



ADAMS OFFSHORE SERVICES LIMITED,
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DPSV ADAMS AQUANAUT



DP Annual Trials

DOCUMENT CONTROL SHEET

“ADAMS AQUANAUT”

ANNUAL DP TRIALS

FOR

ADAMS OFFSHORE SERVICES LTD.

OFFSHORE BAHRAIN, 16th to 19th NOVEMBER 2009

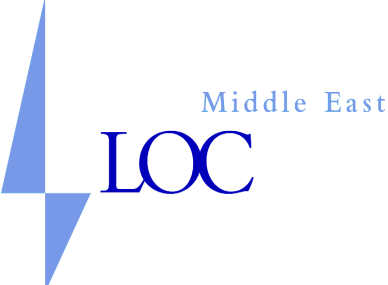
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1 EXECUTIVE SUMMARY

INSTRUCTIONS:		
Ref	Item	Remarks
1.1	Vessel name:	"Adams Aquanaut".
1.2	Vessel type:	Offshore Support Vessel.
1.3	DP Class:	⊗ A1 Offshore Support Vessel,  ⊗ AMS, ⊗ DPS 2
1.4	Instructions received from:	Mr. R. Kumar.
	Company:	Adams Offshore Services Limited.
	Tel:	+ 44 1224 765 308.
	E-mail:	rrajeev@adamsoffshore.net
CIRCUMSTANCES OF THE TRIALS:		
1.5	Date(s):	16 th to 19 th November 2009.
1.6	Location:	Offshore Bahrain.
1.7	Surveyor:	Captain K. S. Spedding.
1.8	Key personnel in attendance:	Captain J. Sloman (Master). Mr. R. Kumar (Technical Manager). Mr. A. Smith (Engineering Manager). Mr. R. K. Reutergaard (Kongsberg).
SCOPE OF DP TRIALS:		
1.9	<p>LOCME was instructed to witness the 2009 Annual DP Trials on the OSV "Adams Aquanaut". Instructions were received by e-mail from Adams Offshore Services Ltd. on 11th November 2009. The vessel was attended between 14th November 2009 and 19th November 2009 at Bahrain and offshore Bahrain.</p> <p>The trials were conducted between 16th and 19th November 2009 offshore Bahrain.</p> <p>The trials were conducted based on the Failure Mode Effect Analysis (FMEA) Report No. GM-22384-0103-14747 Rev-3 dated 13th August 2007 (that has been approved by ABS) and the Annual DP Trials Report LOCH/2764/RVD/R001 Rev-0 dated 13th November 2008.</p> <p>The 2009 trials were intended to show that the vessel meets the requirements of the 1999 IMCA Guidelines for the Design and Operation of DP vessels and the IMO 1994 Guidelines for Vessels with Dynamic Positioning Systems.</p>	

1.10	Location and Limitations: The trials were conducted 3.5 miles east of Bahrain at Lat 26° 11.9'N and Long 050° 47.3'W, water depth was on average 18.8m, drafts of vessel were 4.5m fwd and 4.5m aft.
1.11	Weather: At the time of the trials the winds were mainly light and variable with calm seas becoming northerly on 19 th November at 15kts with slight seas and 1.0 to 1.5 m swells. Current was tidal as per Mina Salman predictions at about 0.3 to 0.8kts.


2 SUMMARY CONCLUSION AND FINDINGS

SUMMARY CONCLUSION:	
2.1	London Offshore Consultants M.E. witnessed the Annual DP trials on the "Adams Aquanaut". The trials have demonstrated that the vessel continues to meet IMCA Guidelines and Recommendations and is fit for purpose and able to carryout DP operations applicable to IMO DP Class 2 within its operational capabilities.
COMMENTS AND RECOMMENDATIONS:	
2.2	Power Distribution. All tests were completed satisfactorily as per the trials programme.
2.3	Engine and Machinery Systems. All tests were completed satisfactorily as per the trials programme.
2.4	DP Computers. All tests were completed satisfactorily as per the trials programme.
2.5	Thrusters. All tests were completed satisfactorily as per the trials programme.
2.6	DP Reference Systems. All tests were completed satisfactorily as per the trials programme, except for boxing the fanbeam.
2.7	Maintenance. The equipment status shows maintenance is up to date.
2.8	Personnel. The personnel on board at the time of the trials demonstrated a thorough understanding of the DP system and a total awareness of their duties. Their assistance and consideration was greatly appreciated.
ACTION LIST	
2.9	High - Immediate Attention. None.
2.10	Medium - When Reasonably Practicable. Test 29 - Fanbeam tests to be completed first opportunity by ship staff.
2.11	Low - Future Attention or Consideration. None.

3 REFERENCE DOCUMENTS

Ref	Relevant Publications
3.1	IMCA M.103: Guidelines for the Designs and Operation of Dynamically Positioned Vessels.
3.2	IMCA M.139: DP Vessels Annual Trials.
3.3	IMO MSC / Circ 645: Guidelines for Vessels with Dynamic Positioning Systems.
3.4	FMEA Ref: GM-22382-0102-14508 Rev-3 dated 20 March 2007.
3.5	Annual DP Trials Report Ref: LOCH/2726/RVD/R001 Rev-0 dated 13 th November 2008.

4 GENERAL PARTICULARS

Ref	Item	Remarks
4.1	Name of vessel:	"Adams Aquanaut".
4.2	Type of vessel:	Offshore Support Vessel.
4.3	Principal special equipment:	Single Boom electro-hydraulic crane GPCO-900-4518. Maximum capacity 45 tonnes. Moonpool. DP-2 capability.
4.4	Flag / Port of registry:	Nassau, Commonwealth of Bahamas.
4.5	IMO No.:	9296717.
4.6	Year/place of construction:	2004, Astilleros Balenciaga, Spain.
4.7	Year/place conversion:	N/A.
4.8	Registered owners:	Adams Aquanaut Limited.
4.9	Operators:	Adams Offshore Services Ltd.
4.10	Dimensions:	73.5m x 16.0m x 7.5m.
4.11	Classification Society:	ABS.
4.12	Class notation:	✱ 1A1 Offshore Support Vessel,  ✱ AMS, ✱ DPS 2
4.13	Gross Registered Tonnage:	2642t.
4.14	Deadweight (summer):	1815t.
4.15	Operating drafts:	4.55m.
4.16	Propulsion Machinery:	2 x Wartsila 6R32E diesel engines 2460 KW at 750rpm (manual running), 780rpm (mechanical backup) and 675rpm (DP running) driving twin Schottel azimuth units (35tbp each). 3 x 700 KW Schottel STT CP electric bow thrusters, fixed speed variable pitch (8.5t thrust each). 3 x Wartsila 4R32 Diesel engines 1950 KVA at 720 RPM driving 440V Brushless Generators 1620 KW, 60 Hz, 3 phase each.
4.17	Contact details:	Technical Manager, Adams Offshore Services Ltd. 5th Floor, Regent Centre, Regent Road Aberdeen. AB11 5NS.
	Vessel E-mail:	captain@adamsaquanaut.atseamail.com
	Inmarsat "M"	+763 936285

5 DP SYSTEM AND REFERENCE EQUIPMENT

Ref	Item	Manufacturer & Model	Remarks
5.1	DP System.	Kongsberg SDP 21.	Filter changed regularly.
5.2	Independent Joystick.	Simrad OT.	None.
5.3	Gyrocompass – 1.	Anschultz Standard 20.	Serviced by ETO 19/08/2009.
5.4	Gyrocompass – 2.	Anschultz Standard 20.	Serviced by ETO 19/08/2009.
5.5	Gyrocompass – 3.	Meridian Surveyor.	Serviced by ETO 19/08/2009.
5.6	VRU – 1.	Kongsberg Seatek.	Maintenance free.
5.7	VRU – 2.	Kongsberg Seatek.	Maintenance free.
5.8	Wind Sensor – 1.	Obsermet.	None.
5.9	Wind Sensor – 2.	Obsermet.	None.
5.10	Wind Sensor – 2.	Obsermet.	None (forward bridge).
5.11	DGPS – 1.	Starfix 4100 LR12.	None .
5.12	DGPS – 2.	Starfix 4100 LR12.	None.
5.13	XP system.	Fugro Multifix 15.	None.
5.14	HPR.	HiPaP 350.	None.
5.15	Taut Wire.	Bandak Mk14B.	None.
5.16	Laser/Radar.	MDL Fanbeam 4.	Regular cleaning of lens & greasing of moving parts by ETO.

6 CERTIFICATION & DOCUMENTATION

Ref	Certificate.	Issue date & place.	Expiry date.
6.1	Certificate of Class.	14/11/2008 Tampa.	13/01/2014
6.2	Hull Special Survey.	14/11/2008 Tampa.	13/01/2014
	Annual survey.	N/A.	N/A
6.3	Machinery Special Survey.	14/11/2008 Tampa.	13/01/2014
	Annual survey.	N/A.	N/A.
6.4	Dry-dock Survey.	31/10/2008 Tampa.	
6.5	Class recommendations.	08/09/2009.	One in place.
6.6	Class DP Survey.	N/A.	
6.7	Class intermediate survey.	N/A.	
6.8	NMD certification.	N/A.	
6.9	Last Annual DP Trial.	13/11/2008 Tampa.	
6.10	Other DP certification.	None.	
6.11	FMEA.	13/08/2007.	

7 PERSONNEL

Ref	Name	Position
7.1	J. Sloman	Master
7.2	S. Nielsen	Chief Mate
7.3	M. Saleh	Chief Mate
7.4	A. Simpson	DPO
7.5	J. Wells	DPO
7.6	L. Hounsell	Chief Engineer
7.7	P. Dybski	2nd Engineer
7.8	J. Simpson	3rd Engineer
7.9	K. Glazik	ETO
7.10	R. K. Reutergaard	Kongsberg System Engineer
7.11	K. S. Spedding	LOC Auditor
7.12	R. Kumar	AOSL
7.13	A. Smith	AOSL

8 MAINTENANCE RECORDS – MAIN ENGINES

Ref		Port	Starboard
8.1	Maintenance records checked	Yes	Yes
8.2	Outstanding maintenance	As per PMS	As per PMS
8.3	Last oil analysis	17/05/2008	05/09/2009
8.4	Last analysis results	OK	OK
8.5	Last major overhaul	None	None
8.6	Running hours 18/11/2009	22998	22116
8.7	Hours since last overhaul	22998	22116
8.8	Remarks:		

9 MAINTENANCE RECORDS – THRUSTERS

Ref		T1 (Bow Fwd)	T2 (Bow)	T3 (Bow Aft)	T4 (Stbd Azi)	T5 (Port Azi)
9.1	Maintenance records checked	Yes	Yes	Yes	Yes	Yes
9.2	Outstanding maintenance	None	None	None	None	None
9.3	Last oil analysis	06/09/2009	21/03/2009	06/09/2009	18/02/2009	05/09/2009
9.4	Last analysis results	OK	OK	OK	OK	OK
9.5	Running hours	12574	5773	14757	22948	22107
9.6	Hours since last overhaul	1121	97	973	1687	810
Remarks						

10 MAINTENANCE RECORDS - GENERATORS

Ref		DG1	DG2	DG3
10.1	Maintenance records checked	Yes	Yes	Yes
10.2	Outstanding maintenance	None	None	None
10.3	Last oil analysis	05/09/2009	06/09/2009	23/02/2009
10.4	Last analysis results	OK	OK	OK
10.5	Last major overhaul	17/12/2008	None	12/04/2008
10.6	Running Hours	22611	14781	25745
10.7	Hours since last overhaul	2725	14871	3722
10.8	Remarks			

11 MAINTENANCE RECORDS - ELECTRICAL PROTECTION

Ref	Circuit breaker	Date	Company
11.1	Switchboard bus ties	01/11/2008	Garba CB Services, 4419 Denver Street, Tampa FL 33619
11.2	Generator bus ties	01/11/2008	Garba CB Services, 4419 Denver Street, Tampa FL 33619
11.3	Thruster breakers	01/11/2008	Garba CB Services, 4419 Denver Street, Tampa FL 33619
11.4	Remarks		

12 COMPUTERS

Ref		Remarks
12.1	Maintenance checked	Yes
12.2	Last software revision	OS 4.08 / OSK 1.9.10
12.3	Remarks	

13 CAPABILITY PLOTS

Ref		Remarks
13.1	Capability plots on board	Yes
13.2	Footprint diagrams on board	Yes

14 DP UPS

Ref	Item	Remarks
14.1	Unit	Last battery check 16/11/2009
14.2	UPS-A	Weekly (Regular battery checks carried out)
14.3	UPS-B	Weekly (Regular battery checks carried out)
14.4	Remarks	Discharge test carried out every four months

15 PRE-TRIAL CHECKLIST

Ref	Item	Remarks
15.1	Position Error Warning & Alarm	3m and 5m
15.2	Heading Error Warning & Alarm	3° and 5°
15.3	Gyro Alignment	OK
15.4	VRU Alignment	OK
15.5	Wind Sensor Calibration	OK
15.6	Consequence Analysis Activated	Yes
15.7	DP Alarm Printer Operating	Yes
15.8	Generator Configuration	As per normal DP Ops
15.9	Fuel System Split	Yes
15.10	All Thrusters on line	Yes

16 TEST # 1 TRIAL READINESS

16.1	Equipment Subsection:	Communications and audible / visual alarms
16.2	Objective	Test of communications and alarms on bridge and DP desk
16.3	Method:	<ol style="list-style-type: none"> 1. Test communications with deck and engine room from bridge 2. Test dive status alarms in all locations 3. Test DP desk keyboard and lamps 4. Print page and check date and time.
16.4	Results Expected:	<ol style="list-style-type: none"> 1. All modes of communication in good working order. 2. Visual and audible alarms in good order in all repeaters 3. All in good order. 4. Page printed and date confirmed as being correct.
16.5	Results:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected. 4. As expected.
16.6	Comments:	<p>Normal DP Mode:</p> <p>Main engines 1 & 2, ST-4 and ST-5.</p> <p>Auxiliary Engines 1 & 3, and any two bow thrusters.</p>
16.7	Witnessed:	K. S. Spedding

17 TEST # 2 AIR – ENGINE SUBSYSTEM FAILURE - AIR

17.1	Equipment Subsection:	Control and combustion air systems
17.2	Objective	Test alarms, response of air systems failures.
17.3	Method:	<p>With all diesel engines on line as required for normal DP.</p> <p>Control Air:</p> <ol style="list-style-type: none"> 1. Isolate and vent, starting and control air and instrument supply to main engine. 2. Isolate and vent, starting and control air and instrument supply to auxiliary engine. 3. Isolate air supply to propeller clutch systems. <p>Combustion Air:</p> <ol style="list-style-type: none"> 1. Fail power supply to engine room ventilation switchboard no.1. 2. Fail power supply to engine room ventilation switchboard no.2. 3. Switch off all engine room ventilation fans.
17.4	Results Expected:	<p>Control Air:</p> <ol style="list-style-type: none"> 1. No effect on running engine, "generator starting air pressure" "oil mist detector failure" alarms on Wärtsila alarm panel. "Main engine ? group alarm" on central alarm system. 2. No effect on running engine, "generator starting air pressure" "oil mist detector failure" alarms on Wärtsila alarm panel. "aux engine ? group alarm" on central alarm system. 3. Clutches remain in for at least 30 minutes. <p>Combustion Air:</p> <ol style="list-style-type: none"> 1. Loss of engine room fan no.1 and auxiliary engine room fan no.1. Air supply continues from no.2 fans. Engine continues to operate, no increase in temperature. 2. Loss of engine room fan no.2 and auxiliary engine room fan no.2. Air supply continues from no.1 fans. Engine continues to operate, no increase in temperature. 3. Engines continue to run, drawing air through ventilation ducting.
17.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected.
17.6	Comments:	
17.7	Witness:	K. S. Spedding

18 TEST # 3 SUBSYSTEM – COOLING WATER

18.1	Equipment Subsection:	Cooling water system
18.2	Objectives:	Test of failure of controllers and sensors and response
18.3	Method:	With all diesel engines on line as required for normal DP. 1. Fail power supply to temperature controller, switch off controller. 2. Fail temperature input to controller, disconnect probe (under plates between coolers)
18.4	Results Expected:	1. Temperature control valve fails as set. 2. Temperature control valve fails to full cooling.
18.5	Results Found:	1. As expected 2. As expected
18.6	Comments:	
18.7	Witness:	K. S. Spedding

19 TEST # 4 MAIN ENGINE GOVERNORS

19.1	Equipment Subsection:	M/E control system and governors
19.2	Objectives:	Test of alarms, sensors and failure / response of M/E control system and governors
19.3	Method:	<p>With both engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Fail 24v batteries to ME control system. 2. Fail 24v supply to ME governor. 3. Fail governor speed sensor, terminal 11 and 12. 4. Fail second governor speed sensor, terminal 13 and 14, then re-instate. 5. Fail actuator input: unplug actuator input cable. 6. Fail speed command signal, terminal 42 and 43.
19.4	Results Expected:	<ol style="list-style-type: none"> 1. Engine continues to run, but ready signal loss, hence loss of thruster. 2. Engine resorts to mechanical backup for continued operation. 3. Engine continues to run, governor switches to second speed sensor, "723 DCS minor alarm" on Wartsila alarm panel. "Main engine ? group alarm" on central alarm system. 4. Governor losses both speed sensors and shuts down. "723 DCS major alarm" on Wartsila alarm panel. "Main engine ? automatic shut down" alarm on central alarm system. 5. Engine continues to run, speed increases to mechanical backup governor speed. 6. Engine continues at last speed setting, in DP speed remains constant, "723 DCS minor alarm" on Wartsila alarm panel. "Main engine ? group alarm" on central alarm system.
19.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected 5. As expected 6. As expected
19.6	Comments:	Items 1 and 2 when restoring power back to M/E governor and control system, M/E may shutdown.
19.7	Witness:	K. S. Spedding

20 TEST # 5 AUXILIARY ENGINE GOVERNORS

20.1	Equipment Subsection:	Auxiliary engine governors
20.2	Objectives:	Test of failure of supply and sensors of A/E governors
20.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Fail governor speed sensor, terminals 11 and 12. 2. Fail second speed sensor, terminals 13 and 14. 3. Fail power supply to governor. 4. Fail load sharing line between two generators, when load sharing with closed bustie, terminal 9 and 10. 5. Fail KW sensor when in isochronous load sharing, terminals 42 and 43.
20.4	Results Expected:	<ol style="list-style-type: none"> 1. Generator continues to run, "723 DCS minor alarm" generated on Wartsila panel, "Engine no. ? group alarm" on central alarm system. 2. Generator shuts down, "723 DCS major alarm" generated on Wartsila panel, "Engine no. ? automatic shutdown" on central alarm system, loss of thruster (LIFO). 3. Generator shuts down, "723 DCS major alarm" generated on Wartsila panel, "Engine no. ? automatic shutdown" on central alarm system, loss of thruster (LIFO). 4. Engine load sharing drifts off. When 20% in load sharing error occurs, switchboard PLC instructs governors to revert to droop load sharing, "Gen sets in droop mode" alarm on central alarm. Bus tie opens if droop mode continues and generators have an imbalanced load share. 5. Engine continues to operate in isochronous load sharing, using actuator position for feedback. May drift and result in droop mode after some time.
20.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected 5. As expected
20.6	Comments:	
20.7	Witness:	K. S. Spedding

21 TEST # 6 POWER DISTRIBUTION – 440 V

21.1	Equipment Subsection:	Power distribution – 440v system
21.2	Objectives:	Test of blackout, failures and response of 440v power distribution system.
21.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <p>Blackout simulation of port side switchboard, ensure BT-1 is the last thruster connected.</p> <ol style="list-style-type: none"> 1. Fail generator connected to port switchboard, via E-stop button. 2. With one generator on line on starboard section of the switchboard and bus tie closed and BT-3 connected. Open bus tie to simulate blackout of port side of the switchboard. 3. Test thruster blocking by trying to connect BT-2 to live section with only one generator online. 4. Connect generator no.2 to starboard switchboard and restart BT-2 no.2.
21.4	Results Expected:	<ol style="list-style-type: none"> 1. Generator breaker opens on reverse power. Last in BT breaker opens. 2. Blackout of port 440v switchboard, hence loss of following consumers: <ol style="list-style-type: none"> a) 440v / 110v transformer no.1 (110v supply continues as transformer no.2 continues supply) b) Port 440v switchboard consumers (port main engine may de-clutch) <p>Vessel remains in DP with BT-3 and starboard main engine. Port engine / thruster can be clutched in and reselected in DP.</p> <ol style="list-style-type: none"> 3. Thruster cannot be connected. 4. Generator no.2 connects to starboard switchboard and BT-2 can be started and reselected in DP control. <p>Vessel in DP with BT-2 and BT-3, with both main engines / thrusters.</p>
21.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected
21.6	Comments:	
21.7	Witness:	K. S. Spedding

22 TEST # 7 POWER DISTRIBUTION – 440 V

22.1	Equipment Subsection:	Power distribution – 440v system
22.2	Objective	Failures and response of 440v power distribution system.
22.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <p>Blackout simulation of starboard side switchboard, ensure BT-3 is the last thruster connected.</p> <ol style="list-style-type: none"> 1. Fail generator connected to starboard switchboard, via E-stop button. 2. With one generator on line on port section of the switchboard and bus tie closed and BT-1 connected. Open bus tie to simulate blackout of starboard side of the switchboard. 3. Test thruster blocking by trying to connect BT-2 to live section with only one generator online. 4. Connect generator no.2 to port switchboard and restart BT-2.
22.4	Results Expected:	<ol style="list-style-type: none"> 1. Generator breaker opens on reverse power. Last in BT breaker opens. 2. Blackout of st'bd 440v switchboard, hence loss of following consumers: <ol style="list-style-type: none"> a) 440v / 110v transformer no.2 (110v supply continues as transformer no.1 continues supply) b) Starboard 440v switchboard consumers (starboard main engine may declutch) <p>Vessel remains in DP with bow thruster no.1 and port main engine. Starboard engine/thruster can be clutched in and reselected in DP.</p> 3. Thruster cannot be connected. 4. Generator No.2 connects to starboard switchboard and BT-2 can be started and reselected in DP control. <p>Vessel in DP with BT-2 and BT-1, with both main engines / thrusters.</p>
22.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected. 4. As expected.
22.6	Comments:	
22.7	Witness:	K. S. Spedding

23 TEST # 8 POWER DISTRIBUTION – E.S.B.

23.1	Equipment Subsection:	Power distribution – emergency switchboard.
23.2	Objective	Test of blackout of ESB and response.
23.3	Method:	<p>With engines and thrusters on line as required for normal DP, confirm that emergency generator starts and connects to switchboard during main switchboard blackouts:</p> <ol style="list-style-type: none"> 1. Open generator breakers. <p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 2. Blackout 110v emergency switchboard. 3. Blackout 440v emergency switchboard.
23.4	Results Expected:	<ol style="list-style-type: none"> 1. Emergency generator starts automatically and connects to the switchboard 2. Loss of emergency 110v consumers: <ol style="list-style-type: none"> a. Lighting switchboards b. Special services switchboard c. 24v DC service switchboard switches to battery backup d. 24v DC wheelhouse services switches to battery backup e. Low voltage switchboard relay Vessel remains in DP with no loss of thrusters. 2. Loss of 440v emergency consumers: <ol style="list-style-type: none"> a. Starting air compressor no.2 b. Engine room exhaust fan Vessel remains in DP with no loss of thrusters.
23.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected
23.6	Comments	Blackout was simulated by tripping ESB breakers in the ECR and Emergency generator room.
23.7	Witness:	K. S. Spedding

24 TEST # 9 POWER DISTRIBUTION – 220 V

24.1	Equipment Subsection:	Power distribution – 220 V
24.2	Objective	Test of failure of 220 V power to switchboard and response.
24.3	Method:	With engines and thrusters on line as required for normal DP: 1. Fail power supply to 220v switchboard
24.4	Results Expected:	1. Loss of main 220v consumers: Port deck sockets. Starboard deck sockets. Port services switchboard. Starboard services switchboard. Vessel remains in DP with no loss of thrusters.
24.5	Results Found:	As expected
24.6	Comments:	
24.7	Witness:	K. S. Spedding

25 TEST # 10 POWER DISTRIBUTION – 110 V

25.1	Equipment Subsection:	Power distribution – 110v
25.2	Objective:	Test of failure of 110v power to switchboard and response.
25.3	Method:	With engines and thrusters on line as required for normal DP: 1. With both 440v / 110v supply breakers closed, open bus tie breakers. 2. Fail both power supplies to 110V switchboard.
25.4	Results Expected:	1. One 440v / 110v breaker opens, to prevent the connection of unsynchronized loads. 2. Loss of main 110v consumers: Lighting switchboards Special services switchboard Generator heating Main switchboard lighting. Vessel remains in DP with no loss of thrusters.
25.5	Results Found:	1. As expected 2. As expected
25.6	Comments:	
25.7	Witness:	K. S. Spedding

26 TEST # 11 POWER DISTRIBUTION – 24 V SERVICES

26.1	Equipment Subsection:	Power distribution – 24v
26.2	Objective	Test of failure of 24v supply to critical equipment
26.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Fail power supply to charger (both inputs). 2. Fail outputs from 24VDC low voltage services switchboard <ul style="list-style-type: none"> • Engine Room 24v DC services switchboard. • Gyro 1 • Gyro control unit • Gyro naut alarm • BT-3 supply no.2 • Serial line splitter RS422 • Supply SDP-OS1 D.P.S • PLC-Bus bars II (modification since last annual trials)
26.4	Results Expected:	<ol style="list-style-type: none"> 1. Unit switches to battery backup and provides 30 minutes supply to consumers. 2. Loss of following DP related low voltage services switchboard consumers: <ul style="list-style-type: none"> • Loss of engine room 24v DC services consumers <ul style="list-style-type: none"> ○ Switchboard PLC2, hence loss of starboard switchboard. ○ Port and starboard Schottel.(back up supply) ○ Signalling system. ○ Auxiliary engine controls. (back up supply) ○ Main engine controls. (back up supply) • Gyro1, vessel remains in DP with gyro 2 and 3. • Loss of other consumers as listed. <p>Net result: Loss of diesel generator 3 and one bow thruster and also ST-5 may clutch out. (BT-2 and No 2 generator are standby during normal configuration) bus tie remains closed. Vessel remains in DP with diesel generator 1, BT-1 and ST-4.</p> <p>ST-5 can be clutched in and reselected in DP. Diesel generator 2 and BT-2 can be started and connected to Bus 1. The vessel will then be in DP with diesel generator 1 and 2, BT-1 and BT-2 (or BT-3 depending on last in first out), ST-4 and ST-5</p>
26.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected
26.6	Comments	Note: Charger has two power supplies; one derived from the emergency switchboard the other from the navigational equipment switchboard.
26.7	Witness:	K. S. Spedding

27 TEST # 12 POWER DISTRIBUTION – 24 V

27.1	Equipment Subsection:	Power distribution – 24 V
27.2	Objective	Test of failure of 24v supply to critical equipment
27.3	Method:	With engines and thrusters on line as required for normal DP: <ol style="list-style-type: none"> 1. Fail power supply to charger. 2. Fail output of 24v DC wheelhouse services switchboard
27.4	Results Expected:	Unit switches to battery backup and provides 30 minutes supply to consumers. <ol style="list-style-type: none"> 1. Loss of supply to consumers: Gyro 2, vessel remains in DP with gyro 1 Gyro 3, vessel remains in DP with gyro 1 Switchboard PLC1, hence loss of port switchboard Port and starboard Schottel .(back up supply) Bow thruster selector switch Auxiliary engine controls .(back up supply) Main engine controls.(back up supply) <p>Net result: Loss of diesel generator 3, and one bow thruster and ST-4 may clutch out. (BT-2 and generator No.2 are standby during normal configuration)</p> <p>Bus tie remains closed.</p> <p>Vessel remains in DP with diesel generator 3, BT-33 and ST-5.</p> <p>The vessel will then be in DP with diesel 2 and 3, bow thruster 2 and 3, (or 1 depending last in first out) and both stern thrusters.</p>
27.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected, ST-4 did not de-clutch but pitch frozen.
27.6	Comments:	ST-4 can be clutched in and reselected in DP, generator No.2 and BT-2 can be started and connected to Bus 2.
27.7	Witness:	K. S. Spedding

28 TEST # 13 POWER MANAGEMENT

28.1	Equipment Subsection:	Power management
28.2	Objective:	Test of power management system.
28.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Test start blocking function, start one thruster, then try to start a second thruster while first is still running up. 2. Activate preference trips, short across terminals 14 and 15 on trip unit. 3. Simulate breaker closed signal failure on generator (remove terminal) and determine effect on power calculations (For DP desk signal, A/E breaker terminals 192, 2503 and 392 respectively for A/E1, A/E2 and A/E3). 4. Test failure of KW signals, failure of bus tie closed signal (wire 8002 on bus tie breaker). 5. With the bus tie open and two generators online one each side of the board, BT-1 and BT-3 running. Start and connect generator No.2 to port switchboard. Then connect and start BT-2 to port switchboard. Observe DP power management screen for variations. 6. With the bus tie open and two generators online one each side of the board, BT-1 and BT-3 running. Start and connect generator No.2 to starboard side. Then connect and start BT-2 to starboard switchboard. Observe DP power management screen for variations.
28.4	Results Expected:	<ol style="list-style-type: none"> 1. Second thruster is blocked from starting until first thruster has completed its start cycle. 2. Preference trips operate, no effect on DP operations. 3. Reduction of power available to DP, pitch reduction for bow thrusters activates "early" to prevent blackout. 4. No effect on switchboard. 5. DP system reflects correct power availability. 6. DP system reflects correct power availability.
28.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected 5. As expected 6. As expected
28.6	Comments:	
28.7	Witness:	K. S. Spedding

29 TEST # 14 BOW THRUSTER PITCH COMMAND / FEEDBACK SIGNALS

29.1	Equipment Subsection:	Bow thrusters
29.2	Objective:	Test of pitch command / feedback signals and response.
29.3	Method:	<p>With all engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Disconnect pitch command signal from DP to thruster ECU. <ol style="list-style-type: none"> a. T1 - U42 TB-3 terminals 1 and 2.(Galvanic isolator 1 terminals 8 and 9) b. T2 - U52 TB-3 terminals 1 and 2.(Galvanic isolator 13 terminals 8 and 9) c. T3 - U51 TB-3 terminals 4 and 5.(Galvanic isolator 8 terminals 8 and 9) 2. Disconnect pitch command signal from thruster ECU to thruster. <ol style="list-style-type: none"> a. T1 - 1X1 terminals (213,214) b. T2 - 1X1 terminals (213,214) c. T3 - 1X1 terminals (213,214) 3. Disconnect pitch feedback signal from thruster to ECU <ol style="list-style-type: none"> a. T1 - 1X1 terminals 205, 206 and 207 b. T2 - 1X1 terminals 205, 206 and 207 c. T3 - 1X1 terminals 205, 206 and 207 4. Disconnect pitch feedback signal from thruster to DP. <ol style="list-style-type: none"> a. T1 - U42 TB-1 terminals 1 and 2 b. T2 - U52 TB-1 terminals 1 and 2 c. T3 - U51 TB-1 terminals 3 and 4
29.4	Results Expected:	<ol style="list-style-type: none"> 1. Thruster fails to zero pitch (on bridge consols), "thruster _ prediction error" alarm generated on SDP. 2. Thruster pitch freezes, thruster ? prediction error" alarm generated on SDP. 3. Thruster trips, "thruster ? not ready" alarm generated on SDP. 4. Thruster continues to operate, loss of indication on DP system "thruster ? input error" and "thruster ? prediction error" alarm generated on SDP.
29.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected. 4. As expected (no prediction after considerable wait).
29.6	Comments	Item 4: Depends on set point and feedback difference when "thruster prediction error" occurs.
29.7	Witness:	K. S. Spedding

30 TEST # 15 STERN THRUSTER PITCH COMMAND / FEEDBACK SIGNALS

30.1	Equipment Subsection:	Stern thrusters
30.2	Objective:	Test of pitch command / feedback signals and response.
30.3	Method:	<p>With all engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Disconnect pitch command signal from DP to thruster ECU. <ol style="list-style-type: none"> a. T4 - U51 TB3 terminals 7 and 8. (Galvanic isolator 9 terminals 8 and 9) b. T5 - U42 TB3 terminals 4 and 5. 2. Disconnect pitch command signal from thruster ECU to thruster. <ol style="list-style-type: none"> a. T4 - Pump 1, 19X2 terminals (25,26) or (26, 27) or Pump 2, 19X2 terminals (42,43) or (43, 44) b. T5 - Pump 1, 29X2 terminals (25,26) or (26, 27) or Pump 2, 29X2 terminals (42,43) or (43, 44) 3. Disconnect pitch feedback signal from thruster to ECU <ol style="list-style-type: none"> a. T4 - 19X2 terminals 22, 23 and 24 b. T5 - 29X2 terminals 22, 23 and 24 4. Disconnect pitch feedback signal from thruster to DP. <ol style="list-style-type: none"> a. T4 - U51 TB-1 terminals 5 and 6 b. T5 - U42 TB-1 terminals 3 and 4
30.4	Results Expected:	<ol style="list-style-type: none"> 1. Thruster freezes on vessel main consol, "thruster ? prediction error" alarm generated on SDP. 2. Thruster de-clutches, "thruster ? not ready" alarm generated on SDP. 3. Thruster declutches, "thruster ? not ready" alarm generated on SDP. 4. Thruster continues to operate, loss of indication on DP system. thruster ? input error" and "thruster ? prediction error" alarm generated on SDP.
30.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected. 4. As expected.
30.6	Comments:	After certain failures the Schottel control system would need to be reset to take control.
30.7	Witness:	K. S. Spedding

31 TEST # 16 STERN THRUSTERS AZIMUTH COMMAND / FEEDBACK SIGNALS

31.1	Equipment Subsection:	Stern thrusters
31.2	Objective:	Test of azimuth command / feedback signals and response.
31.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Disconnect Azimuth command signal from DP to thruster ECU. <ol style="list-style-type: none"> a. T4 - U51 TB3 terminals 10 and 11. (Galvanic isolator 10 terminals 8 and 9.) b. T5 – U42 TB3 terminals 7 and 8. 2. Disconnect Azimuth command signal from thruster ECU to thruster. <ol style="list-style-type: none"> a. T4 - 14X2 terminals (29,30) or (31, 32) b. T5 - 24X2 terminals (29,30) or (31, 32) 3. Disconnect Azimuth feedback signal from thruster to ECU <ol style="list-style-type: none"> a. T4 - 14X2 terminals (27,28) b. T5 - 24X2 terminals (27,28) 4. Disconnect Azimuth feedback signal from thruster to DP. <ol style="list-style-type: none"> a. T4 - U51 TB-1 terminals 7, 8, 9 and 10 b. T5 – U42 TB-1 terminals 5, 6, 7 and 8
31.4	Results Expected:	<ol style="list-style-type: none"> 1. Thruster rotates to thrust ahead, pitch control remains "thruster ? prediction error" alarm generated on SDP. 2. Thruster declutches, "thruster ? not ready" alarm generated on SDP. Azimuth freezes. 3. Thruster declutches, "thruster ? not ready" alarm generated on SDP. Azimuth freezes. 4. Thruster continues to operate, loss of indication on DP system. "Thruster ? prediction error" alarm generated on SDP.
31.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected
31.6	Comments	<p>Test 1, can cause positional instability due the thrust generated by the thruster. To remove the thruster pitch and hence thruster, the operator has to deselect the thruster being tested from the DP desk. After completing some of the tests, the respective cards may require to be reset.</p>
31.7	Witness:	K. S. Spedding

32 TEST # 17 STERN THRUSTER SPEED COMMAND / FEEDBACK SIGNALS

32.1	Equipment Subsection:	Stern thrusters
32.2	Objective:	Test of speed command / feedback signals and response.
32.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Disconnect speed command signal from thruster ECU to thruster. <ol style="list-style-type: none"> a. T4 - 11X3 terminals 19 and 20. b. T5 - 21X3 terminals 19 and 20. 2. Disconnect load feedback signal from thruster to ECU <ol style="list-style-type: none"> a. T4 - 11X3 terminals 21 and 22. b. T5 - 21X3 terminals 21 and 22. 3. Disconnect engine load feedback signal from engine to DP. <ol style="list-style-type: none"> a. T4 - U32 X-1 terminals 7 and 8. b. T5 - U31 X-1 terminals 5 and 6. 4. Operate constant speed / combinator switch when in DP.
32.4	Results Expected:	<ol style="list-style-type: none"> 1. No effect on engine speed, governor uses last valid input. 2. No effect on engine speed. 3. No effect on engine speed. 4. No effect on engine speed.
32.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected
32.6	Comments	Engines working on constant RPM mode.
32.7	Witness:	K. S. Spedding

33 TEST # 18 POSITION MOVES

33.1	Equipment Subsection:	D.P. joystick
33.2	Objective:	Manoeuvring vessel using the Joystick.
33.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Select manual heading and position, move vessel using joystick to demonstrate manual position and heading control. 2. Select auto heading, move vessel using joystick to demonstrate manual surge and sway control and automatic heading control. 3. Select surge control, move vessel using joystick to demonstrate manual sway control and automatic heading and surge control. 4. Select sway control, auto position automatically selected, move vessel and change heading using DP controls. 5. Check manoeuvres with remote joystick. 6. Change point of rotation and move and change heading of vessel, (CG, Manual input, Bow, Stern, LTW and crane) 7. Track follow.
33.4	Results Expected:	<ol style="list-style-type: none"> 1. Vessel moves to joystick commands. 2. Vessel moves in surge and sway direction to joystick commands, heading automatically controlled by DP system. 3. Vessel moves in sway direction to joystick commands, heading and surge control automatically controlled by DP system. 4. Vessel position controlled by DP system and moves to operators input. 5. Satisfactory operation. 6. Vessel moves around new point of rotation. 7. Vessel follows targeted route.
33.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected. 4. As expected. 5. As expected. 6. As expected. 7. As expected.
33.6	Comments:	
33.7	Witness:	K. S. Spedding

34 TEST # 19 SYSTEM CHECKS

34.1	Equipment Subsection:	Reference systems
34.2	Objective:	Test of operations of the position reference systems.
34.3	Method:	<p>With engines and thrusters on line as required for normal DP.</p> <p>Check operation of:</p> <ol style="list-style-type: none"> 1. DP system in high, medium, low, relaxed and green gain settings. 2. Check reference offsets, rotate vessel through 360° with DGPS 1, DGPS 2, HiPAP 1, Tautwire and Fanbeam. 3. Thruster forced bias.
34.4	Results Expected:	<ol style="list-style-type: none"> 1. Acceptable station keeping. 2. Positional references should not be rejected from DP desk, stay within median check. 3. Acceptable operation.
34.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected. None rejected. 3. As expected.
34.6	Comments	Fan beam was not checked in operation will have to be done by ship staff at the earliest opportunity.
34.7	Witness:	K. S. Spedding

35 TEST # 20 SYSTEM LIMIT TESTS

35.1	Equipment Subsection:	D.P. control system
35.2	Objective:	Test of system limits for position.
35.3	Method:	With engines and thrusters on line as required for normal DP: Check operation of: 1. Heading limits 3° 2. Out of position limits 5m.
35.4	Results Expected:	1. Heading out of limits alarm generated, when limit exceeded. 2. Position out of limits alarm generated, when limit exceeded.
35.5	Results Found:	1. As expected 2. As expected
35.6	Comments	
35.7	Witness:	K. S. Spedding

36 TEST # 21 CONSEQUENCE ANALYSIS

36.1	Equipment Subsection:	Consequence analysis
36.2	Objective:	Test of consequences of the failures of equipment.
36.3	Method:	With engines and thrusters on line as required for normal DP: <ol style="list-style-type: none"> 1. With bus tie closed deselect one azimuth thruster. 2. With bus tie closed, reduce to one bow thruster. 3. With bus tie closed disconnect one generator.
36.4	Results Expected:	<ol style="list-style-type: none"> 1. "Consequence analysis warning drift off, thrust critical if thruster ? lost", alarm after 3 minutes. 2. "Consequence analysis warning drift off, thrust critical if Bus ? lost", alarm after 3 minutes. 3. "Consequence analysis warning drift off, thrust critical if Bus ? lost", alarm after 3 minutes.
36.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected. LIFO BT lost.
36.6	Comments:	
36.7	Witness:	K. S. Spedding

37 TEST # 22 DPC AND OS / OT CHANGEOVERS

37.1	Equipment Subsection:	D.P. computer
37.2	Objective:	Test of changeovers of operating consoles and OT joystick.
37.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Fail online A DPC, by failing 230V power supply, (open mcb Q1-1), re-instate. 2. Fail online B DPC, by failing 230V power supply, (open mcb Q2), re-instate. 3. Fail SDP-OS1, reinstate. 4. Fail SDP-OS2. 5. Fail SDP-OS1 without reinstating SDP-OS2 and take control on OT-1 joystick, by changing from DP mode to joystick mode at main command consol.
37.4	Results Expected:	<ol style="list-style-type: none"> 1. Automatic change over to B DPC, "Autoswitch from A to B", "Controller A stopped" and "DpDuA is not communicational" alarm on DP system. 2. Automatic change over to A DPC, "Autoswitch from B to A", "Controller B stopped" "DpDuB is not communicational" alarm on DP system. 3. Loss of SDP-OS1, "OS1 station is not communicational", "Operation station stopped" and "Controller OS died" alarm generated on DP system, operator takes command in OS 2. 4. Loss of SDP-OS2, "OS2 station is not communicational", "Operation station stopped" "Controller OS died" alarm generated on DP system, operator takes command in OS 1. 5. Loss of SDP-OS1 & SDP-OS2, DPO maneuvers vessel on OT-1 Joystick.
37.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected 5. As expected
37.6	Comments:	<p>Note:</p> <ol style="list-style-type: none"> 1. Item 3 & 4 soft booted computers therefore Alarms "Controller OS Stopped". No alarms of "Controller OS died" seen. 2. Item 5 -.OT thrusters require to be enabled after selecting joystick.
37.7	Witness:	K. S. Spedding

38 TEST # 23 D.P. COMPUTERS

38.1	Equipment Subsection:	D.P. computers
38.2	Objective:	To test DPC auto change-overs and selective cutouts of thruster function
38.3	Method:	<p>With engines and thrusters on line as required for normal DP: Fail each fuse in turn in the DPC.</p> <ol style="list-style-type: none"> 1. X 11 fuse 1 and 2. 2. X 21 fuse 1 and 2. 3. X 15 fuse 1 or 4. 4. X 15 fuse 2 or 5. 5. X 15 fuse 3 or 6. 6. Check blown fuse indication, by inserting blown fuse into holder.
38.4	Results Expected:	<ol style="list-style-type: none"> 1. Loss of DPC A, auto change-over to DPC B no loss of other equipment due to dual power supplies. 2. Loss of DPC B, auto change-over to DPC A no loss of other equipment due to dual power supplies. 3. Loss of thruster 5 azimuth control, loss of bow thruster 1 pitch control. 4. Loss of bow thruster 2 pitch control. 5. Loss of thruster 4 azimuth control, loss of bow thruster 3 pitch control. 6. LED light, indicating blown fuse.
38.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected 5. As expected 6. As expected
38.6	Comments:	
38.7	Witness:	K. S. Spedding

39 TEST # 24 D.P. COMPUTERS

39.1	Equipment Subsection:	D.P. computers
39.2	Objective:	To test wind sensor outputs and function.
39.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Fail power supply to wind sensor WS1: UPS 1 F8 WS2: UPS 2 F6 2. Fail input into DP system from sensor disconnect WS1: DPC21, WU 1 U11/P4 X1 terms 2 and 3. WS2: DPC21, WU 1 U13/P5 X1 terms 11 and 12. 3. Deselect all wind sensors and check station keeping.
39.4	Results Expected:	<ol style="list-style-type: none"> 1. Loss of input to DP, wind sensor rejected from DP system, "wind _ not ready" and "wind communication" error alarm generated on SDP, other wind sensor auto selected. 2. Loss of input to DP, wind sensor rejected from DP system, "wind _ not ready" and "wind communication" error alarm generated on SDP, other wind sensor auto selected. 3. "Wind not enabled" alarm on SDP. Acceptable station keeping.
39.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected
39.6	Comments:	
39.7	Witness:	K. S. Spedding

40 TEST # 25 VRU

40.1	Equipment Subsection:	Vertical reference units
40.2	Objective:	To test VRU outputs and function
40.3	Method:	With engines and thrusters on line as required for normal DP: 1. Fail power supply to VRS; VRS 1, DPC21, X15A F1 VRS 2, DPC21, X15A F2 2. Fail input to DP system; VRS1, DPC21, U42, TB-1 term 13, 14 (roll) 15, 16 (pitch) and U31 29,30 (ready) VRS2, DPC21, U51, TB-1 term 13, 14 (roll) 15, 16 (pitch) and U32 29,30 (ready)
40.4	Results Expected:	1. Failure of VRS, rejected from DP system, system automatically switches to healthy VRS, ""VRS _ not ready"" alarm on DP system. 2. Loss of pitch, roll or heave input, VRS difference alarm generated.
40.5	Results Found:	1. As expected 2. As expected
40.6	Comments:	VRS alarms take about 5 minutes to reset.
40.7	Witness:	K. S. Spedding

41 TEST # 26 GYROS HEADING REFERENCE SYSTEM

41.1	Equipment Subsection:	Gyroscopes
41.2	Objective:	To test Gyro outputs and function
41.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Check status; compare output of all 3 gyros. 2. Monitor position keeping with all three, two and single gyros 3. Disconnect gyro input into DP system. <ol style="list-style-type: none"> a. Gyro 1, DPC21, WU1 U11/P5 X1 term 15 and 16. b. Gyro 2, DPC21, WU1 U12/P5 X1 term 15 and 16. c. Gyro 3, DPC21, WU1 U13/P5 X1 term 15 and 16 4. Disconnect gyro ready signal into DP system. <ol style="list-style-type: none"> a. Gyro 1, DPC21, WU1 U31 term 25 and 26. b. Gyro 2, DPC21, WU1 U32 term 27 and 28. c. Gyro 3, DPC21, WU1 U33 term 27 and 28.
41.4	Results Expected:	<ol style="list-style-type: none"> 1. Acceptable variance 2. Acceptable position holding in all cases 3. Gyro rejected from DP system, auto change over other standby gyro: "Compass ? not ready" and "Gyro ? communication error" alarms on DP system. 4. Gyro rejected on voting, auto change over to standby gyro: "Compass ? not ready" alarm on DP system.
41.5	Results Found:	<ol style="list-style-type: none"> 1. As expected (error within 0.8 degree). 2. As expected 3. As expected 4. As expected
41.6	Comments:	After reinstating a card, DPC 21 may require re-power / reboot. If the serial link cannot be reset in desk.
41.7	Witness:	K. S. Spedding

42 TEST # 27 DGPS AND XP POSITION REFERENCE SYSTEMS

42.1	Equipment Subsection:	Position reference systems
42.2	Objective:	To test outputs and function of DGPS and XP systems.
42.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Move vessel in a box with DGPS, and compare with other references. Check for blind spots. 2. Fail differential signal to each DGPS alternately. 3. Power down each DGPS unit alternately. 4. Fail SCF input to XP system alternately. 5. Fail SCF input to XP system simultaneously. 6. Power down L1/L2 GPS unit feeding the XP. 7. Power down XP unit. (Reboot laptop).
42.4	Results Expected:	<ol style="list-style-type: none"> 1. DGPS is a usable reference, weighting shared between selected references. 1. No DGPS blind spots, (this can be site specific and also depends on whether XP is in use). 2. DGPS 2 rejected from DP, "GPS no diff data received" alarm on SDP. DGPS 1 input to DP actually fed from XP and is still accepted. 3. DGPS 2 rejected from DP, "GPS2 communication error" alarm on SDP. DGPS 1 input to DP actually fed from XP and is still available. 4. No affect on XP output as it still has valid SCF from the other DGPS unit. 5. With both SCF input lost, the XP will resort to dead reckoning and may continue providing a feed based on its internal model for a few minutes (3), after which the reference wanders off and is rejected by the DP system. 6. XP may retain position for a few minutes before being rejected from the DP system. 7. Total loss of DGPS 1, rejected from DP desk. "GPS1 communication error".
42.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 4. As expected 5. As expected 6. As expected 7. As expected
42.6	Comments:	
42.7	Witness:	K. S. Spedding

43 TEST # 28 TAUT WIRE POSITION REFERENCE SYSTEM

43.1	Equipment Subsection:	Position reference systems
43.2	Objective	To test the outputs and function of Taut Wire system.
43.3	Method:	<p>With diesel engines and thrusters on line as required for normal DP:</p> <ol style="list-style-type: none"> 1. Compare actual and measured wire length 2. Move vessel in a box with Tautwire, and compare with other references 3. Move vessel to operate Tautwire limits. 4. Disconnect Tautwire input to DP, Tautwire to have a lead <ol style="list-style-type: none"> a. Along: WU4 U41 TB1 terminals 1 and 2 b. Beam: WU4 U41 TB1 terminals 3 and 4 5. Fail power supply to Tautwire computer. (F7 in UPS-1) 6. Fail power supply to Tautwire winch. (Breaker in emergency generator room)
43.4	Results Expected:	<ol style="list-style-type: none"> 1. Readings match 2. Tautwire is a usable reference, weighting shared between selected references. 3. "LTW1 out of limits" alarm then Tautwire rejected from SDP and "LTW1 exceeds fatal limits" alarm on SDP. 4. Tautwire input moves, rejected by voting "reference prediction error LTW1" and "reference median rejected LTW1" 5. Tautwire rejected from DP. 'LTW1 minimum wire length not reached' and 'LTW1 mooring not on' alarm generated on SDP. 6. Tautwire rejected from DP. 'LTW1 alarm messages' and 'LTW1 mooring not on' alarm generated on SDP
43.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. Actual 27.0 and readout 27.0 metres (total available 278m) 2. As expected 4. As expected 5. As expected 5. As expected 6. As expected
43.6	Comments:	
43.7	Witness:	K. S. Spedding

44 TEST # 29 FANBEAM POSITION REFERENCE SYSTEM

44.1	Equipment Subsection:	Position reference systems
44.2	Objective:	To test inputs and function of fanbeam system.
44.3	Method:	With diesel engines and thrusters on line as required for normal DP: <ol style="list-style-type: none"> 1. Move vessel in a box with fan beam and compare with other references 2. Carry out position and heading changes on fan beam alone with both high & low gain 3. Test limits 4. Park the scanner with fan beam selected in DP 5. Fail power supply to fan beam 6. Disconnect Fanbeam input to DPC21, (WU1 U13/P4 X1 terminals 2 and 3).
44.4	Results Expected:	<ol style="list-style-type: none"> 1. Usable reference. Satisfactory weighting shared between selected references 2. Smooth changes no affect on reference 3. Alarm when reaching limits 4. Fanbeam rejected from DP system, "Fanbeam 1 communication error" alarm generated on SDP. DP system uses input from remaining references. 5. Fanbeam rejected from DP system, "Fanbeam 1 communication error" alarm generated on SDP. DP system uses input from remaining references. 6. Fanbeam rejected from DP system, "Fanbeam 1 communication error" alarm generated on SDP. DP system uses input from remaining references.
44.5	Results Found:	<ol style="list-style-type: none"> 1. Not done this call. To be done by ship staff first opportunity. 2. Not done this call. To be done by ship staff first opportunity. 3. Not done this call. To be done by ship staff first opportunity. 4. As expected. 5. As expected. 6. As expected.
44.6	Comments:	Item 1 to 3 to be done at first opportunity by ship staff.
44.7	Witness:	K. S. Spedding

45 TEST # 30 HIPAP POSITION REFERENCE SYSTEM

45.1	Equipment Subsection:	Position reference Systems
45.2	Objective:	To test inputs and function of Hipap system.
45.3	Method:	<p>With engines and thrusters on line as required for normal DP and with HiPAP operational, interrogating an array or single beacon.</p> <ol style="list-style-type: none"> 1. Move vessel in a box with HiPAP, and compare with other references 2. Check performance of the HiPAP is not affected by thruster wash. 3. Fail power to transceiver unit, UPS 2 fuse 5. 4. Fail power to HiPAP OS, UPS 2 fuse 4. 5. Fail gyro input to transceiver unit. (In HPR Tx/Rx TB1-12/14) 6. Fail VRS input to transceiver unit. (In HPR Tx/Rx TB1-2/4) 7. Move transponder when used as a reference input.
45.4	Results Expected:	<ol style="list-style-type: none"> 1. HiPAP is a usable reference, weighting shared between selected references. 2. Acceptable HiPAP performance. 3. HiPAP rejected from DP desk, "HPR 1 communication error". 4. HiPAP rejected from DP desk, "HPR 1 communication error". 5. HiPAP rejected from DP desk, "HPR 1 not OK" alarm on SDP. 6. HiPAP rejected from DP desk, "HPR 1 not OK" alarm on SDP. 7. HiPAP input moves, rejected by voting "reference prediction error HPR1" and "reference median rejected HPR1"
45.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. During this test the hard disk had failed 4. During this test the hard disk had failed 5. As expected. 6. As expected. 7. As expected.
45.6	Comments:	Test 3 and 4 to be completed at a later date by ships staff. After failing serial ports for VRS, HiPaP TX/Rx may require to be reset for detecting serial port.
45.7	Witness:	K. S. Spedding

46 TEST # 31 MATHEMATICAL MODEL

46.1	Equipment Subsection:	Mathematical model
46.2	Objective:	Verifying DP computed model
46.3	Method:	<p>With engines and thrusters on line as required for normal DP:</p> <p>Allow the DP system build up a model over 30 minutes.</p> <ol style="list-style-type: none"> 1. Then remove all positioning reference inputs to system and measure vessel drift. 2. Measure drift using HiPAP or DGPS, over 5 minutes.
46.4	Results Expected:	<ol style="list-style-type: none"> 1. "No position reference active" and "Position drop out" alarm generated on SDP, no increase in thruster activity. 2. Satisfactory drift, vessel moves out of position slowly.
46.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. Drift 090° x 2.4m in 5 minutes.
46.6	Comments:	
46.7	Witness:	K. S. Spedding

47 TEST # 32 SDP-21 INTERFACE CARDS

47.1	Equipment Subsection:	Computer interface cards.
47.2	Objective:	Verifying station keeping capability with DPC failures.
47.3	Method:	With engines and thrusters on line as required for normal DP: 1. Fail power supply to I/O card 11, (X2-1/2). 2. Fail power supply to I/O card 12, (X2-1/2). 3. Fail power supply to I/O card 13, (X2-1/2).
47.4	Results Expected:	1. Loss of: a) Wind sensor 1 (serial line input), "Wind 1 not ready", "wind 1 communication error" alarm generated on SDP. b) Gyro 1 (serial line input), "Compass 1 not ready", "Gyro 1 communication error" alarm generated on SDP. c) DGPS1 Vessel remains in DP with all thrusters and positioning references, wind 2, gyro 2 and 3. 2. Loss of: a) Gyro 2 (serial line input), "Compass 2 not ready", "Gyro 2 communication error" alarm generated on SDP. b) DGPS2 Vessel remains in DP with all thrusters and positioning references, gyro 1 and 3. 3. Loss of: a) Wind sensor 2 (serial line input), "Wind 2 not ready", "wind 2 communication error" alarm generated on SDP. b) Gyro 3 (serial line input), "Compass 3 not ready", "Gyro 3 communication error" alarm generated on SDP. c) H/C printer and "Fanbeam not ready" Vessel remains in DP with all thrusters and positioning references, gyro 1 and 2.
47.5	Results Found:	1. As expected 2. As expected 3. As expected
47.6	Witness:	K. S. Spedding

48 TEST # 33 SDP-21 INTERFACE CARDS

48.1	Equipment Subsection:	Computer interface cards.
48.2	Objective:	Verifying station keeping capability with DPC failures.
48.3	Method:	With engines and thrusters on line as required for normal DP: <ol style="list-style-type: none"> 1. Fail power supply to I/O card 31, (X2-1/3). 2. Fail power supply to I/O card 32, (X2-1/3). 3. Fail power supply to I/O card 33, (X2-1/3).
48.4	Results Expected:	<ol style="list-style-type: none"> 1. Loss of thruster 1 (ready signal), thruster 5 (ready signal), generator 1 status, bus tie status, gyro 1 (ready signal), VRS 1 (ready signal) and UPS1 status. Vessel remains in DP with thruster 2, 3 and 4. With all positioning references, VRS 2 gyro 2 and 3. 2. Loss of thruster 3 (ready signal), thruster 4 (ready signal), generator 3 status, tautwire, gyro 2 (ready signal), VRS 2 (ready signal) and UPS2 status. Vessel remains in DP with thruster 1, 2 and 5. With DGPS, HiPAP and fanbeam references, all positioning references, VRS 1, gyro 1 and 3. 3. Loss of thruster 2 (ready signal), generator 2 status and gyro 3 (ready signal). Vessel remains in DP with thruster 1, 3, 4 and 5. With all positioning references, both VRS, gyro 1 and 2.
48.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected.
48.6	Comments:	
48.7	Witness:	K. S. Spedding

49 TEST # 34 SDP-21 INTERFACE CARDS

49.1	Equipment Subsection:	Computer interface cards.
49.2	Objective:	Verifying station keeping capability with DPC failures.
49.3	Method:	With engines and thrusters on line as required for normal DP: <ol style="list-style-type: none"> 1. Fail power supply to I/O card 42, (X2-1/3). 2. Fail power supply to I/O card 51, (X2-1/3). 3. Fail power supply to I/O card 52, (X2-1/3).
49.4	Results Expected:	<ol style="list-style-type: none"> 1. Loss of : thruster 1 and 5 (command signal), generator 1 load and VRS 1 data "Thruster 1 prediction error", "Thruster 5 prediction error" and "hardware voter 1 error" alarms generated on SDP. Vessel remains in DP with thruster 2, 3 and 4. All positioning references, VRS2 and all gyros. 2. Loss of : thruster 3 and 4 (command signal), generator 3 load and VRS 2 data "Thruster 3 prediction error", "Thruster 4 prediction error" and "hardware voter 2 error" alarms generated on SDP. Vessel remains in DP with thruster 1, 2 and 5. All positioning references, VRS1 and all gyros. 3. Loss of: thruster 2 (command signal) and generator 2 load. "Thruster 2 prediction error" and "hardware voter 3 error" alarms generated on SDP. Vessel remains in DP with thruster 1, 3, 4 and 5. All positioning references, VRS1, VRS2 and all gyros.
49.5	Results Found:	<ol style="list-style-type: none"> 1. As expected, no "Thruster Prediction Error" warning. 2. As expected, no "Thruster Prediction Error" warning. 3. As expected, no "Thruster Prediction Error" warning.
49.6	Comments:	
49.7	Witness:	K. S. Spedding

50 TEST # 35 SDP-21 INTERFACE CARDS

50.1	Equipment Subsection:	Computer interface cards.
50.2	Objective:	Verifying station keeping capability with DPC failures.
50.3	Method:	With engines and thrusters on line as required for normal DP: <ol style="list-style-type: none"> 1. Fail power supply to I/O card 71, (Plug). 2. Fail power supply to I/O card 72, (Plug). 3. Fail power supply to I/O card 73, (Plug).
50.4	Results Expected:	<ol style="list-style-type: none"> 1. Loss of thruster 1 and 5 command signal. "Thruster 1 prediction error", "Thruster 5 prediction error" and "hardware voter 1 error" alarms generated on SDP. Vessel remains in DP with thruster 2, 3 and 4, with all DP references 2. Loss of thruster 3 and 4 command signal. "Thruster 3 prediction error", "Thruster 4 prediction error" and "Hardware voter 2 error" alarms generated on SDP. Vessel remains in DP with thruster 1, 2 and 5, with all DP references 3. Loss of thruster 2 command signal "Thruster 2 prediction error" and "Hardware voter 3 error" alarms generated on SDP. Vessel remains in DP with thruster 1, 3, 4 and 5, with all DP references.
50.5	Results Found:	<ol style="list-style-type: none"> 1. As expected. 2. As expected. 3. As expected.
50.6	Witness:	K. S. Spedding

51 TEST # 36 DPS SYSTEM - UPS

51.1	Equipment Subsection:	Uninterrupted power supply																																	
51.2	Objective:	Verify ability of system to keep station with failure of mains and single UPS																																	
51.3	Method:	With engines and thrusters on line as required for normal DP: With each UPS in turn <ol style="list-style-type: none"> 1. Fail power supply DP UPS. 2. Demonstrate 30 minute endurance of batteries 3. Fail output of UPS. 																																	
51.4	Results Expected:	<ol style="list-style-type: none"> 1. UPS switches to battery backup. "UPS ? failure" alarm generated on SDP. 2. Battery provides 30 minutes power supply to consumers. 3. Loss of: <table border="1" data-bbox="509 873 1430 1356"> <thead> <tr> <th>Fuse</th> <th>UPS 1</th> <th>UPS 2</th> </tr> </thead> <tbody> <tr> <td>F1</td> <td>DPC-21A</td> <td>DPC-21B</td> </tr> <tr> <td>F2</td> <td>SDP-OS1 & Comms Network-A</td> <td>SDP-OS2 & Comms Network-B</td> </tr> <tr> <td>F3</td> <td>Alarm Printer</td> <td>Hard Copy Printer</td> </tr> <tr> <td>F4</td> <td>Fanbeam Laser</td> <td>HiPAP APC-10</td> </tr> <tr> <td>F5</td> <td>Fanbeam Monitor</td> <td>HiPAP Transceiver</td> </tr> <tr> <td>F6</td> <td>Dive Control cabinet remote alarm</td> <td>Wind Display-2</td> </tr> <tr> <td>F7</td> <td>Tautwire Cabinet</td> <td>Wind Display-3 (not used in DP)</td> </tr> <tr> <td>F8</td> <td>Wind Display-1</td> <td>DGPS-2 &</td> </tr> <tr> <td>F9</td> <td>Spare</td> <td>XP and L1/L2 GPS</td> </tr> <tr> <td>F10</td> <td>DGPS-1</td> <td>Spare</td> </tr> </tbody> </table> <p>With the loss of any one UPS, vessel remains in DP with all thrusters. With 50% of the DP system, and available references.</p>	Fuse	UPS 1	UPS 2	F1	DPC-21A	DPC-21B	F2	SDP-OS1 & Comms Network-A	SDP-OS2 & Comms Network-B	F3	Alarm Printer	Hard Copy Printer	F4	Fanbeam Laser	HiPAP APC-10	F5	Fanbeam Monitor	HiPAP Transceiver	F6	Dive Control cabinet remote alarm	Wind Display-2	F7	Tautwire Cabinet	Wind Display-3 (not used in DP)	F8	Wind Display-1	DGPS-2 &	F9	Spare	XP and L1/L2 GPS	F10	DGPS-1	Spare
Fuse	UPS 1	UPS 2																																	
F1	DPC-21A	DPC-21B																																	
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F5	Fanbeam Monitor	HiPAP Transceiver																																	
F6	Dive Control cabinet remote alarm	Wind Display-2																																	
F7	Tautwire Cabinet	Wind Display-3 (not used in DP)																																	
F8	Wind Display-1	DGPS-2 &																																	
F9	Spare	XP and L1/L2 GPS																																	
F10	DGPS-1	Spare																																	
51.5	Results Found:	<ol style="list-style-type: none"> 1. As expected 2. As expected 3. As expected 																																	
51.6	Comment:																																		
51.7	Witness:	K. S. Spedding																																	

52 TEST # 37 THRUSTER EMERGENCY STOPS

52.1	Equipment Subsection:	Thruster emergency stops
52.2	Objective:	Test of emergency stops of thrusters
52.3	Method:	With engines and thrusters on line as required and finished with DP: 1. Stop all thrusters at DP Desk e-stops.
52.4	Results Expected:	1. Thrusters stop on closing of their e-Stop switch.
52.5	Results Found:	1. As expected.
52.6	Comment::	
52.7	Witness:	K. S. Spedding

