



Safety of DP operations on drilling units on the Norwegian Continental Shelf

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Capt. Harry Verhoeven

Dr. Haibo Chen



Project background



NPD report 2003: Risk level development on the NCS.



**NORWEGIAN
SHIPOWNERS' ASSOCIATION**

**DUBE workgroup: Improve safety on the NCS - 10 areas.
Safety of DP operations on drilling units on the NCS.
Smedvig Offshore.**

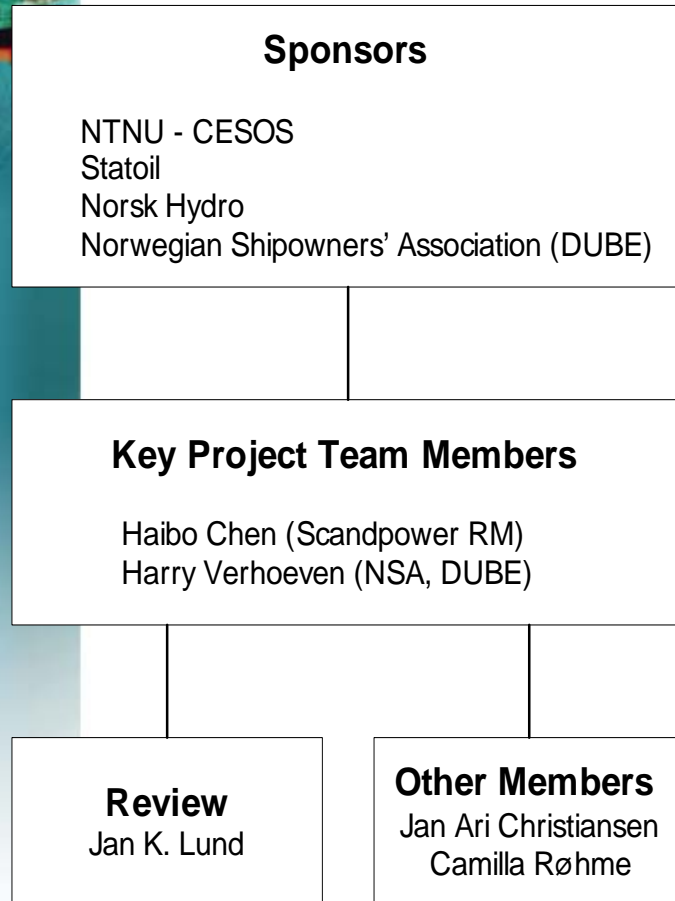


**Centre for
Ships and Ocean Structures**



**CESOS project: safety modeling of DP operations on drilling units.
Scandpower Risk Management.**

Project organisation



Reference Group Members	
CESOS, NTNU:	Torgeir Moan, Asgeir J. Sørensen
Statoil:	Kjell Larsen, Bjørn Abrahamsen
Norsk Hydro:	Hans B. Lie
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NMD:	Kjersti Høgestøl
DNV:	Aleks Karlisen
Kongsberg Maritime:	Bjørn Gjelstad
SMSC:	Helge Samuelson

Project target

- **Improve safety of DP operations on drilling units**
- **HOW:**
 - **Concrete measures to reduce number of LOP's**
 - **Focus on multiple barriers**
 - **Multi discipline workgroup**
 - **Open dialogue between all players**
- **NOT:**
 - **Let statistics get in the way**
 - **Finger pointing**
 - **Just another report collecting dust**

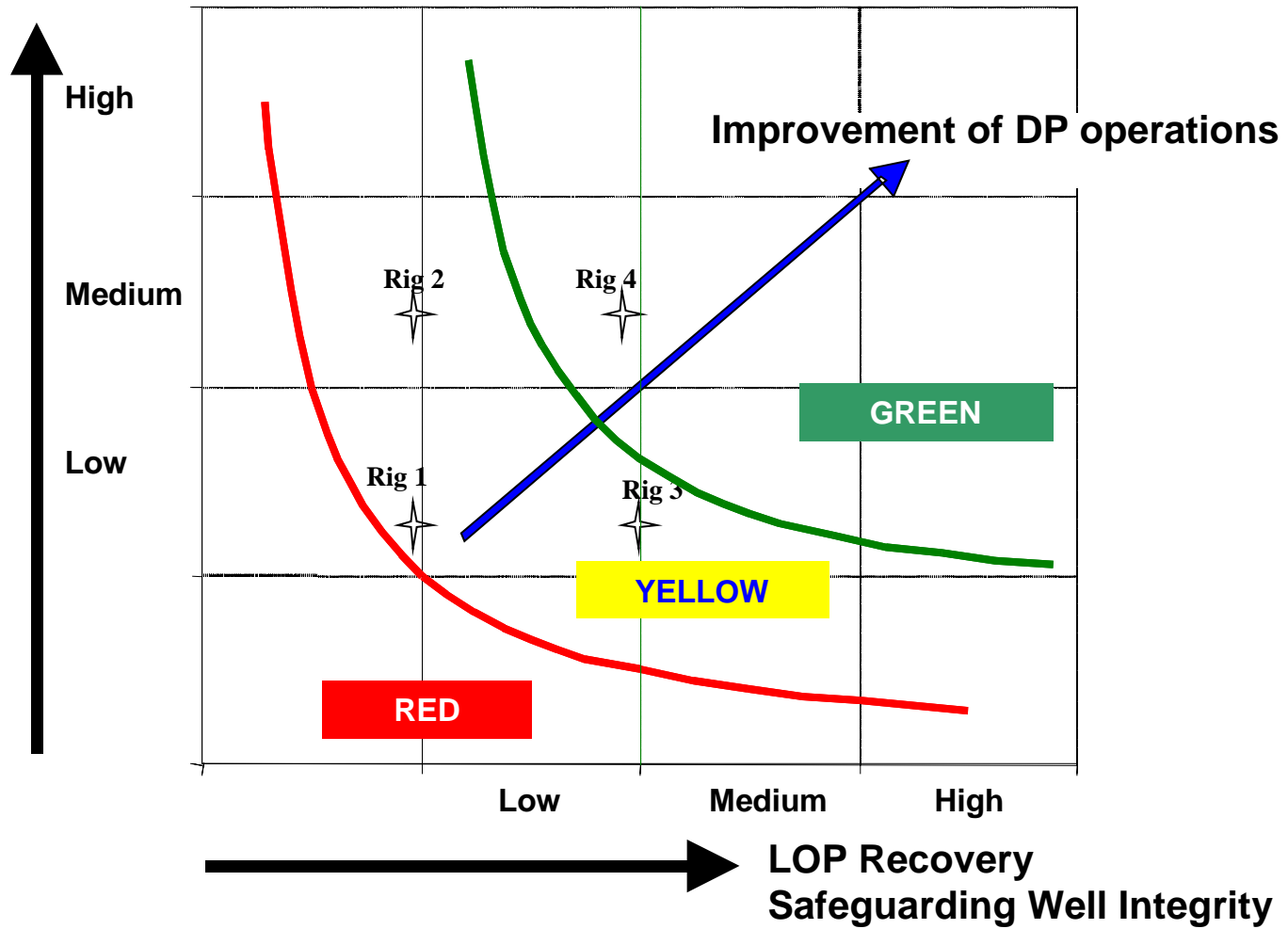
Project milestones

- **Completed**
 - Project outline
 - Workgroup
 - Definitions
 - DP incident data collecting
 - DP incident analysis
- **Technical notes**
- **Papers**
- **Workgroup meetings**
- **Outstanding**
 - Resistance to LOP
 - LOP recovery
 - Well integrity

Project philosophy



Resistance to Loss of Position



Regulations on the NCS

- **Petroleum Safety Authority**
 - **Drilling and well activities**
 - **DP class 3**
 - **Open bustie breakers**
 - **IMO MSC/Circ 645: chapter 3.2.4**
- **Norwegian Maritime Directorate**
 - **IMO MSC/Circ 645**

Project reference for definitions

Statoil governing document

DP Requirements for Drilling and Intervention Units

Technical Requirements

TR1029, Version 1, Valid from 01.09.2002

Validity area:

Statoil Group / All locations / On- and offshore



D&U Norge

Marine Operations

Classification : INTERNAL D&U Norge

DP Unit Requirements

Title: DP Unit requirements for drilling/ well intervention units No. :



A/S NORSKE SHELL
DEEPWATER DRILLING UNIT CONTRACT
CONTRACT No. 4700XXXX

Section VII - Appendix III
DP DRILLING UNIT REQUIREMENTS
Page 1 of 1

WSOG

Well Specific Operating Guidelines (WSOG)

Vessel/unit: **SAMPLE 1** Well: **SAMPLE** Operator: **HYDRO**

Condition		Green	Advisory	Yellow	Red
ANY DP INCIDENT	BLACK-OUT of ALL HV NETWORKS				Immediately
	DRIVE OFF Incident or DRIFT OFF Incident or FORCE OFF Incident Vessel/unit offset deviation from start point Waterdepth: 380 metres			6.5 metres OR Immediately when recognised by DPO	Immediately when confirmed that situation cannot be controlled or NOT > 11 metres
INTACT DP SYSTEM	DP position footprint	< 5 metres	> 5 metres	10 metres	15 metres
	DP heading footprint	< 2 deg	2-3 deg	If threat to position	If threat to position
Power consumption each network (3-split configuration)		< 50%	Any PMS warnings.	>70% or loss of one power station + Consequence alarm	Situation specific
Thrust consumption Each online unit.		< 50%	Thruster & PMS Warnings	Consequence alarm	Situation specific
Position reference available		3 independent	Loss of a system or performance limitation	2 (situation specific)	If threat to position
DP control system (Including IAS- DP controllers)		2 + 1 backup	Any failure or loss of performance in any system	1 or loss of failure of backup controller	Loss of all system or unable to maintain position

Yellow and red limits



DP operating limits for drilling operations

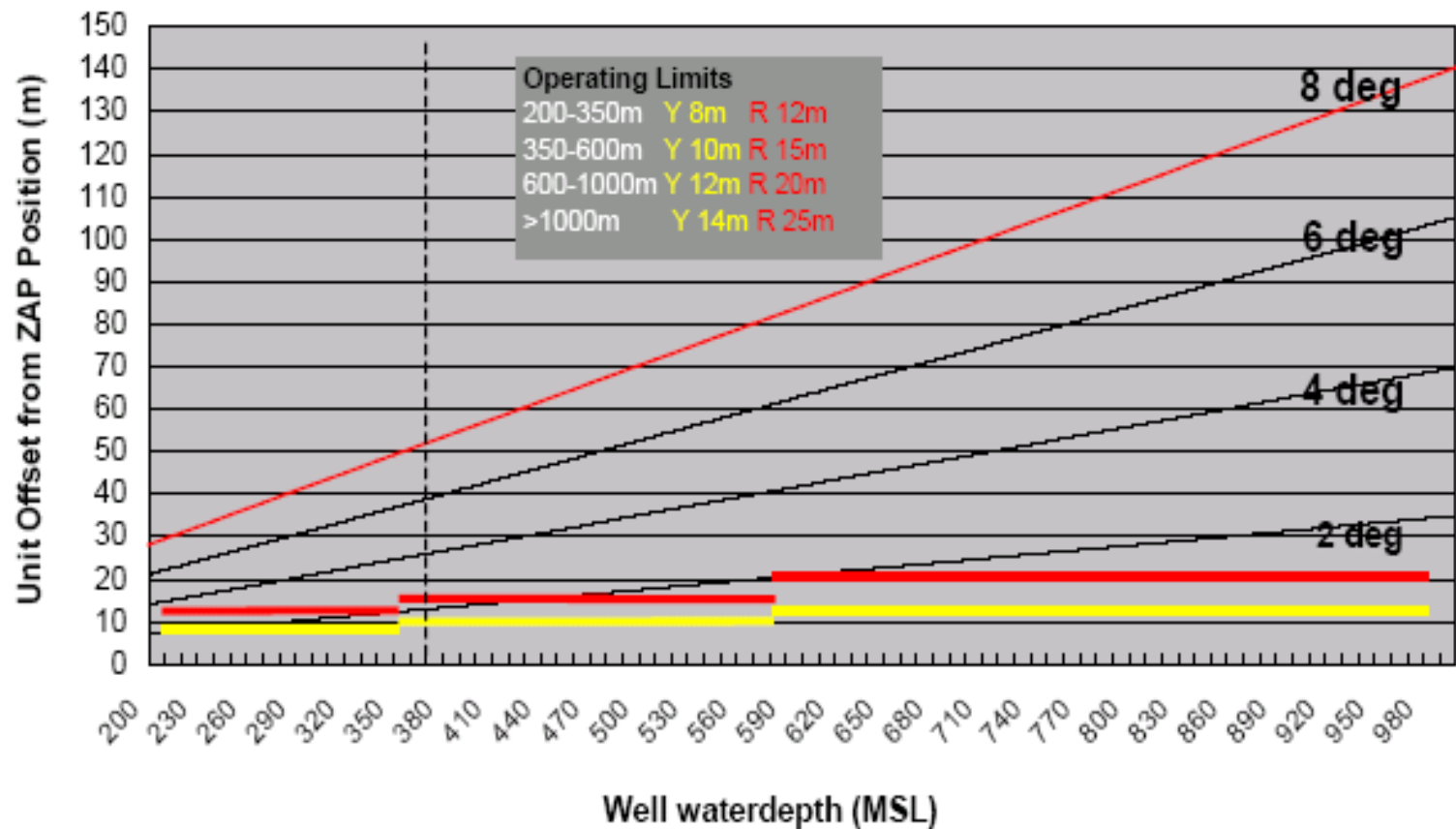


Figure 5.4-1 HYDRO - DP REQUIREMENTS - OPERATING LIMITS WD 200+m MSL

Example of estimating safe disconnect time:

DP operating limits for drilling operations

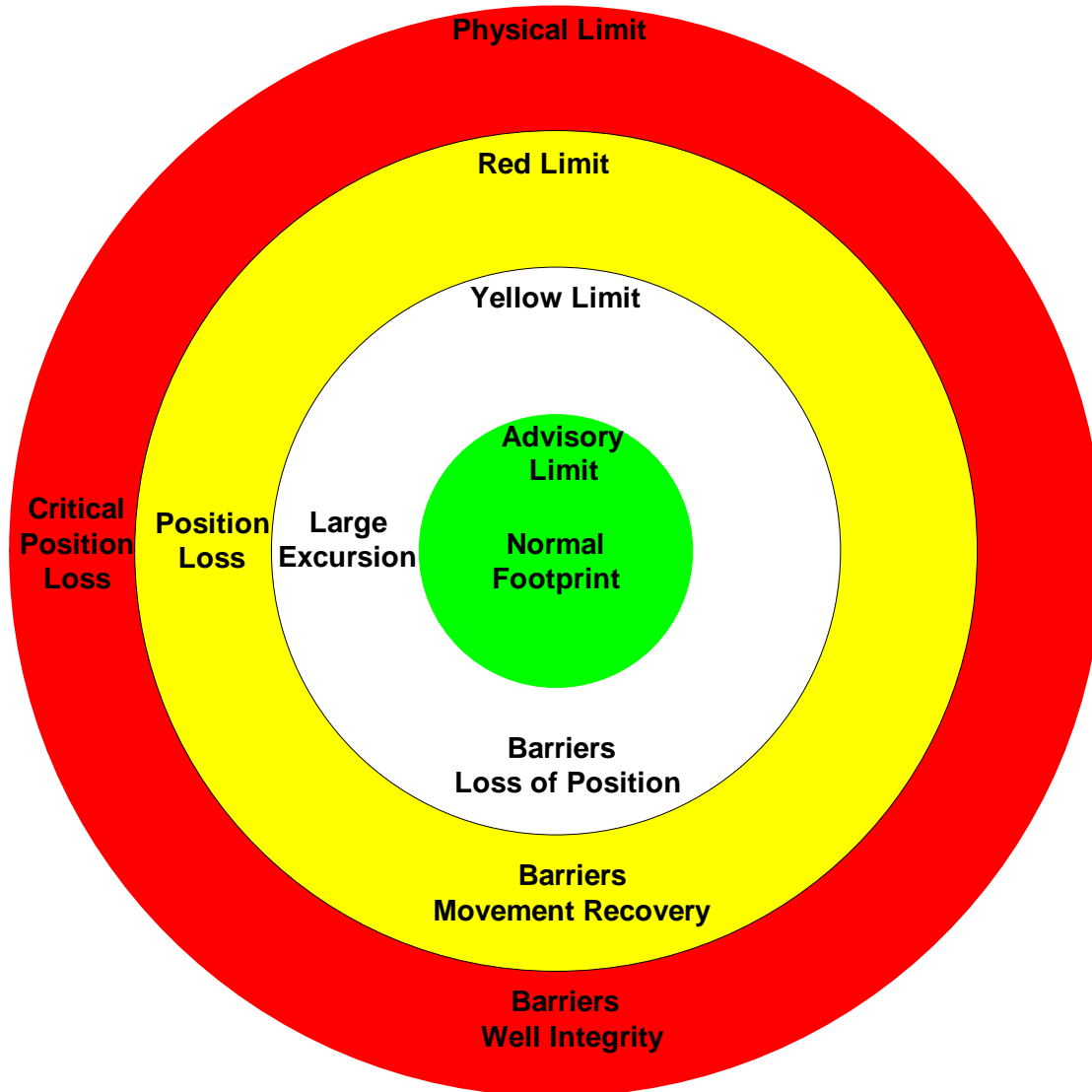


- Key Condition
- A Advisory Status
 - Y Yellow Alert Condition
 - R Red Alert Condition

Water depth														
<200m			200-350m			350-600m			600-1000m			>1000m		
A	Y	R	A	Y	R	A	Y	R	A	Y	R	A	Y	R
5	6	8	5	8	12	5	10	15	5	12	20	5	14	25

Table 5.4-1 Alert status versus position offset

Loss of position definitions



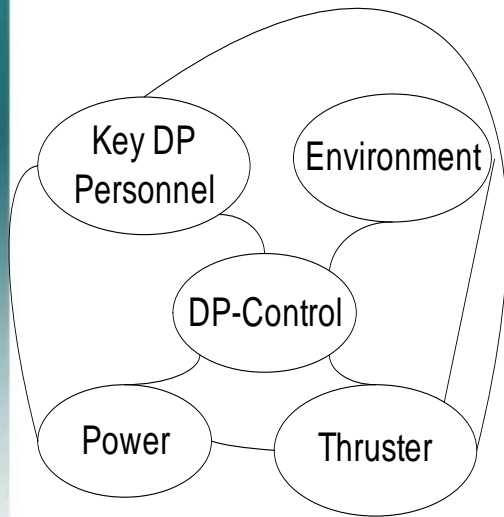
Definitions

- **DP incident**
 - An event that affects DP operations
 - Non LOP
 - LOP
- **Large excursion**
 - loss of position beyond the advisory limit but within the yellow limit
- **Loss of position**
 - The vessel loses, either temporarily or for an extended time, the capability to maintain its position or heading by means of thruster force, and consequently has a position offset that is beyond the yellow limit
- **Critical LOP**
 - LOP beyond the red limit

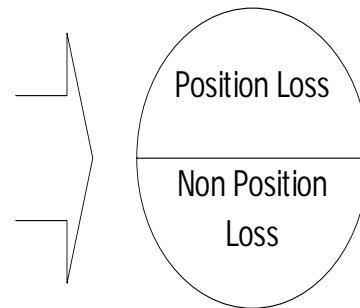
DP incident analysis



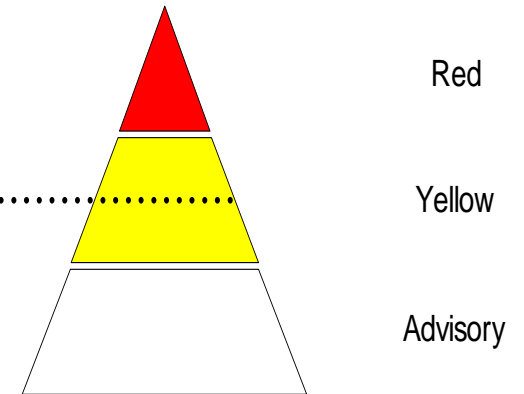
Causal Areas



DP Incidents

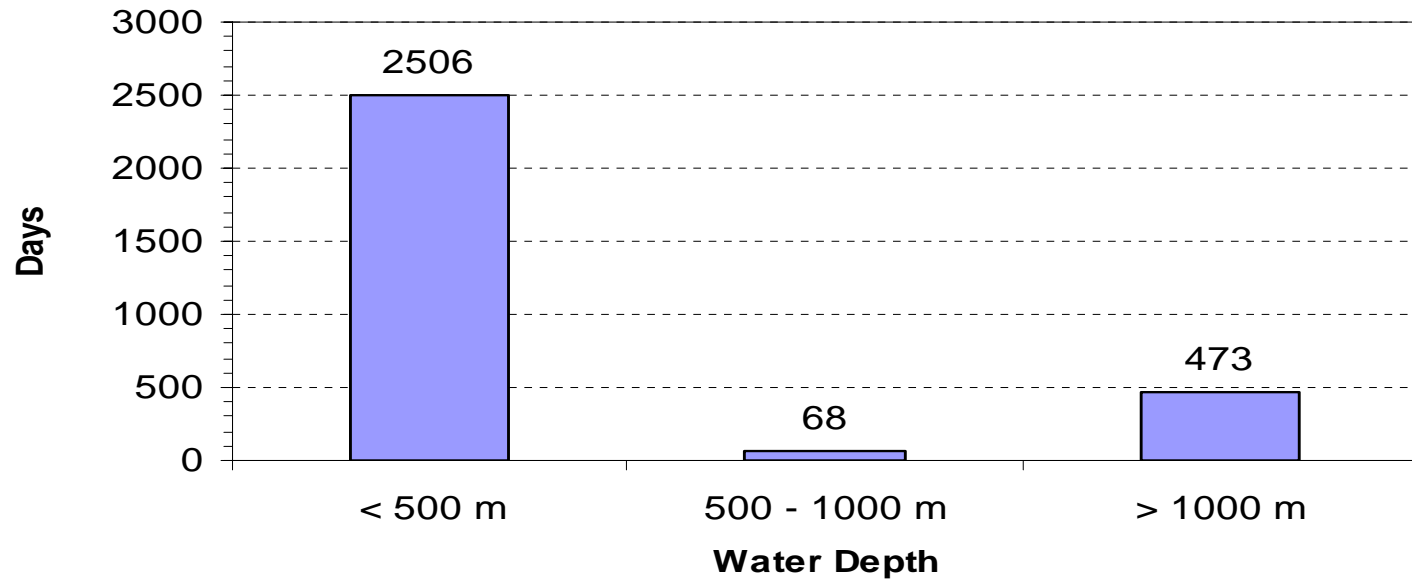


Event Outcomes



Operational time and challenges NCS

DP Drilling & Well Intervention on the NCS



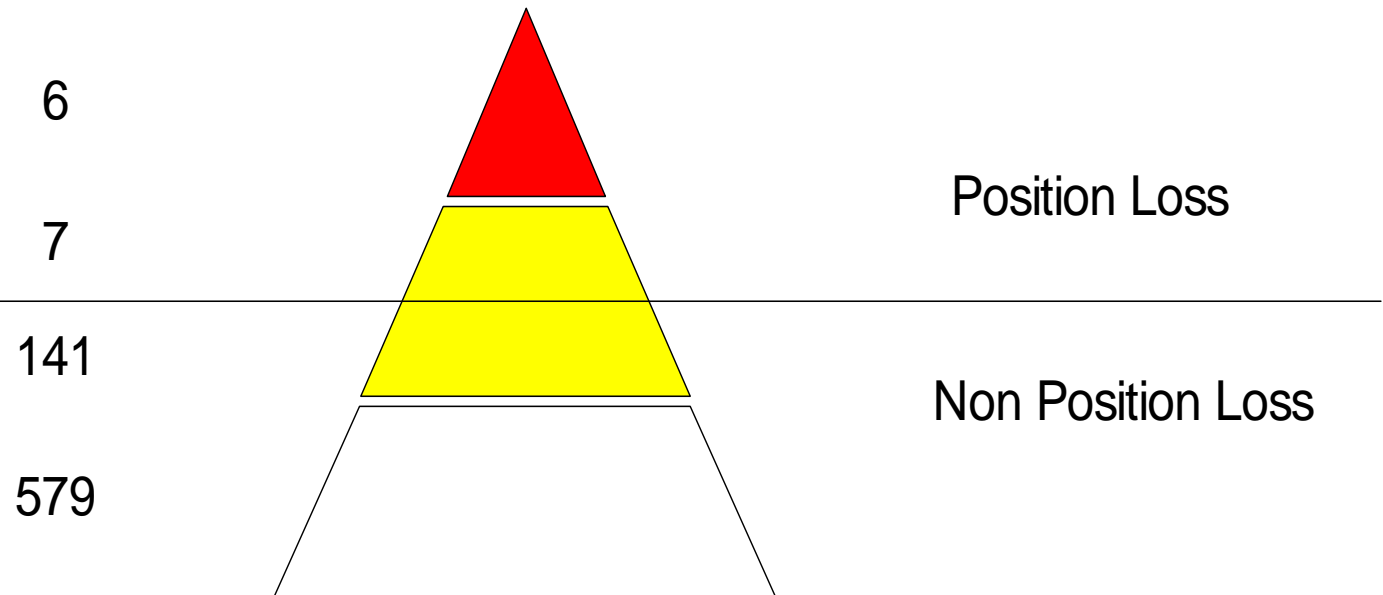
- **Shallow water**
 - **Tight limits**
 - **Limited time to react in case of LOP**
- **Severe weather area**
 - **Significant power and thruster force available**

NCS DP incident data analysis

- **Challenge**
 - No common DP incident data base
 - Synergi (>50%)
 - 87 keywords
 - WSOG logs
 - DP watch checklists
- **IMO MSC/Circ 645**
 - July 1, 1994
- **Participants**
 - Rig owners
 - PSA
 - Oil companies
- **Definitions agreed upon**

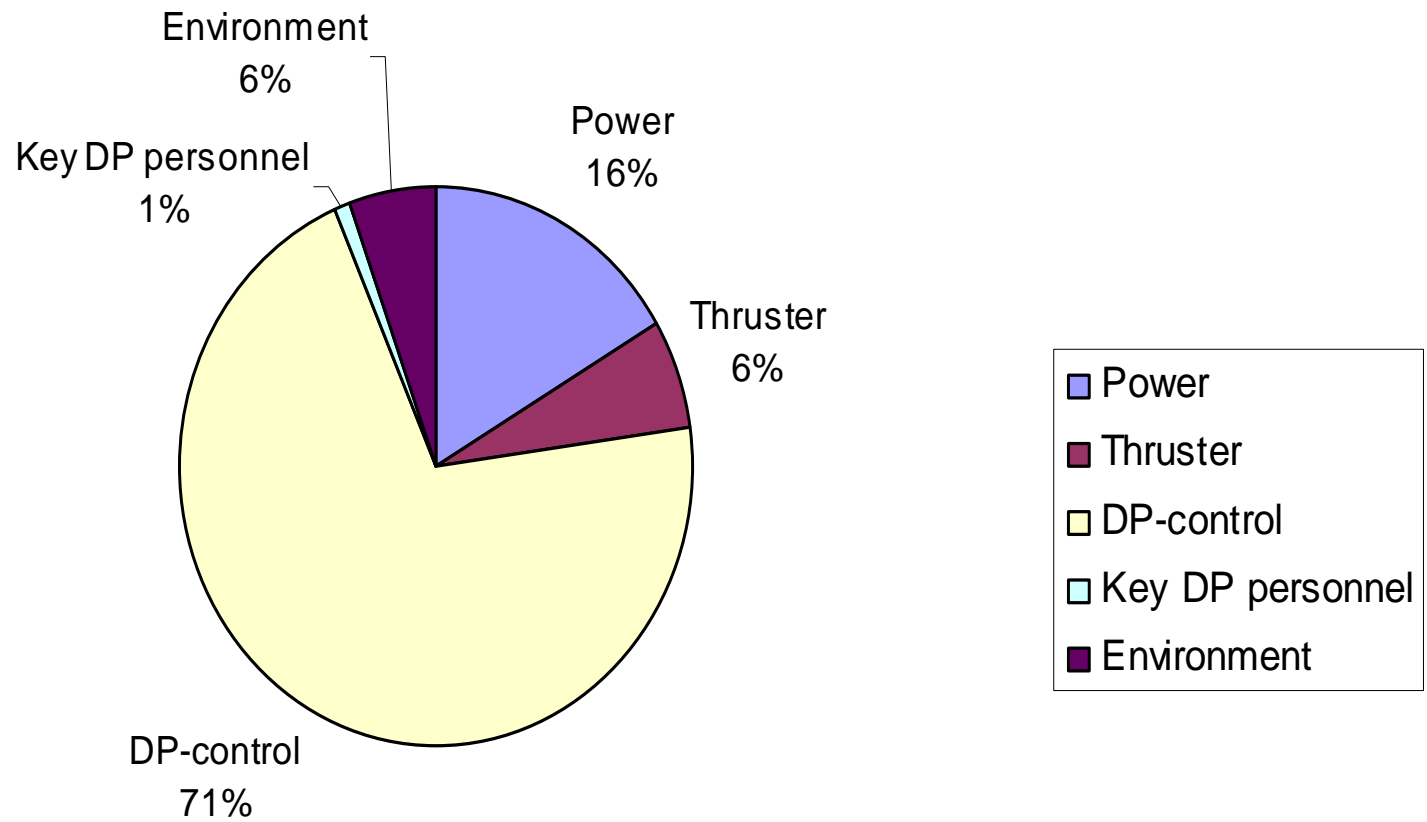
DP incident numbers

Incident Numbers



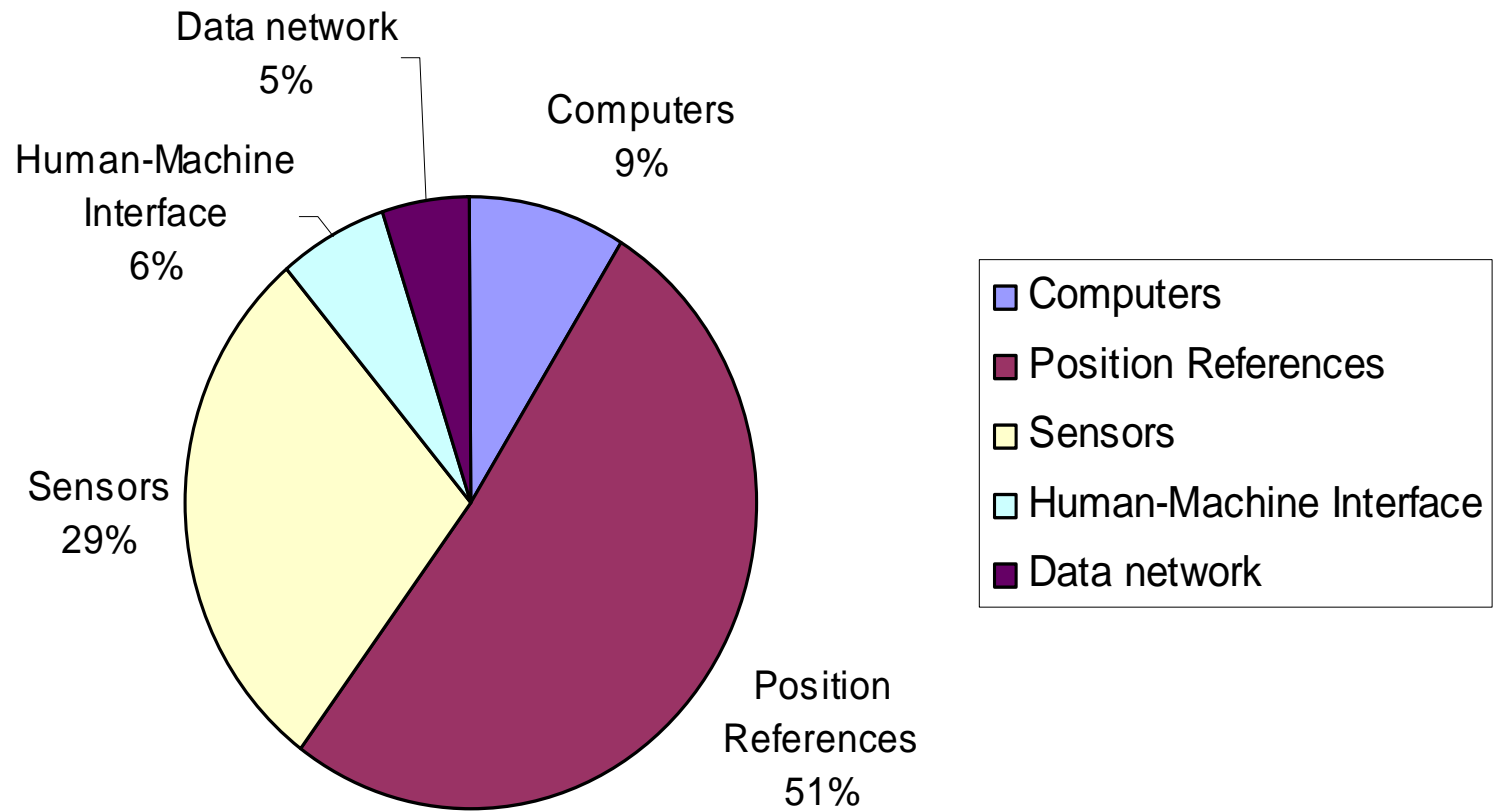
5 out of 6 critical LOP were initiated by DGPS

Non LOP: main causal areas



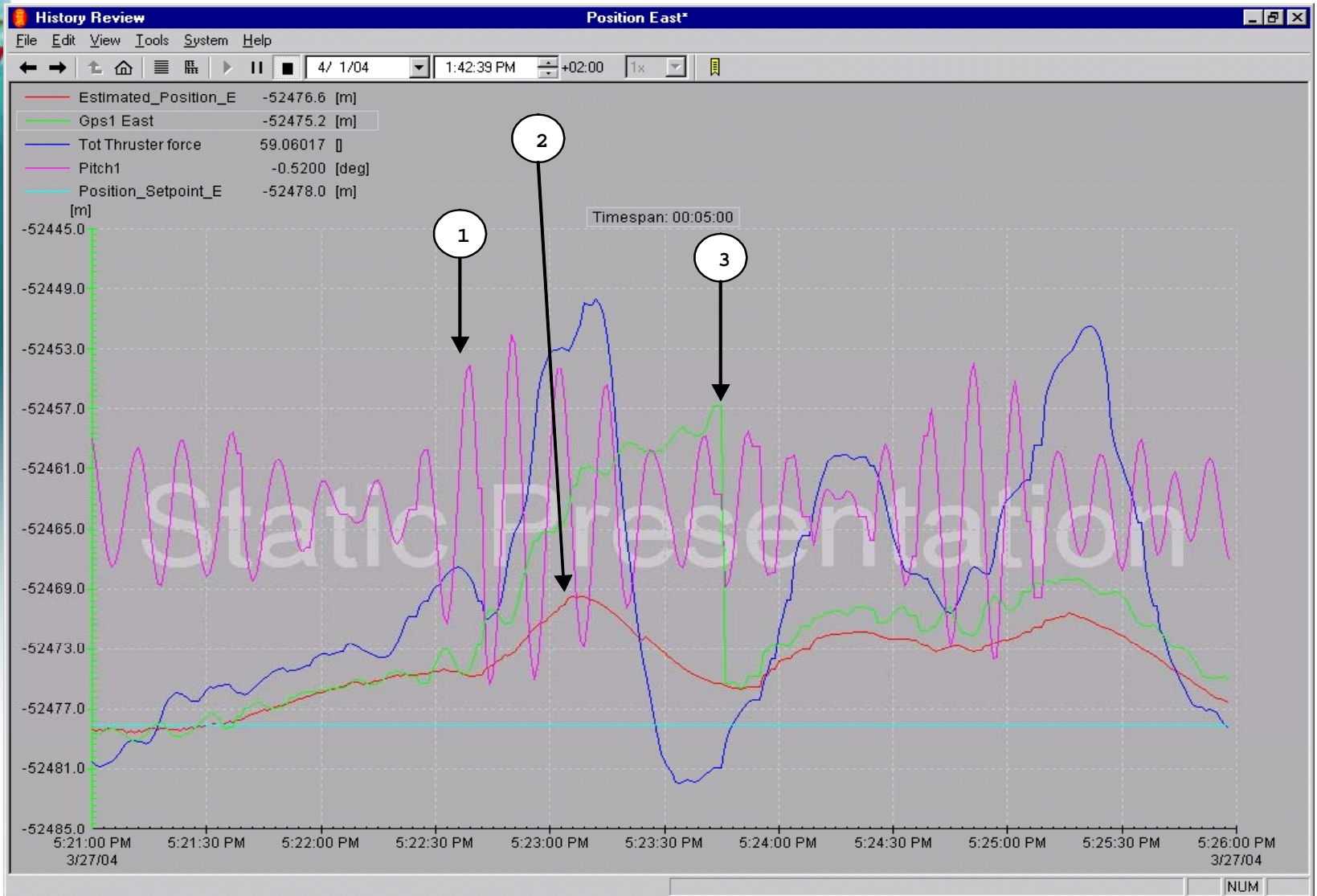
* Total Event Number: 141

Non LOP: DP control system



* Total Event Number: 100

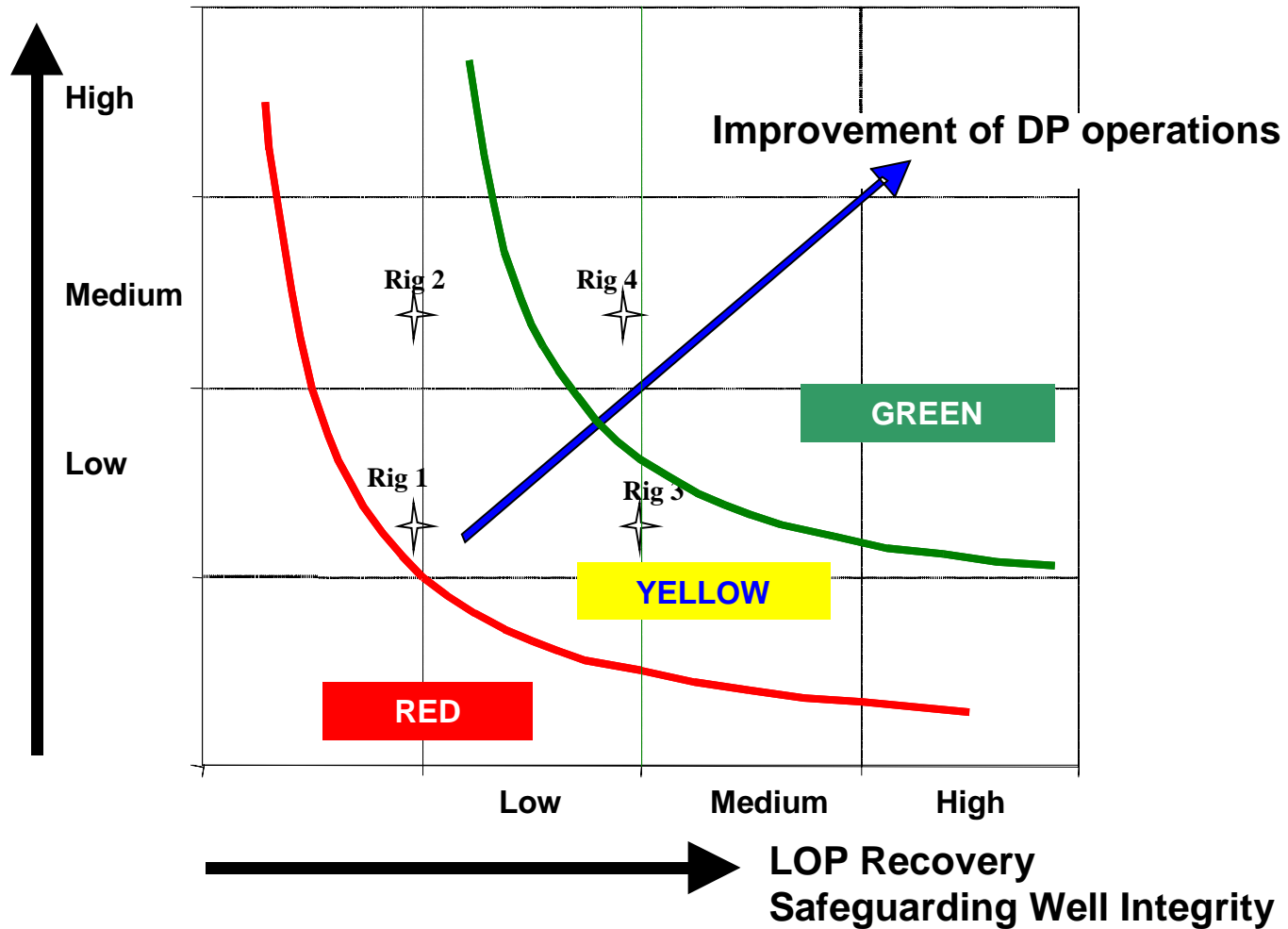
Multiple failures



Project philosophy

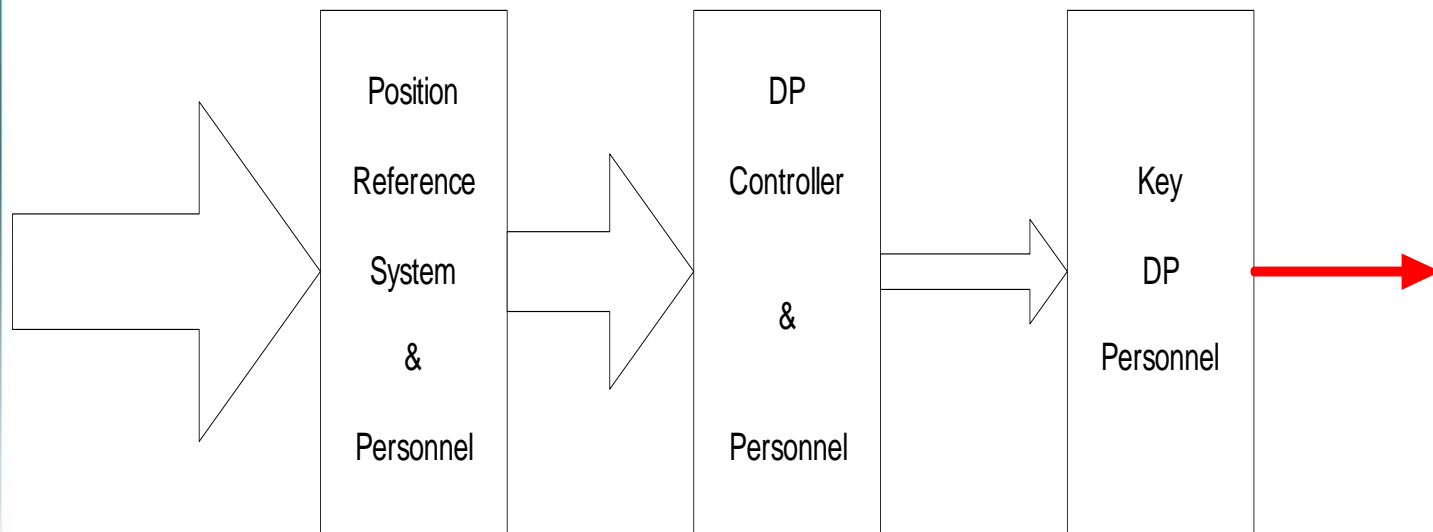


Resistance to Loss of Position



Multiple barriers

- Resistance to LOP
- LOP recovery



System set up
Parameter setting
Screen locations

Alarm jam
Handling of erroneous PRS
Parameter settings

What to do in dead reckoning mode?
When to activate Red Status & EQD?

Competence

- **Rig owners**
 - **refresher courses**
 - **DP control**
 - **Position reference systems**
 - **PMS**
 - **Scenario based exercises**

DP operating principles

- DP ops manual
- Arrival checklist
- Set up of DP system
 - DP class 3
 - Parameters
 - PMS
- WSOG
- Specific requirements for PRS
 - correct mix of PRS
 - reduce influence of DGPS
 - separate difflinks
 - 3rd PRS principle in deepwater
 - INS - HAIN

Multiple barriers

- **Safe guarding well integrity**
 - Yellow and red limits
 - drift off
 - drive off
 - Remove human delay
 - Drive off: thruster setpoint to zero
 - Communication & co-operation
 - DPO
 - Driller
 - Auto EQD in DP system
 - Instigated by
 - DP system
 - DP operator
 - Safe disconnect system on BOP



End of part 1.

Thank you for your attention.

