

ORDER FOR SUPPLIES OR SERVICES

PAGE 1 OF 10 PAGES

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

1. DATE OF ORDER 01/04/2010		2. CONTRACT NO. (If any) HSCG23-06-D-ARB001		6. SHIP TO:		
3. ORDER NO. HSCG23-10-J-ARP083		4. REQUISITION/REFERENCE NO. 2410230ARP083		a. NAME OF CONSIGNEE RB-M PROJECT RESIDENT OFFICE		
5. ISSUING OFFICE (Address correspondence to) ADMINISTRATIVE CONTRACTING OFFICE 1600 ELY STREET, MARINETTE, WI 54143				b. STREET ADDRESS 7848 SOUTH 202 ND STREET		
7a. NAME OF CONTRACTOR Marinette Marine Corporation		c. CITY KENT		d. STATE WA	e. ZIP CODE 98032	
b. COMPANY NAME				f. SHIP VIA		
c. STREET ADDRESS 1600 Ely Street				8. TYPE OF ORDER		
d. CITY Marinette	e. STATE WI	f. ZIP CODE 54143		[] a. PURCHASE REF YOUR: _____ Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated.		[X] b. DELIVERY -- Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.
9. ACCOUNTING AND APPROPRIATION DATA 2A3T 028000130408/72209/2696/TA2PROTNG/DEF.TASK				10. REQUISITIONING OFFICE USCG HEADQUARTERS CG-9		

11. BUSINESS CLASSIFICATION (Check appropriate box(es))

a. SMALL b. OTHER THAN SMALL c. DISADVANTAGED d. WOMEN-OWNED

12. F.O.B. POINT Destination		14. GOVERNMENT B/L NO.	15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date)	16. DISCOUNT TERMS See Basic Contract
13. PLACE OF				
a. INSPECTION Destination	b. ACCEPTANCE Destination			

17. SCHEDULE (See reverse for Rejections)

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
0001	This Task Order, under IDIQ Contract HSCG23-06-D-ARB001, establishes a time period and Not-to-Exceed (NTE) value for Maintenance and Electrical/Control Familiarization in accordance with the attached Scope of Work. Time and Materials CLIN 4007 Technical Service The NTE amount for this order is \$17,500. After the establishment of final costs under this Task Order, a Modification will be issued to deobligate excess funds. Period of Performance is 12 January 2010 – 14 January 2010.	1			NOT-TO-EXCEED (NTE) \$17,500	

SEE BILLING INSTRUCTIONS ON REVERSE	18. SHIPPING POINT	19. GROSS SHIPPING WEIGHT	20. INVOICE NO.		17(h) (Cont. pages)
	21. MAIL INVOICE TO:				
	a. NAME				
	b. STREET ADDRESS (or P.O. Box) See Basic Contract				
	c. CITY	d. STATE	e. ZIP CODE		17(i) GRAND TOTAL
					NTE \$17,500

22. UNITED STATES OF AMERICA BY (Signature)

23. NAME (Typed)
GAIL S. THOMAS
CONTRACTING OFFICER

Scope of Work for Technical Service under CLIN 4007 Task Order

Maintenance and Electrical/Control Familiarization at the RB-M Project Resident Office (PRO) Kent, Washington

1. [Orig] Background

1.1 [Orig] The RB-M project requires system familiarization of the Propulsion Control System to orient them to the unique aspects of the Vector Control system. Day 1 and 3 Class size will be approximately 10-12 RB-M maintenance personnel from various Coast Guard Commands. Familiarization information and technical information will be provided by a Marinette Marine Corporation (MMC) representative, Kvichak Marine Industries (KMI) representative, and Vector Controls instructor. Day 2 familiarization will involve 6 Coast Guard personnel in addition to a Contractor provided coxswain, MMC representative, KMI representative, and Vector Controls instructor. All required computer resources, copies of technical data related to the Vector Controls system that is currently available in the Interactive Electronic Technical Publication (IETP) and drawings will be provided by the Coast Guard. The Contractor representatives and Vector Controls instructor shall prepare and provide any additional technical presentations and handouts necessary to support the agenda. The Government's liability is limited to travel and per diem costs only for the MMC representative and only 8 hours of time at the CLIN 4007 KMI Contract rate for the KMI representative. Material costs to include fuel used for underway demonstrations.

2. [Orig] Requirements

2.1 [Orig] Duration – The Contractor shall provide on-site technical support, and a Vector Controls instructor for Propulsion System familiarization on the RB-M, under CLIN 4007, for 2 ½ days at the PRO facility in Kent, Washington and on Hull 45618 in Tacoma, Washington. The period of performance shall be Tuesday, January 12, 2010 to Thursday, January 14, 2010. Familiarization will begin at 0800 and normally conclude at 1600 (1200 on January 14, 2010). Familiarization may extend beyond 1600 (1200) at the discretion of the Contracting Officer's Technical Representative (COTR).

2.2 [Orig] Agenda

2.2.1. Day 1 – Classroom – January 12, 2010

2.2.1.1 System Design (Estimate (Est.) 2 hours): Review system design to include all functionality, components, software/firmware and designed redundancy and safety features of system.

2.2.1.2 System Installation (Est. 1 hour): Review System commissioning requirements prior to initial delivery including set-up procedures, calibration and software settings and special tools.

2.2.1.3 System Maintenance (Est. 1 hour): Review existing approved and draft preventative and remove/replace maintenance procedures.

2.2.1.4 System Troubleshooting and Repair (Est. 4 hours): Review system fault codes and alarms. Review failure modes listed in enclosure (1) including initial casualty response, follow on trouble shooting actions and eventual diagnostics

and repair for each failure mode. Note the Government has added failure modes and comments to the original Vector Failure Modes Effect Analysis (FMEA) document, which are to be reviewed as part of this training.

2.2.2 Day 2 – Classroom/Underway – January 13, 2010

2.2.2.1 Review of system commissioning process with demonstration of software set-up. (Est. 1 hour)

2.2.2.2 Demonstrate failure modes while underway for all modes highlighted in enclosure (1). Items not highlighted, do not require demonstration underway. (Est. 7 hours)

2.2.3 Day 3 - Classroom/Underway – January 14, 2010

2.2.3.1 Finish underway familiarization (if necessary).

2.2.3.2 Summarize information from Day 1 and Day 2 and address questions. (Est. 2 hours)

2.2.3.3 Review design differences between RB-M control system and vector control systems installed on similar designs. (Est. 1 hour)

2.2.3.4 Review Training programs provided by Vector for operators and maintainers of boats with similar control systems. Include examples of training agendas for both initial and follow-on training. (Est. 1 hour)

FMEA Work Sheet
 Vector Controls, Inc.
 Project: RB-M
Subsystem: Engine RPM Control System
 Ref: Engine RPM Control System Block Diagram

Equipment Name	Function	ID No.	Failure Mode	Failure Cause	Failure Effect		Failure Detection	Central Alarm Panel Display	Corrective Action	Severity of Failure Effect	CG Severity of Failure Effect	Test Method	CG Test Method	CG RPM Result	CG Control Result
					Local effect	End Effect									
Joystick 1	Engine RPM control interface	E1	Loss of output	Sensor Failure	Loss of control at the joystick	Port & Stbd go to idle	"- summary alarm" "- LCD Display"	ST1 Joy X, ST1 Joy Y	Transfer Stations or switch to Backup	minor	minor	Disconnect Pot wiper	Disconnect JX1A	Dropped to idle (650)	Loss of bucket control. Steering control available
unable to perform		E1	Fails out of tolerance (high)	Sensor Failure	Loss of control at the joystick	Port & Stbd go to idle	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup	minor		Disconnect - Pot lead			
unable to perform		E1	Fails out of tolerance (low)	Sensor Failure	Loss of control at the joystick	Port & Stbd go to idle	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup	minor		Disconnect + Pot lead			
Joystick 2	Engine RPM control interface	E2	Loss of output	Sensor Failure	Loss of control at the joystick	Port & Stbd go to idle	"- summary alarm" "- LCD Display"	ST2 Joy X, ST2 Joy Y	Transfer Stations or switch to Backup	minor	minor	Disconnect Pot wiper	Disconnect JX2A	Dropped to idle (650)	Loss of bucket control. Steering control available
unable to perform		E2	Fails out of tolerance (high)	Sensor Failure	Loss of control at the joystick	Port & Stbd go to idle	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup	minor		Disconnect - Pot lead			
unable to perform		E2	Fails out of tolerance (low)	Sensor Failure	Loss of control at the joystick	Port & Stbd go to idle	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup	minor		Disconnect + Pot lead			
Processing Unit	CPU	E5	Loss of output	Hardware failure	Loss of control in Auto Mode	Loss of control in Auto Mode	"- summary alarm, RS232 fault on LCD display"	All alarms. Disconnecting P1 indicates an RS232 fault	Switch to Backup	minor	monor	Remove P1 & P2 Connectors	Remove P1 & P2 Connectors	Dropped to idle (650)	Loss of all controls. Tiller maintained last commanded position
		E5	Loss of output	Power Failure	Loss of control in Auto Mode	Loss of control in Auto Mode	"- summary alarm, RS232 fault on LCD display"	RS232 fault	Switch to Backup	minor	minor	Secure 24V (EP1) power feed at distribution panel	Secure VP2	Dropped to idle (650)	Loss of all controls. Tiller maintained last commanded position
Power Failure	Control System Power Supply	EP1	Loss of Supply	Power Failure	Control Unit Shuts Down	Hydraulic actuators fail "as is" and engine RPM goes to idle.	"- summary alarm, RS232 fault on LCD display, Nonresponsive Controls"	RS232 fault	Switch to Backup Control (Powered by different source)	minor	minor	Remove power from controller	Secure VP2	Dropped to idle (650)	Loss of all controls. Tiller maintained last commanded position

FMEA Work Sheet
 Vector Controls, Inc.
 Project: RB-M
Subsystem: Reversing Bucket Control System
 Ref: Reversing Bucket Control System Block Diagram

Equipment Name	Function	ID No.	Failure Mode	Failure Cause	Failure Effect		Failure Detection	Central Alarm Panel Display	Corrective Action	Result of Failure Effect	CG Result of Failure Effect	Test Method	CG Test Method	CG RPM Result	CG Control Result	Notes
					Local effect	End Effect										
Joystick 1	Reversing Bucket Control interface	R1	Loss of output	Sensor Failure	Loss of control at the joystick	Port & Stbd buckets are frozen in last commanded position	"- summary alarm" "- LCD Display"	ST1 Joy X, ST1 Joy Y	Transfer Stations or switch to Backup	minor	minor	Disconnect Pot wiper	JX1A	Dropped to idle (650)	Loss of bucket control. Steering control available	Bucket transducer wiring needs strain relief.
unable to perform		R1	Fails out of tolerance (high)	Sensor Failure	Loss of control at the joystick	Port & Stbd buckets are frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup			Disconnect - Pot lead				
unable to perform		R1	Fails out of tolerance (low)	Sensor Failure	Loss of control at the joystick	Port & Stbd buckets are frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup			Disconnect + Pot lead				
Joystick 2	Reversing Bucket Control interface	R2	Loss of output	Sensor Failure	Loss of control at the joystick	Port & Stbd buckets are frozen in last commanded position	"- summary alarm" "- LCD Display"	ST2 Joy X, ST1 Joy Y	Transfer Stations or switch to Backup	minor	minor	Disconnect Pot wiper	JX2A	Dropped to idle (650)	Loss of bucket control. Steering control available	Bucket transducer wiring needs strain relief.
unable to perform		R2	Fails out of tolerance (high)	Sensor Failure	Loss of control at the joystick	Port & Stbd buckets are frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup			Disconnect - Pot lead				
unable to perform		R2	Fails out of tolerance (low)	Sensor Failure	Loss of control at the joystick	Port & Stbd buckets are frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Stations or switch to Backup			Disconnect + Pot lead				
Port Prop. Valve (up)	Electro-Hyd Interface	R4	Fails to open	solenoid failure	Loss of hydraulic output	Loss of control port bucket	"- summary alarm" "- LCD Display"	No alarm displays. If you move the joystick outside of the 10 percent parameter a NFU alarm will display in approximately 30 sec.Port Bkt NFU.	Shut down port engine and operate stbd side only	minor	minor	Pull connector from proportional valve	PV-PB down	Dropped to idle (650)	had engine control ahead position, no engine control reverse	There are two control solenoids per DCV (up and down). If you interrupt the down cylinder circuit you only have control of the bucket in the up position and vise versa.
Port Prop. Valve (down)	Electro-Hyd Interface		Fails to open	solenoid failure	Loss of hydraulic output	Loss of control port bucket	"- summary alarm" "- LCD Display"	No alarm displays. If you move the joystick outside of the 10 percent parameter a NFU alarm will display in approximately 30 sec.Port Bkt NFU.	Shut down port engine and operate stbd side only	minor	minor	Pull connector from proportional valve	PV-PB up	Dropped to idle (650)	had engine control astearn position, no engine control ahead	There are two control solenoids per DCV (up and down). If you interrupt the down cylinder circuit you only have control of the bucket in the up position and vise versa.
Stbd Prop. Valve (up)	Electro-Hyd Interface	R5	Fails to open	solenoid failure	Loss of hydraulic output	Loss of control stbd bucket	"- summary alarm" "- LCD Display"		Shut down stbd engine and operate port side only	minor	minor	Pull connector from proportional valve	PV-SB down	Dropped to idle (650)	had engine control ahead position, no engine control reverse	There are two control solenoids per DCV (up and down). If you interrupt the down cylinder circuit you only have control of the bucket in the up position and vise versa.
Stbd Prop. Valve (down)	Electro-Hyd Interface	R6	Fails to open	solenoid failure	Loss of hydraulic output	Loss of control stbd bucket	"- summary alarm" "- LCD Display"		Shut down stbd engine and operate port side only	minor	minor	Pull connector from proportional valve	PV-SB up	Dropped to idle (650)	had engine control astearn position, no engine control ahead	There are two control solenoids per DCV (up and down). If you interrupt the down cylinder circuit you only have control of the bucket in the up position and vise versa.
Port Hyd. Cylinder	Hydro-Mech Interface	R6	Leakage	failed seal	leaking oil	degradation or loss of cylinder response	"- summary alarm" "- LCD Display"		If no response, shut down port engine and operate Stbd side only			Pull connector from proportional valve	PV-PB up/down			unable to perform

FMEA Work Sheet
 Vector Controls, Inc.
 Project: RB-M
Subsystem: Reversing Bucket Control System
 Ref: Reversing Bucket Control System Block Diagram

Equipment Name	Function	ID No.	Failure Mode	Failure Cause	Failure Effect		Failure Detection	Central Alarm Panel Display	Corrective Action	Result of Failure Effect	CG Result of Failure Effect	Test Method	CG Test Method	CG RPM Result	CG Control Result	Notes
					Local effect	End Effect										
Stbd Hyd. Cylinder	Hydro-Mech Interface	R7	Leakage	failed seal	leaking oil	degradation or loss of cylinder response	" - summary alarm" "- LCD Display"		If no response, shut down stbd engine and operate port side only			Pull connector from proportional valve	PV-SB up/down			unable to perform
Port Feedback Sensor	Position Feedback to processing unit	R8	Loss of output	Sensor Failure	Loss of control of the port bucket	Port bucket is frozen in last commanded position	" - summary alarm" "- LCD Display"	Port bucket sensor alarm	Switch to Backup	minor	minor	Disconnect Pot wiper	Bucket XDCR-PB	engine control fwd, none in reverse, bucket stuck in fwd position on affected side.	Port bucket is frozen in last commanded position	
unable to perform		R8	Fails out of tolerance (high)	Sensor Failure	Loss of control of the port bucket	Port bucket is frozen in last commanded position	" - summary alarm" "- LCD Display"		Switch to Backup			Disconnect - Pot wiper				unable to perform
unable to perform		R8	Fails out of tolerance (low)	Sensor Failure	Loss of control of the port bucket	Port bucket is frozen in last commanded position	" - summary alarm" "- LCD Display"		Switch to Backup			Disconnect + Pot wiper				unable to perform
Stbd Feedback Sensor		R9	Loss of output	Sensor Failure	Loss of control of the stbd bucket	Stbd bucket is frozen in last commanded position	" - summary alarm" "- LCD Display"	Stbd bucket sensor alarm	Switch to Backup Control (Powered by different source)	minor	minor	Disconnect Pot wiper	Bucket XDCR-SB	engine control fwd, none in reverse, bucket stuck in fwd position on affected side.	Stbd bucket is frozen in last commanded position	
unable to perform		R9	Fails out of tolerance (high)	Sensor Failure	Loss of control of the stbd bucket	Stbd bucket is frozen in last commanded position	" - summary alarm" "- LCD Display"		Switch to Backup			Disconnect - Pot wiper				unable to perform
unable to perform		R9	Fails out of tolerance (low)	Sensor Failure	Loss of control of the stbd bucket	Stbd bucket is frozen in last commanded position	" - summary alarm" "- LCD Display"		Switch to Backup			Disconnect + Pot wiper				unable to perform
Processing Unit	CPU	R10	Loss of output	Hardware failure	loss of control in Auto Mode	loss of control in Auto Mode	" - summary alarm, RS232 fault on LCD display"	All alarms	Switch to Backup Control (Powered by different source)	minor	minor	Remove P1 & P2 Connectors	P2 & P1	Dropped to idle (650)	Loss of all controls all controls frozen in last position	Had to reset cb3 - waterjet control breaker to regain control first time.
		R10	Loss of input	Power Failure	loss of control in Auto Mode	loss of control in Auto Mode	" - summary alarm, RS232 fault on LCD display"	All alarms	Switch to Backup Control (Powered by different source)	minor	minor	Secure 24V (EP1) Power Feed at distribution panel	Secure VP2	Dropped to idle (650)	Loss of all controls all controls frozen in last position	
Indication Panel	Visual indication of reversing bucket position	I1	Loss of output	Failed Hardware	bucket position not properly indicated	Unable to view bucket position or faults while operating in Auto or Backup mode	Display not functioning	N/a	Operate without display	minor	minor	Disconnect signal transmission line (CAN) from display unit.	Secure VP4	not affected	not affected	
Power Failure	Control System Power Supply	EP1	Loss of Supply	Power Failure	Control Unit Shuts Down	Hydraulic actuators fail "as is" and engine RPM goes to idle.	" - summary alarm, RS232 fault on LCD display, Nonresponsive Controls"	RS232 fault	Switch to Backup Control (Powered by different source)	minor	minor	Remove power from controller	Secure VP2	Dropped to idle (650)	Loss of all controls all controls frozen in last position	

FMEA Work Sheet
 Vector Controls, Inc.
 Project: RB-M
Subsystem: Steering System
 Ref: Steering System Block Diagram

Equipment Name	Function	ID No.	Failure Mode	Failure Cause	Failure Effect		Failure Detection	Central Alarm Panel Display	Corrective Action	Result of Failure Effect	CG Result of Failure Effect	Test Method	CG Test Method	CG RPM Result	CG Control Result	Comments
					Local effect	End Effect										
Tiller1	Steering control Interface	S1	Loss of output	Sensor Failure	Loss of control at the helm	Steering is frozen in last commanded position	"- summary alarm" "- LCD Display"	ST1 helm till	Transfer Station or Switch to Backup	minor	minor	Disconnect Pot wiper	JX1B	no change. Full control	nozzle stayed in position	nozzle axis locked, transfer to other control sat.
unable to perform		S1	Fails out of tolerance (high)	Sensor Failure	Loss of control at the helm	Steering is frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Station or Switch to Backup	minor		Disconnect - Pot Lead				
unable to perform		S1	Fails out of tolerance (low)	Sensor Failure	Loss of control at the helm	Steering is frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Station or Switch to Backup	minor		Disconnect + Pot lead				
Tiller2	Steering control Interface	S2	Loss of output	Sensor Failure	Loss of control at the helm	Steering is frozen in last commanded position	"- summary alarm" "- LCD Display"	ST2 helm till	Transfer Station or Switch to Backup	minor	minor	Disconnect Pot wiper	JX2B	no change. Full control	nozzle stayed in position	nozzle axis locked, transfer to other control sat.
unable to perform		S2	Fails out of tolerance (high)	Sensor Failure	Loss of control at the helm	Steering is frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Station or Switch to Backup	minor		Disconnect - Pot Lead				
unable to perform		S2	Fails out of tolerance (low)	Sensor Failure	Loss of control at the helm	Steering is frozen in last commanded position	"- summary alarm" "- LCD Display"		Transfer Station or Switch to Backup	minor		Disconnect + Pot lead				
Prop. Valve	Electro-Hyd Interface	S4	Fails to open	solenoid failure	Loss of hydraulic output	loss of control nozzle	"- summary alarm" "- LCD Display"	No alarm displays. If you move the joystick outside of the 10 percent parameter a NFU alarm will display in approximately 30 sec.	Shut down engine and operate on unaffected side only	minor	moderate	Pull connector from proportional valve	Port PV STRG	no change. Full control	Stuck going stbd. No alarm if no movement	If you interrupt the stbd DCV signal the nozzle will on go to port and vice versa. This may be an area of concern because you do not have an indication that something is wrong until you try to come to the affected side and nothing happens. If you are already in a turn you cannot go back but you can turn further into the non-affected direction.
Hyd. Cylinder	Hydro-Mech Interface	S6	Leakage	failed seal	leaking oil	degradation or loss of cylinder	"- summary alarm" "- LCD Display"		If no response, shut down port engine and operate Stbd side only.	minor	minor	Pull connector from proportional valve				Unable to perform
Port Feedback Sensor	Position Feedback to processing unit	S8	Loss of output	Sensor Failure	loss of control of the port nozzle	nozzle is frozen in last commanded position	"- summary alarm" "- LCD Display"	Port nozzle sensor	Switch to Backup	minor	minor	Disconnect Pot wiper	XDCR STRG	no change. Full control	nozzle is frozen in last commanded position	Panel displays full right rudder. Rpm full control. Stayed in last position.
unable to perform		S8	Fails out of tolerance (high)	Sensor Failure	loss of control of the port nozzle	port nozzle is frozen in last commanded position	"- summary alarm" "- LCD Display"		Switch to Backup	minor		Disconnect - Pot Lead				
unable to perform		S8	Fails out of tolerance (low)	Sensor Failure	loss of control of the port nozzle	port nozzle is frozen in last commanded position	"- summary alarm" "- LCD Display"		Switch to Backup	minor		Disconnect + Pot lead				
unable to perform		S9	Fails out of tolerance (high)	Sensor Failure	loss of control of the stbd nozzle	Stbd nozzle is frozen in last commanded position	"- summary alarm" "- LCD Display"		Switch to Backup	minor		Disconnect - Pot Lead				
unable to perform		S9	Fails out of tolerance (low)	Sensor Failure	loss of control of the stbd nozzle	Stbd nozzle is frozen in last commanded position	"- summary alarm" "- LCD Display"		Switch to Backup	minor		Disconnect + Pot lead				
Autopilot	Automatic Heading Control	S10	Loss of input	Power Failure	Loss of control	Nozzles locked in last commanded position	Autopilot Alarm	Rudder drive error on auto pilot	Take control at Helm or Tiller	minor	Switched to manual control. Full control	Disconnect Autopilot Signal	JX9	no change. Full control	All stayed same	
unable to perform		S10	Signal out of range	autopilot failure	loss of control of the port & stbd nozzle	port & stbd nozzle are frozen in last commanded position	Autopilot Alarm		Switch autopilot to Helm	minor		Simulate high and low signal	JX9A			

FMEA Work Sheet
 Vector Controls, Inc.
 Project: RB-M
Subsystem: Steering System
 Ref: Steering System Block Diagram

Equipment Name	Function	ID No.	Failure Mode	Failure Cause	Failure Effect		Failure Detection	Central Alarm Panel Display	Corrective Action	Result of Failure Effect	CG Result of Failure Effect	Test Method	CG Test Method	CG RPM Result	CG Control Result	Comments
					Local effect	End Effect										
Processing Unit	CPU	S11	Loss of output	Hardware Failure	loss of control in Auto Mode	loss of control in Auto Mode	" - summary alarm, RS232 fault on LCD display"	All alarms	Switch to Backup Control (Powered by different source)	minor	minor	Remove P1 & P2 Connectors	P2 & P1	Dropped to idle (650)	Loss of all controls all controls frozen in last position	Had to reset cb3 - waterjet control breaker to regain control first time.
		S11	Loss of input	Power Failure	loss of control in Auto Mode	loss of control in Auto Mode	" - summary alarm, RS232 fault on LCD display"	All alarms	Switch to Backup Control (Powered by different source)	minor	minor	Secure 24V (EP1) Power Feed at distribution panel	Secure VP2	Dropped to idle (650)	Loss of all controls all controls frozen in last position	
Indication Panel	Visual indication of nozzle position	I1	Loss of output	Failed Hardware	nozzle position not properly indicated	unable to view nozzle position or faults while operating in Auto or Backup mode at Station #1	Display not functioning	N/a	Operate without display	minor	minor	Disconnect signal transmission line (CAN) from display unit.	Secure VP4	not affected	not affected	
Power Failure	Control System Power Supply	EP1	Loss of Supply	Power Failure	Control Unit Shuts Down	Hydraulic actuators fail "as is" and engine RPM goes to idle.	" - summary alarm, RS232 fault on LCD display, Nonresponsive Controls"	RS232 fault	Switch to Backup Control (Powered by different source)	minor	minor	Remove power from controller	Secure VP2	Dropped to idle (650)	Loss of all controls all controls frozen in last position	

Subsystem: Interceptor Control System

Equipment Name	Function	Failure Mode	Failure Cause	Failure Effect		Failure Detection	Central Alarm Panel Display	Corrective Action	Severity of Failure Effect	CG Test Method	CG Actual Test Results	CG RPM Result	CG Control Result
				Local effect	End Effect								
Trim/Roll Joystick 1	Trim Control	Loss of output	Sensor Failure				St1 roll and St1 trim	Switch station. Go to backup	minor	JX1C	No rpm change. Stayed same position.	Stayed same	No control. When interceptor deployed, came back to zero thrust, then they retracted
unable to perform		Fails out of tolerance (high)	Sensor Failure										
unable to perform		Fails out of tolerance (low)	Sensor Failure										
Trim/Roll Joystick 2	Steering control Interface	Loss of output	Sensor Failure				St2 roll and St2 trim	Switch station. Go to backup	minor	JX2C	No rpm change. Stayed same position.	Stayed same	No control. When interceptor deployed, came back to zero thrust, then they retracted
unable to perform		Fails out of tolerance (high)	Sensor Failure										
unable to perform		Fails out of tolerance (low)	Sensor Failure										
Port Prop. Valve	Electro-Hyd Interface	Fails to open	solenoid failure			none	Non-followup if interceptor position does not match trim/roll jorstick in approx. 30 sec		minor	PV-PI	Lost port control	Stayed same	Full throttle and steering control
Stbd Prop Valve	Electro-Hyd Interface	Fails to open	solenoid failure			none	Non-followup if interceptor position does not match trim/roll jorstick in approx. 30 sec		minor	PV-SI	Lost stbd control	Stayed same	Full throttle and steering control
Port Hyd. Cylinder	Hydro-Mech Interface	Leakage	failed seal										unable to perform
Stbd Hyd. Cylinder	Hydro-Mech Interface	Leakage	failed seal										unable to perform
Port Feedback Sensor	Position Feedback to processing unit	Loss of output	Sensor Failure				Port tab sensor alarm		minor	XDCR-PI	Lost control of interceptor	Full control - stayed same	Interceptor stayed in same position
unable to perform		Fails out of tolerance (high)	Sensor Failure										
unable to perform		Fails out of tolerance (low)	Sensor Failure										
Stbd Feedback Sensor	Position Feedback to processing unit	Loss of output	Sensor Failure				Stbd tab sensor alarm		minor	XDCR-SI	Lost control of interceptor	Full control - stayed same	Interceptor stayed in same position
unable to perform		Fails out of tolerance (high)	Sensor Failure										
unable to perform		Fails out of tolerance (low)	Sensor Failure										

FMEA Work Sheet
 Vector Controls, Inc.
 Project: RB-M
Subsystem: Additional Tests

Equipment Name	Function	Failure Mode	Failure Cause	Failure Effect		Failure Detection	Corrective Action	Severity of Failure Effect	CG Actual Test Results	CG Test Method	CG RPM Result	CG Control Result	Comment
				Local effect	End Effect								
JX2	Port Controls					st2 roll roll, trim, y axis, x axis, helm/tiller	shifted control	minor	Lost control of rpm and tiller	JX1	Dropped back to idle	Buckets and nozzle stayed in same position	
JX1	Stbd Controls					st1 roll roll, trim, y axis, x axis, helm/tiller	shifted control	minor	Lost control of rpm and tiller	JX2	Dropped back to idle	Buckets and nozzle stayed in same position	
JX3	Port Transducers (Bucket/ Intercept/ Nozzle)					port bucket sensor, port tab sensor, stbd nozzle	backup box	minor	Control of engine, not of buckets. Stayed in position until tried to move.	JX3	Control of engine	Stayed in position until tried to move	
JX4	Stbd Transducers (Bucket/ Intercept)					Stbd bucket and interceptor	backup box	minor	Control of engine, not of buckets. Stayed in position until tried to move.	JX4	No change in RPM	Everything stayed same	
JX6	Vector Backup Relay Panel					no alarm except non followup if command tried.	backup box	minor	Rpm control, but no bucket, interceptor, or nozzle control.	JX6	Full RPM control	Buckets, nozzle, interceptor stayed in same position	Need to cycle through controls
VP1	Vector Backup Relay Power Supply					No alarm	backup box is inoperative	minor	Have steering and throttle control	VP1	Full control	Full control	
JX5	Port / Stbd Engine Primary Throttle (MTU Engine Control Panel)					no alarm	backup box	minor	Bucket control, no throttle control	JX5	back to idle	Bucket/Nozzle control	
JX8	Clutch Panel Control					VCI CAN fault		minor	Stayed clutched in. Still had full control	JX8	stayed same	If manually declutch, will not clutch back in	alarm not in manual
VP3	Cluth Panel Power Supply					VCI CAN fault		minor	Declutched, but engine rpm stayed same	VP3	stayed same	Declutched	potential of unloaded overspeed