On the Execution of a Fast-Track Disconnectable FPSO

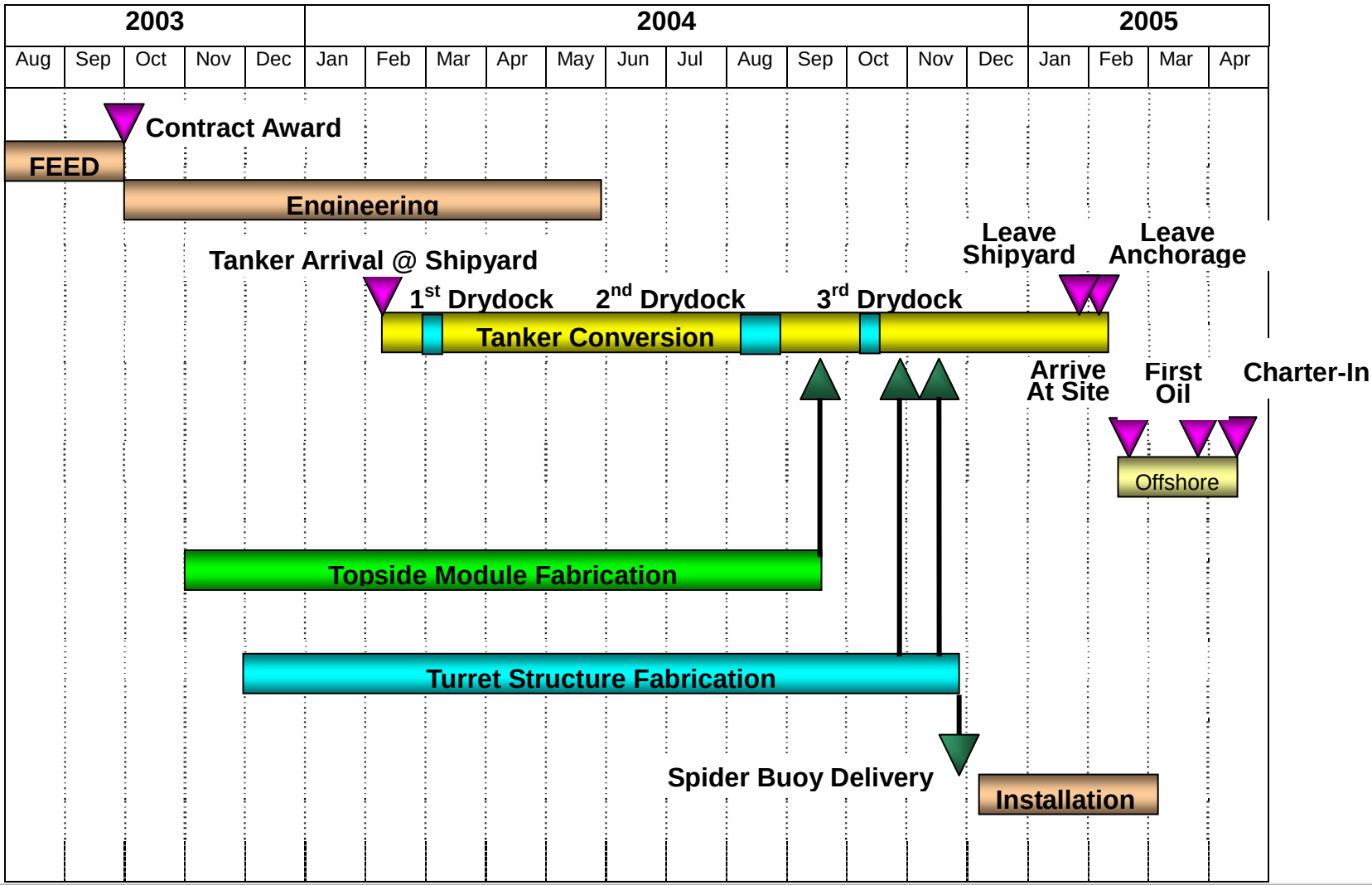
Yoshihide Shimamura
(MODEC, Inc)

Arun Duggal
Scott Binnion
Charles Garnero
(FMC Technologies Floating Systems Inc.)

Overview

- Introduction
- Challenges with Fast-Track Projects
- Example Fast-Track Project: Santos Mutineer – Exeter FPSO
- System Description
- Project Schedule
- Project Execution
- Key Point / Lessons Learned
- Summary

Master Schedule

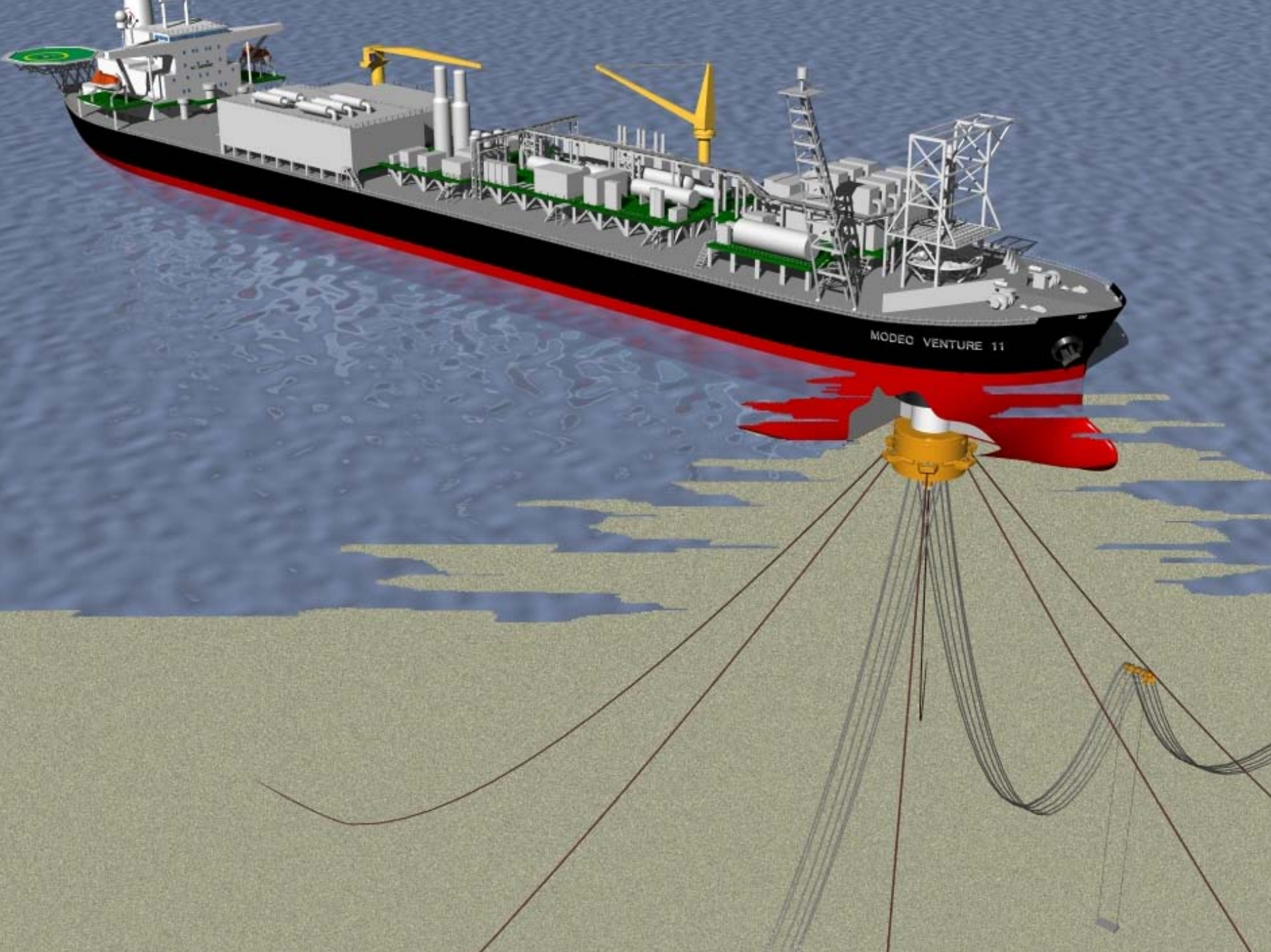


Challenges with Fast-Track FPSO Projects

- Management of world-wide project execution
  - Quick decision making ability when required
- Development of design basis and various key interfaces between contractors
- Preliminary engineering to support procurement of long-lead items
- Management of parallel activities
  - Engineering
  - Procurement
  - Fabrication
- Optimization of execution schedule
  - Engineering
  - Procurement and fabrication schedule are fairly fixed
  - Reduced time for integration and commissioning

Santos Mutineer – Exeter FPSO

- Off North-Western Australia, 160 m water depth
- Leased Disconnectable FPSO
  - Operated by MODEC, Inc.
  - Suezmax tanker conversion, ~930,000 bbls storage
  - Topsides: 100,000 bbls/day
  - Power for subsea multi-phase pumps and downhole electrical submersible pumps
  - Disconnects to avoid cyclones
  - Disconnectable turret mooring system
    - Supports 12 risers and umbilicals
  - Design validated and classed by ABS

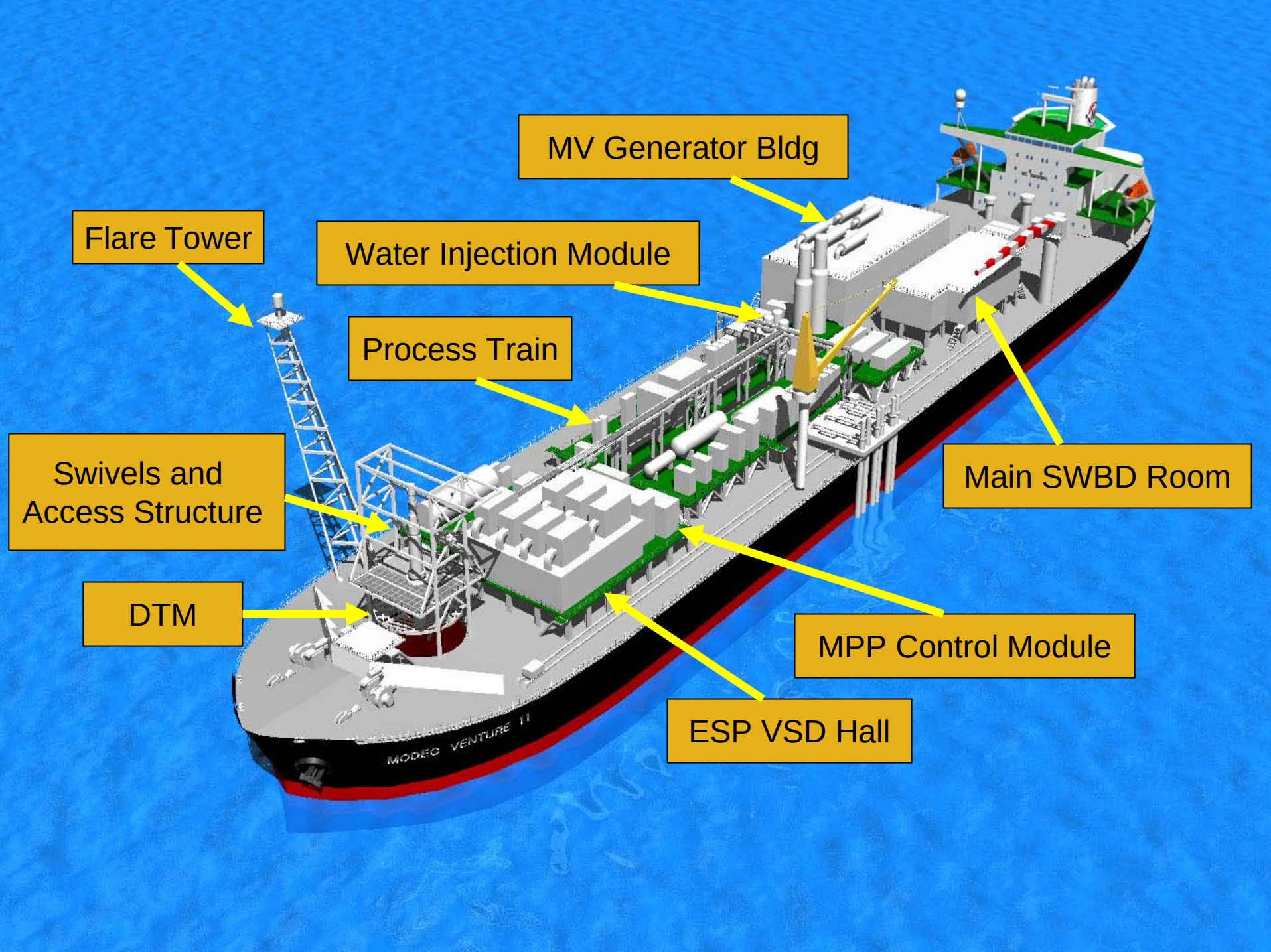

MODEC VENTURE 11

FPSO Hull

- MT ‘Fairway’, built by MES, Japan 1992
- Suezmax tanker, first generation double hull
  - LBP = 258 meters
  - Breadth = 46 meters
  - Depth = 23.9 meters
  - Storage: 931,650 bbls
- Good maintenance history and records by previous owner

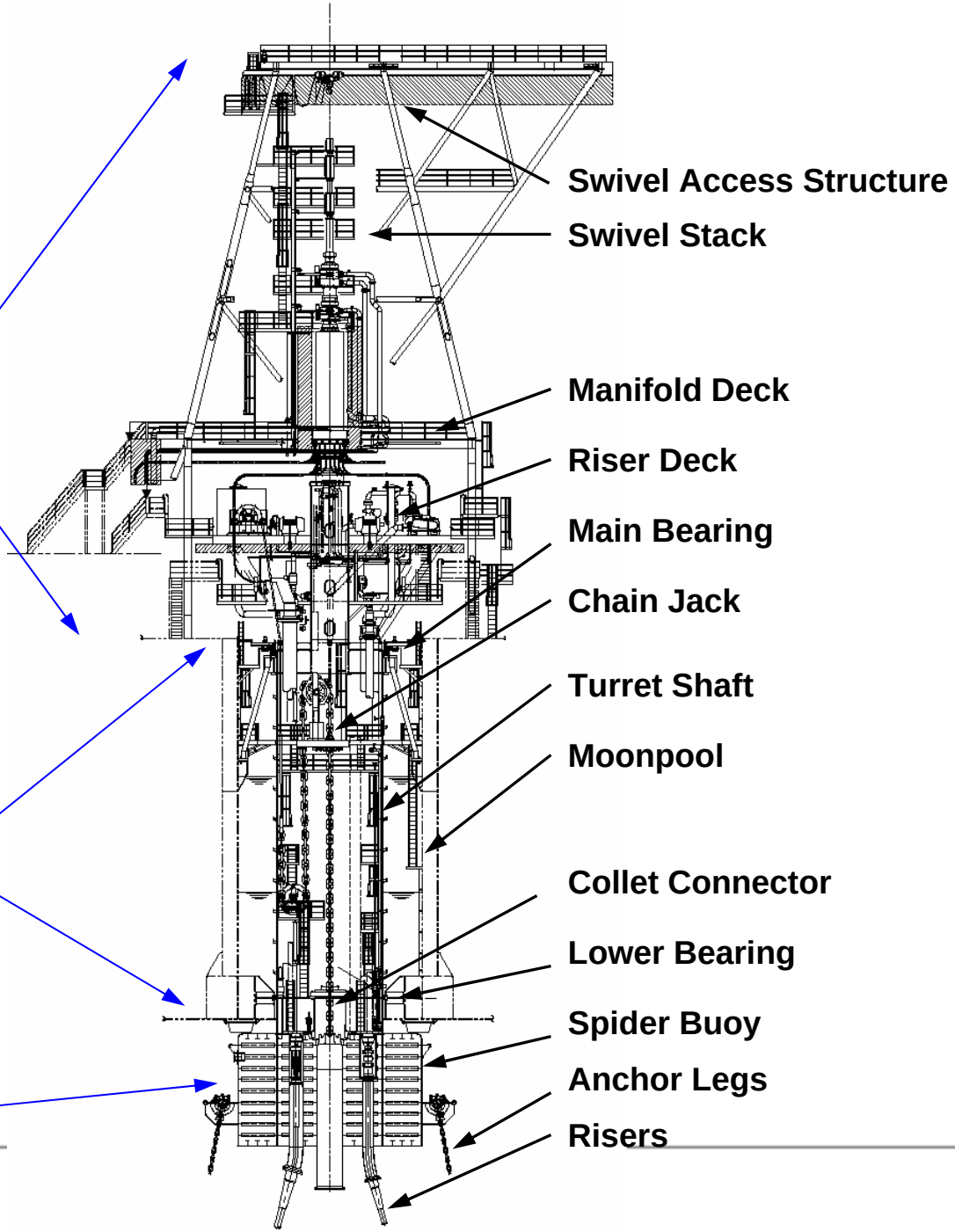
FPSO Topsides

- Oil processing capacity: 100,000 bbls/day
- Simple single train process (no gas production)
  - Three main modules
- Low gas to oil ratio; crude burning diesel generators
  - Produced gas directed to flare
  - Crude fuel treatment plant – safe grade fuel for generators
- Two water injection modules (150,000 bbls/day)
- Power generation plant: 5 x 6.4 MW diesel generators


MV Generator Bldg
Flare Tower
Water Injection Module
Process Train
Swivels and Access Structure
Main SWBD Room
DTM
MPP Control Module
ESP VSD Hall
MODEC VENTURE 11

Disconnectable Turret Mooring

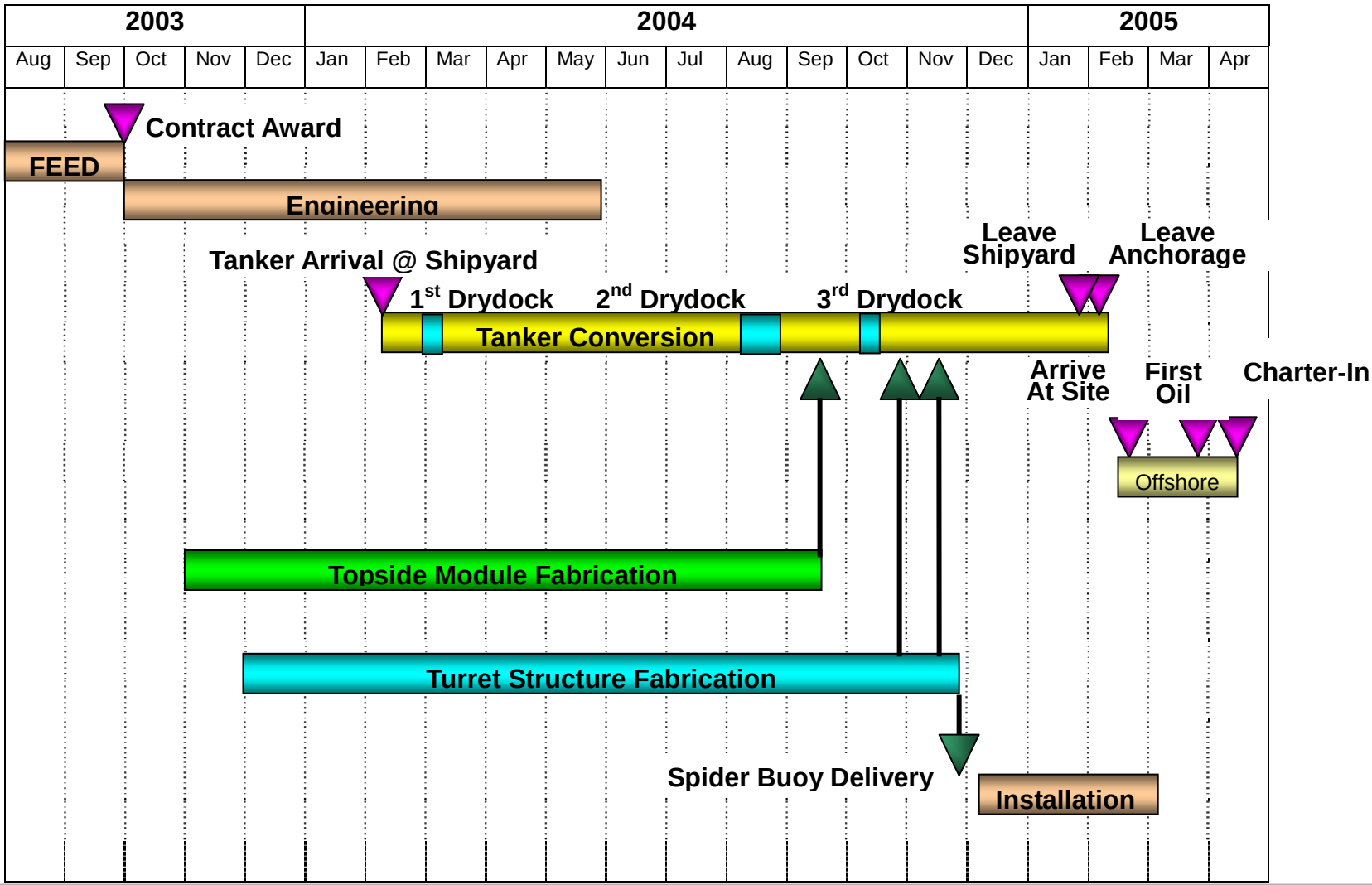
- Mooring designed to remain connected for 100-year winter storm
- Turret mooring designed to disconnect for cyclones
  - Disconnect duration ~ 6 hours
  - Reconnect w/o assistance in seas up to Hs of 3m
- Disconnectable Spider Buoy
  - Spider buoy: 12m diameter, 7.3m height
  - Symmetric 6 X 1 chain – wire anchor leg system
  - 12 risers and umbilicals (Lazy S configuration)
    - 5 fluid risers (3 x 12” ID, 2 x 2” ID)
    - 6 umbilicals (2 service and 4 electrical power)
    - 1 spare slot – production/umbilical
- Swivel stack:
  - Toroidal swivels (production/water injection): 4 paths, 12” ID, 1500# rating
  - Medium voltage power slip rings: 52 paths
  - Low voltage power/control & signal slip rings + utility swivel
- 625 MT chain-jack + assoc. equipment for spider buoy retrieval


Swivel Access Structure
Swivel Stack
Manifold Deck
Riser Deck
Main Bearing
Chain Jack
Turret Shaft
Moonpool
Collet Connector
Lower Bearing
Spider Buoy
Anchor Legs
Risers
Upper Turret Module
Lower Turret Module
Spider Buoy Module

Project Execution

- Management of world-wide project execution
  - Australia, Japan, USA, Singapore, Europe
- Execution of FEED
  - Duration of 2 months
  - Key period for assessment of engineering and project execution focus
  - Identification of critical interfaces between marine, topsides, mooring, and client supplied scope
  - Design & development of purchase specifications for long-lead items
- Planning and management of parallel activities
  - Engineering
  - Procurement
  - Fabrication
  - Integration & commissioning
  - Preparation for operations

Master Schedule



FPSO Vessel

- FEED
  - Detailed surveys, inspection & review of maintenance records
  - Early definition of scope of repair work and optimization of drydock and repair/integration work
- Life extension, conversion & integration works (JSPL)
  - 2.1 million man-hours, zero LTI
  - Construction of moonpool, helideck, main switchboard room
  - Dry dock period optimized for installation of moon pool structure
  - Coordination of the various repair, construction & integration activities
- Duration
  - Arrival at shipyard: February 2004
  - Topsides & Turret Integration: October & November 2004
  - Sailaway to site: February 2005

FPSO Vessel

FPSO Topsides

- Topsides engineering & fabrication
  - Process train – Technip, Australia
  - Water injection modules – MES, Japan
  - Fabrication in Singapore
- Power Generation
  - Delivery of generators critical path for project
  - Power demand study and specifications completed during FEED
- Integration and Commissioning
  - Delivery of modules: September 2004
  - MV Generator startup: December 2004
  - Commissioning: October 2004 – March 2005

Module Integration at JSPL

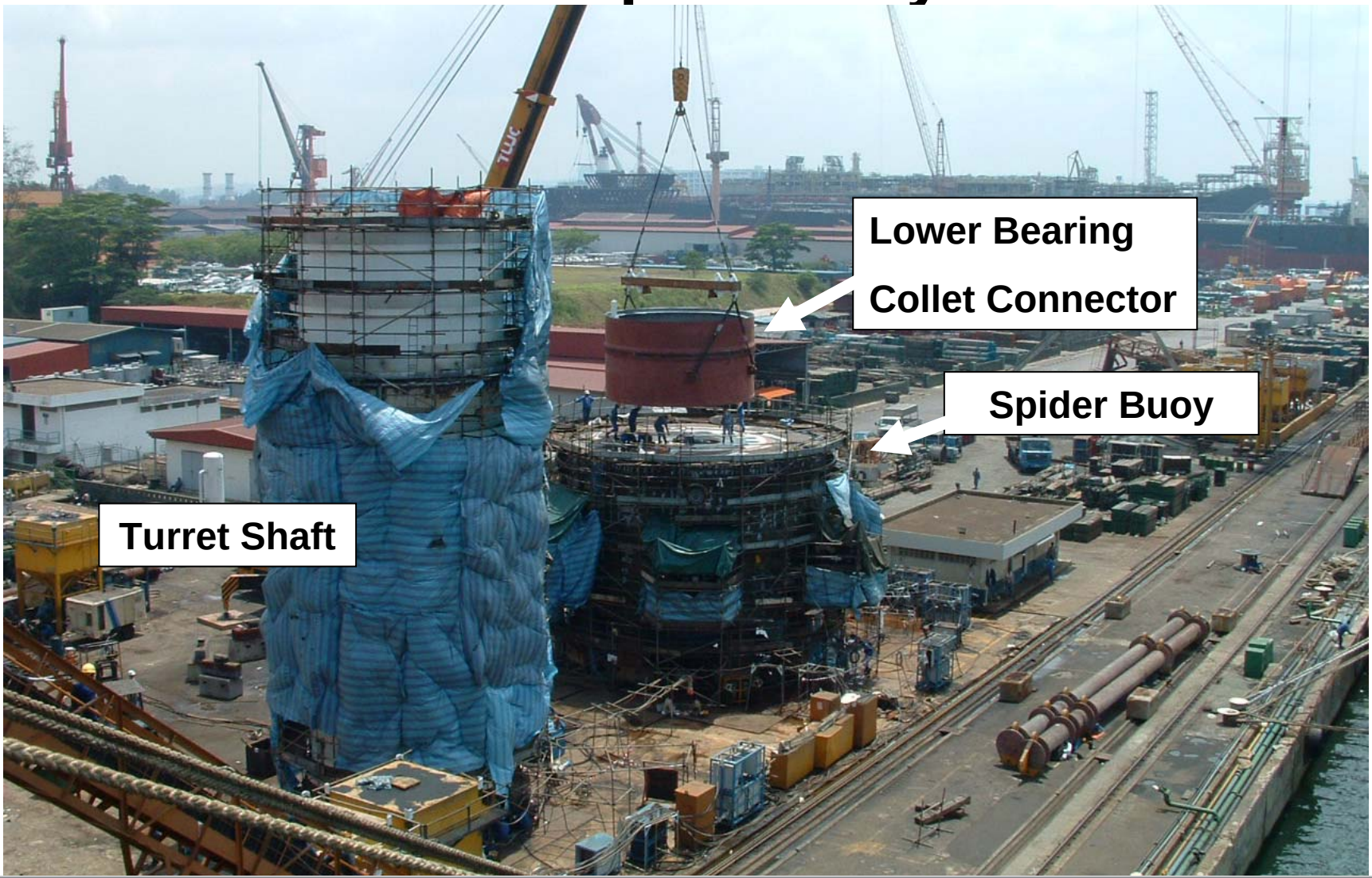
Turret Mooring System

- Critical path for project
  - New design based on project / regulatory requirements
  - Large number of specially designed mechanical components
  - Procurement of long-lead items
  - Complex fabrication and system integration
  - Required parallel engineering, procurement and fabrication activities
- FEED
  - Freeze of turret design including spider buoy
  - Complete global analysis and development of design loads
  - Design & development of specification of long-lead items

Turret Mooring System

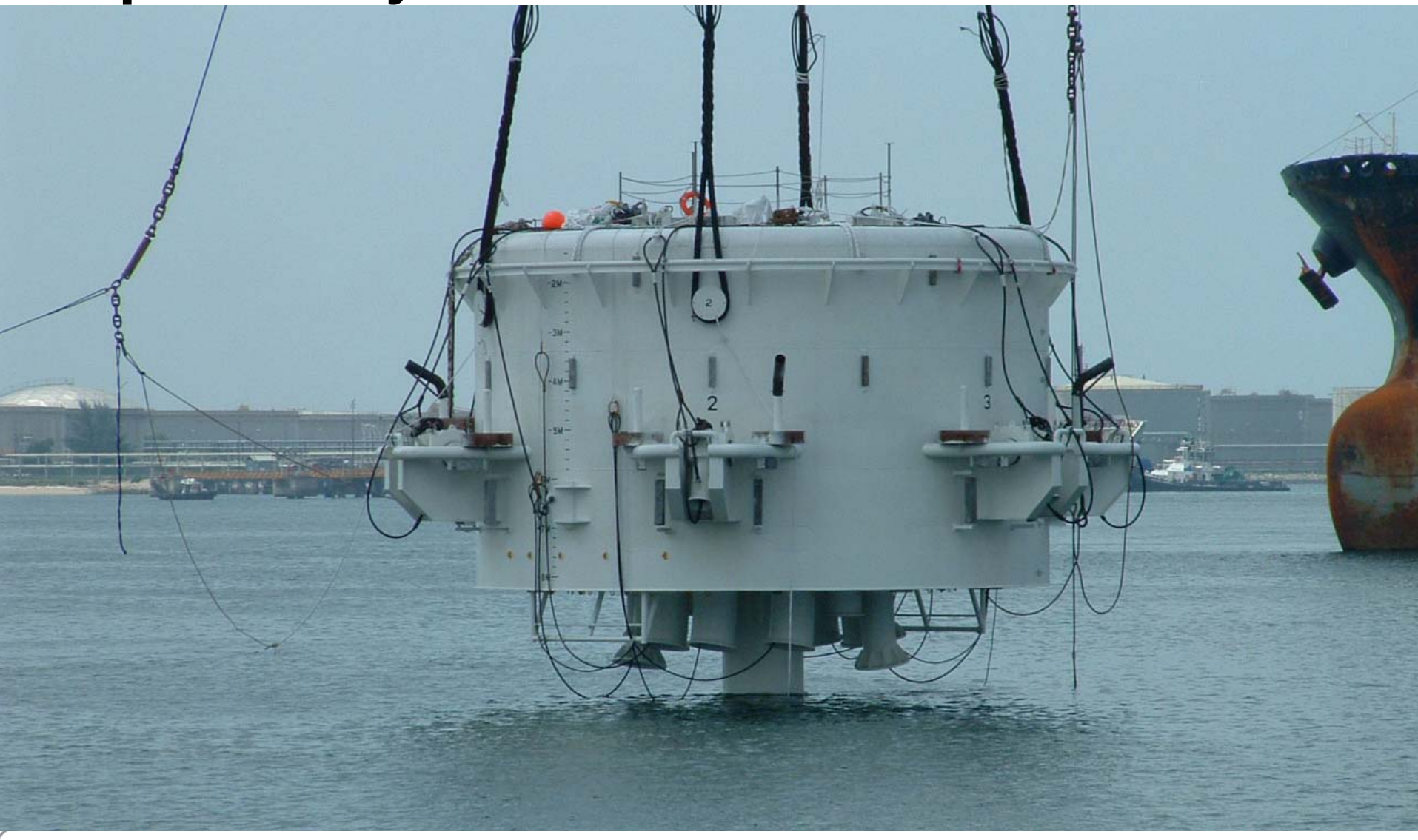
- Detailed engineering: Oct 2003 – Apr 2004
- Turret & spider buoy fabrication: Dec 2003 – Dec 2004
- Test fit between lower turret and spider buoy: Sept 2004
- Lower turret module delivery and integration: Oct 2004
- Upper turret module delivery and integration: Nov 2004
- Spider buoy delivery to installation contractor: Nov 2004
- Turret commissioning complete: Jan 2005

Test Fit of Turret – Spider Buoy Interface



Integration of Lower Turret in Moonpool

Spider Buoy Loadout



Key Points / Lessons Learned

- Experienced project management and engineering teams
  - Quick completion of engineering and efficient project execution
- Small project team
  - Allowed close communication & quick decision making
- FPSO vessel condition
  - Impacts shipyard schedule for repair & integration
- Zero LTI at shipyard
  - Experienced safety team and strict enforcement of procedures/JSAs
- Involvement of operations team
  - Input for design
  - Familiarity with on-board systems after takeover
- Importance of logistic control
  - Monitoring and tracking of all procured and shipped items critical

Key Points / Lessons Learned

- Riser payload on disconnected buoy
  - Impact on freeze of turret design/development of design loads
- Early procurement of long-lead items
  - Current strategy is to pre-order raw materials in anticipation of contract award
- Utilize alliances with key vendors
  - Better control of delivery time / pricing
- Design of turret to minimize integration and commissioning time
  - Easy integration (no dry docking required)
  - In situ machining of turret and vessel structure minimized
- Construction of turret in same facility as conversion
  - Allowed optimization of schedule
  - Cooperation between project teams
  - Easier management of carryover work
  - Ease in commissioning
  - Competition for yard resources

Measure of Project Execution Success

- Successful operation of FPSO:
  - Production uptime >98%
  - Total of 32 offtake operations by end of 2005
  - Successful disconnection and reconnection for Cyclone Clare (Jan 2006)

FMC Technologies

Thank you!

MODEC