Operation of a Disconnectable Turret Moored FPSO

Offshore Asia, Kuala Lumpur, Malaysia

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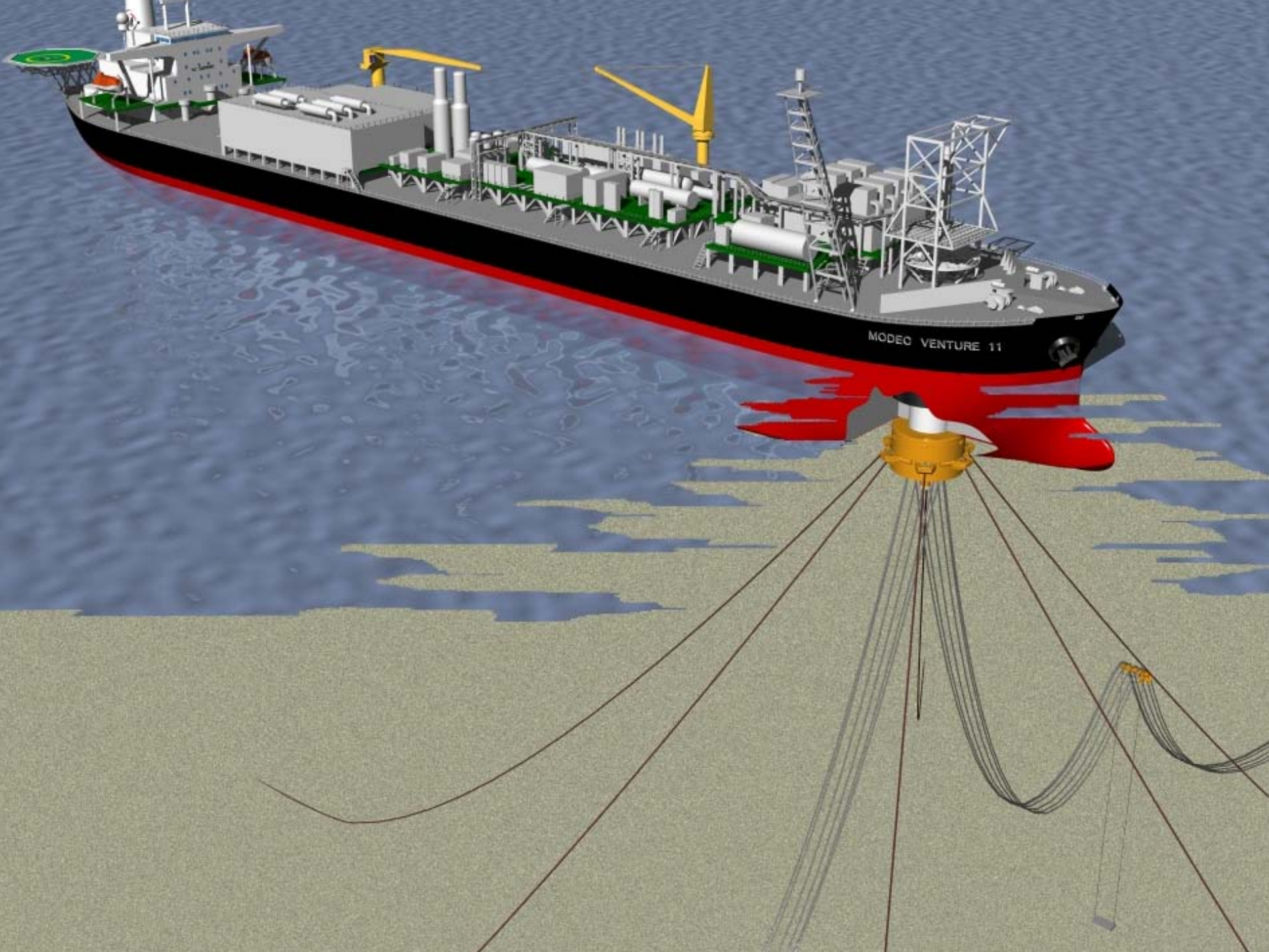
Outline

- Brief Introduction to MV-11
  - Santos Mutineer-Exeter Field, NW Australia
  - Disconnectable Turret Mooring System
- Operating Performance (2005 - 2006)
  - Performance in Cyclones
- Summary

Santos Mutineer – Exeter FPSO

- Off North-Western Australia, 160 m water depth
- Leased Disconnectable FPSO
  - Contract award to First Oil – 18 months
  - Operated by MODEC, Inc. (April 2005)
  - Suezmax tanker conversion, ~930,000 bbls storage
  - Topsides: 100,000 bbls/day
  - Disconnectable turret mooring system

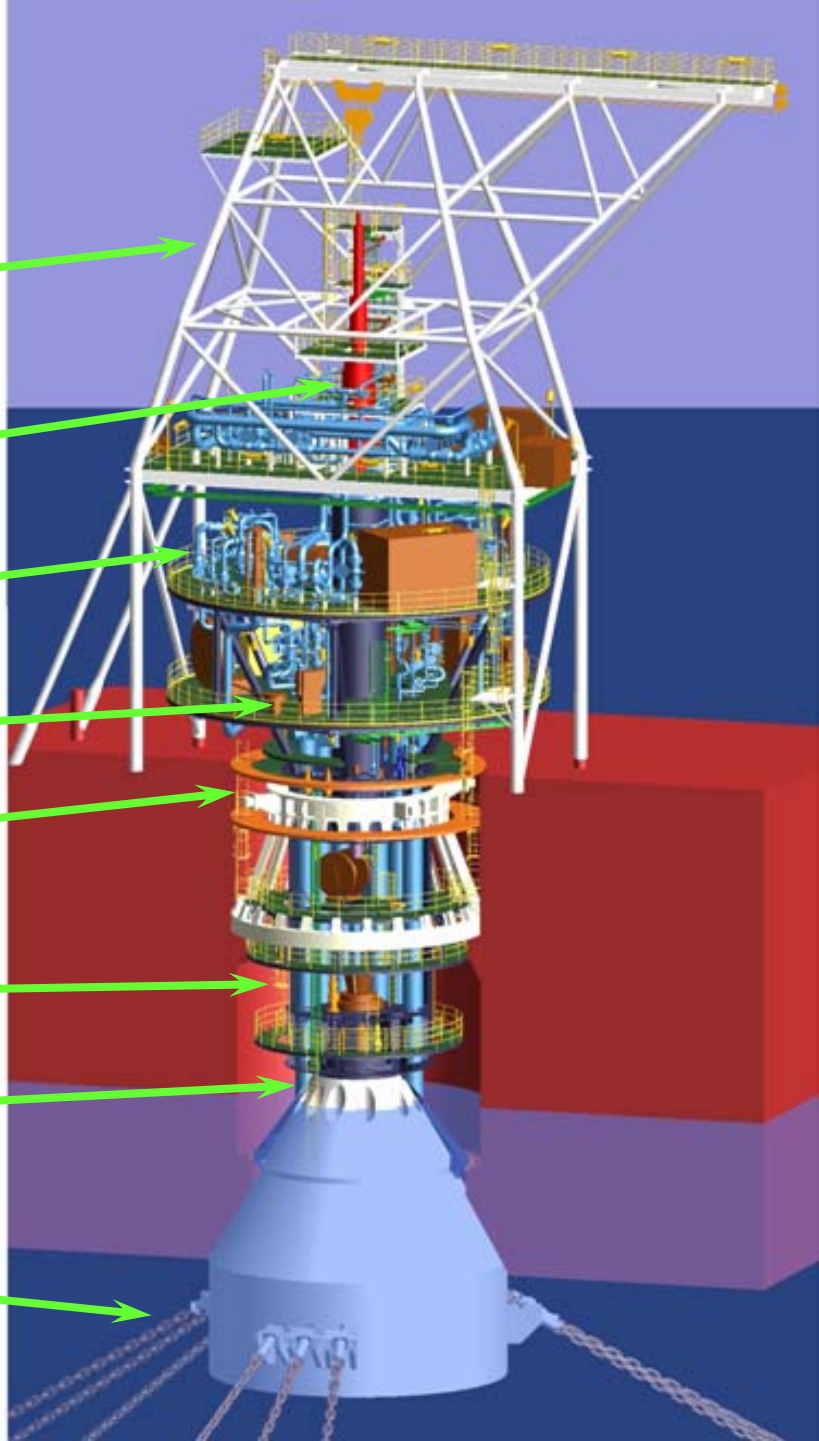

MODEC VENTURE 11

Disconnectable Turret Mooring

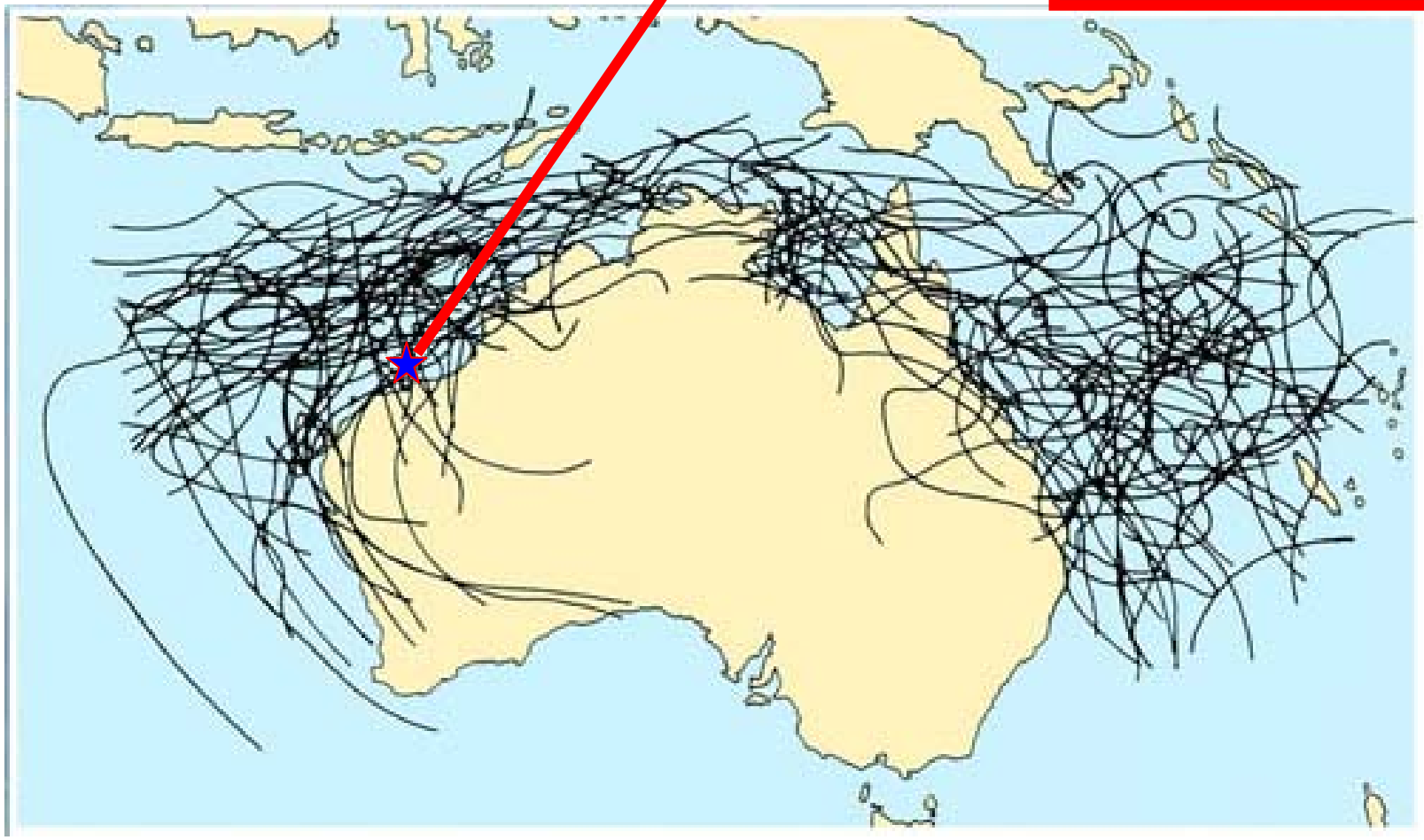
- Robust design based on proven internal turret technology
  - Fluid-transfer and load-transfer components designed to disconnect separately
- Mooring designed to remain connected for 100-year winter storm
- Turret mooring designed to disconnect for cyclones
  - Disconnect duration ~ 6 hours
  - Reconnect w/o assistance in seas up to Hs of 3m
- Disconnectable spider buoy
  - Supports mooring and 12 risers and umbilicals

Disconnectable Turret
(BHBP Stybarrow)

- Swivel Access Structure
- Swivel Stack
- Manifold Piping
- Riser Deck
- Main Bearing
- Turret Shaft
- Risers & Umbilicals
- Anchor Legs



Cyclones around Australia



Reference: Australian Government, Bureau of Meteorology
http://www.bom.gov.au/info/cyclone/#severity

Cyclones over Mutineer/Exeter Field

Name		Period	Max Category
• Clare	Jan	7-10 2006	3
• Daryl	Jan	18-23 2006	2
• Emma	Feb	27-28 2006	1
• Floyd	Mar	21-26 2006	4
• Glenda	Mar	27-31 2006	5
• Hubert	April	6-7 2006	2
• Isabel	Jan	2-4 2007	1

Emergency Disconnect Procedures at Mutineer/Exeter

- **Blue**

✓ A plan for preparation for disconnection

✓ A ballast plan

✓ A plan for evacuating non-essential personnel

- **Yellow (12-hour window)**

✓ Shutdown production

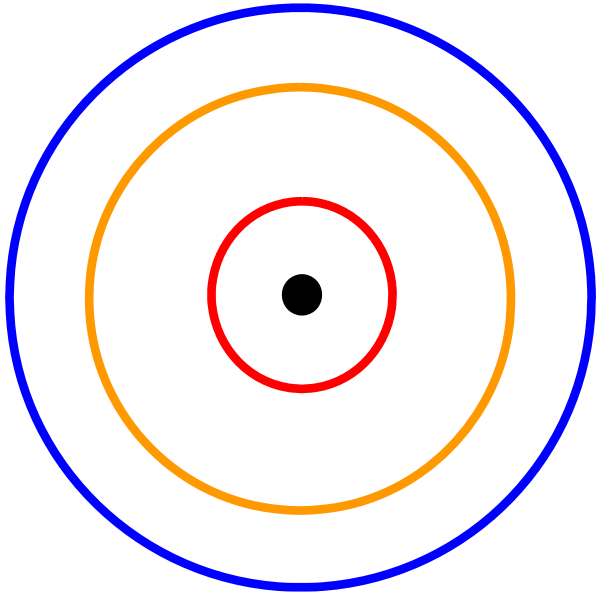
✓ Prepare to disconnect from DTM

✓ Proceed with ballast plan

✓ Prepare disconnection of Offloading Hose

- **Red**

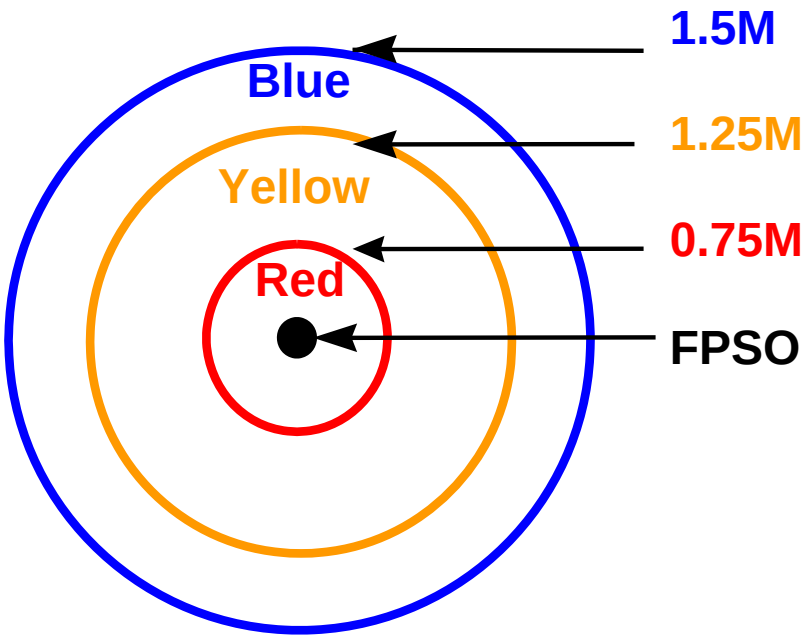
✓ Disconnect from DTM



Cyclone Phase Boundaries

$$M = (K + N) \times V$$

Category	K
Tropical Low	10
1	12
2	16
3	20
4	22
5	24



Example: A category 3 cyclone moving at 10 knots,
time required to sail to safe area is 12 hours.

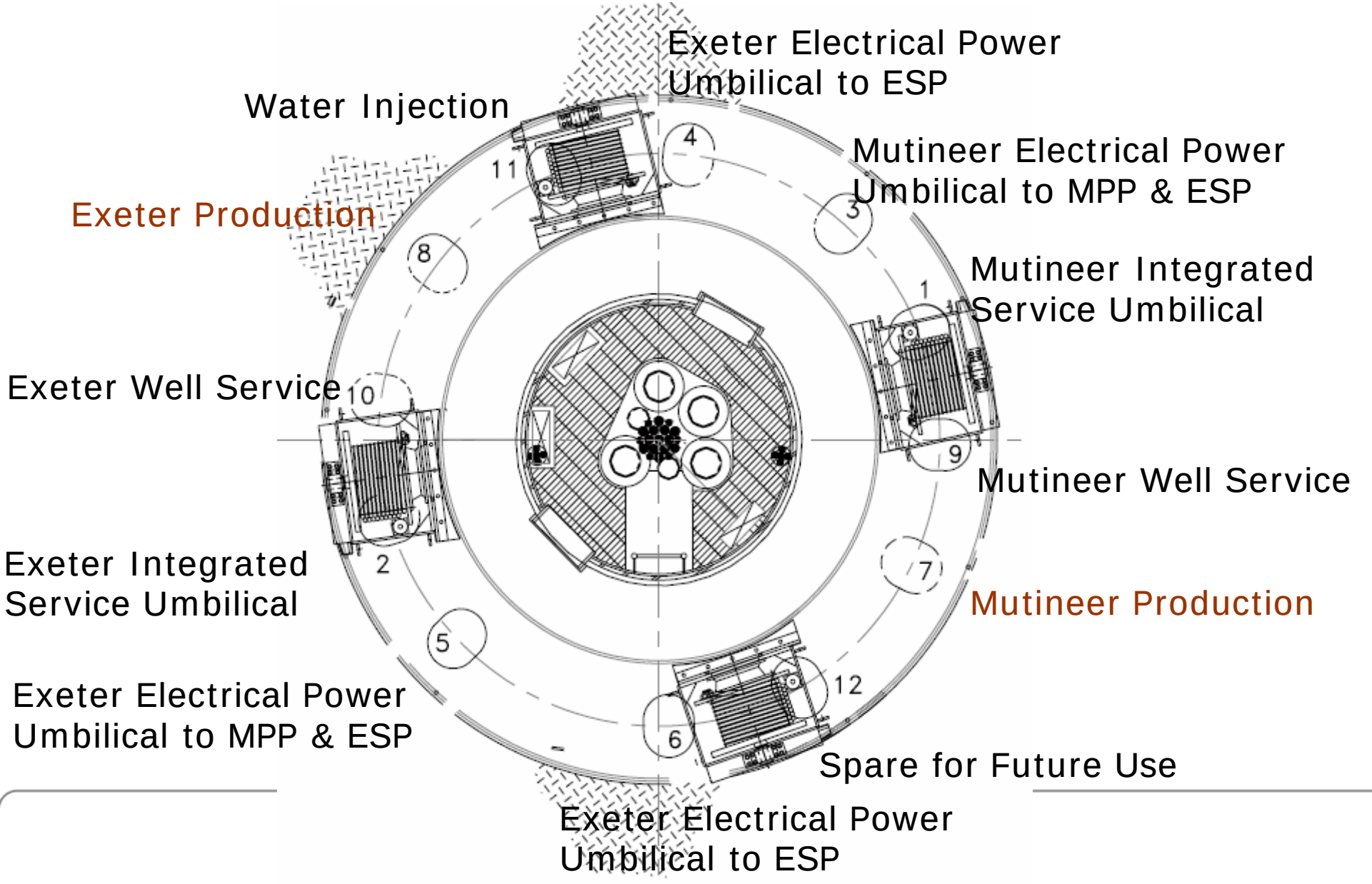
$$M = (20 + 12) \times 10 = 320$$

Blue = 1.5 M = 480 nautical miles = 890km

Yellow = 1.25 M = 400 nautical miles = 740km

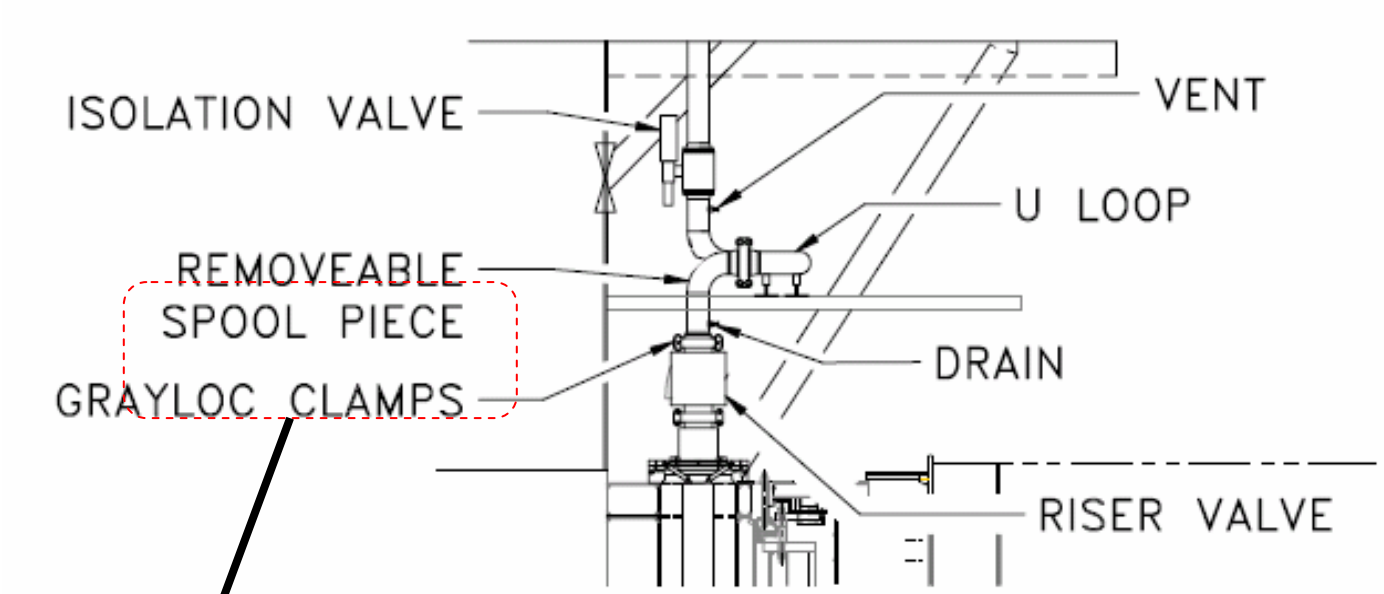
Red = 0.75 M = 240 nautical miles = 440km

Riser Arrangement



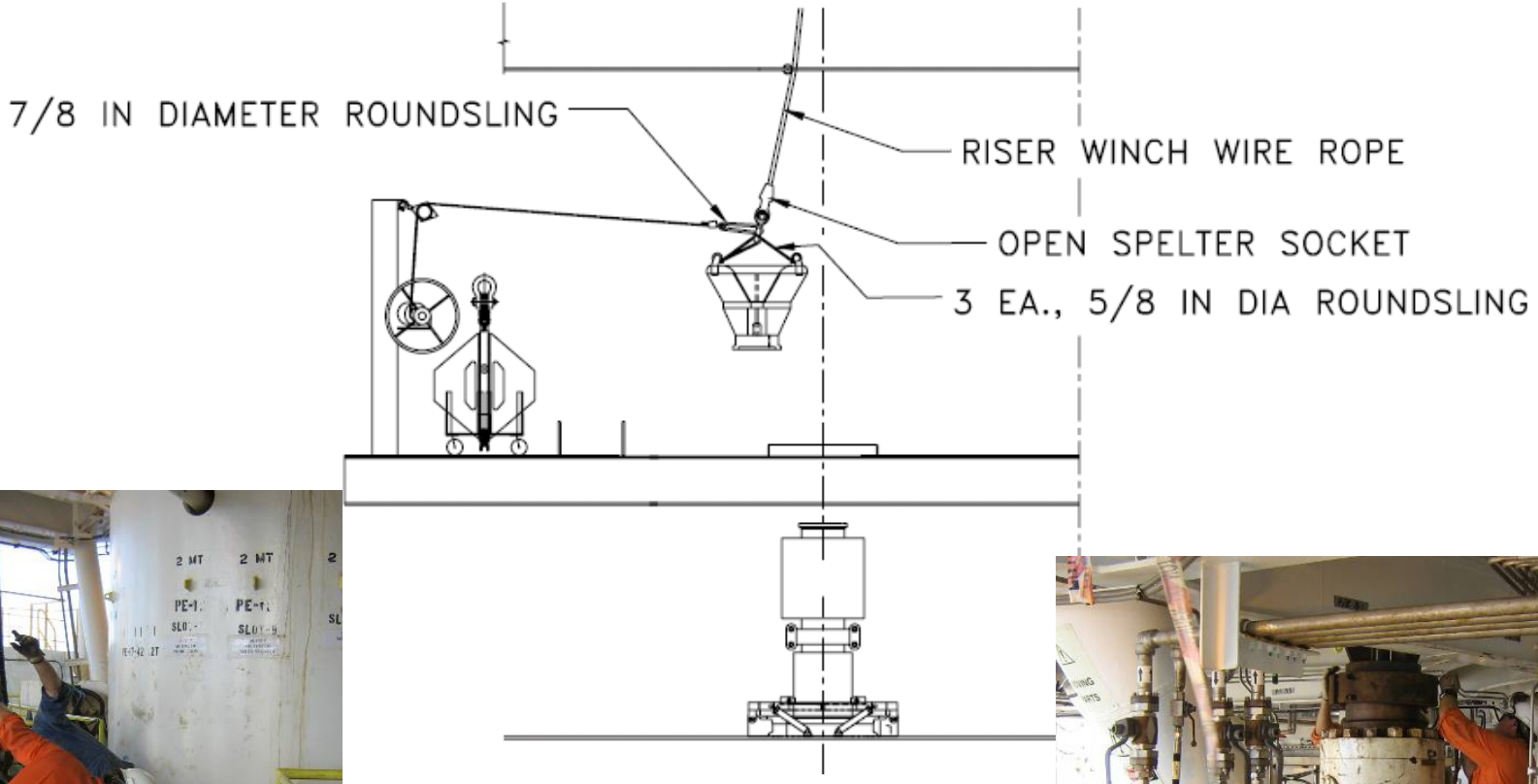
Production Riser Disconnection

Removing Spool



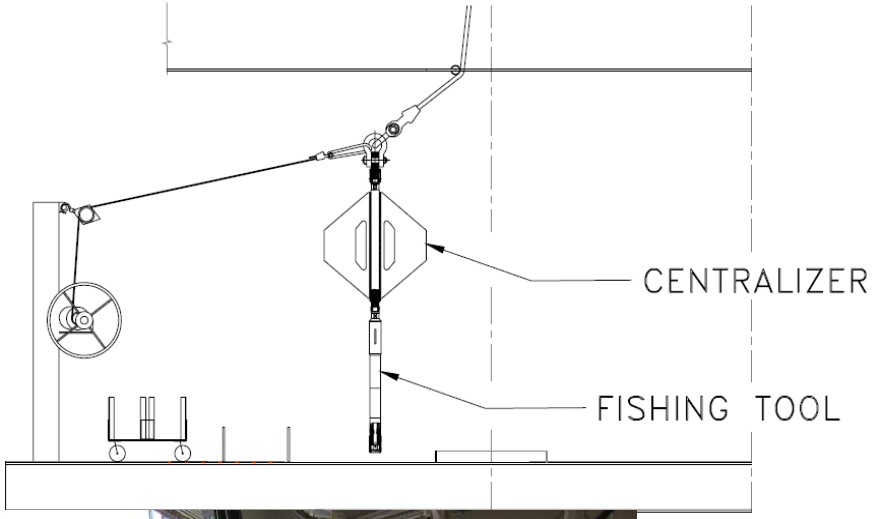
Production Riser Disconnection

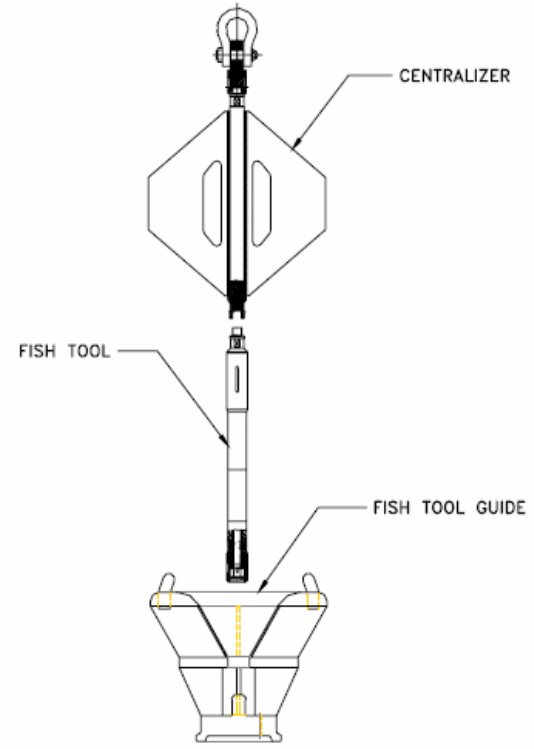
Placing Fish Tool Guide

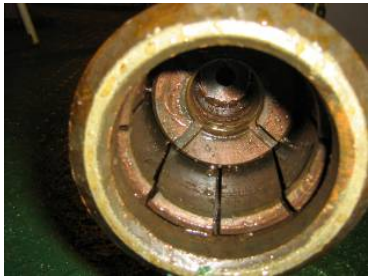


Production Riser Disconnection

Assembling Fish Tool



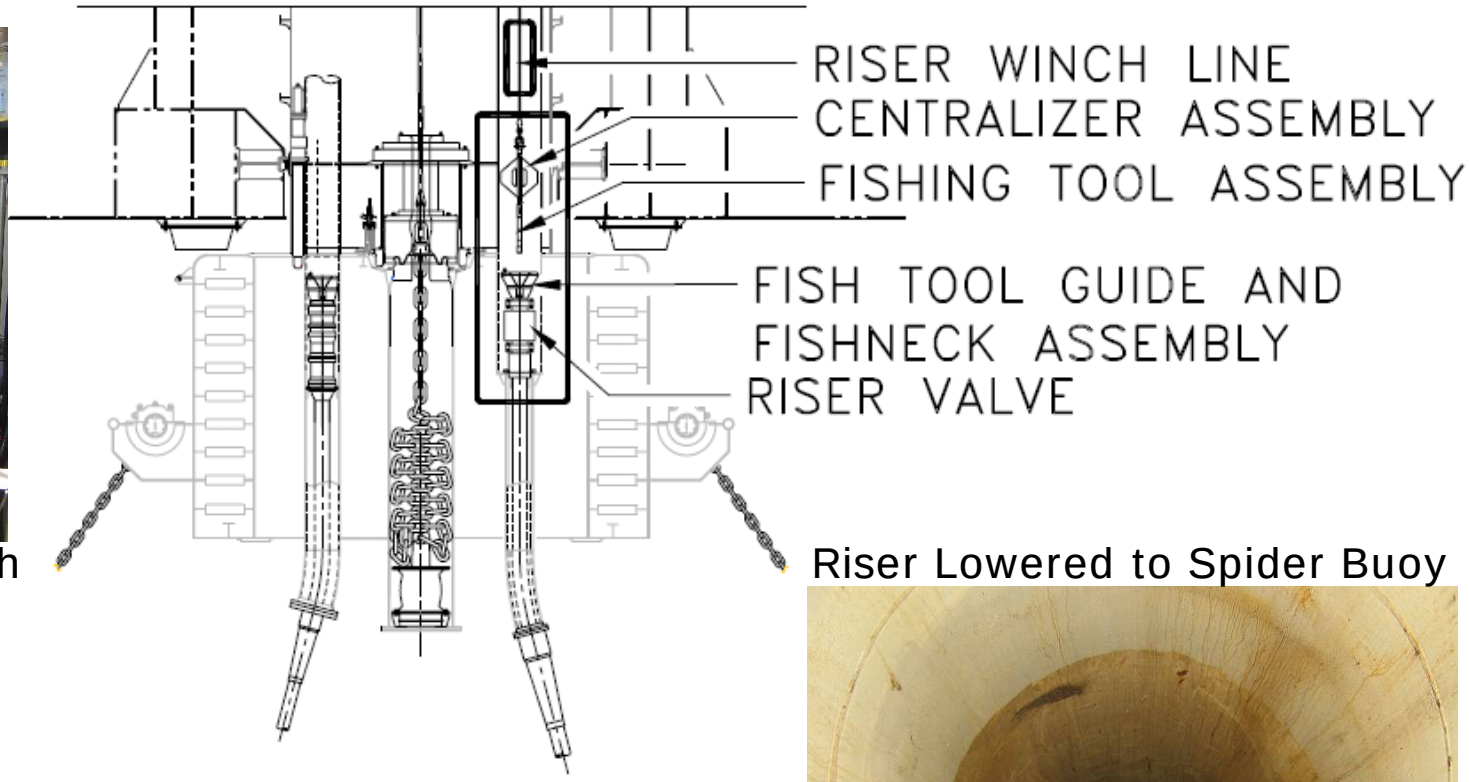




Production Riser Disconnection

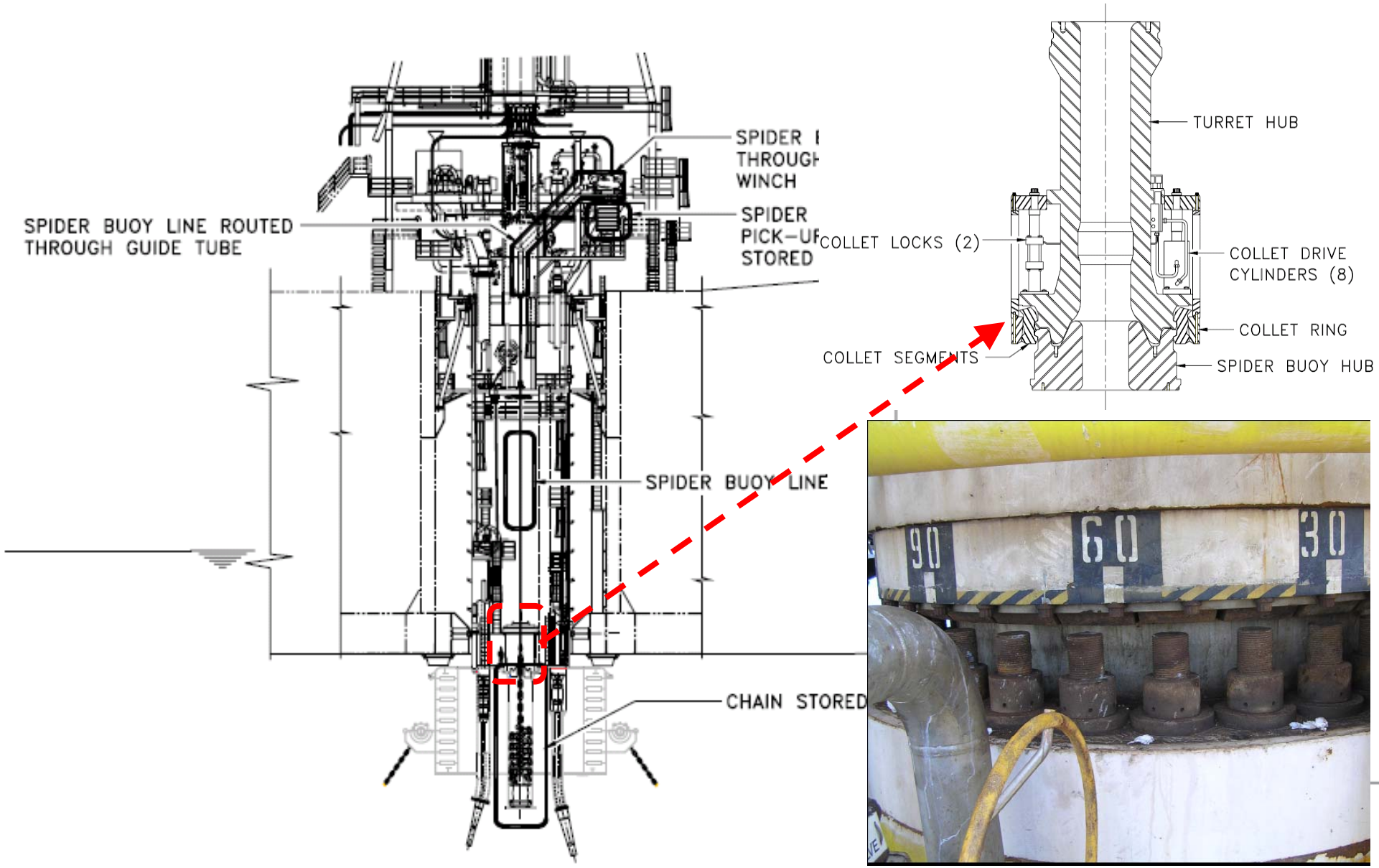
Lowering Riser

Riser Winch



Riser Lowered to Spider Buoy

Spider Buoy Disconnection

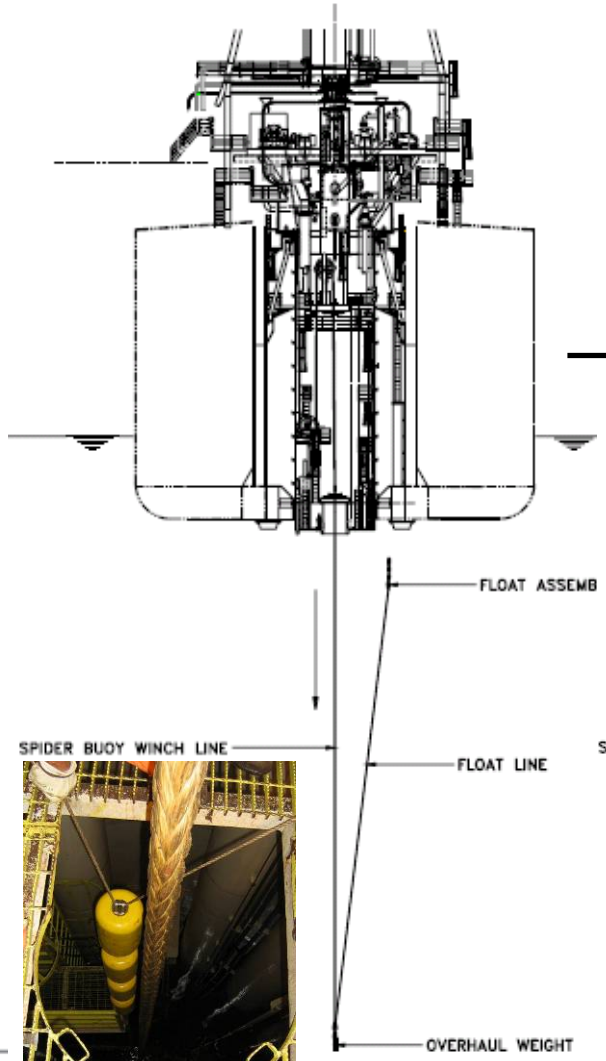


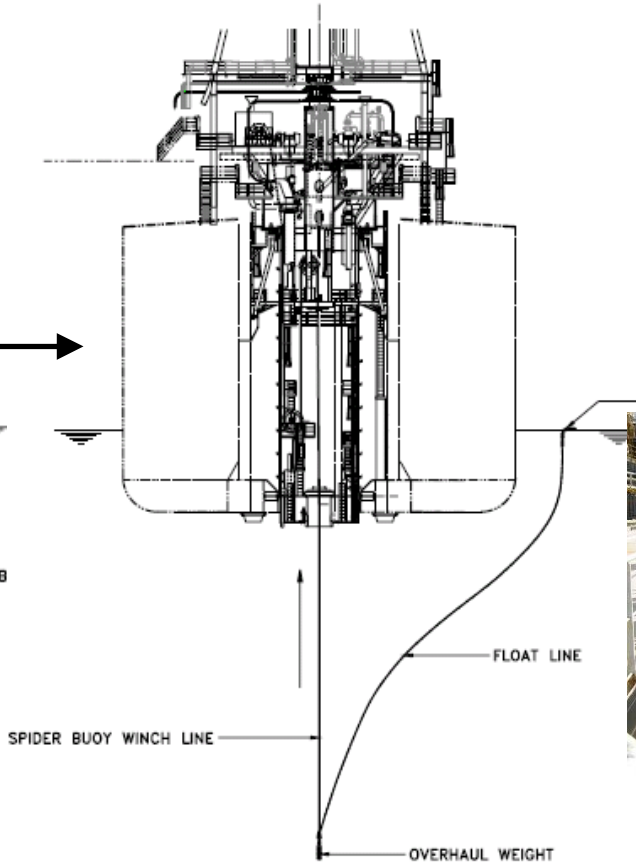
Reconnection 1

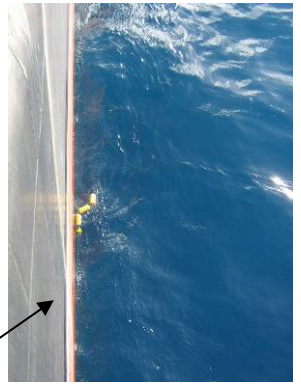
Find Spider Buoy Line

Reconnection 2

Bring Float Assembly to Surface







Picking up Float Assembly

Lowering Float Assembly from Turret

Picked up Overhaul Weight

Reconnection 3

Connect Winch Rope and Spider Buoy Line

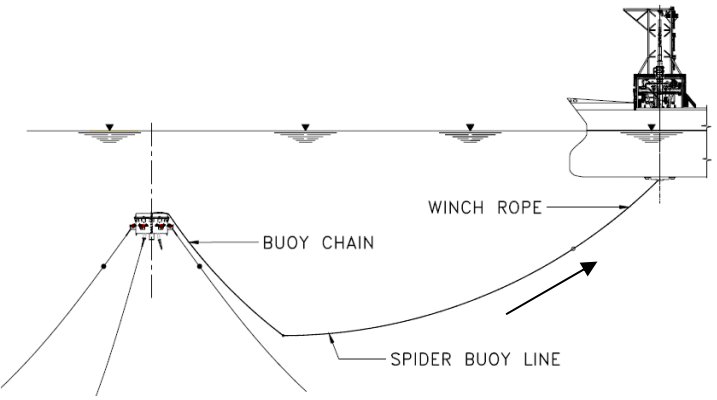
Connecting the two lines on the deck

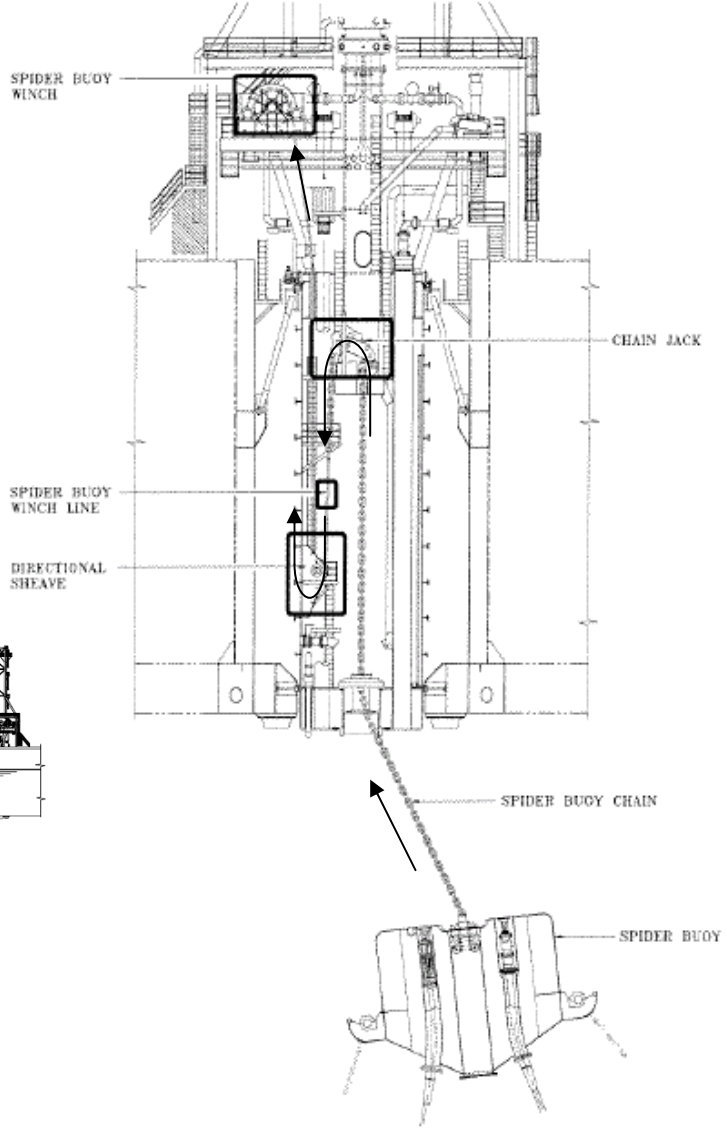
Bringing Spider Buoy Line by Workboat

Reconnection 4

Pull in Spider Buoy

Spider Buoy Winch





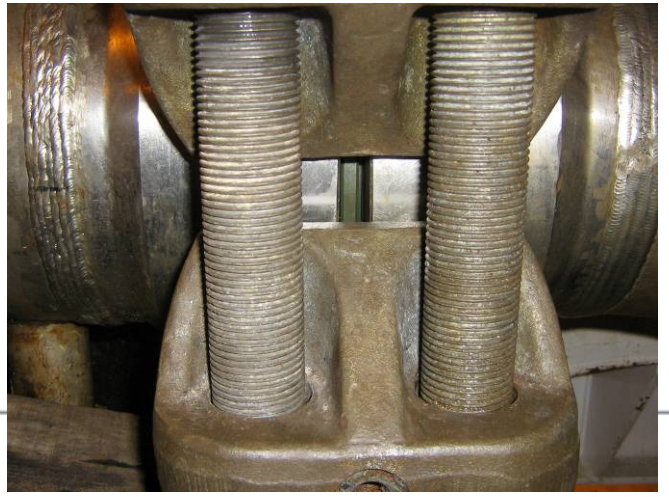
Chain Jack

Reconnection 5

Pick up Risers

Reconnection 6

Connect Production Spools



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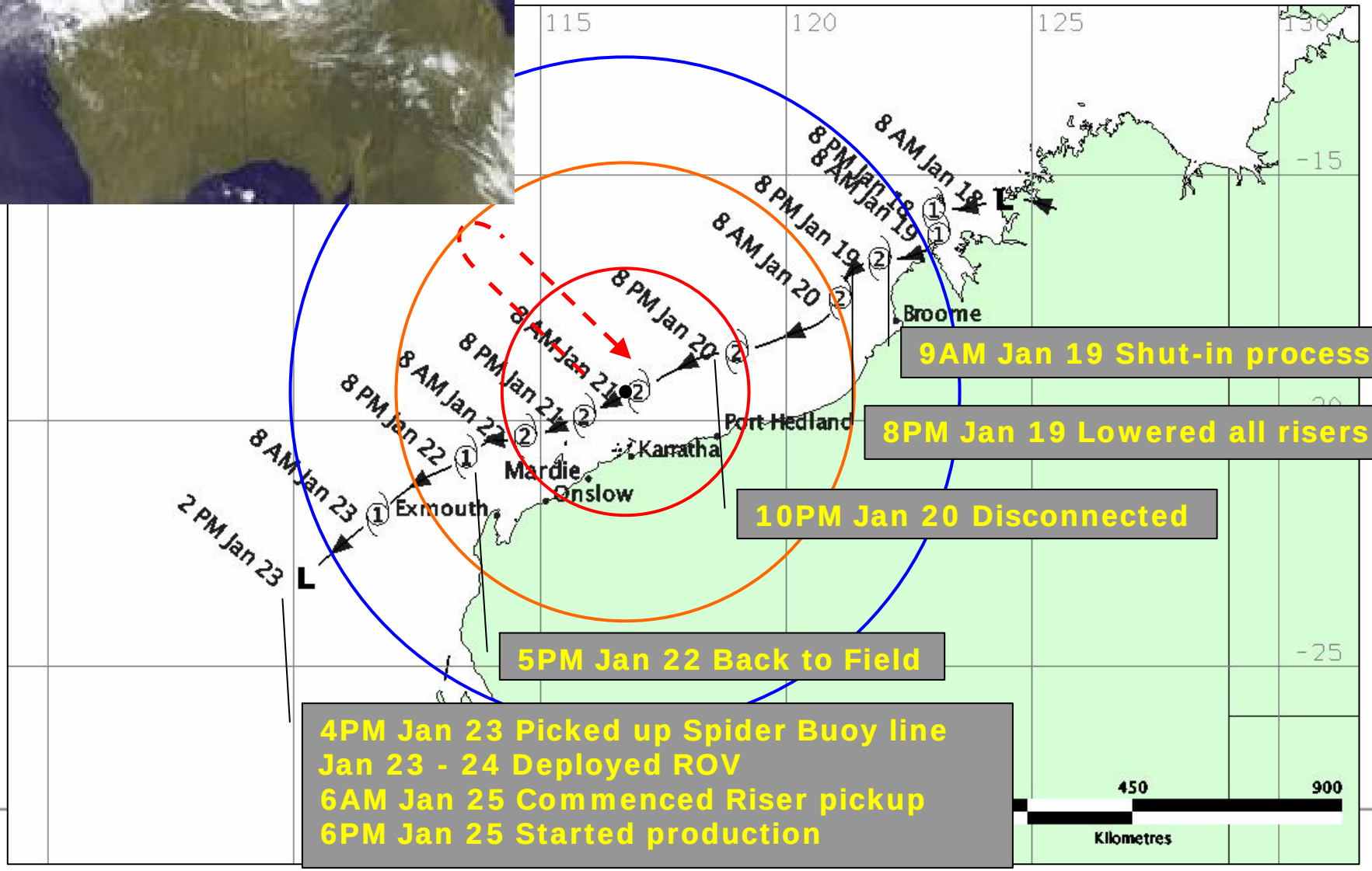
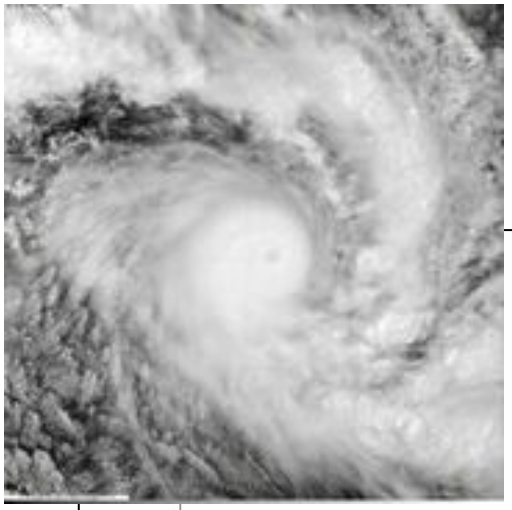
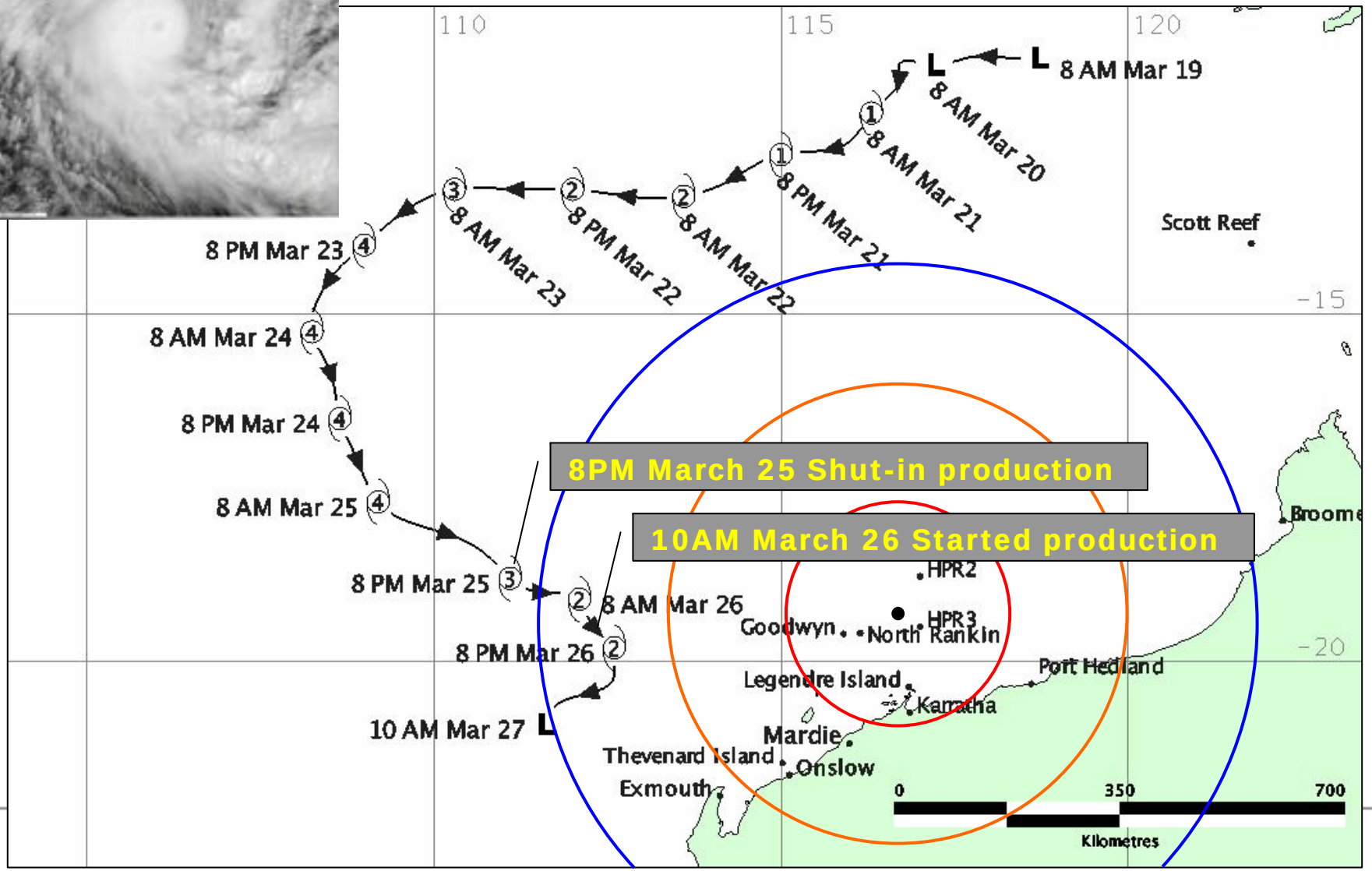
Clare: 7 – 10 January 2006

Daryl: 18–23 January 2006

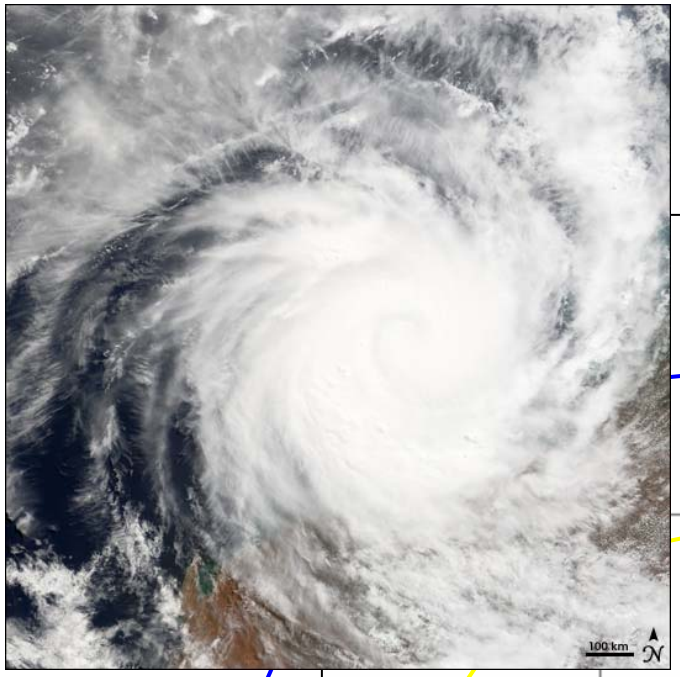


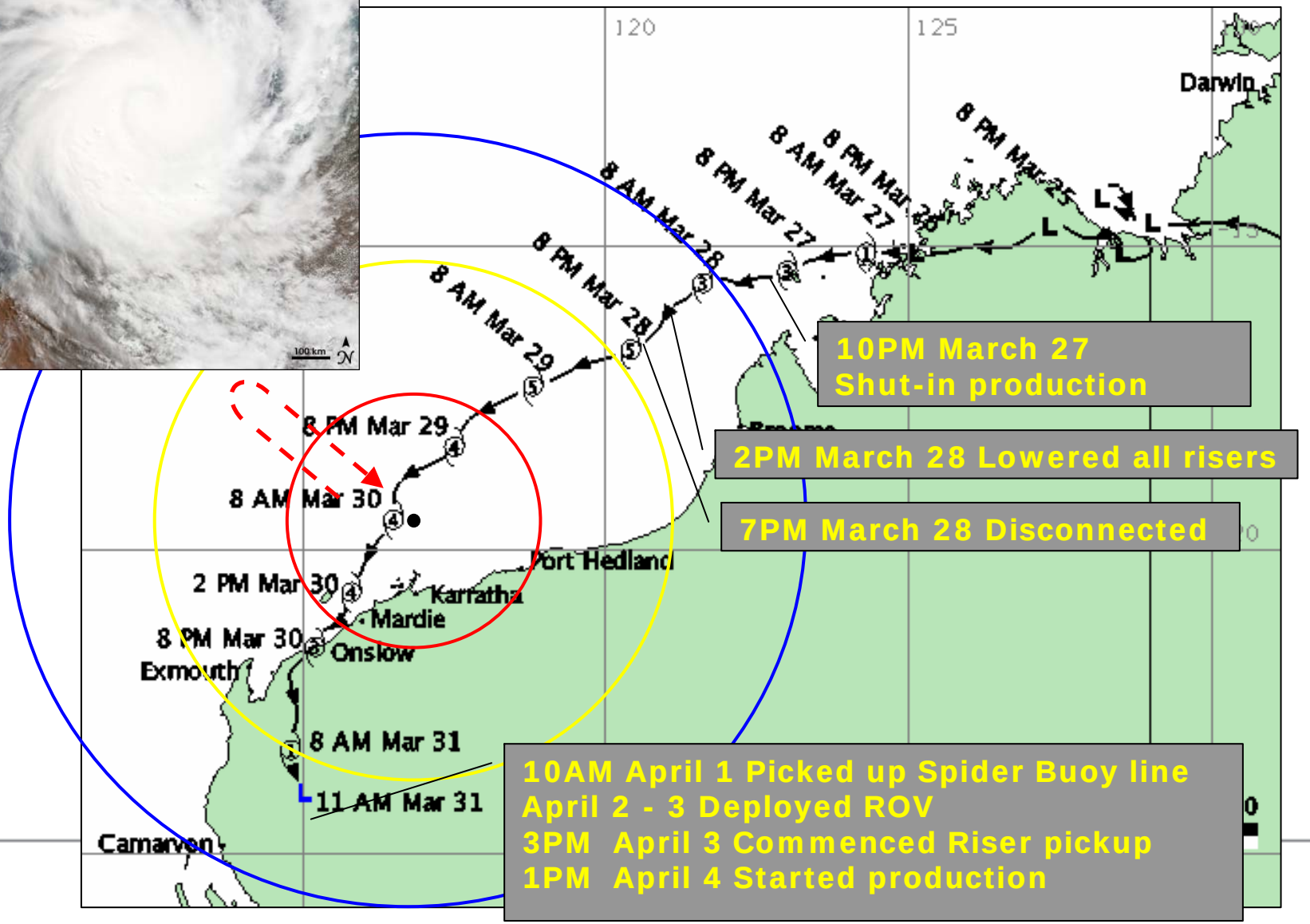
Floyd: 21 – 26 March 2006



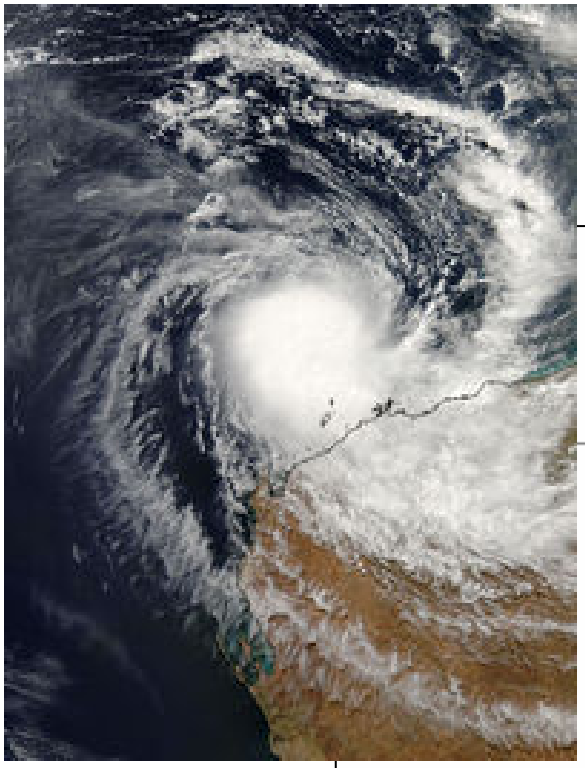


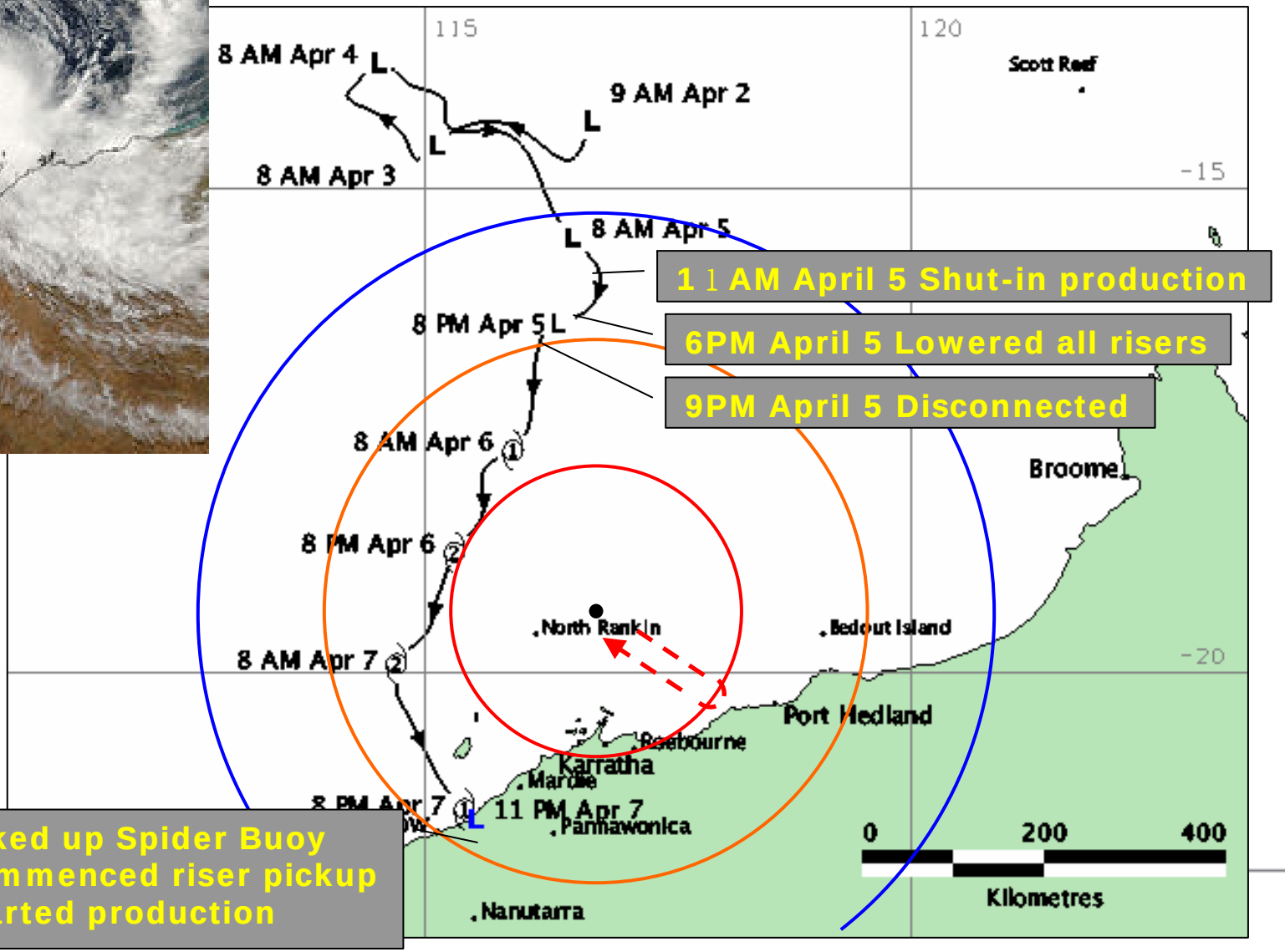
Glenda: 27 – 31 March 2006





Hubert: 6 – 7 April 2006



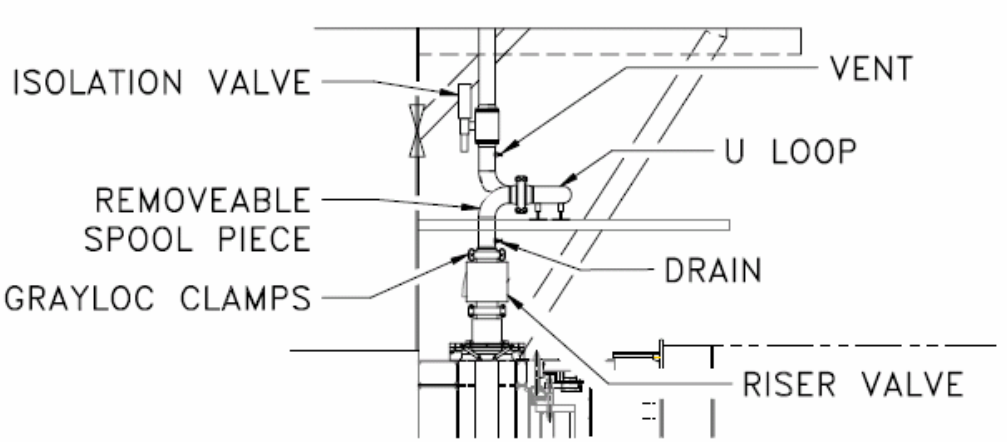


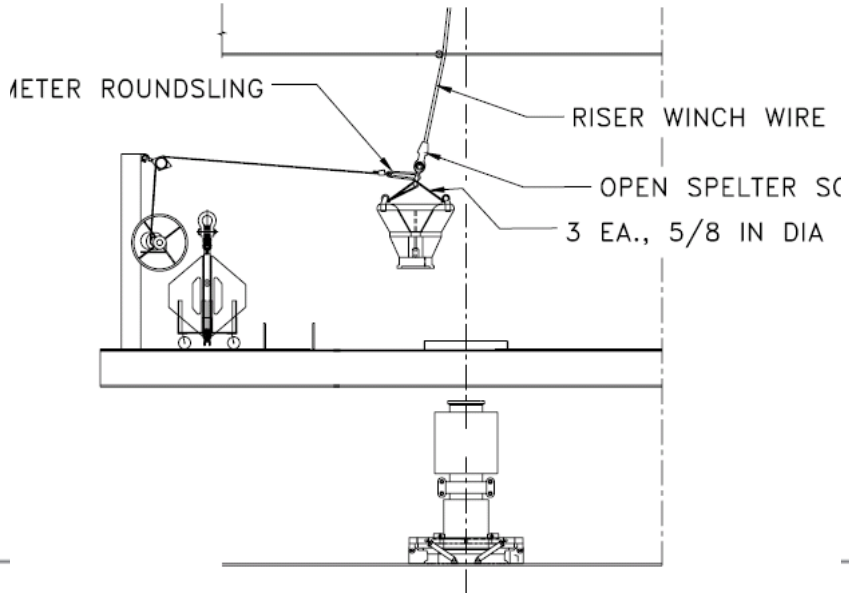
0PM April 8 Picked up Spider Buoy
7PM April 8 Commenced riser pickup
1PM April 9 Started production

Time Logs

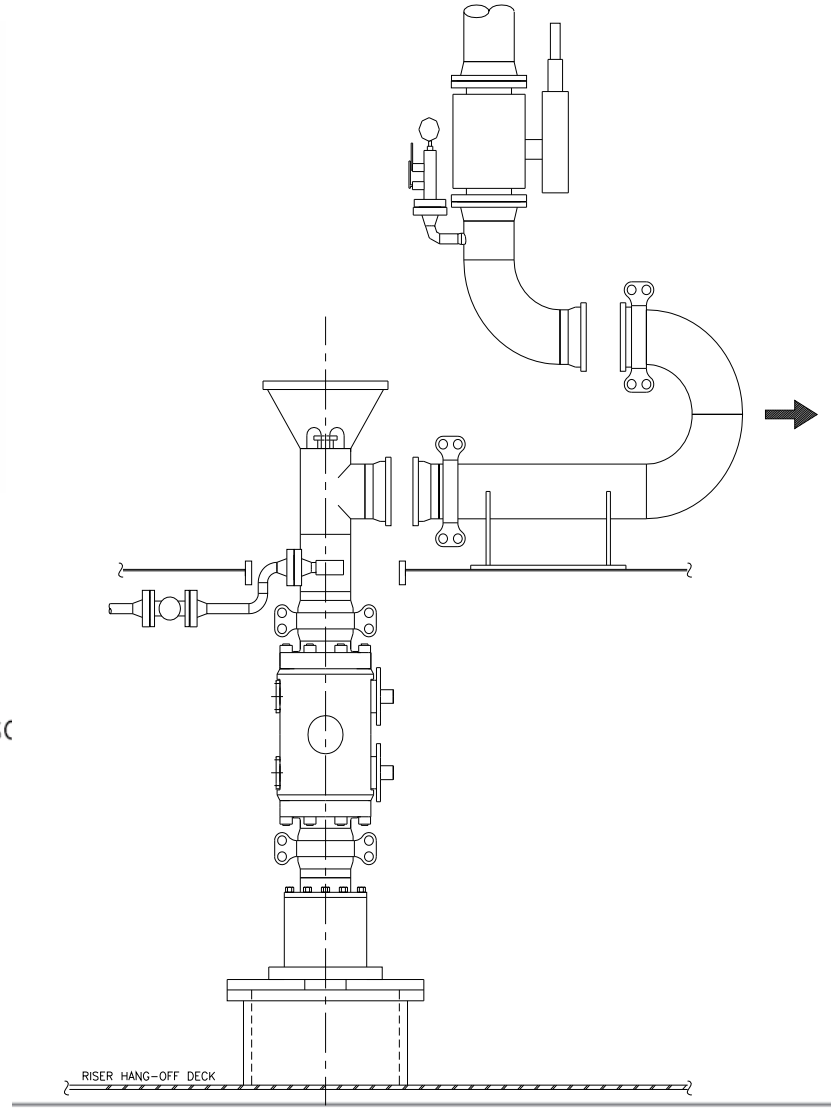
Disconnection	Clare	Daryl	Glenda	Hubert
Shut-in Production	0200 Jan 8	0930 Jan 19	2215 March 27	1100 April 5
Commenced Lowering Risers	0600 Jan 8	1300 Jan 19	0800 March 28	1145 April 5
Lowered all Risers	2115 Jan 8	1940 Jan 19	1400 March 29	1750 April 5
Disconnected from Spider Buoy	0210 Jan 9	2140 Jan 20	1915 March 28	2130 April 5
Total Hours	**24 hours**	**36 hours**	**21 hours**	**10.5 hours**
Reconnection	**Clare**	**Daryl**	**Glenda**	**Hubert**
Picked-up Spider Buoy Line	0730 Jan 11	1600 Jan 23	1000 April 1	1200 April 8
Pulled-in Spider Buoy	1200 Jan 11	2030 Jan 24	1500 April 3	1630 April 8
Commenced Picking Up Risers	1500 Jan 11	0600 Jan 25	1530 April 3	1900 April 8
Connected All Risers	1200 Jan 11	1400 Jan 25	0600 April 4	0900 April 9
Started Production	1600 Jan 12	1800 Jan 25	1300 April 4	1300 April 9
Total Hours	**32.5 hours**	**50 hours**	**74 hours**	**25 hours**

Riser Disconnection – Improvement





Old



New

Summary and Conclusions

- MV-11 has demonstrated successful performance in a cyclone environment
  - > 98% Uptime
  - 5 successful disconnects and reconnects to avoid cyclones
  - 57 crude oil exports (34,270,000 bbls)
- Improvement in procedures / experience has improved disconnect – reconnect times
- Input from MV-11 has allowed development of new DTM for deepwater (Stybarrow Field, 850m water depth).
  - Less labor intensive, improved disconnect and reconnect times over MV-11

SOFEC

Thank you!

MODEC