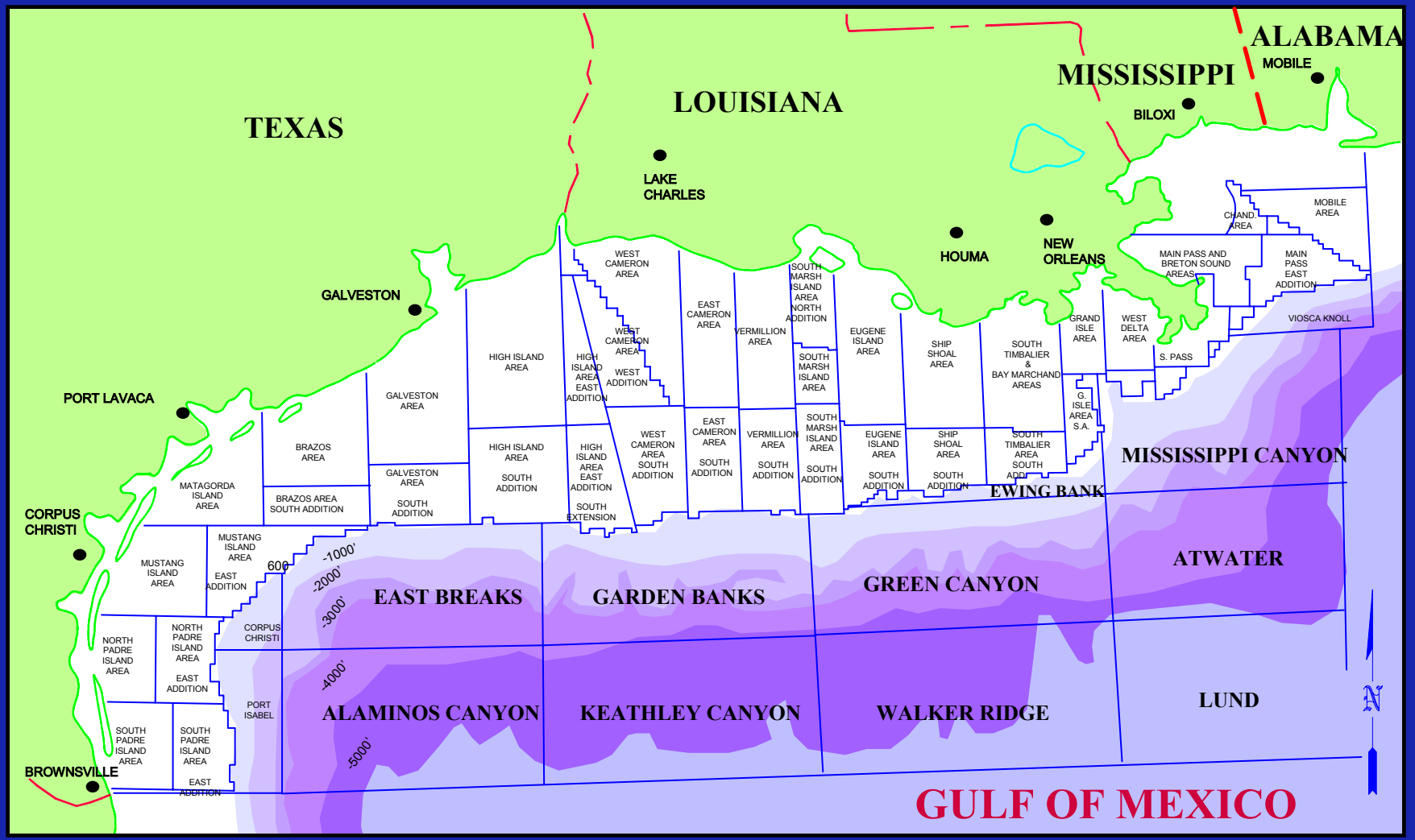
INTEC ENGINEERING

DEEPWATER
PIPELINE OR SHUTTLE TANKER

?

GULF OF MEXICO – WESTERN & CENTRAL PLANNING AREAS

Deepwater Pipelines, Deepwater Fields, Shipping Lanes



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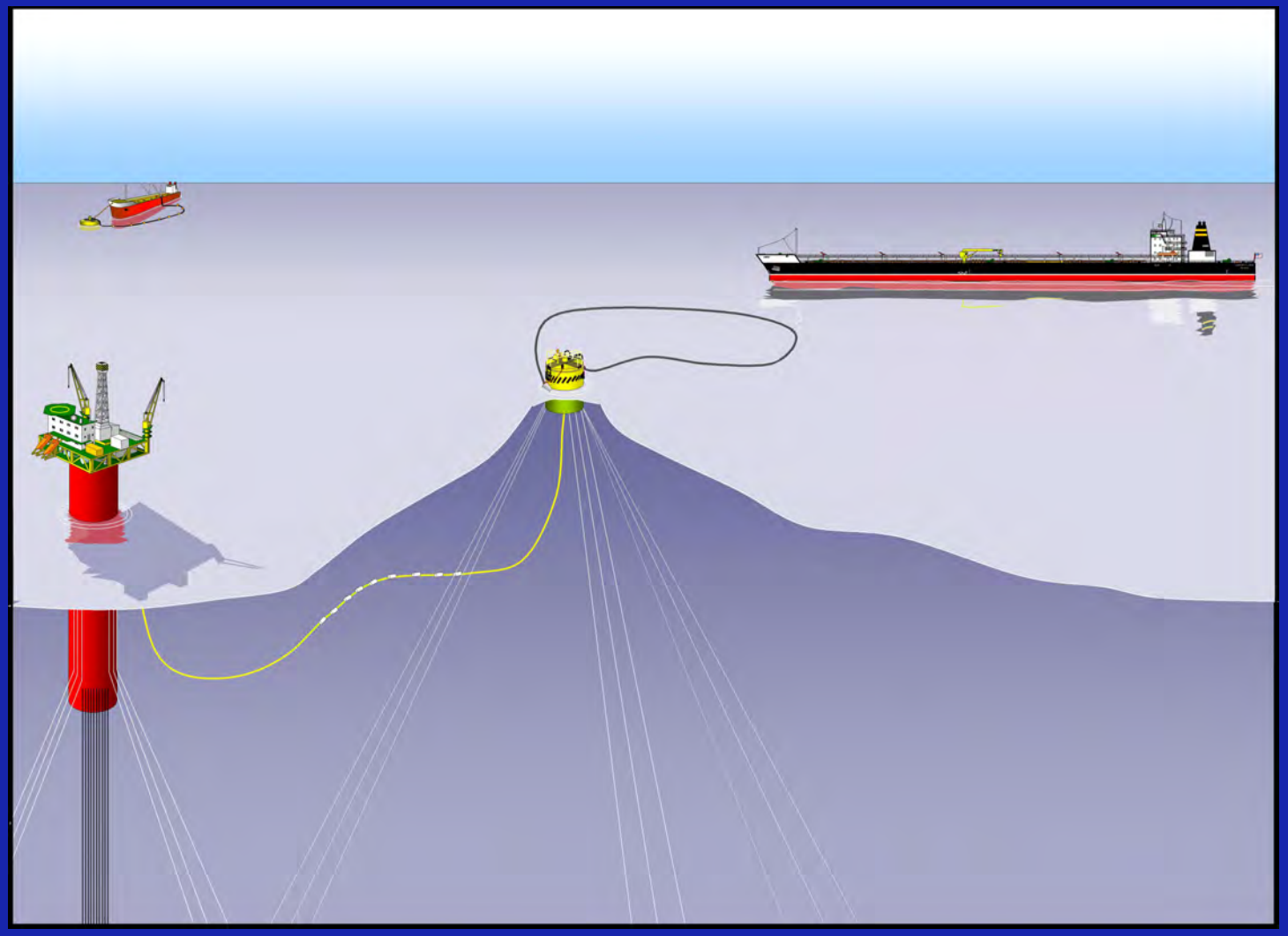
CONSTRAINTS FOR OIL SHUTTLING SYSTEM IN GOM

- Pipeline Technology the Norm for GOM
- Politics (US and Oil Co.)
- Memories of the Exxon Valdez Incident
- Jones Act (US Vessels and Crews)
- Shipyard Capacity to Built Shuttle Tankers
- Risks Associated with Regulatory Gaps
- Risks of Going First – Market, Timing

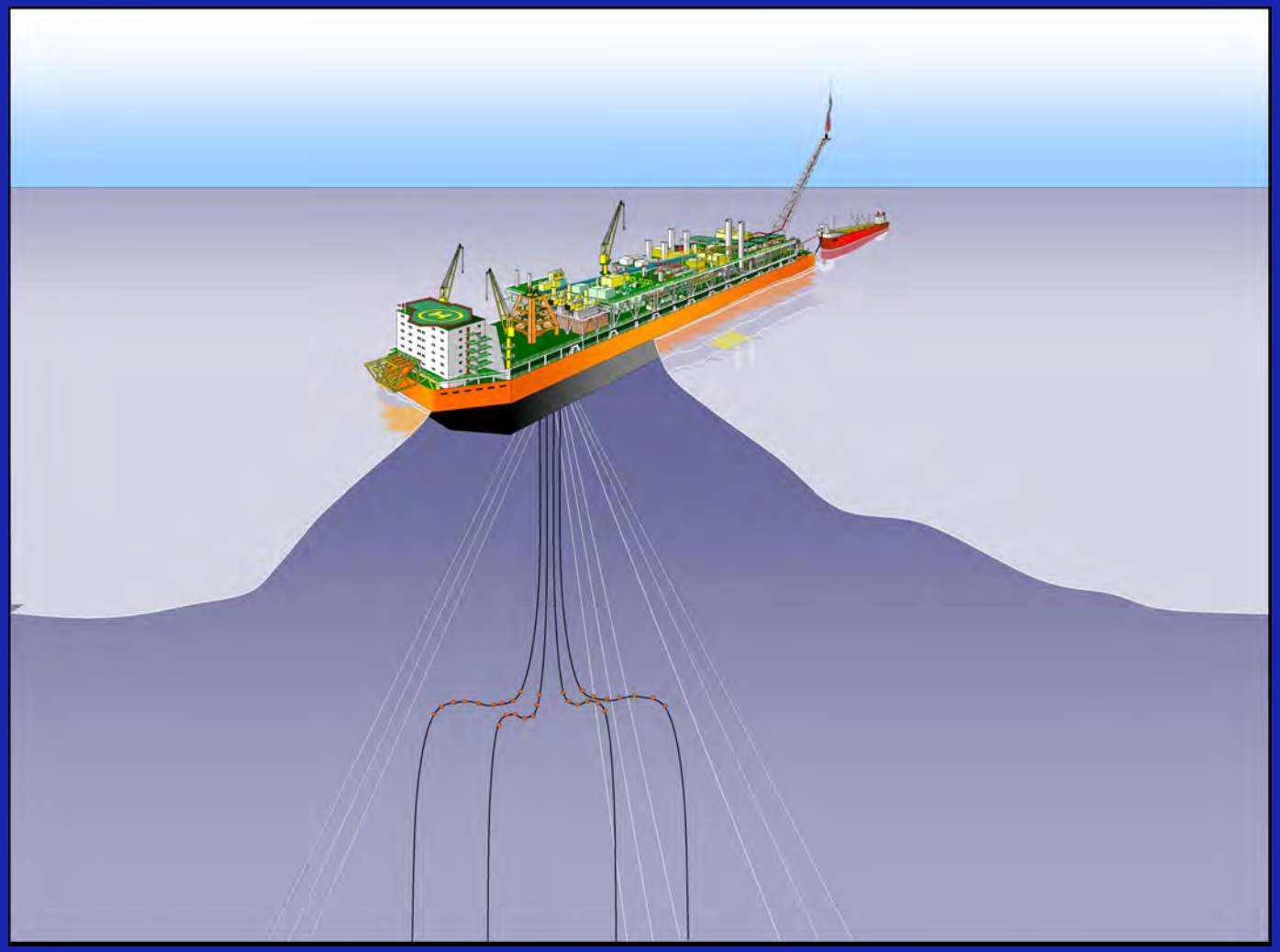
DRIVERS FOR OIL SHUTTLING SYSTEM IN GOM

- Future US Energy Needs
- Recent Signing of the ROD to allow FPSOs in GOM
- Economic Development of Deepwater Fields
  - Remote from Pipeline Infrastructure
  - Irregular Seabed Conditions for Pipeline in Deepwater
- Economic Development of Small Remote Fields
- Service Multi-fields – Oil Segregation Possible
- Reusable (Service Life: 20 – 30 years)
- Reliable
- Proven Elsewhere
- Delivery of Oil to Various US Markets
- Cost Effective Alternative to Pipelines

SPAR WITH TWO CALM BOUYS



FPSO WITH TANDEM OFFLOADING



ISSUES & CHALLENGES FACING GOM SHUTTLE TANKERS (1)

- **US Regulations & Guidelines for Shuttle Operations**
  (Jones Act, Gaps – Lightering Regs Only, Joint Operations Manual between Host & Shuttle need to be developed)
- **Port Draught / Size Restrictions**
  (40 ft draught, preferred refinery parcel size – 500,000 bbl)
- **US Shipyard Capacity, Experience, Cost & Schedule**
  (4 – 5 US yards, $116 - $150 million > 2xKorea, 36+ months)
- **Crews**
  (US Experience, Certification, Training, Pilots, Fatigue)

ISSUES & CHALLENGES FACING GOM SHUTTLE TANKERS (2)

- Dynamic Positioning (if used) ✓

  (Ability to connect and remain connected – DP in Winter Storms/Loop Eddies/Squalls, Vessels' response wrt vessel size differences)

- Telemetry Systems – Oil & VOC Return ✓

  (Reduce risks of spills during offshore loading standardize system for GOM, Green Line 'Oil' & Blue Line 'VOC', ESD I & II)

- Cargo Handling

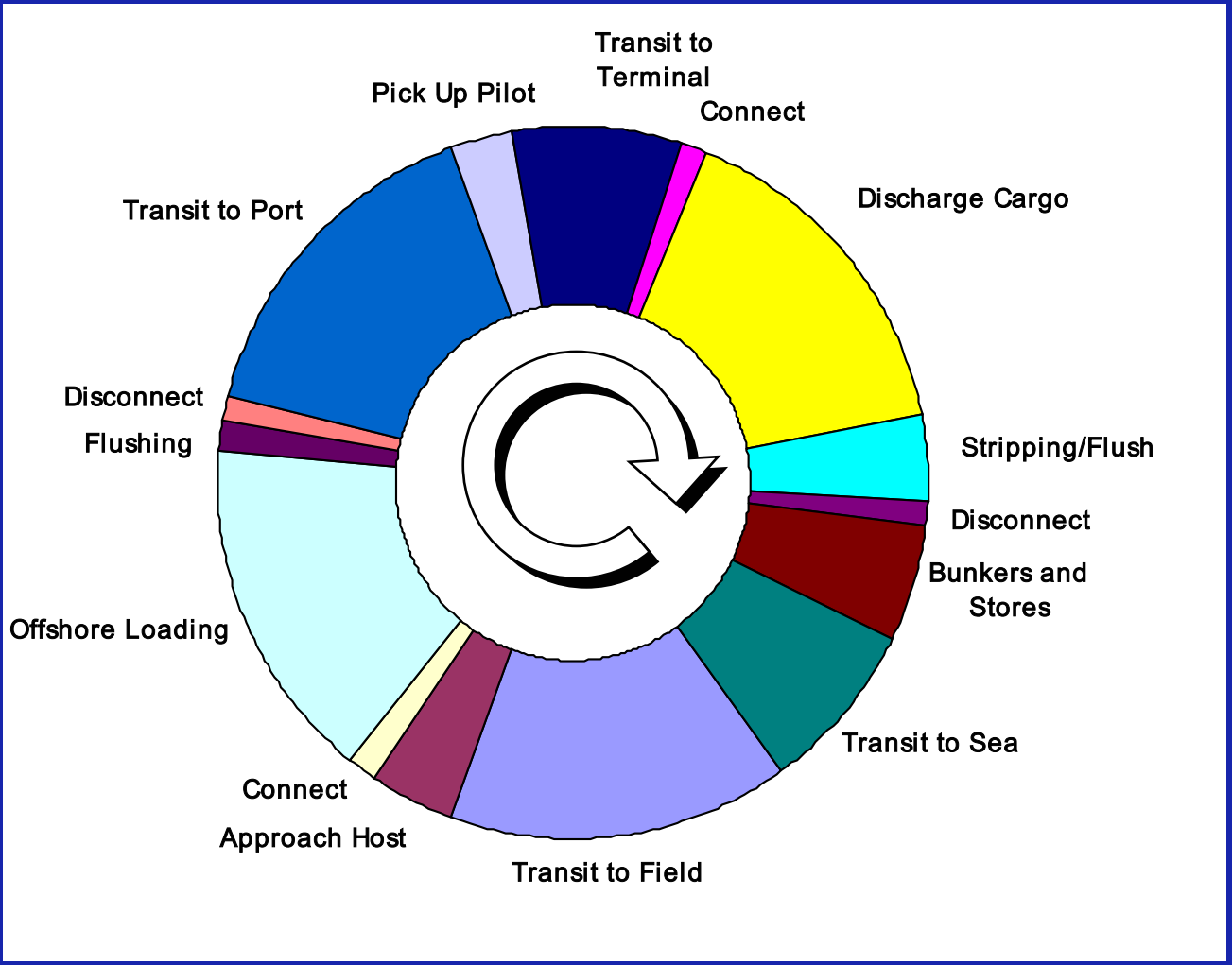
  (Offloading, Pumping, Segregation, Heating, Metering, COW)

- Shuttle Schedule ✓
  (Reliability, Ports)

- Emissions – Air, Land & Sea ✓

  (In particular engine exhaust emissions and VOC from cargo tanks)

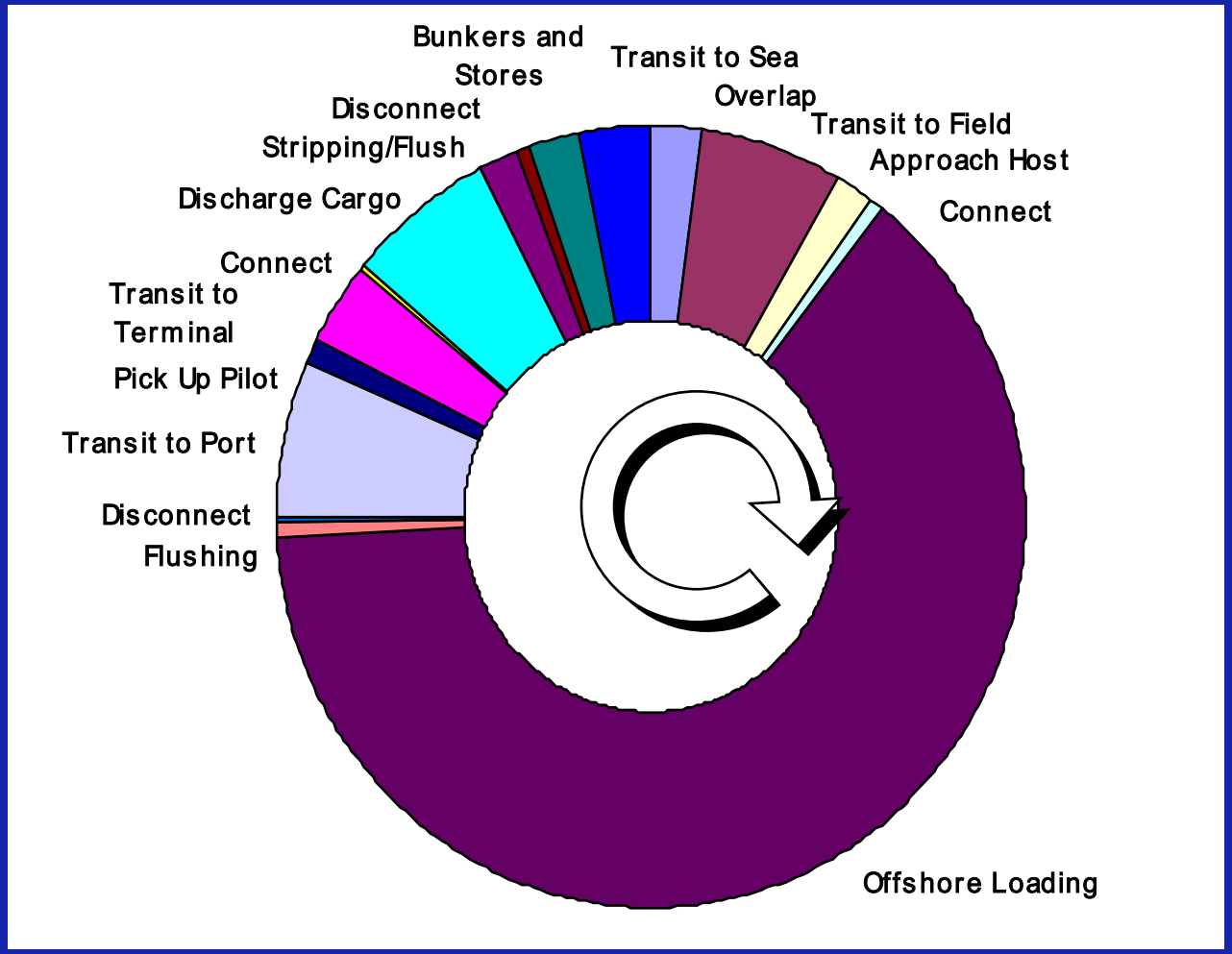
SHUTTLE TANKER SCHEDULE (Offshore Storage)



Schedule Durations

Overlap	0
Transit to Field	12
Approach Host	3
Connect	1
Offshore Loading	12
Flushing	1
Disconnect	1
Transit to Port	12
Pick Up Pilot	2
Transit to Terminal	6
Connect	1
Discharge Cargo	12
Stripping/Flush	3
Disconnect	1
Bunkers and Stores	4
Transit to Sea	6
	77

SHUTTLE TANKER SCHEDULE (Continuous Offloading)



Schedule Durations

Overlap	4
Transit to Field	12
Approach Host	3
Connect	1
Offshore Loading	120
Flushing	1
Disconnect	1
Transit to Port	12
Pick Up Pilot	2
Transit to Terminal	6
Connect	1
Discharge Cargo	12
Stripping/Flush	3
Disconnect	1
Bunkers and Stores	4
Transit to Sea	6
	189

PIPELINE TARRIFS IN G.O.M.

- Shallow Water
  - 30 cents/bbl to 45 cents/bbl (own)
  - 30 cents/bbl to 85 cents/bbl (other)
- Deep Water
  - 45 cents/bbl to 65 cents/bbl (own)
  - 75 cents/bbl to 105 cents/bbl (other)

SHUTTLE TANKER TARRIFS (600,000 bbls)

- Own Shuttle Tanker
  - 35 cents/bbl – 45 cents/bbl
- Other Shuttle Tanker
  - 40 cents/bbl – 60 cents/bbl

CONCLUSIONS (1)

- Studies have shown that for deepwater fields, the cost per barrel for a shuttling system is cheaper than a pipeline system
- Studies have shown that the risks of oil spill associated with shuttling oil is comparable (EIS), if not less than those of a pipeline system
- The limits of pipeline technology are being stretched to accommodate fields in deeper, more remote locations and where the seabed conditions described as rugged

CONCLUSIONS (2)

- The provision of a shuttling system in the GOM has to be considered as a major challenge for the introduction of the first FPSO/FSO. But one that can be overcome through common sense and application good engineering practices. “Systems approach required”
- The ability for the FPSO/FSO to offload crude to a shuttle vessel is a major issue with regard to system uptime
- There no specific regulations for shuttle vessel operations. A Joint Operations Manual will be needed between the host facility and the shuttle vessels(s)

CONCLUSIONS (3)

- Setting up agreements with the intended discharge ports may significantly reduce shuttle schedule times
- Standardization of Systems (Offloading, Telemetry)
- Offshore discharge terminals (LOOP) will improve shuttle efficiency
- There are still some risks to be addressed:
  - Technical – Engineering, Shipyards
  - Logistical – Crews, Training
  - Regulatory - Gaps