Fast Ferries &
Floating Production/Storage/Offloading (FPSO) Vessels

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Fast Ferries: Outline

• Technical Overview
• Background and History
• Present Market Conditions
• Likely Developments
• Financial and Risk Management Considerations
Fast Ferries: State of the Art

• large catamaran (Incat): 100 m, 500 dwt, 900 passengers/240 vehicles, 50 knots; $44m
• small catamaran: 30 m, 325 passengers, 40 knots; $15m
• Italian monohull: 150 m, 1800 passengers/460 cars, 40 knots
Fast Ferries: Earlier Approaches

- hydrofoil
- hovercraft
- SWATH
Fast Ferries: World Fleet

- 903 in 1990; 1218 in 1997; 12% growth
- over 1000 are passenger-only
- catamarans and monohulls growing fastest
- major regions: Greece (10%), China, Indonesia, Scandinavia, Western Europe, Turkey, Singapore, Australia, South America
Fast Ferries: Leading Builders

• Incat, Austal: Australian catamarans
• Kvaerner Fjellstrand, FBM: Eurasian catamarans
• Fincantieri, Rodriguez Cantieri Navali: Italian monohulls
Fast Ferries: Supply

• Italian and N. European yards: largest ferries
• Australian yards: 40% of fast pass/vehicle market
• licensing of designs from Australia
Fast Ferries: Current Demand

- passenger-only craft dominate
- greatest current demand still from Europe and the Asian Pacific Rim
Fast Ferries: Nearterm Growth

- United States: metropolitan transport systems
- Greece: replacement of aging hydrofoils
Fast Ferries: Longterm Growth

• Caribbean
• Indonesia
• Philippines
• South America
Fast Ferries: Developments

- size and speed
- propulsion
- reduced environmental impacts
- rough sea operations
Fast Ferries: Size and Speed

- gas turbines and composites: high speed more economical; long open water routes
- 95 m/1000 t/65 knots freight catamaran on offer
- 120-130 m/2000 t/50+ knots freight catamaran being designed
- flexible, modular designs
Fast Ferries: (Gas) Turbines

- more kW/kg, but higher purchase price
- fuel cost, maintenance cost coming down
- inefficient at low power
- four diesels is max. installation for catamaran hull (30,000 kW)
Fast Ferries: Environment

• wake wash
• emissions
• ship strikes on marine mammals
Fast Ferries: Rough Sea Ops

• motion control systems (refinements)
• SLICE: modified SWATH concept, focus on Hawaiian islands
Fast Ferries: Risk Management

• environmental and regulatory restrictions
• inexperienced operators
• secondary market
FPSOS and Fast Ferries: Conclusions

- growth in both markets areas
- opportunities exist
- cash flows, not asset values
- examine deployment specifics
- consider redeployment opportunities and limitations
Floating Production, Storage, and Offloading (FPSO) Vessels
Outline

• Technical Overview
• Background and History
• FPSO Market Development
• Market Forecasts
• Prospects for Conversions
• Conclusions
Technical Overview

• jackups
• semisubmersibles
• monohull FPSOs
Context

- offshore production about 20% of world production
- mobile production about 10% of offshore production
- both fractions are increasing
Mobile Production Installations

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
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<tbody>
<tr>
<td>FPSO newbuildings</td>
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<tr>
<td>FPSO conversions</td>
<td>46</td>
</tr>
<tr>
<td>semisubmersible newbuildings</td>
<td>4</td>
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<tr>
<td>semisubmersible conversions</td>
<td>31</td>
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<tr>
<td>jack-ups</td>
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<tr>
<td>total</td>
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History

• first installation in Mediterranean
• first substantial development in benign waters of Far East, Australia
• move to North Sea, South America, West Africa
• likely soon in U.S. Gulf of Mexico
Technology Development

- flexible mooring to riser buoy
- rigid mooring to riser buoy (detachable)
- mooring turret in bow
- mooring turret within length of vessel
- dynamic positioning
Technology Development

• water depth: 120 m (1977) to about 2500 m today
• production (flow) rates: 15,000 b/d (1977) to 200,000 b/d
Water Depth Trend

FPSo deployments, 1981-1998
FPSO Vessel Size Trend

FPSO deployments, 1981-1998
Production Capability Trend

FPSO deployments, 1981-1998
# Geographic Regions

<table>
<thead>
<tr>
<th>Region</th>
<th>FPS installations as of 1998</th>
<th>FPS installations 2003 (est.)</th>
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<tbody>
<tr>
<td>Europe</td>
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<td>South America</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>75</strong></td>
<td><strong>135</strong></td>
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</table>
U.S. Gulf of Mexico

- USCG, MMS share management responsibility
- FPSOs are tank vessels (OPA 90 etc. apply)
- stored oil is cargo
- offloading is lightering
- possibility of ISIS
- EIS underway
- gas flaring is illegal
Economics

• structure cost insensitive to water depth
• operating cost compares favorably to fixed platforms
• rapid deployment, redeployment
• easy abandonment
• (subsea tiebacks)
• (semisubmersibles)
Conversion vs. Newbuild

- 2/3 to date are conversions
- cost: factor of 10 (conversion costs $15-30 million)
- availability of suitable tankers: 1970s and 1980s, 100 - 160,000 dwt
FPSO Deployment History

- **FPSOs entering service/year**

  - **newbuilds**
  - **conversions**

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<tr>
<th>Year</th>
<th>newbuilds</th>
<th>conversions</th>
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<td>1998</td>
<td>6</td>
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</table>
New vs. Convert: Vessel Size

![Bar chart showing the number of FPSOs deployed for newbuild and convert options by vessel size categories (dwt (1000s))]{10}
New vs. Convert: Production Cap

![Bar chart showing the comparison between newbuilds and converting FPSOs by production capability, 1000 bopd. The chart is divided into four categories: 0-50, 51-100, 101-150, and 151-200.](chart.png)
New vs. Convert: Storage Cap.

![Bar chart showing the number of FPSO deployments for different storage capacities (0 to 5, 5 to 10, 10 to 15, 15 to 20, 20 to 25, >25 days at max. prod. rate) for convert (red) and newbuild (blue) options.](image-url)
Indications for Newbuild

- harsh environment (seas always head-on)
- long field life or deployment prospects
Indications for Conversion

• benign environment
• short term deployment
Tank Vessels for Conversion

- steel condition is paramount
- turbo generator a plus
- segregated ballast tanks (post-1980) a plus
- condition of piping does not matter
Demand Forecast

• 20+ deepwater fields/year being developed

• half of these to involve one or more FPSO: 10+ FPSOs/year
OOG Drivers

- deepwater fields: 44% of reserves deeper than 300 m
- average field size decreasing
- large new fields (West Africa, Brazil) are in deep water
- $44b in OOG development expenditures forecast for next 5 years; 250 to 400 subsea completions per year
Effect of Oil Price

• average deepwater finding/developing cost is just above $4/barrel (range: $2.11 to $9.42)

• deepwater development is relatively insensitive to oil price above $10/barrel
Oil Price and U.S. OOG Activity

- Oil price ($97/bbl)
- US O&G CAPEX
- tracts leased

Graph showing the relationship between oil price, US O&G CAPEX, and the number of GOM tracts leased from 1968 to 1998.
Likely Developments

- Standardization -- not yet
- connection technologies
- gas production/disposal
Standardization

• has not yet happened: too many one-off conversions
• shift to contractor ownership will help drive standardization
• production system components
Connection Technologies

- subsurface buoys
- riser connections
- S-shaped risers
- composite risers
- synthetic rope moorings
Gas Production

• conversion to methanol
• liquefaction – now proven
• pipeline
• reinjection
• flaring
Conclusions

• growth projection healthy
• conversions now slowing
• investment opportunities in newbuildings