



Operations and Requirements

A Practical Approach to Managing DP Operations

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A Practical Approach to Managing DP Operations

An Operator's Perspective



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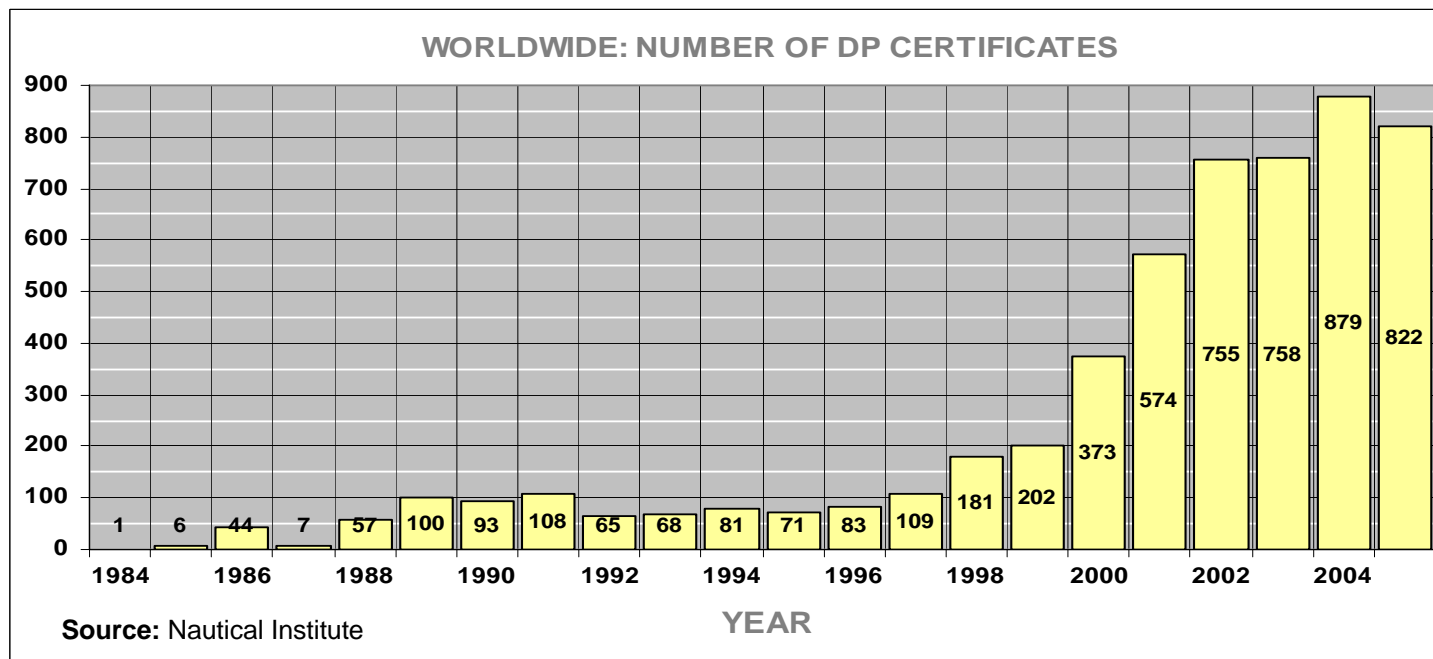
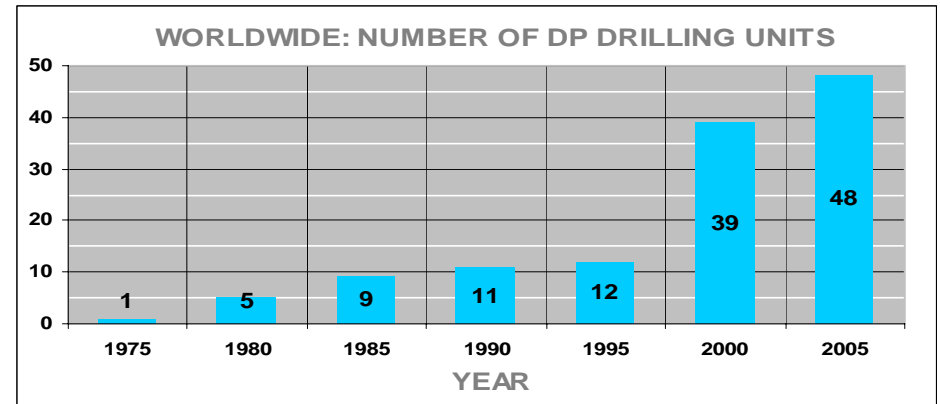
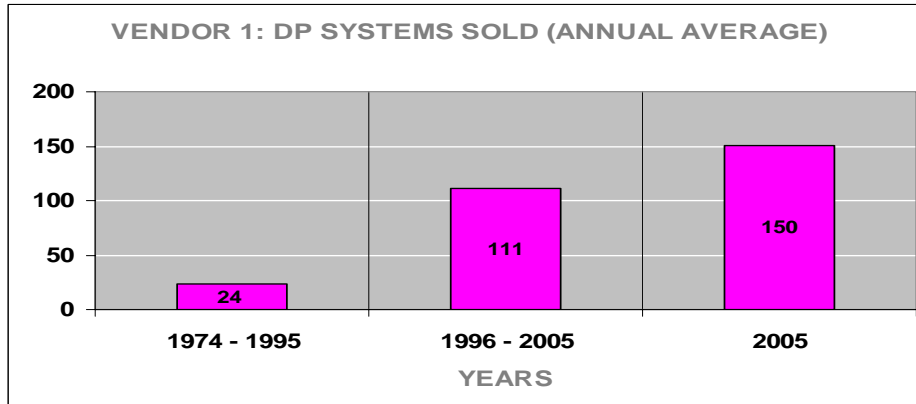


Increasing use of DP Vessels in Shell's Marine Construction Activities

SHELL PROJECT	YEAR	WATER DEPTH (ft)	FOUND/MOOR PRE-INSTALL	HOST INSTALLATION	TOPSIDE LIFT	EXPORT LINES	RISERS FLOWLINES	UMBILICALS	SUBSEA
Auger	1994	2,860	NO	YES	N/A	YES	N/A	N/A	N/A
Mars	1996	2,940	NO	NO	N/A	YES	YES	YES	NO
Ram Powell	1997	3,300	NO	NO	N/A	YES	N/A	N/A	N/A
Ursa	1999	3,900	NO	NO	NO	YES	N/A	N/A	N/A
Brutus	2001	2,985	NO	NO	N/A	YES	N/A	N/A	N/A
Na Kika	2003	6,300	YES	YES	N/A	YES	YES	YES	YES
Holstein	2004	4,400	YES	YES	YES	YES	N/A	N/A	N/A
Bonga	2005	3,380	YES	YES	N/A	YES	YES	YES	YES

Increasing use of DP Vessels

Experience Base ??



Managing DP Operations

- Background
- **Why manage?**
- Experience at Shell & industry
- Shell's philosophy
- DP vessel requirements
- Keys to success

The Potential Consequences of a Loss of Position

An Operator's Perspective

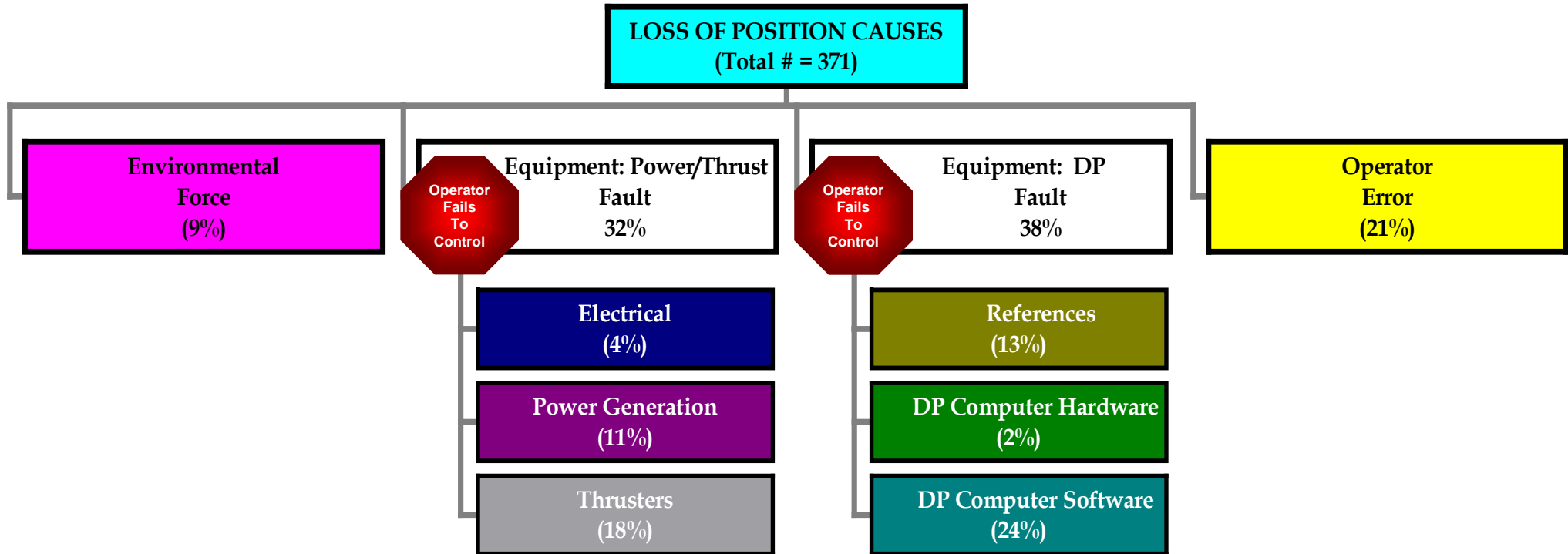
- Harm to personnel: >1,040 people
- Harm to environment: Irrevocable
- Damage to assets: \$50 Million - \$1 Billion
- Loss of revenue: \$ 15 Million/day
- Delays in revenue: Day(s) - year(s)
- Loss of reputation: Intangible



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Nearly 98% of the Incidents may have been Mitigated by Attention to Human Factors



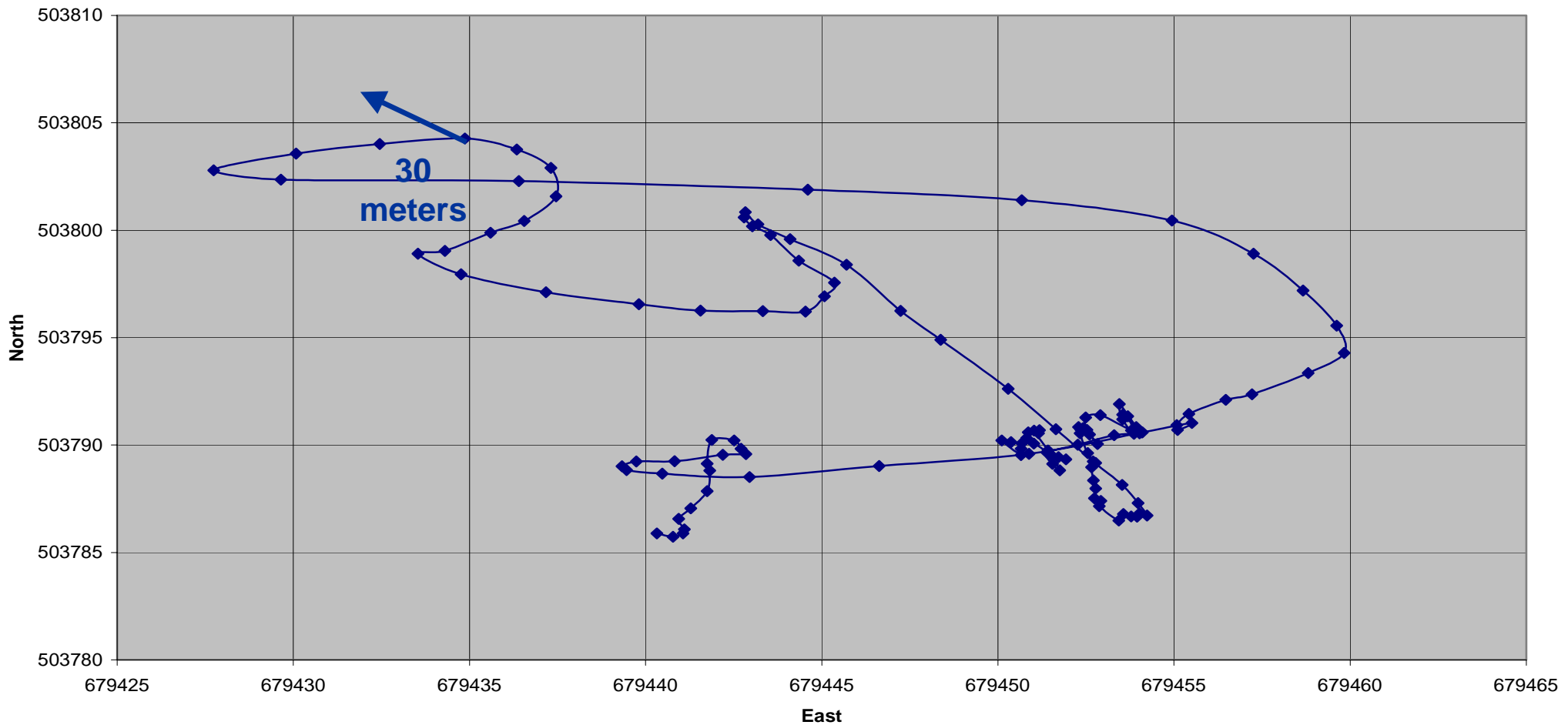
- **Human factors:** Poor procedures, poor design, insufficient testing/commissioning/QA, and/or operator error
- **DP systems:** Complex and require personnel and equipment to work together seamlessly for safe operations
- **Reported incidents from 1994 to 2003:** Total # = 371 (LOP1 = 43%, LOP2 = 57%)
 - ◆ Loss of position 1 (LOP1): Major loss of position
 - ◆ Loss of position 2 (LOP2): Minor loss of position
 - ◆ Lost time incident (LTI): Downtime through loss of redundancy
- **Attention to human factors:** LOP1 → LOP2 → LTI

The Bonga Experience - Lessons Learnt

VESSEL	INCIDENT	CAUSE	POTENTIAL			AUDIT FINDINGS
			H	M	L	
1	Blackout	Operating outside of design intent				
2	Loss of Position	Operator error				
3	Loss of Position	Non-adherence to procedures				
4	Loss of Position	Lack of Management of Change				
5	Loss of Position	Lack of familiarity with vessel systems				
6	Loss of Position	Vessel inadequately equipped				
7						<ul style="list-style-type: none"> ▪ Gaps in FMEA ▪ Safe configuration not specified (complex vessel)
8						<ul style="list-style-type: none"> ▪ Gaps in FMEA ▪ Significant single point failure exceeding design intent
9						<ul style="list-style-type: none"> ▪ Gaps in FMEA ▪ Lack of Management of Change ▪ Safe configuration not specified

A High Impact Incident at Bonga

Position Trace



What Worked

What did not Work



Engagement by Operator Facilitated Incident Free Execution

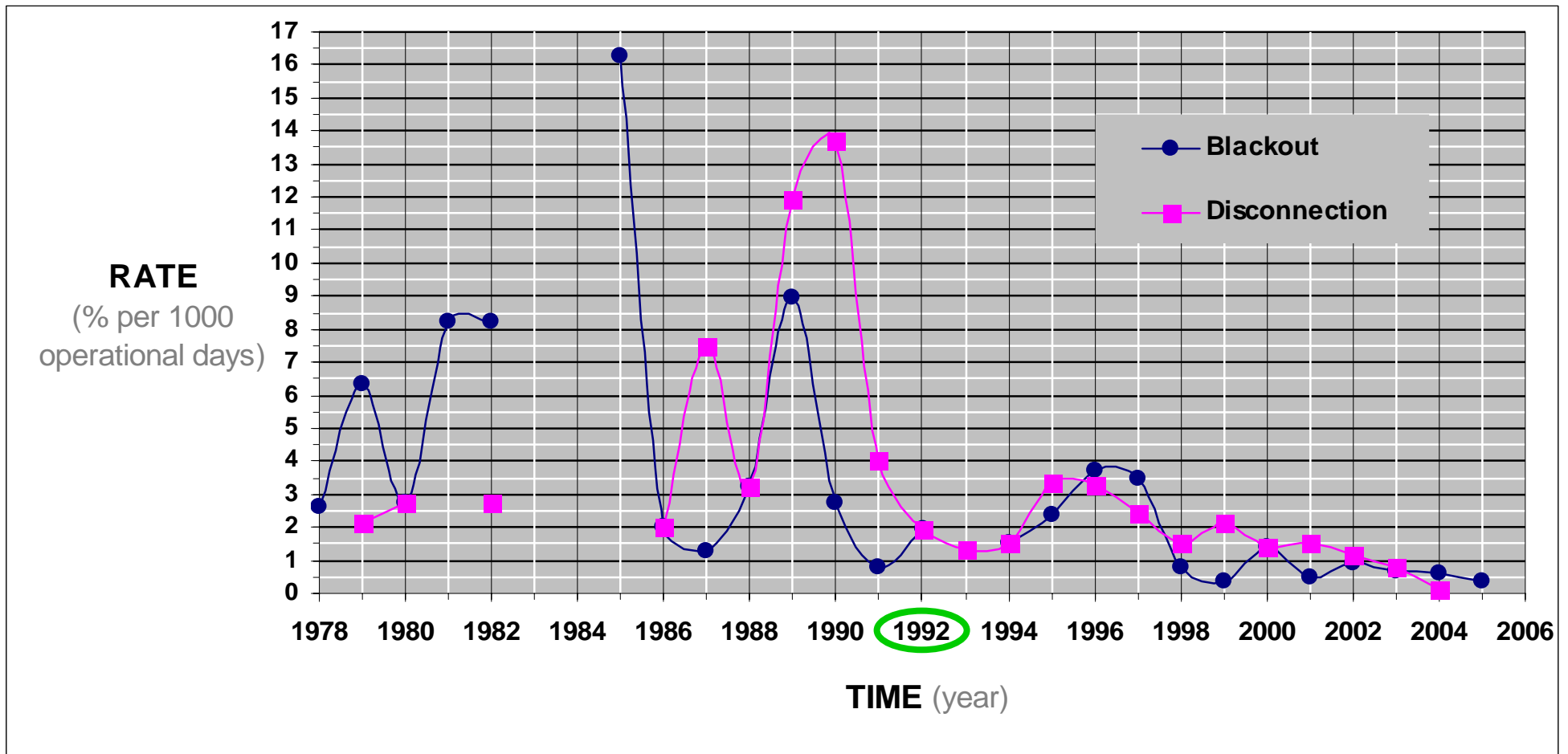
NA KIKA HOLSTEIN

- **Operator:** Engaged early on
 - ◆ Indepth technical review of vessels
 - ◆ Vessel's capabilities established by trials
 - ◆ Operational parameters established
- **Audits:** Preceded by technical reviews
 - ◆ Not a *"tick in the box"* exercise
 - ◆ Opportunity taken to educate project team
- **Engagement:** With Contractors project and operational teams
- **Work Activities:** Undertaken within the vessel's capabilities

BONGA

- **Relied on audits:** Focused on the availability of documentation and not on content
- **Audits:** Lacked emphasis for DP vessels
- **Marine Warranty Surveyor (MWS) personnel:** Lacked skill sets to oversee DP related activities
- **EPIC contract:** *"Leave it to contractor"* approach

Proactive Operator Engagement Reduces DP Incident Rates

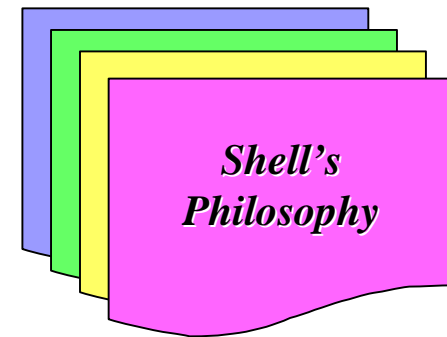
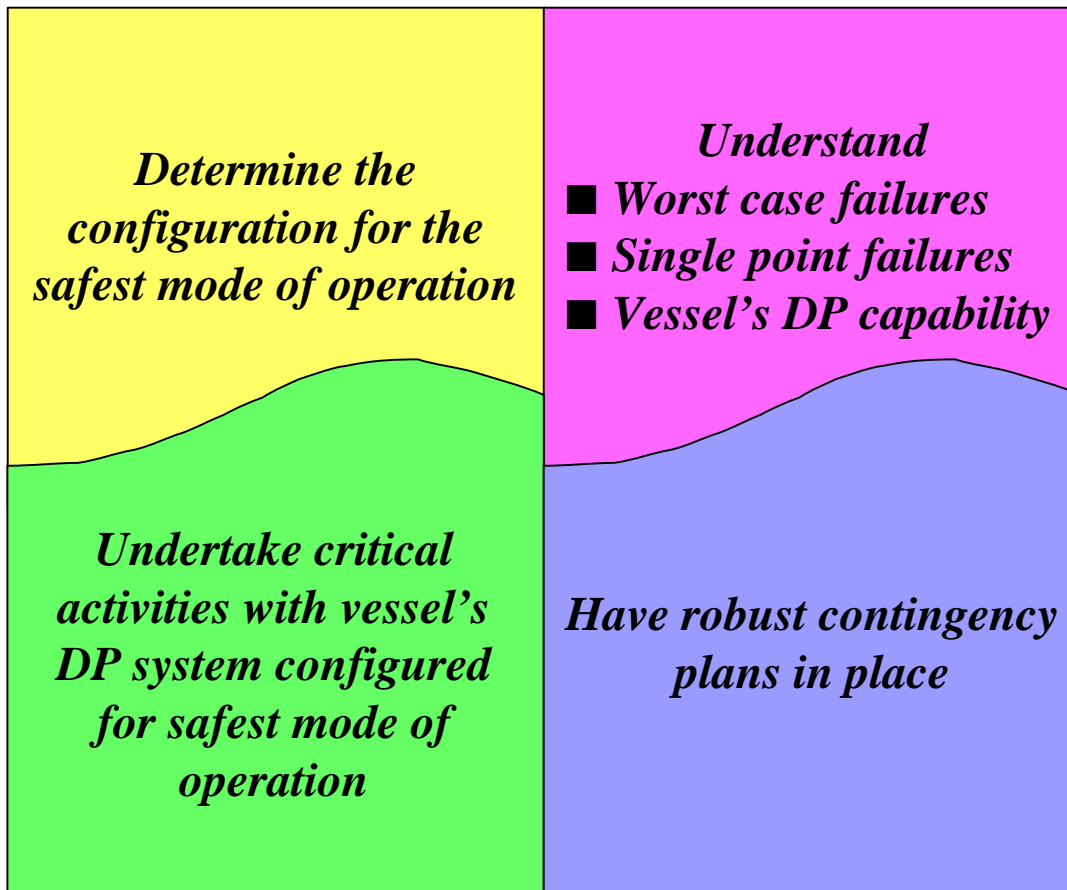


Source: Petrobras S.A. Keynote Presentation, Dynamic Positioning Conference, MTS 2005

Managing DP Operations

- Background
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Shell's Philosophy for Managing DP Operations



PRIMARY TOOLS FOR ASSESSMENT

- ✓ Failure Mode Effects Analysis
- ✓ Proving trials documents
- ✓ Capability plots
- ✓ Contractor's operational philosophy

*If FMEAs considered only
already known & reported incidents
then 97.6% of likely DP incident
causes may be identified*

FMEA Failings

VESSEL PROJECT TEAM

- Seen as a deliverable to obtain Class
- Improperly specified
- Proving trials are insufficient

VESSEL OPERATIONS TEAM

- Sits on a shelf
- Seldom used or understood

FMEA

Lack of Ownership

FMEA PRACTITIONER

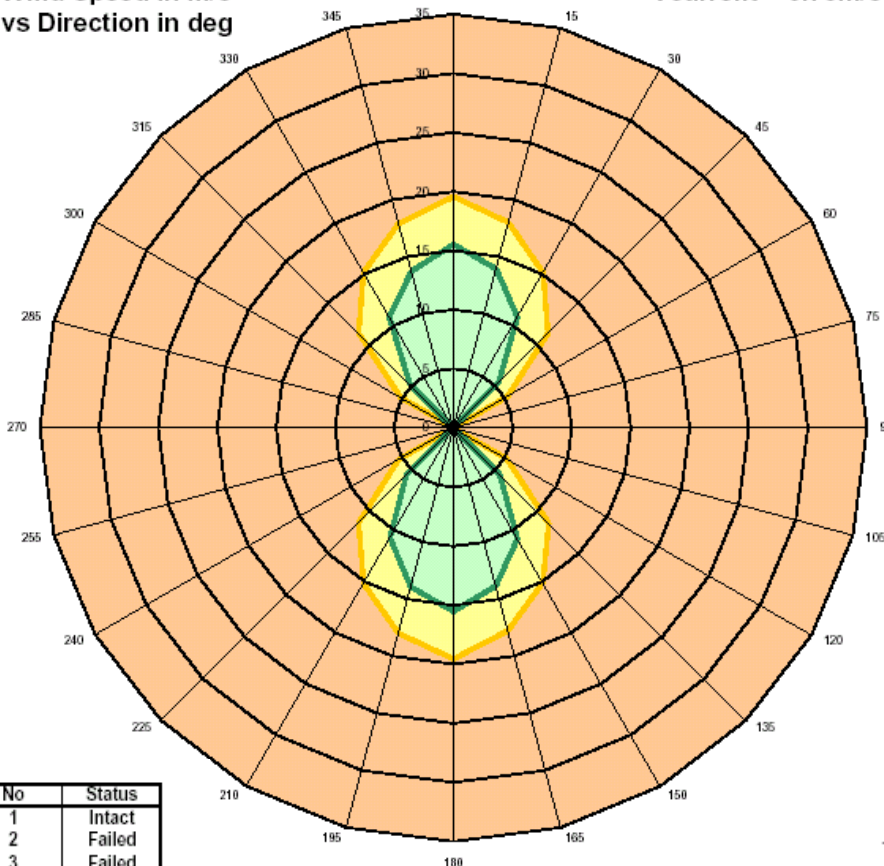
- Experience based (not analytical)
- Lack of multidisciplinary team
- Lack of resources

REGULATORY

- Approval given without adequate review
- Operational issues not understood

Validation of Capability Case of Actual vs. Theoretical

Wind Speed in m/s vs Direction in deg
Vcurrent = 0.75m/s

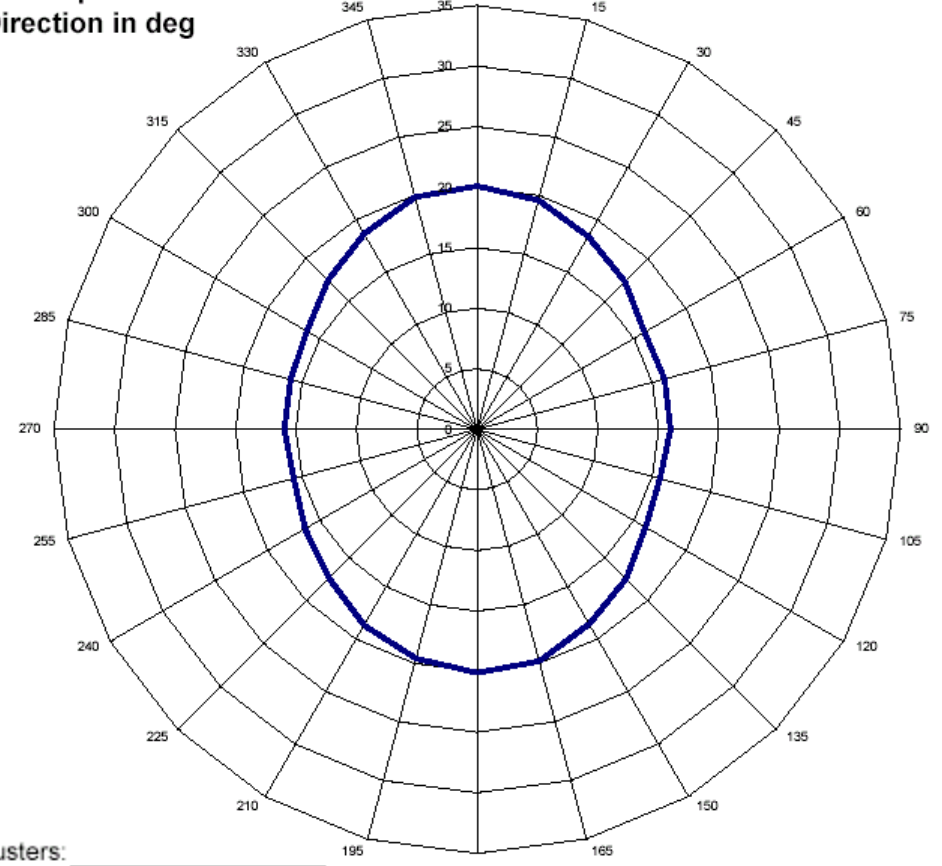


Thrusters:

No	Status
1	Intact
2	Failed
3	Failed
4	Intact

- Definite Capability
- Possible Capability
- No Capability Proven in Trials

Wind Speed in m/s vs Direction in deg
Vcurrent = 0.75m/s



Thrusters:

No	Status
1	Intact
2	Fail
3	Fail
4	Intact

Development of Field/Well Specific Operational Guidelines



- Results of FMEA review
- Results of Proving/Field Trials
- Vessel's capability
- Consequences of loss of position
- Contractor's operational philosophy
- SIMOPS
- Work activity
- Contingency planning

WSOG Operating Guidelines – xxxxx

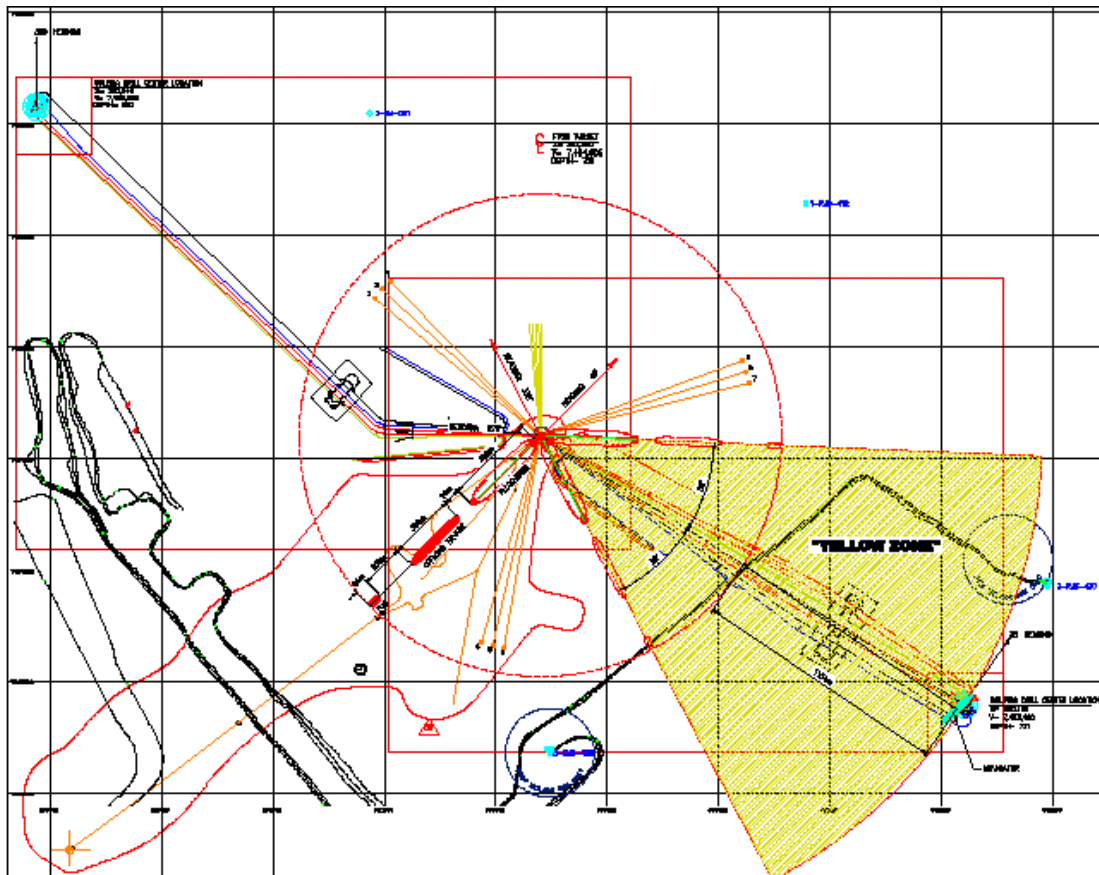
BJ-B

Operator: XXX

CONDITION	GREEN	ADVISORY	YELLOW	RED
NOTIFY D/WV OIM DRILLER IMMEDIATELY OPERATOR/CLIENT IMMEDIATELY	NORMAL COMMUNICATIONS	YES	YES	YES
ACTION	CONTINUE NORMAL OPERATIONS	INFORMATIVE/CONSULTATIVE STATUS (RISK ASSESS)	SOUND YELLOW ALARM RIG FLOOR CEASE DRILLING OPERATIONS. HANG OFF. INITIATE EDS PREPARATION (DO NOT SHEAR)	SOUND EMERGENCY DISCONNECT ALARM. IMMEDIATELY CLEAR DRILL FLOOR AND MOONPOOL AREAS OF PERSONNEL, DISCONNECT AND MOVE AWAY FROM WELL.

DP INCIDENT				
BLACK-OUT OF ALL HV BUS			If recovery unlikely or riser threatened NOTE In absence of Capt or OIM's presence at DP desk, DPO empowered to advise Driller to initiate EDS	On reaching Red Alarm Circle
LOSS OF TOW VESSEL		Depending on operations and weather conditions / forecast may dictate drift away from Sub Sea assets and FPSO	Depending on operations and weather conditions / forecast may dictate drift towards Sub Sea assets and FPSO	
COMMUNICATIONS WITH TOW VESSEL	VHF and Single side band and Global star	If lose VHF have Single side band and Global star	IF lose VHF and Single side band have Global star	
OPERATIONAL COMMUNICATIONS WITH TOW VESSEL		When non shearable tubulars are passing through BOP's		
IMPENDING COLLISION		If minimum CPA is less than 500m	If Consequence of Collision is high, Yes	If the consequence of a collision is high and collision imminent then initiate disconnect
FIRE IN AN ENGINE ROOM		Any fire alarm in that area	Fire confirmed	Room #1 Uncontrollable loss of position imminent in Engine room #2
FIRE IN SWBD ROOM		Any fire alarm in that area	Fire confirmed	Uncontrollable loss of position imminent
SCR ROOM		Any fire alarm in that area	Fire confirmed	Uncontrollable loss of position imminent
BLACK OUT OF 1 SIDE HV BUS LOSS OF MORE THAN ONE RUNNING DIESEL GENERATOR FAILURE SUCH THAT THE SET UP OF GENERATORS ON EACH SIDE OF HV BUS IS NOT SYMMETRIC FOR LONGER THAN START TIME OF THE NEXT GENERATOR		Yes	Yes If a fuel problem	Uncontrollable loss of position imminent
SWITCHBOARD 125V V CONTROL VOLTAGE FAILURE GROUP OF THRUSTERS FAILURE (SPU, PLC, SCR OR E STOP MAIN PROPS)		One charger failed Two thrusters	On batteries Three thrusters	If total failure of 125V DC System Uncontrollable loss of position imminent
DATA HIGHWAY PLUS FAILURE		Multiple Alarms	If double failure	Remarks DP system continues to work PMS affected Uncontrollable loss of position imminent.

Contingency Planning



- **Process:** Carry out & implement
 - ◆ HAZID HAZOP's
 - ◆ Mitigation measures

- **Contingency plans:** Robust & developed
 - ◆ Operators project team
 - ◆ Contractors project team and operational team

- **Contingency Plans:** Effective & executable
 - ◆ Pre task drills
 - ◆ Demonstrate skills (if required)

Contingency Planning: Execution



Contingency Planning: Demonstration of Skills




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The Development of Shell's DP Vessel Requirements

EPP-PS-17
DP Vessel Requirements
Page 1 of 11

 SHELL INTERNATIONAL E&P EP PROJECTS <u>DYNAMICALLY POSITIONED VESSEL REQUIREMENTS</u>							
0	2/5/06	For RFQ	SM		FK		
REV.	DATE	DESCRIPTION	PREP. BY	CHECKED BY	APPR. BY	DISTR. CODE	DISTR. TYPE
DOCUMENT TITLE: DYNAMICALLY POSITIONED (DP) VESSEL REQUIREMENTS							
DOCUMENT NUMBER: EPP-PS-17							

- **Shell - EPP (Construction):** Learning prompted the development of “*Dynamically Positioned Vessel Requirements*” document
 - ◆ Specifies the minimum requirements for DP vessels engaged in construction activities
 - ◆ Becomes part of a RFQ/ITT package

- **Shell - EPP (Other communities)**
 - ◆ Adopted the document and made it into a Design Engineering Practice (DEP)
 - ◆ In use by Deepwater (regional)
 - ◆ In process of becoming a Global DEP

- **Requirements:** Are applicable to the following activities
 - ◆ Construction (*includes Subsea & Pipelines*)
 - ◆ Accommodation support
 - ◆ Drilling & Well Intervention (*additional requirements TBD*)

DEP Requirements Specifies: Submission of Following Documents

- FMEA*
- Proving trials
- Annual trials
- Audits
- Modifications since last FMEA
- Power system discrimination, Selectivity, Calibration
- Bus tie philosophy
- DP
 - ◆ Incidents and service reports
 - ◆ Capability plots and proving trials
 - ◆ Operations manual
- DPO experience
- Examples of WSOG or FSOG

DEP Requirements Specifies: FMEA Fundamentals

FMEA REQUIREMENTS

- FMEA must define
 - ◆ Safest mode of operation
 - ◆ Worse case failures
 - ◆ Significant single point failures
- FMEA must be
 - ◆ Updated after major modifications
 - ◆ Reviewed and updated in the last 5 years
- Annual trials must be adequate
- Action items from annual trials
 - ◆ Must be closed out
 - ◆ Or in the process of close out

FMEA MUST COVER

- Governor and AVR failure modes
- Main switchboard control power failure modes
- DP control system I/O arrangement
- Position reference processing
- One line drawings of DGPS, HPR, and other PRS
- Networks
- Communications
- Consequence analysis

DEP Requirements Specifies: Project Specific Training When Necessary

- PST is used to provide
 - ◆ An overview of the project
 - ◆ Criticality of the specific operation(s)

- PST must cover
 - ◆ Worst case failure
 - ◆ Significant single point failures of the DP system
 - ◆ Configuration for the safest mode of operation
 - ◆ DP and Contingency Planning required
 - ◆ Development & practical use of WSOG or FSOG

- PST must be
 - ◆ Conducted at suitable training facility
 - ◆ On equipment similar to that on the vessel

REQUIRED ATTENDEES

- ✓ Master(s)
- ✓ Chief Mate(s)
- ✓ DPO(s)
- ✓ Chief Engineer(s)
- ✓ Chief Electrician(s)

Keys to Success

■ Operator engagement

- ◆ Understand DP vessel's capability
- ◆ Review operational management
- ◆ Provide appropriate tools to project teams

■ Stakeholder involvement

- ◆ Foster collaboration (*contractors, operators, professional associations, training centers, and vendors*)
- ◆ Train personnel (*operators, contractors, vessel management, etc.*)
- ◆ Share learning (*failures and successes*)

■ Training center effectiveness

- ◆ Identify training needs
- ◆ Consider project specific simulator training



Thank You



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