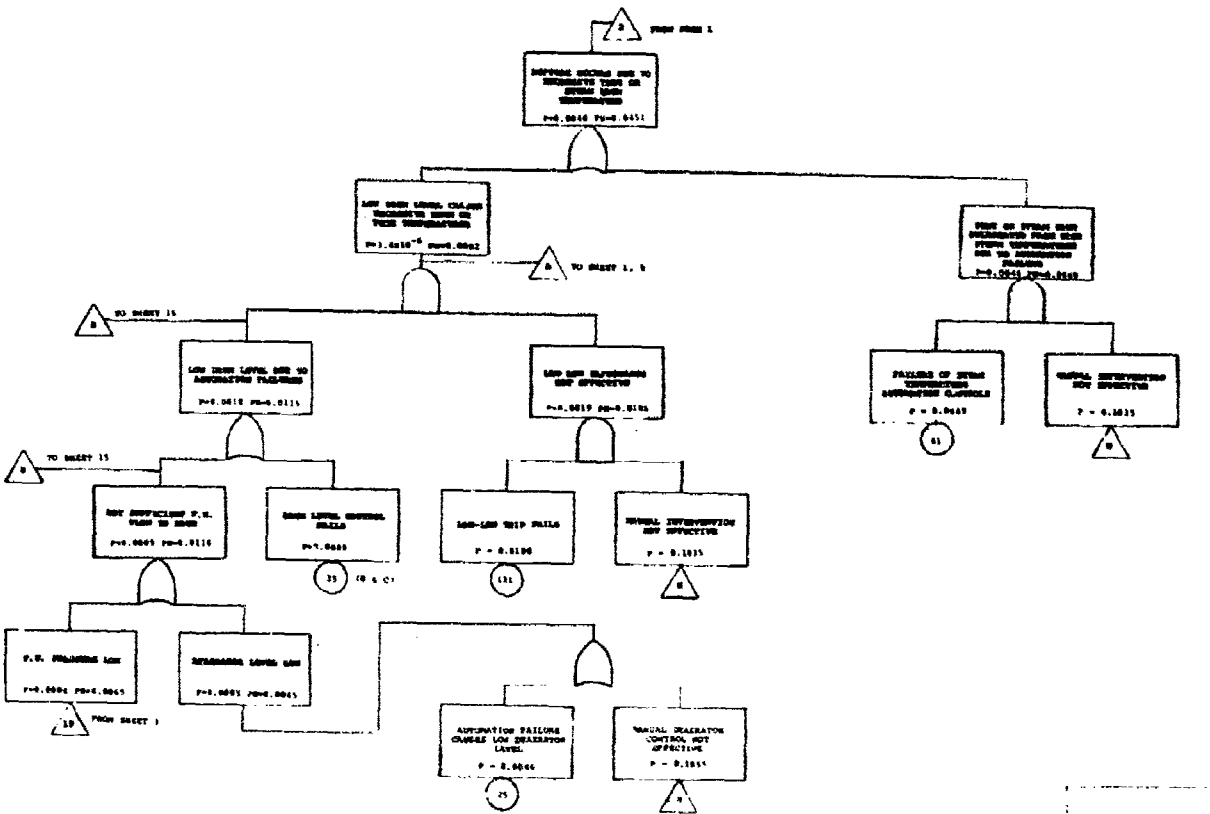


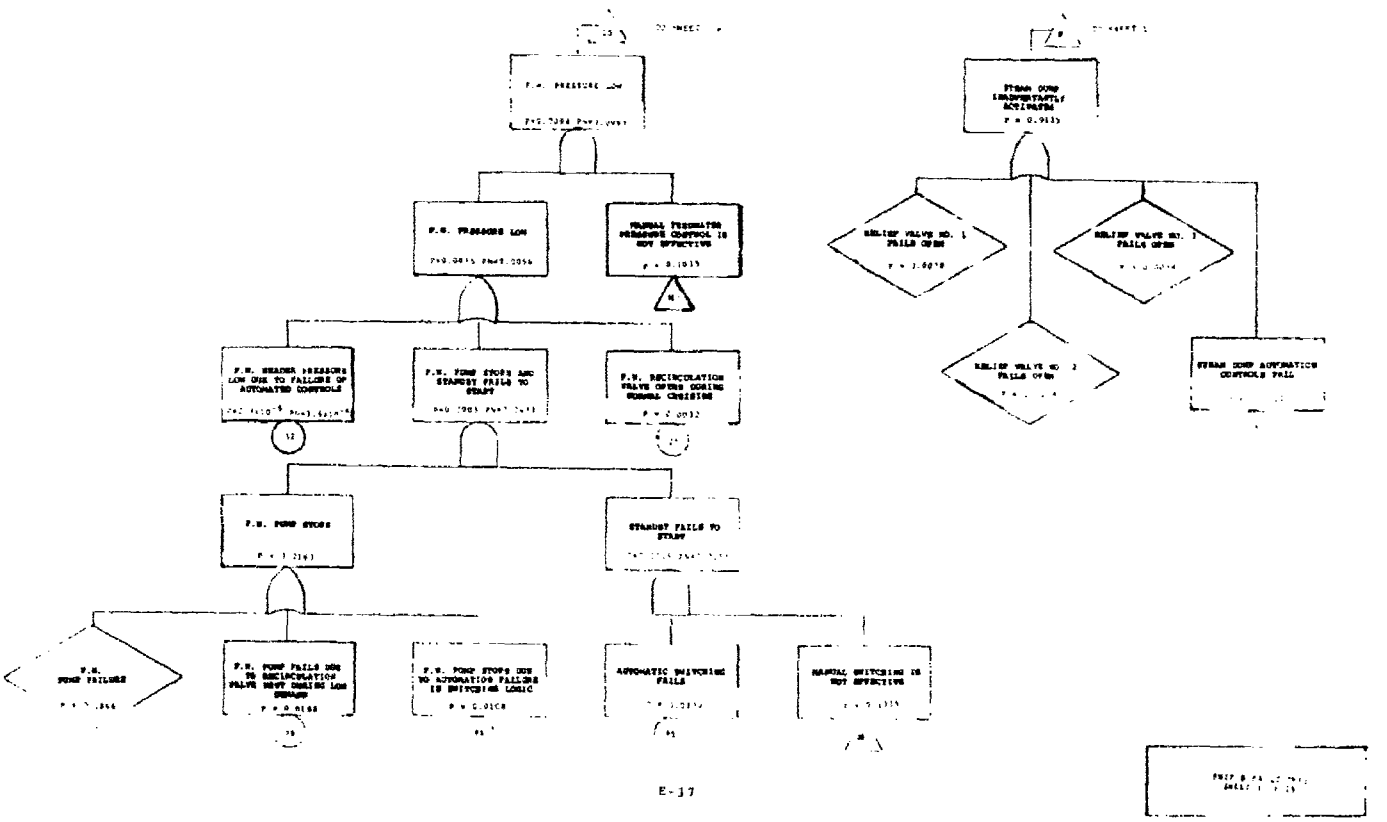


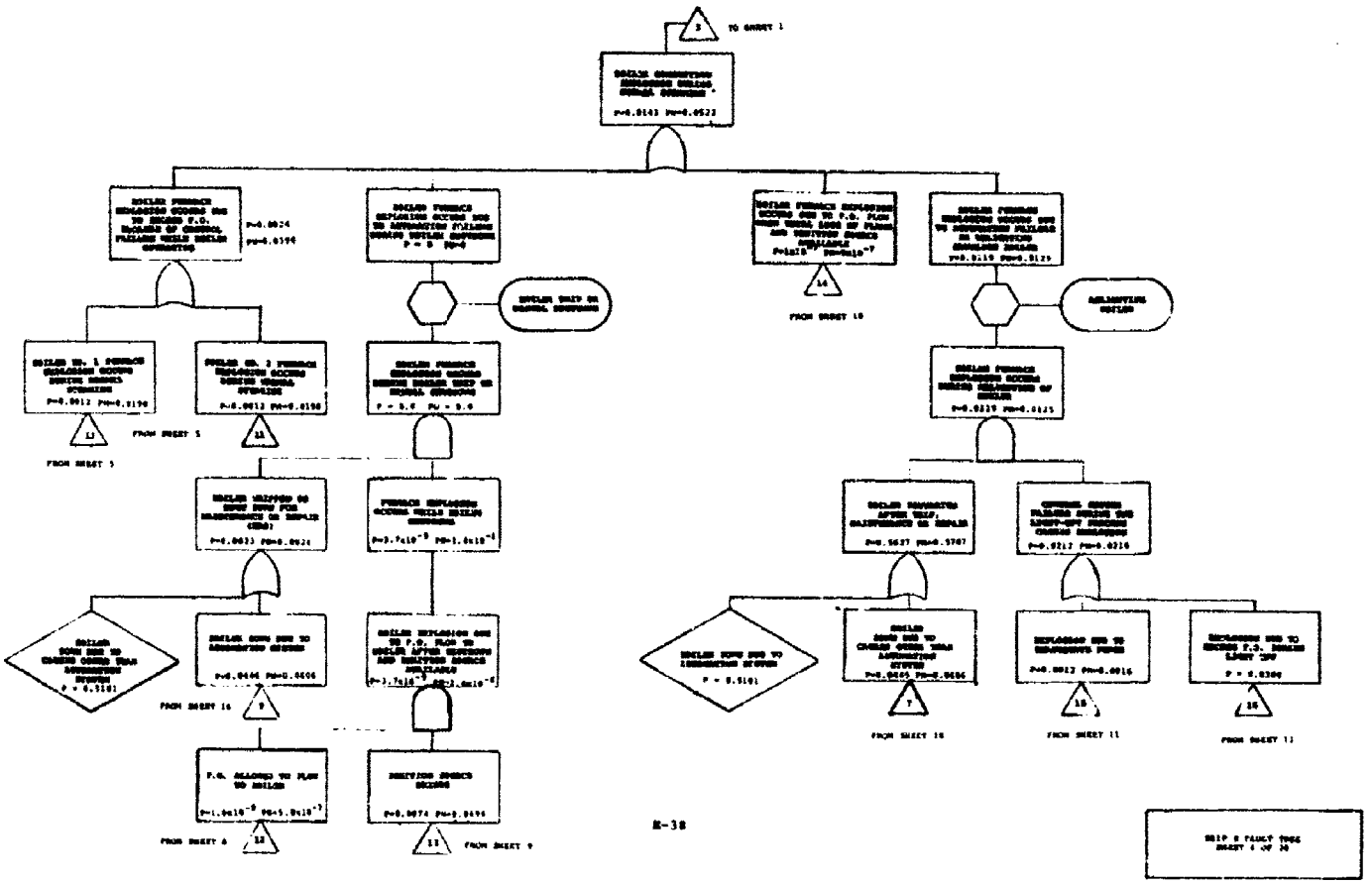


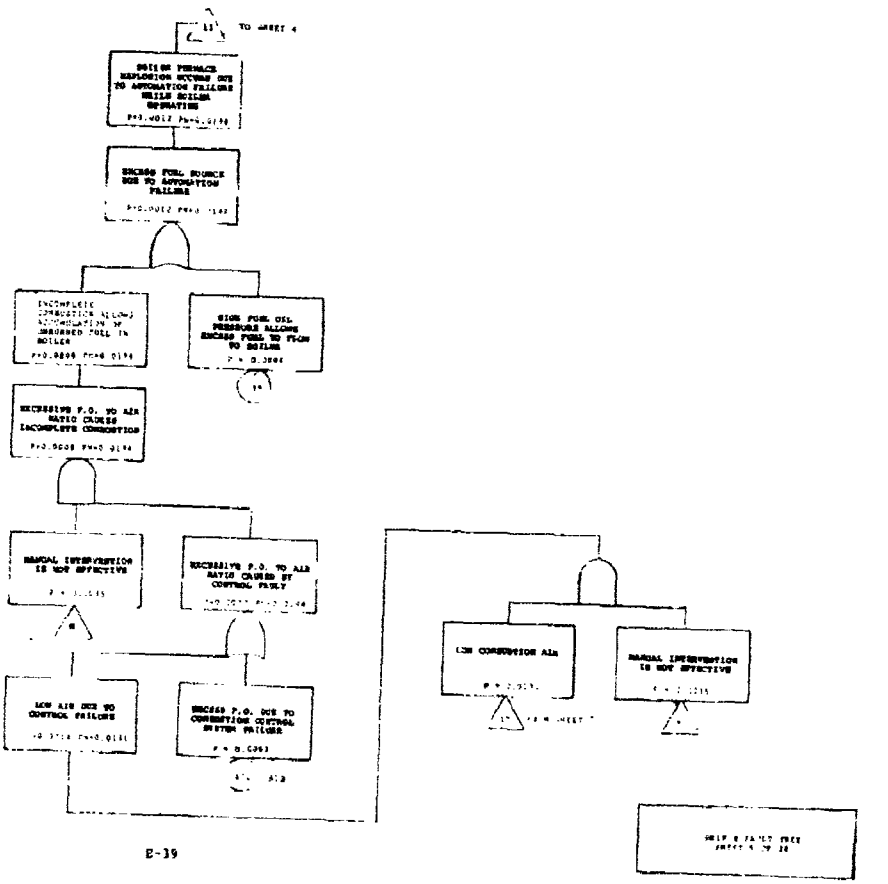


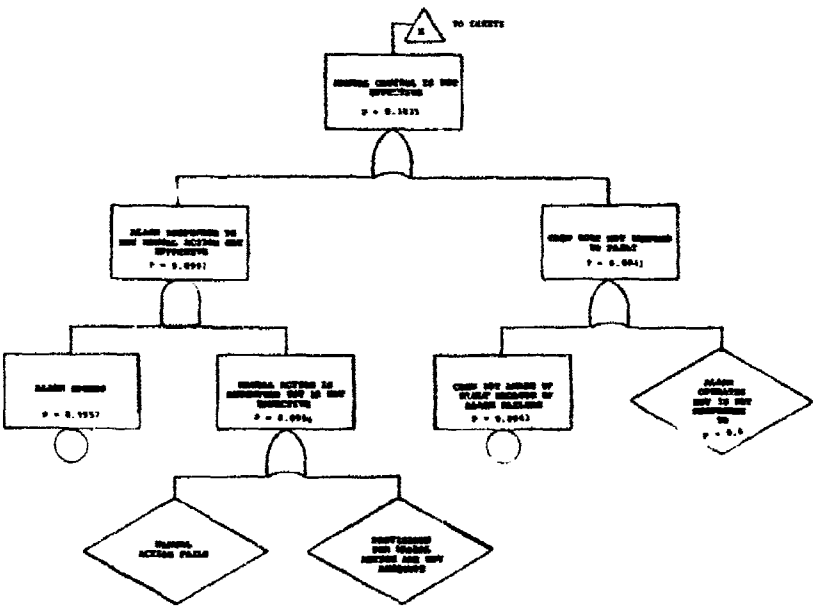


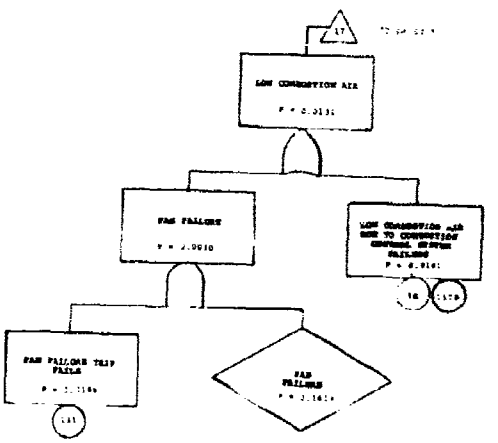


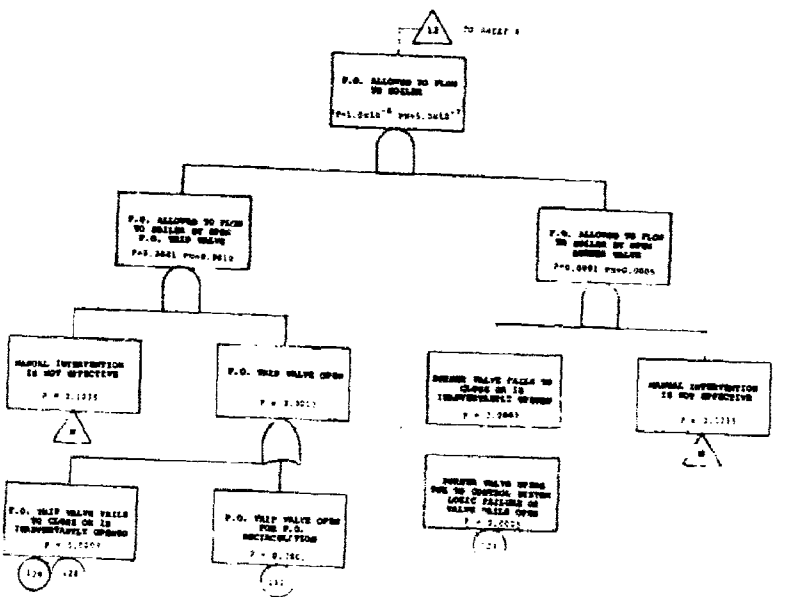


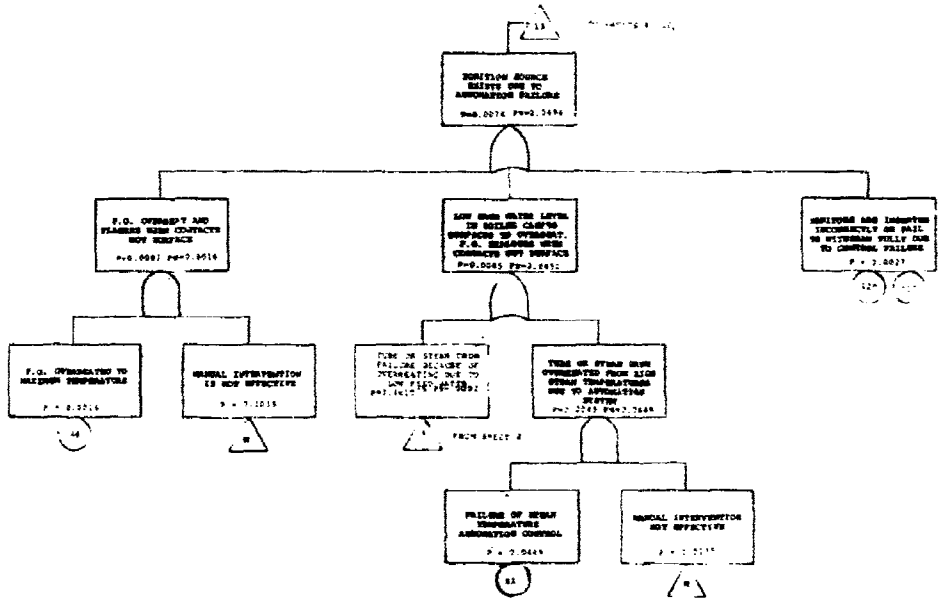


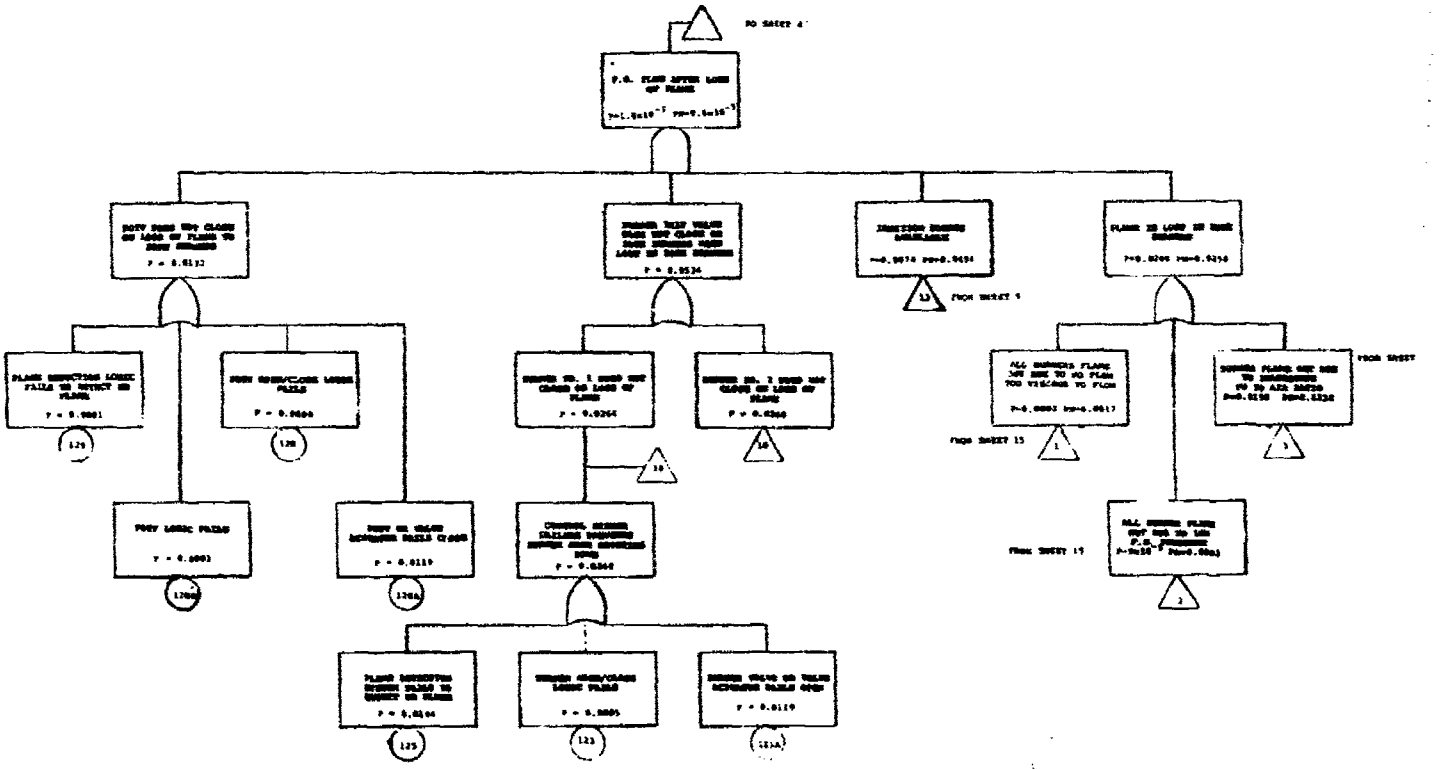


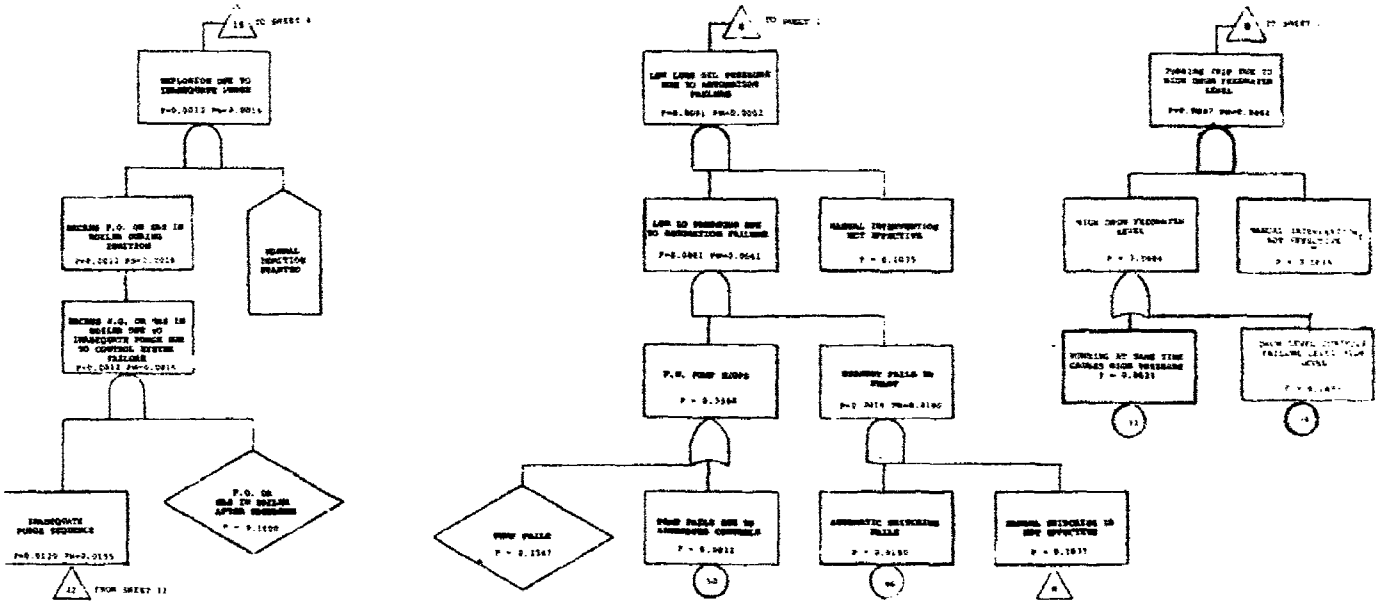


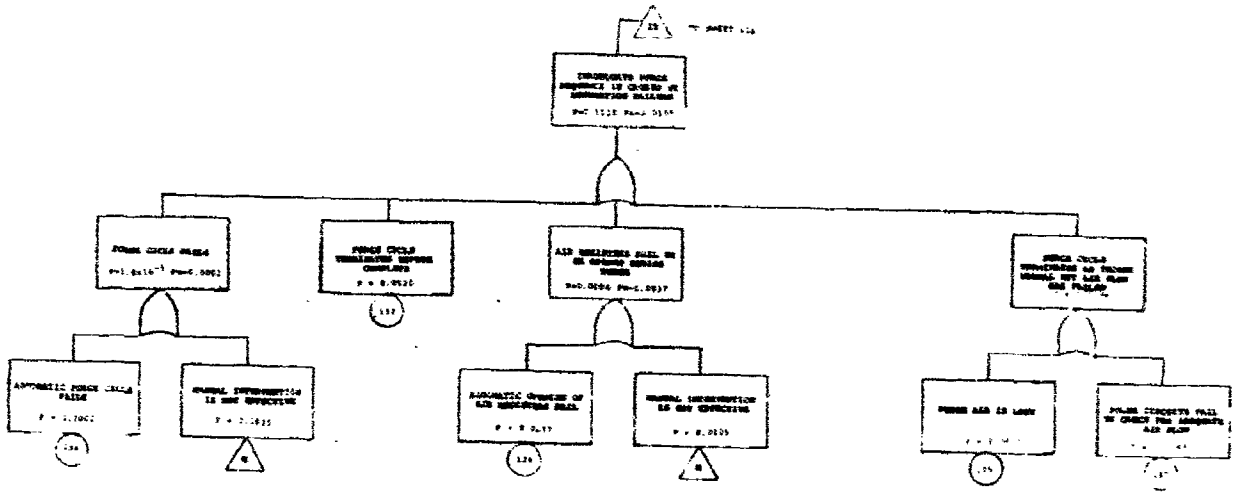

17
LOW COMBUSTION AIR
FAN FAILURE
P = 2.0010
FAN FAILURE TRIP
FAILS
FAN
FAILURE

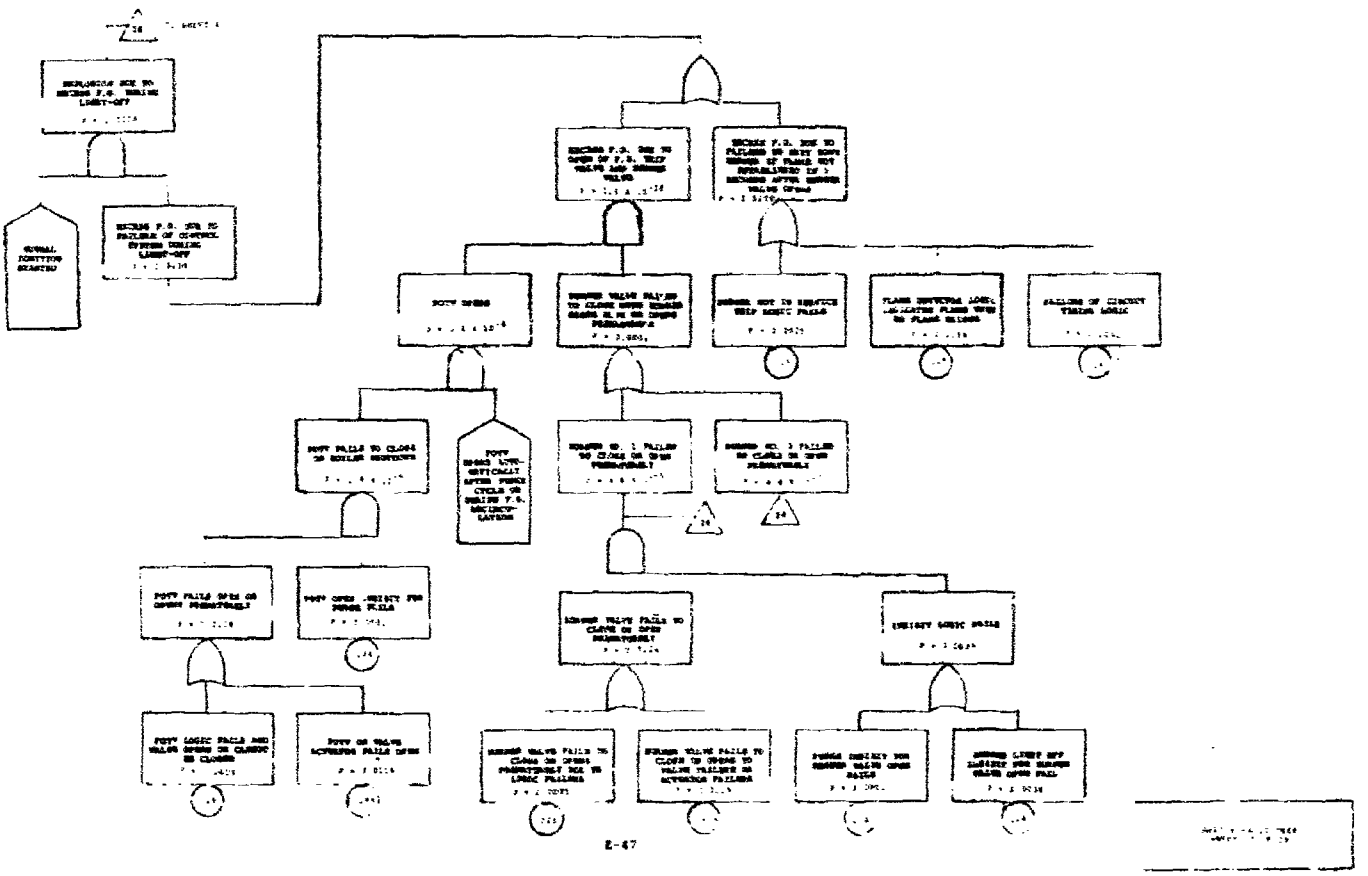


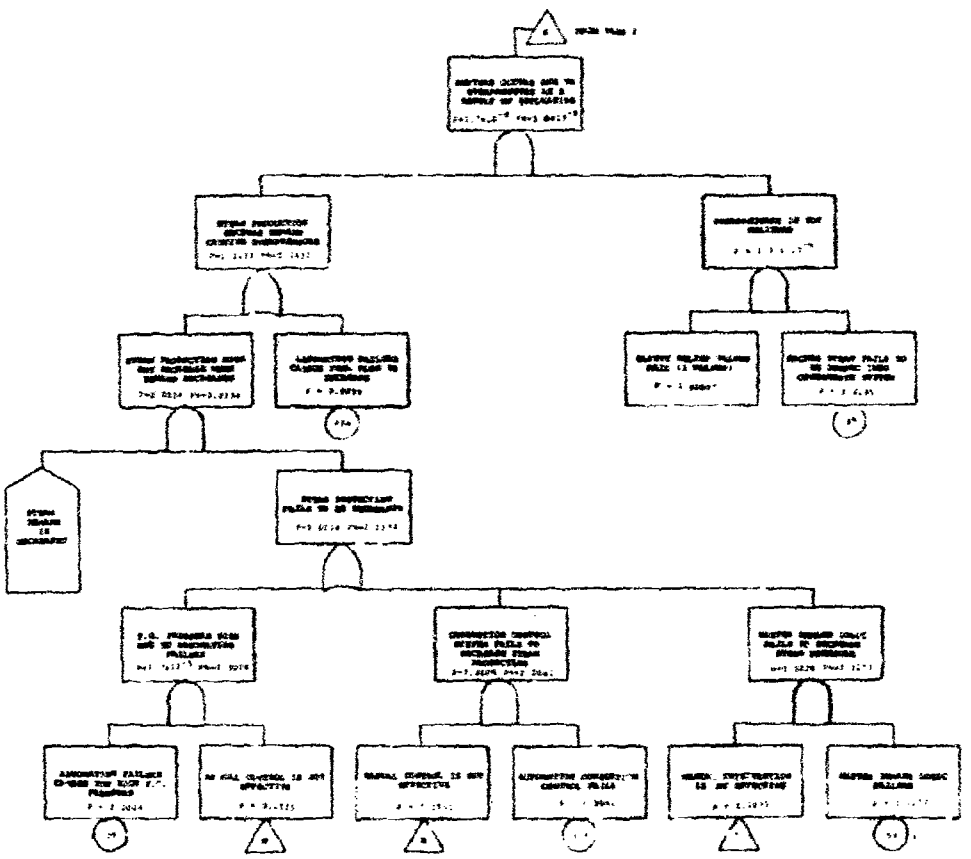

F.O. OPERATION TO MAINTAIN TEMPERATURE
MANUAL INTERVENTION IS NOW EFFECTIVE
FROM SHEET 2
FAILURE OF STEAM TEMPERATURE ATTEMPERATION CONTROL
MANUAL INTERVENTION NOT EFFECTIVE

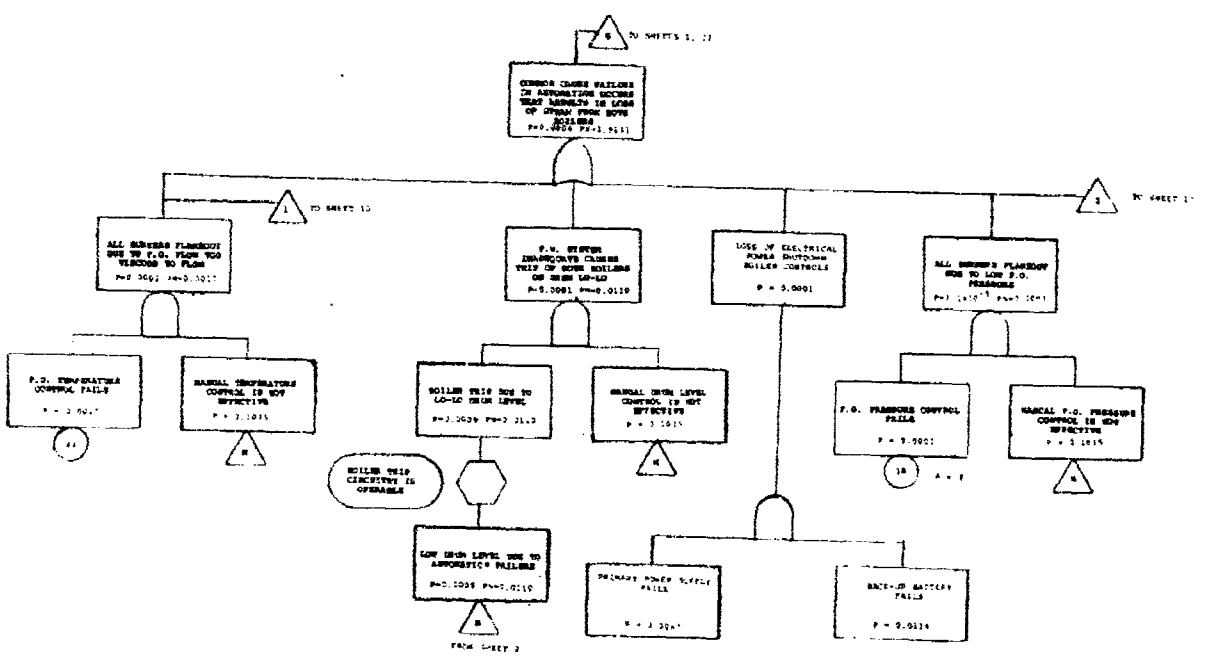


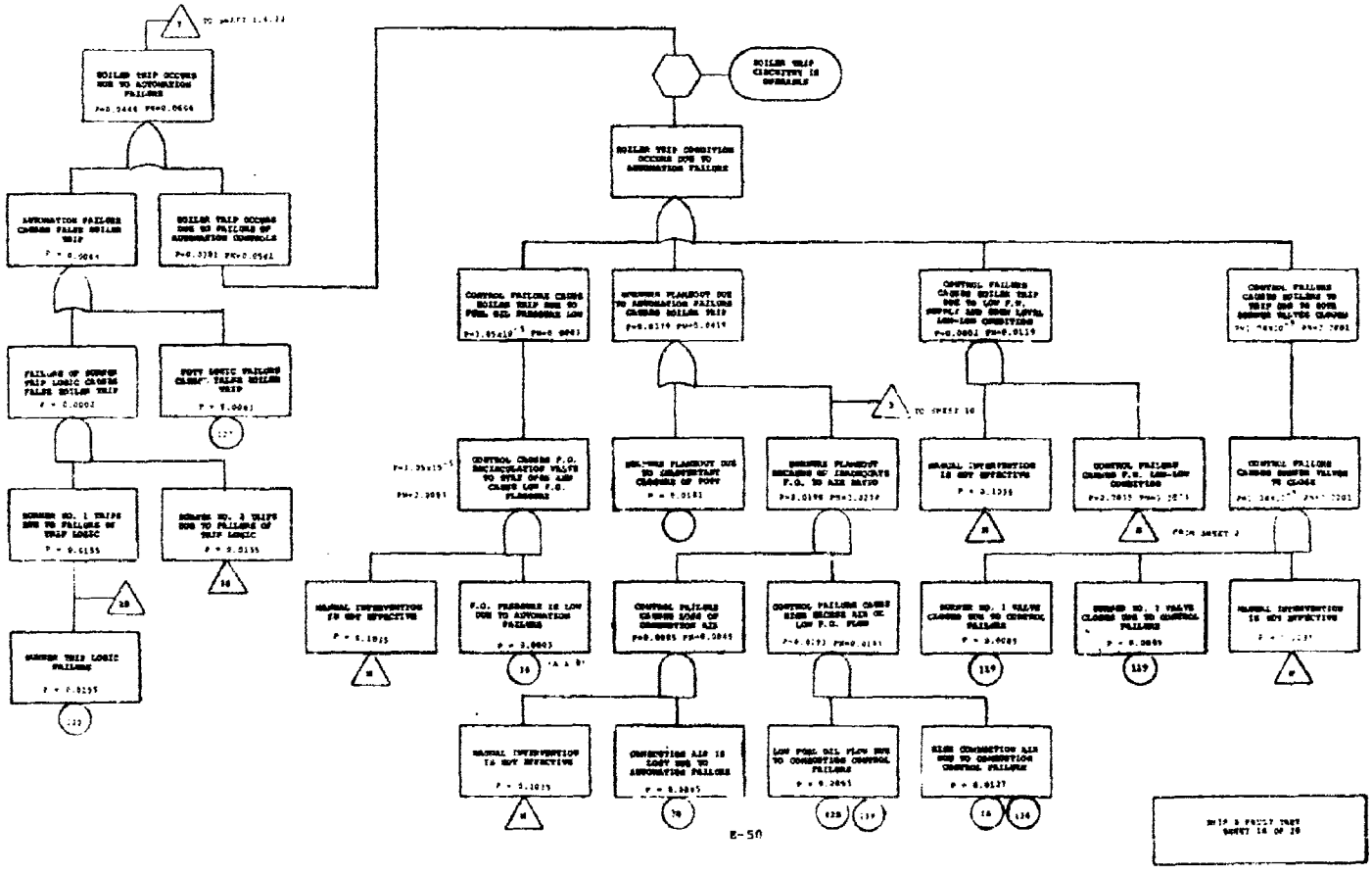


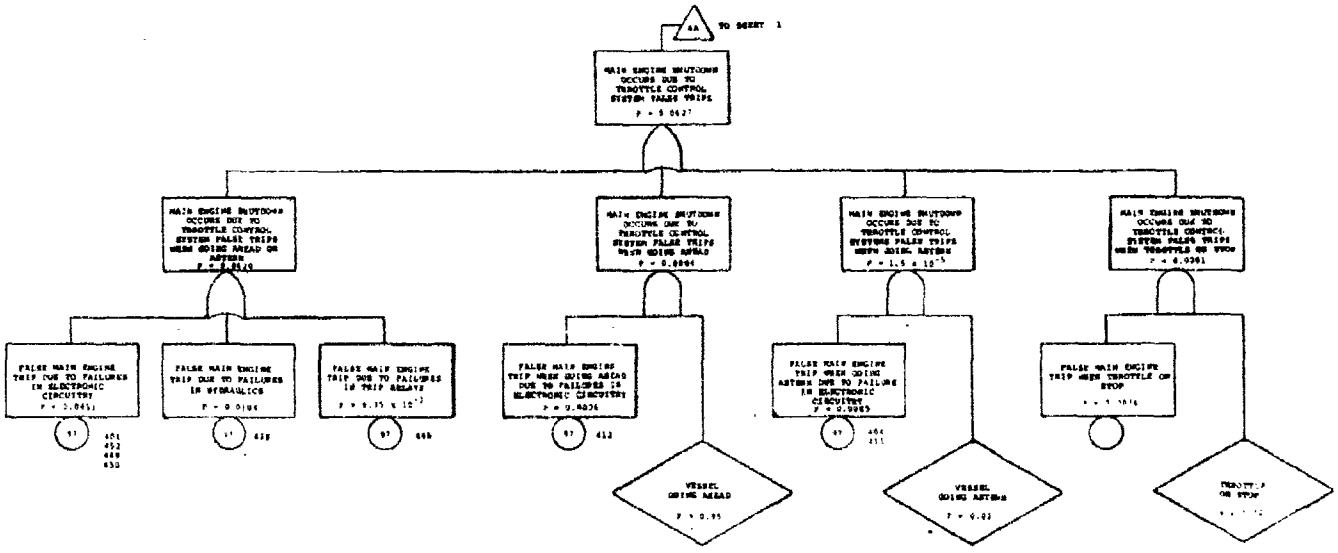


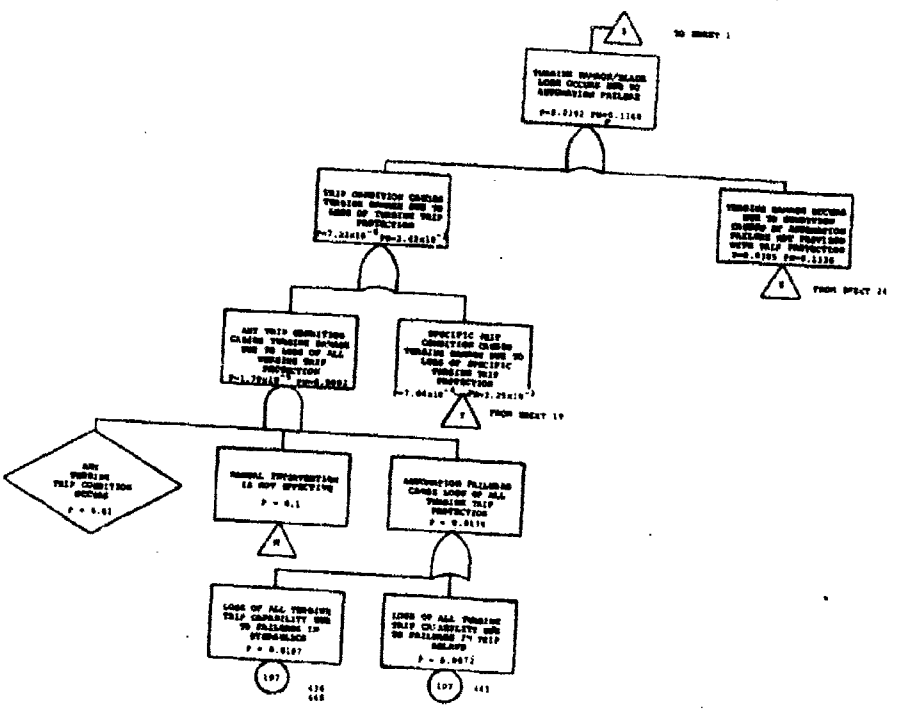


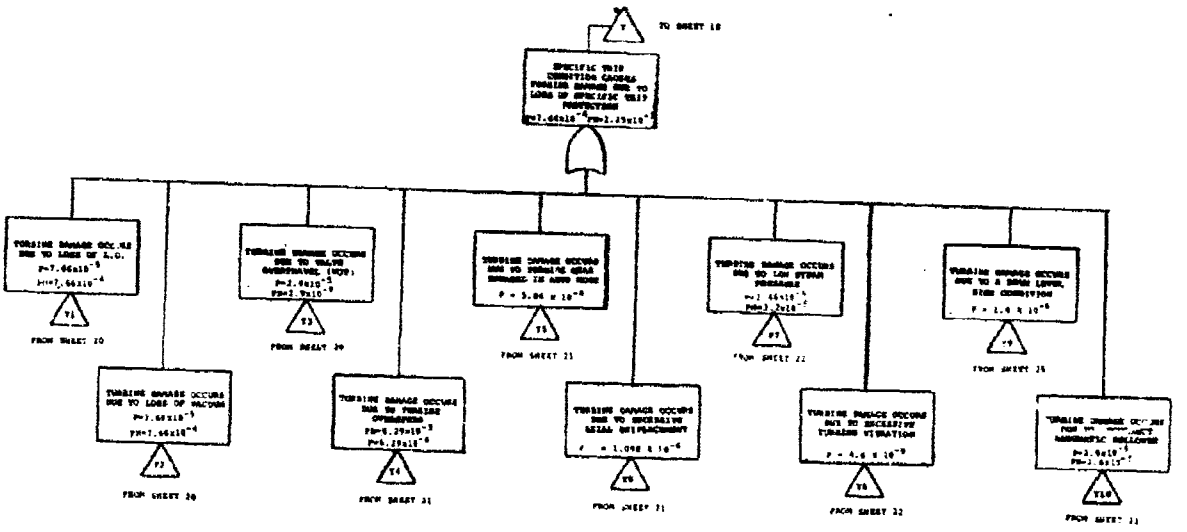


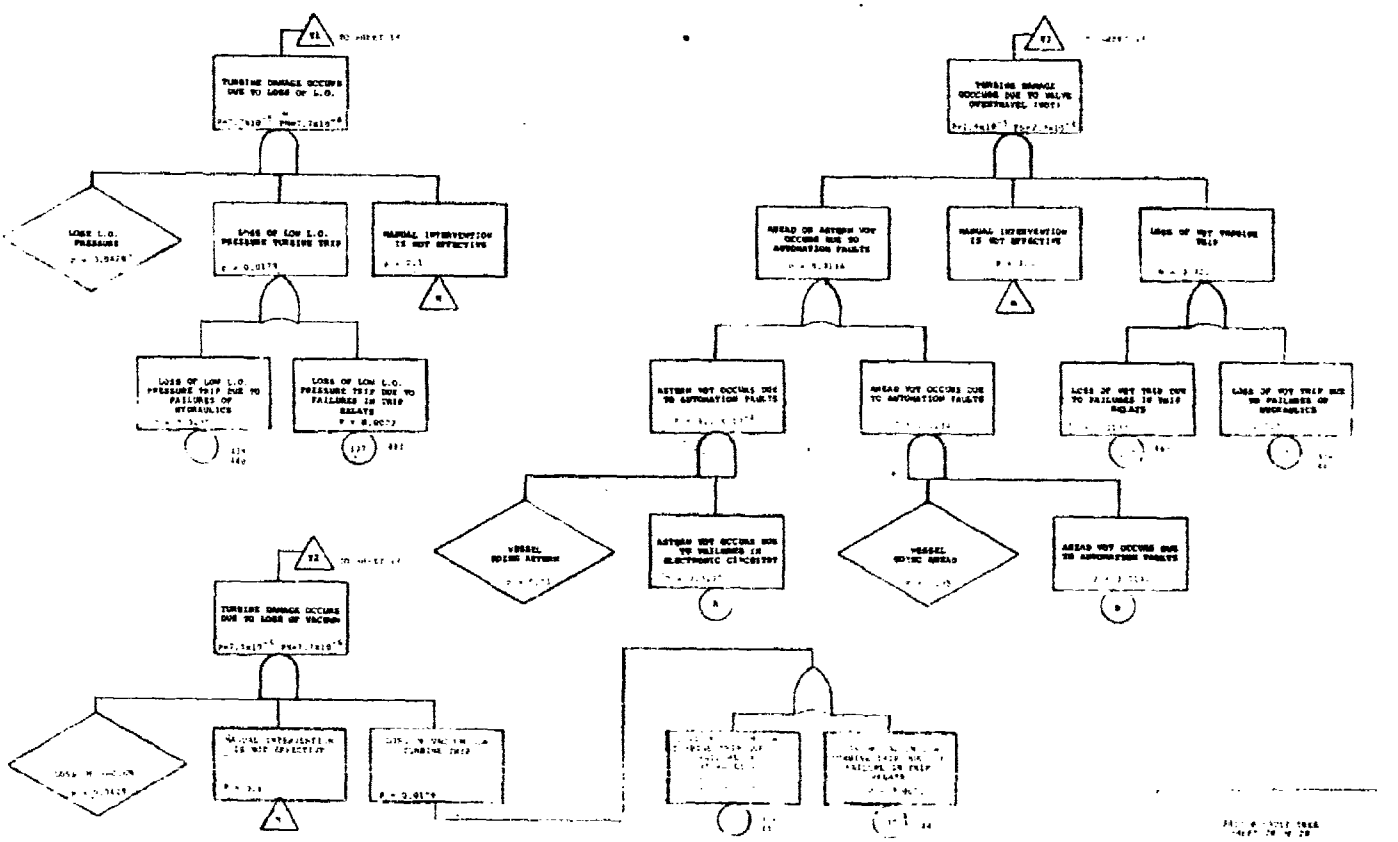


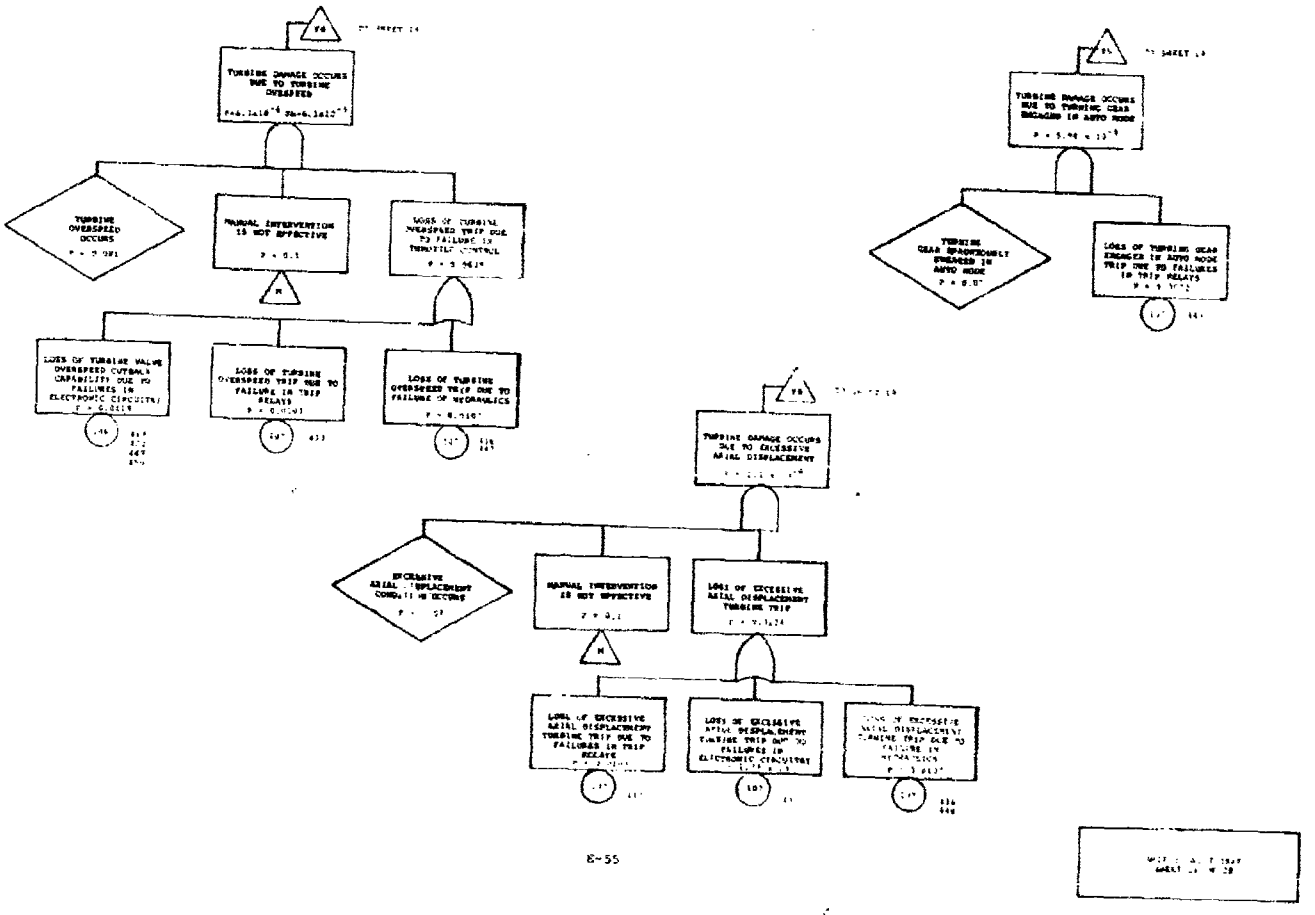


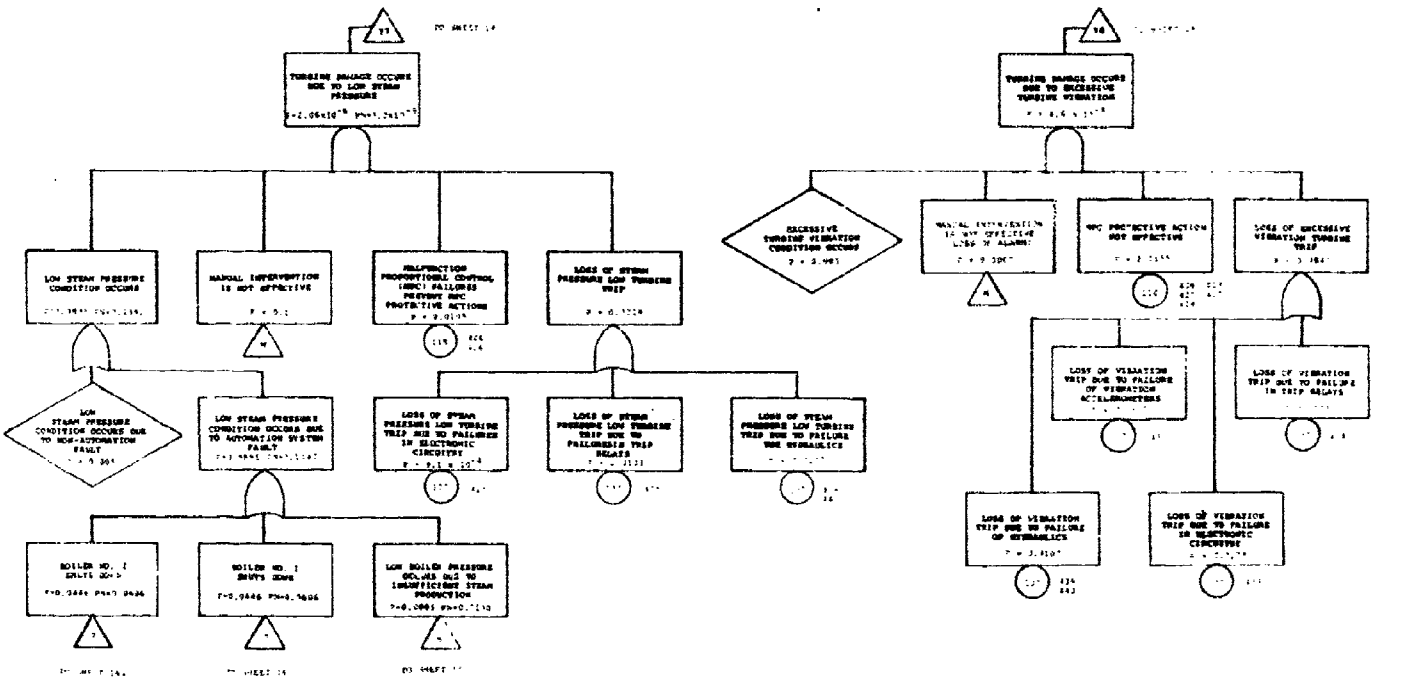

4A
TO SHEET 1
MAIN ENGINE SHUTDOWN OCCURS DUE TO THROTTLE CONTROL SYSTEM FALSE TRIPS
P = 5.0627
MAIN ENGINE SHUTDOWN OCCURS DUE TO THROTTLE CONTROL SYSTEM FALSE TRIPS WHEN GOING AHEAD OR ASTERN
MAIN ENGINE SHUTDOWN OCCURS DUE TO THROTTLE CONTROL SYSTEM FALSE TRIPS WHEN GOING AHEAD
P = 0.0004
MAIN ENGINE SHUTDOWN OCCURS DUE TO THROTTLE CONTROL SYSTEMS FALSE TRIPS WHEN GOING ASTERN
MAIN ENGINE SHUTDOWN OCCURS DUE TO THROTTLE CONTROL SYSTEM FALSE TRIPS WHEN THROTTLE ON STOP
P = 4.0361
FALSE MAIN ENGINE TRIP DUE TO FAILURES IN ELECTRONIC CIRCUITRY
FALSE MAIN ENGINE TRIP DUE TO FAILURES IN HYDRAULICS
FALSE MAIN ENGINE TRIP DUE TO FAILURES IN TRIP RELAYS
FALSE MAIN ENGINE TRIP WHEN GOING AHEAD DUE TO FAILURES IN ELECTRONIC CIRCUITRY
P = 0.0026
FALSE MAIN ENGINE TRIP WHEN GOING ASTERN DUE TO FAILURE IN ELECTRONIC CIRCUITRY
P = 0.0005
FALSE MAIN ENGINE TRIP WHEN THROTTLE ON STOP
VESSEL GOING AHEAD
P = 0.95
VESSEL GOING ASTERN
P = 0.05

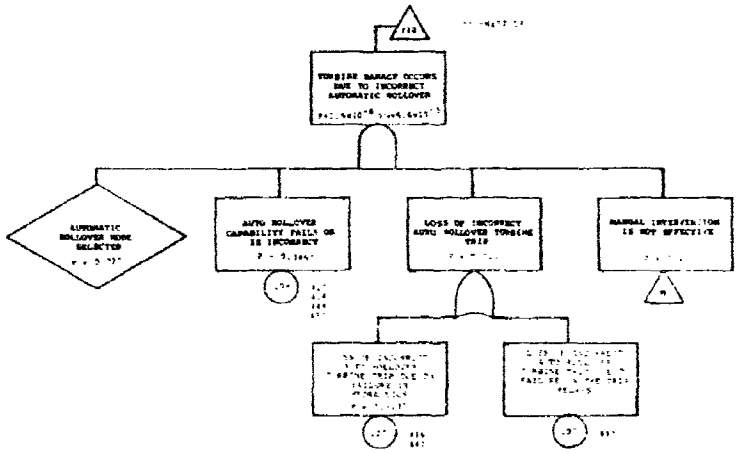


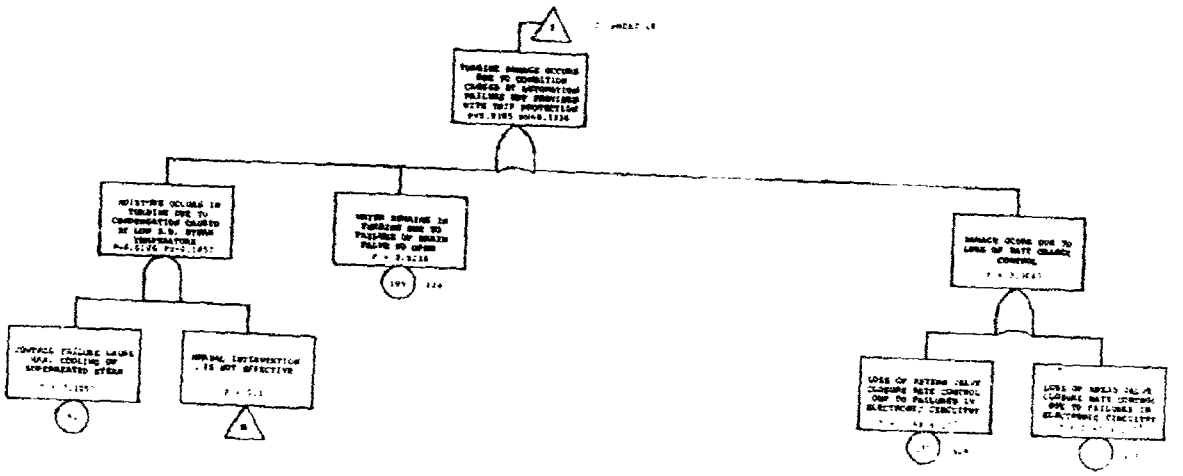


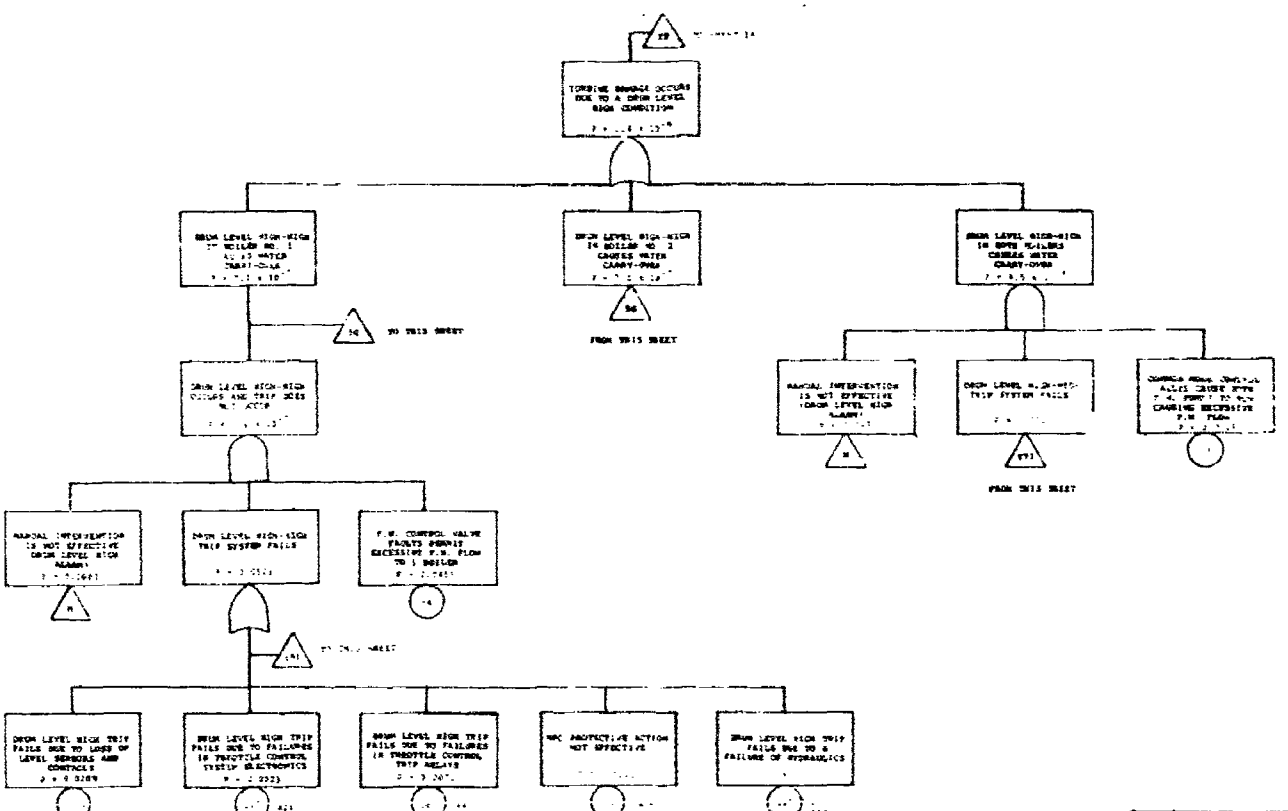


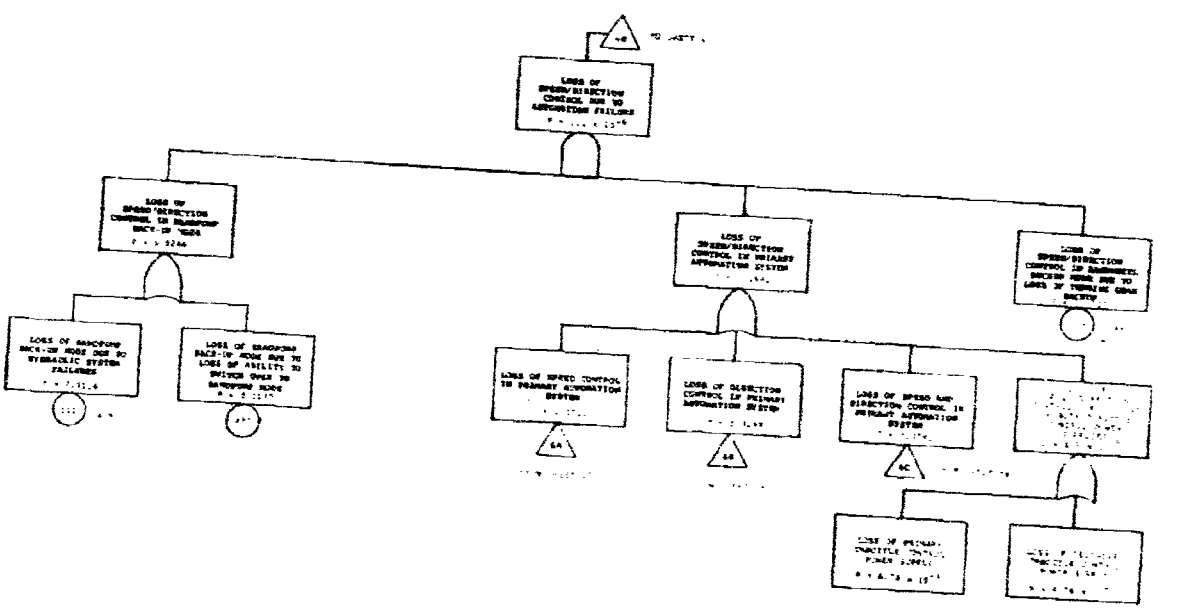

TURBINE DAMAGE OCCURS DUE TO TURBINE OVERSPEED
TURBINE OVERSPEED OCCURS
MANUAL INTERVENTION IS NOT EFFECTIVE
LOSS OF TURBINE OVERSPEED TRIP DUE TO FAILURE IN THROTTLE CONTROL
LOSS OF TURBINE VALVE OVERSPEED CUTBACK CAPABILITY DUE TO FAILURES IN ELECTRONIC CIRCUITRY
LOSS OF TURBINE OVERSPEED TRIP DUE TO FAILURE IN TRIP RELAYS
LOSS OF TURBINE OVERSPEED TRIP DUE TO FAILURE OF HYDRAULICS
TURBINE DAMAGE OCCURS DUE TO TURBINE GEAR ENGAGING IN AUTO MODE
TURBINE GEAR SPONTANEOUSLY ENGAGED IN AUTO MODE
LOSS OF TURBINE GEAR ENGAGED IN AUTO MODE TRIP DUE TO FAILURES IN TRIP RELAYS
TURBINE DAMAGE OCCURS DUE TO EXCESSIVE AXIAL DISPLACEMENT
EXCESSIVE AXIAL DISPLACEMENT CONDITION OCCURS
MANUAL INTERVENTION IS NOT EFFECTIVE
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP DUE TO FAILURES IN TRIP RELAYS
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP DUE TO FAILURES IN ELECTRONIC CIRCUITRY
LOSS OF EXCESSIVE AXIAL DISPLACEMENT TURBINE TRIP DUE TO FAILURE IN HYDRAULICS

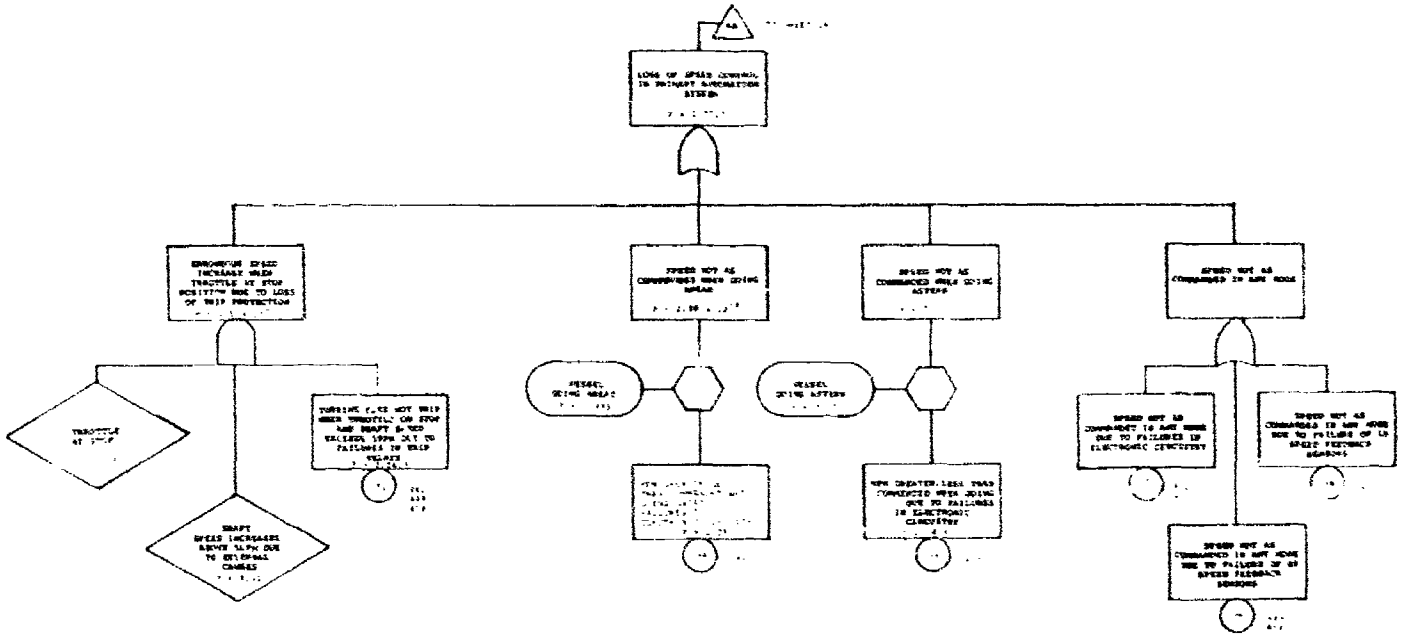

TURBINE DAMAGE OCCURS DUE TO LOW STEAM PRESSURE
LOW STEAM PRESSURE CONDITION OCCURS
MANUAL INTERVENTION IS NOT EFFECTIVE
MALFUNCTION PROPORTIONAL CONTROL (MPC) FAILURES PREVENT MPC PROTECTIVE ACTIONS
LOSS OF STEAM PRESSURE LOW TURBINE TRIP
LOW STEAM PRESSURE CONDITION OCCURS DUE TO NON-AUTOMATION FAULT
LOW STEAM PRESSURE CONDITION OCCURS DUE TO AUTOMATION SYSTEM FAULT
LOSS OF STEAM PRESSURE LOW TURBINE TRIP DUE TO FAILURES IN ELECTRONIC CIRCUITRY
LOSS OF STEAM PRESSURE LOW TURBINE TRIP DUE TO FAILURES TRIP RELAYS
LOSS OF STEAM PRESSURE LOW TURBINE TRIP DUE TO FAILURE THRU HYDRAULICS
BOILER NO. 1 SHUTS DOWN
BOILER NO. 2 SHUTS DOWN
LOW BOILER PRESSURE OCCURS DUE TO INSUFFICIENT STEAM PRODUCTION
TURBINE DAMAGE OCCURS DUE TO EXCESSIVE TURBINE VIBRATION
EXCESSIVE TURBINE VIBRATION CONDITION OCCURS
MANUAL INTERVENTION IS NOT EFFECTIVE LOSS OF ALARMS
MPC PROTECTIVE ACTION NOT EFFECTIVE
LOSS OF EXCESSIVE VIBRATION TURBINE TRIP
LOSS OF VIBRATION TRIP DUE TO FAILURE OF VIBRATION ACCELEROMETERS
LOSS OF VIBRATION TRIP DUE TO FAILURE IN TRIP RELAYS
LOSS OF VIBRATION TRIP DUE TO FAILURE OF HYDRAULICS
LOSS OF VIBRATION TRIP DUE TO FAILURE IN ELECTRONIC CIRCUITRY

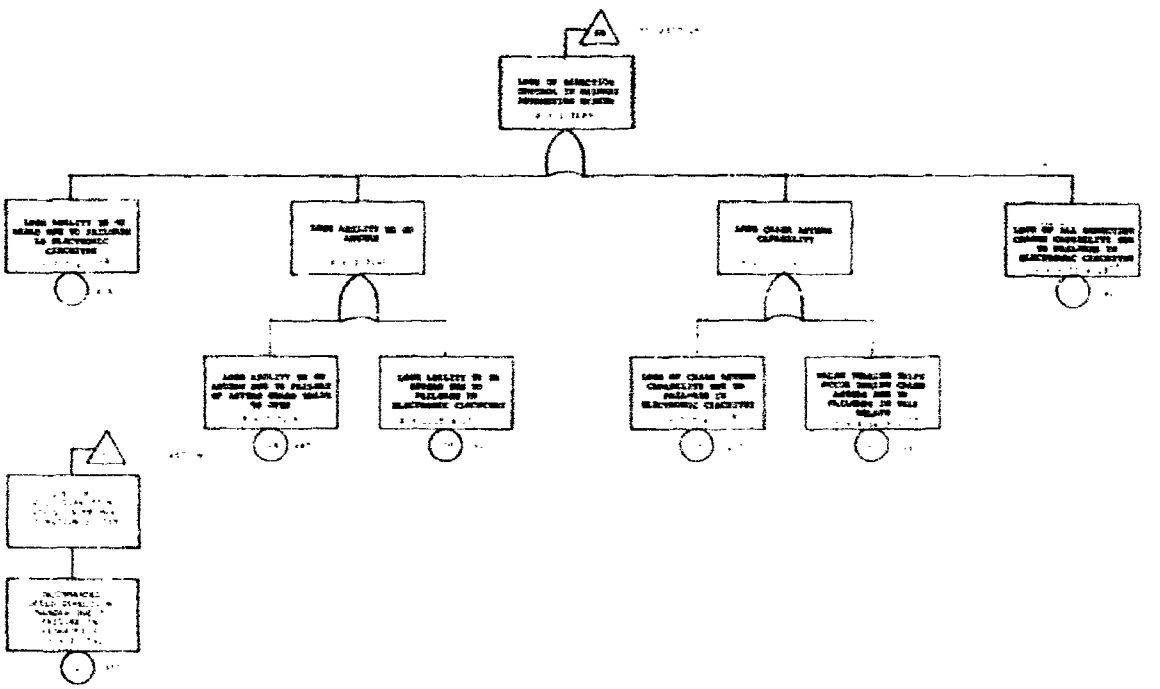


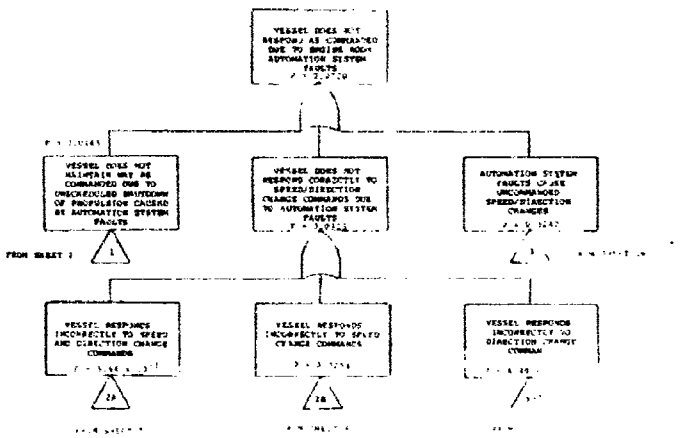


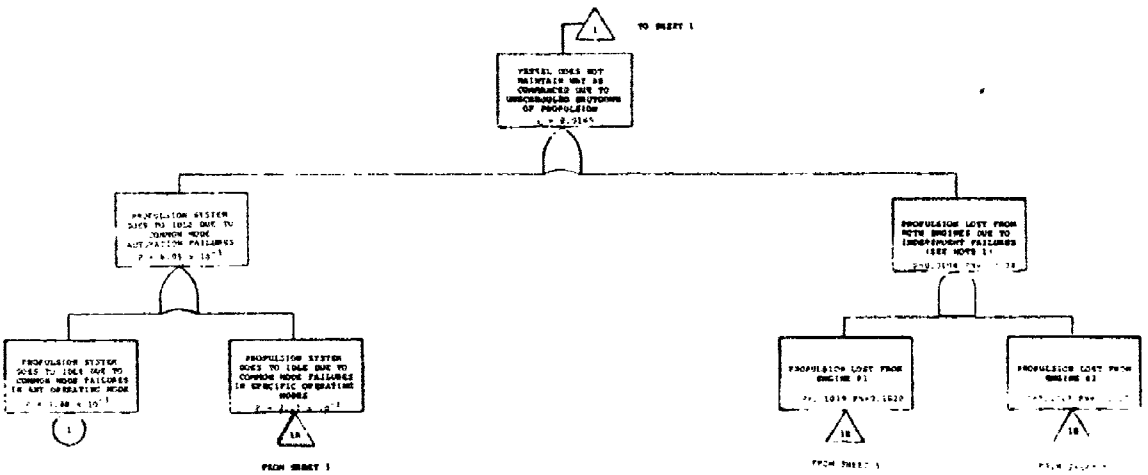




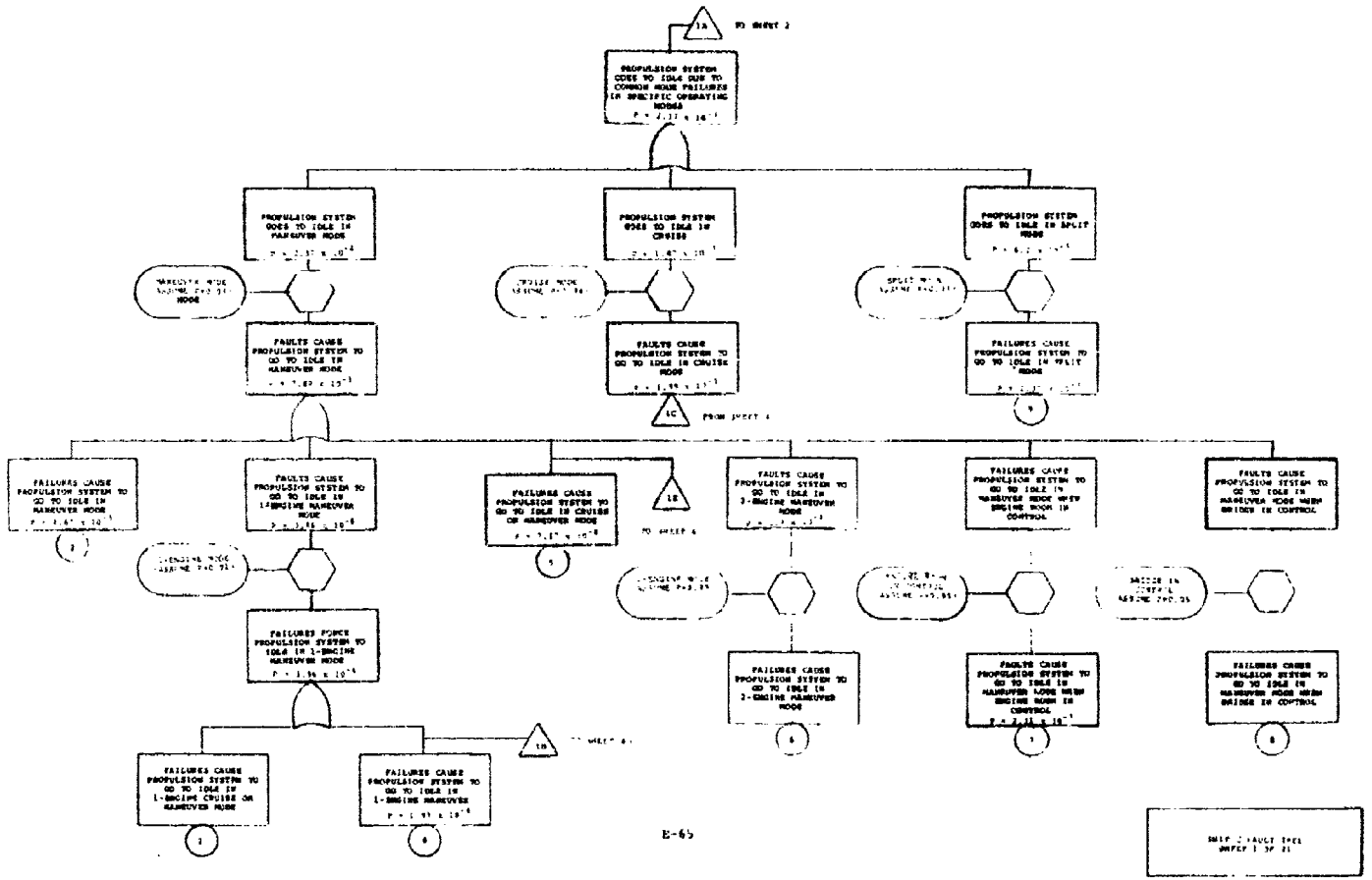


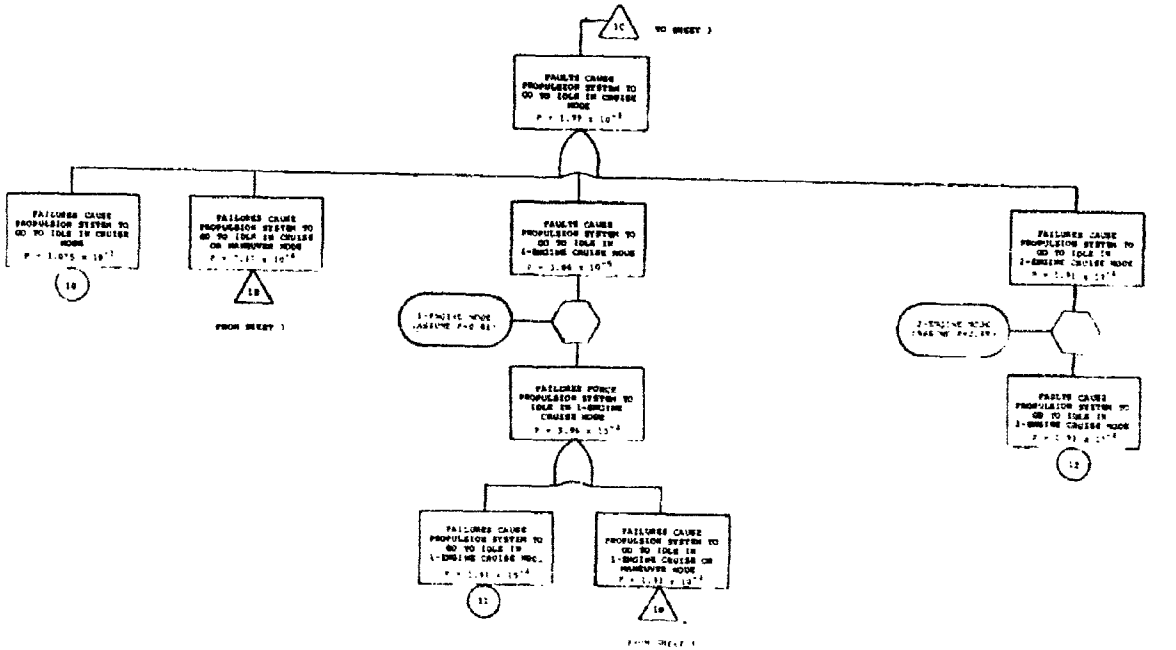


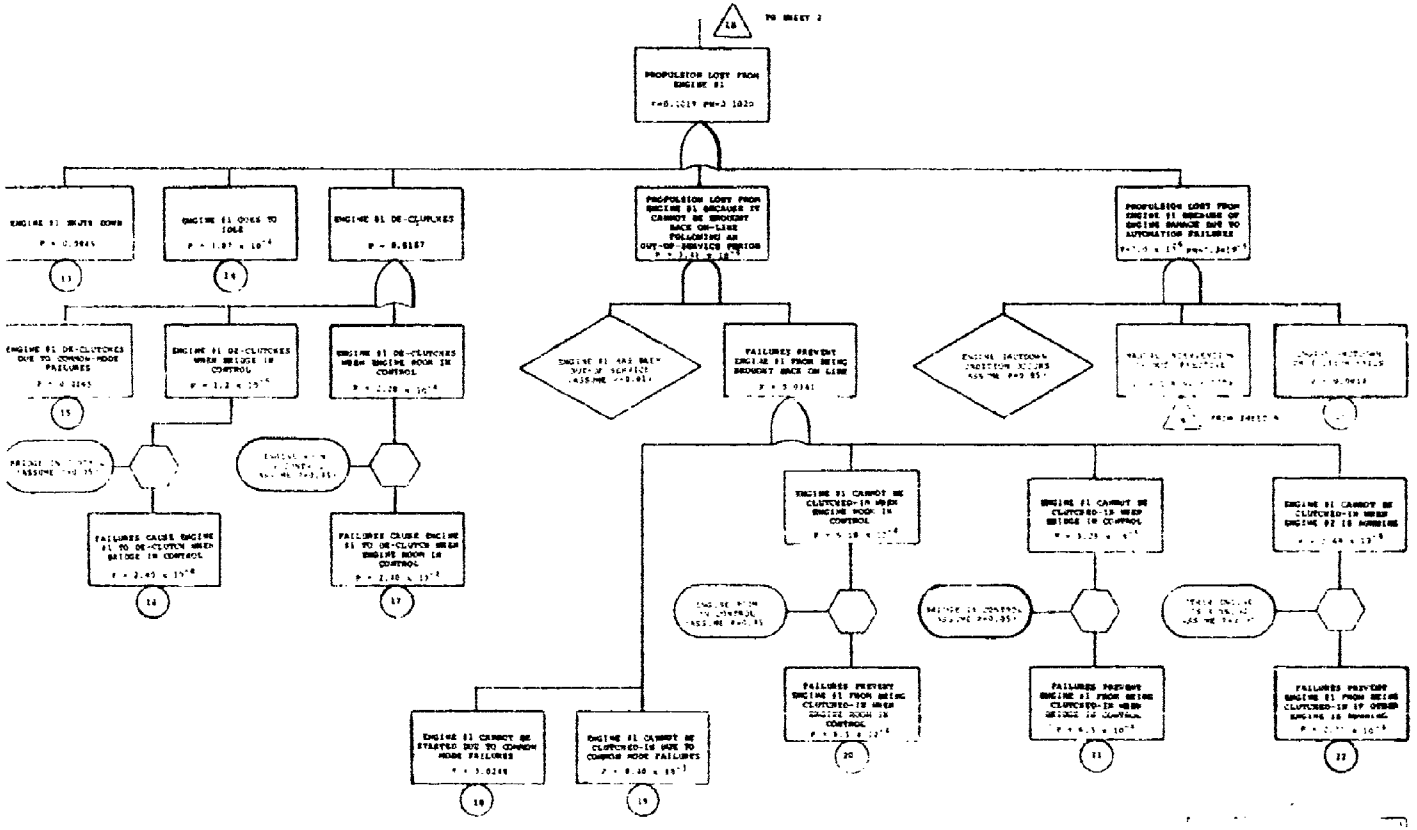

VESSEL DOES NOT RESPOND AS COMMANDED DUE TO ENGINE ROOM AUTOMATION SYSTEM FAULTS
VESSEL DOES NOT MAINTAIN WAY AS COMMANDED DUE TO UNSCHEDULED SHUTDOWN OF PROPULSION CAUSED BY AUTOMATION SYSTEM FAULTS
VESSEL DOES NOT RESPOND CORRECTLY TO SPEED/DIRECTION CHANGE COMMANDS DUE TO AUTOMATION SYSTEM FAULTS
AUTOMATION SYSTEM FAULTS CAUSE UNCOMMANDED SPEED/DIRECTION CHANGES
FROM SHEET 1
1
VESSEL RESPONDS INCORRECTLY TO SPEED AND DIRECTION CHANGE COMMANDS
VESSEL RESPONDS INCORRECTLY TO SPEED CHANGE COMMANDS
VESSEL RESPONDS INCORRECTLY TO DIRECTION CHANGE COMMAND
2A
2B

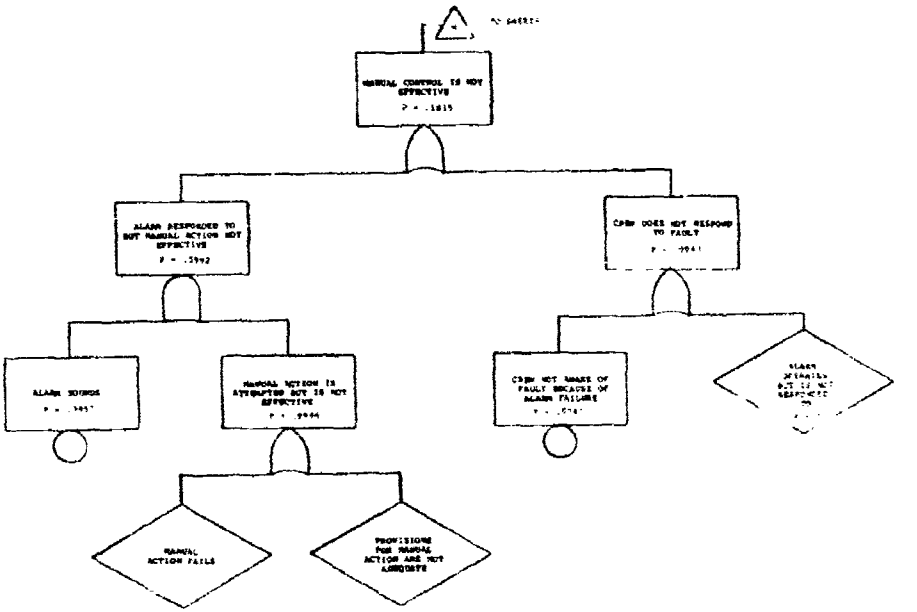


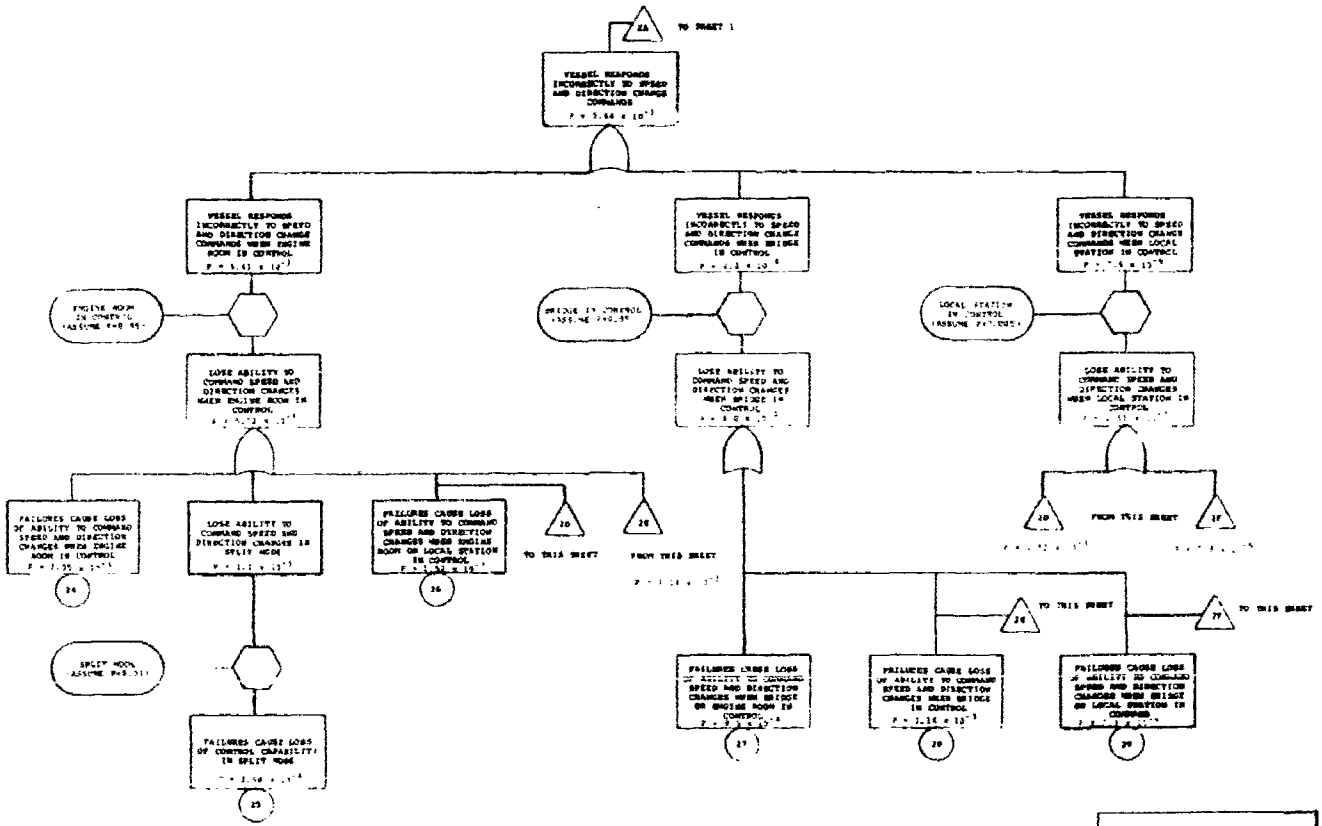
NOTES:
1. ASSUME THAT PROPULSION LOST FROM SECOND ENGINE DURING PERIOD WHEN PROPULSION LOST FROM FIRST ENGINE (WORST CASE).

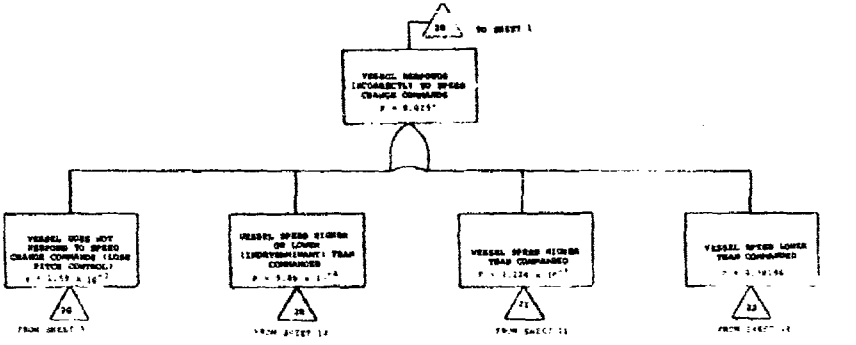

PROPULSION SYSTEM GOES TO IDLE DUE TO COMMON MODE FAILURES IN SPECIFIC OPERATING MODES
PROPULSION SYSTEM GOES TO IDLE IN MANEUVER MODE
PROPULSION SYSTEM GOES TO IDLE IN CRUISE
PROPULSION SYSTEM GOES TO IDLE IN SPLIT MODE
FAULTS CAUSE PROPULSION SYSTEM TO GO TO IDLE IN MANEUVER MODE
FAULTS CAUSE PROPULSION SYSTEM TO GO TO IDLE IN CRUISE MODE
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN SPLIT MODE
FROM SHEET 4
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN MANEUVER MODE
FAULTS CAUSE PROPULSION SYSTEM TO GO TO IDLE IN 1-ENGINE MANEUVER MODE
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN CRUISE OR MANEUVER MODE
TO SHEET 4
FAULTS CAUSE PROPULSION SYSTEM TO GO TO IDLE IN 2-ENGINE MANEUVER MODE
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN MANEUVER MODE WITH ENGINE NOZZ IN CONTROL
FAULTS CAUSE PROPULSION SYSTEM TO GO TO IDLE IN MANEUVER MODE WITH ENGINES IN CONTROL
FAILURES FORCE PROPULSION SYSTEM TO IDLE IN 1-ENGINE MANEUVER MODE
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN 1-ENGINE CRUISE OR MANEUVER MODE
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN 1-ENGINE MANEUVER MODE
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN 2-ENGINE MANEUVER MODE
FAULTS CAUSE PROPULSION SYSTEM TO GO TO IDLE IN MANEUVER MODE WITH ENGINE NOZZ IN CONTROL
FAILURES CAUSE PROPULSION SYSTEM TO GO TO IDLE IN MANEUVER MODE WITH ENGINES IN CONTROL

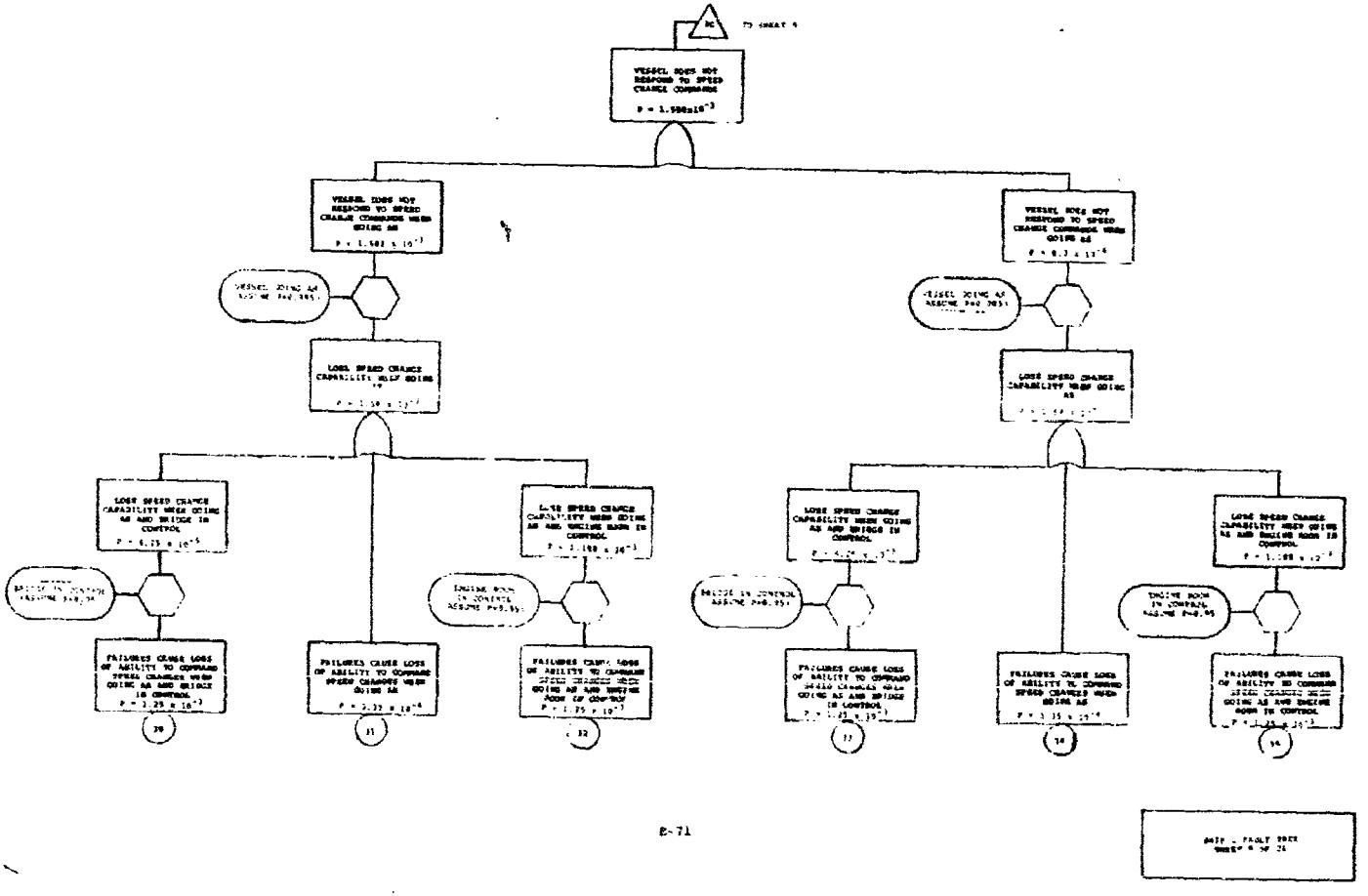


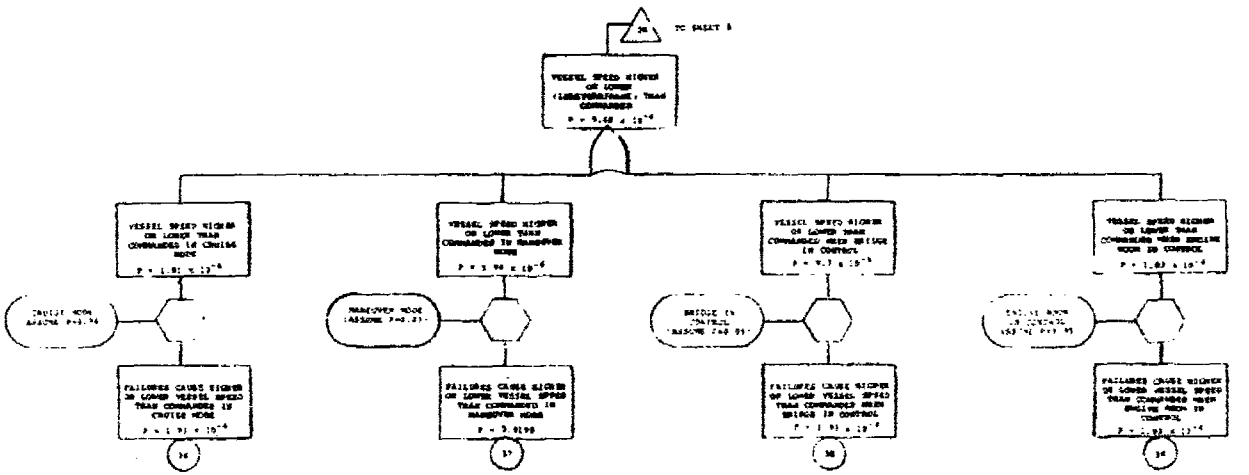

PROPULSION LOST FROM ENGINE #1
PROPULSION LOST FROM ENGINE #1 BECAUSE IT CANNOT BE BROUGHT BACK ON-LINE FOLLOWING AN OUT-OF-SERVICE PERIOD
PROPULSION LOST FROM ENGINE #1 BECAUSE OF ENGINE DAMAGE DUE TO AUTOMATION FAILURES
ENGINE #1 DE-CLUTCHES
FAILURES PREVENT ENGINE #1 FROM BEING BROUGHT BACK ON LINE
ENGINE #1 CANNOT BE CLUTCHED-IN WHEN ENGINE ROOM IN CONTROL
ENGINE #1 CANNOT BE CLUTCHED-IN WHEN BRIDGE IN CONTROL
ENGINE #1 CANNOT BE CLUTCHED-IN WHEN ENGINE #2 IS RUNNING
ENGINE #1 CANNOT BE STARTED DUE TO COMMON MODE FAILURES
ENGINE #1 CANNOT BE CLUTCHED-IN DUE TO COMMON MODE FAILURES

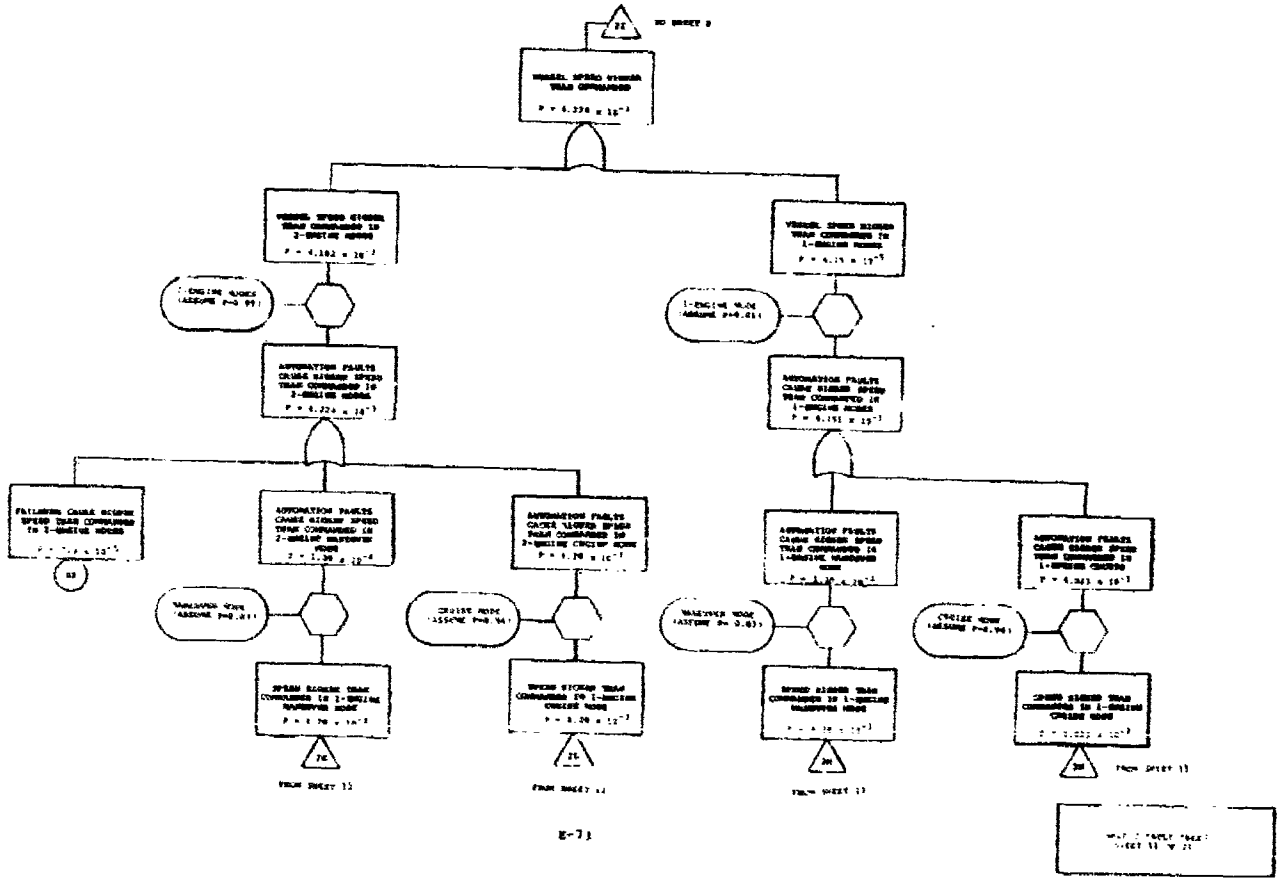


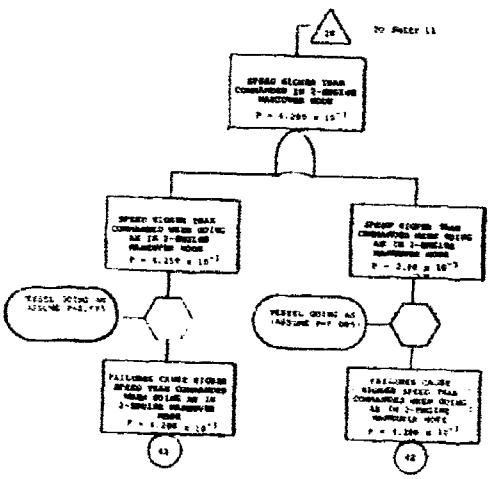

TO SHEET 1
VESSEL RESPONDS INCORRECTLY TO SPEED AND DIRECTION CHANGE COMMANDS
VESSEL RESPONDS INCORRECTLY TO SPEED AND DIRECTION CHANGE COMMANDS WHEN ENGINE ROOM IS CONTROL
VESSEL RESPONDS INCORRECTLY TO SPEED AND DIRECTION CHANGE COMMANDS WHEN BRIDGE IS CONTROL
VESSEL RESPONDS INCORRECTLY TO SPEED AND DIRECTION CHANGE COMMANDS WHEN LOCAL STATION IS CONTROL
ENGINE ROOM IN CONTROL
BRIDGE IN CONTROL
LOCAL STATION IN CONTROL
LOSE ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN ENGINE ROOM IS CONTROL
LOSE ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN BRIDGE IS CONTROL
LOSE ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN LOCAL STATION IS CONTROL
FAILURES CAUSE LOSS OF ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN ENGINE ROOM IS CONTROL
LOSE ABILITY TO COMMAND SPEED AND DIRECTION CHANGES IN SPLIT MODE
FAILURES CAUSE LOSS OF ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN ENGINE ROOM OR LOCAL STATION IS CONTROL
TO THIS SHEET
FROM THIS SHEET
FROM THIS SHEET
TO THIS SHEET
TO THIS SHEET
SPLIT MODE
FAILURES CAUSE LOSS OF CONTROL CAPABILITY IN SPLIT MODE
FAILURES CAUSE LOSS OF ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN BRIDGE OR ENGINE ROOM IS CONTROL
FAILURES CAUSE LOSS OF ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN BRIDGE IS CONTROL
FAILURES CAUSE LOSS OF ABILITY TO COMMAND SPEED AND DIRECTION CHANGES WHEN BRIDGE OR LOCAL STATION IS CONTROL

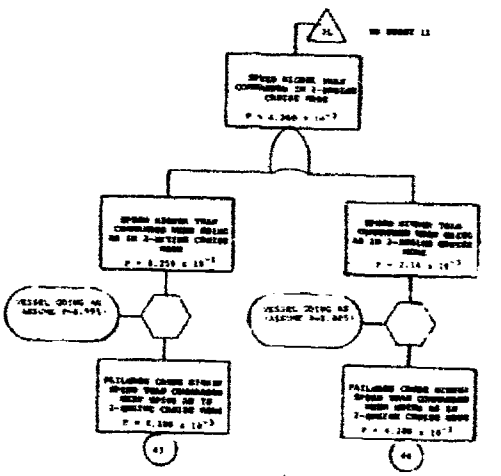


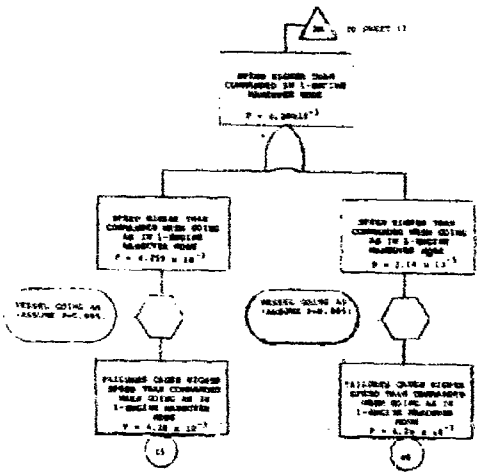


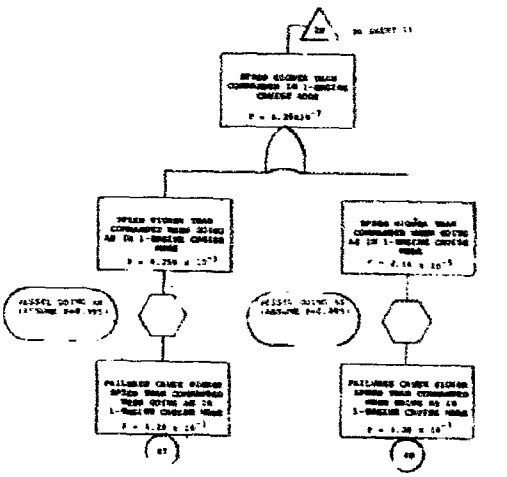


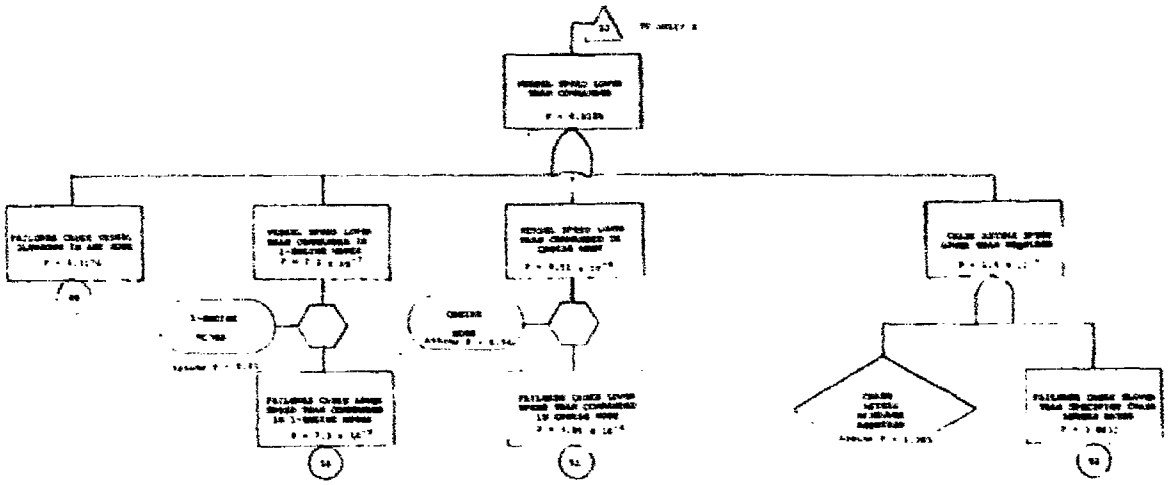


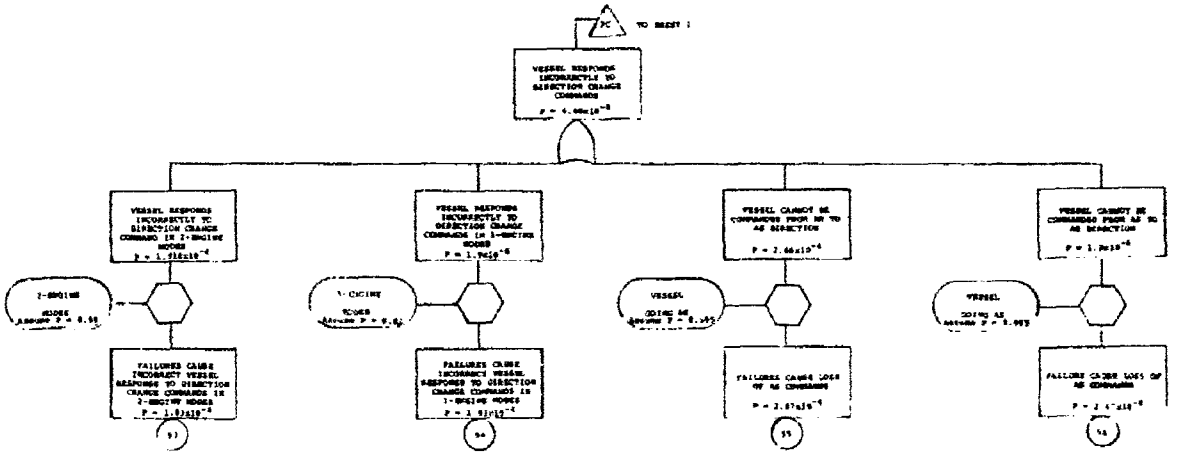


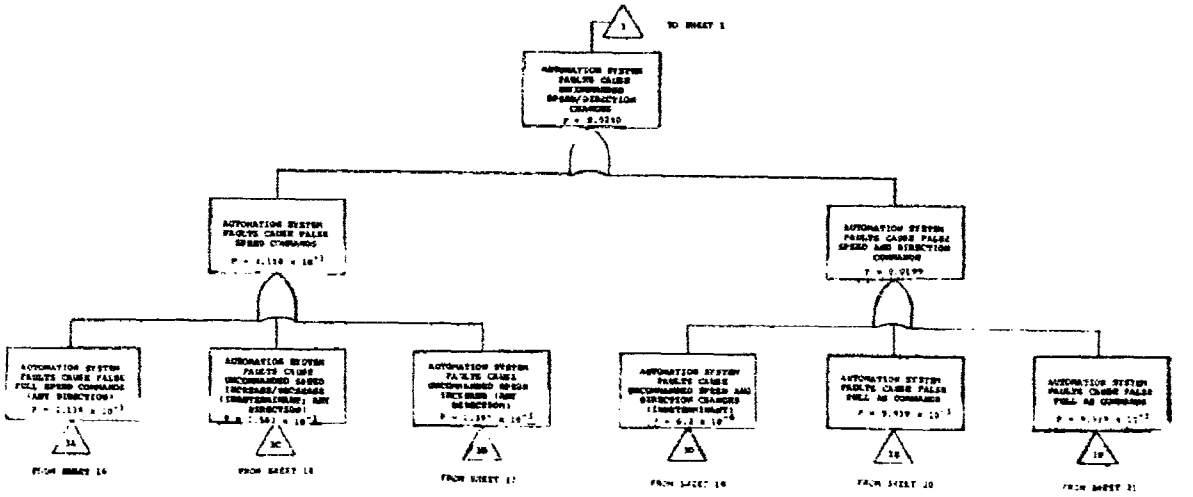


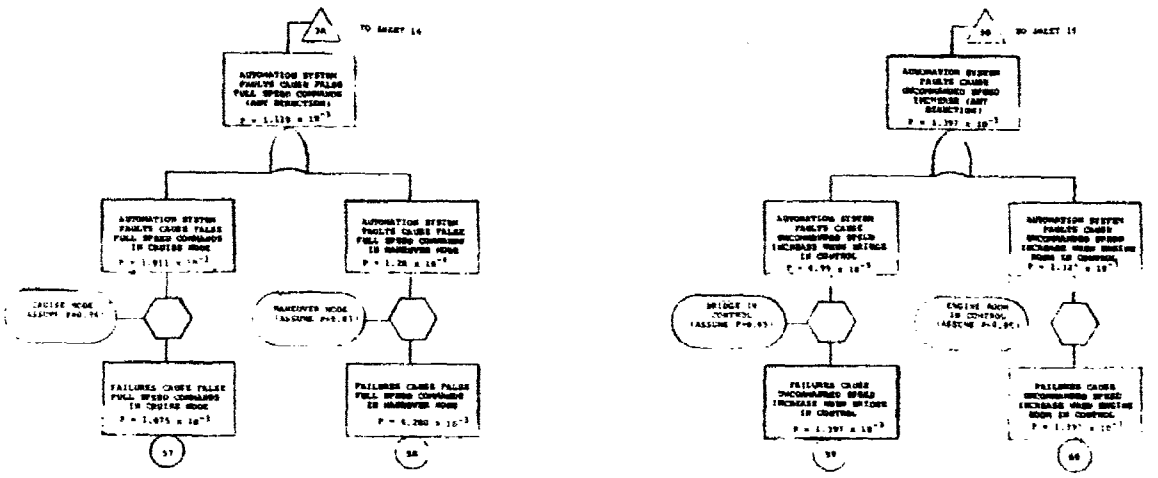


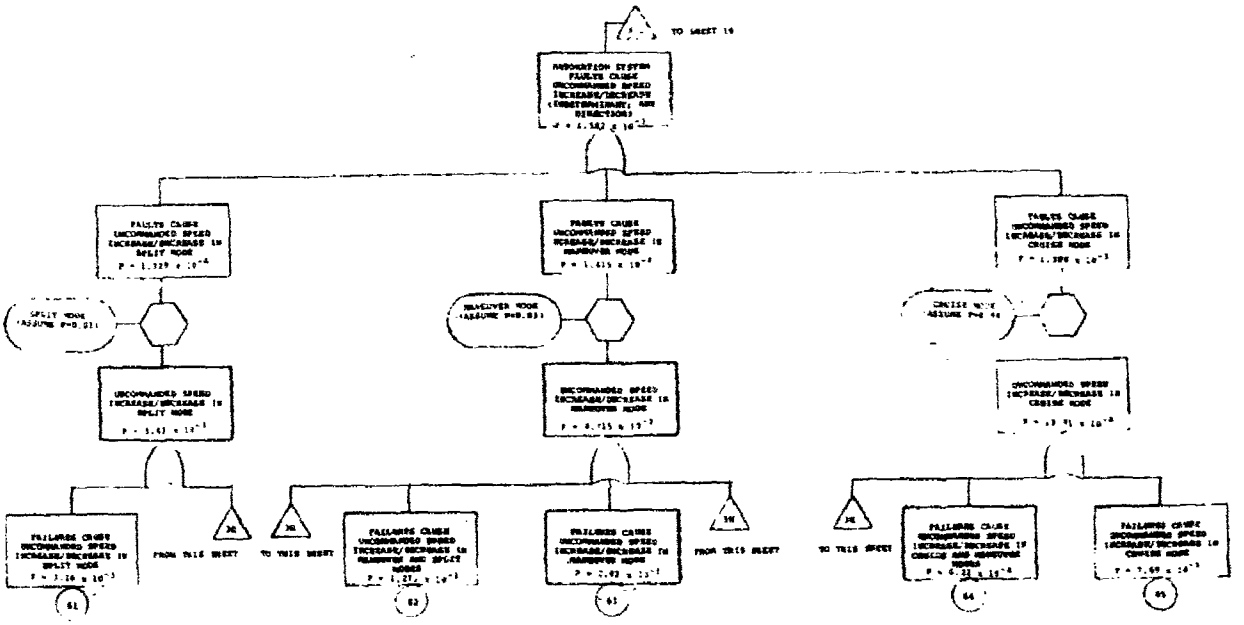


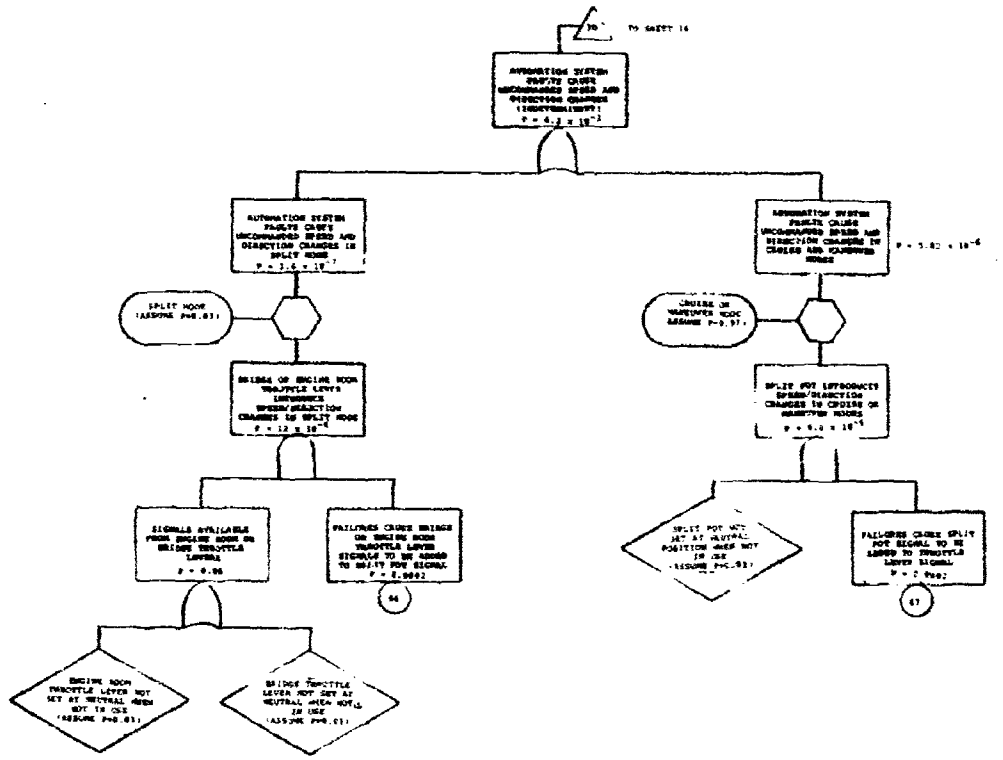


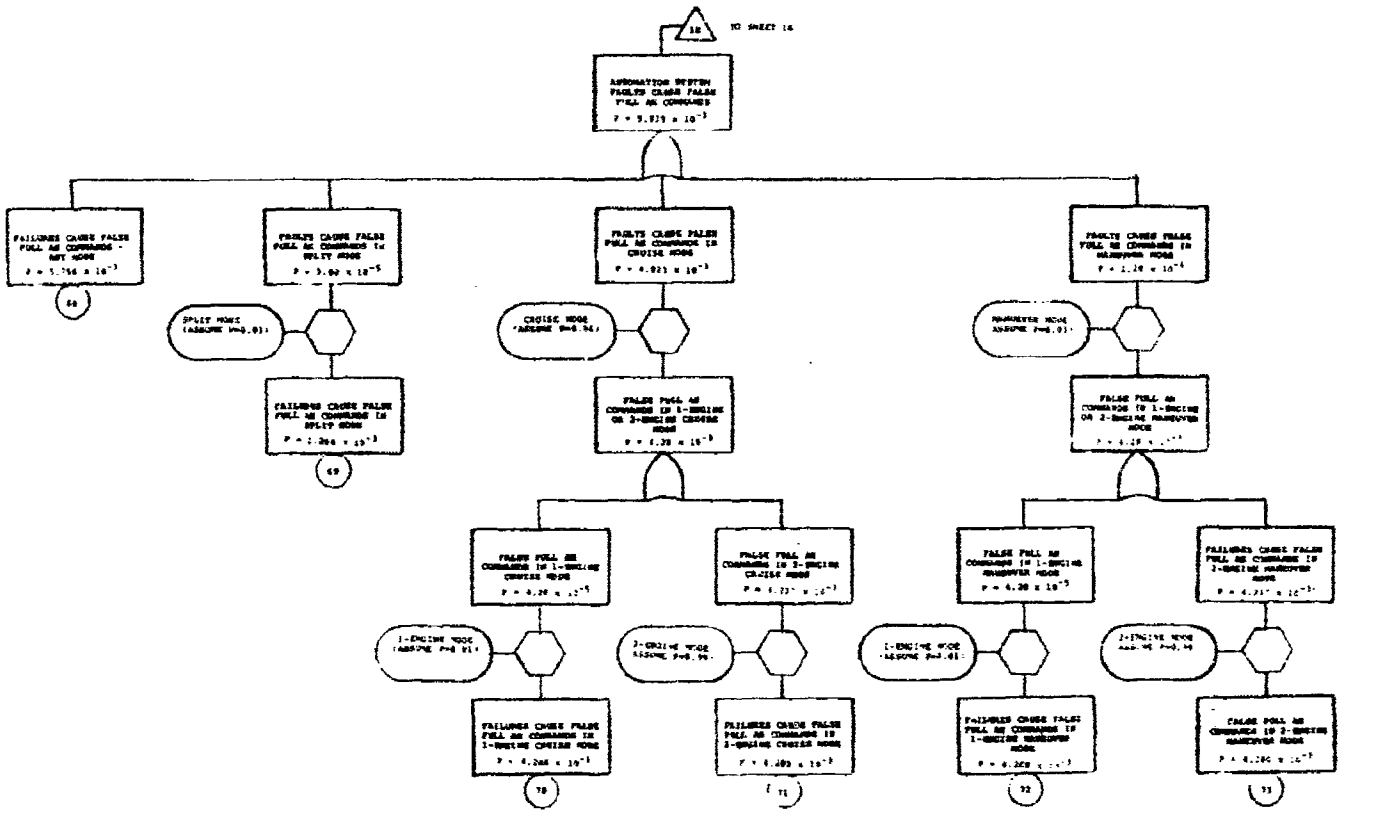


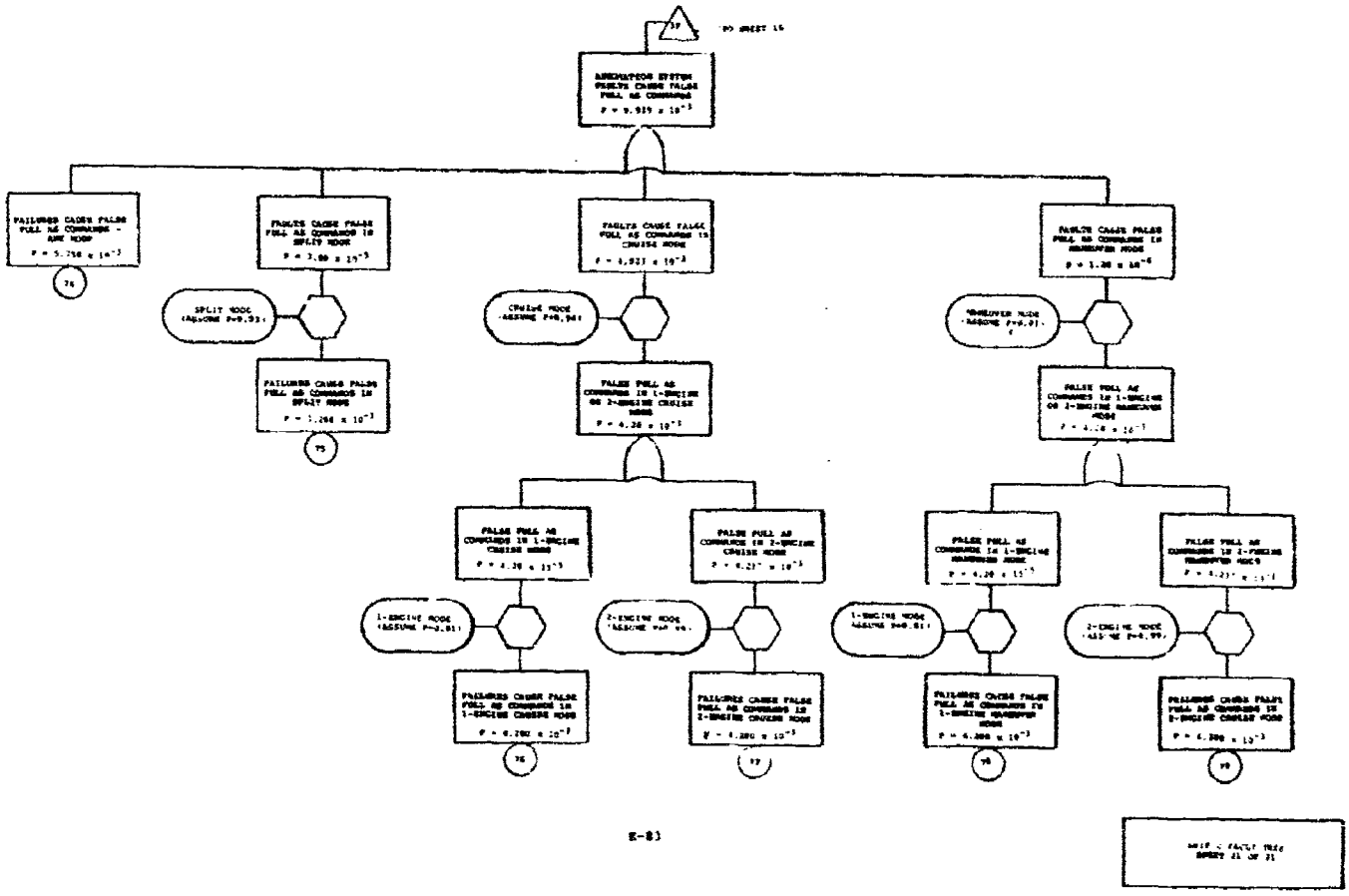

TO SHEET 1
AUTOMATION SYSTEM FAULTS CAUSE FALSE SPEED/DIRECTION COMMANDS
P = 9.9210
AUTOMATION SYSTEM FAULTS CAUSE FALSE SPEED COMMANDS
P = 4.110 x 10⁻³
AUTOMATION SYSTEM FAULTS CAUSE FALSE SPEED AND DIRECTION COMMANDS
P = 9.9199
AUTOMATION SYSTEM FAULTS CAUSE FALSE FULL SPEED COMMANDS (ANY DIRECTION)
P = 1.110 x 10⁻³
AUTOMATION SYSTEM FAULTS CAUSE UNCOMMANDED SLOWED (DECREASE/INCREASE (DRAPERBELOW) ANY DIRECTION)
P = 1.50 x 10⁻³
AUTOMATION SYSTEM FAULTS CAUSE UNCOMMANDED HIGH SPEED (ANY DIRECTION)
P = 1.39 x 10⁻³
AUTOMATION SYSTEM FAULTS CAUSE UNCOMMANDED SPEED AND DIRECTION CHANGES (INSTRUMENTSHAFT)
P = 6.2 x 10⁻⁶
AUTOMATION SYSTEM FAULTS CAUSE FALSE FULL AS COMMANDS
P = 9.939 x 10⁻³
AUTOMATION SYSTEM FAULTS CAUSE FALSE FULL AS COMMANDS
P = 9.939 x 10⁻³
FROM SHEET 16
FROM SHEET 18
FROM SHEET 17
FROM SHEET 19
FROM SHEET 20
FROM SHEET 21




TO SHEET 19
FAILURE CAUSE UNCOMMANDED SPEED INCREASE/DECREASE IN SPLIT MODE
FAILURE CAUSE UNCOMMANDED SPEED INCREASE/DECREASE IN CRUISE MODE
UNCOMMANDED SPEED INCREASE/DECREASE IN SPLIT MODE
UNCOMMANDED SPEED INCREASE/DECREASE IN CRUISE MODE
FAILURE CAUSE UNCOMMANDED SPEED INCREASE/DECREASE IN SPLIT MODE
FROM THIS SHEET
TO THIS SHEET
FAILURE CAUSE UNCOMMANDED SPEED INCREASE/DECREASE IN
FAILURE CAUSE UNCOMMANDED SPEED INCREASE/DECREASE IN
FROM THIS SHEET
TO THIS SHEET
FAILURE CAUSE UNCOMMANDED SPEED INCREASE/DECREASE IN CRUISE MODE
FAILURE CAUSE UNCOMMANDED SPEED INCREASE/DECREASE IN CRUISE MODE




TO SHEET 16
AUTOMATION SYSTEM FAILURE CAUSES FALSE FULL AB COMMANDS
FAILURES CAUSE FALSE FULL AB COMMANDS - WET MODE
CRUISE CAUSE FALSE FULL AB COMMANDS IN SPLIT MODE
FAILURES CAUSE FALSE FULL AB COMMANDS IN SPLIT MODE
FAILURE CAUSE FALSE FULL AB COMMANDS IN CRUISE MODE
FALSE FULL AB COMMANDS IN 1-ENGINE OR 2-ENGINE CRUISE MODE
FALSE FULL AB COMMANDS IN 1-ENGINE CRUISE MODE
FALSE FULL AB COMMANDS IN 2-ENGINE CRUISE MODE
FAILURES CAUSE FALSE FULL AB COMMANDS IN 1-ENGINE CRUISE MODE
FAILURES CAUSE FALSE FULL AB COMMANDS IN 2-ENGINE CRUISE MODE
FAILURE CAUSE FALSE FULL AB COMMANDS IN MANEUVER MODE
FALSE FULL AB COMMANDS IN 1-ENGINE OR 2-ENGINE MANEUVER MODE
FALSE FULL AB COMMANDS IN 1-ENGINE MANEUVER MODE
FAILURES CAUSE FALSE FULL AB COMMANDS IN 2-ENGINE MANEUVER MODE
FAILURES CAUSE FALSE FULL AB COMMANDS IN 1-ENGINE MANEUVER MODE
FALSE FULL AB COMMANDS IN 2-ENGINE MANEUVER MODE



APPENDIX F

CRITICALITY ANALYSIS SUMMARY SHEETS

INDEX

CRITICALITY ITEM
SHIP A

NOTE #:	PAGE #:
1	F-1
2	F-1
3	F-2
4	F-3
5	F-3
6	F-4
7	F-5
8	F-5
9	F-6
10	F-7
11	F-7
12	F-8
13	F-9
14	F-9
15	F-10
16	F-10
17	F-11
18	F-12
19	F-13
20	F-14
21	F-14
22	F-15
23	F-16
24	F-16
25	F-17
26	F-18
27	F-18
28	F-19
29	F-20
30	F-21
31	F-21
32	F-22
33	F-23
34	F-23
35	F-24
36	F-25
37	F-25
38	F-26
39	F-26
40	F-27
41	F-28
42	F-28
43	F-29
44	F-30
45	F-30
46	F-31
47	F-32
48	F-32
49	F-32

SHIP A	NOTE #:	PAGE #:
	50	F-33
	51	F-34
	52	F-35

SHIP B	NOTE #:	PAGE #:
	1	F-36
	4	F-36
	5	F-37
	6	F-37
	7	F-38
	8	F-38
	9	F-39
	10	F-40
	11	F-40
	12	F-41
	13	F-41
	14	F-42
	15	F-43
	16	F-43
	17	F-44
	18	F-44
	19	F-45
	20	F-45
	21	F-46
	22	F-46
	23	F-47
	24	F-47
	25	F-48
	26	F-49
	27	F-49
	28	F-50
	29	F-51
	30	F-52
	31	F-52
	32	F-53
	33	F-54
	34	F-54
	35	F-56
	36	F-57
	37	F-58
	38	F-58
	39	F-59
	40	F-60
	41	F-61
	42	F-62
	43	F-63
	44	F-64
	45	F-65
	46	F-66

SHIP B

NOTE #:	PAGE #:
47	F-67
48	F-68
49	F-68
50	F-69
51	F-70
52	F-70
53	F-70
54	F-71
55	F-71
56	F-72
57	F-72
58	F-73
59	F-74
60	F-75
61	F-77
62	F-78
63	F-78
64	F-79
65	F-79
66	F-79
67	F-80
68	F-80
80	F-82
81	F-82
82	F-83
83	F-85
84	F-85
85	F-86
86	F-87
87	F-88
88	F-89
89	F-90
90	F-91
91	F-92
92	F-93
93	F-94
94	F-95
95	F-96
96	F-97
97	F-97
98	F-98
99	F-99
100	F-100
101	F-101
102	F-102
103	F-102
104	F-103
105	F-104
111	F-105
112	F-105
113	F-106
114	F-107

SHIP B	NOTE #:	PAGE #:
	115	F-108
	116	F-109
	117	F-109
	118	F-110
	119	F-111
	120	F-112
	121	F-113
	122	F-113
	123	F-114
	124	F-115
	125	F-116
	126	F-117
	127	F-117
	128	F-118
	129	F-119
	130	F-120
	131	F-121
	132	F-121
	133	F-122
	134	F-123
	135	F-124
	136	F-125
	137	F-125
	138	F-127
	139	F-128
	140	F-129
	141	F-130
	142	F-131
	143	F-133

SHIP C	NOTE #:	PAGE #:
	1	F-136
	2	F-136
	3	F-137
	4	F-137
	5	F-138
	6	F-138
	7	F-139
	8	F-139
	9	F-140
	10	F-140
	11	F-141
	12	F-141
	13	F-142
	14	F-143
	15	F-143
	16	F-144
	17	F-144
	18	F-145
	19	F-145

SHIP C	NOTE #:	PAGE #:
	20	F-146
	21	F-146
	22	F-147
	23	F-147
	24	F-148

SHIP A NOTE #1 *****

FAILURE EFFECT: Both boilers shutdown (lose control power).

POSSIBLE SYSTEM EFFECTS: Dead in the water.

SYMPTOM OR HOW DETECTED: ERC and local panel would be "dead" (i.e., no lights); obvious indication that control electrical power lost.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Relight 1 or both boilers completely manually (i.e., jack open valves manually, etc.); bring up diesel generator for back-up electrical power; go to harbor feedpump (electrical) for back-up feedpump.

-SECONDARY ACTION: Troubleshoot system via card tester. Isolate and replace defective card. Return to auto operation.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 11 - Dead in water.
(b) Maneuvering: 41 - Dead in water.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #2 *****

FAILURE EFFECT: Incomplete, low air flow, or total loss of purge.

POSSIBLE SYSTEM EFFECTS:
(a) Light-off inhibited.
(b) Possible explosion if inhibit fails.

SYMPTOM OR HOW DETECTED: No auto light-off. Purge complete light not on, or, purge fail light comes on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually purge system and light boiler manually.

-SECONDARY ACTION: Troubleshoot digital logic when time permits and replace defective card. Return to automatic control.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 24 - Delay in light off.

SHIP A NOTE #3 *****

FAILURE EFFECT: Lose boiler protective trips or protective light-off inhibits.

POSSIBLE SYSTEM EFFECTS: Possible explosion/boiler damage if condition protected against occurs.

SYMPTOM OR HOW DETECTED: Cannot be detected unless condition protected against occurs; then would involve detection of forbidden occurrence.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:
- -No effect and no action if forbidden condition does not occur.
- -If forbidden condition occurs, major repair/restoration required.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #4 *****

FAILURE EFFECT: Inadvertent purge, master F.O. valve closes.

MISSION EFFECT: Boiler shutdown.

SYMPTOM OR HOW DETECTED: Loss of flame and master F.O. valve closed indication.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler shutdown. Proceed on one boiler with reduced capability; relight boiler from local panel.

-SECONDARY ACTION: Troubleshoot digital logic when time permits and replace defective card. Return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #5 *****

FAILURE EFFECT: High combustion air (poor air/fuel ratio)

POSSIBLE SYSTEM EFFECT:
(a) Excessive smoke--white.
(b) Could blow out flame at low fuel demand.

SYMPTOM OR HOW DETECTED: Windbox pressure gauge on ERC. No alarm for high air. There is alarm for boiler smoke. Boiler will trip if any burner flames out.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators to determine problem. If pressure indicator shows high combustion air, activate remote manual controls or switch fan to low speed. Continue at normal cruising speed. For burner trip, check indicators and annunciator for reason for trip. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system using card tester. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection. Damper could be ma- nually positioned if remote manual not functioning properly.

CRITICALITY EVALUATION: Based on most likely events.
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 21 - Not applicable to during light-off.

SHIP A NOTE #6 *****

FAILURE EFFECT: Failure of boiler protection circuits.

MISSION EFFECT: False boiler trip.

SYMPTOM OR HOW DETECTED: Boiler trip alarm; other lights and gauges for:
(a) Combustion air flow.
(b) Boiler drum level low.
(c) Loss of flame.
(d) Master F.o. valve closed.
(e) F.O. header pressure.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check lights and instruments. Proceed on one boiler at reduced capacity. Verify that trip was erroneous.

-SECONDARY ACTION: Restart boiler from local panel. Troubleshoot when time permits and return to auto mode.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler, reduced RPM.
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #7 *****

FAILURE EFFECT: Master F.O. valve open during purge.

POSSIBLE SYSTEM EFFECTS: Ineffective purge if any burner valve open.

SYMPTOM OR HOW DETECTED: Master F.O. valve open/close light.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Abort light-off sequence and verify master F.O. valve status.

-SECONDARY ACTION: Conduct purge and light-off manually; troubleshoot when time permits and return to auto mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during manuevering.
(c) Light-Off: 25 - Possible boiler damage/explosion.

SHIP A NOTE #8 *****

FAILURE EFFECT: Automatic light-off inhibited.

POSSIBLE SYSTEM EFFECTS: No automatic boiler light-off.

SYMPTOM OR HOW DETECTED: One or more light-off sequence indicator lamps do not illuminate.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify that light-off sequence failed; verify that light-off sequence is not legitimately inhibited.

-SECONDARY ACTION: Conduct manual purge and light-off sequence; troubleshoot when time permits and return to auto mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #9 *****

FAILURE EFFECT: Air register stays open.

MISSION EFFECT:
(1) Fails to light.
(2) Could blow out flame at low demand.

SYMPTOM OR HOW DETECTED: Ignitor would not extend and burner valve remains closed.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Try a relight. Observe indicators and annunciator for problem.

-SECONDARY ACTION: Manually close air register for light-off. Troubleshoot when time permits.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 35 - Temporary loss of one boiler; reduced RPM.

(c) Light Off: 24 - Delay in light-off.

SHIP A NOTE #10 *****

FAILURE EFFECT: F.O. recirculation valve open during normal operation or light-off.

POSSIBLE SYSTEM EFFECTS:
(a) Low fuel oil pressure
(b) Flame out
(c) Low steam pressure.

SYMPTOM OR HOW DETECTED: Indicator but no alarm or trip for recirculation valve open. Alarm and trip for steam pressure low; alarm for F.O. burner header pressure low.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler shutdown. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot system using card tester.If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler, reduced RPM.
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #11 *****

FAILURE EFFECT: Master F.O. valve stays open.

POSSIBLE SYSTEM EFFECTS: Master F.O. valve would not close

on boiler safety trip.

SYMPTOM OR HOW DETECTED: Master F.O. valve open/close indicator; boiler safety trip annunciator.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Close master F.O. valve manually following a boiler trip. Proceed on one boiler.

-SECONDARY ACTION: Troubleshoot when time permits; replace defective component, restart boiler.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage/explosion.
(b) Maneuvering: 38 - Possible boiler damage/explosion.
(c) Light-Off: 25 - Possible boiler damage/explosion.

SHIP A NOTE #12 *****

FAILURE EFFECT: One burner shuts down or cannot be lit.

POSSIBLE SYSTEM EFFECTS:
(1) Light-off not successful.
(2) Steam demand exceeds production.

SYMPTOM OR HOW DETECTED: Burner on/off indicator, burner valve open/close indicator; burner flame intensity gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Proceed on the remaining two burners.

-SECONDARY ACTION: Troubleshoot when time permits; replace defective component; light burner.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 4 - Temporary loss of one burner, performance degradation.
(b) Maneuvering: 34 - Temporary loss of one burner, performance degradation.

(c) Light-Off: 23 - Slight delay in light-off.

SHIP A NOTE #13 *****

FAILURE EFFECT: One burner cannot be shut off.

POSSIBLE SYSTEM EFFECTS:
(1) Burner valve stays open following a trip.
(2) Steam production exceeds demand.

SYMPTOM OR HOW DETECTED: Burner on/off indicator, burner valve open/close indicator; burner flame intensity gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Proceed on the remaining two burners.

-SECONDARY ACTION: Troubleshoot when time permits; replace defective component; light burner.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage/explosion.
(b) Maneuvering: 38 - Possible boiler damage/explosion.
(c) Light-Off: 1 - Not applicable during light-off.

SHIP A NOTE #14 *****

FAILURE EFFECT: Light-off sequence timing errors.

POSSIBLE SYSTEM EFFECTS: Light-off sequence incorrect.

SYMPTOM OR HOW DETECTED: Could be difficult to detect; light-off sequence indicators provide some detection capability.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage/explosion.

SHIP A NOTE #15 *****

FAILURE EFFECT: Burner demand management malfunctions.

POSSIBLE SYSTEM EFFECTS: Burner management logic problems.

SYMPTOM OR HOW DETECTED: Superheater outlet pressure low alarm, burner valve open/close indicators, burner on/off indicators, burne flame intensity gauge. Possible turbine trip due to low steam pressure.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and alarm on control console. Activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoote digital logic when time permits and replace defective card. Return to automatic manual control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 39 - Large performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #16 *****

FAILURE EFFECT: Lose combustion air.

POSSIBLE SYSTEM EFFECTS: Burner flame out and boiler trip.

SYMPTOM OR HOW DETECTED: Boiler trip annunciator; windbox pressure gauge, FDB discharge pressure gauge, air flow controller gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Attempt to determine cause of trip; relight and operate boiler on manual.

-SECONDARY ACTION: Troubleshoot when time permits; replace defective component; restore auto mode operation.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler, reduced RPM.
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #17 *****

FAILURE EFFECT: High combustion air.

MISSION EFFECT:
(1) Boiler not lit due to high air flow.
(2) Burners could go out at low demand rates.

SYMPTOM OR HOW DETECTED: Boiler trip annunciator; windbox pressure gauge, FDB discharge pressure gauge, air flow controller gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Attempt to determine cause of tip; relight and operate boiler on manual.

-SECONDARY ACTION: Troubleshoot system when time permits; replace defective component; restore auto mode operation.

CRITICALITY EVALUATION:

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 35 - Possible loss of one boiler, reduced RPM.
(c) Light-Off: 23 - Slight delay in light-off.

SHIP A NOTE #18 *****

FAILURE EFFECT: Low combustion air.

POSSIBLE FAILURE EFFECTS:
(a) Black smoke, poor air/fuel ratio.
(b) Incomplete combustion and possible explosion due to accumulation of unburned fuel.
(c) Low steam pressure.
(d) Boiler trip if burner flame out.

SYMPTOM OR HOW DETECTED: Smoke alarm, boiler trip annunciator; windbox pressure gauge, FDB discharge pressure gauge, air flow controller gauge.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE:

Effect (a): Verify alarm and check indicators for problems. If pressure indicator show low combustion air, activate remote manual.

Effect (b): Explosion, boiler down. Continue on one boiler at reduced capability.

Effect (c): Check indicators and annuncator for reason for trip. Continue on one boiler at reduced capability.

-SECONDARY ACTION:

Effect (a): Verify alarm and check indicators on control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

Effect (b): Boiler probably down for rest of cruise. Proceed at reduced speed.

Effect (c): Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

CRITICALITY EVALUATION: Based on most likely events.
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler, reduced RPM
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #19 *****

FAILURE EFFECT: Fuel oil, low pressure.

SYSTEM EFFECTS: Loss of flame and boiler trip.

SYMPTOM OR HOW DETECTED: F.O. to burner header pressure low alarm, F.O. service pressure low alarm, fuel flow controller gauge, F.O. header pressure gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control. Restart boiler after completing corrective action.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler, reduced RPM.
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #20 *****

FAILURE EFFECT: Low fuel oil flow.

FAILURE EFFECT: Low steam pressure at high demand rates.

SYMPTOM OR HOW DETECTED: Would get alarms from lo steam pressure. Could get turbine run back or trip. F.O. to burner header pressure low alarm, F.O. service pressure low alarm, fuel flow controller gauge, F.o. header pressure gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm, activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 9 - Large performance degradation.
(b) Maneuvering: 39 - Large performance degradation, cannot execute maneuvers requiring high steam pressure demand.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #21 *****

FAILURE EFFECT: High fuel oil pressure.

SYSTEM EFFECT: Overfire, high steam pressure.

SYMPTOM OR HOW DETECTED: No alarms for high oil pressure or steam pressure. Excess steam will dump or relief valves open (3 valves). Pressure indicators for fuel oil and steam.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

-SECONDARY ACTION:

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 39 - Large performance degradation.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #22 *****

FAILURE EFFECT: Low fuel oil temperature.

SYSTEM EFFECT: High smoke. Would probably shutdown burners and boilers because scanners indicate loss of flame. Would flame out at around 140°F. or because F.O. too viscous to flow.

SYMPTOM OR HOW DETECTED: F.O. temperature low alarm, F.O. to burner temperature gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler when fuel oil temperature is above 180°F.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler, reduced RPM.

(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #23 *****

FAILURE EFFECT: High fuel oil temperature.

SYSTEM EFFECT:
(a) May get flash on light off.
(b) No problem under normal auto operation--excessive smoke.

SYMPTOM OR HOW DETECTED: F.O. temperature high alarm; F.O. to burner temperature gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 25 - Possible boiler damage/explosion.

SHIP A NOTE #24 *****

FAILURE EFFECT: High drum level.

SYSTEM EFFECT: Water to turbine, possible turbine damage. Pressure drops when water carries over to superheater.

SYMPTOM OR HOW DETECTED: Drum level high alarm, drum level gauge, feedpump status lamps, feedpump discharge pressure gauge, gauges on feedpump controllers.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine nature of failure; go to manual feedwater control.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 11 - Dead in water.
(b) Maneuvering: 41 - Dead in water one.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #25 *****

FAILURE EFFECT: Standby feedpump started when primary pump still running.

SYSTEM EFFECT: High feedwater pressure, high drum level.

SYMPTOM OR HOW DETECTED: Drum level high alarm, drum level gauge, feedpump status lamps, feedpump discharge pressure gauge, gauges on feedpump controllers.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually shutdown back-up pump.

-SECONDARY ACTION: Troubleshoot when time permits. Return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.

(c) Light-Off: 22 - No effect.

SHIP A NOTE #26 *****

FAILURE EFFECT: Low drum level.

POSSIBLE SYSTEM EFFECTS:
(a) Boiler trip.
(b) High steam temperature, tube or drum failure, steam explosion.
(c) High drum or tube metal temperature, steam explosion.

SYMPTOM OR HOW DETECTED: Drum level low alarm; drum level low-low trip; drum level gauge, feedpump status lamps, feedpump discharge pressure gauge, gauges on feedpump controllers.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify low water condition. Check analog logic and annunciator. Go to remote manual if electronic problem. Use handjack or emergency feed bypass if not electronic problem. Continue on one boiler at reduced capability.

-SECONDARY ACTION: Restart boiler when water level is within limits. Troubleshoot and correct problem when time permits.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 6 - Temporary loss of one boiler, can damage boiler if immediate corrective action not taken.
(b) Maneuvering: 36 - Temporary loss of one boiler, can damage boiler if immediate corrective action not taken.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE #27 *****

FAILURE EFFECT: Feedwater recirculation valve stays open.

SYSTEM EFFECT: Possible low feedwater flow, and low drum level.

SYMPTOM OR HOW DETECTED: F.W. recirculation valve open/close indicator; drum level low alarm; drum level low-low trip; drum level gauge; feedpump status lamps; feedpump discharge pressure gauge; gauges on feedpump controllers.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler, reduced RPM.
(b) Maneuvering: 31 - Not applicable to maneuvering.
(c) Light-Off: 21 - Not applicable to light-off.

SHIP A NOTE #28 *****

FAILURE EFFECT: Standby control feedwater pump failure.

SYSTEM EFFECT: Low drum level.

SYMPTOM OR HOW DETECTED: Feedpump run/standby/stop indicator lights; drum level low alarm; drum level low-low trip; drum level gauge; feedpump status lamps; feedpump discharge pressure gauge; gauges on feedpump controllers.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Back-up pump manually activated. Pump not part of control system.

-SECONDARY ACTION: Troubleshoot and repair; return feedpump to auto control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #29 *****

FAILURE EFFECT: Steam high pressure.

SYSTEM EFFECT: Damage turbine, rupture. Rupture tubes, steam explosion. No high pressure alarm or light. Have steam dump and relief valves back-up.

SYMPTOM OR HOW DETECTED: Boiler drum pressure gauge, superheater outlet pressure gauge, gauges on boiler controllers.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Possibility that failure mode not immediately found due to automatic back-up. Very low probability of all back-ups failing. Switch to remote manual control. If remote manual ineffective, activate manual control in field.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 38 - Possible boiler damage/explosion.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #30 *****

FAILURE EFFECT: Lose auto mode control of boiler.

POSSIBLE SYSTEM EFFECTS: Boiler would shutdown and could not be operated in auto mode.

SYMPTOM OR HOW DETECTED: No direct indications; numerous alarms/lamps would indicate abnormal situation.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Relight and operate boiler from local panel.

-SECONDARY ACTION: Troubleshoot and repair; return system to auto mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 5 - Temporary loss of one boiler; reduced RPM.
(b) Maneuvering: 35 - Temporary loss of one boiler, reduced RPM.
(c) Light-Off: 24 - Delay in light-off.

SHIP A NOTE # 31 *****

FAILURE EFFECT: Failure of back-up functions in boiler local panel.

POSSIBLE SYSTEM EFFECTS: Lose boiler local panel back-up.

SYMPTOM OR HOW DETECTED: Probably would not be detected in auto mode; numerous abnormal indications would occur in boiler front mode.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: No effect in auto mode; would have to go to manual operation of valves, ignitors, etc. if boiler front operation attempted.

-SECONDARY ACTION: Troubleshoot and repair; might have tot take boiler out-of-service to accomplish this.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #32 *****

FAILURE EFFECT: Loss of S.H. steam cooling.

POSSIBLE SYSTEM EFFECTS: Possible high S.H. steam temperature.

SYMPTOM OR HOW DETECTED: Steam temperature high alarm; superheater outlet temperature gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Go to manual control of S.H. steam temperature control loop.

-SECONDARY ACTION: Troubleshoot and repair; return to auto temperature control mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #33 *****

FAILURE EFFECT: Steam, superheated. Low temperature.

POSSIBLE SYSTEM EFFECTS: Degrades performance. Could result in wet steam in turbine.

SYMPTOM OR HOW DETECTED: Temperature indicators, but no alarms.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Good possibility that failure mode not noticed due to no alarm and no auto back-up. Could result in turbine damage. When problem noticed, switch to remote manual.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during normal steaming.

SHIP A NOTE #34 *****

FAILURE EFFECT: Lose atomizing steam pressure control.

POSSIBLE SYSTEM EFFECTS:
(a) Possible flame out if pressure too low.
(b) Possible damage to piping or burner nozzles if pressure too high.

SYMPTOM OR HOW DETECTED: Atomizing steam pressure low alarm; atomizing steam pressure gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Go to manual control of atomizing steam pressure control loop.

-SECONDARY ACTION: Troubleshoot and repair; return to auto pressure control mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage/explosion.
(b) Maneuvering: 38 - Possible boiler damage/explosion.
(c) Light-Off: 23 - Slight delay in light-off.

SHIP A NOTE #35 *****

FAILURE EFFECT: Lose gland steam pressure control.

POSSIBLE SYSTEM EFFECTS:
(a) Possible loss of vacuum and turbine trip if pressure too low.
(b) Possible damage to piping if pressure too high.

SYMPTOM OR HOW DETECTED: Gland steam pressure. Low alarm, condenser vacuum low alarm, gland steam pressure gauge, ahead chest pressure gauge, astern chest pressure gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Go to manual control of gland steam pressure control loop.

-SECONDARY ACTION: Troubleshoot and repair; return to auto pressure control mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #36 *****

FAILURE EFFECT: Difference between bleed steam pressure and turbine pressure.

POSSIBLE SYSTEM EFFECTS: Possible backflow of steam into turbine.

SYMPTOM OR HOW DETECTED: Bleed steam and turbine steam pressure gauges; possible turbine trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine cause of problem; go to manual control to the extent necessary.

-SECONDARY ACTION: Replace defective components; return to auto operation.

CRITICALITY EVALUATION:
Mission Effects:
35a:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during light-off.

36b:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #37 *****

FAILURE EFFECT: Excessive steam release to condenser.

POSSIBLE SYSTEM EFFECTS: Rise in condenser level and possible loss of vacuum.

SYMPTOM OR HOW DETECTED: Condenser hotwell level high alarm; possible turbine trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine cause of problem; go to manual control of exhaust steam and steam dump system.

-SECONDARY ACTION: Replace defective components; return to manual operation.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #38 *****

FAILURE EFFECT: DS steam never dumped to exhaust system.

POSSIBLE SYSTEM EFFECTS: Possible DS steam line overpressure.

SYMPTOM OR HOW DETECTED: No indicators available.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine cause of problem; go to manual control of exhaust steam and steam dump system.

-SECONDARY ACTION: Replace defective components; return to manual operation.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #39 *****

FAILURE EFFECT: Lose control of exhaust header pressure.

POSSIBLE SYSTEM EFFECTS: Possible exhaust headeroverpressure.

SYMPTOM OR HOW DETECTED: No indicators available.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine cause of problem; go to manual control of exhaust steam and steam dump system.

-SECONDARY ACTION: Replace defective components; return to manual operation.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #40 *****

FAILURE EFFECT: Lose high SH steam header pressure protection.

POSSIBLE SYSTEM EFFECTS: Possible SH steam header over pressure.

SYMPTOM OR HOW DETECTED: No indicators available.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine cause of problem; go to manual control of exhaust steam and steam dump system.

-SECONDARY ACTION: Replace defective components; return to manual operation.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.

(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #41 *****

FAILURE EFFECT: Lose exhaust steam dump.

POSSIBLE SYSTEM EFFECTS:
(a) Possible exhaust header overpressure.
(b) Possible eventual depletion of F.W.

SYMPTOM OR HOW DETECTED: No indicators available.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine cause of problem; go to manual control of exhaust steam and steam dump system.

-SECONDARY ACTION: Replace defective components; return to manual operation.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #42 *****

FAILURE EFFECT: Deaerator high level.

SYSTEM EFFECT: No effect.

SYMPTOM OR HOW DETECTED: DC heater level high alarm; relief valve opens.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm activate remote manual or

manual control.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #43 *****

FAILURE EFFECT: Deaerator low level.

SYSTEM EFFECT: Possible low drum feedwater level.

SYMPTOM OR HOW DETECTED: DC heater level low alarm. Also, low drum level alarm and trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #44 *****

FAILURE EFFECT: Lose feed heater control.

SYSTEM EFFECT: Loss in efficiency; possible damage to heater.

SYMPTOM OR HOW DETECTED: No alarms or indicators provided.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine nature of problem; to manual control of feedheater.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #45 *****

FAILURE EFFECT: L.O. supply to turbine shut-off.

POSSIBLE SYSTEM EFFECTS: Turbine trip on low L.O. pressure or turbine damage.

SYMPTOM OR HOW DETECTED: L.O. header pressure low alarm; turbine trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Attempt to clear alarm; go to manual control of L.O. control loop.

-SECONDARY ACTION: Replace defective component; return to

auto mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #46 *****

FAILURE EFFECT: Lube oil pump stops.

SYSTEM EFFECT: L.O. pressure low.

SYMPTOM OR HOW DETECTED: L.O. header pressure low alarm; L.O. pump status indicators.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Back-up pump automatically starts.

-SECONDARY ACTION

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #47 *****

FAILURE EFFECT: Lose auto start of standby L.O. pump.

POSSIBLE SYSTEM EFFECTS: Lose L.O. pump redundancy.

SYMPTOM OR HOW DETECTED: L.O. header pressure low alarm; L.O. pump status indicators.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Start standby pump manually.

-SECONDARY ACTION: Replace defective component.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #48 *****

FAILURE EFFECT: Condenser hotwell level fall.

POSSIBLE SYSTEM EFFECTS: Possible damage to condensate equipment.

SYMPTOM OR HOW DETECTED: No alarms or indicators provided.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Attempt to identify nature of problem; operate condensate system on manual.

-SECONDARY ACTION: Troubleshoot and replace defective component; return to auto mode.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 9 - Large performance degradation.
(b) Maneuvering: 39 - Large performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP A NOTE #49 *****

FAILURE EFFECT: Lose auto start of standby condensate pump.

POSSIBLE SYSTEM EFFECTS: Lose condensate pump redundancy.

SYMPTOM OR HOW DETECTED: Condensate pump status indicators; condensate pump discharge pressure gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Start standby pump manually.

-SECONDARY ACTION: Replace defective component.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #50 *****

FAILURE EFFECT: Condensate pump shuts down.

POSSIBLE SYSTEM EFFECTS: Condenser level rise.

SYMPTOM OR HOW DETECTED: Condensate pump status indicators; condensate pump discharge pressure gauge; hotwell level high alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Back-up pump starts automatically.

-SECONDARY ACTION:

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #51 *****

FAILURE EFFECT: Lose auto start of standby vacuum pump.

POSSIBLE SYSTEM EFFECTS: Lose vacuum.

SYMPTOM OR HOW DETECTED: Vacuum pump status indicators, vacuum low alarm, condenser vacuum gauge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Start standby pump manually.

-SECONDARY ACTION: Replace defective component.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

SHIP A NOTE #52 *****

FAILURE EFFECT: Lose condensate dump capability.

SYSTEM EFFECT: Deaerator level rise.

SYMPTOM OR HOW DETECTED: DC heater level high alarm; relief valve opens.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP B NOTE #1 *****

FAILURE EFFECT: High combustion air, did not decrease during light-off.

SYSTEM EFFECT: Boiler not lit due to high air flow.

SYMPTOM OR HOW DETECTED: Boiler trips due to no flame.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Make second attempt to light burners and monitor indicators for problem.

-SECONDARY ACTION: Manually set fan on low and light boiler. Troubleshoot system when time permits.

-CRITICALITY EVALUATION:
(a) Normal Steaming: Not applicable to this phase.
(b) Maneuvering: Not applicable to this phase.
(c) Light-Off: Slight delay in light-off.

SHIP B NOTE #4 *****

FAILURE EFFECT: Loss of combustion air--fan fails.

SYSTEM EFFECT: Open switch in fan would trip boiler.

SYMPTOM OR HOW DETECTED: Switch in contacts of motor sequence-V. Alarms ECC, and BF (also alarm for lo air). Lights stop, slow, fast ECC and BF.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #5 *****

FAILURE EFFECT: Loss of automation combustion air control.

SYSTEM EFFECT: Air varies--stays within limits.

SYMPTOM OR HOW DETECTED: No alarm. Smoke, poor combustion.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #6 *****

FAILURE EFFECT: Air register open during light off.

SYSTEM EFFECT: Fails to light.

SYMPTOM OR HOW DETECTED: Ignitor would not extend and burner valve remains closed.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Try a relight. Observe indicators and annunciator for problem.

-SECONDARY ACTION: Manually close air register for light-off. Troubleshoot when time permits.

-CRITICALITY EVALUATION:

(a) Normal Steaming: Not applicable to this phase.
(b) Maneuvering: Not applicable to this phase.
(c) Light Off: Slight delay in light-off.

SHIP B NOTE #7 *****

FAILURE EFFECT: Air register closed during normal operation

POSSIBLE SYSTEM EFFECTS:
(a) Poor combustion.
(b) Possible flame out.

SYMPTOM OR HOW DETECTED: Limit switch trips burner or burner shuts down due to flame out.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

-SECONDARY ACTION: Manually open air register and restart burner. Troubleshoot system when time permits.

-CRITICALITY EVALUATION OF MOST LIKELY EVENTS:
(a) Normal Steaming: Temporary loss of one burner, performance degradation.
(b) Maneuvering: Temporary loss of one burner, performance degradation.
(c) Light-Off: Failure mode not applicable to this phase.

SHIP B NOTE #8 *****

FAILURE EFFECT: Air register closed during purge.

POSSIBLE SYSTEM EFFECTS:
(a) Purge abort.
(b) Inadequate purge, possible explosion if boiler shutdown due to lack of air (excess fuel).

SYMPTOM OR HOW DETECTED: Air register closed light. Logic would abort purge.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Attempt second purge and observe indicators and annunciators.

-SECONDARY ACTION: Manually open air register and purge boiler. Troubleshoot system when time permits.

CRITICALITY EVALUATION:
(a) Normal Steaming: Not applicable to this phase.
(b) Maneuvering: Not applicable to this phase.
(c) Light-Off: Slight delay in light-off.

SHIP B NOTE #9 *****

FAILURE EFFECT: Automated control fails to shut down boiler when atomizing steam pressure is low.

POSSIBLE SYSTEM EFFECTS:
(a) Poor atomization results in poor flame/smoke.
(b) Possible explosion from unburned fuel.

SYMPTOM OR HOW DETECTED: Pressure switch vital alarm. Pressure indicators in boiler front and engine room control console. Pressure switch normally open closes at 125 PSI--open switch will close burner valve.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Low atomizing steam pressure not part of automated control. Would first determine reason for low pressure and take corrective action.

-SECONDARY ACTION: Determine why pressure switch failed to open.

-CRITICALITY EVALUATION:
(a) Normal Steaming: Slight performance degradation.
(b) Maneuvering: Slight performance degradation.

(c) Light-Off: Delay in light-off.

SHIP B NOTE #10 *****

FAILURE EFFECT: Atomizing steam.

SYSTEM EFFECT: High pressure.

SYMPTOM OR HOW DETECTED: Vital alarm--PS 205, 206.
Hi 168 PSI pressure indicators BF and ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #11 *****

FAILURE EFFECT: Atomizing steam.

SYSTEM EFFECT: Wet steam.

SYMPTOM OR HOW DETECTED:

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #12 *****

FAILURE EFFECT: Burner management problem.

POSSIBLE SYSTEM EFFECTS: Burner management logic problem, true or false.
(a) Combustion control in low fire.
(b) Burner management in manual.
(c) Burner tripped.
(d) Ignitor problem

SYMPTOM OR HOW DETECTED: Nonvital alarm. Indicator lights for all.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm, activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot digital logic when time permits and replace defective card. Return to automatic controls.

CRITICALITY EVALUATION:
(a) Normal Steaming: Slight performance degradation.
(b) Maneuvering: Slight performance degradation.
(c) Light-Off: Failure mode not applicable in this phase.

SHIP B NOTE #13 *****

FAILURE EFFECT: Boiler smoking.

SYSTEM EFFECT: Wager system, 20% scale.

SYMPTOM OR HOW DETECTED: Alarm NV ECC and BF.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #14 *****

FAILURE EFFECT: Failure of boiler protection circuits.

SYSTEM EFFECT: False boiler trip.

SYMPTOM OR HOW DETECTED: Vital group alarm for engine room control console, boiler front and boiler console. First out lights.

(a) Operator trip.
(b) Combustion air flow--low. Pressure switch set at 0.1 WC (same as alarm).
(c) Boiler drum level low--low level switch set at 8" below (alarm set at 5").
(d) Fuel oil presssure low. Pressure switch set at 40 PSI (same as alarm).
(e) Loss of all flame.
(f) All burner oil valves closed.
(g) Unsuccessful shutdown.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check first out lights and instruments. Proceed on one boiler at reduced capacity. Verify that trip was erroneous.

-SECONDARY ACTION: Restart boiler and activate remote manual for erroneous function. Troubleshoot when time permits.

CRITICALITY EVALUATION
(a) Normal Steaming: Temporary loss of one burner, performance degradation.
(b) Maneuvering: Not applicable to this phase.
(c) Light-Off: Delay in light-off.

SHIP B NOTE #15 *****

FAILURE EFFECT: Condensate.

SYSTEM EFFECT: Aux condenser vacuum low. PS-321, 22" Hg.

SYMPTOM OR HOW DETECTED: Alarm V, ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #16 *****

FAILURE EFFECT: Aux condenser level high.

SYSTEM EFFECT: LS-319 (Gems) 11.5" abcve bottom of hotwell

SYMPTOM OR HOW DETECTED: Alarm NV ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #17 *****

FAILURE EFFECT: Aux condenser pump failure.

SYSTEM EFFECT: Motor contact switch.

SYMPTOM OR HOW DETECTED: Alarm NV ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #18 *****

FAILURE EFFECT: Condensate Main condenser.

SYSTEM EFFECT: INBD main pump failure.

SYMPTOM OR HOW DETECTED: Alarm V, ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #19 *****

FAILURE EFFECT: Main condenser vacuum low.

SYSTEM EFFECT: PS-301, 24" Hg.

SYMPTOM OR HOW DETECTED: Alarm V ECC, signal to throttle control.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #20 *****

FAILURE EFFECT: OUTBD pump failure.

SYSTEM EFFECT:

SYMPTOM OR HOW DETECTED: Alarm NV ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #21 *****

FAILURE EFFECT: Main condenser level high.

SYSTEM EFFECT: Level switch LS 304--13" above bottom of hotwell.

SYMPTOM OR HOW DETECTED: Alarm V ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #22 *****

FAILURE EFFECT: Console power on battery.

SYSTEM EFFECT:

SYMPTOM OR HOW DETECTED: Alarm V ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #23 *****

FAILURE EFFECT: Control module power failure.

SYSTEM EFFECT:

SYMPTOM OR HOW DETECTED: Alarm V ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #24 *****

FAILURE EFFECT: Deaerator high level.

SYSTEM EFFECT: No effect.

SYMPTOM OR HOW DETECTED: Vital alarm in engine room control console. Level transmitter set at 81" (high). Relief valve opens.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:

System Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 61 - Not applicable during this phase.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 2 - No effect.
(c) Light-Off: 21 Not applicable during light-off.

FAILURE RATE:
-Transducers = 6.63
-Valves = 49.14
-Electronics = 9.8930
Total = 65.6630

SHIP B NOTE #25 *****

FAILURE EFFECT: Deaerator low level.

SYSTEM EFFECT: Low drum feedwater level.

SYMPTOM OR HOW DETECTED: Vital alarm in engine room control console. Level transmitter set at 45" (low). Also, low drum level alarm and trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable during this phase.

Mission Effects:

(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Transducers = 6.25
-Valves = 16.38
-Electronics = 9.8441
Total = 32.4741

SHIP B NOTE #26 *****

FAILURE EFFECT: Deaerator.

SYSTEM EFFECT: Feedpump overspeed/trip could fail due to lack of water.

SYMPTOM OR HOW DETECTED:

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #27 *****

FAILURE EFFECT: Feedwater recirculation valve opens during high demand.

SYSTEM EFFECT: Possible low feedwater flow, and low drum level.

SYMPTOM OR HOW DETECTED: No alarm or indicator except for low drum level and low drum level trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and restart boiler.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 1 - Not applicable to maneuvering.
(c) Light-Off: 1 - Not applicable to light-off.

FAILURE RATE:
-Transducers = 19.64
-Electronics = 2.8308
-Valves = 16.38
Total = 38.8508

SHIP B NOTE #28 *****

FAILURE EFFECT: Feedwater recirculation valve closes during low demand.

SYSTEM EFFECT: Possible pump overheat, pump failure.

SYMPTOM OR HOW DETECTED: No alarm or indicator. Back-up pump would activate if primary failed.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Back-up pump automatically activated.

-SECONDARY ACTION: Loss of back-up pump. Could be dead in water if second pump fails. Crew would try to repair failed pump.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 5 - Auto back-up--back-up takes over function.
(b) Maneuvering: 35 - Auto back-up--back-up takes over function.
(c) Light-Off: 61 - Not applicable during this phase.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light Off: 22 - No effect.

FAILURE RATE:
-Transducers = 9.64
-Valves = 16.38
-Electronics = 3.7744
Total = 29.7944

SHIP B NOTE #29 *****

FAILURE EFFECT: Feedwater control pump failure.

SYSTEM EFFECT: Low drum level.

SYMPTOM OR HOW DETECTED: Pressure sensor set at 800 PSI, vital alarm in engine room control console, light--run, standby, stop.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Back-up pump automatically activated. Pump not part of control system.

-SECONDARY ACTION: Crew would try repair failed pump.

CRITICALITY EVALUATION:
System Effects:

(a) Normal Steaming: 5 - Auto back-up -- back-up takes over function.
(b) Maneuvering: 35 - Auto back-up -- back-up takes over function.
(c) Light-off: 65 - Auto back-up -- back-up takes over function.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-off: 62 - No effect.

SHIP B NOTE #30 *****

FAILURE EFFECT: Feedwater pump

SYSTEM EFFECT: Lube oil pressure low.

SYMPTOM OR HOW DETECTED: Alarm NV, ECC. Pressure indicator PI 337 25 PSI (?), not part of GR controls

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #31 *****

FAILURE EFFECT: Feedwater pump.

SYSTEM EFFECT: Lube oil temp high.

SYMPTOM OR HOW DETECTED: Alarm ECC, NV. Resistance temp device RTD 331 160F, temp indicator ECC TI 331.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP 8 NOTE #32 *****

FAILURE EFFECT: Boiler feedpump heater pressure low.

SYSTEM EFFECT: Low drum level

SYMPTOM OR HOW DETECTED: Pressure sensor set at 850 PSIG, alarm for engine room control console and boiler front (separate pressure transmitter to control logic and engine room control console indicator redundant).

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm, activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
-Transducers = 6.13

SHIP B NOTE #33 *****

FAILURE EFFECT: Standby feedpumps started when primary pump still running.

SYSTEM EFFECT: High feedwater pressure, high drum level.

SYMPTOM OR HOW DETECTED: Nonvital alarm for engine room control console. Relief valve pops.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually shutdown back-up pump.

-SECONDARY ACTION: Troubleshoot digital logic when time permits and replace defective card. Return to automatic control.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 62 - No effect.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

FAILURE RATE:
-Electronics = 3.99407

SHIP B NOTE #34 *****

FAILURE EFFECT: High feedwater level.

SYSTEM EFFECT:
(a) No effect.
(b) Possible spill over to turbine.

SYMPTOM OR HOW DETECTED: Non vital alarm for engine room control console. Relief valve pops. Possible turbine MPC or trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Switch to remote manual and lower level.

-SECONDARY ACTION: Troubleshoot system when time permits and replace defective card. Return to automatic control.

CRITICALITY EVALUATION:
34a--System Effects:
(a) Normal Steaming: 3 - Alarm, activate remote manual.
(b) Maneuvering: 33 - Alarm, activate remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

34a--Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

34b--System Effects:
(a) Normal Steaming: 20 - Loss of protective feature.
(b) Maneuvering: 50 - Loss of protective feature.
(c) Light-Off: 80 - Loss of protective feature.

34b--Mission Effects:
(a) Normal Steaming: 7 - Possible turoine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 22 - No effect.

FAILURE RATE:
34a: Transducers = 4.122
Electronics = 53.2910
Total = 57.4130

34b: Transducers = 0.458
Electronics = 5.9212
Total = 6.3792

SHIP 8 NOTE #35 *****

FAILURE EFFECT: Low feedwater drum level.

POSSIBLE SYSTEM EFFECTS:
(a) Boiler trip.
(b) High steam temperature, tube or drum failure, steam explosion.
(c) High drum or tube metal temperature, steam explosion.

SYMPTOM OR HOW DETECTED: Indicators and alarms set at low 5" below drum center line. Also lo lo level trip to Brn, Mgmt. Lo lo level switch set at 8" below center line. Tubes exposed at 10".

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify low water by observing gauge glass and yarway on boiler front. Check analog logic and annunciator. Go to remote manual if electronic problem. Use handjack or emergency feed bypass if not electronic problem. Continue on one boiler at reduced capability.

-SECONDARY ACTION: Restart boiler when water level is within limits. Troubleshoot and correct problem when time permits.

CRITICALITY EVALUATION:
35a--System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and restart boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and restart boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

35a--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 24 - Delay in light-off.

35b--System Effects:
(a) Normal Steaming: 6 - Explosive condition--actual probability of explosion depends on other factors.
(b) Maneuvering: 36 - Explosive condition--actual probability of explosion depends on other factors.
(c) Light-Off: 61 - Not applicable during this phase.

35b--Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage.
(b) Maneuvering: 38 - Possible boiler damage.
(c) Light-Off: 21 - Not applicable during light-off.

35c--System Effects:
(a) Normal Steaming: 6 - Explosive condition--actual probability of explosion depends on other factors.
(b) Maneuvering: 36 - Explosive condition--actual probability of explosion depends on other factors.
(c) Light-Off: 61 - Not applicable during this phase.

35c--Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage.
(b) Maneuvering: 38 - Possible boiler damage.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:

35a:	Transducers =	1.26
	Electronics =	33.7113
	Total =	34.9713
35b:	Transducers =	0.63
	Electronics =	16.8556
	Total =	17.5856
35c:	Transducers =	.210
	Electronics =	5.6185
	Total =	5.8285

SHIP B NOTE #36 *****

FAILURE EFFECT: Fuel oil.

SYSTEM EFFECT: Loss of ECC remote maneuver control.

SYMPTOM OR HOW DETECTED:

MOST LIKELY ACTION AND SYSTEM STATUS
-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #37 *****

FAILURE EFFECT: Fuel oil.

SYSTEM EFFECT: Loss of automatic control, variation in pressure.

SYMPTOM OR HOW DETECTED: Header pressure low alarm NV, PS706, 150 PSI. Header pressure indicator PI 707, boiler pressure low alarm PS 715 (starboard), boiler PI 717 ECC and PI 719 BF (SB).

MOST LIKELY ACTION AND SYSTEM STATUS
-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #38 *****

FAILURE EFFECT: Fuel oil, low pressure.

SYSTEM EFFECT:
(a) Boiler trip, low pressure.
(b) Loss of flame, no flame boiler trip.

SYMPTOM OR HOW DETECTED: Low F.O. pressure will trip boiler control valve at 40 PSI.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control. Restart boiler after completing corrective action.

CRITICALITY EVALUATION:
38a--System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and restart boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and restart boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

38a--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 24 - Delay in light-off.

38b--System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and restart boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and restart boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

38b--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
38a: Electronics = 2.9689
Valves = 10.008
Total = 12.9769

38b: Electronics = 1.9793
Valves = 6.672
Total = 8.6513

SHIP 8 NOTE #39 *****

FAILURE EFFECT: High FO, hi stm press

SYSTEM EFFECT: (a) High steam pressure.

SYMPTOM OR HOW DETECTED: No alarms for high oil pressure or steam pressure. Excess steam will dump or relief valves open (3 valves). Pressure indicators for fuel oil and steam.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

-SECONDARY ACTION:

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 11 - No alarm--only light or indicators
(b) Maneuvering: 41 - No alarm--only light or indicators.
(c) Light-Off: 61 - No alarm--only light or indicators.

Mission Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Transducers = 0.50
-Electronics = 8.0536
-Valves = 16.98
Total = 25.5336

SHIP B NOTE #40 *****

FAILURE EFFECT: Fuel flow does not decrease for light-off.

SYSTEM EFFECT: (a) Flash or explosion.

SYMPTOM OR HOW DETECTED: Obvious flash, explosion, or loss of flame. Manually shutdown boiler and assess damage.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Relays = 0.0495

SHIP B NOTE #41 *****

FAILURE EFFECT: F.O. service pump discharge strainer

SYSTEM EFFECT: High differential pressure high.

SYMPTOM OR HOW DETECTED: High differential pressure alarm. PS-705 setpoint 8 PSI P, alarm NV.

MOST LIKELY ACTION AND SYSTEM STATUS
-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP 8 NOTE #42 *****

FAILURE EFFECT: Low fuel oil flow.

SYSTEM EFFECT:
(a) Low steam pressure.
(b) Possible flame-out.

SYMPTOM OR HOW DETECTED: No alarm or indicator--would get alarms from lo steam pressure. Could get turbine run back or trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm, activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
42a--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 3 - Alarm --activate remote manual.
(c) Light-Off: 61 - Not applicable during this phase.

42a--Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicalbe during light-off.

42b--System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and re-start boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and re-start boiler.
(c) Light-Off: 61 - Not applicable during this phase.

42B--Mission Effects:
(a) Normal Steaming: 5 - Auto back-up--back-up takes over function.
(b) Maneuvering: 35 - Auto back-up--back-up takes over function.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:

42a:	Electronics =	5.9981
	Relays =	0.0534
	Transducers =	8.6760
	Total =	14.7275
42b:	Electronics =	3.9989
	Relays =	0.0712
	Transducers =	5.7840
	Total =	9.8541

SHIP B NOTE #43 *****

FAILURE EFFECT: High fuel oil flow.

SYSTEM EFFECT:
(a) Excessive black smoke (if air low).
(b) High steam pressure.
(c) Possible explosion when F.O. increase leads air.

SYMPTOM OR HOW DETECTED: No alarm or indicator for high F.O. flow. Would get alarm for smoke. High steam pressure would dump and relief valves pop. Would check steam pressure on pressure indicator.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Switch to remote manual. Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

-SECONDARY ACTION :

CRITICALITY EVALUATION:
43a--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

43a--Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.

(c) Light-Off: 21 - No effect.

43b--System Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 61 - Not applicable to this phase.

43b--Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicable during light-off.

43c--System Effects:
(a) Normal Steaming: 6 - Explosive condition--actual probability of explosion depends on other factors.
(b) Maneuvering: 36 - Explosive condition--actual probability of explosion depends on other factors.
(c) Light-Off: 61 - Not applicable to this phase.

43d--Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage.
(b) Maneuvering: 37 - Possible boiler damage.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:

43a:	Electronics =	7.5860
	Relays =	0.0801
	Transducers =	5.9360
	Total =	13.6021
43b:	Electronics =	3.9244
	Relays =	0.0400
	Transducers =	4.4520
	Total =	8.4164
43c:	Electronics =	1.5707
	Relays =	0.0133
	Transducers =	4.4520
	Total =	6.0360

SHIP B NOTE #44 *****

FAILURE EFFECT: Low fuel oil temperature.

SYSTEM EFFECT: High smoke. Would probably shutdown burners and boilers because scanners indicate loss of flame. Would flame out at around 140°F.

SYMPTOM OR HOW DETECTED: Controller, resistance temp device, temp indicators for engine room control console and boiler front, vital alarms for engine room control console and boiler room low at 180°F. Boiler trip alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler when fuel oil temperature is above 180°F.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and restart boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and restart boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
-Transducers = 2.00
-Electronics = 10.9649
-Valves = 18.70
Total = 31.6649

SHIP B NOTE #45 *****

FAILURE EFFECT: Low fuel oil temperature--light off.

SYSTEM EFFECT:

SYMPTOM OR HOW DETECTED:

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP 8 NOTE #46 *****

FAILURE EFFECT: High fuel oil temperature.

SYSTEM EFFECT: May get flash on light off. No problem under normal auto operation--excessive smoke.

SYMPTOM OR HOW DETECTED: Alarms/indicators, high--245°F. Alarm and controller are different RTD's. Also smoke alarms.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:

(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Transducers = 2.2208
-Electronics = 7.8389
-Valves = 17.35
Total = 27.4097

SHIP B NOTE #47 *****

FAILURE EFFECT: Recirculation valve open during normal operation or light-off.

POSSIBLE SYSTEM EFFECTS:
(a) Low fuel oil pressure
(b) Flame out
(c) Low steam pressure.

SYMPTOM OR HOW DETECTED: No alarm or trip for recirculation valve open. Should inhibit light-off if open. Alarms and trip for low fuel pressure and steam pressure.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshooting system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

-CRITICALITY EVALUATION:
(a) Normal Steaming: Temporary loss of one boiler, reduce

RPM.
(b) Maneuvering: Not applicable to this phase.
(c) Light-Off: Delay in light-off.

SHIP B NOTE #48 *****

FAILURE EFFECT: Lube oil, turbine.

SYSTEM EFFECT: (a) Activate pump with suction or disharge valves closed.
(b) Loss of lube oil standby.
(c) Both pumps running at same time.

SYMPTOM OR HOW DETECTED:

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #49 *****

FAILURE EFFECT: Lube pump activate with suction or discharge valves closed.

SYSTEM EFFECT: Loss of lube oil.

SYMPTOM OR HOW DETECTED: Vital alarm for engine room control console. Pressure switch set at 20 PSI.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicator lights. Back-up pump automatically starts.

-SECONDARY ACTION:

-CRITICALITY EVALUATION:
(a) Normal Steaming: No effect.
(b) Maneuvering: No effect.
(c) Light-Off: No effect.

SHIP B NOTE #50 *****

FAILURE EFFECT: Lube oil, turbine. Pump failure.

SYSTEM EFFECT: Pressure low. Pressure switch open at 10 PSI, close at 4 PSI.

SYMPTOM OR HOW DETECTED: Vital alarm for engine room control console.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Back-up pump automatically starts.

-SECONDARY ACTION:

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 5 - Auto back-up--back-up takes over function.
(b) Maneuvering: 35 - Auto back-up--back-up takes over function.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Switches = 1.4500
-Electronics = 1.4989
Total = 2.9489

SHIP B NOTE #51 *****

FAILURE EFFECT: Lube oil, turbine.

SYSTEM EFFECT: Decharge filter differential pressure.

SYMPTOM OR HOW DETECTED: PS-607, 15 PSI P. Alarm NV ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #52 *****

FAILURE EFFECT: Lube oil turbine.

SYSTEM EFFECT: Oil sump low.

SYMPTOM OR HOW DETECTED: Gems le switch--18" below top. Alarm V ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #53 *****

FAILURE EFFECT: Lube oil, turbine

SYSTEM EFFECT:

SYMPTOM OR HOW DETECTED: Alarm NV ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #54 *****

FAILURE EFFECT: Lube oil, turbine

SYSTEM EFFECT: Lube oil coalescer differential pressure. Differential pressure switch, 35 PSI P.

SYMPTOM OR HOW DETECTED: Alarm NV ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #55 *****

FAILURE EFFECT: Lube oil, turbine.

SYSTEM EFFECT: Temperature off limits.

SYMPTOM OR HOW DETECTED: Alarm V ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #56 *****

FAILURE EFFECT: Inadvertent purge.

SYSTEM EFFECT: Could blow out flame during low demand or light-off.

SYMPTOM OR HOW DETECTED: Loss of flame and burner or boiler tripped alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually switch fan to low. Check indicators and annunciator for reason for boiler trip. Proceed on one boiler with reduced capability.

-SECONDARY ACTION: Troubleshoot digital logic when time permits and replace defective card. Return to automatic control.

-CRITICALITY EVALUATION:
(a) Normal Steaming: No effect.
(b) Maneuvering: Temporary loss of one boiler, degraded performance. Cannot execute extreme maneuvers on re-remaining boiler.
(c) Light-Off: Delay in light-off.

SHIP B NOTE #57 *****

FAILURE EFFECT: Incomplete low air flow or total loss of purge.

POSSIBLE SYSTEM EFFECTS:
(a) Light-off inhibited.
(b) Possible explosion if inhibit fails.

SYMPTOM OR HOW DETECTED: No auto light-off. Purge complete light not on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually purge system and light boiler manually.

-SECONDARY ACTION: Troubleshoot digital logic when time permits and replace defective card. Return to automatic control.

CRITICALITY EVALUATION
(a) Normal Steaming: No effect.
(b) Maneuvering: No effect.
(c) Light-Off: Delay in light off.

SHIP B NOTE #58 *****

FAILURE EFFECT: Steam, superheated. Low pressure.

SYSTEM EFFECT: Turbine reduce RPM/trips (at 775 to 650). Also reduces steam to electrical generators. Could have secondary failure due to low electrical power.

SYMPTOM OR HOW DETECTED: Pressure transmitter set at 830 PSI. Pressure indicator in engine room control console and boiler front. Lo pressure vital alarm for engine room control console and boiler front.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

-SECONDARY ACTION: Troubleshoot system using analog test

station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 8 - Turbine MPC reduces RPM--trouble-shoot and resume normal RPM's.
(b) Maneuvering: 38 - Turbine MPC reduces RPM--trouble shoot and resume normal RPM's.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 9 - Large performance degradation.
(b) Maneuvering: 39 - Large performance degradation. Cannot execute maneuvers requiring high steam pressure demand.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Transducers = 36.76
-Electronics = 21.3959
Total = 58.1559

SHIP 8 NOTE #59 *****

FAILURE EFFECT: Steam high pressure.

SYSTEM EFFECT:
(a) Have steam dump and three relief valves back-up.
(b) Rupture tubes and drum, steam explosion. No high pressure alarm or light.

SYMPTOM OR HOW DETECTED: Pressure indicators.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Possibility that failure mode not immediately found due to automatic back-up. Very low probability of all back-ups failing. Switch to remote manual control. If remote manual ineffective, activate manual control in field.

-SECONDARY ACTION: Troubleshoot system using analog test

station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
59a--System Effects:
(a) Normal Steaming: 5 - Auto back-up--back-up takes over function.
(b) Maneuvering: 35 - Auto back-up--back-up takes over function.
(c) Light-Off: 61 - Not applicable to this phase.

59a--Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 21 - Not applicable to this phase.

59b--System Effects:
(a) Normal Steaming: 6 - Explosive condition--actual probability of explosion depends on other factors.
(b) Maneuvering: 36 - Explosive condition--actual probability of explosion depends on other factors.
(c) Light-Off: 61 - Not applicable during this phase.

59b--Mission Effects:
(a) Normal Steaming: 7 - Possible boiler damage.
(b) Maneuvering: 37 - Possible boiler damage.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
59a: Transducers = 18.38
Electronics = 9.7525
Total = 28.1325

59b: Transducers = 18.38
Electronics = 9.0317
Total = 27.4117

SHIP B NOTE #60 *****

FAILURE EFFECT: Steam, superheated. Low temperature.

SYSTEM EFFECT: Could result in wet steam in turbine.

SYMPTOM OR HOW DETECTED: Temperature indicators, but no

alarms.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Good possiblity that failure mode not noticed due to no alarm and no auto back-up Could result in turbine damage. When problem noticed, switch to remote manual.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 11 - No alarm--only lightbar indicators show problem condition.
(b) Maneuvering: 41 - No alarm--only lightbar indicators show problem condition.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Transducers = 19.66
-Electronics = 23.9891
-Sensors = 2.2208
-Valves = 32.76
Total = 78.6299

SHIP B NOTE #61 *****

FAILURE EFFECT: Steam, superheated. High steam temperature.

SYSTEM EFFECT: Tube rupture (superheater tube) steam explosion.

SYMPTOM OR HOW DETECTED: Resistance temperature device set at 970°F. Vital alarms for engine room control console and boiler front. Temperature indicators for engine room control console and boiler front.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable during this phase.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicalbe during light-off.

FAILURE RATE:
-Transducers = 9.64
-Electronics = 14.9915
-Valves = 32.76
-Sensors = 5.5076
Total = 62.8991

SHIP B NOTE #62 *****

FAILURE EFFECT: Throttle control.

SYSTEM EFFECT: Throttle control problem non-critical.

SYMPTOM OR HOW DETECTED: Alarm NV, ECC-group.
(a) Boiler drum high--LT-348 and LT-347, 5" to 8" above dr centerline.
(b) Steam pressure low, PT-107, 108, 775 to 650 PSI.
(c) Excess vibration. Viax system.
(d) Overspeed limiting, 103 to 112%.
(e) Electronic supply failure.
(f) Turbine trip bypassed.
(g) Control hydraulics oil sump low.
(h) Control hydraulics pump off.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION

CRITICALITY EVALUATION:

SHIP B NOTE #63 *****

FAILURE EFFECT: Throttle control.

SYSTEM EFFECT: Throttle control override.

SYMPTOM OR HOW DETECTED: Alarm V, BC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #64 *****

FAILURE EFFECT: Throttle control.

SYSTEM EFFECT: Shaft stopped overtime.

SYMPTOM OR HOW DETECTED: Alarm V, BC

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #65 *****

FAILURE EFFECT: Throttle control.

SYSTEM EFFECT: Throttle control out of service.

SYMPTOM OR HOW DETECTED: Alarm V, BC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #66 *****

FAILURE EFFECT: Throttle control.

SYSTEM EFFECT: Throttle control problem critical.

SYMPTOM OR HOW DETECTED: Alarm V, ECC (group).
(a) Main engine tripped.
(b) Astern gard valve failed to open timer--7 seconds after command.
(c) Shaft stopped overtime (also BC). Timer--stopped over 2 minutes.
(d) Control pump off. Sensor in hydraulic oil system.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #67 *****

FAILURE EFFECT: Turbine viax problem.

SYSTEM EFFECT:

SYMPTOM OR HOW DETECTED: Alarm V, ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #68 *****

FAILURE EFFECT: Turbine.

SYSTEM EFFECT: Wrong direction.

SYMPTOM OR HOW DETECTED: Alarm NV, ECC.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #69 *****

FAILURE EFFECT: Turbine tripped.

SYSTEM EFFECT:

SYMPTOM OR HOW DETECTED: Alarm V, ECC and BC (group).
(a) Lube oil pressure low. Pressure switch.
(b) Rotor axial motion trip.
(c) Main condenser vacuum low-low PS-301, 18" Hg.
(d) Manual trip.
(e) Automatic shaft rollover malfunction.
(f) Turbine overspeed sensor, 112% of max.
(g) Throttle valve overtrave. Limit switch.
(h) Lube oil gravity tank low. Gems LT 4'0 below top of tank.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION:

SHIP B NOTE #80

FAILURE EFFECT: Loss of control, combustion control.

SYSTEM EFFECT: No response to auto controls inputs. Output varies.

SYMPTOM OR HOW DETECTED: Indicators show no response to inputs or erratic outputs.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate remote manual controls. Continue at normal cruising speed. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection.

CRITICALITY EVALUATION: Based on most likely events.
System Effects:
(a) Normal Steaming: 12 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(b) Maneuvering: 42 - Erratic response--auto control output is erractic when compared to known inputs. Use remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Electronics = 9.4033
-Relays = 0.0890
Total = 9.4923

SHIP B NOTE #81 *****

FAILURE EFFECT: Poor air/fuel ratio.

POSSIBLE SYSTEM EFFECTS:
(a) Smoke.
(b) Incomplete combustion and possible explosion due to accumulation of unburned fuel.

SYMPTOM OR HOW DETECTED: Nonvital alarm, smoke alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE:

Effect (a): Verify alarm and check indicators for problems. If pressure indicator show low combustion air, activate remote manual. Continue at normal cuising speed.

Effect (b): Explosion, boiler down. Continue on one boiler at reduced capability.

-SECONDARY ACTION:

Effect (a): Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

Effect (b): Boiler probably down for rest of cruise. Proceed at reduced speed.

CRITICALITY EVALUATION: Based on most likely events.
81a--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

81a--Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable to during light-off.

81b--System Effects:
(a) Normal Steaming: 6 - Explosive condition--actual probability of explosion depends on other factors.
(b) Maneuvering: 36 - Explosive condition--actual probability of explosion depends on other factors.
(c) Light-Off: 61 - Not applicable to this phase.

81b--Mission Effects:
(a) Normal Steaming: 7 - Possible boiler damage.
(b) Maneuvering: 38 - Possible boiler damage.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
81a: Electronics = 2.6166

81b: Electronics = 2.6166

SHIP B NOTE #82 *****

FAILURE EFFECT: Loss of remote manual.

SYSTEM EFFECT: Must resort to field manual operation if automatic control fails.

SYMPTOM OR HOW DETECTED: No response when remote manual activated.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually open and close field controlling components.

-SECONDARY ACTION: Troubleshoot system for loss of auto and remote control failure. Replace defective component and activate auto control.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 13 - Loss of back-up or alarm.
(b) Maneuvering: 43 - Loss of back-up or alarm.
(c) Light-Off: 73 - Loss of back-up or alarm.

Mission Effects:
(a) Normal Steaming: 14 - Back-up failure, primary and back-up must both fail.
(b) Maneuvering: 44 - Back-up failure, primary and back-up must both fail.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
-Electronic = 1.8876

SHIP B NOTE #83 *****

FAILURE EFFECT: False alarm.

SYSTEM EFFECT: No effect.

SYMPTOM OR HOW DETECTED: Alarm sounds.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Crew checks indicators and control panel lights to verify alarms are false.

-SECONDARY ACTION: Troubleshoot to determine cause for false alarm and correct problem.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 14 - False alarm.
(b) Maneuvering: 44 - False alarm.
(c) Light-Off: 74 - False alarm.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 63 - Slight delay in light-off.

FAILURE RATE:
-Electronic = 17.655

SHIP B NOTE #84 *****

FAILURE EFFECT: Alarm fails to sound.

SYSTEM EFFECT: In most cases, the condition will degrade and boiler will trip.

SYMPTOM OR HOW DETECTED:

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine reason for trip and switch to remote manual for that function.

- ECONDARY ACTION: Troubleshoot reason for trip and failure of alarm to sound. Correct problem and restart boiler.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 13 - Loss of back-up or alarm.
(b) Maneuvering: 43 - Loss of back-up or alarm.
(c) Light-Off: 73 - Loss of back-up or alarm.

Mission Effects:
(a) Normal Steaming: 14 - Back-up failure, primary and back-up must both fail.
(b) Maneuvering: 44 - Back-up failure, primary and back-up must both fail.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
Electronic = 27.2208

SHIP B NOTE #85 *****

FAILURE EFFECT: Feedwater header pressure high.

SYSTEM EFFECT: High feedwater pressure, high drum level.

SYMPTOM OR HOW DETECTED:
(a) Nonvital alarm for engine room control console. Relief valve pops.
(b) Turbine trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually operates pump.

-SECONDARY ACTION: Troubleshoot when time permits and replace defective component. Return to automatic control.

CRITICALITY EVALUATION:
85a--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote control.
(b) Maneuvering: 33 - Alarm--activate remote control.
(c) Light-Off: 63 - Alarm--activate remote control.

85a--Mission Effects:
(a) Normal Steaming: 1 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 24 - Delay in light-off.

85b--System Effects:
(a) Normal Steaming: 7 - Turbine trip--troubleshoot and restart turbine.
(b) Maneuvering: 37 - Turbine trip--troubleshoot and restart turbine.
(c) Light-Off: 67 - Turbine trip--troubleshoot and restart turbine.

85b--Mission Effects:
(a) Normal Steaming: 10 - Temporary DIW.
(b) Maneuvering: 40 - Temporary DIW.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
-Transducers = 12.64
-Electronics = 15.4650
Total = 28.1050

SHIP B NOTE #86 *****

FAILURE EFFECT: Loss of control, drum level.

SYSTEM EFFECT: No response to auto controls inputs. Output varies.

SYMPTOM OR HOW DETECTED: Indicators show no response to inputs or erratic outputs.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate remote manual controls. Continue at normal cruising speed. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection.

CRITICALITY EVALUATION: Based on most likely events.
System Effects:
(a) Normal Steaming: 12 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(b) Maneuvering: 42 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(c) Light-Off: 72 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
-Transducers = 29.3
-Electronics = 14.1552
Total = 43.4552

SHIP B NOTE #87 *****

FAILURE EFFECT: Loss of control, feedpump control.

SYSTEM EFFECT: No response to auto controls inputs. Output varies.

SYMPTOM OR HOW DETECTED: Indicators show no response to inputs or erratic outputs.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate remote manual controls. Continue at normal cruising speed. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection.

CRITICALITY EVALUATION: Based on most likely events.
System Effects:
(a) Normal Steaming: 12 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(b) Maneuvering: 42 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(c) Light-Off: 72 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
-Transducers = 12.64
-Electronics = 5.1044
Total = 17.7444

SHIP B NOTE #88 *****

FAILURE EFFECT: Loss of control, superheated steam.

SYSTEM EFFECT: No response to auto controls inputs. Output varies.

SYMPTOM OR HOW DETECTED: Indicators show no response to inputs or erratic outputs.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate remote manual controls. Continue at normal cruising speed. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system. Replace defective card. If not electronic failure, would have to isolate to

the field components using meters and visual inspection.

CRITICALITY EVALUATION: Based on most likely events.
System Effects:
(a) Normal Steaming: 12 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(b) Maneuvering: 42 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(c) Light-Off: 72 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
-Electronic = 11.5383
-Sensor = 1.1548
Total = 12.6931

SHIP B NOTE #89 *****

FAILURE EFFECT: Steam high pressure.

SYSTEM EFFECT: Rupture tubes and drum, steam explosion. No high pressure alarm or light. Have three relief valves back-up.

SYMPTOM OR HOW DETECTED: Pressure indicators.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Possibility that failure mode not immediately found due to back-up. Very low probability of all back-ups failing. Switch to remote manual control. If remote manual ineffective, activate manual control in field.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective

component and return to automatic control.

CRITICALITY EVALUATION:
(a) Normal Steaming: No effect.
(b) Maneuvering: No effect.
(c) Light-Off: Failure mode not applicable to this phase.

SHIP B NOTE #90 *****

FAILURE EFFECT: Steam dump system inadvertently activates low steam.

SYSTEM EFFECT:
(a) Turbine reduces RPM
(b) Turbine reduces trips (at 775 to 650). Also reduces steam to electrical generators. Could have secondary failure due to low electrical power.

SYMPTOM OR HOW DETECTED: Pressure transmitter set at 830 PSI. Pressure indicator in engine room control console and boiler front. Lo pressure vital alarm for engine room control console and boiler front.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
90a--System Effects:
(a) Normal Steaming: 8 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(b) Maneuvering: 38 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(c) Light-Off: 61 - Not applicable to this phase.

90a--Mission Effects:

(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

90b--System Effects:
(a) Normal Steaming: 7 - Turbine trip--troubleshoot and restart turbine.
(b) Maneuvering: 37 - Turbine trip--troubleshoot and restart turbine.
(c) Light-Off: 61 - Not applicable to this phase.

90b--Mission Effects:
(a) Normal Steaming: 10 - Temporary DIW.
(b) Maneuvering: 40 - Temporary DIW.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Transducers = 0.50
-Electronics = 2.3957
-Valves = 16.38
Total = 19.2757

SHIP B NOTE #91 *****

FAILURE EFFECT: Loss of control of steam dump system.

SYSTEM EFFECT: No response to auto controls inputs. Output varies.

SYMPTOM OR HOW DETECTED: Indicators show no response to inputs or erratic outputs.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate remote manual controls. Continue at normal cruising speed. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection.

CRITICALITY EVALUATION: Based on most likely events.
System Effects:
(a) Normal Steaming: 12 - Erratic response--auto control

output is erratic when compared to known inputs. Use remote manual.
(b) Maneuvering: 42 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Electronic = 3.2479

SHIP 8 NOTE #92 *****

FAILURE EFFECT: Loss of control, deaerator.

SYSTEM EFFECT: No response to auto controls inputs. Output varies.

SYMPTOM OR HOW DETECTED: Indicators show no response to inputs or erratic outputs.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate remote manual controls. Continue at normal cruising speed. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection.

CRITICALITY EVALUATION: Based on most likely events.
System Effects:
(a) Normal Steaming: 12 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(b) Maneuvering: 42 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(c) Light-Off: 72 - Erratic response--auto control output is erratic when compared to known inputs. Use remote

manual.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
-Electronics = 0.89385

SHIP 8 NOTE #93 *****

FAILURE EFFECT: Loss of control, fuel oil header temp.

SYSTEM EFFECT: No response to auto controls inputs. Output varies.

SYMPTOM OR HOW DETECTED: Indicators show no response to inputs or erratic outputs.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate remote manual controls. Continue at normal cruising speed. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection.

CRITICALITY EVALUATION: Based on most likely events.
System Effects:
(a) Normal Steaming: 12 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(b) Maneuvering: 42 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.
(c) Light-Off: 72 - Erratic response--auto control output is erratic when compared to known inputs. Use remote manual.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.

(c) Light-Off: 23 - Slight delay in light-off.

FAILURE EFFECTS:
-Transducers = 1.1548
-Electronics = 0.89385
Total = 2.04865

SHIP 8 NOTE #94 *****

FAILURE EFFECT: Feedwater pump failure due to control system.

SYSTEM EFFECT: Low drum level.

SYMPTOM OR HOW DETECTED: Pressure sensor set at 800 PSI, vital alarm in engine room control console, light--run, standby, stop.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Back-up pump automatically activated. Pump not part of control system.

-SECONDARY ACTION: Crew would try repair failed pump.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 5 - Auto back-up--back-up takes over function.
(b) Maneuvering: 35 - Auto back-up--back-up takes over function.
(c) Light-Off: 65 - Auto back-up--back-up takes over function.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 22 - No effect.

FAILURE RATE:
-Electronics = 5.07978
-Switches = 9.84
Total = 14.91978

SHIP 8 NOTE #95 *****

FAILURE EFFECT: Loss of auto feedwater pump back-up.

MISSION EFFECT: Low drum level

SYMPTOM OR HOW DETECTED: Pressure sensor set at 850 PSIG, alarm for engine room control console and boiler front (separate pressure transmitter to control logic and engine room control console indicator redundant).

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. Manually start back-up pump.

-SECONDARY ACTION: Troubleshoot system. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 13 - Loss of back-up or alarm.
(b) Maneuvering: 43 - Loss of back-up or alarm.
(c) Light-Off: 53 - Loss of back-up or alarm.

Mission Effects:
(a) Normal Steaming: 14 - Back-up failure, primary and back-up must both fail.
(b) Maneuvering: 44 - Back-up failure, primary and back-up must both fail.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
-Switches = 15.02
-Electronics = 6.274925
Total = 21.294925

SHIP B NOTE #96 *****

FAILURE EFFECT: Loss of auto lube oil pump back-up.

SYSTEM EFFECT: Loss of auto switching for lube oil back-up.

SYMPTOM OR HOW DETECTED: Low lube oil pressure alarm. Lube oil gravity tank provides back-up when pressure is lost.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually switch on back-up pump.

-SECONDARY ACTION: Troubleshoot digital switching logic to determine cause of failure. Correct and switch to auto mode.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 13 - Loss of back-up or alarm.
(b) Maneuvering: 43 - Loss of back-up or alarm.
(c) Light-Off: 73 - Loss of back-up or alarm.

Mission Effects:
(a) Normal Steaming: 14 - Back-up failure, primary and back-up must both fail.
(b) Maneuvering: 44 - Back-up failure, primary and back-up must both fail.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
-Switches = 18.68
-Electronics = 5.6590
-Relays = 0.5300
Total = 24.8690

SHIP B NOTE #97 *****

FAILURE EFFECT: False turbine trip.

MISSION EFFECT: Turbine control valves shut.

SYMPTOM OR HOW DETECTED: Turbine tripped alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate handpump.

-SECONDARY ACTION: Troubleshoot system and switch back to primary modes when problem corrected.

CRITICALITY EVALUATION:
System Effects:
(a) Normal Steaming: 10 - False turbine trip--troubleshoot and restart turbine.
(b) Maneuvering: 40 - False turbine trip--troubleshoot and restart turbine.
(c) Light-Off: 70 - False turbine trip--troubleshoot and restart turbine.

Mission Effects:
(a) Normal Steaming: 10 - Temporary DIW.
(b) Maneuvering: 40 - Temporary DIW.
(c) Light-Off: 61 - Not applicable during light-off.

FAILURE RATE:
-Electronic = 38.0858
-Valves = 15.92
-Solenoids = 14.02
-Relays = 2.49
-Sensors = 33.6
Total = 104.1108

SHIP B NOTE #98 *****

FAILURE EFFECT: Loss of RPM control.

SYSTEM EFFECT: RPM not same as throttle control.

SYMPTOM OR HOW DETECTED: Erratic RPM.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate handpump.

-SECONDARY ACTION: Troubleshoot system and switch back to primary mode when problem corrected.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 18 - Erratic RPM's, turbine control failure, activate handpump.
(b) Maneuvering: 48 - Erratic RPM's, turbine control failure, activate handpump.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 12 - Temporary loss of RPM control.
(b) Maneuvering: 42 - Temporary loss of RPM control.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Electronics = 13.4186
-Sensors = 57.4000
Total = 70.8186

SHIP B NOTE #99 *****

FAILURE EFFECT: Loss of crash back.

SYSTEM EFFECT: Loss of direction control, possible collision.

SYMPTOM OR HOW DETECTED: No symptom, unless periodically tested.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Switch to handpump emergency mode and open astern valve.

-SECONDARY ACTION: Troubleshoot system and switch back to primary mode when corrected.

CRITICALITY EVALUATION
System Effects:

(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 49 - Erratic directional control, turbine control failure, activate handpump.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 43 - Temporary loss of directional control.
(c) Light-Off: 22 - Not applicable to this phase.

FAILURE RATE:
-Electronics = 1.0596
-Relays = 0.62
Total = 1.6796

SHIP B NOTE #100 *****

FAILURE EFFECT: Loss of direction control.

SYSTEM EFFECT: Loss of directional control.

SYMPTOM OR HOW DETECTED: Wrong direction alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Activate handpump.

-SECONDARY ACTION: Troubleshoot system and switch back to primary when problem corrected.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 48 - Erratic RPM's, turbine control failure, activate handpump.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 43 - Temporary loss of directional control.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Sensors = 57.4
-Electronics = 6.2598
Total = 63.6598

SHIP B NOTE #101 *****

FAILURE EFFECT: Loss of rate change.

SYSTEM EFFECT: Possible thermal stress damage due to sudden changes in steam flow to turbine.

SYMPTOM OR HOW DETECTED: Sudden changes in RPM, possible temporary low steam alarm when going from maneuvering to full ahead.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Throttle must be changed gradually.

-SECONDARY ACTION: Troubleshoot system and correct problem.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 11 - No alarm--only lightbar indicators show problem condition.
(b) Maneuvering: 41 - No alarm--only lightbar indicators show problem condition.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 7 - Possible turbine damage.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Electronics = 5.8917
-Sensors = 57.4
Total = 63.2917

SHIP B NOTE #102 *****

FAILURE EFFECT: Turbine fails to trip.

MISSION EFFECT: Loss of RPM control.

SYMPTOM OR HOW DETECTED: Vessel tries to move when at stop.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually trip turbine.

-SECONDARY ACTION: Troubleshoot system and restore ARO when corrected.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 16 - Loss of trip.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 42 - Temporary loss of RPM control.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Sensors = 57.4
-Relays = 0.62
Total = 58.02

SHIP B NOTE #103 *****

FAILURE EFFECT: Loss of turning gear back-up

SYSTEM EFFECT: Loss of back-up system.

SYMPTOM OR HOW DETECTED: Erratic RPM.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATELY: Manually trip turbine.

-SECONDARY ACTION: Dead in water until system repaired.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 13 - Loss of back-up or alarm.
(b) Maneuvering: 43 - Loss of back-up or alarm.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 14 - Back-up failure, primary and back-up must both fail.
(b) Maneuvering: 44 - Back-up failure, primary and back-up must both fail.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Switches = 3.43
-Relays = 0.31
Total = 3.74

SHIP B NOTE #104 *****

FAILURE EFFECT: Loss of direction control.

SYSTEM EFFECT: Cannot activate astern turbine alarm.

SYMPTOM OR HOW DETECTED: Astern guard valve closed. Lamp on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually open guard valve.

-SECONDARY ACTION: Troubleshoot guard valve and restore automation function.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 49 - Erratic directional control, turbine

control failure, activate handpump.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 43 - Temporary loss of directional control.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Valves = 19.21

SHIP B NOTE #105 *****

FAILURE EFFECT: Possible turbine damage.

SYSTEM EFFECT: Water could cause damage.

SYMPTOM OR HOW DETECTED: Vessel inspection.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually open valves.

-SECONDARY ACTION: Troubleshoot to determine why valve did not open automatically.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 80 - Loss of protective feature.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 66 - Possible turbine damage.

FAILURE RATE:
-Valves = 32.75

SHIP B NOTE #111 *****

FAILURE EFFECT: Loss of control due to hydraulic failure.

SYSTEM EFFECT: Loss of control both directional and RPM.

SYMPTOM OR HOW DETECTED: Pump failure lamp on if failure is due to low pressure. Erratic RPM of shaft.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Switch to handpump.

-SECONDARY ACTION: Troubleshoot hydraulic system. Reactivate primary controls if problem resolved.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 18 - Erratic RPM's, turbine control failure, activate handpump.
(b) Maneuvering: 48 - Erratic RPM's, turbine control failure, activate handpump.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 12 - Temporary loss of RPM control.
(b) Maneuvering: 42 - Temporary loss of RPM control.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:

-Motors	=	11.35
-Actuators	=	2.34
-Pumps	=	157.8086
-Valves	=	52.4000
-Switches	=	32.51
-LVDT	=	20.70
Total	=	277.1086

SHIP B NOTE #112 *****

FAILURE EFFECT: Loss of handpump capability.

SYSTEM EFFECT: Loss of back-up.

SYMPTOM OR HOW DETECTED: Erratic RPM of shaft.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Switch to handwheel control.

-SECONDARY ACTION: Troubleshoot hydraulic system. Restore primary mode if problem corrected.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 13 - Loss of back-up or alarm.
(b) Maneuvering: 43 - Loss of back-up or alarm.
(c) Light-Off: 61 - Not applicable to this phase.

Mission Effects:
(a) Normal Steaming: 14 - Back-up failure, primary and back-up must both fail.
(b) Maneuvering: 44 - Back-up failure, primary and back-up must both fail.
(c) Light-Off: 21 - Not applicable during light-off.

SHIP B NOTE #113 *****

FAILURE EFFECT: 20-second timer times long.

SYSTEM EFFECT: Possible explosion.

SYMPTOM OR HOW DETECTED: All burner valves closed light does not come on after valve open for 5 seconds and no flame indication.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually trip burner.

-SECONDARY ACTION: Manually light burner. Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:

(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Electronics = 5.709825

SHIP B NOTE #114 *****

FAILURE EFFECT: Burner valve does not trip after open for 5 seconds and no flame detected.

SYSTEM EFFECT: Possible explosion.

SYMPTOM OR HOW DETECTED: All burner valve closed light does not come on after 5 seconds and no flame indication.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually trip burner.

-SECONDARY ACTION: Manually trip burner. Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Electronics = 5.169615

SHIP B NOTE # 115 *****

FAILURE EFFECT: Burner valve open more than 20 seconds after burner on initiated.

SYSTEM EFFECT: Possible explosion, could attempt light off with burner valve already open.

SYMPTOM OR HOW DETECTED: All burner valves closed light not on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Close burner valve manually.

-SECONDARY ACTION: Manually light off. Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Switches = 3.28
-Electronics = 0.16087
Total = 3.44087

SHIP B NOTE #116 *****

FAILURE EFFECT: Air register closes or cannot be opened.

SYSTEM EFFECT: Flame-out.

SYMPTOM OR HOW DETECTED: All air registers open light not on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually relight burner.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and re-start boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and re-start boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
116: Electronics = 0.712555

116a: Actuator = 8.62

SHIP B NOTE #117 *****

FAILURE EFFECT: Ignitor not withdrawn.

SYSTEM EFFECT: Possible explosion. Ignitor will burn up if burner on.

SYMPTOM OR HOW DETECTED: No indication, no light to show ignitor position.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually remove ignitor.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mision Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATES:
-Electronics = 3.049505

SHIP B NOTE #118 *****

FAILURE EFFECT: Air register opens or cannot be closed.

SYSTEM EFFECT: Prevents light-off.

SYMPTOM OR HOW DETECTED: Unsuccessful light-off attempt.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine reason for light-off failure.

-SECONDARY ACTION: Manually light burner and troubleshoot when time permits.

CRITICALITY EVALUATION
System Effects:

(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 77 - Light-off is inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 23 - Slight delay in light-off.

FAILURE RATE:
118: Electronics = 0.712555

118a: Actuator = 8.62

SHIP B NOTE #119 *****

FAILURE EFFECT: Burner valve closes or cannot be opened.

SYSTEM EFFECT: Burner shuts down.

SYMPTOM OR HOW DETECTED: Burner management problem alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine reason for burner shutdown.

-SECONDARY ACTION: Manually relight burner operating burner valve by hand.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
119: Electronics = 0.712555
Switches = 11.47
Total = 12.18255

119a: Valves = 16.38

SHIP B NOTE #120 *****

FAILURE EFFECT: Ignitor extended or cannot be withdrawn.

SYSTEM EFFECT: Possible explosion if F.O. or gases in shutdown boiler. Would burn up if boiler in operation . Burner valve would open immediately if light-off attempted and possible explosion. No light indicating ignitor extended.

SYMPTOM OR HOW DETECTED: No indication except light-off of sequence wrong. Burner valve opens immediately.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually shutdown burner. Withdraw ignitor.

-SECONDARY ACTION: Manually light burner using torch.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
120: Electronics = 0.69477

120a: Actuators = 8.62

SHIP B NOTE #121 *****

FAILURE EFFECT: Ignitor cannot be extended.

SYSTEM EFFECT: Unsuccessful light-off, burner shuts down.

SYMPTOM OR HOW DETECTED: No flame detector.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually light-off burner.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
121: Electronics = 0.69477
Relays = 1.44
Total = 2.13477

121a: Actuators = 8.62

SHIP B NOTE #122 *****

FAILURE EFFECT: False burner trip when burner valve and air register are open and flame is detected.

SYSTEM EFFECT: Burner shuts down.

SYMPTOM OR HOW DETECTED: Burner management problem alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify that all functions are within limits.

-SECONDARY ACTION: Restart boiler manually. Troubleshoot digital logic as time permits

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 17 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATES:
-Electronics = 14.8098
-Switches = 6.56
Total = 21.3698

SHIP B NOTE #123 *****

FAILURE EFFECT: Burner valve opens or cannot be closed.

SYSTEM EFFECT: Possible explosion during light-off or during shutdown. Purge and light-off inhibited.

SYMPTOM OR HOW DETECTED: All burner valves closed light not on. No purge light.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually operate burner valve.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
123: Electronics = 0.712555

123a: Valves = 16.38

SHIP 8 NOTE #124 *****

FAILURE EFFECT: Burner fails to trip when air register closed.

SYSTEM EFFECT: Burner would probably flame out, no air register closed light.

SYMPTOM OR HOW DETECTED: Smoke or flame out alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine cause of flame out.

-SECONDARY ACTION: Manually re-light boiler and activate air register by hand. Troubleshoot as time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and re-start boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and re-start boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
-Electronics = 1.145125
-Switches = 3.28
Total = 4.425125

SHIP B NOTE #125 *****

FAILURE EFFECT: Burner fails to trip on loss of flame.

SYSTEM EFFECT: Redundant logic would trip boiler.

SYMPTOM OR HOW DETECTED: Boiler trip alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine reason for loss of flame and correct.

-SECONDARY ACTION: Manually relight boiler and troubleshoot flame detection system when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 16 - Loss of trip.
(b) Maneuvering: 46 - Loss of trip.
(c) Light-Off: 76 - Loss of trip.

Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage.
(b) Maneuvering: 38 - Possible boiler damage.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Electronic = 18.429255

SHIP 8 NOTE #126 *****

FAILURE EFFECT: Burner fails to trip when burner valve closed.

SYSTEM EFFECT: Unsuccessful burner shutdown logic will trip boiler. Burner will not light if it fails during light-off attempt.

SYMPTOM OR HOW DETECTED: Boiler trip alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Determine initial reason for closing of burner valve. Correct initial problem.

-SECONDARY ACTION: Manually restart boiler. Troubleshoot as time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 16 - Loss of trip.
(b) Maneuvering: 46 - Loss of trip.
(c) Light-Off: 76 - Loss of trip.

Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage.
(b) Maneuvering: 38 - Possible boiler damage.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE EFFECTS:
-Electronics = 1.145125
-Switches = 3.28
Total = 4.425125

SHIP 8 NOTE #127 *****

FAILURE EFFECT: FOTV closes or cannot be opened.

SYSTEM EFFECT: Shuts down boiler if in operation or cannot light off.

SYMPTOM OR HOW DETECTED: FOTV trip valve closed light on. Logic will not give trip alarm for this failure. Would get alarm for flame out or low steam pressure.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually open FOTV and manually relight boiler.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and re-start boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and re-start boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 9 - Large performance degradation.
(b) Maneuvering: 39 - Large performance degradation.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATES:
127: Electronics =8.671105

127a: Valves = 16.38

SHIP B NOTE #128 *****

FAILURE EFFECT: FOTV opens or cannot be closed.

SYSTEM EFFECT: FOTV remains opens, F.O. could enter shutdown boiler if burner valve also open. Inhibits light-off.

SYMPTOM OR HOW DETECTED: FOTV closed light not on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually close FOTV.

-SECONDARY ACTION: Troubleshoot to determine reason why valve not closed.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive condition--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
128: Electronic = 1.252765

128a: Valves = 16.38

128b: Electronics = 0.39219

SHIP B NOTE #129 *****

FAILURE EFFECT: Flame detect logic failure. Will not close FOTV when no flame.

SYSTEM EFFECT: Boiler does not shut FOTV when flame out.

SYMPTOM OR HOW DETECTED: Burner shuts down. Burner management alarm.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Use manual trip to close FOTV. Determine reason for flame-out.

-SECONDARY ACTION: Restart boiler when reason for flame out corrected. Troubleshoot flame detection system.

CRITICALITY EVALUATION

Systems Effects:
(a) Normal Steaming: 16 - Loss of trip.
(b) Maneuvering: 46 - Loss of trip.
(c) Light-Off: 76 - Loss of trip.

Missions Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 65 - Possible turbine damage.

FAILURE RATE:
-Electronics = 0.15050

SHIP B NOTE #130 *****

FAILURE EFFECT: Failure of trip logic, false trip.

SYSTEM EFFECT: Boiler shut down due to false trip.

SYMPTOM OR HOW DETECTED: Boiler trip and alarm. Indicated cause of trip within limits.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Open FOTV manually and relight burner manually.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
(a) Normal Steaming: Temporary loss of one boiler, reduced RPM.
(b) Maneuvering: Temporary loss of one boiler, reduced RPM.
(c) Light-Off: Delay in light-off.

SHIP B NOTE #131 *****

FAILURE EFFECT: Loss of boiler trip.

SYSTEM EFFECT: Boiler does not trip for EM trip, water lo-lo, AF low, all BOVCL, oil press low, manual, flame, and boiler logic.

SYMPTOM OR HOW DETECTED: Alarm for hi/lo condition sounds but boiler fails to trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Try manual trip. If that fails, shut down burners, and manually shut FOTV.

-SECONDARY ACTION: Correct out of limit function and manually restart boiler. Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
Systems Effects:
(a) Normal Steaming: 16 - Loss of trip.
(b) Maneuvering: 46 - Loss of trip.
(c) Light-Off: 76 - Loss of trip.

Missions Effects:
(a) Normal Steaming: 7 - Possible turbine damage.
(b) Maneuvering: 37 - Possible turbine damage.
(c) Light-Off: 25 - Possible turbine damage.

FAILURE RATE:
-Electronics = 1.740180
-Relays = 0.229055
-Switches = 23.78
Total = 25.749235

SHIP B NOTE #132 *****

FAILURE EFFECT: Loss of purge time cycle (30 seconds). Fails to time or bypasses time and satisfactory air.

SYSTEM EFFECT: Possible explosion due to inadequate purge.

SYMPTOM OR HOW DETECTED: Purge complete light comes on immediately.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Increase air using remote manual. Purge for 30 seconds.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Possible turbine damage.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Electronics = 2.789045

SHIP B NOTE #133 *****

FAILURE EFFECT: Air register opened or cannot be closed.

SYSTEM EFFECT: Loss of light-off.

SYMPTOM OR HOW DETECTED: Ignitor does not extend, no burner light-off.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually close air register and light-off.

-SECONDARY ACTION: Troubleshoot digital logic when time

permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 24 - Delay in light-off.

SHIP B NOTE #134 *****

FAILURE EFFECT: Purge initiated--overrides all inhibits except air satisfactory. Could purge with low air pressure.

SYSTEM EFFECT: Possible explosion due to inadquate purges.

SYMPTOM OR HOW DETECTED: No air flow satisfactory light, FOTV open light.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Increase air using remote manual. Purge for 30 seconds.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive condition--actual probability for explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.

(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible turbine damage.

FAILURE RATE:
-Electronic = 0.24418

SHIP B NOTE #135 *****

FAILURE EFFECT: Loss of purge--no air flow increase.

SYSTEM EFFECT: Possible explosion due to inadequate purge.

SYMPTOM OR HOW DETECTED: No purge in process light. FOTV light not on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Increase air using remote manual. Purge for 30 seconds.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable tc this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive conditon--actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible turbine damage.

FAILURE RATE:
-Electronics = 0.956735
-Relay = 0.0445
Total = 1.001235

SHIP B NOTE #136 *****

FAILURE EFFECT: Increase air flow to purge level.

SYSTEM EFFECT: Could blow out flame during low demand or light-off. Poor air/fuel ratio, smoke.

SYMPTOM OR HOW DETECTED: Boiler purge in process light on, loss of flame alarm, smoke alarm, combustion air indicator.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Switch to remote manual control and reduce air flow.

-SECONDARY ACTION: Troubleshoot when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and re-start boiler.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
-Electronics = 0.956735

SHIP B NOTE #137 *****

FAILURE EFFECT: Decrease air flow to light-off level.

POSSIBLE SYSTEM EFFECTS:
(a) Black smoke, poor air/fuel ratio.
(b) Incomplete combustion and possible explosion due to accumulation of unburned fuel.
(c) Low steam pressure.
(d) Boiler trip at 0.1 WC.

SYMPTOM OR HOW DETECTED: Nonvital alarm. Pressure transmitter set at 0.1 W.C. Pressure indicator at boiler front. Alarm and indicators in engine room control console.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE:

Effect (a): Verify alarm (smoke or low air) and check indicators for problems. If pressure indicator show low combustion air, activate remote manual. Continue at normal cuising speed.

Effect (b): Explosion, boiler down. Continue on one boiler at reduced capability.

Effect (c): Check indicators and annuncator for reason for trip. Continue on one boiler at reduced capability.

-SECONDARY ACTION:

Effect (a): Verfiy alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

Effect (b): Boiler probably down for rest of cruise. Proceed at reduced speed.

Effect (a): Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

CRITICALITY EVALUATION: Based on most likely events.
137a--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

137a--Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

137b--System Effects:

(a) Normal Steaming: 6 - Explosive condition--actual probability of explosion depends on other factors.
(b) Maneuvering: 36 - Explosive condition--actual probability of explosion depends on other factors.
(c) Light-Off: 61 - Not applicable to this phase.

137b--Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage.
(b) Maneuvering: 38 - Possible boiler damage.
(c) Light-Off: 21 - Not applicable during light-off.

137c--System Effects:
(a) Normal Steaming: 8 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(b) Maneuvering: 38 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(c) Light-Off: 61 - Not applicable to this phase.

137c--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

137d--System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and restart boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshost and restart boiler.
(c) Light-Off: 61 - Not applicable to this phase.

137d--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Electronics = 0.72541
-Switches = 11.47
Total = 12.19541

SHIP B NOTE #138 *****

FAILURE EFFECT: Air flow not decreased when boiler pressure low.

SYSTEM EFFECT: Low pressure inceases demand signal. Possible boiler thermal damage of cold boiler. F.O. rate

increases too rapidly.

SYMPTOM OR HOW DETECTED: Low air flow light not on, air flow indicator shows low air.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Switch to remote manual control and reduce demand signal.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 80 - Loss of protective feature.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
-Electronic = 0.72541
-Switches = 11.47
Total = 12.19541

SHIP B NOTE #139 *****

FAILURE EFFECT: Decrease F.O. flow to light-off level.

SYSTEM EFFECT:
(a) Low steam pressure.
(b) Possible flame-out.

SYMPTOM OR HOW DETECTED: No alarm or indicator--would get alarms from lo steam pressure. Could get turbine run back or trip.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators in control console. If cannot clear alarm, activate remote manual or manual control.

-SECONDARY ACTION: Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and return to automatic control.

CRITICALITY EVALUATION:
139a--System Effects:
(a) Normal Steaming: 8 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(b) Maneuvering: 38 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(c) Light-Off: 61 - Not applicable to this phase.

139a--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 5 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

139b--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 3 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

139b--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 5 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:
-Electronic = 0.56454

SKIP B NOTE #140 *****

FAILURE EFFECT: Recirculate F.O. with FOTV closed.

SYSTEM EFFECT: F.O. temperature in pipes to boiler remain cold. Boiler fails to light-off.

SYMPTOM OR HOW DETECTED: FOTV closed light on. Cannot

light boiler.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Manually open FOTV.

-SECONDARY ACTION: Troubleshoot digital logic when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 77 - Light-off inhibited or aborted.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 24 - Delay in light-off.

FAILURE RATE:
-Electronic = 1.56454
-Relay = 0.91
Total = 1.47454

SHIP B NOTE #141 *****

FAILURE EFFECT: Recirculate with inhibits suppressed. Opens FOTV and recirculation valve.

SYSTEM EFFECT: F.O. could enter boiler if burner valve open, possible explosion.

SYMPTOM OR HOW DETECTED: Burner valve open and F.O. recirculation light on.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Shut down recirculation. Ensure all inhibit conditions met by checking lights.

-SECONDARY ACTION: Troubleshoot when time permits.

CRITICALITY EVALUATION
System Effects:
(a) Normal Steaming: 1 - Not applicable to this phase.
(b) Maneuvering: 31 - Not applicable to this phase.
(c) Light-Off: 66 - Explosive conditions -- actual probability of explosion depends on other factors.

Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.
(c) Light-Off: 25 - Possible boiler damage.

FAILURE RATE:
- Electronics = 0.11395

SHIP B NOTE #142 *****

FAILURE EFFECT: High combustion air (poor air/fuel ratio)

SYSTEM EFFECT:
(a) Excessive smoke--white.
(b) Could blow out flame at low fuel demand.
(c) Low steam pressure.

SYMPTOM OR HOW DETECTED: Pressure indicator on boiler front. No alarm for high air. There is alarm for boiler smoke. Burner will trip if flame is blown out and burner management problem alarm sounds. Boiler trip if both burners flame out.

MOST LIKELY ACTION AND SYSTEM STATUS

-IMMEDIATE: Verify alarm and check indicators to determine problem. If pressure indicator shows high combustion air, activate remote manual controls or switch fan to low speed. Continue at normal cruising speed. For burner trip, check indicators and annunciator for reason for trip. Proceed at reduced capability.

-SECONDARY ACTION: Troubleshoot system using analog circuit analyzer. Replace defective card. If not electronic failure, would have to isolate to the field components using meters and visual inspection. Damper could be manually positioned if remote manual not functioning properly.

CRITICALITY EVALUATION: Based on most likely events.

1a--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

1a--Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

1b--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable to this phase.

1b--Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

1c--System Effects:
(a) Normal Steaming: 8 - Turbine reduces RPM--troubleshoot and resume normal RPM's.
(b) Maneuvering: 38 - Turbine reduces RPM--troubleshoot and resume normal RPM's.
(c) Light-Off: 61 - Not applicable to this phase.

1c--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:

1a:	Transducers	= 6.8400
	Relays	= 0.0178
	Controllers	= 0.7360
	Actuators	= 3.4480
	Electronics	= 13.6985
	Total	= 24.7403
1b:	Transducers	= 5.1300
	Relays	= 0.0133
	Controllers	= 1.8400
	Actuators	= 0.8620
	Electronics	= 8.7319
	Total	= 16.5772
1c:	Transducers	= 5.1300
	Relays	= 0.0133
	Controllers	= 0.3680

Actuators = 1.7240
Electronics = 8.2072
Total = 15.4425

ld: Electronics = 0.9884
Controllers = 0.5520
Actuators = 2.5860
Total = 4.1264

SHIP B NOTE #143 *****

FAILURE EFFECT: Low combustion air.

POSSIBLE SYSTEM EFFECTS:
(a) Black smoke, poor air/fuel ratio.
(b) Incomplete combustion and possible explosion due to accumulation of unburned fuel.
(c) Low steam pressure.
(d) Boiler trip at 0.1 WC.

SYMPTOM OR HOW DETECTED: Nonvital alarm. Pressure transmitter set at 0.1 W.C. Pressure indicator at boiler front. Alarm and indicators in engine room control console.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE:

Effect (a): Verify alarm (smoke or low air) and check indicators for problems. If pressure indicator show low combustion air, activate remote manual. Continue at normal cuising speed.

Effect (b): Explosion, boiler down. Continue on one boiler at reduced capability.

Effect (c): Check indicators and annuncator for reason for trip. Continue on one boiler at reduced capability.

-SECONDARY ACTION:

Effect (a): Verfiy alarm and check indicators in control console. Switch to remote manual control. If remote manual ineffective, activate manual control of function. Proceed with slightly degraded capabilities.

Effect (b): Boiler probably down for rest of cruise. Proceed at reduced speed.

Effect (a): Troubleshoot system using analog test station. If problem in the field, isolate to component using meters and visual inspection. Replace defective component and restart boiler.

CRITICALITY EVALUATION: Based on most likely events.
3a--System Effects:
(a) Normal Steaming: 3 - Alarm--activate remote manual.
(b) Maneuvering: 33 - Alarm--activate remote manual.
(c) Light-Off: 61 - Not applicable during this phase.

3a--Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.
(c) Light-Off: 21 - Not applicable during light-off.

3b--System Effects:
(a) Normal Steaming: 6 - Explosive condition--actual probability of explosion depends on other factors.
(b) Maneuvering: 36 - Explosive condition--actual probability of explosion depends on other factors.
(c) Light-Off: Not applicable during this phase.

3b--Mission Effects:
(a) Normal Steaming: 8 - Possible boiler damage.
(b) Maneuvering: 38 - Possible boiler damage.
(c) Light-Off: 21 - Not applicable during light-off.

3c--System Effects:
(a) Normal Steaming: 8 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(b) Maneuvering: 38 - Turbine MPC reduces RPM--troubleshoot and resume normal RPM's.
(c) Light-Off: 61 - Not applicable during this phase.

3c--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

3d--System Effects:
(a) Normal Steaming: 4 - Boiler trip--troubleshoot and restart boiler.
(b) Maneuvering: 34 - Boiler trip--troubleshoot and restart boiler.
(c) Light-Off: 61 - Not applicable during this phase.

3d--Mission Effects:
(a) Normal Steaming: 5 - Temporary reduced RPM's.
(b) Maneuvering: 35 - Temporary reduced RPM's.
(c) Light-Off: 21 - Not applicable during light-off.

FAILURE RATE:

3a:	Transducers =	13.9840
	Controllers =	0.5840
	Actuators =	3.4480
	Electronics =	17.6866
	Total =	35.7026
3b:	Transducers =	3.4961
	Controllers =	0.1450
	Actuators =	0.8620
	Electronics =	5.7821
	Total =	10.2862
3c:	Electronics =	2.0858
	Controllers =	0.2920
	Actuators =	1.7240
	Total =	4.1018
3d:	Electronics =	3.1286
	Controllers =	0.4380
	Actuators =	2.5860
	Total =	6.1526

SHIP C NOTE #1 *****

FAILURE EFFECT: Propulsion system goes to idle.

SYSTEM EFFECT: Lose way on vessel.

SYMPTOM OR HOW DETECTED: Bridge/Engine room RPM indicators.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Attempt to restore propulsion; go to manual operation.

-SECONDARY ACTION: Troubleshoot, repair; restore system to auto mode.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 6 - Dead in the water.
(b) Maneuvering: 36 - Dead in the water.

SHIP C NOTE #2 *****

FAILURE EFFECT: Lose control capability at 1 or more control stations.

SYSTEM EFFECT: No effect.

SYMPTOM OR HOW DETECTED: Station in control indicators.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Attempt to determine nature of problem; transfer control to another station.

-SECONDARY ACTION: Troubleshoot, repair.

CRITICALITY EVALUATION

Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.

SHIP C NOTE #3 *****

FAILURE EFFECT: Incorrect transfer of station in control.

SYSTEM EFFECT: No effect.

SYMPTOM OR HOW DETECTED: Station in control indicators.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Attempt to determine nature of problem; transfer control to another station.

-SECONDARY ACTION: Troubleshoot, repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.

SHIP C NOTE #4 *****

FAILURE EFFECT: No station in control transfers possible.

SYSTEM EFFECT: No effect.

SYMPTOM OR HOW DETECTED: Station in control indicators.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Leave control at existing station until problem resolved.

-SECONDARY ACTION: Troubleshoot, repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.

SHIP C NOTE #5 *****

FAILURE EFFECT: Incorrect station-in-control indicators.

SYSTEM EFFECT: None unless crew takes wrong action.

SYMPTOM OR HOW DETECTED: No direct indications; nature of problem would have to be identified through voice communication.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Leave control at existing station until problem resolved.

-SECONDARY ACTION: Troubleshoot, repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.

SHIP C NOTE #6 *****

FAILURE EFFECT: 1 engine shutsdown or de-clutches.

SYSTEM EFFECT: Vessel thrust reduction.

SYMPTOM OR HOW DETECTED: Bridge/engine room RPM indicators; engine stop annunciator.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Attempt to bring engine back on line; go to manual operation.

-SECONDARY ACTION: Troubleshoot, repair; restore system to auto mode.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 35 - Large performance degradation.

SHIP C NOTE #7 *****

FAILURE EFFECT: Lose engine/clutch protective shutdowns on or inhibits.

SYSTEM EFFECT: Engine/clutch damage if condition protected against occurs.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: No effect and no action if forbidden condition does not occur.

-SECONDARY ACTION: If forbidden condition occurs, major repair/restoration required.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 7 - Possible equipment damage.
(b) Maneuvering: 37 - Possible equipment damage.

SHIP C NOTE #8 *****

FAILURE EFFECT: Engine cannot be started or clutched-in.

SYSTEM EFFECT: Full thrust not available.

SYMPTOM OR HOW DETECTED: Bridge/engine room RPM indicators, engine start annunciator.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Attempt re-start or clutch-in; go to manual operation.

-SECONDARY ACTION: Troubleshoot, repair; restore system to auto mode.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 35 - Large performance degradation.

SHIP C NOTE #9 *****

FAILURE EFFECT: 1 engine starts spontaneously.

SYSTEM EFFECT: None.

SYMPTOM OR HOW DETECTED: Bridge/engine room RPM indicators.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Stop engine via stop switch.

-SECONDARY ACTION: Troubleshoot, repair.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 32 - No effect.

SHIP C NOTE #10 *****

FAILURE EFFECT: Lose split mode.

SYSTEM EFFECT: None.

SYMPTOM OR HOW DETECTED: No direct indication.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Verify split mode operation not possible; go to another mode manual-local operation.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 33 - Slight performance degradation.

SHIP C NOTE #11 *****

FAILURE EFFECT: Incorrect visual indication/annunciator.

SYSTEM EFFECT: Crew receives incorrect status information.

SYMPTOM OR HOW DETECTED: No direct indication.

MOST LIKELY ACTION AND SYSTEM STATUS: Indeterminant.

-IMMEDIATE:

-SECONDARY ACTION:

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 33 - Slight performance degradation.

SHIP C NOTE #12 *****

FAILURE EFFECT: Lose pitch control when going AH.

SYSTEM EFFECT: Loss of speed/direction change control.

SYMPTOM OR HOW DETECTED: Would be obvious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 8 - Incorrect response to speed/direction change commands.
(b) Maneuvering: 38 - Incorrect response to speed/direction change commands.

SHIP C NOTE #13 *****

FAILURE EFFECT: Lose pitch control when going AS.

SYSTEM EFFECT: Loss of speed/direction change control.

SYMPTOM OR HOW DETECTED: Would be obvious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 8 - Incorrect response to speed/direction change commands.
(b) Maneuvering: 38 - Incorrect response to speed/direction change commands.

SHIP C NOTE #14 *****

FAILURE EFFECT: False full AH or AS commands.

SYSTEM EFFECT: Vessel out of control.

SYMPTOM OR HOW DETECTED: Would be obvious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
14a
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 39 - Uncommanded speed/direction changes.
14b
(a) Normal Steaming: 9 - Uncommanded speed/direction changes.
(b) Maneuvering: 32 - No effect.

SHIP C NOTE #15 *****

FAILURE EFFECT: Uncommanded speed increases.

SYSTEM EFFECT: Vessel out of control.

SYMPTOM OR HOW DETECTED: Would be obvious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 9 - Uncommanded speed/direction changes.
(b) Maneuvering: 9 - Uncommanded speed/direction changes.

SHIP C NOTE #16 *****

FAILURE EFFECT: Speed higher/lower than commanded.

SYSTEM EFFECT: Vessel out of control.

SYMPTOM OR HOW DETECTED: Would be obvious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 9 - Uncommanded speed/direction changes.
(b) Maneuvering: 9 - Uncommanded speed/direction changes.

SHIP C NOTE #17 *****

FAILURE EFFECT: Lose speed/direction control in maneuver mode.

SYSTEM EFFECT: No vessel control in maneuver mode.

SYMPTOM OR HOW DETECTED: Would be ovious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 2 - No effect.
(b) Maneuvering: 38 - Incorrect response to speed/direction change commands.

SHIP C NOTE #18 *****

FAILURE EFFECT: Lose speed/direction control in cruide mode.

SYSTEM EFFECT: No vessel control in cruise mode.

SYMPTOM OR HOW DETECTED: Would be obvious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 8 - Incorrect response to speed/direction change commands.
(b) Maneuvering: 32 - No effect.

SHIP C NOTE #19 *****

FAILURE EFFECT: Lose speed/direction control in any auto mode.

SYSTEM EFFECT: No vessel control in any auto mode.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 8 - Incorrect response to speed/direction change commands.
(b) Maneuvering: 8 - Incorrect response to speed/direction change commands.

SHIP C NOTE #20 *****

FAILURE EFFECT: Lose speed control of 1 engine.

SYSTEM EFFECT: Available thrust not as expected.

SYMPTOM OR HOW DETECTED: Engine RPM indicators.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 3 - Slight performance degradation.
(b) Maneuvering: 35 - Large performance degradation.

SHIP C NOTE #21 *****

FAILURE EFFECT: Erroneous speed/direction commands when vessel not underway.

SYSTEM EFFECT: Possible damage at dock.

SYMPTOM OR HOW DETECTED: Would be obvious from vessel response.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 31 - Not applicable during maneuvering.

SHIP C NOTE #22 *****

FAILURE EFFECT: Incorrect change rates for pitch/engine commands.

SYSTEM EFFECT: Engine/CPP could be streesed.

SYMPTOM OR HOW DETECTED: Not directly obvious.

MOST LIKELY ACTION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY: Troubleshoot and repair.

CRITICALITY EVALUATION:
Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 37 - Possible equipment damage.

SHIP C NOTE #23 *****

FAILURE EFFECT: Lose ability to go AH or AS.

SYSTEM EFFECT: Lose directional control.

MOST LIKELY ACION AND SYSTEM STATUS:

-IMMEDIATE: Go to manual pitch control.

-SECONDARY ACTION: Troubleshoot and repair.

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 8 - Incorrect response to speed/direction change commands.
(b) Maneuvering: 38 - Incorrect response to speed/direction change commands.

SHIP C NOTE #24 *****

FAILURE EFFECT: Crash astern rates inhibited.

SYSTEM EFFECT: Crash astern maneuvers too slow.

SYMPTOM OR HOW DETECTED: Not directly.

MOST LIKELY ACTION AND SYSTEM STATUS: Dependent on reason why crash astern.

-IMMEDIATE:

-SECONDARY:

CRITICALITY EVALUATION
Mission Effects:
(a) Normal Steaming: 1 - Not applicable during normal steaming.
(b) Maneuvering: 38 - Incorrect response to speed/direction change commands.

APPENDIX G

PREDICTOR CRITICALITY PRINT-OUTS

INDEX

Pages	DESCRIPTION
G 1-10	Subsystem Failure Modes and System Effects Blocks (Subsystems) 1 through 15, Basic Failure Rates.
G 11-15	System Effect Criticality summary by subsystem Basic Failure Rates.
G 16-18	Contribution to Mission Effects Groups Basic Failure Rates.
G 19-23	Subsystem Failure Modes and System Effects Blocks (Subsystem) 1 through 7, Temperature increased to 50 degrees C.
G 24-25	System Effect Criticality summary by subsystem, Temperature increased to 50 degrees C.
G 25	Mission Effect Criticality, Temperature increased to 50 degrees C.
G 26-31	Subsystem Failure Modes and System Effect Blocks (Subsystem) 1 through 5, Quality level increased.
G 32-34	System Effect Criticality summary by subsystem, Quality level increased.
G 34	Mission Effect Criticality, Quality level increased.
G 35-39	Subsystem Failure Modes and System Effect Blocks (Subsystem) 1 through 4.*
G 40-41	System Effect Criticality summary by subsystem.*
G 41	Mission Effect Criticality.*

*Premature Failure Rates.

	B.E.	QTY	FUNCTION FAILURE prob. FREQ	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 1 FUNCTIO ELECTRONIC/RUN MGT MST								
PARTS	1.00	2	138.1002					
MODE1 MODE=LOSS OF PURGE		1	138.1002	0.09	.87910-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=INADVERTENT PURGE			138.1002	0.01	.68650-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LIGHT-OFF LOGIC FAILURE			138.1002	0.23	.22020-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF TRIP			138.1002	0.07	.71360-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=INADVERTENT PURGE			138.1002	0.01	.78668-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS/INADEQUATE RECRC			138.1002	0.06	.58670-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FALSE TRIP			138.1002	0.11	.11020-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FDTV CLOSED OR CANT OPEN			138.1002	0.12	.12090-01	RLR TRIP/CORRECT/RESTART RLR	0.400	.48370-02
MODE=FDTV CLOSED OR CANT OPEN			138.1002	0.12	.12090-01	RLR TRIP/CORRECT/RESTART RLR	0.400	.48370-02
MODE=FDTV OPEN OR CANT CLOSE			138.1002	0.02	.14660-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FDTV OPEN OR CANT CLOSE			138.1002	0.02	.14660-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FDTV OPEN OR CANT CLOSE			138.1002	0.02	.14660-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF BOILER TRIP			138.1002	0.02	.23520-02	LOSS OF TRIP	0.500	.11760-02
MODE=LOSS OF PURGE TIMER			138.1002	0.04	.38190-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=PURGE INITIATED/NO INHPT			138.1002	0.00	.29830-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=AIR FLOW TO PURGE LEVEL			138.1002	0.01	.12750-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=AIR FLOW TO PURGE LEVEL			138.1002	0.01	.13730-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.13730-03
MODE=FD FLD LYOFF LVL/FLM DTH			138.1002	0.04	.39240-03	MPL REDUCED RPM/CORRECT/RESTART	0.400	.15690-03
MODE=FD FLD LYOFF LVL/NO FLAME			138.1002	0.04	.39240-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.39240-04
MODE=FD RECRC WITH FDTV CLOSED			138.1002	0.02	.19620-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FD RECRC INHBT SUPPRESSED			138.1002	0.00	.19620-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 1 FUNCTIO SWITCHES								
PARTS	1.00	2	70.9200					
MODE1 MODE=LOSS OF PURGE		1	70.9200	0.11	.52730-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF TRIP			70.9200	0.09	.66220-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS/INADEQUATE RECRC			70.9200	0.13	.66250-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF BOILER TRIP			70.9200	0.07	.33220-01	LOSS OF TRIP	0.500	.16610-01
BLOCK 1 FUNCTIO RELAYS								
PARTS	1.00	2	2.3646					
MODE1 MODE=LOSS OF PURGE		1	2.3646	0.08	.16346-05	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FALSE TRIP			2.3646	0.81	.15890-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF BOILER TRIP			2.3646	0.20	.32560-01	LOSS OF TRIP	0.500	.16280-01
MODE=FD RECRC WITH FDTV CLOSED			2.3646	0.79	.12980-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 1 FUNCTIO VALVES								
PARTS	1.00	2	131.0400					
MODE1 MODE=LOSS/INADEQUATE PURGE		1	131.0400	0.50	.65450-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FDTV CLOSED OR CANT OPEN			131.0400	0.25	.32990-01	RLR TRIP/CORRECT/RESTART RLR	0.400	.13190-02
MODE=FDTV OPEN OR CANT CLOSE			131.0400	0.25	.32990-01	NOT APPLICABLE TO THIS PHASE	0.0	.0

		D.C.	QTY	FUNCTION FAILURE PROB. FAIT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	2	FUNCTIO ELECTRONIC/ANR MODULE							
PARTS			1.00	4	270.6858				
MODE:		MODE=ANR LTOFF LOGIC FAILS		1	270.6858	0.02	.46120-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=IGNITOR FAILURE			270.6858	0.06	.10499-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FALSE TRIP			270.6858	0.07	.12790-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF TRIP			270.6858	0.02	.38160-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FLAME INDICATOR PROBLEM			270.6858	0.01	.15340-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=20 SEC TIMER/TIMER LONG			270.6858	0.08	.16610-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=ANR VLV 5 SEC SHTDN FAIL			270.6858	0.08	.16500-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=ANR VLV 20 SEC SHTDN FAIL			270.6858	0.05	.97580-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=AR CLOSES OR CANT OPEN			270.6858	0.01	.19200-02	BLR TRIP/CORRECT/RESTART BLR	0.000	.76800-03
		MODE=IGNITOR NOT WITHDRAWN			270.6858	0.05	.88820-02	NO EFFECT	0.0	.0
		MODE=AR OPENS OR CANT CLOSE			270.6858	0.01	.19260-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=ANR VLV CLOSES/CANT OPEN			270.6858	0.01	.19200-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.19200-03
		MODE=IGNITOR EXTENDED			270.6858	0.01	.19280-02	NO EFFECT	0.0	.0
		MODE=IGNITOR CANT BE EXTENDED			270.6858	0.01	.19280-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FALSE BURNER TRIP			270.6858	0.20	.37520-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.37520-02
		MODE=ANR VLV OPENS/CANT CLOSE			270.6858	0.01	.19200-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=ANR FAILS TO TRIP/AR CLOS			270.6858	0.02	.34530-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.13810-02
		MODE=ANR FAILS TO TRP/NO FLAME			270.6858	0.27	.51110-01	LOSS OF TRIP	0.500	.25560-01
		MODE=ANR FAILS TO TRIP/ANR CLS			270.6858	0.02	.32620-02	LOSS OF TRIP	0.500	.16310-02
BLOCK	2	FUNCTIO SWITCHES							
PARTS			1.00	4	186.6424				
MODE:		MODE=IGNITOR FAILURE		1	186.6424	0.14	.18910-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF TRIP			186.6424	0.26	.34120-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=ANR VLV 20 SEC SHTDN FAIL			186.6424	0.07	.92330-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=ANR VLV CLOSES/CANT OPEN			186.6424	0.25	.32870-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.32870-02
		MODE=FALSE ANR TRIP			186.6424	0.14	.18510-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.18510-02
		MODE=ANR FAILS TO TRP/AR CLOSE			186.6424	0.07	.92330-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.36930-02
		MODE=ANR FAILS TO TRP/ANR CLS			186.6424	0.07	.92330-02	LOSS OF TRIP	0.500	.46170-02
BLOCK	2	FUNCTIO VALVES							
PARTS			1.00	4	131.0488				
MODE:		MODE=ANR VLV CLOSES/CANT OPEN		1	131.0488	0.50	.45650-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.45650-02
		MODE=ANR VLV OPENS/CANT CLOSE			131.0488	0.50	.45650-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	2	FUNCTIO RELAYS							
PARTS			1.00	4	17.2440				
MODE:		MODE=ANR LTOFF LOGIC FAILS		1	17.2440	0.33	.48880-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=IGNITOR FAILURE			17.2440	0.12	.14880-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF TRIP			17.2440	0.21	.25790-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=IGNITOR CANT BE EXTENDED			17.2440	0.33	.48880-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	2	FUNCTIO TRANSFORMERS							
PARTS			1.00	4	0.1600				
MODE:		MODE=IGNITOR FAILURE		1	0.1600	1.00	.11360-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	2	FUNCTIO ACTUATORS							
PARTS			1.00	4	137.9200				
MODE:		MODE=AR CLOSES OR CANT OPEN		1	137.9200	0.25	.24180-01	BLR TRIP/CORRECT/RESTART BLR	0.000	.9A730-02
		MODE=AR OPENS OR CANT CLOSE			137.9200	0.25	.24180-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=IGNITOR EXTENDED			137.9200	0.25	.24180-01	NO EFFECT	0.0	.0
		MODE=IGNITOR CANT BE EXTENDED			137.9200	0.25	.24180-01	NOT APPLICABLE TO THIS PHASE	0.0	.0

		P.F.	QTY	FUNCTION FAILURE PROB. FRAT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 5	FUNCTIO ELECTRONIC/COMBUST CNTL BLR DWR LO								
PARTS		1.00	1	63.6739					
MODES	MODE=LOW STM PRES		1	63.6739	0.32	.14540-01	MPC REDUCES RPM/CORRECT/RESUME	0.000	.5816D-02
	MODE=HI STM PRES/STM DUMP ACT			63.6739	0.14	.63690-02	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=HI STM PRES/RUPTURE TUBE			63.6739	0.18	.63690-02	EXPLOSIVE CONDITION	0.500	.3155D-02
	MODE=FALSE ALARM			63.6739	0.19	.83290-02	FALSE ALARM	0.0	.0
	MODE=ALARM FAILS			63.6739	0.19	.83290-02	LOSS OF BACK-UP ON ALARM	0.200	.1666D-02
	MODE=FALSE TURBINE TRIP			63.6739	0.03	.11750-02	FALSE TURB TRP/CORRECT/RESTART	0.700	.8223D-03
BLOCK 3	FUNCTIO TRANSDUCERS								
PARTS		1.00	1	73.5200					
MODES	MODE=LOW STM PRES		1	73.5200	0.50	.25760-01	MPC REDUCES RPM/CORRECT/RESUME	0.000	.1030D-01
	MODE=HI STM PRES/STM DUMP ACT			73.5200	0.25	.12870-01	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=HI STM PRES/RUPTURE TUBE			73.5200	0.25	.12870-01	EXPLOSIVE CONDITION	0.500	.6443D-02
BLOCK 8	FUNCTIO ELECTRONIC/COMBUST CNTL								
PARTS		1.00	2	200.9384					
MODES	MODE=LOW FO FLO/LOW STM PRES		1	200.9384	0.06	.85230-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.8523D-03
	MODE=LOW FO FLO/FLAME OUT			200.9384	0.04	.56900-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.2276D-02
	MODE=HI FO FLO/SMOKE			200.9384	0.08	.10780-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1078D-02
	MODE=HI FO FLOW/HI STM PRES			200.9384	0.04	.55490-02	NO EFFECT	0.0	.0
	MODE=HI FO FLOW/EXCSV FO			200.9384	0.02	.22800-02	EXPLOSIVE CONDITION	0.500	.1140D-02
	MODE=LOW STM PRES			200.9384	0.01	.11410-02	MPC REDUCES RPM/CORRECT/RESUME	0.050	.4563D-03
	MODE=HI STM PRES/STM DUMP ACT			200.9384	0.01	.11410-02	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=HI STM PRES/RUPTURE TUBE			200.9384	0.00	.14270-03	EXPLOSIVE CONDITION	0.500	.7133D-04
	MODE=LOSS OF CONTROL/COMB CNTL			200.9384	0.09	.13180-01	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.1318D-02
	MODE=POOR AIR/FO RATIO/SMOKE			200.9384	0.03	.37020-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.3702D-03
	MODE=POOR AIR/FO /EXCSV FO			200.9384	0.01	.37620-02	EXPLOSIVE CONDITION	0.500	.1851D-02
	MODE=LOSS OF REMOTE MANUAL			200.9384	0.01	.99820-03	LOSS OF BACK-UP OR ALARM	0.200	.1996D-03
	MODE=HI COMBUST AIR/SMOKE			200.9384	0.14	.19220-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1922D-02
	MODE=HI COMBUST AIR/FLAME OUT			200.9384	0.09	.12340-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1234D-02
	MODE=HI COMBUST AIR/LOW STEAM			200.9384	0.08	.11630-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1163D-02
	MODE=HI COMBUST AIR/SMOKE			200.9384	0.01	.14260-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1426D-03
	MODE=LOW COMBUST AIR/SMOKE			200.9384	0.18	.25880-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.2588D-02
	MODE=LOW COMBUST AIR/EXCSV FO			200.9384	0.06	.80990-02	EXPLOSIVE CONDITION	0.500	.4050D-02
	MODE=LOW COMBUST AIR/LOW STEAM			200.9384	0.02	.29920-02	MPC REDUCES RPM/CORRECT/RESUME	0.000	.1197D-02
	MODE=LOW COMBUST AIR/BLR TRIP			200.9384	0.03	.44130-02	BLR TRIP/CORRECT/RESTART BLR	0.000	.1765D-02
BLOCK 6	FUNCTIO VALVES								
PARTS		1.00	2	65.5200					
MODES	MODE=LOW FO FLO/LOW STM PRES		1	65.5200	0.30	.13680-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1368D-02
	MODE=LOW FO FLO/FLAME OUT			65.5200	0.15	.68500-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.2741D-02
	MODE=HI FO FLO/SMOKE			65.5200	0.05	.23230-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.2323D-03
	MODE=HI FO FLO/HI STM PRES			65.5200	0.30	.13680-01	NO EFFECT	0.0	.0
	MODE=HI FO FLO/EXCSV FO			65.5200	0.20	.92610-02	EXPLOSIVE CONDITION	0.500	.4630D-02

		D.C.	QTY	FUNCTION FAILURE PROB. FRAT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	4	FUNCTIO RELAYS							
PARTS		1.00	2	0.0718					
MODES		MODE=LOW FD FLO/LOW STM PRES	1	0.0718	0.12	.75510-04	ALARM/ACTIVATE REMOTE MANUAL	0.100	.75510-05
		MODE=LOW FD FLO/FLAME OUT		0.0718	0.16	.10070-03	RLR TRIP/CORRECT/RESTART RLR	0.400	.40360-04
		MODE=HI FD FLO/SMOKE		0.0718	0.18	.11390-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.11390-04
		MORE=HI FD FLO/HI STM PRES		0.0718	0.89	.56040-02	NO EFFECT	0.0	.0
		MODE=HI FD FLO/EXCSV FD		0.0718	0.01	.10570-04	EXPLOSIVE CONDITION	0.500	.92450-05
		MODE=LOSS OF CONTROL/COMB CNTL		0.0718	0.20	.12610-03	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.12610-04
		MODE=LOSS OF PURGE/LOW AIR		0.0718	0.10	.63130-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=HI COMBUST AIR/SMOKE		0.0718	0.04	.25380-04	ALARM/ACTIVATE REMOTE MANUAL	0.100	.25380-04
		MODE=HI COMBUST AIR/FLAME OUT		0.0718	0.03	.19190-04	ALARM/ACTIVATE REMOTE MANUAL	0.100	.19190-05
		MODE=HI COMBUST AIR/LOW STEAM		0.0718	0.03	.19190-04	HPC REDUCES RPM/CORRECT/RESUME	0.400	.76750-05
BLOCK	4	FUNCTIO ACTUATORS							
PARTS		1.00	2	34.4800					
MODES		MODE=HI COMBUST AIR/SMOKE	1	34.4800	0.20	.68960-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.68960-03
		MODE=HI COMBUST AIR/FLAME OUT		34.4800	0.05	.12230-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.12230-03
		MODE=HI COMBUST AIR/LOW STEAM		34.4800	0.10	.24450-02	HPC REDUCES RPM/CORRECT/RESUME	0.400	.97800-03
		MODE=HI COMBUST AIR/SMOKE		34.4800	0.15	.36650-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.36650-03
		MODE=LOW COMBUST AIR/EXCSV FD		34.4800	0.05	.12230-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.12230-03
		MODE=LOW COMBUST AIR/EXCSV FD		34.4800	0.05	.12230-02	EXPLOSIVE CONDITION	0.500	.61160-03
		MODE=LOW COMBUST AIR/LOW STM		34.4800	0.10	.24450-02	HPC REDUCES RPM/CORRECT/RESUME	0.400	.97800-03
		MODE=LOW COMBUST AIR/RLR TRIP		34.4800	0.15	.36650-02	RLR TRIP/CORRECT/RESTART RLR	0.400	.14660-02
BLOCK	4	FUNCTIO TRANSDUCERS							
PARTS		1.00	1	43.8801					
MODES		MODE=LOW FD FLO/LOW STM PRES	1	43.8801	0.14	.61490-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.61490-03
		MODE=LOW FD FLOW/FLAME OUT		43.8801	0.09	.40740-02	RLR TRIP/CORRECT/RESTART RLR	0.400	.16290-02
		MODE=HI FD FLOW/SMOKE		43.8801	0.09	.42090-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.42090-03
		MODE=HI FD FLO4/HI STM PRES		43.8801	0.07	.31700-02	NO EFFECT	0.0	.0
		MODE=HI FD FLOW/EXCSV FD		43.8801	0.07	.31700-02	EXPLOSIVE CONDITION	0.500	.15850-02
		MODE=HI COMBUST AIR/SMOKE		43.8801	0.11	.48810-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.48810-03
		MODE=HI COMBUST AIR/FLAME OUT		43.8801	0.08	.36220-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.36220-03
		MODE=HI COMBUST AIR/LOW STEAM		43.8801	0.08	.36220-02	HPC REDUCES RPM/CORRECT/RESUME	0.400	.14490-02
		MODE=LOW COMBUST AIR/SMOKE		43.8801	0.22	.98840-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.98840-03
		MODE=LOW COMBUST AIR/EXCSV FD		43.8801	0.05	.24910-02	EXPLOSIVE CONDITION	0.500	.12460-02
BLOCK	4	FUNCTIO CONTROLLERS							
PARTS		1.00	2	9.9120					
MODES		MODE=HI COMBUST AIR/SMOKE	1	9.9120	0.15	.10480-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.10480-03
		MODE=HI COMBUST AIR/FLAME OUT		9.9120	0.27	.26880-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.26880-03
		MODE=HI COMBUST AIR/LOW STEAM		9.9120	0.07	.52060-03	HPC REDUCES RPM/CORRECT/RESUME	0.400	.20810-03
		MODE=HI COMBUST AIR/SMOKE		9.9120	0.11	.78690-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.78690-04
		MODE=LOW COMBUST AIR/SMOKE		9.9120	0.12	.85610-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.85610-04
		MODE=LOW COMBUST AIR/EXCSV FD		9.9120	0.03	.20410-03	EXPLOSIVE CONDITION	0.500	.10200-03
		MODE=LOW COMBUST AIR/LOW STM		9.9120	0.06	.41610-03	HPC REDUCES RPM/CORRECT/RESUME	0.400	.16610-03
		MODE=LOW COMBUST AIR/RLR TRP		9.9120	0.09	.62410-03	RLR TRIP/CORRECT/RESTART RLR	0.400	.25850-03

		D.C.	QTY	FUNCTION FAILURE PROB. FREQ	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 5	FUNCTIO ELECTRONIC/DRUM LVL CNTL								
PARTS		1.00	2	271.4355					
MODE1	MODE=HI DRUM LVL		1	271.4355	0.39	.7294D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.7294D-02
	MODE=HI DRUM LVL/SPILL TO TURB			271.4355	0.04	.8848D-02	LOSS OF PROTECTIVE FEATURE	0.500	.4422D-02
	MODE=LOW DRUM LVL/BLR TRIP			271.4355	0.25	.6667D-01	BLR TRIP/CORRECT/RESTART BLR	0.800	.1867D-01
	MODE=LOW DRUM LVL/HI STM TEMP			271.4355	0.12	.2341D-01	EXPLOSIVE CONDITION	0.500	.1171D-01
	MODE=LOW DRUM LVL/HI BLR TEMP			271.4355	0.04	.8842D-02	EXPLOSIVE CONDITION	0.500	.4851D-12
	MODE=FALSE ALARM			271.4355	0.09	.8635D-02	FALSE ALARM	0.0	.0
	MODE=LOSS OF CONTROL/DRUM LVL			271.4355	0.14	.1984D-01	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.1984D-02
BLOCK 5	FUNCTIO TRANSDUCERS								
PARTS		1.00	2	71.9600					
MODE1	MODE=HI DRUM LVL		1	71.9600	0.12	.5858D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.5858D-03
	MODE=HI DRUM LVL/SPILL TO TURB			71.9600	0.01	.6649D-03	LOSS OF PROTECTIVE FEATURE	0.500	.3329D-03
	MODE=LOW DRUM LVL/BLR TRIP			71.9600	0.04	.1787D-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.7146D-03
	MODE=LOW DRUM LVL/HI STM TMEP			71.9600	0.02	.6822D-03	EXPLOSIVE CONDITION	0.500	.4341D-03
	MODE=LOW DRUM LVL/HI BLR TEMP			71.9600	0.01	.3865D-03	EXPLOSIVE CONDITION	0.500	.1933D-03
	MODE=LOSS OF CONTROL/DRUM LVL			71.9600	0.81	.4074D-01	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.4074D-02
BLOCK 6	FUNCTIO ELECTRONIC/FW CNTL								
PARTS		1.00	1	42.7669					
MODE1	MODE=LOW FD PRES/LOW DRUM		1	42.7669	0.51	.1560D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1560D-02
	MODE=LOSS OF REMOTE MANUAL			42.7669	0.01	.2429D-03	LOSS OF BACK-UP OR ALARM	0.200	.4858D-04
	MODE=HI FW PRESS/HI DRUM LVL			42.7669	0.18	.5481D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.5481D-03
	MODE=HI FW PRESS/HI DRUM LVL			42.7669	0.18	.5481D-02	TURB TRIP--CORRECT/RESTART TUR	0.700	.3837D-02
	MODE=LOSS OF CONTROL/FW PMP			42.7669	0.12	.3667D-02	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.3667D-03
BLOCK 6	FUNCTIO TRANSDUCERS								
PARTS		1.00	1	37.5400					
MODE1	MODE=LOW FD PRES/LOW DRUM		1	37.5400	0.33	.4678D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.4678D-03
	MODE=HI FW PRESS/HI DRUM LVL			37.5400	0.17	.4848D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.4848D-03
	MODE=HI FW PRESS/HI DRUM LVL			37.5400	0.17	.4848D-02	TURB TRIP--CORRECT/RESTART TUR	0.700	.3393D-02
	MODE=LOSS OF CONTROL/FW PMP			37.5400	0.34	.9842D-02	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.9842D-03
BLOCK 7	FUNCTIO ELECTRONIC/FW RECRC VLV CNTL								
PARTS		1.00	1	18.3752					
MODE1	MODE=FW RECRC VLV OPN/LO DRUM		1	18.3752	0.15	.2020D-02	BLR TRIP/CORRECT/RESTART BLR	0.800	.8081D-03
	MODE=FW RECRC VLV CLS/PMP FAIL			18.3752	0.20	.2691D-02	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=FALSE ALARM			18.3752	0.32	.4166D-02	FALSE ALARM	0.0	.0
	MODE=ALARM FAILS			18.3752	0.32	.4166D-02	LOSS OF BACK-UP OR ALARM	0.200	.8332D-03

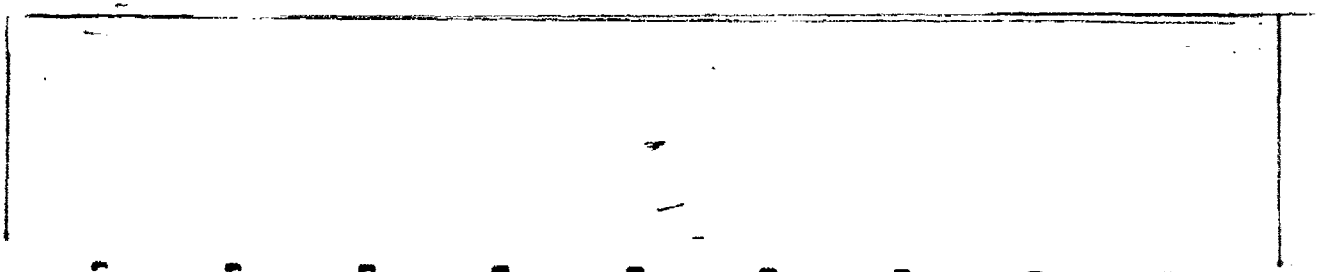
			D.C.	QTY	FUNCTION FAILURE PROB. FRAT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	7	FUNCTIO VALVES								
PARTS			1.00	1	32.7600					
MODES		MODE=FM RECRC VLV OPN/LO DRUM		1	32.7600	0.50	.11560-01	RLR TRIP/CORRECT/RESTART RLR	0.400	.46250-02
		MODE=FM RECRC VLV CLS/PMP FAIL			32.7600	0.50	.11560-01	AUTO BACK-UP TAKES OVER	0.0	.0
BLOCK	7	FUNCTIO TRANSDUCERS								
PARTS			1.00	1	29.3000					
MODES		MODE=FM RECRC VLV OPN/LO DRUM		1	29.3000	0.67	.13860-01	RLR TRIP/CORRECT/RESTART RLR	0.400	.55450-02
		MODE=FM RECRC VLV CLS/PMP FAIL			29.3000	0.33	.68210-02	AUTO BACK-UP TAKES OVER	0.0	.0
BLOCK	A	FUNCTIO ELECTRONIC/BHTR STM TEMP CNTL								
PARTS			1.00	2	132.0700					
MODES		MODE LOW STM TEMP/WET STM TRP		1	132.0700	0.36	.33470-01	NO ALARM--ONLY LIGHT/INDICATOR	0.560	.16730-01
		MODE=HI STM TEMP/RUPTURE TIME			132.0700	0.23	.21060-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.21060-02
		MODE=LOSS OF REMOT MANUAL			132.0700	0.00	.03770-04	LOSS OF BACK-UP OR ALARM	0.200	.18750-06
		MODE=FALSE ALARM			132.0700	0.09	.83110-02	FALSE ALARM	0.0	.0
		MODE=ALARM FAILS			132.0700	0.18	.13500-01	LOSS OF BACK-UP OR ALARM	0.200	.27010-02
		MODE=LOSS OF CONTROL/STM PRES			132.0700	0.18	.16280-01	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.16280-02
BLOCK	A	FUNCTIO VALVES								
PARTS			1.00	2	65.5200					
MODES		MODE=LOW STM TEMP/WET STM TRP		1	65.5200	1.00	.45450-01	NO ALARM--ONLY LIGHT/INDICATOR	0.560	.22730-01
BLOCK	A	FUNCTIO TRANSDUCERS								
PARTS			1.00	2	58.6000					
MODES		MODE=LOW STM TEMP/WET STM TRP		1	58.6000	0.67	.27530-01	NO ALARM--ONLY LIGHT/INDICATOR	0.560	.13770-01
		MODE=HI STM TEMP/RUPTURE TIME			58.6000	0.33	.13600-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.13600-02
BLOCK	A	FUNCTIO SENSORS								
PARTS			1.00	2	17.7664					
MODES		MODE=LOW STM TEMP/WET STM TRP		1	17.7664	0.35	.31490-02	NO ALARM--ONLY LIGHT/INDICATOR	0.560	.15740-02
		MODE=HI STM TEMP/RUPTURE TIME			17.7664	0.62	.77900-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.77900-03
		MODE=LOSS OF CONTROL/STM PRES			17.7664	0.13	.16380-02	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.16380-03

		D.C.	QTY	FUNCTION FAILURE PROB. FRAT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	4	FUNCTIO ELECTRONIC/STM DUMP CNTL							
PARTS		1.00	1	13.1357					
MODE:	MODE=STEAM DUMP FAILS		1	13.1357	0.57	.53020-02	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=STM DUMP VLV PARTLY OPEN			13.1357	0.09	.8483D-03	HPC REDUCES RPM/CORRECT/RESUME	0.600	.31930-03
	MODE=STM DUMP VLV TOTAL OPEN			13.1357	0.09	.8483D-03	TURB TRIP--CORRECT/RESTART TUR	0.700	.59380-03
BLOCK	9	FUNCTIO VALVES							
PARTS		1.00	1	36.0400					
MODE:	MODE=STEAM DUMP FAILS		1	36.0400	0.51	.12860-01	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=STM DUMP VLV PARTLY OPEN			36.0400	0.35	.63000-02	HPC REDUCES RPM/CORRECT/RESUME	0.600	.25200-02
	MODE=STM DUMP VLV TOTAL OPEN			36.0400	0.25	.63000-02	TURN TRIP--CORRECT/RESTART TUR	0.700	.88100-02
BLOCK	9	FUNCTIO TRANSDUCERS							
PARTS		1.00	2	2.0000					
MODE:	MODE=STEAM DUMP FAILS		1	2.0000	0.50	.70970-03	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=STM DUMP VLV PARTLY OPEN			2.0000	0.25	.35490-03	HPC REDUCES RPM/CORRECT/RESUME	0.600	.14200-03
	MODE=STM DUMP VLV TOTAL OPEN			2.0000	0.25	.35490-03	TURN TRIP--CORRECT/RESTART TUR	0.700	.24850-03
BLOCK	10	FUNCTIO ELECTRONIC/FWD FD START/STOP CNTL							
PARTS		1.00	2	30.6976					
MODE:	MODE=STDBY FPSTRT/HI FW PRES		1	30.6976	0.26	.56510-02	NO EFFECT	0.0	.0
	MODE=FW PMP FAIL DUE TO CNTL			30.6976	0.33	.71680-02	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=FW PMP AUTO SW FAILURE			30.6976	0.41	.88750-02	LOSS OF BACK-UP OR ALARM	0.200	.17750-02
BLOCK	10	FUNCTIO SWITCHES							
PARTS		1.00	2	49.6800					
MODE:	MODE=FW PMP FAIL DUE TO CNTL		1	49.6800	0.40	.13870-01	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=FW PMP AUTO SW FAILURE			49.6800	0.60	.21080-01	LOSS OF BACK-UP OR ALARM	0.200	.42160-02
BLOCK	11	FUNCTIO ELECTRONIC/DEAERATOR LVL CNTL							
PARTS		1.00	1	20.9772					
MODE:	MODE=HI DEAERATOR/LOW DRUM		1	20.9772	0.47	.70850-02	NO EFFECT	0.0	.0
	MODE=LOW DEAERATOR/LOW DRUM			20.9772	0.07	.69610-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.69610-03
	MODE=LOSS OF REMOTE MANUAL			20.9772	0.02	.23830-03	LOSS OF BACK-UP OR ALARM	0.200	.47650-04
	MODE=LOSS OF CONTROL/DEAERATOR			20.9772	0.04	.66820-03	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.66820-04

		D.C.	QTY	FUNCTION FAILURE PROB. FNCT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 11	FUNCTIO VALVES								
PARTS		1.00	1	65.5200					
MODE1	MODE=HI DEAERATOR/LOW DRUM		1	65.5200	0.75	.34290-01	NO EFFECT	0.0	.0
	MODE=LOW DEAERATOR/LOW DRUM			65.5200	0.25	.11560-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.11560-02
BLOCK 11	FUNCTIO TRANSDUCERS								
PARTS		1.00	1	19.1300					
MODE1	MODE=HI DEAERATOR/LOW DRUM		1	19.1300	0.67	.90990-02	NO EFFECT	0.0	.0
	MODE=LOW DEAERATOR/LOW DRUM			19.1300	0.33	.44320-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.44320-03
BLOCK 12	FUNCTIO ELECTRONIC/FO HEADER TEMP								
PARTS		1.00	1	20.8022					
MODE1	MODE=LO FO TEMP/SMOKE		1	20.8022	0.53	.77530-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.31010-02
	MODE=HI FO TEMP/POSAL FLASH			20.8022	0.38	.55430-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.55530-03
	MODE=LOSS OF REMOTE MANUAL			20.8022	0.05	.78250-03	LOSS OF BACK-UP OR ALARM	0.200	.15650-03
	MODE=LOSS OF CONTROL/FO TEMP			20.8022	0.04	.63490-03	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.63490-04
BLOCK 12	FUNCTIO VALVES								
PARTS		1.00	1	36.0500					
MODE1	MODE=LO FO TEMP/SMOKE		1	36.0500	0.52	.13280-01	BLR TRIP/CORRECT/RESTART BLR	0.400	.52780-02
	MODE=HI FO TEMP/POSAL FLASH			36.0500	0.48	.12240-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.12240-02
BLOCK 12	FUNCTIO TRANSDUCERS								
PARTS		1.00	1	5.3756					
MODE1	MODE=LO FO TEMP/SMOKE		1	5.3756	0.37	.14140-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.56750-03
	MODE=HI FO TEMP/POSAL FLASH			5.3756	0.41	.15750-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.15750-03
	MODE=LOSS OF CONTROL/FO TEMP			5.3756	0.21	.82020-03	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.82020-04
BLOCK 13	FUNCTIO ELECTRONIC/FO RECRC CNTL								
PARTS		1.00	1	13.0018					
MODE1	MODE=LOW FO PRES/BLR TRIP		1	13.0018	0.23	.21030-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.8810D-03
	MODE=LOW FO PRES/FLAME OUT			13.0018	0.15	.14020-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.5609D-03
	MODE=HI FO/HI STM PRESSURE			13.0018	0.62	.57070-02	NO ALARM--ONLY LIGHT/INDICATOR	0.500	.28540-02

		D.C.	QTY	FUNCTION FAILURE PROB. FR*T	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 13	FUNCTIO VALVES								
PARTS		1.00	1	33,6600					
MODE:	MODE=LOW FO PRES/BLR TRIP		1	33,6600	0,30	.7073D-02	BLR TRIP/CORRECT/RESTART BLR	0,400	.2829D-02
	MODE=LOW FO PRES/FLAME OUT			33,6600	0,20	.4721D-02	BLR TRIP/CORRECT/RESTART BLR	0,400	.1888D-02
	MODE=HI FO/HI STM PRESSURE			33,6600	0,50	.1208D-01	NO ALARM--ONLY LIGHT/INDICATOR	0,500	.5998D-02
BLOCK 13	FUNCTIO TRANSDUCERS								
PARTS		1.00	1	0,5000					
MODE:	MODE=HI FO/HI STM PRESSURE		1	0,5000	1,00	.3549D-03	NO ALARM--ONLY LIGHT/INDICATOR	0,500	.1775D-03
BLOCK 14	FUNCTIO ELECTRONIC/LO PUMP CNTLS								
PARTS		1.00	2	14,3158					
MODE:	MODE=LO PMP FAIL/LOW LO		1	14,3158	0,21	.2122D-02	AUTO BACK-UP TAKES OVER	0,0	.0
	MODE=LO PMP AUTO SW FAILURE			14,3158	0,79	.8008D-02	LOSS OF BACK-UP OR ALARM	0,200	.1602D-02
BLOCK 14	FUNCTIO SWITCHES								
PARTS		1.00	2	40,2600					
MODE:	MODE=LO PMP FAIL/LOW LO		1	40,2600	0,07	.2856D-02	AUTO BACK-UP TAKES OVER	0,0	.0
	MODE=LO PMP AUTO SW FAILURE			40,2600	0,93	.2618D-01	LOSS OF BACK-UP OR ALARM	0,200	.5236D-02
BLOCK 14	FUNCTIO RELAYS								
PARTS		1.00	2	1,0600					
MODE:	MODE=LO PMP AUTO SW FAILURE		1	1,0600	1,00	.7523D-03	LOSS OF BACK-UP OR ALARM	0,200	.1505D-03
BLOCK 15	FUNCTIO ELECTRONIC/ITC								
PARTS		1.00	1	134,5641					
MODE:	MODE=FALSE TURBINE TRIP		1	134,5641	0,28	.2649D-01	FALSE TURB TRP/CORRECT/RESTART	0,700	.1848D-01
	MODE=AHD/AST VLV SETTING FAILS			134,5641	0,10	.9457D-02	ERRATIC RPMS/USE HANDPUMP	0,600	.5674D-02
	MODE=LOSS OF CRASH BACK			134,5641	0,01	.7736D-03	ERRATIC DIR CONTROL/USE HDPMP	0,600	.4642D-03
	MODE=WRONG AHD/AST VLV OPENED			134,5641	0,05	.4459D-02	ERRATIC DIR CONTROL/USE HDPMP	0,600	.2676D-02
	MODE=LOSS OF RATE CHANGE			134,5641	0,04	.4161D-02	NO ALARM--ONLY LIGHT/INDICATOR	0,500	.2080D-02
	MODE=LOSS OF OVERSPEED TRIP			134,5641	0,27	.7149D-02	LOSS OF PROTECTIVE FEATURE	0,500	.3575D-02
	MODE=LOSS OF TURB TRIP			134,5641	0,19	.1787D-01	LOSS OF TRIP	0,500	.8937D-02
	MODE=SHAFT STOPPED IN ARC			134,5641	0,03	.3291D-02	NOT APPLICABLE TO THIS PHASE	0,0	.0
	MODE=ARC IN ONE DIRECTION			134,5641	0,06	.5841D-02	NOT APPLICABLE TO THIS PHASE	0,0	.0
	MODE=LOSS OF HPC			134,5641	0,17	.1654D-01	LOSS OF PROTECTIVE FEATURE	0,500	.8269D-02

	P.P.	QTY	FUNCTION FAILURE PROB. FHAT	FAIL. MODE FRED. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 15 FUNCTIO SWITCHES								
PARTS	1.00	1	123.5400					
MODE:		1	123.5400	0.01	.24540-02	LOSS OF BACK-UP OR ALARM	0.200	.49080-03
MODE=LOSS OF TURNING GEAR			123.5400	0.03	.93610-01	LOSS OF TRIP	0.500	.24810-01
MODE=LOSS OF TURB TRIP			123.5400	0.26	.32810-01	ERRATIC RPMS/USE HANDPUMP	0.600	.13690-01
MODE=LOSS OF CONTROL/HYDR FAIL			123.5400	0.08	.70820-02	LOSS OF BACK-UP OR ALARM	0.200	.14160-02
MODE=LOSS OF HANDPUMP								
BLOCK 15 FUNCTIO VALVES								
PARTS	1.00	1	128.2400					
MODE:		1	128.2400	0.12	.11230-01	FALSE TURB TRP/CORRECT/RESTART	0.700	.78590-02
MODE=FALSE TURBINE TRIP			128.2400	0.15	.13560-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=AST GUARD VLV FAIL CLOSED			128.2400	0.25	.22950-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=DRAIN VLV FAILS CLOSED			128.2400	0.41	.36550-01	ERRATIC RPMS/USE HANDPUMP	0.600	.21930-01
MODE=LOSS OF CONTROL/HYDR FAIL			128.2400	0.96	.54240-02	LOSS OF BACK-UP OR ALARM	0.200	.11260-02
MODE=LOSS OF HANDPUMP								
BLOCK 15 FUNCTIO RELAYS								
PARTS	1.00	1	25.2500					
MODE:		1	25.2500	0.10	.17910-02	FALSE TURB TRP/CORRECT/RESTART	0.700	.12540-02
MODE=FALSE TURBINE TRIP			25.2500	0.02	.43020-03	ERRATIC DIR CONTROL/USE HNDPMP	0.600	.25810-03
MODE=LOSS OF CRASH RACK			25.2500	0.02	.43020-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF TRP/ABO RPM +5			25.2500	0.01	.21510-03	LOSS OF BACK-UP OR ALARM	0.200	.43020-04
MODE=LOSS OF TURNING GEAR			25.2500	0.84	.14950-01	LOSS OF TRIP	0.500	.74730-02
MODE=LOSS OF TURB TRIP								
BLOCK 15 FUNCTIO ACTUATORS								
PARTS	1.00	1	2.5400					
MODE:		1	2.5400	1.00	.16400-02	ERRATIC RPMS/USE HANDPUMP	0.600	.98400-03
MODE=LOSS OF CONTROL/HYDR FAIL								
BLOCK 15 FUNCTIO TRANSFORMERS								
PARTS	1.00	1	28.7400					
MODE:		1	28.7400	1.00	.14590-01	ERRATIC RPMS/USE HANDPUMP	0.600	.87540-02
MODE=LOSS OF CONROL/HYDR FAIL								
BLOCK 15 FUNCTIO SENSORS								
PARTS	1.00	1	763.2000					
MODE:		1	763.2000	0.15	.83640-01	FALSE TURB TRP/CORRECT/RESTART	0.700	.16550-01
MODE=FALSE TURBINE TRIP			763.2000	0.22	.30020-01	ERRATIC RPMS/USE HANDPUMP	0.600	.23950-01
MODE=AMO/AST VLV SETTING FAILS			763.2000	0.22	.30020-01	ERRATIC DIR CONTROL/USE HNDPMP	0.600	.23950-01
MODE=WRONG AMO/AST VLV OPENED			763.2000	0.22	.30020-01	NO ALARM--ONLY LIGHT/INDICATOR	0.500	.19960-01
MODE=LOSS OF RATE CHANGE			763.2000	0.22	.30020-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF TRP/ABO RPM +5								
BLOCK 15 FUNCTIO SOLENOIDS								
PARTS	1.00	1	25.3700					
MODE:		1	25.3700	0.53	.94300-02	FALSE TURB TRP/CORRECT/RESTART	0.700	.66010-02
MODE=FALSE TURBINE TRIP			25.3700	0.47	.85620-02	ERRATIC RPMS/USE HANDPUMP	0.600	.51010-02
MODE=LOSS OF CONTROL/HYDR FAIL								
BLOCK 15 FUNCTIO PUMPS								
PARTS	1.00	1	157.8000					
MODE:		1	157.8000	1.00	.1040	ERRATIC RPMS/USE HANDPUMP	0.600	.63000-01
MODE=LOSS OF CONTROL/HYDR FAIL								



SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS BURNER MANAGEMENT/MASTER

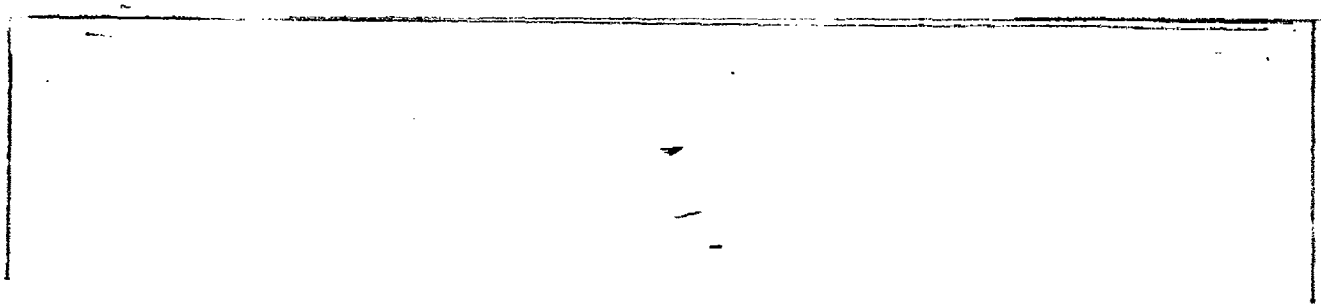
SFE	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF BURNER MAN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION BURNER MAN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
4	MLR TRIP/CORRECT/RESTART MLP	5	.4759E-01	19.5736	1.8365	0.4000	.1807E-01	58.7892	2.4266
16	LOSS OF TRIP	7	.3647E-01	14.9987	1.4067	0.5000	.1795E-01	48.3138	2.4088
3	ALARM/ACTIVATE REMOTE MANUAL	3	.1766E-02	4.7263	4.4681	0.1000	.1765E-03	0.4758	0.4264
8	MPC REDUCES RPM/CORRECT/RESUME	5	.3924E-03	0.1614	0.0151	0.4000	.1569E-03	0.4224	0.0235
1	NOT APPLICABLE TO THIS PHASE	1	.1569	64.5399	0.0468	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS BURNER MODULE

SFE	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF BURNER MOD FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION BURNER MOD CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
16	LOSS OF TRIP	7	.6481E-01	12.3121	2.5060	0.5000	.3184E-01	52.2511	4.7681
4	MLR TRIP/CORRECT/RESTART MLP	5	.3914E-01	7.4123	1.5087	0.4000	.1552E-01	25.4910	2.3242
3	ALARM/ACTIVATE REMOTE MANUAL	3	.1380	26.1298	5.3183	0.1000	.1355E-01	22.2579	2.0294
2	NO EFFECT	2	.3524E-01	6.6766	1.3585	0.0	.0	0.0	0.0
1	NOT APPLICABLE TO THIS PHASE	1	.2507	47.4712	0.4621	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS COMBUST CNTL/BLR AND LOC

SFE	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUST CN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUST CN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
8	MPC REDUCES RPM/CORRECT/RESUME	5	.4075E-01	41.6316	1.9707	0.4000	.1612E-01	57.0734	2.9148
6	EXPLOSIVE CONDITION	7	.1938E-01	19.8947	0.7478	0.5000	.9637E-02	34.1102	1.4436
13	LOSS OF BACK-UP OR ALARM	14	.8564E-02	8.5862	0.3228	0.2000	.1666E-02	5.8972	0.2495
14	FALSE TIMR TMP/CORRECT/RESTART	10	.1175E-02	1.2067	0.0453	0.7000	.8223E-03	2.9112	0.1232
5	AUTO BACK-UP TAKES OVER	2	.1938E-01	19.8947	0.7478	0.0	.0	0.0	0.0
14	FALSE ALARM	2	.8564E-02	8.5862	0.3228	0.0	.0	0.0	0.0



SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS COMBUSTION CONTROL

SFF	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUSTION FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUSTION CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
3	ALARM/ACTIVATE REMOTE MANUAL	3	.158A	58.8465	5.4657	0.1000	.1538E-01	32.1343	2.3038
6	EXPLOSIVE CONDITION	7	.3069E-01	11.6677	1.1029	0.5000	.1538E-01	31.9633	2.2912
4	RLR TRIP/CONNECT/RESTART RLR	5	.2559E-01	9.7293	0.9844	0.4000	.1021E-01	21.3336	1.5293
8	HPC REDUCES RPM/CONNECT/RESUME	9	.1362E-01	5.1775	0.5249	0.4000	.5440E-02	11.3670	0.8148
12	AUTO CONTROL OUTPUT IS ERRATIC	3	.1339E-01	5.0928	0.5163	0.1000	.1331E-02	2.7806	0.1993
13	LOSS OF BACK-UP OR ALARM	14	.9987E-03	0.3797	0.0385	0.2000	.1904E-03	0.8172	0.0299
1	NOT APPLICABLE TO THIS PHASE	1	.6314E-04	0.0240	0.0024	0.0	.0	0.0	0.0
5	AUTO BACK-UP TAKES OVER	2	.1161E-02	0.4380	0.0444	0.0	.0	0.0	0.0
2	NO EFFECT	2	.2274E-01	8.6506	0.8770	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS FEEDWATER CONTROL

SFF	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF FEEDWATER FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION FEEDWATER CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
7	TURN TRIP--CONNECT/RESTART TURB	10	.9978E-02	17.8923	0.3885	0.7000	.6964E-02	59.6759	1.8432
3	ALARM/ACTIVATE REMOTE MANUAL	3	.3421E-01	59.9911	1.3185	0.1000	.3402E-02	29.1547	0.9096
12	AUTO CONTROL OUTPUT IS ERRATIC	3	.1268E-01	22.8906	0.4855	0.1000	.1251E-02	10.7532	0.3348
13	LOSS OF BACK-UP OR ALARM	14	.2829E-03	0.9260	0.0098	0.2000	.4858E-04	0.4163	0.0073

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS DRUM LEVEL CONTROL

SFF	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF DRUM LEVEL FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION DRUM LEVEL CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
4	RLR TRIP/CONNECT/RESTART RLR	5	.4958E-01	20.3365	1.9113	0.4000	.1938E-01	35.6959	2.4834
6	EXPLOSIVE CONDITION	7	.3317E-01	13.6034	1.2785	0.5000	.1863E-01	30.2498	2.0868
3	ALARM/ACTIVATE REMOTE MANUAL	3	.8161E-01	33.4744	3.1460	0.1000	.7884E-02	14.5121	1.1888
12	AUTO CONTROL OUTPUT IS ERRATIC	3	.6163E-01	25.2764	2.3757	0.1000	.6054E-02	11.1566	0.9074
28	LOSS OF PROTECTIVE FEATURE	7	.9148E-02	3.7504	0.3525	0.5000	.4554E-02	8.3866	0.6821
14	FALSE ALARM	2	.8472E-02	3.5570	0.3343	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS FW RECRC VALVE CONTROL

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF FW RECRC V FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION FW RECRC V CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
4	MLK TRIP/CORRECT/RESTART BLR	5	.2761E-01	68.5476	1.0683	0.4000	.1098E-01	92.9853	1.6448
13	LOSS OF BACK-UP OR ALARM	14	.4175E-02	7.3183	0.1609	0.2000	.8332E-03	7.0547	0.1248
5	AUTO BACK-UP TAKES OVER	2	.2115E-01	37.8318	0.8152	0.0	.0	0.0	0.0
14	FALSE ALARM	2	.4175E-02	7.3183	0.1609	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS SHTR STM TEMP CNTL

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF SHTR STM T FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION SHTR STM T CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
11	NO ALARM--ONLY LIGHT/INDICATOR	7	.1116	57.5940	4.3830	0.5000	.5608E-01	84.2235	8.2066
3	ALARM/ACTIVATE REMOTE MANUAL	1	.4279E-01	22.0815	1.6896	0.1000	.4245E-02	6.6786	0.6358
13	LOSS OF BACK-UP OR ALARM	14	.1369E-01	7.0385	0.5277	0.2000	.2720E-02	4.2792	0.4074
12	AUTO CONTROL OUTPUT IS ERRATIC	1	.1805E-01	9.2796	0.6958	0.1000	.1791E-02	2.8187	0.2683
14	FALSE ALARM	2	.8344E-02	4.2906	0.3217	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS STEAM DUMP CONTROL

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF STEAM DUMP FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION STEAM DUMP CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
7	TURB TRIP--CORRECT/RESTART TURB	10	.7524E-02	22.1153	0.2900	0.7000	.5253E-02	63.6363	0.7468
8	HPC REDUCES RPM/CORRECT/RESUME	5	.7524E-02	22.1153	0.2900	0.4000	.3001E-02	36.3636	0.4496
5	AUTO BACK-UP TAKES OVER	2	.1897E-01	55.7694	0.7314	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS FWD FP START/STOP CNTL MODULE

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF FWD FP STA FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION FWD FP STA CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
13	LOSS OF BACK-UP OR ALARM	14	.3822E-01	52.9526	1.1649	0.2000	.5991E-02	138.8886	0.8976
2	NO EFFECT	2	.5467E-02	9.9208	0.2184	0.0	.0	0.0	0.0
5	AUTO BACK-UP TAKES OVER	2	.2116E-01	37.1175	0.8165	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS DEAERATOR LEVEL CONTROL

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF DEAERATOR FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION DEAERATOR CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
7	ALARM/ACTIVATE REMOTE MANUAL	5	.2306E-01	59.7038	0.8488	0.1000	.2305E-02	95.3606	0.3638
12	AUTO CONTROL OUTPUT IS ERRATIC	5	.4604E-03	0.8544	0.0247	0.1000	.4602E-04	2.6597	0.0096
13	LOSS OF BACK-UP OR ALARM	18	.2583E-03	0.3178	0.0092	0.2000	.4765E-04	1.0797	0.0071
2	NO EFFECT	7	.5104E-01	40.0846	1.9682	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS FUEL OIL HEADER TEMP

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF FUEL OIL H FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION FUEL OIL H CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
4	RLR TRIP/CORRECT/RESTART RLR	5	.2249E-01	58.8976	0.8658	0.4000	.8947E-02	79.9898	1.3442
3	ALARM/ACTIVATE REMOTE MANUAL	5	.1948E-01	44.0359	0.7508	0.1000	.1738E-02	17.3311	0.2901
13	LOSS OF BACK-UP OR ALARM	18	.7828E-03	1.7717	0.0302	0.2000	.1565E-03	1.3991	0.0234
12	AUTO CONTROL OUTPUT IS ERRATIC	5	.1054E-02	3.2947	0.0541	0.1000	.1055E-03	1.3009	0.0218

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS FD RECRC CONTROL

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF FD RECRC C FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION FD RECRC C CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
11	NO ALARM--ONLY LIGHT/INDICATOR	7	.1815E-01	54.1952	0.6495	0.5000	.9029E-02	59.6685	1.1525
6	RLR TRIP/CORRECT/RESTART RLR	5	.1534E-01	45.8048	0.5512	0.4000	.6119E-02	40.3955	0.9166

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS LO PUMP CONTROLS

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF LO PUMP CO FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION LO PUMP CO CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
13	LOSS OF BACK-UP OR ALARM	18	.3552E-01	89.4128	1.5416	0.2000	.6588E-02	100.0000	1.8867
5	AUTO BACK-UP TAKES OVER	7	.4182E-02	10.5888	0.1812	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS ITC

MFE	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF ITC FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION ITC CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
18	EQUATIC PPNS/USE HANDPUMP	17	.247%	39.4752	9.5e+1	0.6000	.1437	47.5562	25.5243
10	FALSE TIMR TRP/CORRECT/RESTART	10	.7353F-01	11.7276	2.8343	0.7000	.5096E-01	16.8542	7.6386
16	LOSS OF TRIP	7	.4420F-01	10.0670	3.3967	0.5000	.4322E-01	14.1923	6.4733
19	ERRATIC DIR CONTRM/ABE IMPR?	13	.4848E-03	7.4814	1.7887	0.6000	.2735E-01	9.0502	4.0961
11	NO ALARM--ONLY LIGHT/INDICATOR	7	.999IE-01	7.1624	1.7318	0.5000	.2204E-01	7.2943	3.3014
20	LOSS OF PROTECTIVE FEATURE	7	.2385F-01	3.8884	0.9194	0.5000	.1104E-01	3.9199	1.7742
13	LOSS OF BACK-UP OR LEARN	14	.1542E-01	2.4681	0.5844	0.2000	.3076F-02	1.0180	0.4608
1	NOT APPLICABLE TO THIS PHASE	1	.8716E-01	13.9815	3.3507	0.0	.0	0.0	0.0

CONTRIBUTIONS TO MISSION EFFECTS BY GROUPS

MISSION EFFECT	SYSTEM CRITICALITY PROBABILITY	PCT CONT. TO SYSTEM CRITICALITY	MISSION CRITICALITY	PCT CONT. TO MISSION CRITICALITY
MFF				
10 TEMPORARY DIR	.9220E-01	3.558	.6398E-01	9.584
-----GROUP -----				
3 COMBUST CNTLR/LR AND LGC	.1175E-02	1.275	0.0008	1.285
-----GROUP -----				
6 FEEDWATER CONTROL	.9974E-02	10.817	0.0070	10.885
-----GROUP -----				
9 STEAM DUMP CONTROL	.7529E-02	8.168	0.0053	8.218
-----GROUP -----				
15 ITC	.7353E-01	79.782	0.0509	79.628
MFF				
13 TEMP LOSS DIRECTIONAL CONTROL	.4648E-01	1.789	.2735E-01	4.096
-----GROUP -----				
15 ITC	.4648E-01	100.000	0.0273	100.000

CONTRIBUTIONS TO MISSION EFFECTS BY GROUPS

MISSION EFFECT	SYSTEM CRITICALITY PROBABILITY	PCT CONT. TO SYSTEM CRITICALITY	MISSION CRITICALITY	PCT CONT. TO MISSION CRITICALITY
MFF*				
5 TEMPORARY REDUCED RPMS	.2896	11.164	.1147	17.187
*****GROUP *****				
1 BURNER MANAGEMENT/MASTER	.4798E-01	16.568	0.0190	16.582
*****GROUP *****				
2 BURNER MODULE	.3914E-01	13.514	0.0155	13.523
*****GROUP *****				
3 COMBUST CNTL/HLR DMD LGC	.4675E-01	16.469	0.0161	14.050
*****GROUP *****				
4 COMBUSTION CONTROL	.3921E-01	13.537	0.0156	13.630
*****GROUP *****				
5 DRUM LEVEL CONTROL	.4958E-01	17.120	0.0194	16.893
*****GROUP *****				
7 FW RECRC VALVE CONTROL	.2761E-01	9.534	0.0110	9.547
*****GROUP *****				
9 STEAM DUMP CONTROL	.7529E-02	2.598	0.0030	2.616
*****GROUP *****				
12 FUEL OIL HEADER TEMP	.2269E-01	7.765	0.0089	7.798
*****GROUP *****				
13 FD RECRC CONTROL	.1534E-01	5.296	0.0061	5.333
MFF*				
12 TEMPORARY LOSS OF RPM CONTROL	.2875	9.530	.1437	21.524
*****GROUP *****				
15 TFC	.2875	100.000	0.1437	100.000
MFF*				
10 MACK-UP FAILURE	.1095	9.219	.2173E-01	3.254
*****GROUP *****				
3 COMBUST CNTL/HLR DMD LGC	.9364E-02	7.681	0.0017	7.667
*****GROUP *****				
4 COMBUSTION CONTROL	.9987E-03	8.912	0.0002	8.919
*****GROUP *****				
6 FEEDWATER CONTROL	.2929E-03	8.272	0.0000	8.228
*****GROUP *****				
7 FW RECRC VALVE CONTROL	.4175E-02	3.814	0.0008	3.835
*****GROUP *****				
8 SHTR STM TEMP CNTL	.1369E-01	12.508	0.0027	12.518
*****GROUP *****				
10 FWD FW START/STOP CNTL MODULE	.3022E-01	27.609	0.0060	27.575
*****GROUP *****				
11 DEAERATOR LEVEL CONTROL	.2336E-03	0.213	0.0000	0.219
*****GROUP *****				
12 FUEL OIL HEADER TEMP	.7828E-03	0.715	0.0002	0.729
*****GROUP *****				
14 LO PUMP CONTROLS	.3532E-01	32.268	0.0070	32.163
*****GROUP *****				
15 TFC	.1542E-01	14.092	0.0031	14.159

CONTRIBUTIONS TO MISSION EFFECTS BY GROUPS

MISSION EFFECT	SYSTEM CRITICALITY PROBABILITY	PCT CONT. TO SYSTEM CRITICALITY	MISSION CRITICALITY	PCT CONT. TO MISSION CRITICALITY
MFE				
5 SMALL PERFORMANCE DEGRADATION	.6014	23.259	.5951E-01	8.914
-----GROUP -----				
1 BURNER MANAGEMENT/MASTER	.1766E-02	0.293	0.0002	0.297
-----GROUP -----				
2 BURNER MODULE	.1380	22.866	0.0155	22.767
-----GROUP -----				
4 COMBUSTION CONTROL	.1662	27.469	0.0167	28.481
-----GROUP -----				
5 DRUM LEVEL CONTROL	.1432	23.748	0.0139	23.422
-----GROUP -----				
6 FEEDWATER CONTROL	.4680E-01	7.756	0.0047	7.826
-----GROUP -----				
8 SHTR STM TEMP CNTL	.6084E-01	10.088	0.0060	10.143
-----GROUP -----				
11 DEAERATOR LEVEL CONTROL	.2170E-01	3.597	0.0024	3.965
-----GROUP -----				
12 FUEL OIL HEADER TEMP	.2091E-01	3.466	0.0021	3.499
MFE				
7 POSSIBLE BLR/TURB DAMAGE	.4946	18.525	.2346	35.840
-----GROUP -----				
1 BURNER MANAGEMENT/MASTER	.3687E-01	7.588	0.0179	7.587
-----GROUP -----				
2 BURNER MODULE	.6501E-01	13.527	0.0318	13.443
-----GROUP -----				
3 COMBUST CNTL/MLR DMD LOC	.1938E-01	4.032	0.0096	4.073
-----GROUP -----				
4 COMBUSTION CONTROL	.3069E-01	6.385	0.0153	6.465
-----GROUP -----				
9 DRUM LEVEL CONTROL	.4231E-01	8.804	0.0210	8.867
-----GROUP -----				
8 SHTR STM TEMP CNTL	.1114	23.228	0.0548	23.162
-----GROUP -----				
13 FD RFCMC CONTROL	.1815E-01	3.776	0.0090	3.814
-----GROUP -----				
15 ITC	.1570	32.659	0.0771	32.587

			U.C.	QTY	FUNCTION FAILURE RATE, F/MY	FAIL. MODE FAIL. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	1	FUNCTIO ELECTRONICS/UP HRT IST								
PARTS			1.00	2	138,1402					
MODES		MODE=LOSS OF PURGE		1	138,1402	0.00	.0791D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=INADVERTENT PURGE			13A,1402	0.01	.6A5D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LIGHT-OFF LOGIC FAILURE			13A,1402	0.21	.2202D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF TRIP			13A,1402	0.07	.713AD-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=INADVERTENT PURGE			13A,1402	0.01	.784AD-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS/INADEQUATE RECRC			13A,1402	0.06	.5869D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FALSE TRIP			13A,1402	0.11	.1102D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FDIV CLOSES OR CANT OPEN			13A,1402	0.12	.1209D-01	BLR TRIP/CORRECT/RESTART BLR	0.000	.4837D-02
		MODE=FDIV CLOSES OR CANT OPEN			13A,1402	0.12	.1209D-01	BLR TRIP/CORRECT/RESTART BLR	0.400	.4837D-02
		MODE=FDIV OPEN OR CANT CLOSE			13A,1402	0.02	.1666D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FDIV OPEN OR CANT CLOSE			13A,1402	0.02	.1666D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FDIV OPEN OR CANT CLOSE			13A,1402	0.02	.1666D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF BOILER TRIP			13A,1402	0.42	.2352D-02	LOSS OF TRIP	0.500	.1176D-02
		MODE=LOSS OF PURGE TIMER			13A,1402	0.06	.3419D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=PURGE INITIATED/NO INHBT			13A,1402	0.00	.2943D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=AIR FLOWS TO PURGE LEVEL			13A,1402	0.01	.1275D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=AIR FLOW TO PURGE LEVEL			13A,1402	0.01	.1373D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1373D-03
		MODE=FD FLD LIGHT LVL/FLAM SIM			13A,1402	0.00	.3924D-03	NPC REDUCED RPM/CORRECT/RESUME	0.000	.1569D-03
		MODE=FD FLD LIGHT LVL/NO FLAME			13A,1402	0.00	.3924D-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.3924D-04
		MODE=FD RECRC WITH FDIV CLOSED			13A,1402	0.02	.1960D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FD RECRC INHBT SUPPRESSED			13A,1402	0.00	.1962D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	1	FUNCTIO SWITCHES								
PARTS			1.00	2	70,9200					
MODES		MODE=LOSS OF PURGE		1	70,9200	0.11	.5273D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF TRIP			70,9200	0.09	.6622D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS/INADEQUATE RECRC			70,9200	0.13	.6625D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF BOILER TRIP			70,9200	0.67	.3322D-01	LOSS OF TRIP	0.500	.1661D-01
BLOCK	1	FUNCTIO RELAYS								
PARTS			1.00	2	2,3044					
MODES		MODE=LOSS OF PURGE		1	2,3044	0.00	.1636D-05	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FALSE TRIP			2,3044	0.01	.1A80D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF BOILER TRIP			2,3044	0.20	.325AD-03	LOSS OF TRIP	0.500	.1628D-03
		MODE=FD RECRC WITH FDIV CLOSED			2,3044	0.79	.1290D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	1	FUNCTIO VALVES								
PARTS			1.00	2	131,0400					
MODES		MODE=LOSS/INADEQUATE PURGE		1	131,0400	0.50	.6565D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FDIV CLOSES OR CANT OPEN			131,0400	0.25	.2299D-01	BLR TRIP/CORRECT/RESTART BLR	0.000	.9196D-02
		MODE=FDIV OPEN OR CANT CLOSE			131,0400	0.25	.2299D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0

		D.C.	QTY	FUNCTION FAILURE PROB. PART	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 2	FUNCTIO ELECTRONIC/AMP MODULE								
PARTS	1.00		#	270.6858					
MODES	MODE=AMP LTOFF LOGIC FAILS		1	270.6858	0.02	.40020-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=IGNITOR FAILURE			270.6858	0.06	.1080D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FALSE TRIP			270.6858	0.07	.1274D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF TRIP			270.6858	0.02	.3836D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FLAME INDICATOR PROBLEM			270.6858	0.01	.1534D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=20 SEC TIMER/TIMES LONG			270.6858	0.08	.1601D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AMP VLV 5 SEC SHTDN FAIL			270.6858	0.06	.1058D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AMP VLV 20 SEC SHTDN FAIL			270.6858	0.05	.9754D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AR CLOSES OR CANT OPEN			270.6858	0.01	.1920D-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.7680D-03
	MODE=IGNITOR NOT WITHDRAWN			270.6858	0.05	.9602D-02	NO EFFECT	0.0	.0
	MODE=AR OPENS OR CANT CLOSE			270.6858	0.01	.1920D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AMP VLV CLOSES/CANT OPEN			270.6858	0.01	.1920D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1920D-03
	MODE=IGNITOR EXTENDED			270.6858	0.01	.1920D-02	NO EFFECT	0.0	.0
	MODE=IGNITOR CANT BE EXTENDED			270.6858	0.01	.1920D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FALSE BURNER TRIP			270.6858	0.20	.3752D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.3752D-02
	MODE=AMP VLV OPENS/CANT CLOSE			270.6858	0.01	.1920D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AMP FAILS TO TRIP/AR CLOSE			270.6858	0.02	.3453D-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.1381D-02
	MODE=AMP FAILS TO TRIP/NO FLAME			270.6858	0.27	.5111D-01	LOSS OF TRIP	0.500	.2556D-01
	MODE=AMP FAILS TO TRIP/AMP CLS			270.6858	0.02	.3262D-02	LOSS OF TRIP	0.500	.1631D-02
BLOCK 2	FUNCTIO SWITCHES								
PARTS	1.00		#	184.6424					
MODES	MODE=IGNITOR FAILURE		1	184.6424	0.14	.1851D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF TRIP			184.6424	0.24	.3412D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AMP VLV 20 SEC SHTDN FAIL			184.6424	0.07	.9233D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AMP VLV CLOSES/CANT OPEN			184.6424	0.75	.1207D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1207D-02
	MODE=FALSE AMP TRIP			184.6424	0.14	.1851D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1851D-02
	MODE=AMP FAILS TO TRIP/AR CLOSE			184.6424	0.07	.9233D-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.3693D-02
	MODE=AMP FAILS TO TRIP/AMP CLS			184.6424	0.07	.9233D-02	LOSS OF TRIP	0.500	.4617D-02
BLOCK 2	FUNCTIO VALVES								
PARTS	1.00		#	131.0000					
MODES	MODE=AMP VLV CLOSES/CANT OPEN		1	131.0000	0.50	.6545D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.6545D-02
	MODE=AMP VLV OPENS/CANT CLOSE			131.0000	0.50	.6545D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 2	FUNCTIO RELAYS								
PARTS	1.00		#	17.2000					
MODES	MODE=AMP LTOFF LOGIC FAILS		1	17.2000	0.33	.6888D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=IGNITOR FAILURE			17.2000	0.12	.1488D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF TRIP			17.2000	0.21	.2579D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=IGNITOR CANT BE EXTENDED			17.2000	0.33	.6888D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 2	FUNCTIO TRANSFORMERS								
PARTS	1.00		#	0.1600					
MODES	MODE=IGNITOR FAILURE		1	0.1600	1.00	.1131D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 2	FUNCTIO ACTUATORS								
PARTS	1.00		#	137.9200					
MODES	MODE=AR CLOSES OR CANT OPEN		1	137.9200	0.25	.2418D-01	BLR TRIP/CORRECT/RESTART BLR	0.400	.9673D-02
	MODE=AR OPENS OR CANT CLOSE			137.9200	0.25	.2418D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=IGNITOR EXTENDED			137.9200	0.25	.2418D-01	NO EFFECT	0.0	.0
	MODE=IGNITOR CANT BE EXTENDED			137.9200	0.25	.2418D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0

		D.C.	QTY	FUNCTION FAILURE RATE, FR&T	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	5	FUNCTIO ELECTRONIC/COMBUST CNTL HLR D'O LO							
PARTS			1.00	1	63,6739				
MODES:		MODE=LOW STM PRES		1	63,6739	0.32	.16560-01	HPC REDUCES RPM/CORRECT/RESUME	0.400	.6616D-02
		MODE=HI STM PRES/STM DUMP ACT			63,6739	0.18	.6530D-02	AUTO BACK-UP TAKES OVER	0.0	.0
		MODE=HI STM PRES/RUPTURE TUBE			63,6739	0.18	.6530D-02	EXPLOSIVE CONDITION	0.500	.3155D-02
		MODE=FALSE ALARM			63,6739	0.19	.8329D-02	FALSE ALARM	0.0	.0
		MODE=ALARM FAILR			63,6739	0.19	.8329D-02	LOSS OF BACK-UP OR ALARM	0.200	.1666D-02
		MODE=FALSE TURBINE TRIP			63,6739	0.01	.1175D-02	FALSE TURB TRP/CORRECT/RESTART	0.700	.8223D-03
BLOCK	6	FUNCTIO TRANSDUCERS								
PARTS			1.00	1	73,5200					
MODES		MODE=LOW STM PRES		1	73,5200	0.50	.25760-01	HPC REDUCES RPM/CORRECT/RESUME	0.400	.1030D-01
		MODE=HI STM PRES/STM DUMP ACT			73,5200	0.25	.1297D-01	AUTO BACK-UP TAKES OVER	0.0	.0
		MODE=HI STM PRES/RUPTURE TUBE			73,5200	0.25	.1297D-01	EXPLOSIVE CONDITION	0.500	.6483D-02
BLOCK	8	FUNCTIO ELECTRONIC/COMBUST CNTL								
PARTS			1.00	2	200,9384					
MODES		MODE=LOW FD FLO/LOW STM PRES		1	200,9384	0.06	.85230-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.8523D-03
		MODE=LOW FD FLO/FLAME OUT			200,9384	0.06	.5690D-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.2276D-02
		MODE=HI FD FLO/SMOKE			200,9384	0.08	.1078D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1078D-02
		MODE=HI FD FLOW/HI STM PRES			200,9384	0.04	.5540D-02	NO EFFECT	0.0	.0
		MODE=HI FD FLOW/EXCSV FD			200,9384	0.02	.2280D-02	EXPLOSIVE CONDITION	0.500	.1140D-02
		MODE=LOW STM PRES			200,9384	0.01	.11410-02	HPC REDUCES RPM/CORRECT/RESUME	0.400	.4563D-03
		MODE=HI STM PRES/STM DUMP ACT			200,9384	0.01	.11410-02	AUTO BACK-UP TAKES OVER	0.0	.0
		MODE=HI STM PRES/RUPTURE TUBE			200,9384	0.00	.1427D-03	EXPLOSIVE CONDITION	0.500	.7133D-04
		MODE=LOSS OF CONTROL/COMB CNTL			200,9384	0.09	.1318D-01	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.1318D-02
		MODE=PROM AIR/FD RATIO/SMOKE			200,9384	0.03	.3782D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.3782D-03
		MODE=PROM AIR/FD /EXCSV FD			200,9384	0.03	.3782D-02	EXPLOSIVE CONDITION	0.500	.1891D-02
		MODE=LOSS OF REMOTE MANUAL			200,9384	0.01	.9982D-03	LOSS OF BACK-UP OR ALARM	0.200	.1996D-03
		MODE=HI COMBUST AIR/SMOKE			200,9384	0.14	.1922D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1922D-02
		MODE=HI COMBUST AIR/FLAME OUT			200,9384	0.09	.12340-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1234D-02
		MODE=HI COMBUST AIR/LOW STEAM			200,9384	0.08	.11630-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1163D-02
		MODE=HI COMBUST AIR/SMOKE			200,9384	0.01	.1426D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1426D-03
		MODE=LOW COMBUST AIR/SMOKE			200,9384	0.18	.2488D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.2488D-02
		MODE=LOW COMBUST AIR/EXCSV FD			200,9384	0.06	.8899D-02	EXPLOSIVE CONDITION	0.500	.4950D-02
		MODE=LOW COMBUST AIR/LOW STEAM			200,9384	0.02	.29970-02	HPC REDUCES RPM/CORRECT/RESUME	0.400	.1197D-02
		MODE=LOW COMBUST AIR/HLR TRIP			200,9384	0.01	.44130-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.1765D-02
BLOCK	9	FUNCTIO VALVES								
PARTS			1.00	2	65,5200					
MODES		MODE=LOW FD FLO/LOW STM PRES		1	65,5200	0.30	.13860-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1386D-02
		MODE=LOW FD FLO/FLAME OUT			65,5200	0.15	.69540-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.2781D-02
		MODE=HI FD FLO/SMOKE			65,5200	0.05	.2323D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.2323D-03
		MODE=HI FD FLO/HI STM PRES			65,5200	0.30	.13860-01	NO EFFECT	0.0	.0
		MODE=HI FD FLO/EXCSV FD			65,5200	0.20	.92610-02	EXPLOSIVE CONDITION	0.500	.4630D-02

		D.C.	QTY	FUNCTION FAILURE PROB. EFFECT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	4	FUNCTIO RELAYS							
PARTS			1.00	2	0.8718				
MODE 1		MODE=LOW FO FLO/LOW STM PRES		1	0.8718	0.12	.75510-04	ALARM/ACTIVATE REMOTE MANUAL	0.100	.7551n-05
		MODE=LOW FO FLO/FLAME OUT			0.8718	0.16	.10060-03	BLR TRIP/CORRECT/RESTART BLR	0.400	.4024n-04
		MODE=HI FO FLO/SMOKE			0.8718	0.18	.11390-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1139n-04
		MODE=HI FO FLO/HI STM PRES			0.8718	0.09	.56960-04	NO EFFECT	0.0	.0
		MODE=HI FO FLO/EXCSV FO			0.8718	0.03	.18570-04	EXPLOSIVE CONDITION	0.500	.9285n-05
		MODE=LOSS OF CONTROL/COMM CNTL			0.8718	0.20	.12630-03	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.1263n-04
		MODE=LOSS OF PURGE/LOW AIR			0.8718	0.10	.63130-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=HI COMBUST AIR/SMOKE			0.8718	0.44	.25380-04	ALARM/ACTIVATE REMOTE MANUAL	0.100	.2538n-05
		MODE=HI COMBUST AIR/FLAME OUT			0.8718	0.03	.19190-04	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1919n-05
		MODE=HI COMBUST AIR/LOW STEAM			0.8718	0.03	.19190-04	MPC REDUCES RPM/CORRECT/RESUME	0.400	.7675n-05
BLOCK	5	FUNCTIO ACTUATORS								
PARTS			1.00	2	34.6000					
MODE 1		MODE=HI COMBUST AIR/SMOKE		1	34.6000	0.24	.88840-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.8884n-03
		MODE=HI COMBUST AIR/FLAME OUT			34.6000	0.05	.12230-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1223n-03
		MODE=HI COMBUST AIR/LOW STEAM			34.6000	0.18	.26450-02	MPC REDUCES RPM/CORRECT/RESUME	0.400	.9748n-03
		MODE=HI COMBUST AIR/SMOKE			34.6000	0.15	.34650-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.3465n-03
		MODE=LOW COMBUST AIR/EXCSV FO			34.6000	0.05	.12230-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1223n-03
		MODE=LOW COMBUST AIR/EXCSV FO			34.6000	0.05	.12230-02	EXPLOSIVE CONDITION	0.500	.6116n-03
		MODE=LOW COMBUST AIR/LOW STM			34.6000	0.18	.26450-02	MPC REDUCES RPM/CORRECT/RESUME	0.400	.9748n-03
		MODE=LOW COMBUST AIR/BLR TRIP			34.6000	0.15	.34650-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.1386n-02
BLOCK	6	FUNCTIO TRANSDUCERS								
PARTS			1.00	1	43.6001					
MODE 1		MODE=LOW FO FLO/LOW STM PRES		1	43.6001	0.14	.61400-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.6140n-03
		MODE=LOW FO FLOW/FLAME OUT			43.6001	0.04	.14760-02	BLR TRIP/CORRECT/RESTART BLR	0.400	.1476n-02
		MODE=HI FO FLOW/SMOKE			43.6001	0.09	.42090-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.4209n-03
		MODE=HI FO FLOW/HI STM PRES			43.6001	0.07	.31760-02	NO EFFECT	0.0	.0
		MODE=HI FO FLOW/EXCSV FO			43.6001	0.07	.31760-02	EXPLOSIVE CONDITION	0.500	.1588n-02
		MODE=HI COMBUST AIR/SMOKE			43.6001	0.11	.48410-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.4841n-03
		MODE=HI COMBUST AIR/FLAME OUT			43.6001	0.08	.36220-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.3622n-03
		MODE=HI COMBUST AIR/LOW STEAM			43.6001	0.08	.34220-02	MPC REDUCES RPM/CORRECT/RESUME	0.400	.1369n-02
		MODE=LOW COMBUST AIR/SMOKE			43.6001	0.22	.98640-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.9864n-03
		MODE=LOW COMBUST AIR/EXCSV FO			43.6001	0.05	.24910-02	EXPLOSIVE CONDITION	0.500	.1246n-02
BLOCK	8	FUNCTIO CONTROLLERS								
PARTS			1.00	2	9.9128					
MODE 1		MODE=HI COMBUST AIR/SMOKE		1	9.9128	0.15	.18480-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1848n-03
		MODE=HI COMBUST AIR/FLAME OUT			9.9128	0.37	.26080-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.2608n-03
		MODE=HI COMBUST AIR/LOW STEAM			9.9128	0.07	.52060-03	MPC REDUCES RPM/CORRECT/RESUME	0.400	.2083n-03
		MODE=HI COMBUST AIR/SMOKE			9.9128	0.11	.78090-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.7809n-04
		MODE=LOW COMBUST AIR/SMOKE			9.9128	0.12	.83810-03	ALARM/ACTIVATE REMOTE MANUAL	0.100	.8381n-04
		MODE=LOW COMBUST AIR/EXCSV FO			9.9128	0.03	.20610-03	EXPLOSIVE CONDITION	0.500	.1029n-03
		MODE=LOW COMBUST AIR/LOW STM			9.9128	0.06	.41510-03	MPC REDUCES RPM/CORRECT/RESUME	0.400	.1661n-03
		MODE=LOW COMBUST AIR/BLR TRP			9.9128	0.09	.62610-03	BLR TRIP/CORRECT/RESTART BLR	0.800	.2505n-03

		P.C. QTY	FUNCTION FAILURE PROB. FRAT	FAIL. MODE FRED. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 5	FUNCTIO ELECTRONIC/DRUM LVL CNTL							
PARTS		1.00 2	271.4355					
MODEL	MODE=HI DRUM LVL	1	271.4355	0.39	.7294D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.7294D-02
	MODE=HI DRUM LVL/SPILL TO TURB		271.4355	0.04	.8448D-02	LOSS OF PROTECTIVE FEATURE	0.500	.4222D-02
	MODE=LOW DRUM LVL/RLR TRIP		271.4355	0.25	.6667D-01	RLR TRIP/CORRECT/RESTART RLR	0.400	.1067D-01
	MODE=LOW DRUM LVL/HI STM TEMP		271.4355	0.12	.2581D-01	EXPLOSIVE CONDITION	0.500	.1291D-01
	MODE=LOW DRUM LVL/HI RLR TEMP		271.4355	0.04	.8062D-02	EXPLOSIVE CONDITION	0.500	.4031D-02
	MODE=FALSE ALARM		271.4355	0.05	.8435D-02	FALSE ALARM	0.0	.0
	MODE=LOSS OF CONTROL/DRUM LVL		271.4355	0.10	.1948D-01	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.1948D-02
BLOCK 5	FUNCTIO TRANSDUCERS							
PARTS		1.00 2	71.9688					
MODEL	MODE=HI DRUM LVL	1	71.9688	0.12	.5858D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.5858D-03
*** AP FI REFER.	SET MODE=? CODE=342 SI=?0,50,A1 PR=.015 MODE=HI D							
	MODE=LOW DRUM LVL/RLR TRIP		71.9688	0.04	.1787D-02	RLR TRIP/CORRECT/RESTART RLR	0.400	.7148D-03
	MODE=LOW DRUM LVL/HI STM TEMP		71.9688	0.02	.6882D-03	EXPLOSIVE CONDITION	0.500	.6341D-03
	MODE=LOW DRUM LVL/HI RLR TEMP		71.9688	0.01	.3465D-03	EXPLOSIVE CONDITION	0.500	.1533D-03
	MODE=LOSS OF CONTROL/DRUM LVL		71.9688	0.81	.4078D-01	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.4078D-02
BLOCK 6	FUNCTIO ELECTRONIC/FW CNTL							
PARTS		1.00 1	42.7669					
MODEL	MODE=LOW FD PRES/LOW DRUM	1	42.7669	0.51	.1540D-01	ALARM/ACTIVATE REMOTE MANUAL	0.100	.1540D-02
	MODE=LOSS OF REMOTE MANUAL		42.7669	0.01	.2029D-03	LOSS OF BACK-UP OR ALARM	0.200	.4056D-04
	MODE=HI FW PRESS/HI DRUM LVL		42.7669	0.18	.5481D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.548ID-03
	MODE=HI FW PRESS/HI DRUM LVL		42.7669	0.18	.5481D-02	TURB TRIP--CORRECT/RESTART RLR	0.700	.3837D-02
	MODE=LOSS OF CONTROL/FW PMP		42.7669	0.12	.3607D-02	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.3607D-03
BLOCK 6	FUNCTIO TRANSDUCERS							
PARTS		1.00 1	37.5488					
MODEL	MODE=LOW FD PRES/LOW DRUM	1	37.5488	0.33	.4478D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.9678D-03
	MODE=HI FW PRESS/HI DRUM LVL		37.5488	0.17	.4648D-02	ALARM/ACTIVATE REMOTE MANUAL	0.100	.4648D-03
	MODE=HI FW PRESS/HI DRUM LVL		37.5488	0.17	.4648D-02	TURB TRIP--CORRECT/RESTART RLR	0.700	.3254D-02
	MODE=LOSS OF CONTROL/FW PMP		37.5488	0.38	.8942D-02	AUTO CONTROL OUTPUT IS ERRATIC	0.100	.8942D-03
BLOCK 7	FUNCTIO ELECTRONIC/FW RECRC VLV CNTL							
PARTS		1.00 1	18.3752					
MODEL	MODE=FW RECRC VLV OPN/CLO DRUM	1	18.3752	0.15	.2828D-02	RLR TRIP/CORRECT/RESTART RLR	0.400	.4481D-03
	MODE=FW RECRC VLV CLS/PMP FAIL		18.3752	0.28	.5271D-02	AUTO BACK-UP TAKES OVER	0.0	.0
	MODE=FALSE ALARM		18.3752	0.52	.9566D-02	FALSE ALARM	0.0	.0
	MODE=ALARM FAILS		18.3752	0.32	.5864D-02	LOSS OF BACK-UP OR ALARM	0.200	.9552D-03

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS RUNNER MODULE

SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF RUNNER MOD FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION RUNNER MOD CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
10 LOSS OF THIP	7	.6501E-01	12,3121	3,3857	0,5000	.3140E-01	52,2511	8,7112
4 RLH TRIP/CORRECT/RESTART RLP	5	.3914F-01	7,4125	1,9981	0,4000	.1552F-01	25,4916	6,2498
5 ALARM/ACTIVATE REMOTE MANUAL	3	.1340	24,1298	7,0157	0,1000	.1355F-01	22,2570	3,7168
2 NO EFFECT	2	.3524E-01	6,6746	1,7921	0,0	.0	0,0	0,0
1 NOT APPLICABLE TO THIS PHASE	1	.2507	47,4712	12,7457	0,0	.0	0,0	0,0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS COMBUST CNTL/PLR BND LUC

SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUST CN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUST CN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
8 HPC REDUCES RPM/CORRECT/RESUME	5	.9975E-01	91,8315	2,8720	0,4000	.1612E-01	57,4734	9,8155
6 EXPLOSIVE CONDITION	7	.1914E-01	19,8967	0,9854	0,5000	.9637E-02	34,1182	2,8396
13 LOSS OF BACK-UP OR ALARM	14	.8364E-02	8,5862	0,4253	0,2000	.1646E-02	5,8972	0,8562
10 FALSE TURN IPP/CORRECT/RESTART	10	.1375E-02	1,2667	0,0598	0,7000	.8223E-03	2,9112	0,2252
5 AUTO BACK-UP TAKES OVER	2	.1936E-01	19,8967	0,9854	0,0	.0	0,0	0,0
14 FALSE ALARM	2	.8364E-02	8,5862	0,4253	0,0	.0	0,0	0,0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS COMBUSTION CONTROL

SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUSTION FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUSTION CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
5 ALARM/ACTIVATE REMOTE MANUAL	3	.1340	58,9665	7,8694	0,1000	.1538E-01	32,1393	4,2125
6 EXPLOSIVE CONDITION	7	.3849E-01	11,0677	1,5464	0,5000	.1538E-01	31,9433	4,1995
4 RLH TRIP/CORRECT/RESTART RLR	5	.2554E-01	9,7295	1,3012	0,4000	.1021E-01	21,1336	2,7963
8 HPC REDUCES RPM/CORRECT/RESUME	5	.1362E-01	5,1775	0,6924	0,4000	.5448E-02	11,3678	1,4897
12 AUTO CONTROL OUTPUT IS ERRATIC	3	.1339E-01	5,0920	0,6811	0,1000	.1331E-02	2,7686	0,3649
13 LOSS OF BACK-UP OR ALARM	14	.9987E-03	0,3797	0,0508	0,2000	.1946E-03	0,8172	0,0547
1 NOT APPLICABLE TO THIS PHASE	1	.6314F-03	0,0240	0,0032	0,0	.0	0,0	0,0
9 AUTO BACK-UP TAKES OVER	2	.1181E-02	0,4489	0,0580	0,0	.0	0,0	0,0
2 NO EFFECT	2	.2274E-01	8,6504	1,1564	0,0	.0	0,0	0,0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS BURNER MANAGEMENT/MASTER

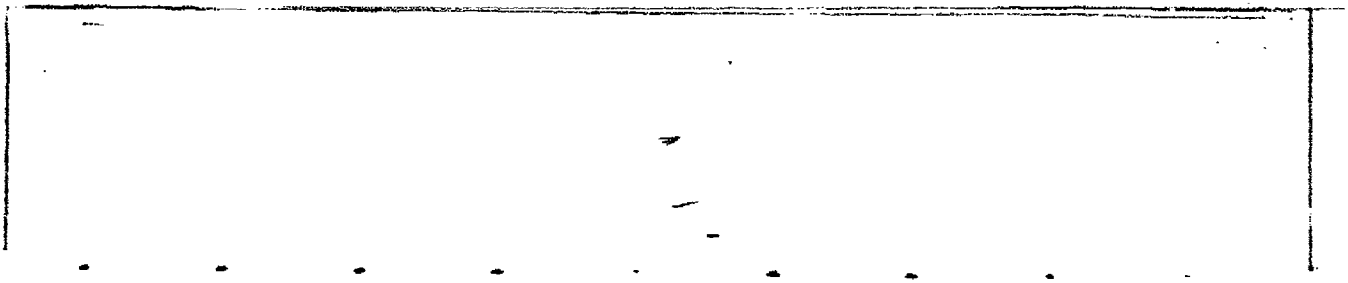
SYSTEM EFFECT	SYSTEM EFFECT NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF BURNER MAN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION BURNER MAN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
4 RLP TRIP/CORRECT/RESTART RLP	5	.4759E-01	19.5736	2.4109	0.4000	.1847E-01	58.7892	5.1688
16 LOSS OF TRIP	7	.3647E-01	14.9987	1.8503	0.5000	.1705E-01	48.3134	6.9168
3 ALARM/ACTIVATE REMOTE MANUAL	3	.1766E-02	0.7263	0.0896	0.1000	.1765E-03	0.4750	0.0443
6 EXPLOSIVE CONDITION	5	.1926E-03	0.1414	0.0200	0.4000	.1549E-03	0.4224	0.0030
1 NOT APPLICABLE TO THIS PHASE	1	.1569	46.5499	7.0702	0.0	.0	0.0	0.0

SYSTEM EFFECT	SYSTEM EFFECT NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION ALL GROUPS CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
4 RLP TRIP/CORRECT/RESTART RLR	5	.2273	11.5598	11.5598	0.4000	.9882E-01	28.6568	28.6568
11 NO ALARM--ONLY LIGHT/INDICATION	7	.1298	6.5998	6.5998	0.5000	.6838E-01	17.4825	17.4825
16 LOSS OF TRIP	7	.1015	5.1600	5.1600	0.5000	.4975E-01	13.4277	13.4277
3 ALARM/ACTIVATE REMOTE MANUAL	4	.4956	25.2022	25.2022	0.1000	.4876E-01	13.3835	13.3835
6 EXPLOSIVE CONDITION	7	.8523E-01	4.2323	4.2323	0.5000	.4136E-01	11.3279	11.3279
8 HPC REDUCES RPM/CORRECT/RESUME	5	.6228E-01	3.1669	3.1669	0.4000	.2472E-01	6.7765	6.7765
15 LOSS OF BACK-UP OR ALARM	14	.9463E-01	4.7813	4.7813	0.2000	.1865E-01	5.1088	5.1088
7 TURN TRIP--CORRECT/RESTART RLR	14	.1750E-01	4.8897	4.8897	0.7400	.1222E-01	3.3461	3.3461
12 AUTO CONTROL OUTPUT IS ERRATIC	5	.1078	5.4798	5.4798	0.1000	.1064E-01	2.9155	2.9155
20 LOSS OF PROTECTIVE FEATURE	7	.8608E-02	4.4312	4.4312	0.5000	.4222E-02	1.1566	1.1566
18 FALSE TURB TRP/CORRECT/RESTART	10	.1175E-02	0.6598	0.6598	0.7000	.8223E-03	0.2252	0.2252
5 AUTO BACK-UP TAKES OVER	2	.8681E-01	4.3734	4.3734	0.0	.0	0.0	0.0
19 FALSE ALARM	2	.2954E-01	1.5829	1.5829	0.0	.0	0.0	0.0
1 NOT APPLICABLE TO THIS PHASE	1	.4076	20.7281	20.7281	0.0	.0	0.0	0.0
2 NO EFFECT	2	.1147	5.8335	5.8335	0.0	.0	0.0	0.0

MISSION EFFECT CRITICALITY

MISSION EFFECT	MIS. NO.	SYSTEM EFFECT FAILURE PROBABILITY	PCT. OF SYSTEM FAILURE PROBABILITY	MISSION LOSS PROBABILITY	MISSION CRITICALITY	PERCENT CONTRIBUTION TO MISSION CRITICALITY
7 POSSIBLE RLR/TURB DAMAGE	1	.3238	16.02	.5000	.1592	43.59
5 TEMPORARY REDUCED RPMS	2	.2896	14.73	.4000	.1147	31.43
8 SMALL PERFORMANCE DEGRADATION	3	.6038	30.68	.1000	.5951E-01	16.30
14 BACK-UP FAILURE	4	.9603E-01	4.781	.2000	.1865E-01	5.108
10 TEMPORARY DIM	5	.1467E-01	.9495	.7000	.1384E-01	3.571
1 NOT APPLICABLE/NORMAL STEAMING	7	.4076	20.73	.0	.0	.0
2 NO EFFECT	10	.2303	11.71	.0	.0	.0

	B.C.	QTY	FUNCTION FAILURE PROB. FRAT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 1 FUNCTIO ELECTRONIC/PNR HGT MST								
PARTS	1.00	2	13A,1A02					
MODES		1	13A,1A02	0.00	.2487D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF PURGE			13A,1A02	0.01	.1735D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=INADVERTENT PURGE			13A,1A02	0.23	.6271D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LIGHT-OFF LOGIC FAILURE			13A,1A02	0.07	.2617D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF TRIP			13A,1A02	0.01	.2211D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=INADVERTENT PURGE			13A,1A02	0.06	.1458D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS/INADEQUATE RECRC			13A,1A02	0.11	.3122D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FALSE TRIP			13A,1A02	0.12	.3426D-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.2398D-03
MODE=FDTV CLOSES OR CANT OPEN			13A,1A02	0.12	.3426D-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.2398D-03
MODE=FDTV CLOSES OR CANT OPEN			13A,1A02	0.02	.4698D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FDTV OPEN OR CANT CLOSE			13A,1A02	0.02	.4698D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FDTV OPEN OR CANT CLOSE			13A,1A02	0.02	.4698D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=LOSS OF BOILER TRIP			13A,1A02	0.02	.6412D-04	LOSS OF TRIP	0.500	.3316D-04
MODE=LOSS OF PURGE TIMER			13A,1A02	0.04	.1078D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=PURGE INITIATED/NO INHBT			13A,1A02	0.00	.8291D-05	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=AIR FLOWL TO PURGE LEVEL			13A,1A02	0.01	.3593D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=AIR FLOW TO PURGE LEVEL			13A,1A02	0.01	.3869D-04	BLR TRIP/CORRECT/RESTART BLR	0.700	.2748D-04
MODE=FD FLD LTOFF LVL/LOW SIM			13A,1A02	0.06	.1105D-04	MPC REDUCES RPM/CORRECT/RESUME	0.700	.7738D-05
MODE=FD FLD LTOFF LVL/NO FLAME			13A,1A02	0.04	.1105D-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.6633D-05
MODE=FD RECRC WITH FDTV CLOSED			13A,1A02	0.02	.5527D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE=FD RECRC INHBT SUPPRESSED			13A,1A02	0.00	.5527D-05	NOT APPLICABLE TO THIS PHASE	0.0	.0



		B.C.	QTY	FUNCTION FAILURE PROB. FRAC	FAIL. MODE EFFECT RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 1	FUNCTIO SWITCHES								
PARTS		1.00	2	70.9204					
MODE:	MODE=LOSS OF PURGE		1	70.9204	0.11	.14890-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF TRIP			70.9204	0.09	.13850-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS/INADEQUATE RECIC			70.9204	0.13	.18720-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF BOILER TRIP			70.9204	0.47	.95130-03	LOSS OF TRIP	0.500	.47560-03
BLOCK 1	FUNCTIO RELAYS								
PARTS		1.00	2	2.3046					
MODE:	MODE=LOSS OF PURGE		1	2.3046	0.80	.46890-07	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FALSE TRIP			2.3046	0.01	.50760-06	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF BOILER TRIP			2.3046	0.70	.91720-05	LOSS OF TRIP	0.500	.45860-05
	MODE=FO RECIC WITH FDIV CLOSED			2.3046	0.79	.36370-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 1	FUNCTIO VALVES								
PARTS		1.00	2	131.8400					
MODE:	MODE=LOSS/INADEQUATE PURGE		1	131.8400	0.50	.13190-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FDIV CLOSES OR CANT OPEN			131.8400	0.25	.65500-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.45850-03
	MODE=FDIV OPEN OR CANT CLOSE			131.8400	0.25	.65500-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 2	FUNCTIO ELECTRONIC/ANR MODULE								
PARTS		1.00	4	278.6858					
MODE:	MODE=ANR LTOFF LOGIC FAILS		1	278.6858	0.02	.12990-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=IGNITOR FAILURE			278.6858	0.06	.38850-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FALSE TRIP			278.6858	0.07	.36270-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF TRIP			278.6858	0.02	.14850-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FLAME INDICATOR PROBLEM			278.6858	0.01	.43310-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=20 SEC TIMER/TIMES LONG			278.6858	0.08	.85460-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=BTR VLV 5 SEC SHTDN FAIL			278.6858	0.08	.41140-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=BTR VLV 20 SEC SHTDN FAIL			278.6858	0.05	.27610-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=AR CLOSES OR CANT OPEN			278.6858	0.01	.54140-04	BLR TRIP/CORRECT/RESTART BLR	0.700	.37980-04
	MODE=IGNITOR NOT WITHDRAWN			278.6858	0.05	.24980-03	NO EFFECT	0.0	.0
	MODE=AR OPENS OR CANT CLOSE			278.6858	0.01	.54140-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=BTR VLV CLOSES/CANT OPEN			278.6858	0.01	.54140-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.32480-04
	MODE=IGNITOR EXTENDED			278.6858	0.01	.54140-04	NO EFFECT	0.0	.0
	MODE=IGNITOR CANT BE EXTENDED			278.6858	0.01	.54140-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FALSE BURNER TRIP			278.6858	0.20	.10770-02	ALARM/ACTIVATE REMOTE MANUAL	0.600	.64620-03
	MODE=BTR VLV OPENS/CANT CLOSE			278.6858	0.01	.54140-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=BTR FAILS TO TRIP/AR CLOS			278.6858	0.02	.97440-04	BLR TRIP/CORRECT/RESTART BLR	0.700	.68211-04
	MODE=BTR FAILS TO TRIP/NO FLAME			278.6858	0.22	.11770-02	LOSS OF TRIP	0.500	.73940-03
	MODE=BTR FAILS TO TRIP/FDR CLS			278.6858	0.02	.92030-04	LOSS OF TRIP	0.500	.46010-04

		B.C.	QTY	FUNCTION FAILURE PROB. FACT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	2	FUNCTIO SWITCHES							
PARTS			1.00	4	146.6424				
MODE1		MODE=IGNITOR FAILURE		1	146.6424	0.14	.5262D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF TRIP			146.6424	0.26	.9775D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=RNR VLV 20 SEC SHTDN FAIL			146.6424	0.07	.2613D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=RNR VLV CLOSES/CANT OPEN			146.6424	0.25	.9179D-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.5507D-03
		MODE=FALSE RNR TRIP			146.6424	0.14	.5262D-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.3157D-03
		MODE=RNR FAILS TO TRP/AR CLOSE			146.6424	0.07	.2613D-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.1829D-03
		MODE=RNR FAILS TO TRP/RNR CLS			146.6424	0.07	.2613D-03	LOSS OF TRIP	0.500	.1306D-03
BLOCK	2	FUNCTIO VALVES							
PARTS			1.00	4	131.8480				
MODE1		MODE=RNR VLV CLOSES/CANT OPEN		1	131.8480	0.50	.1318D-02	ALARM/ACTIVATE REMOTE MANUAL	0.600	.7907D-03
		MODE=RNR VLV OPENS/CANT CLOSE			131.8480	0.50	.1318D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	2	FUNCTIO RELAYS							
PARTS			1.00	4	17.2400				
MODE1		MODE=RNR LTOFF LOGIC FAILS		1	17.2400	0.53	.1152D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=IGNITOR FAILURE			17.2400	0.12	.2172D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=LOSS OF TRIP			17.2400	0.21	.7275D-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=IGNITOR CANT BE EXTENDED			17.2400	0.33	.1157D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	2	FUNCTIO TRANSFORMERS							
PARTS			1.00	4	0.1600				
MODE1		MODE=IGNITOR FAILURE		1	0.1600	1.00	.3200D-05	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK	2	FUNCTIO ACTUATORS							
PARTS			1.00	4	137.9200				
MODE1		MODE=AR CLOSES OR CANT OPEN		1	137.9200	0.25	.6896D-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.4827D-03
		MODE=AR OPENS OR CANT CLOSE			137.9200	0.25	.6896D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=IGNITOR EXTENDED			137.9200	0.25	.6896D-03	NO EFFECT	0.0	.0
		MODE=IGNITOR CANT BE EXTENDED			137.9200	0.25	.6896D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0

		Q.C.	QTY	FUNCTION FAILURE FREQ. FREQ	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. FREQ.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	3	FUNCTIO ELECTRONIC/COMBUST CNTL BLK (HP LO							
PARTS			1.00	1	63.6735				
MODE:		NONE=LOW STM PRES		1	63.6739	0.32	.91250-03	HPC REDUCES RPM/CORRECT/RESUME	0.700	.26480-03
		NONE=HI STM PRES/STM DUMP ACT			63.6739	0.14	.17830-03	AUTO BACK-UP TAKES OVER	0.0	.0
		NONE=HI STM PRES/RUPTURE TURB			63.6739	0.14	.17830-03	EXPLOSIVE CONDITION	0.500	.44140-04
		NONE=FALSE ALARM			63.6739	0.19	.23540-03	FALSE ALARM	0.0	.0
		NONE=ALARM FAILS			63.6739	0.19	.23540-03	LOSS OF BACK-UP OR ALARM	0.044	.98230-04
		NONE=FALSE TURBINE TRIP			63.6739	0.03	.33110-04	FALSE TURB TRIP/CORRECT/RESTART	0.900	.29800-04
BLOCK	5	FUNCTIO TRANSDUCERS							
PARTS			1.00	1	75.5288				
MODE:		NONE=LOW STM PRES		1	75.5288	0.50	.73690-03	HPC REDUCES RPM/CORRECT/RESUME	0.700	.51590-03
		NONE=HI STM PRES/STM DUMP ACT			75.5288	0.25	.36750-03	AUTO BACK-UP TAKES OVER	0.0	.0
		NONE=HI STM PRES/RUPTURE TURB			75.5288	0.25	.36750-03	EXPLOSIVE CONDITION	0.500	.18380-03
BLOCK	4	FUNCTIO ELECTRONIC/COMBUST CNTL							
PARTS			1.00	2	200.9384				
MODE:		NONE=LOW FD FLO/LOW STM PRES		1	200.9384	0.04	.24110-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.14470-03
		NONE=LOW FD FLO/FLAME OUT			200.9384	0.08	.16870-03	ALR TRIP/CORRECT/RESTART ALR	0.700	.11250-03
		NONE=HI FD FLO/SMOKE			200.9384	0.08	.30540-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.18320-03
		NONE=HI FD FLOW/HI STM PRES			200.9384	0.08	.15670-03	NO EFFECT	0.0	.0
		NONE=HI FD FLOW/FICSV FD			200.9384	0.02	.64360-04	EXPLOSIVE CONDITION	0.500	.32150-04
		NONE=LOW STM PRES			200.9384	0.01	.32150-04	HPC REDUCES RPM/CORRECT/RESUME	0.700	.22500-04
		NONE=HI STM PRES/STM DUMP ACT			200.9384	0.01	.32150-04	AUTO BACK-UP TAKES OVER	0.0	.0
		NONE=HI STM PRES/RUPTURE TURB			200.9384	0.00	.80190-05	EXPLOSIVE CONDITION	0.500	.2640D-05
		NONE=LOSS OF CONTROL/COMB CNTL			200.9384	0.09	.17370-03	AUTO CONTROL OUTPUT IS ERRATIC	0.600	.22830-03
		NONE=PUMP AIR/FD RATIO/SMOKE			200.9384	0.03	.10450-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.6269D-04
		NONE=PUMP AIR/FD /FICSV FD			200.9384	0.01	.18450-03	EXPLOSIVE CONDITION	0.500	.92260-04
		NONE=LOSS OF REMOTE MANUAL			200.9384	0.01	.28130-04	LOSS OF BACK-UP OR ALARM	0.400	.11250-04
		NONE=HI COMBUST AIR/SMOKE			200.9384	0.14	.54640-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.9278D-03
		NONE=HI COMBUST AIR/FLAME OUT			200.9384	0.09	.36960-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.2097D-03
		NONE=HI COMBUST AIR/LOW STEAM			200.9384	0.08	.32950-03	HPC REDUCES RPM/CORRECT/RESUME	0.700	.23060-03
		NONE=HI COMBUST AIR/SMOKE			200.9384	0.01	.40190-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.2411D-04
		NONE=LOW COMBUST AIR/SMOKE			200.9384	0.18	.70710-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.4242D-03
		NONE=LOW COMBUST AIR/FICSV FD			200.9384	0.06	.22980-03	EXPLOSIVE CONDITION	0.500	.1149D-03
		NONE=LOW COMBUST AIR/LOW STEAM			200.9384	0.02	.86390-04	HPC REDUCES RPM/CORRECT/RESUME	0.700	.5907D-04
		NONE=LOW COMBUST AIR/BLR TRIP			200.9384	0.03	.12440-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.8723D-04

		D.F.	QTY	FUNCTION FAILURE PROB. FAIL	FAIL. MODE FAIL. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	1 FUNCTIO VALVES								
PARTS		1.00	2	65.5200					
MODE1	MODE=LOW FO FLO/LOW STM PRES		1	65.5200	0.30	.39360-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.23580-03
	MODE=LOW FO FLO/FLAME OUT			65.5200	0.15	.19650-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.13760-03
	MODE=HI FO FLO/SMOKE			65.5200	0.05	.65520-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.39310-04
	MODE=HI FO FLO/HI STM PRES			65.5200	0.30	.39360-03	NO EFFECT	0.0	.0
	MODE=HI FO FLO/EXCSV FO			65.5200	0.20	.26200-03	EXPLOSIVE CONDITION	0.500	.13100-03
BLOCK	4 FUNCTIO RELAYS								
PARTS		1.00	2	0.8718					
MODE1	MODE=LOW FO FLO/LOW STM PRES		1	0.8718	0.12	.20270-05	ALARM/ACTIVATE REMOTE MANUAL	0.600	.12760-05
	MODE=LOW FO FLO/FLAME OUT			0.8718	0.14	.24420-05	BLR TRIP/CORRECT/RESTART BLR	0.700	.16890-05
	MODE=HI FO FLO/SMOKE			0.8718	0.18	.32890-05	ALARM/ACTIVATE REMOTE MANUAL	0.600	.19250-05
	MODE=HI FO FLO/HI STM PRES			0.8718	0.89	.16040-05	NO EFFECT	0.0	.0
	MODE=HI FO FLO/EXCSV FO			0.8718	0.03	.52310-04	EXPLOSIVE CONDITION	0.500	.26150-04
	MODE=LOSS OF CONTROL/COMD FUTL			0.8718	0.78	.35570-05	AUTO CONTROL OUTPUT IS ERRATIC	0.600	.21340-05
	MODE=LOSS OF PURGE/LOW AIR			0.8718	0.10	.17780-05	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/SMOKE			0.8718	0.04	.71090-06	ALARM/ACTIVATE REMOTE MANUAL	0.600	.42990-06
	MODE=HI COMBUST AIR/FLAME OUT			0.8718	0.03	.54050-06	ALARM/ACTIVATE REMOTE MANUAL	0.600	.32630-06
	MODE=HI COMBUST AIR/LOW STEAM			0.8718	0.03	.54056-06	MPC REDUCES RPM/CORRECT/RESUME	0.700	.37880-06
BLOCK	6 FUNCTIO ACTUATORS								
PARTS		1.00	2	54.4800					
MODE1	MODE=HI COMBUST AIR/SMOKE		1	54.4800	0.20	.13790-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.82750-04
	MODE=HI COMBUST AIR/FLAME OUT			54.4800	0.05	.34480-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.20690-04
	MODE=HI COMBUST AIR/LOW STEAM			54.4800	0.14	.68960-04	MPC REDUCES RPM/CORRECT/RESUME	0.700	.48270-04
	MODE=HI COMBUST AIR/SMOKE			54.4800	0.15	.10340-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.62060-04
	MODE=LOW COMBUST AIR/EXCSV FO			54.4800	0.05	.34480-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.20690-04
	MODE=LOW COMBUST AIR/EXCSV FO			54.4800	0.05	.34480-04	EXPLOSIVE CONDITION	0.500	.17240-04
	MODE=LOW COMBUST AIR/LOW STM			54.4800	0.14	.68960-04	MPC REDUCES RPM/CORRECT/RESUME	0.700	.48270-04
	MODE=LOW COMBUST AIR/BLR TRIP			54.4800	0.15	.10340-03	BLR TRIP/CORRECT/RESTART BLR	0.700	.72400-04

		QTY	FUNCTION FAILURE PROB. FRAC	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 4	FORCED TRANSDUCERS							
PARTS	1.00	1	63.8801					
MODES	MODE=LOW FD FLO/LOW STM PRES	1	63.8801	0.18	.17370-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.10420-03
	MODE=LOW FD FLOW/FLAME OUT		63.8801	0.09	.11500-03	RLR TRIP/CORRECT/RESTART RLR	0.200	.23000-04
	MODE=HI FD FLOW/SMOKE		63.8801	0.09	.11880-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.71280-04
	MODE=HI FD FLOW/HI STM PRES		63.8801	0.07	.89430-04	NO EFFECT	0.0	.0
	MODE=HI FD FLOW/EXCSV FD		63.8801	0.07	.69630-04	EXPLOSIVE CONDITION	0.500	.46710-04
	MODE=HI COMBUST AIR/SMOKE		63.8801	0.11	.13670-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.82020-04
	MODE=HI COMBUST AIR/FLAME OUT		63.8801	0.08	.10220-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.61320-04
	MODE=HI COMBUST AIR/LOW STEAM		63.8801	0.08	.10220-03	HPC REDUCES RPM/CORRECT/RESUME	0.700	.71540-04
	MODE=LOW COMBUST AIR/SMOKE		63.8801	0.22	.27980-03	ALARM/ACTIVATE REMOTE MANUAL	0.600	.16790-03
	MODE=LOW COMBUST AIR/EXCSV FD		63.8801	0.05	.70270-04	EXPLOSIVE CONDITION	0.500	.35130-04
BLOCK 6	FUNCTIO CONTROLLERS							
PARTS	1.00	2	9.9120					
MODES	MODE=HI COMBUST AIR/SMOKE	1	9.9120	0.15	.29540-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.17720-04
	MODE=HI COMBUST AIR/FLAME OUT		9.9120	0.37	.73580-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.44130-04
	MODE=HI COMBUST AIR/LOW STEAM		9.9120	0.07	.14670-04	HPC REDUCES RPM/CORRECT/RESUME	0.700	.10270-04
	MODE=HI COMBUST AIR/SMOKE		9.9120	0.11	.22080-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.13240-04
	MODE=LOW COMBUST AIR/SMOKE		9.9120	0.12	.23190-04	ALARM/ACTIVATE REMOTE MANUAL	0.600	.13900-04
	MODE=LOW COMBUST AIR/EXCSV FD		9.9120	0.03	.57490-05	EXPLOSIVE CONDITION	0.500	.28740-05
	MODE=LOW COMBUST AIR/LOW STM		9.9120	0.06	.11700-04	HPC REDUCES RPM/CORRECT/RESUME	0.700	.81970-05
	MODE=LOW COMBUST AIR/RLR TRP		9.9120	0.09	.17480-04	RLR TRIP/CORRECT/RESTART RLR	0.700	.12350-04
BLOCK 5	FUNCTIO ELECTRONIC/DRUM LVL CNTL							
PARTS	1.00	2	271.4355					
MODES	MODE=HI DRUM LVL	1	271.4355	0.39	.21310-02	ALARM/ACTIVATE REMOTE MANUAL	0.600	.12790-02
	MODE=HI DRUM LVL/SPILL TO TURB		271.4355	0.08	.23840-03	LOSS OF PROTECTIVE FEATURE	0.500	.11920-03
	MODE=LOW DRUM LVL/RLR TRIP		271.4355	0.25	.13450-02	RLR TRIP/CORRECT/RESTART RLR	0.700	.94150-03
	MODE=LOW DRUM LVL/HI STM TEMP		271.4355	0.12	.67290-03	EXPLOSIVE CONDITION	0.500	.33650-03
	MODE=LOW DRUM LVL/HI RLR TEMP		271.4355	0.08	.22800-03	EXPLOSIVE CONDITION	0.500	.11400-03
	MODE=FALSE ALARM		271.4355	0.05	.24830-01	FALSE ALARM	0.0	.0
	MODE=LOSS OF CONTROL/DRUM LVL		271.4355	0.10	.54440-03	AUTO CONTROL OUTPUT IS ERRATIC	0.600	.32670-03

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS COMBUST CNTL/BLR AND LGC

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUST CN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUST CN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
34	HPC REDUCES RPM/CORRECT/RESUME	35	.1104E-02	41.8314	2.4720	0.7000	.4632E-03	66.9267	3.7354
36	EXPLOSIVE CONDITION	37	.5450E-03	19.8967	0.9850	0.5000	.2729E-03	22.7391	1.2695
43	LOSS OF HACK-UP OR ALARM	44	.2356E-03	8.5962	0.4253	0.4000	.9423E-04	7.8513	0.4383
40	FALSE TURB TRIP/CORRECT/RESTART	40	.3311E-04	1.2067	0.0598	0.9000	.2980E-04	2.4829	0.1386
35	AUTO HACK-UP TAKES OVER	32	.5859E-05	19.8947	0.9850	0.0	.0	0.0	0.0
44	FALSE ALARM	32	.2356E-05	8.5962	0.4253	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS COMBUSTION CONTROL

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUSTION FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUSTION CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
33	ALARM/ACTIVATE REMOTE MANUAL	34	.4030E-02	54.3966	7.2748	0.6000	.2418E-02	59.9375	11.2885
34	HPC REDUCES RPM/CORRECT/RESUME	35	.7131E-03	9.6256	1.2873	0.7000	.4991E-03	12.3747	2.3215
36	EXPLOSIVE CONDITION	37	.4044E-03	11.4477	1.5604	0.5000	.2322E-03	10.7144	2.4181
30	BLR TRIP/CORRECT/RESTART BLR	35	.6058E-03	8.1772	1.0936	0.7000	.4240E-03	10.5130	1.9723
42	AUTO CONTROL OUTPUT IS ERRATIC	33	.3773E-03	5.0928	0.6811	0.6000	.2263E-03	5.6115	1.0527
60	BLR TRIP/CORRECT/RESTART BLR	23	.1150E-03	1.5520	0.2076	0.2000	.2300E-04	0.5701	0.1070
43	LOSS OF HACK-UP OR ALARM	44	.2813E-04	0.3797	0.0508	0.4000	.1125E-04	0.2790	0.0523
31	NOT APPLICABLE TO THIS PHASE	31	.1774E-05	0.0240	0.0032	0.0	.0	0.0	0.0
32	NO EFFECT	32	.6409E-03	8.6596	1.1569	0.0	.0	0.0	0.0
35	AUTO HACK-UP TAKES OVER	32	.3215E-04	0.4340	0.0580	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS RUNNER MANAGEMENT/MASTER

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF RUNNER MAN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION RUNNER MAN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
49	BLR TRIP/CORRECT/RESTART BLR	35	.1379E-02	28.1345	2.4448	0.7000	.9653E-03	64.4511	4.8895
46	LOSS OF TRIP	37	.1023E-02	14.9487	1.8543	0.5000	.5138E-03	38.3486	2.3479
34	HPC REDUCES RPM/CORRECT/RESUME	35	.1105E-04	0.1614	0.0200	0.7000	.7738E-05	0.5163	0.0360
33	ALARM/ACTIVATE REMOTE MANUAL	33	.1105E-04	0.1614	0.0200	0.6000	.6633E-05	0.4442	0.0308
31	NOT APPLICABLE TO THIS PHASE	31	.4420E-02	64.5600	7.9792	0.0	.0	0.0	0.0

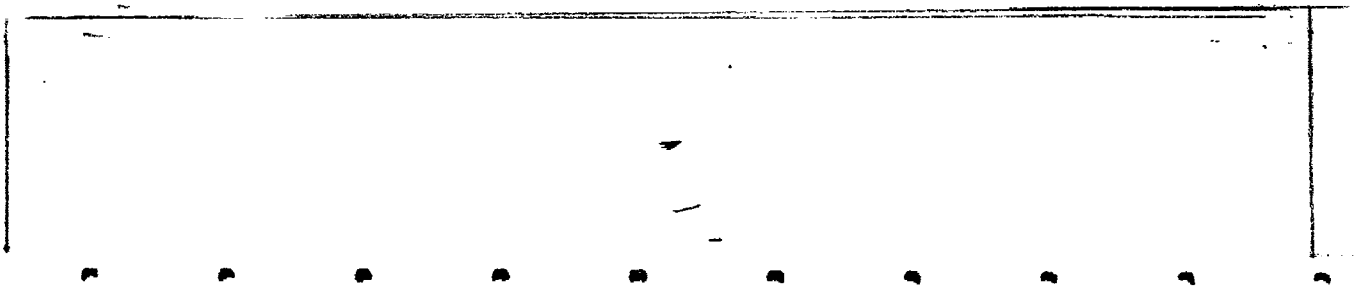
SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS BURNER MODULE

SEQ	SYSTEM EFFECT	SEF NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF BURNER MOD FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION BURNER MOD CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
33	ALARM/ACTIVATE REMOTE MANUAL	33	.3888E-02	24.1298	7.4157	0.6000	.2331E-02	58.8182	14.2843
36	LOSS OF TRIP	37	.1831E-02	12.3127	3.3057	0.5000	.9351E-03	22.7783	4.2541
39	DLY TRIP/INCORRECT/RESTART DLY	35	.1102E-02	7.4129	1.9901	0.7400	.7715E-03	19.2055	3.5285
31	NOT APPLICABLE TO THIS PHASE	31	.7061E-02	47.4712	12.7857	0.0	.0	0.0	0.0
32	NO EFFECT	32	.0924E-01	6.6746	1.7921	0.0	.0	0.0	0.0

SFF	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION ALL GROUPS CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
33	ALARM/ACTIVATE REMOTE MANUAL	33	.1359E-01	24.5375	24.5375	0.0000	.0153E-02	37.9182	37.9182
34	RLP TRIP/CORRECT/RESTART RLR	35	.5647E-02	10.2304	10.2304	0.7000	.3966E-02	18.8461	18.8461
41	NO ALARM--ONLY LIGHT/INDICATOR	37	.3656E-02	6.5998	6.5998	0.5000	.1827E-02	8.4975	8.4975
42	AUTO CONTROL OUTPUT IS ERRATIC	33	.3834E-02	5.4709	5.4709	0.6000	.1021F-02	8.4446	8.4446
58	RPC REDUCES RPP/CORRECT/RESUME	35	.2048E-02	3.7418	3.7418	0.7000	.1458F-02	6.7836	6.7836
46	LOSS OF TRIP	37	.2859E-02	5.1608	5.1608	0.5000	.1429F-02	6.6446	6.6446
36	EXPLOSIVE CONDITION	37	.2345E-02	4.2323	4.2323	0.5000	.1172E-02	5.4515	5.4515
45	LOSS OF BACK-UP OR ALARM	44	.2649E-02	4.7813	4.7813	0.4000	.1059F-02	4.9264	4.9264
57	TURN TRIP--CORRECT/RESTART RLR	40	.4929E-03	8.8897	8.8897	0.9000	.4436E-03	2.0631	2.0631
50	LOSS OF PROTECTIVE FEATURE	37	.2189E-03	8.4312	8.4312	0.5000	.1194E-03	0.5554	0.5554
48	FALSE TURN TRIP/CORRECT/RESTART	48	.3311E-04	0.0598	0.0598	0.9000	.2980F-04	0.1386	0.1386
44	RLP TRIP/CORRECT/RESTART RLR	23	.1150E-03	0.2076	0.2076	0.2400	.2760F-04	0.1070	0.1070
18	FALSE ALARM	2	.2443E-03	0.4410	0.4410	0.0	.0	0.0	0.0
31	NOT APPLICABLE TO THIS PHASE	31	.1226E-01	22.1321	22.1321	0.0	.0	0.0	0.0
32	NO EFFECT	32	.3232E-02	5.8335	5.8335	0.0	.0	0.0	0.0
35	AUTO BACKUP TAKES OVER	32	.2423E-02	4.3734	4.3734	0.0	.0	0.0	0.0
44	FALSE ALARM	32	.4707E-03	0.8496	0.8496	0.0	.0	0.0	0.0

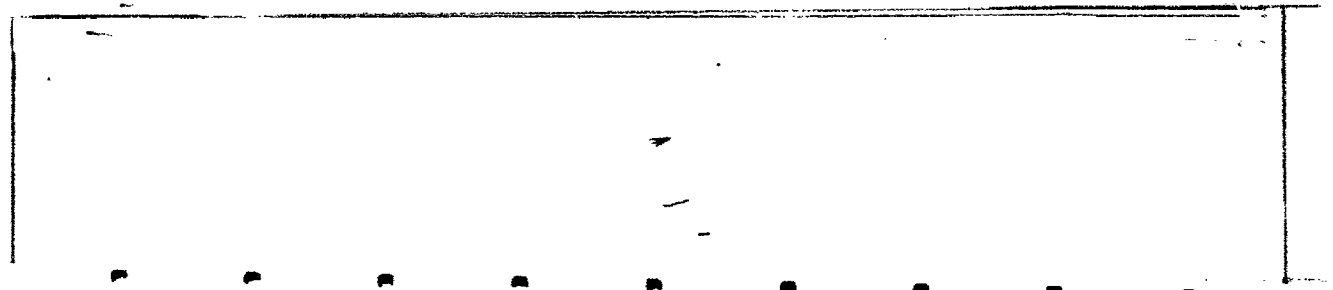
MISSION EFFECT CRITICALITY

	MISSION EFFECT	NO.	SYSTEM EFFECT FAILURE PROBABILITY	PCT. OF SYSTEM FAILURE PROBABILITY	MISSION LOSS PROBABILITY	MISSION CRITICALITY	PERCENT CONTRIBUTION TO MISSION CRITICALITY
33	SMALL PERFORMANCE DEGRADATION	1	.1443E-01	38.87	.4000	.9973E-02	44.39
35	TEMPORARY REDUCED RPMS	2	.7751E-02	13.99	.7000	.5424E-02	25.23
37	POSSIBLE RLP/TURN DAMAGE	3	.4698E-02	16.42	.5000	.4567E-02	21.15
58	BACK-UP FAILURE	4	.2648F-02	4.781	.4000	.1059E-02	4.927
40	TEMPORARY DIM	5	.5268F-03	.9895	.9000	.4734E-03	2.202
23	SLIGHT DELAY IN LIGHT-OFF	6	.1150E-03	.2076	.2000	.2304E-04	.1070
31	NOT APPLICABLE/MANEUVERING	31	.1226F-01	22.13	.0	.0	.0
32	NO EFFECT	32	.6125F-02	11.06	.0	.0	.0
2	NO EFFECT	35	.2443E-03	.4410	.0	.0	.0



		D.C.	QTY	FUNCTION FAILURE PROB. FAIL	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK	1	FUNCTIO ELECTRONIC/PNEU NOT MST							
PARTS			1.00	2	134,1402				
MODE1		MODE=LOSS OF PURGE		1	134,1402	0.49	.9837D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.3615D-02
		MODE=INADVERTENT PURGE			134,1402	0.01	.7059D-05	LIGHT-OFF INHIBITS OR ABORTED	0.480	.7823D-03
		MODE=LIGHT-OFF LOGIC FAILURE			134,1402	0.25	.2264D-01	LIGHT-OFF INHIBITS OR ABORTED	0.480	.4955D-02
		MODE=LOSS OF TRIP			134,1402	0.07	.7337D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.2935D-02
		MODE=INADVERTENT PURGE			134,1402	0.01	.8846D-03	LIGHT-OFF INHIBITS OR ABORTED	0.480	.3227D-03
		MODE=LOSS/INADEQUATE RECRC			134,1402	0.06	.6034D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.2418D-02
		MODE=FALSE TRIP			134,1402	0.11	.1133D-01	LIGHT-OFF INHIBITS OR ABORTED	0.480	.4538D-02
		MODE=FDTV CLOSES OR CAN'T OPEN			134,1402	0.12	.1243D-01	LIGHT-OFF INHIBITS OR ABORTED	0.480	.4972D-02
		MODE=FDTV CLOSES OR CAN'T OPEN			134,1402	0.12	.1243D-01	LIGHT-OFF INHIBITS OR ABORTED	0.480	.4972D-02
		MODE=FDTV OPEN OR CAN'T CLOSE			134,1402	0.02	.1713D-02	EXPLOSIVE CONDITION	0.500	.8567D-03
		MODE=FDTV OPEN OR CAN'T CLOSE			134,1402	0.02	.1713D-02	EXPLOSIVE CONDITION	0.500	.8567D-03
		MODE=FDTV OPEN OR CAN'T CLOSE			134,1402	0.02	.1713D-02	EXPLOSIVE CONDITION	0.500	.8567D-03
		MODE=LOSS OF BOILER TRIP			134,1402	0.02	.2418D-02	LOSS OF TRIP	0.500	.1209D-02
		MODE=LOSS OF PURGE TIMER			134,1402	0.04	.3026D-02	EXPLOSIVE CONDITION	0.500	.1513D-02
		MODE=PURGE INTITIATED/NO INHBT			134,1402	0.00	.3026D-03	EXPLOSIVE CONDITION	0.500	.1513D-03
		MODE=AIR FLOWE TO PURGE LEVEL			134,1402	0.01	.1310D-02	EXPLOSIVE CONDITION	0.500	.6552D-03
		MODE=AIR FLOW TO PURGE LEVEL			134,1402	0.01	.1411D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.5645D-03
		MODE=FD FLD LIGHT LVL/LOW STM			134,1402	0.00	.0034D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FD FLD LIGHT LVL/NO FLAME			134,1402	0.00	.0034D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
		MODE=FD RECRC WITH FDTV CLOSED			134,1402	0.02	.2015D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.8062D-03
		MODE=FD RECRC INHBT SUPPRESSED			134,1402	0.00	.2017D-03	LIGHT-OFF INHIBITS OR ABORTED	0.480	.8069D-04
BLOCK	1	FUNCTIO SWITCHES								
PARTS			1.00	2	70,9200					
MODE1		MODE=LOSS OF PURGE		1	70,9200	0.11	.5821D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.2169D-02
		MODE=LOSS OF TRIP			70,9200	0.09	.4752D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.1801D-02
		MODE=LOSS/INADEQUATE RECRC			70,9200	0.13	.6811D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.2724D-02
		MODE=LOSS OF BOILER TRIP			70,9200	0.47	.3414D-01	LOSS OF TRIP	0.500	.1707D-01
BLOCK	1	FUNCTIO RELAYS								
PARTS			1.00	2	2,3046					
MODE1		MODE=LOSS OF PURGE		1	2,3046	0.48	.1682D-03	LIGHT-OFF INHIBITS OR ABORTED	0.480	.6729D-04
		MODE=FALSE TRIP			2,3046	0.01	.1851D-04	LIGHT-OFF INHIBITS OR ABORTED	0.480	.7402D-05
		MODE=LOSS OF BOILER TRIP			2,3046	0.20	.1347D-03	LOSS OF TRIP	0.500	.1674D-03
		MODE=FD RECRC WITH FDTV CLOSED			2,3046	0.79	.1327D-02	LIGHT-OFF INHIBITS OR ABORTED	0.480	.5306D-03
BLOCK	1	FUNCTIO VALVES								
PARTS			1.00	2	131,0480					
MODE1		MODE=LOSS/INADEQUATE PURGE		1	131,2480	0.50	.4670D-01	LIGHT-OFF INHIBITS OR ABORTED	0.480	.1868D-01
		MODE=FDTV CLOSES OR CAN'T OPEN			131,0480	0.25	.2363D-01	LIGHT-OFF INHIBITS OR ABORTED	0.480	.9452D-02
		MODE=FDTV OPEN OR CAN'T CLOSE			131,0480	0.25	.2363D-01	EXPLOSIVE CONDITION	0.500	.1182D-01

		U.C.	QTY	FUNCTION FAILURE PROB. FACT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 2	FUNCTIO ELECTRONIC/ANP MODULE								
PARTS		1.00	4	270.6858					
MODE1	MODE=RHR LTOFF LOGIC FAILS		1	270.6858	0.02	.67310-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1093D-02
	MODE=IGNITOR FAILURE			270.6858	0.04	.11280-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.4488D-02
	MODE=FALSE TRIP			270.6858	0.07	.1315D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.5261D-02
	MODE=LOSS OF TRIP			270.6858	0.02	.39540-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1578D-02
	MODE=FLAME INDICATOR PROBLEM			270.6858	0.01	.15860-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.6318D-03
	MODE=20 SEC TIMER/TIMES LONG			270.6858	0.00	.1446D-01	EXPLOSIVE CONDITION	0.500	.8231D-02
	MODE=RHR VLV 5 SEC SNTCH FAIL			270.6858	0.00	.1401D-01	EXPLOSIVE CONDITION	0.500	.7953D-02
	MODE=RHR VLV 20 SEC SNTCH FAIL			270.6858	0.05	.1883D-01	EXPLOSIVE CONDITION	0.500	.5018D-02
	MODE=AR CLOSES OR CANT OPEN			270.6858	0.01	.1974D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.7896D-03
	MODE=IGNITOR NOT WITHDRAWN			270.6858	0.05	.9068D-02	EXPLOSIVE CONDITION	0.500	.6524D-02
	MODE=AR OPENS OR CANT CLOSE			270.6858	0.01	.1974D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.7896D-03
	MODE=RHR VLV CLOSES/CANT OPEN			270.6858	0.01	.1974D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.7896D-03
	MODE=IGNITOR EXTENDED			270.6858	0.01	.1974D-02	EXPLOSIVE CONDITION	0.500	.9870D-03
	MODE=IGNITOR CANT BE EXTENDED			270.6858	0.01	.1974D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.7896D-03
	MODE=FALSE MINOR TRIP			270.6858	0.20	.5454D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1542D-01
	MODE=RHR VLV OPENS/CANT CLOSE			270.6858	0.01	.1974D-02	EXPLOSIVE CONDITION	0.500	.9870D-03
	MODE=RHR FAILS TO TRIP/AR CLOS			270.6858	0.02	.3558D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1423D-02
	MODE=RHR FAILS TO TRIP/NO FLAME			270.6858	0.27	.5252D-01	LOSS OF TRIP	0.500	.2626D-01
	MODE=RHR FAILS TO TRIP/RHR CLS			270.6858	0.02	.3354D-02	LOSS OF TRIP	0.500	.1677D-02
BLOCK 2	FUNCTIO SWITCHES								
PARTS		1.00	4	186.6424					
MODE1	MODE=IGNITOR FAILURE		1	186.6424	0.10	.1403D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.7411D-02
	MODE=LOSS OF TRIP			186.6424	0.26	.3507D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1483D-01
	MODE=RHR VLV 20 SEC SNTCH FAIL			186.6424	0.07	.9402D-02	EXPLOSIVE CONDITION	0.500	.4746D-02
	MODE=RHR VLV CLOSES/CANT OPEN			186.6424	0.25	.3294D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1318D-01
	MODE=FALSE RHR TRIP			186.6424	0.14	.1881D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.7611D-02
	MODE=RHR FAILS TO TRP/AR CLOSE			186.6424	0.07	.9402D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.3791D-02
	MODE=RHR FAILS TO TRP/RHR CLS			186.6424	0.07	.9402D-02	LOSS OF TRIP	0.500	.4746D-02
BLOCK 2	FUNCTIO VALVES								
PARTS		1.00	4	131.0400					
MODE1	MODE=RHR VLV CLOSES/CANT OPEN		1	131.0400	0.50	.4670D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1868D-01
	MODE=RHR VLV OPENS/CANT CLOSE			131.0400	0.50	.4670D-01	EXPLOSIVE CONDITION	0.500	.2335D-01
BLOCK 2	FUNCTIO RELAYS								
PARTS		1.00	4	17.2400					
MODE1	MODE=RHR LTOFF LOGIC FAILS		1	17.2400	0.33	.6195D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1678D-02
	MODE=IGNITOR FAILURE			17.2400	0.12	.1522D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.6087D-03
	MODE=LOSS OF TRIP			17.2400	0.21	.2652D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1061D-02
	MODE=IGNITOR CANT BE EXTENDED			17.2400	0.33	.8195D-02	LIGHT-OFF INHIBITS OR ABORTED	0.400	.1678D-02
BLOCK 2	FUNCTIO TRANSFORMERS								
PARTS		1.00	4	0.1600					
MODE1	MODE=IGNITOR FAILURE		1	0.1600	1.00	.1160D-03	LIGHT-OFF INHIBITS OR ABORTED	0.400	.4632D-04
BLOCK 2	FUNCTIO ACTUATORS								
PARTS		1.00	4	137.9200					
MODE1	MODE=AR CLOSES OR CANT OPEN		1	137.9200	0.25	.2486D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.9943D-02
	MODE=AR OPENS OR CANT CLOSE			137.9200	0.25	.2486D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.9943D-02
	MODE=IGNITOR EXTENDED			137.9200	0.25	.2486D-01	EXPLOSIVE CONDITION	0.500	.1243D-01
	MODE=IGNITOR CANT BE EXTENDED			137.9200	0.25	.2486D-01	LIGHT-OFF INHIBITS OR ABORTED	0.400	.9943D-02



				FUNCTION FAILURE PROB. FRAT	FAIL. MODE FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 4	FUNCTIO ELECTRONIC/COMBUST CNTL ALR AND LO								
PARTS		1.00	1	43.6739					
MODE:	MODE=LOW STM PRES		1	43.6739	0.32	.14950-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI STM PRES/STM DUMP ACT			43.6739	0.14	.64860-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI STM PRES/RUPTURE TUBE			43.6739	0.14	.64860-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FALSE ALARM			43.6739	0.19	.85620-02	FALSE ALARM	0.200	.1712D-02
	MODE=ALARM FAILS			43.6739	0.19	.85620-02	LOSS OF BACK-UP OR ALARM	0.666	.5625D-02
	MODE=FALSE TURBINE TRIP			43.6739	0.03	.12000-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 5	FUNCTIO TRANSDUCERS								
PARTS		1.00	1	73.5200					
MODE:	MODE=LOW STM PRES		1	73.5200	0.58	.26480-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI STM PRES/STM DUMP ACT			73.5200	0.25	.1135D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI STM PRES/RUPTURE TUBE			73.5200	0.29	.1335D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 6	FUNCTIO ELECTRONIC/COMBUST CNTL								
PARTS		1.00	2	200.9384					
MODE:	MODE=LOW FD FLO/LOW STM PRES		1	200.9384	0.06	.87620-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW FD FLO/FLAME OUT			200.9384	0.04	.5950D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLO/SMOKE			200.9384	0.46	.1100D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLOW/HI STM PRES			200.9384	0.04	.5704D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLOW/EXCSV FD			200.9384	0.02	.2384D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW STM PRES			200.9384	0.01	.1173D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI STM PRES/STM DUMP ACT			200.9384	0.01	.1173D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI STM PRES/RUPTURE TUBE			200.9384	0.08	.1467D-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF CONTROL/COMB CNTL			200.9384	0.09	.1335D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=POOR AIR/FD RATIO/SMOKE			200.9384	0.03	.3667D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=POOR AIR/FD /EXCSV FD			200.9384	0.03	.3667D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF REMOTE MANUAL			200.9384	0.01	.1026D-02	LOSS OF BACK-UP OR ALARM	0.666	.6835D-03
	MODE=HI COMBUST AIR/SMOKE			200.9384	0.14	.1775D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/FLAME OUT			200.9384	0.09	.1264D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/LOW STEAM			200.9384	0.08	.1196D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/SMOKE			200.9384	0.01	.1466D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/SMOKE			200.9384	0.18	.2547D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/EXCSV FD			200.9384	0.06	.8326D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/LOW STEAM			200.9384	0.02	.3476D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/ALR TRIP			200.9384	0.03	.4537D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 7	FUNCTIO VALVES								
PARTS		1.00	2	65.5288					
MODE:	MODE=LOW FD FLO/LOW STM PRES		1	65.5288	0.38	.1425D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW FD FLO/FLAME OUT			65.5288	0.15	.7149D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLO/SMOKE			65.5288	0.45	.2385D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLO/HI STM PRES			65.5288	0.38	.1425D-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLO/EXCSV FD			65.5288	0.28	.9520D-02	NOT APPLICABLE TO THIS PHASE	0.0	.0

		D.C.	QTY	FUNCTION FAILURE PROB. FRAT	FAIL. PROOF FREQ. RATIO	FAIL. MODE FAIL. PROB.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 4	FUNCTIO TRANSDUCERS								
PARTS		1.00	1	43.8401					
MODE 1	MODE=LOW FD FLO/LOW STM PRES		1	43.8401	0.14	.61220E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW FD FLOW/FLAME OUT			43.8401	0.09	.41880E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLOW/SMOKE			43.8401	0.09	.41220E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLOW/HI STM PRES			43.8401	0.07	.32560E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLOW/EXCSV FD			43.8401	0.07	.32560E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/SMOKE			43.8401	0.11	.49770E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/FLAME OUT			43.8401	0.08	.37260E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/LOW STEAM			43.8401	0.08	.37260E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/SMOKE			43.8401	0.22	.10160E-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/EXCSV FD			43.8401	0.05	.25620E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 6	FUNCTIO CONTROLLERS								
PARTS		1.00	2	9.9120					
MODE 1	MODE=HI COMBUST AIR/SMOKE		1	9.9120	0.15	.19780E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/FLAME OUT			9.9120	0.11	.26810E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/LOW STEAM			9.9120	0.07	.53530E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/SMOKE			9.9120	0.11	.80280E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/SMOKE			9.9120	0.12	.85350E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/EXCSV FD			9.9120	0.03	.20980E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/LOW STM			9.9120	0.06	.42660E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW COMBUST AIR/BLR TRP			9.9120	0.09	.64380E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
BLOCK 5	FUNCTIO ELECTRONIC/DRUM LVL CNTL								
PARTS		1.00	2	271.4355					
MODE 1	MODE=HI DRUM LVL		1	271.4355	0.39	.78920E-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI DRUM LVL/SPILL FD TURN			271.4355	0.08	.86810E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW DRUM LVL/BLR TRIP			271.4355	0.25	.67950E-01	LIGHT-OFF INHIBITS OR ABORTED	0.480	.19180E-01
	MODE=LOW DRUM LVL/HI STM TEMP			271.4355	0.12	.24270E-01	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW DRUM LVL/HI BLR TEMP			271.4355	0.04	.82880E-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=FALSE ALARM			271.4355	0.05	.88770E-02	FALSE ALARM	0.200	.17750E-02
	MODE=LOSS OF CONTROL/DRUM LVL			271.4355	0.10	.20480E-01	AUTO CONTROL OUTPUT IS ERRATIC	0.200	.40790E-02
BLOCK 4	FUNCTIO RELAYS								
PARTS		1.00	2	8.8718					
MODE 1	MODE=LOW FD FLO/LOW STM PRES		1	8.8718	0.12	.77640E-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOW FD FLO/FLAME OUT			8.8718	0.16	.10370E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLO/SMOKE			8.8718	0.18	.11710E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLO/HI STM PRES			8.8718	0.09	.58550E-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI FD FLO/EXCSV FD			8.8718	0.03	.19490E-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF CONTROL/COMB CNTL			8.8718	0.20	.12980E-03	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=LOSS OF PURGE/LOW AIR			8.8718	0.18	.64910E-04	EXPLOSIVE CONDITION	0.500	.32460E-04
	MODE=HI COMBUST AIR/SMOKE			8.8718	0.04	.26690E-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/FLAME OUT			8.8718	0.03	.19750E-04	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE=HI COMBUST AIR/LOW STEAM			8.8718	0.03	.19750E-04	NOT APPLICABLE TO THIS PHASE	0.0	.0

		D.C.	QTY	FUNCTION FAILURE PROB. FRAT	FAIL. MODE FREQ. RATIO	FAIL. MODE PROB. FAIL.	SYSTEM EFFECT	MISSION LOSS PROB.	MISSION CRITICALITY (C)
BLOCK 4	FUNCTIO ACTUATORS	1.00	2	34.0000					
PASS			1	34.0000	0.20	.58219-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
MODE1	MODE#M1 COMBUST AIR/SMOKE			34.0000	0.05	.12548-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE#M1 COMBUST AIR/FLAME OUT			34.0000	0.10	.25140-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE#M1 COMBUST AIR/LOW STEAM			34.0000	0.15	.37680-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE#M1 COMBUST AIR/SMOKE			34.0000	0.05	.12548-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE#LOW COMBUST AIR/EXCSV FD			34.0000	0.05	.1254A-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE#LOW COMBUST AIR/EXCSV FD			34.0000	0.10	.25140-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE#LOW COMBUST AIR/LOW BTH			34.0000	0.15	.37680-02	NOT APPLICABLE TO THIS PHASE	0.0	.0
	MODE#LOW COMBUST AIR/ALR TRIP								

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS BURNER MANAGEMENT/MASTER

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF BURNER MAN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION BURNER MAN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
77	LIGHT-OFF INHIBITS OR ABORTED	24	.1171	70.8347	8.7575	0.6000	.7042E-01	64.2920	10.4542
76	LOSS OF TRIP	25	.3769E-01	18.9987	1.0543	0.5000	.1885E-01	17.4450	3.0622
66	EXPLOSIVE CONDITION	25	.3461E-01	13.8837	1.7115	0.5000	.1716E-01	16.2922	3.4917
61	NOT APPLICABLE TO THIS PHASE	21	.8073E-03	0.3220	0.0398	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS BURNER MODULE

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF BURNER MOD FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION BURNER MOD CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
77	LIGHT-OFF INHIBITS OR ABORTED	24	.3388	62.4624	16.7546	0.6000	.1357	57.1059	27.9827
66	EXPLOSIVE CONDITION	25	.1375	25.2854	6.7498	0.5000	.6772E-01	28.4935	14.1743
76	LOSS OF TRIP	25	.4688E-01	12.3121	3.3057	0.5000	.3268E-01	13.9626	6.8021

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VS COMBUST CNTL/PLR BMD LOG

SFE	SYSTEM EFFECT	SFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUST CN FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUST CN CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
73	LOSS OF BACK-UP OR ALARM	24	.4598E-02	0.5862	0.4255	0.6000	.3429E-02	66.6667	6.7176
74	FALSE ALARM	25	.4598E-02	0.5862	0.4253	0.2000	.1712E-02	33.3333	0.3545
61	NOT APPLICABLE TO THIS PHASE	21	.6295E-01	82.8277	8.1025	0.0	.0	0.0	0.0

SYSTEM EFFECT CRITICALITY SUMMARY FOR ALL GROUPS VB COMBUSTION CONTROL

SFE	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF COMBUSTION FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION COMBUSTION CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
75	LOSS OF BACK-UP OR ALARM	24	.1877E-02	8.3797	0.0588	0.4000	.8185E-03	92.6738	0.0859
64	EXPLOSIVE CONDITION	25	.6891E-03	0.3280	0.3032	0.5000	.3284E-03	7.3278	0.0068
61	NOT APPLICABLE TO THIS PHASE	21	.2693	90.5963	13.3195	0.0	.0	0.0	0.0

SFE	SYSTEM EFFECT	MFE NO.	SYSTEM EFFECT FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	PERCENT OF ALL GROUPS FAILURE PROBABILITY	MISSION LOSS PROB.	SYSTEM CRITICALITY	PERCENT OF CONTRIBUTION ALL GROUPS CRITICALITY	PERCENT OF CONTRIBUTION TO ALL GROUPS CRITICALITY
77	LIGHT-OFF INHIBITS OR ABORTED	28	.6364	31.1988	31.1988	0.4000	.2498	92.1269	92.1269
64	EXPLOSIVE CONDITION	25	.1919	9.4930	9.4930	0.5000	.9484E-01	10.4644	10.4644
74	LOSS OF TRIP	25	.1483	5.1600	5.1600	0.5000	.5113E-01	10.7083	10.7083
75	LOSS OF BACK-UP OR ALARM	24	.9468E-01	4.7813	4.7813	0.4000	.3834E-01	8.9271	8.9271
72	AUTO CONTROL OUTPUT IS ERRATIC	23	.9781E-01	4.7988	4.7988	0.2000	.1915E-01	4.0803	4.0803
34	RLM TRIP/CORRECT/RESTART RLR	35	.1866E-01	0.9228	0.9228	0.7000	.1306E-01	2.7207	2.7207
76	FALSE ALARM	23	.3839E-01	1.5629	1.5629	0.2000	.6853E-02	1.2673	1.2673
63	ALARM/ACTIVATE REMOTE MANUAL	24	.1825E-01	0.5672	0.5672	0.8000	.4891E-02	0.9566	0.9566
67	TURN TRIP--CORRECT/RESTART RLR	23	.1825E-01	0.5672	0.5672	0.2000	.2046E-02	0.4283	0.4283
61	NOT APPLICABLE TO THIS PHASE	21	.8042	39.7720	39.7720	0.0	.0	0.0	0.0
62	NO EFFECT	22	.5426E-02	0.2682	0.2682	0.0	.0	0.0	0.0
65	AUTO BACK-UP TAKES OVER	22	.2178E-01	1.0771	1.0771	0.0	.0	0.0	0.0

MISSION EFFECT CRITICALITY

MISSION EFFECT	NO.	SYSTEM EFFECT FAILURE PROBABILITY	PCT. OF SYSTEM FAILURE PROBABILITY	MISSION LOSS PROBABILITY	MISSION CRITICALITY	PERCENT CONTRIBUTION TO MISSION CRITICALITY
26	DELAY IN LIGHT-OFF	1	.7376	36.48	.2650	.2916	41.01
29	POSSIBLE BOILER DAMAGE	2	.2965	14.65	.5000	.1480	20.76
23	SLIGHT DELAY IN LIGHT-OFF	3	.1377	6.809	.2000	.2724E-01	3.784
39	TEMPORARY REDUCED RPMS	4	.1866E-01	.9228	.7000	.1306E-01	2.721
21	NOT APPLICABLE/LIGHT-OFF	21	.8042	39.77	.0	.0	.0
22	NO EFFECT	22	.2741E-01	1.365	.0	.0	.0