Facilities and Construction Engineering
The History and Future
What SPE Can Do For You

By
Kenneth E. Arnold
Paragon Engineering Companies
SPE Specialty Director, Facilities and Construction

2002
• What is a Production Facility?

• Why do we need Facilities Engineers?

• Why is Facilities Engineering Important Today?

• What New Technology is Being Developed?

• How Can SPE Help to Keep Your Technology Current?
Steps In Oil And Gas Production

- Finding the reserves
- Defining and managing the reservoir
- Fluid Flow into and up the wellbore
- Fluid processing and transportation on the surface
FIGURE 1: TYPICAL OIL FACILITY
Source: Paragon Engineering Services
Job Of A Production Facility

Auxiliary Systems

- Process Heating Systems
- Process Cooling Systems
- Power Generation and Electrical Systems
- Safety Systems
  - Pressure Relief
  - Shutdown and Control
  - Fire and Gas Detection
  - Fire Fighting
  - Escape Systems
  - Grounding and Lightning Protection
Job Of A Production Facility (Continued)

- Life Support and Maintenance
  - Material Handling and Lifting
  - Ingress and Egress - Roads, Boat Landings, Helidecks, Runways
  - Access
  - Quarters, Control Rooms and Maintenance Facilities
  - Lighting
  - Power and Instrument Air
  - Sewage Treating
  - Fresh Water and Washdown Water
  - Drain and Sump Systems
Job Of A Production Facility (Continued)

- **Corrosion Control Systems**
  - Material Selection
  - External Protection
  - Internal Protection

- **Product Disposal**
  - Metering Facilities
  - Storage Tanks and Pressure Vessels
  - Pipelines
  - Pumping Stations
  - Truck and Train Loading Facilities
  - Barge Loading Facilities
  - Ship Loading Facilities
Job Of A Production Facility

Site Development

• Onshore
  – Drainage
  – Security
  – Foundations and Piles

• Offshore
  – Platforms
  – Ship-shape
  – Spurs, TLPs, Semi-Submersibles
  – Subsea
# SPE’s Technical Interest List

1. **Process Systems and Equipment** - 22 Sub-Categories
2. **Gas Utilization** - 3 Sub-Categories
3. **Measurement and Control** - 6 Sub-Categories
4. **Electrical Systems** - 9 Sub-Categories
5. **Pipelines and Piping Design** - 6 Sub-Categories
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In The Early Days

- Facilities were simple
- Not much need for a specialty
- Store the oil and let the gas escape to atmosphere
- By early 1900’s saw benefit for flash stabilization
Separator and Tank, Titusville, PA
Fig. 1—Common type of lease treating set-up in East Texas field
After World War II demand for:

- Offshore facilities,
- High pressure gas production
- Produced water treating

Led to:

- More complex facilities
- “Mechanical”, “Facilities” and “Construction” Engineering Departments introduced
Offshore Facilities

- Trestles to Land Facilities
- Islands of Piles for Wellhead with Pipelines to Land Facilities
- Multi-Platform Mounted Facilities (Spread Out)
- Single Level Platforms
- Compact Multi-Level Platforms
- Harsh Environment Enclosed Platforms
FIRST OFFSHORE FIELD
SUMMERLAND FIELD (CALIFORNIA) IN 1903
Offshore Field, Early 1900s
Offshore Field, 1940s
Offshore Platform, 1960
Offshore Platform, 1990’s
Jacket Structure – Water Depth Milestone
Offshore Gas Well, 1912
Fig. 1—Generalized proposed types of foundations for support of drilling rigs at offshore locations in the Gulf of Mexico along the Continental shelf of Texas and Louisiana.

Source: O & G Journal, June 28, 1947
Production Systems
High Pressure Gas

• Relief systems
• Spec breaks
• Protecting tanks and low pressure equipment from “gas blowby”
• SAFETY!!
POSITION OF VALVES AROUND GAS BOOT
A = FOUND OPEN
B = FOUND CLOSED
C = FOUND CLOSED [SUPPOSED TO HAVE BEEN OPEN]
Plate 4  The Piper Alpha platform: view from the south-east.
Plate 19(a) The fires on Piper before riser rupture: photograph taken by Mr Ritchie from the Lowland Cavalier.
Plate 21  The remains of A Module on the morning of 7 July.
P-36 – Less Than One Year Old
P-34 FPSO in the Campos Basin, Brazil Oct. 14, 2002. Petrobras said tilted over after a failure in its electronics systems.
Produced Water Treating

**Onshore**

- Produced water discharged on surface from tanks and holding pits
- Better separation of free oil from water
- Treatment for injection

**Offshore**

- Discharge from free Water Knockouts
- Requirement for Skim Tank downstream of FWKO
- Specific Oil & Grease and Toxicity Limits
- Treatment for injection
Fig. 103—Water Flowing from Automatic Drip Shown in Fig. 102.
Oil Storage and Water Skim Tank, 1950s
Deoiling Hydrocyclones, 1980s
Facilities Engineering Today

• Design
  – Larger more complex projects
    • Ten years ago – Hundreds of $1MM to $25MM projects
    • Now several $500MM – $2B projects
  – Facilities cost is becoming a large part of total field development cost
    • A $4.2B North Sea Field Development
      Drilling - $1.0B 23 %
      Topsides - 2.0B 47%
      Hull - 0.8B 20%
      Commissioning & Operations Support - 0.4B 10%
Facilities Engineering Today (Continued)

• Construction
  – Project cycle times significantly impact project profitability
  – Construction options limited
  – Construction execution plan critical to meeting profitability
Future Technology

• Improved Separator Internals
  – Use of CFD
  – Centrifugal Devices

• Oil and water treating
  – De-oiling Hydrocyclones
  – De-watering Hydrocyclones

• Multiphase Technology
  – Meters
  – Pumps

• Absorption and Contact Towers
  – Improved Packing
  – Co-current Flow in Pipes
Future Technology (Continued)

• Subsea and Downhole Systems
  – Direct Water Injection/Disposal
  – Direct Gas Injection
  – Reduce Backpressure

• Stranded Gas and Alternatives to Flaring for Associated Gas (Especially Offshore)
  – CNG Transportation
  – Gas to Methanol
  – Gas to Middle Distillates
  – Gas to Hydrates
  – Gas to Power
Future Technology (Continued)

• Project Management and Contracting Strategies
  – Web Based/Data Base Design
    • Link multiple locations: design, fabrication, operation, maintenance. Take advantage of knowledge where it is.
    • Create a real time life cycle database
    • Use database to help schedule maintenance, reduce operating costs and manage change.
  – Owner/Contractor Planning for Limited Resources
  – Standardization/Typicalization
    • Utilize work processes, standards, “typicals” to automate and reduce engineering man-hours/ton.
How Does SPE Help Keep Facilities Technology Current?

- Publications
- Conferences and Symposia
- Forum Series
- Applied Technology Workshops
- Technical Interest Groups
- e-Library
Types of Meetings

- Annual Technical Conference and Exhibition (ATCE)
  F & C Programming Committee

- Regional Meetings & Symposia
  Region plans and manages under SPE Meetings Policy. Held periodically

- Applied Technology workshop (ATW) –
  Limited attendance focused on latest applications of a specific technology. One or two days with no formal papers.

- Forum Series –
  Brings together experts on specific topics to focus on future aspects. Usually one week with no formal papers

- Section Meeting –
  Held on periodic basis for benefit of section members. Often scheduled for lunch or dinner.

- Joint Meeting –
  Offshore Technology Conference
Technical Interest Groups

• Production Facilities and Systems
• Offshore Operations
• Oilfield Chemistry and Corrosion
• Environmental, Health and Safety
Conclusions

- The Facilities and Construction specialty is important
- This is a field that is growing in importance and complexity
- SPE has programming in place to help F & C engineers
- SPE wants to expand this programming
Future Programming

• Join SPE
  www.SPE.org

• Chose Facilities and Construction Technical Discipline

• Work with Local Section to develop F & C programming

• Work with Local Section to encourage more F & C membership – operators, vendors, consultants and contractors

• Volunteer to help with SPEI programming – Email me your interests  Karnold@paraengr.com

List your interests (Level 2 of TIL) and your expertise (Level 3 of TIL)
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<td>2002 ATW Progressive Cavity</td>
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<td>17-Sep-2002</td>
<td>Pumping Systems</td>
<td>Calgary</td>
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<td>11-Nov-2002</td>
<td>2002 ATW Multi-Discipline</td>
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<td>16-Feb-2003</td>
<td>2003 ATW Gas Monetisation</td>
<td>Phuket, Thailand</td>
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<td>19-Feb-2003</td>
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<td>25-Feb-2003</td>
<td>2003 ATW Facilities and Construction</td>
<td>Langkawi, Malaysia</td>
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### Applied Technology Workshops (Continued)

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<td>May-2003</td>
<td>2003 ATW Subsea Facilities Management</td>
<td>Houston, TX</td>
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<td>08-Jun-2003</td>
<td>2003 ATW Development of Marginal Offshore Oilfields</td>
<td>Ho Chi Minh, Vietnam</td>
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<td>11-Jun-2003</td>
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<td>19-Aug-2003</td>
<td>2003 ATW Deepwater Technology</td>
<td>Kota Kinabalu, Malaysia</td>
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