GLOBAL MARITIME A/S
MARINE, OFFSHORE AND ENGINEERING CONSULTANTS

FABRIKKVEIEN 5, P.O.BOX 343, 4067 STAVANGER, NORWAY
TEL.: +47 51 81 61 61. FAX: +47 51 80 01 48. E-MAIL: gmas@globalmaritime.no

MENAS MARINE SERVICES LTD (MMSL)

OSV RELUME - ANNUAL DP TRIALS 2007

GM-320-002-R02

Document details and issue record

Project: OSV Relume - Annual DP Trials 2007

GM Doc. No.: GM-320-002-R02

Made by: Dave Talloen

File Name: GM-320-002-R02_rev1

Rev	Date	Document Status	Prepared	Reviewed	Approved
1	26.10.2007	Issued for Comments	DT		

REVISION SHEET

Rev.	Reason	References(s)
1	Issue for Comments	

TABLE OF CONTENTS

1 STATUS SUMMARY

1.1.1 The following table summarises outstanding items revealed during the annual trials, gives consequence/ priority for repair, shows the date of implementation and includes a section where the owner has the opportunity to state reasons for not carrying out the recommendations or any other comments.

1.1.2 Recommendations are made in three categories. 'A' should be implemented as soon as practicable, 'B' is for serious consideration and 'C' is "nice to have".

Item	Category	Witness/Date/Sign	Close-out /Remark
3.4.1	**A**	Email from master 13/09/07	Closed
3.4.2	**A**	Email from master 13/09/07	Closed
3.5.1	B	Email from master 13/09/07	Closed
3.5.2	B	Email from master 13/09/07	Closed
3.5.3	B	Email from master 21/09/07	Closed
3.5.4	B	Email from master 13/09/07	Closed
3.5.5	B		
3.6.1	C	Email from master 13/09/07	Rejected
3.6.2	C	Email from master 13/09/07	Ongoing

2 INTRODUCTION

2.1 Instructions

2.1.1 Global Maritime A/S was requested by Mr. Alan Adamson of MMSL to conduct and witness the annual trials on the 'Relume'. The vessel was attended by Captain Dave Talloen on the 26th August 2007 in Stavanger, Norway.

2.2 Scope of Work

2.2.1 The Annual Audit programme is extracted from the FMEA proving trials 2004 and Annual Trials 2006, compiled to determine that the vessel meets the requirements of the 1994 IMO MSC Circ. 645 Guidelines for Vessels with Dynamic Positioning and with the UKOOA/DPVOA publication on annual DP trials issued in 1993. Global Maritime AS scope of work was to witness and document the Annual Trials carried out by the vessels own crew

2.2.2 The Guidelines for the Annual Audit requires that a review of particular onboard documentation is carried out followed by a series of failure trials which demonstrate the adequacy of the DP System redundancy.

2.3 Conduct of Trials

2.3.1 The Annual DP Trials cover the following main areas, power generation and power management, thrusters and also the DP control system along with their associated power supplies, position reference systems, sensors, etc. All tests are to be co-ordinated by the Master or his Deputy, with full regard to the safety of navigation of the vessel.

2.3.2 The trials were carried out in accordance with the completed procedures that can be found in section 5 of this document.

2.3.3 If there are any doubts about a test, it should be repeated. If test results are unexpected, then the test should also be repeated. Tests will continue only when all those involved have been informed and (where necessary) suitable communications have been set up, e.g. DP console to thruster room. The tests should not only prove power/thruster redundancy and DP capability after failures, but also that the operators have the necessary training and experience to use the system and deal successfully with such failures.

2.3.4 The vessel's FMEA (Failure Mode & Effect Analysis) made by Global Maritime Ltd., is used as the basis of the trials program. The primary objective of FMEA is to provide a comprehensive, systematic and documented investigation which establishes the important failure conditions of the vessel systems and assesses their significance with regard to station keeping. The FMEA is contained in Report GM-44514-0404-47837 Rev5. It is intended that both this trials report and the vessel's FMEA are used as a source of information for both new and experienced operating personnel.

2.4 Locations and Limitations

The trials we conducted took place off Stavanger in sheltered waters in Amøyfjorden. Weather conditions were moderate with passing squalls.

2.5 Personnel

2.5.1 The trials were used as a training and familiarisation exercise with great success. Due to the splitting of the trials, both crews were involved. We would recommend that IMCA logbooks for all essential personnel are used to log participation in this extensive trials program. The following personnel attended during these Annual DP trials:

NAME	POSITION	(IMCA) logbook	DP Cert.
Trevor Gwynne	Master	✓	31
Justin Moseley	Ch. Officer	✓	1867
James Thompson	2nd Officer	✓	5021
Adityya	2nd Officer	✓	
Gavin Dillon	Ch. Engineer	✓	
David Brindle	2nd Engineer	✓	
Vinko Khadzija	ETO	✓	DP maintenance
Eugene Reambonanza	3rd Engineer		
Artemio Martinez	3rd Engineer		
Trond Kleven	Kongsberg Simrad		
Dave Talloen /	Global Maritime		

3 CONCLUSIONS, COMMENTS AND RECOMMENDATIONS 2007

3.1 Conclusions

3.1.1 The vessel performed well on DP and coped adequately with most simulated mechanical, electrical, power distribution and computer control failures during these trials but some unexpected results were experienced. The vessel demonstrates that the DP system, thrusters and power distribution are complying with current redundancy requirements as applied to Class 2 DP vessels once the 'A' recommendations are closed out satisfactory.

3.2 Comments

3.2.1 Power Distribution

All systems performed satisfactory during the trials.

3.2.2 Engine and Machinery System

All systems performed satisfactory during the trials.

3.2.3 DP Computers

All systems performed satisfactory during the trials.

3.2.4 Thrusters

All systems performed satisfactory during the trials with exception of the bow tunnel 1 which had an offset on the electrical zero point.

3.2.5 DP Reference Systems

All systems performed satisfactory during the trials with exception of the HiPAP which was only working on Network A and the Wind sensors that failed both on s/c simulation of the wheelhouse 24V distribution.

3.2.6 Maintenance

All maintenance was noted to be up to date.

3.2.7 Capability Plots

Capability plots for worst case failure are not onboard. Footprints were not sighted either.

3.2.8 Personnel

The crew offered all assistance with the trials and proved to be knowledgeable of the DP control system and its functions. The vessel technical staff proved to be very competent and demonstrated to us that they are very knowledgeable of the electrical and mechanical systems on board that will aid troubleshooting offshore.

3.3 Recommendations 2007

3.3.1 Recommendations are made in three categories.

'A' should be implemented to meet with Class 2 DP
'B' is for attention when reasonably convenient
'C' is for further improvement or 'nice to have'

3.4 "A" Recommendations: For Immediate Attention

3.4.1 Simulating S/C of the 24V distribution located in the wheel house (ER system 1) also interrupted the signal of both wind sensors to the DP although these get their supplies from UPS 1/2. Cause for this effect should be identified and resolved. **Reference is made to test 16**

Email from Master 13/09/07: *The two Wind speed data buffers had been paralleled with the supply for the DP consoles Echo sounder repeater. This has been rectified by fitting 230/24V adapters in both DP consoles to provide separate supplies for the data buffers and thus avoid a single point failure, these supplies are fed from the appropriate DP UPS.* **GM comment:** Closed

3.4.2 When failing power to OS1 from UPS1 , also the HiPAP (UPS2) signal to the DP is interrupted as only the A-network connection is working. The connection to the B-network should be (re)-established, so the HiPAP works on dual network as per design. **Reference is made to test 17**

Email from Master 13/09/07: *Connection re-established.* **GM comment:** Closed

3.5 "B" Recommendations: For Serious Consideration

3.5.1 Rolls Royce adjusted the bow tunnel mechanically while in dry-dock but not electrically (the feedback signals). Now is there a bias in the DP to correct for the error and a difference in the DP and RR feedback of 12%. RRM should revisit the vessel together with KM to re-calibrate the thrusters. **Reference is made to test 24**

Email from Master 13/09/07: *Rolls Royce and Kongsberg attended the vessel in Kristiansund on the 5th September. Bow thrusters recalibrated and there is no difference in the DP and RR feedback.* **GM comment:** Closed

3.5.2 The crew wasn't able to identify the correct azimuth command signal from ACU to thruster. RRM should be contacted to advise the correct terminals and the failure test of the signals conducted. The result should be as expected **Reference is made to test 27-2**

Email from Master 13/09/07: *There are two motors and supply was disconnected from one only. At the time the auditor did not request that both supplies be disconnected. However the ships working copy of the FMEA has been amended.* **GM comment:** Closed

3.5.3 The HiPAP has Gyro and VRS input from the Seapath. Also is there an input from VRS2, which is connected to UPS1 and shouldn't be used for that reason. Seapath 2 should be connected to an UPS and preferably to UPS2. **Reference is made to test 38**

Email from Master 21/09/07: *Decided to swap the UPS supplies for MRU 1 and 2* **GM comment:** discussed several possible alternatives with the Master; and this is accepted, Closed

3.5.4 The DGPS's 2 and 3 (+differential decoder) have unknown 24V supplies. This should be identified and fuse numbers labelled on the units. **Reference is made to test 37**

Email from Master 13/09/07: *24v supplies and fuses identified and labelled.* **GM comment:** Closed

3.5.5 The vessel doesn't possess the correct DP capability plots and Foot prints as per IMO guidelines. A request should be send to KM to send the capability plots including worst case failure and the vessel crew should plot the vessels DP foot prints in varying environmental conditions. **Reference is made to test 4.9**

3.6 "C" Recommendations: For Future Attention/Consideration

3.6.1 The UPS's don't have the DP odd/even numbering philosophy of their consumers sustained. When time allows, effort should be made to re-organize the consumer distribution. **Reference is made to test 17/18**

Email from Master 13/09/07: *Clear list of consumers made and posted.*

3.6.2 The power consumption of the thrusters on the Alarm display (Praxis) is confusing as the main propellers show different type of value then the tunnel thrusters. Effort should be made to change this in a more logic presentation when Praxis is visiting the vessel again. . **Reference is made to test 15.1.6**

Email from Master 13/09/07: *Personnel onboard are familiar with the system and the displays; however this will be put forward for change when a Praxis engineer is onboard.* **GM comment:** ongoing

4 VESSEL DETAILS

4.1 General

Vessel Name:	"Relume"		
Built:	2004		
Class:	LR	DP Notation	AA
Flag:	Bahamas	Call sign	C6TR4
LOA:	82.6 m	Beam:	16.5 m
Design Draught	4.0 m		
Last Annual Trials:	2006		
First Annual Trials:	2004		

4.2 Power Generation

Main Engines:	2 x Wärtsilä 8L20/C2 + 2 x Wärtsilä 6L20/C2
Main Switchboard:	2 x 690V 2 x 450V 2 x 230V
Generators:	2 x 1269 kW and 2 x 948 kW

4.3 Thrusters

4.3.1 The thruster and propulsion system consists of two aft azimuth thrusters of the type Aquamaster equipped with fixed propeller (each 1590 kW). In the bow are located two tunnel thrusters of the type Rolls Royce TT1660 (each 515 kW). All thrusters are electrically driven and supplied from the 690V switchboard system.

4.4 DP System

Main system:	Simrad SDP 21; 3 OS's (1 forward and one on each bridge wing aft)
Backup DP:	N/A
Reference Systems:	Light Weight Taut Wire (LWTW) Mk 14B
	DGPS's 1 x Leica MX420B – IALA MF/HF 1 x VERIPOS LD2 Standard+ - spotbeam and inmarsat 1 x Trimble 4000 - spotbeam
	HiPAP 500
	Fanbeam MDL interface (hired on project demand)
UPS:	2 off
Gyro:	3 x SR180MK1 Mod 10
VRS:	2 x Seatex, MRU 5 + MRU H
Wind Sensors:	2 x RM young
Voting Position:	Reference systems
Consequence Analysis:	Class II (in SDP software)

4.5 Main Electrical Protection

CIRCUIT BREAKERS	**Date**	**Company**
Generator Breakers PS	8/2007	
Generator Breakers SB	8/2007	
Thruster Breakers	8/2007	
Bus tie breaker	8/2007	
Remarks: In house checked by ships electrician		

4.6 Hydraulic and Lubrication Oil Tests

THRUSTER OIL	Last Analysis	Current, Remarks
Main Thruster PS	21/05/2007	Oil changed
Main Thruster SB	31/05/2007	Oil changed
Fwd tunnel thruster 1	10/08/2007	Oil changed
Fwd tunnel thruster 2	10/08/2007	Oil changed

Main Engines	ME 1	ME 2	ME 3	ME 4
Lub Oil Last Analysis	31/05/07	31/05/07	07/05/07	12/07/07
Last Analysis Results	normal	normal	normal	normal
Running hours	14111	13182	12768	12443
Last major overhaul	14107	13149	12757	12433
Remarks	-	-	-	-
Maintenance record	Update*	Update*	Update*	Update*
Outstanding maintenance	none	none	none	none

* Vessel just had been in dry-dock and PM system still had to be updated

4.7 Main Engine Governors Adjustment

ME 1	ME 2	ME 3	ME 4
-	-	-	-

4.8 DP Sensors

Sensor	Records Checked	Remarks
DGPS 1 – Veripos	✓	
DGPS 2 – MX	✓	
DGPS 3- HiPAP	✓	
HiPAP	✓	
LWTW	✓	
Fanbeam	N/A	
MRU 1	✓	
MRU 2	✓	
Gyro 1	✓	
Gyro 2	✓	
Gyro 3	✓	
Wind Sensor 1	✓	
Wind Sensor 2	✓	

4.9 Capability Plots

Are the correct capability plots onboard	No
Are there verifying footprints onboard	No

4.10 Computers

Maintenance checked	Yes
Last DP software revision	SW deliv CD_mirror_040904 SW Basis 4.0.6 GMS 6.0q1p4_LIF OSK update 1.9 update 9 (build 48) Windows NT Service pack 4.0 SP6 (build 1381)
Remarks	

4.11 UPS

Unit	Battery Checked	Remarks
UPS 1	✓	30 minutes duration test during trials
UPS 2	✓	

4.12 Hardware Modification

Have there been any modifications since last annual trials?	No
Have modifications been thoroughly tested?	
Have trials procedures been updated?	

5 ANNUAL TRIALS PROGRAMME

Test	System	Subsystem	Component	Comment
1	Power Generation	Fuel Oil System	Q/C V/Vs	
2	Power Generation	Fuel Oil System	Boost P/ps	
3	Power Generation	Fuel Oil System	Tk. level and filter alarms	
4	Power Generation	Lub. Oil System	Pre lub test	
5	Power Generation	SW Cooling	P/P auto start A101 & A102	
6	Power Generation	SW Cooling	Loss and temp rise	
7	Power Generation	FW Cooling	FW P/p speed change	
8	Power Generation	FW Cooling	Loss of FW cooling	
9	Power Generation	Control Air	Loss of Control	
10	Power Generation	DG	Loss of speed sensor	
11	Power Distribution	Main Switchboard	Loss of Port Section	
12	Power Distribution	Main Switchboard	Loss of Stbd. Section	
13	Power Distribution	440V switchboard	Loss of Port & Stbd. Sections	
14	Power Distribution	220V switchboard	Loss of T1 and T2	
15	Power Distribution	Emergency. Switchboard	Loss of switchboard	
16	Power Distribution	24V dc	Loss of supply	
17	Power Distribution	UPS 1	Loss of UPS	
18	Power Distribution	UPS 2	Loss of UPS	
19	Power Management	Power Supply	Loss of supply	
20	Power Management	PMS Function	Blackout recovery	
21	Power Management	kW signal	Loss of kW & bus tie signals	
22	Power Management	CAN Bus	Loss of CAN Bus	
23	Power Management	DPU	Loss of DPU	
24	Thrusters	Thrusters No. 1 & 2	Pitch signals (KS)	
25	Thrusters	Thrusters No. 1 & 2	Pitch signals (Imtech)	
26	Thrusters	Thruster No. 3 & 4 (Azi)	Speed signal	
27	Thrusters	Thruster No. 4 (Azi)	Azimuth signal	
28	Thrusters	Hydraulics	Loss of hydraulics	
29	Thrusters	Emergency Stops	Function test	
30	Thrusters	Frequency Drives	Alarms	
31	DP Control	Networks	Loss of network	
32	DP Control	DP Consoles	Loss of consoles	
33	DP Control	Computer Failure	Loss of one computer	
34	DP Control	Gyros	Loss of gyros	
35	DP Control	Anemometers	Loss of anemometers	
36	DP Control	MRU	Loss of MRU	
37	DP Control	DGPS Capability	Loss of DGPS	
38	DP Control	HiPAP	Loss of HPR	
39	DP Control	Taut Wire	Test	
40	DP Control	Fan Beam	Test	
41	DP Control	Model Control	Test	
42	DP Control	I/O modules and 24V	Loss of I/O cards and 24V	Added 2007
43	DP Control	Consequence Analysis	Test	
44	DP Control	Operational modes	Test	
45	DP Control	Control Modes	Test	
46	DP Control	DP/ Joystick	Test transfer	
47	DP Control	Communications	Test	
48				
49				
50				

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 1	SUBSYSTEM: **FUEL OIL SYSTEM**

PURPOSE :

1. Check operation of Quick Closing Valves.

METHOD :

1) Operate controls for quick-closing valves located at the Emergency Headquarters.
2) Monitor the action of each valve and record result

EXPECTED RESULTS :

1) Valves closes and fuel supply shut off.
2) Quick closing valves close as per test schedule.

RESULTS:

1.

2.

COMMENTS :

Lloyds E0 / AMOS quarterly tested as per PM's

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 2	SUBSYSTEM: **Fuel Oil**

PURPOSE :

Check operation of ME FO Boost Pumps, Auto stand-by start.

METHOD :

With generators on normal load,

1) Stop pump (A12 – DG3), reinstate
2) Stop pump (A10 – DG1), reinstate
3) Stop pump (A11 – DG4), reinstate
4) Stop pump (A13 – DG2), reinstate

EXPECTED RESULTS :

1) Alarm, low fuel supply pressure, Stand-by pump starts.
2) Alarm, low fuel supply pressure, Stand-by pump starts.
3) Alarm, low fuel supply pressure, Stand-by pump starts.
4) Alarm, low fuel supply pressure, Stand-by pump starts.

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 3	SUBSYSTEM: **Fuel Oil**

PURPOSE :

Check operation of Daily Service Tank port and starboard low-level alarms.
Check operation of high differential pressure across fuel filters.

METHOD :

1) Simulate low level alarm sensor on port fuel oil service tank.
2) Simulate low level alarm sensor on starboard fuel oil service tank.
3) Simulate high differential pressure across filter port side
4) Simulate high differential pressure across filter starboard side

EXPECTED RESULTS :

1) Alarm.
2) Alarm.
3) Alarm
4) Alarm

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 4	SUBSYSTEM: **Lubricating Oil**

PURPOSE :

1) Test operation of low-low lub oil sensor
2) Check operation of diesel generator pre-lube oil pump.
3) Check operation of auto generator start, following loss of pre lub pump

METHOD :

1) Isolate low-low lub oil sensor and drain
2) Check pre-lube pump start/stop at engine stop/start.
3) Isolate pre lub pump and try to start generator engine.

EXPECTED RESULTS :

1) Alarm, generator sheds load, trips and shuts down.
2) Pre-lube pump starts when DG stops, and stops when DG starts.
3) Generator will not start if pre lub pump has not run in the previous 4 minutes.

RESULTS :

1. DG3 & DG4 , as expected
2. DG3 & DG4 , as expected
3. Not tested 2007

COMMENTS :

Generator sheds load only when one generator is running

Non preferential trips no matter what load is taken.

.

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 5	SUBSYSTEM: **SW Cooling**

PURPOSE :

Simulate low SW pressure
Check for SW stand-by pump auto start.

METHOD :

For each sea suction in turn:

1) Isolate SW low-pressure switch and drain. Restore and stop the pump before test of the next pump.

EXPECTED RESULTS :

1) Alarm SW low pressure.
2) Pump auto starts. Standby pump start alarm

RESULTS :

Sea water pump A101

1. As expected

2. As expected

Sea water pump A102

1. As expected

2. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 6	SUBSYSTEM: **SW Cooling**

PURPOSE :

Simulate loss of SW pressure
Engines running at 50% load, measure subsequent temperature rise.

METHOD :

1. Stop each seawater pump.

EXPECTED RESULTS :

1) Alarm SW low pressure.
2) Alarm of High temperature, FW Low Temperature circuit, after five minutes.

RESULTS :

1.

2.

HT Temperature readings: Start degrees. Stop: degrees.

LT Temperature readings: Start degrees. Stop: degrees.

COMMENTS :

Not tested 2007

WITNESSED BY :	**DATE :**

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 7	SUBSYSTEM: **FW Cooling Generator engines**

PURPOSE :

With each diesel generator running, simulate failure of one FW circulation pump.
Check for FW cooling alarm and auto start of standby pump.

METHOD :

For each circulation pump in turn
1) Stop FW pump No. 1. Restore.
2) Stop FW pump No. 2. Restore.

EXPECTED RESULTS :

1) Alarm FW low pressure. Auto start of standby pump.
2) Alarm FW low pressure. Auto start of standby pump.

RESULTS :

1. As expected

2. As expected

COMMENTS :

Common cooling system

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 8	SUBSYSTEM: **FW Cooling System**

PURPOSE :

Simulate loss of FW circulation pumps.
Check for temperature rise over five minutes.

METHOD :

Stop both circulation pumps and monitor temperature rise. For each circulation pump in turn
1) Stop FW pump No. 1 & No. 2. Monitor temperature rise on engines and thrusters

EXPECTED RESULTS :

1) Alarm FW low pressure. Gradual increase in temperature on engines and thrusters
2) Loss of cooling water to frequency converters result in immediate shut of converter and loss of associated azimuth thruster

RESULTS :

1.

HT Temperature readings: Start degrees. Stop: degrees.

LT Temperature readings: Start degrees. Stop: degrees.

2.

COMMENTS :

Frequency Converter Alarm HT 105 º C, Shutdown 110 º C.
Not tested 2007

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 9	SUBSYSTEM: **Control Air / Start Air**

PURPOSE :

Simulate loss of control air and start air

METHOD :

1) Isolate control air system.
2) Bleed control air pressure
3) Isolate Start air system and bleed pressure

EXPECTED RESULTS :

1) No effect on cooling water system, no pneumatic valves fitted.
2) Low pressure alarm on Thruster header tank.
3) Low pressure alarm on affected engine

RESULTS :

1. As expected
2. Header tank holds pressure
3. As expected, no effect on running engine

COMMENTS :

Low service air; alarm set at 5 Bar.

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **POWER GENERATION**

TEST NO. 10	SUBSYSTEM: **Diesel Engines, speed Sensors**

PURPOSE :

Simulate failure of Speed Sensor.

METHOD :

1) To each engine in turn fail one speed sensor. Restore before continuing.

EXPECTED RESULTS :

1) Alarm only, no effect on engine.

RESULTS :

Main sensors disconnected.

1) DG 1 Top sensor
2) DG2 Bottom sensor
3) DG 3 Not tested 2007
4) DG 4 Not tested 2007

COMMENTS :

Top Sensor – Main, Bottom sensor – back up.

WITNESSED BY :	Dave Talloen	**DATE :**	26th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 11	SUBSYSTEM: **Main Switchboard, Port Section**

PURPOSE :

Simulate loss of port section of the main switchboard.

METHOD :

Set up with the bustie breaker open, in DP mode.
Reduce number of DG on line to one; trip the breaker of the remaining DG.

EXPECTED RESULTS :

Partial Blackout

1) Loss of BT fwd when DG3 breaker is open, loss of connected consumers. Two servo failure and loss of hydraulics.
2) Switchboard section blacked out, loss of Bow Thruster and Port Azimuth, Pumps supplied from port switchboard stop, alarms and auto change over to standby pumps.
3) Momentary loss of 220V main switchboard until supply changeover to transformer T2.
4) Alarm for DP UPS, transfer to internal power.
5) Consequence alarm on DP.

Vessel maintains position with remaining thrusters.

RESULTS :

1.

2.

3.

4.

COMMENTS :

See tests 13/14/15

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 12	SUBSYSTEM: **Main Switchboard, Stbd. Section**

PURPOSE :

Simulate loss of Stbd. section of the main switchboard.

METHOD :

Set up with the bustie breaker open, normal DP configuration.

EXPECTED RESULTS :

Loss of BT Aft when No. 4 DG shut down
Partial Blackout when switchboard section s/d. Emergency generation starts

1) Loss of Bow thruster (T2) and Stbd. Azimuth (T4).
2) Connected pumps stop, alarms and change over to pumps powered from port switchboard.
3) Momentary loss of 220V main switchboard until manual supply changeover to transformer T1.
4) Consequence alarm on DP.

Vessel maintains position with remaining thrusters.

RESULTS :

1.

2.

3.

4.

COMMENTS :

See tests 13/14/15

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 13	SUBSYSTEM: **440V Main Switchboard**

PURPOSE :

Simulate loss of 440V Switchboard Port.
Simulate loss of 440V Switchboard Stbd.

METHOD :

Set up with 440V switchboard bus tie open and inhibit auto start of EM generator

1) Trip supply to Port Section, restore
2) Trip supply to Stbd. Section, restore.

EXPECTED RESULTS :

1) Loss of Port Azimuth, Fwd BT. Loss of consumers from Port Section, no loss of position.
2) Loss of Stbd Azimuth, Aft BT, and consumers from Starboard Section, no loss of position.

No effects to DP.

RESULTS :

1. As expected + SW1 & FW1 , air comp 1

2. As expected + SW2 & FW2 , air comp 2

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 14	SUBSYSTEM: **220V Main Switchboard**

PURPOSE :

Simulate loss of 440V/220V transformers T1 and T2

METHOD :

Set up with transformer T1 online,
1) Trip the breaker supplying T1, restore
Set up with transformer T2 online,
2) Trip the breaker supplying T2
No effect on DP

EXPECTED RESULTS :

1) Loss of BT fwd and aft electrical cabinet system failure, Azimuth PS & SS ATU converter No. 1 gear fail. Momentary loss of 220V main distribution until manual changeover to other transformer.
2) Client No. 12 communication Ethernet main & back up fail.
3) Alarms for engine room 24VDC battery systems Nos. 1 and 2. (on batteries).
4) Loss of supply to forward bridge distribution panel (no effects, change over to 220V emergency).

No effects on DP keeping.

RESULTS :

1. As expected
2. Not observed
3. As expected
4. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 15	SUBSYSTEM: **Emergency Distribution**

PURPOSE :

Simulate loss of supply to emergency switchboard. EM generator in st-by

METHOD :

1) Trip the 220V supply breaker on the EM switchboard.
2) Trip the 440V supply breaker on the main switchboard.
3) Trip the EM generator

EXPECTED RESULTS :

Loss of 440V and 220V emergency distribution and auto start of EM generator

1) Loss of Stbd Azimuth due to loss of lub oil pressure. Loss of 220V backup supply to forward bridge distribution panel (no effects, main 220V still available, no alarm).Alarm, loss of port and stbd. back up 220V supplies. Loss of backup supply to engine room 24VDC battery systems nos. 1 and 2 (no effects, main 220V still available, no alarm).
2) Auto start of EM generator
3) Loss of EM SWBD

No effects to DP keeping.

RESULTS :

1. As expected
2. As expected
3. As expected

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 16	SUBSYSTEM: **Engine Room 24VDC Distribution**

PURPOSE :

Simulate failures to the engine room 24VDC systems.
Test batteries.

METHOD :

To each engine room 24VDC distribution system in turn:
1) 24VDC UPS, fail supply from 220V main switchboard (Praxis ER monitoring)
2) 24VDC battery charger, fail supply from 220V main switchboard;
3) 24VDC battery charger, fail supply from 220V emergency switchboard;
4) Test batteries for 30 minutes.
5) Simulate 24V s/c by tripping all breakers to consumers

EXPECTED RESULTS :

1) Alarm. Breaker within distribution panel automatically closes, supply to 24VDC UPS consumers from battery charger.
2) 220V supply changes over 220V emergency.
3) 24VDC consumers on batteries.
4) 30 minutes OK.
5) No affect on DP keeping.

RESULTS :

	ER system No. 2 (MSB)	ER system No. 1 (wheelhouse)
1.	As expected	As expected
2.	As expected	As expected
3.	As expected	As expected
4.	As expected	As expected
5.	Loss of engine monitoring, SWBD monitoring	Loss of engine monitoring, PS Azi control, GPS 3, both wind sensors

COMMENTS : **See recommendation 3.4.1**

Complete list of consumers detailed in appendix A.

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 17	SUBSYSTEM: **UPS Systems No. 1 for DP**

PURPOSE :

Simulate failure of the UPS No. 1 for DP.
Test batteries.

METHOD :

1) Fail 440V main supply to UPS 1.
2) Test batteries for 30 minutes.
3) Turn off power supply to DP consumers.

EXPECTED RESULTS :

1. Output to consumers change over to battery supply.
2. 30 minutes OK.
3. Loss of: <u>UPS 1 consumers</u>
   F1 DPC 21 (Controller A)
   F2 OS1 (Fwd Bridge)
   F3 Fan beam power (not currently fitted)
   F4 DGPS 1
   F5 DP alarm printer
   F6 Gyro 1 (dual supply)
   F7 Taut Wire 220V
   F8 MRU 2
   F9 Wind 2

RESULTS :

<u>DP UPS no. 1</u>

1. As expected

2. As expected

3. HiPAP drops out when shutting down OS1. F3 & F4 were not correctly labelled

COMMENTS :

See recommendation 3.4.2 & 3.6.1

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER DISTRIBUTION**

TEST NO. 18	SUBSYSTEM: **UPS Systems No. 2 for DP**

PURPOSE :

Simulate failure of the UPS No. 2 for DP.
Test batteries.

METHOD :

1) Fail 440V main supply to UPS 2.
2) Test batteries for 30 minutes.
3) Turn off power supply to DP consumers.

EXPECTED RESULTS :

1) Output to consumers change over to battery supply.
2) 30 minutes OK.
3) Loss of: <u>UPS 2 consumers</u>
   - F1 DPC 21 Controller B)
   - F2 OS2
   - F3 Screen capture printer
   - F4 APC 10 & HiPAP display
   - F5 OS 3
   - F6 HiPAP Transducer
   - F7 Gyro 2 (dual supply)
   - F8 Wind 1

RESULTS :

<u>DP UPS No.2</u>

1. As expected
2. As expected
3. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER MANAGEMENT SYSTEM**

TEST NO. 19	SUBSYSTEM: **Power Supplies**

PURPOSE :

Simulate loss of power supply to PMS and alarm system.

METHOD :

1) Fail 24VDC supply to PMS from ER distribution panel no. 1.
   Restore.
2) Fail power supply to alarm computer from ER distribution panel no. 2.
   Restore.
3) Fail power supply to alarm system monitor from dedicated UPS system.
   Restore

EXPECTED RESULTS :

1) No immediate effects. Not possible to remotely operate the switchboard, or start thrusters from the bridge.
2) Loss of alarm and monitoring system. No effect.
3) Loss of monitor. No effects.

No effect on DP

RESULTS :

1. As expected

2. As expected

3. As expected (master / slave set up)

COMMENTS :

See recommendation 3.6.2

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER MANAGEMENT SYSTEM**

TEST NO. 20	SUBSYSTEM: **PMS functions**

PURPOSE :

Test blackout recovery, autostart of standby auxiliary generator.
Test load dependent autostart of standby auxiliary generator.
Test heavy load consumers start inhibit.

METHOD :

Setup with only one diesel generator running on port switchboard section selected other generator as standby.

1) Trip running generator (i.e. simulate LO low pressure).
2) Increase the load on busbar, i.e. input move on DP, or operate in manual joystick.
3) Attempt start of a thruster.

EXPECTED RESULTS :

1) Blackout, standby generator starts and connects.
2) Standby generator starts and connects.
3) Starting blocked. Standby generator starts and connects.

No effect on vessel position.

RESULTS :

1.

2.

3.

COMMENTS :

Second Generator to be running before starting second thruster.
Not tested in 2007

WITNESSED BY :	**DATE :**

EQUIPMENT SYSTEM : **POWER MANAGEMENT SYSTEM**

TEST NO. 21	SUBSYSTEM: **Kilowatt Signal Loss / Bus Tie Info**

PURPOSE :

Test system to loss of kW signals.
Test system for loss of bus tie status data

METHOD :

With all thrusters and generators on line.

1) Disconnect kW signal cable from DP system. Terminal Board 25A1 tag 8C / 9C.
2) Disconnect bus tie status signal, Terminals DPJC 441 and DP11 439.

EXPECTED RESULTS :

1) DP shows loss of generator on mimic, spinning reserve unaffected. No change in thruster or generator status.
2) DP alarm, "Power out of Range", No change in thruster or generator status

No effect on DP.

RESULTS :

1. As expected; DP shows: power out of range DG - xx
2. As expected
3. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **POWER MANAGEMENT SYSTEM**

TEST NO. 22	SUBSYSTEM: **Loss of CAN Bus**

PURPOSE :

Test system to loss of CAN Bus.

METHOD :

With all thrusters and generators on line.

1) Test for loss of one of the dual CAN Bus to the individual PMS module.
2) Fail second CAN Bus feed

EXPECTED RESULTS :

1) Alarm, Board not present.
2) Generator operates in droop mode.

RESULTS :

1. As expected

2. As expected; loss of mimics on PMS

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **POWER MANAGEMENT SYSTEM**

TEST NO. 23	SUBSYSTEM: **DPU Failure**

PURPOSE :

Test system to loss of DPU.

METHOD :

With all thrusters and generators on line.

1) Simulate failure of DPU 1
2) Simulate failure of DPU 2
3) Simulate failure of DPU 3
4) Simulate failure of DPU 4
5) Simulate failure of DPU 5.

EXPECTED RESULTS :

1. On E/R mimic, Loss of “indication only” on Fwd BT.
2. On E/R mimic, Loss of “indication only” on Aft BT.
3. On E/R mimic, Loss of “indication only” on Port Azimuth.
4. On E/R mimic, Loss of “indication only” on Stbd. Azimuth.
5. Alarm, loss of consumers.

No effect on DP.

RESULTS :

1. As expected
2. As expected
3. As expected + air system
4. As expected
5. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **THRUSTERS**

TEST NO. 24	SUBSYSTEM: **T 1 & T2 (Tunnel Thrusters), Pitch Signals (KS)**

PURPOSE :

Simulate failure of signals to each tunnel thruster in turn.

METHOD :

To each tunnel thruster in turn:

1) Fail pitch reference (command) signal from DP to control unit, before isolation amplifier. 2
2) Fail pitch feedback signal from control unit to DP, before isolation amplifier.
3) Fail pitch reference (command) signal after isolation amplifier from control unit to thruster.
4) Fail pitch feedback signal from thruster to control unit.

EXPECTED RESULTS :

1) Pitch fails to zero, "Thruster Prediction error" alarm on DP.
2) Thruster still controlling pitch, feedback indication on DP to zero, No alarm on DP.
3) Pitch freeze, thruster "Ready Signal" lost, and "Thruster Not Ready alarm on DP).
4) Thruster's pitch to zero immediately.

RESULTS :

	Thruster T 1	Thruster T2
1.	-5% on manoeuvre desk & +10% on DP	As expected
2.	+10% fb – input alarm	As expected
3.	As expected	As expected
4.	As expected – EM control	As expected – EM control

COMMENTS :

See recommendation 3.5.1

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **THRUSTERS**

TEST NO. 25	SUBSYSTEM: **T 1 & T2 (Tunnel Thrusters), Pitch Signals (Rolls Royce)**

PURPOSE :

Simulate failure of signals to each tunnel thruster in turn.

METHOD :

To each tunnel thruster in turn:
1) Fail pitch command signal.
2) Fail pitch feedback signal.

EXPECTED RESULTS :

1) Pitch fails to zero, Alarm "Thruster not ready" alarm. DP indicates zero pitch, gives indication that thruster stopped, but is actually running, ready and enabled.
2) Thruster still controlling pitch, feedback indication on DP to zero, Alarm "Thruster input error". Thruster remains running ready and enabled.

RESULTS :

	Thruster T 1	Thruster T2
1.	As expected	As expected
2.	As expected	As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **THRUSTERS**

TEST NO. 26	SUBSYSTEM: **T 3 & T4, Speed Signals**

PURPOSE :

Simulate failure of speed signals to azimuth thruster.

METHOD :

1) Fail speed reference (command) signal from DP to thruster converter before isolation amplifier.
2) Fail speed feedback signal from thruster to DP.
3) Fail speed reference (command) signal after isolation amplifier.
4) Fail speed feedback signal from thruster to Aquamaster control unit.

EXPECTED RESULTS :

1) Speed fails to zero, alarm "Thruster deselected" alarm on DP.
2) Thruster still controlling speed, alarm "input error" on DP. Thruster lost from Aquamaster RR Control desk.
3) Thruster stops, no alarm, indicating running, ready and enabled.
4) No effect.

RESULTS :

	T 3	**T 4**
1.	No deselect, only prediction error	No deselect, only prediction error
2.	Thruster not lost but shows 100%	Thruster not lost but shows 100%
3.	As expected and prediction error	As expected and prediction error
4.	No alarms	No alarms (???)

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **THRUSTERS**

TEST NO. 27	SUBSYSTEM: **T 3 & T4 Azimuth Signals**

PURPOSE :

Simulate failure of azimuth signals to azimuth thruster.

METHOD :

1) Fail azimuth reference (command) signal from DP to control unit.
2) Fail azimuth reference (command) signal from control unit to thruster
3) Fail azimuth feedback signal from control unit to DP.
4) Fail azimuth feedback signal from thruster to control unit.

EXPECTED RESULTS :

1) Azimuth fails to zero position, speed still controlling. Alarm "Thruster prediction error". No control, thruster running, ready and enabled, fails to fore & aft position.
2) Azimuth fails to zero position, speed to zero, not ready in DP
3) No effect.
4) Thruster deselected. Thruster fails as set, Alarm "Thruster Steering Prediction error" on DP. Thruster stays in desk, indicated as running, ready and enabled.

RESULTS :

	T 3	**T 4**
1.	As expected	As expected
2.	Couldn't find correct terminal	Couldn't find correct terminal
3.	Prediction error on DP, shows 180˚, working normal	Prediction error on DP, shows 180˚, working normal
4.	As expected but no deselect	As expected but no deselect

COMMENTS :

See recommendation 3.5.2

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **THRUSTERS**

TEST NO. 28	SUBSYSTEM: **Hydraulic Systems**

PURPOSE :

Simulate failure of hydraulic system for each thruster in turn.
Test hydraulic level alarms

METHOD :

1) Bow thrusters; locally stop running hydraulic pump.
   Restore and repeat for other tunnel thruster.
2) Simulate hydraulic level alarms

EXPECTED RESULTS :

1) Alarm automatic start of standby pump. Tunnel thruster remaining in operation.
2) Alarm, low level. Thruster stays running.

RESULTS :

1. As expected

2. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **THRUSTERS**

TEST NO. 29	SUBSYSTEM: **Emergency Stops**

PURPOSE :

Test thruster emergency stops.

METHOD :

Activate thruster emergency stops from all locations. Restore and reselect to DP before tripping the next

EXPECTED RESULTS :

1) Thruster T1 stop. Deselect from DP, "Unavailable" alarm.
2) Thruster T2 stop. Deselect from DP, "Unavailable" alarm.
3) Thruster T3 stop. Deselect from DP, "Unavailable" alarm.
4) Thruster T4 stop. Deselect from DP, "Unavailable" alarm.

RESULTS :

	Local	Bridge Fwd	Bridge Port	Bridge Stbd.	ECR
1.					N/A
2.					N/A
3.					
4.					

COMMENTS :

Five emergency stops tested. All emergency stops are tested monthly, as per AMOS PMS.
Not tested 2007, last recorded test 1st august

WITNESSED BY : Dave Talloen	**DATE :** 26th August 2007

EQUIPMENT SYSTEM : **THRUSTERS**

TEST NO. 30	SUBSYSTEM: **Frequency Drives**

PURPOSE :

1. Verify Alarms on T3 and T4

METHOD :

1) Simulate water temperature alarm
2) Simulate water leakage alarm in converter panel
3) Simulate motor temperature alarm
4) Simulate current control system fault.
5) Intitial affect on thrusters
6) Fail PLC on frequency drive converter

EXPECTED RESULTS :

1) Alarm, HH alarm results in thruster shut down.
2) Alarm, water leakage, thruster shuts down
3) Alarm, HH alarm results in thruster shut down.
4) Alarm, no effect on DP
5) Power to thrusters chopped back
6) Alarm, loss of thruster

RESULTS :

T3	T4
1. As expected	As expected
2. Alarm: cw flow low	Alarm: cw flow low
3. As expected	As expected
4. As expected	As expected
5. As expected	As expected
6. As expected	As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 31	SUBSYSTEM: **Networks**

PURPOSE :

Simulate failure of Ethernet networks.

METHOD :

1) One at a time, disconnect the Ethernet cables from each Ethernet hub. Restore before disconnecting the next.
2) One at a time, fail the power supply to Ethernet hub. Restore before failing the other.
3) Test Ethernet LAN for O/C, S/C and ground

EXPECTED RESULTS :

1) Alarm, communications between consoles continue on other Ethernet network.
2) Alarm, communications between consoles interrupt. No effects to online console and DP.
3) Alarm, communications continue on other network. Earth indication.

RESULTS :

1. As expected
2. As expected (UPS test, powered from OS)
3. Not tested 2007

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 32	SUBSYSTEM: **DP Consoles**

PURPOSE :

Simulate power failure to OS Display.

METHOD :

1) Turn off power supply to master DP Display. Restore.
2) Turn off power supply to stand-by DP Display. Restore

EXPECTED RESULTS :

1) Alarm but no loss of position. Requires manual change over to one of the stand by consoles.
2) Same for other consoles.

No effects to positioning.

RESULTS :

1. As expected

2. As expected

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 33	SUBSYSTEM: **Computer Failure**

PURPOSE :

To check that a bumpless transfer takes place to the offline desk

METHOD :

On DP, DPC 21-1 on line

1. Trip power supply to DPC21-1
2. Observe position accuracy. Restore

DPC 21-2 On line

1. Trip power supply to DPC21-2
2. Observe position accuracy. Restore
3. Fail supply to OS1 when OS1 in use. Restore
4. Fail supply to OS2 when OS2 in use. Restore

EXPECTED RESULTS :

1 Loss of DPC21-1, auto changeover to DPC21-2
2 No change in position.
3 Loss of DPC21-2, auto changeover to DPC21-1.
4 No change in position.
5 Alarm
6 Alarm

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected
5. As expected
6. As expected

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 34	SUBSYSTEM: **Gyro Compasses**

PURPOSE :

Simulate failure of gyro compasses.
Prove gyro redundancy.

METHOD :

To one gyro compass at a time:
1) Fail gyro compass power supply. (all dual supply)
2) Fail gyro compass interface to DP console.
3) Test gyro difference alarms

EXPECTED RESULTS :

1) Alarm, Gyro switches to back up supply
2) Gyro 2: alarm "Gyro Failure", rejected from median. Loss of HiPAP.
3) Rejected when more then 2˚ difference from median

RESULTS :

	Gyro 1 (UPS1 / 24V)	Gyro 2 (UPS2 / 24V	Gyro 3 220V msb/esb
1.	As expected	As expected	No alarm on Bridge
2.	As expected	As expected but HiPAP on Seapath	As expected
3.	As expected		

COMMENTS :

There is no alarm for the (back-up) supply of Gyro 3.
The gyro's drifted from each other during the trials. This should be closely monitored and possible service called in.

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 35	SUBSYSTEM: **Anemometers**

PURPOSE :

Simulate failure of anemometers.
Prove anemometers redundancy.

METHOD :

1 Lead wind direction at a 45 degrees angle (partly shielding and leading by small board), release after 20 seconds.
2 Fail power supply to wind sensor
3 Fail serial input wind sensor to DPC
4 Stop preferred wind sensor by hand (bucket test)
5 Change to other wind sensor
6 Measure excursion of position
7 Release sensor

EXPECTED RESULTS :

1. Wind direction difference alarm, small increase in thruster activity.
2. Alarm, wind not ready.
3. Alarm, wind not ready.
4. Wind speed difference alarm.
5. Increase in thruster activity.
6. Unstable position.
7. Position restored.

RESULTS :

1. Not able to access the mast
2. As expected
3. As expected
4.
5
6.
7.

COMMENTS :

See recommendation 3.4.1

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 36	SUBSYSTEM: **Motion Reference Unit (MRU)**

PURPOSE :

Simulate failure of MRU.

METHOD :

1) Fail MRU 1 power supply. Restore.
2) Fail MRU 2 power supply. Restore.
3) Fail MRU 1 input signal, roll, pitch & heave to DP. Restore
4) Fail MRU 2 input signal roll, pitch & heave to DP. Restore

EXPECTED RESULTS :

1) Alarm to DP. . Possible effects to both DGPS positioning.
2) Alarm. Possible effects to both DGPS positioning. Loss of HiPAP when selected as online MRU
3) Alarm to DP.
4) Alarm to DP.

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected

COMMENTS :

MRU 1 – Powered from DPC-2
MRU 2 – UPS 1
MRU 2 signal to HPR.
After NOTE: UPS supplies to the MRU's swapped because of HiPAP, to be updated in 2008

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 37	SUBSYSTEM: **DGPS Systems**

PURPOSE :

Test performance of DGPS systems.
Simulate failures.

METHOD :

1. Rotate vessel through 360º and check for blind sectors.
2. Simulate communication failure by failing input telegram from DGPS's in turn to DP
3. Simulate DGPS rejection by reducing the number of satellites from 6 downwards and wait to see when rejection takes place.
4. Fail IALA diff. Signal of DGPS 2
5. Fail diff signal from Inmarsat- DGPS 1
6. Fail Spotbeam diff signal, DGPS 1
7. Fail Spotbeam diff signal, DGPS 3

EXPECTED RESULTS :

1. No sectors where position data is lost
2. Time out alarm and zero weight
3. Use of altitude aiding, rejection when four satellites
4. Alarm, loss of diff. signal to DGPS, rejected from DP
5. Alarm, loss of diff signal to DGPS, other corrections still available
6. Alarm, loss of diff. signal to DGPS, rejected from DP
7. Alarm, loss of diff. signal to DGPS, rejected from DP

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected
5. As expected
6. As expected
7. As expected

COMMENTS :

DGPS 1- Veripos- Diff Spot and Inmarsat- UPS 1
DGPS 2- Lecia- Diff IALA MF/HF- 24V GMDSS Supply
DGPS 3- Trimble- Diff Spot Beam – 24V MSB 1, **See recommendation 3.5.4**

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 38	SUBSYSTEM: **HiPAP System**

PURPOSE :

Test performance of acoustic system.
Simulate failures.

METHOD :

Setup with acoustic system online with other reference systems.
1) Compare performance with other systems.
2) Fail power supply to position reference console.
3) Fail online gyro input.
4) Fail online MRU input.

EXPECTED RESULTS :

1) Weighting equally divided with other reference systems.
2) Loss of acoustics and rejected from DP.
3) Acoustics rejected from DP.
4) Acoustics rejected from DP.

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected

COMMENTS :

Gyro's: Gyro 1 & Seapath
MRU's: MRU 2 & Seapath
See recommendation 3.5.3

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **SENSORS**

TEST NO. 39	SUBSYSTEM: **Taut Wire**

PURPOSE :

Verify operation of Taut Wire Alarm Limits

METHOD :

Move vessel to exceed taut wire warning and alarm limits.

1) To port
2) To starboard
3) To aft
4) To forward

EXPECTED RESULTS **:**

1) Alarm, taut wire exceeding limits, Taut wire deselected.
2) Alarm, taut wire exceeding limits, Taut wire deselected.
3) Alarm, taut wire exceeding limits, Taut wire deselected.
4) Alarm, taut wire exceeding limits, Taut wire deselected.
5) No dragging of C/W observed

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected
5. As expected

COMMENTS :

360˚rotaion test with all references online showed a max deviation of 8m between the references (4m radius)

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 40	SUBSYSTEM: **Fan Beam**

PURPOSE :

Test position reference stability and overshoot.

METHOD :

Establish vessel in stable position relative to the target.
Compare with another reference system.

1) Move vessel 20m towards target and compare with other reference systems.
2) Move vessel aft 20m from target and compare with other reference systems.

EXPECTED RESULTS :

1) No significant difference.
2) No significant difference.

RESULTS :

1.

2.

COMMENTS :

Test not carried out due to Fan Beam not being fitted.

WITNESSED BY :	**DATE :**

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 41	SUBSYSTEM: **Model Control**

PURPOSE :

Test model control upon loss of all position references.

METHOD : **On DP**

1) Leave system to build the model for at least 20 minutes (do not input moves/heading changes or change thruster configuration)
2) Deselect all position references from DP.
3) Utilise independent reference to measure position loss, measure after 6 minutes.

EXPECTED RESULTS :

1. Position drop out alarm
2. Vessel moves of position slowly.

RESULTS :

1. As expected
2. Start N992 E089 . Heading 140˚ Wind 302˚x18kts Current 296˚ x 0.9kts
3. End N005 E072, total drift 21m WNW

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 42	SUBSYSTEM: **Computer I/O Modules and 24V fuses in DPC**

PURPOSE :

Test affect of I/O module failure and 24V fuse failure

METHOD :

1) Fail each fuse, by disconnecting one at the time, for each wait 30 second.
2) Insert a defect or remove fuse in fuse panel for those who have LED light.
3) Fail each I/O board one by one and restore. Check against KM I/O Spec list : U11, U12, U13, U14, U31, U32, U41, U42, U51, U71, U72,

EXPECTED RESULTS :

1) Alarm for fuse failure and loss of respective equipment if single supplied no loss of position.
2) The LED lights up.
3) A failure of either I/O should not result in loss of position keeping

RESULTS :

1. As expected
2. As expected
3. As expected

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 43	SUBSYSTEM: **Consequence Analysis**

PURPOSE :

Test consequence analysis alarms.

METHOD :

With all generators on line and all thrusters
1) Reduce number of generators, restore
2) Reduce number of thrusters, restore.

EXPECTED RESULTS :

1) Consequence analysis warning
2) Consequence analysis warning.

RESULTS :

1. As expected
2. As expected

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 44	SUBSYSTEM: **Operational Modes**

PURPOSE :

Test all operational modes while on DP.

METHOD :

While on DP, test operation of all operational modes,

1) High gain.
2) Medium gain.
3) Low gain

EXPECTED RESULTS :

1) Improved position keeping
2) Reduced fuel consumption
3) Reduced fuel consumption.

RESULTS :

1. As expected
2. As expected
3. As expected

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 45	SUBSYSTEM: **Control Modes**

PURPOSE :

Test all other control modes while on DP.

METHOD :

While on DP, test operation of all other control modes,

1) Manual control, levers, transit etc.
2) Check DP switch

EXPECTED RESULTS :

1) DP system in control, others ineffective.
2) Protected from non-intentional operation

RESULTS :

1. As expected

2. As expected

COMMENTS :

Test to include all consoles.
Note: DP switch could do with some 'high lighting'

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **DP CONTROL SYSTEM**

TEST NO. 46	SUBSYSTEM: **Change over, DP Main / DP Joystick Control**

PURPOSE :

Test the change over between DPC (Aft) and DPC (Fwd)

METHOD :

1) Check operation of command transfer from SDP-21 to joystick control.
2) Simulate fault in transfer line.

With all sensors and reference systems on line:

3) Test operation from OS 1 console. (Bridge Fwd)
4) Test joystick.

EXPECTED RESULTS :

1) Smooth change-over.
2) Alarm, no transfer possible.
3) Normal operation
4) Joystick manoeuvre smoothly.

RESULTS :

1. As expected
2. As expected
3. As expected
4. As expected

COMMENTS :

WITNESSED BY : Dave Talloen	**DATE :** 27th August 2007

EQUIPMENT SYSTEM : **Communications**

TEST NO. 47	SUBSYSTEM: **Communication Systems and DP Alerts**

PURPOSE :

Check functionality of communication systems and DP alerts.

METHOD :

1) Test all communications system (telephones, intercoms, etc.).
2) Test DP alerts.

EXPECTED RESULTS :

All systems operational.

RESULTS :

1. UHF/VHF to 'project' and telephone to ECR
2. Not in use

COMMENTS :

WITNESSED BY :	Dave Talloen	**DATE :**	27th August 2007

Appendix A

POWER DISTRIBUTION 24V DC CONSUMERS WHEELHOUSE ECR SUPPLY MSB1

Located in Void space under Bridge

Breaker	Consumer
Q1	TLDP1 (See list of consumers below)
Q2	DP 24V ER Port Side
Q3	Docking Console PS wheelhouse – no alarm upon loss of supply
Q4	Docking Console SS wheelhouse – no alarm upon loss of supply
Q5	Magnetic Compass Lamp – no alarm upon loss of supply
Q6	Master Compass Gyro 1 – alarm "fail dc supply" + horn – c/o to backup supply
Q7	Master Compass Gyro 2 - alarm "fail dc supply" + horn – c/o to backup supply
Q8	Rate of Turn repeater wheelhouse – no alarm – back up supply to be identified.
Q9	Steering Control Unit Wheelhouse – alarmed – Auto c/o to backup supply
Q10	Sound Reception System Wheelhouse – no alarm
Q11	SDP – OS Mounting Plate Combined Prop Control – Alarm in centre DP Control Panel
Q12	PS – OS Mounting Plate Combined Prop Control – Alarm in centre and PS DP Control Panel
Q13	SS – OS Mounting Plate Combined Prop Control – Alarm in centre and SS DP Control Panel
Q14	Hull Mounted Sonar display unit – no alarm upon loss of supply
Q15	Echo Sounder digital repeater, - no alarm – backup supply? Identify
Q16	Speed log digital display wheelhouse no alarm
Q17	Speed log analogue display wheelhouse port side no alarm
Q18	Speed log analogue display wheelhouse stbd side no alarm
Q19	CapSat Fleet 77 electric unit comms console (Sat Comms)– no alarm
Q20	Emergency Table Mounted Console – no alarm – backup supply?
Q21	Aquamaster Control Unit – loss of Port side Azi, - alarms and deselected from DP desk
Q22	Combined propulsion and steering console – no alarm
Q23	Alarm and monitoring System DPU5 - Loss of Bow Thruster Aft, - no ECR alarms – Alarms on bridge with associated BT alarms - No DPU5 supply c/o alarm. - When power restored to DPU5 BT aft restarted without intervention.
Q24	Master Compass Gyro 3 – DP system alarm – gyro still functional
Q25	Speed log master display wheel house – still working – no alarm
Q26	Sensor unit GPS Hydro Console off during test due to earth fault

MSB2 24V DC – UPS Consumers. E.Room – Port Upper

Q1	TLDP 3 – see below
Q2	Spare
Q3	Engine PS Fwd relay module
Q4	Engine SS Fwd relay module
Q5	FW Preheater Control Voltage – Alarm Control voltage loss, common alarm Stbd Fwd Engine.
Q6	DDG set A003 PS Aft backup supply – alarm "PS Aft relay module failure"
Q7	Stbd. Aft Common alarm Loss of A004 Stbd Aft Main supply.
Q8	PMS Genr. SB aft – alarm "DG4 CB Control Supply Fail.
Q9	MBS 690V Stbd. Fwd. Alarm " DG3 CB Control Supply Fail.
Q10	Mach. Control Room Console ECR indication lights only
Q11	Steering Control Unit wheelhouse – no alarm, no effect on DP – secondary supply to autopilot provided from UPS.

DP 24V DC Supply. E.Room – Stbd Upper

Breaker	**Consumer**
Q1	DG A001 PS Fwd Main supply - Loss of indication (run) engine stays running – alarm "relay module, coms error"
Q2	DG A002 SB Fwd Backup supply, running indication maintained by primary supply – additional alarms (see printout)
Q3	DG A003 PS Aft Main supply - alarm "relay module comm error, common alarm turbo rpm indication" – running indication lost
Q4	DG A004 Stbd. Aft – retained running indication. Via backup supply – alarm "eng stbd aft relay module fail" other alarms"Start air, LO inlet press. Relay module fail, LT and HT FW inlet
Q5	Fresh water Preheater Control – no alarm upon loss of supply
Q6	Alarm- "Bow Thruster Fwd. Electrical Cabinet System failure" alarms stay up – restore and reset at panel in Bow Thruster Room
Q7	Bow Thruster Forward alarm indications only, Alarms for Seal Tk Low, Gravity Tk low, Servo oil pressure low, motor O/L, high filter diff pressure – Thruster continues running
Q8	PMS Port side Aft Alarms – "DG1 CB Control Supply fail" – engine keeps running
Q9	PMS PS Fwd Alarms – "DG2 CB Control Supply fail – engine keeps running – failure of indication in the one line diagram

TLDP 1

Breaker	Consumer
Q1	Lighting
Q2	Lighting
Q3	Lighting
Q4	Lighting
Q5	Lighting
Q6	WT doors control alarm – "Power Failure" (doors close automatically)
Q7	WT doors – alarm/indication – alarm – "WT doors power failure"
Q8	WT door magnets – no alarm
Q9	Emergency Telegraph – loss of indication - no alarm
Q10	Bridge Control Unit for thrusters Warning s for: Stbd Azimuth ACU unit Port Azimuth ACU unit Azimuth master /slave bridge warning. Thrusters continue to run.
Q11	Spare
Q12	Provisional deck crane – no effect on DP.
Q13	Navigation light panel – alarm "Nav. Light panel main supply missing"
Q14	Junction box for Aldis lamp - alarm "Aldis Lamp main supply missing"
Q15	Talkback – inoperative due to loss of power – no alarm
Q16	Hospital Call Unit – not commissioned yet.
Q17	Ship's security alarm system DSAJ – not commissioned
Q18	Emergency Whistle – no alarm
Q19	Switchover unit (gyro) - no alarm

TLDP3

Breaker	Consumer
Q1	Lighting
Q2	Lighting
Q3	Lighting
Q4	Aquamaster control supply. Loss of Stbd. Azimuth Alarms on DP
Q5	PLC Panel Alarm "Loss of buoy handling power winch"