“The Bishop Process™, if proved successful, has the potential to significantly increase world LNG trade and provide a highly secure, economical and flexible way to expand LNG imports and augment the nation’s energy supply, CGI’s report couldn’t have come at a more advantageous time.”

“My meeting last month with the National Petroleum Council raised concerns about natural gas supplies in the United States. Innovative ideas such as the Bishop Process could make all the difference.”

Spencer Abraham
U.S. Secretary of Energy
July 22, 2003
DOE / NETL Cooperative Research
DOE ($1.9MM) + Industry Participants ($0.9MM)

- Arthur D. Little
- AGL Resources
- ABS*
- Bluewater Offshore
- BP
- Bureau Veritas*
- Carter Cryogenics
- Charles River Associates
- CS First Boston
- Dominion Resources
- Ebara
- Ecology & Environment Inc.
- EnCana
- ExxonMobil
- Fluor
- FMC
- Heogh LNG
- HNG Storage
- Marathon
- Marsh & McLennan*
- Nikkiso Cryo
- Paragon Engineering
- PB Energy Storage Services
- Remora Technology
- RRS Engineering
- SBM
- U.S. Coast Guard

* Invited
Tank Based LNG Terminals

- Surface Tank Storage
- LNG Inventory
- Sendout Limited by Vaporizer Capacity
- Visually Intimidating
Salt Cavern LNG Terminals

- Underground = Maximum Security
- Gas Inventory
- Peak Sendout Limited Only by Pipelines
- Visually Insignificant

Patented Bishop Process™ Salt Cavern Terminals

Offshore Mooring LNG Pumps Heat Exchanger

GAS Cavern Storage

Natural Gas Grid

Security  Economy  Capacity

LNG Carrier

2000 psi + 40F

3+ Bcf/d

CGI LP
Bishop Process™ LNG Receiving Terminals
Onshore and Offshore Applications

Applied Technology

Onshore and Offshore
Bishop Process™
Terminal Designs

Source: Paragon Engineering

Security  Economy  Capacity
400 Formations / 1,000 Storage Caverns
Salt Cavern Layout ...

GULF COAST SALT DOME

STORAGE WELL

Security  Economy  Capacity
Bishop Process™ LNG Receiving Terminals
Salt + Market = North American Opportunities
Bishop Process™ LNG Receiving Terminals
Salt + Market = Global Opportunities

Atlantic Canada

Europe

Gulf of Mexico (US & Mexico)

China

Security Economy Capacity
Who Are The Customers?

- Majors and Super Majors
- Strategic Independents
- National Oil Companies
- Public Utilities
- Private Developers
### Phase I: Findings (2003)

- Combination Will Work
- Can Be Built Quickly
- Will Be Lower In Cost To Build And Operate Than Tank Based Terminals
- Will Have Scale & Deliverability Advantages Over Conventional Terminals

### Phase II: Objectives (2004)

- Field Test Equipment
- Define Onshore and Offshore Facilities
- Answer Skeptics
- Accelerate Commercial Applications

**SUCCESSFULLY COMPLETED**

**IN PROGRESS**
Phase II Cooperative Research ...

- **Task I:** Field Test Heat Exchanger
  - *IN PROGRESS*
  - Scheduled April 5th – 19th (Cherokee Co. Georgia)

- **Task II:** Field Test High Pressure LNG Pump
  - *SUCCESSFULLY COMPLETED*
  - 2000+ PSI Pump Tested In September 2003

- **Task III:** Model Test Offshore Mooring & LNG Transfer
  - *IN PROGRESS*
  - Multiple Sites, Multiple Methods

- **Task IV:** Northeast U.S. LNG Supply Analysis

**DOE / NETL Cooperative Research**

Solving The 15 Bcf/Day “Sidebar Task”

**Security**  **Economy**  **Capacity**
DOE / Industry Cooperative Study Of Bishop Process™

High Pressure LNG Pumps Successfully Tested
Task I: Field Test Heat Exchanger

14" CS tying outlet headers to outlet pipe will be below grade to allow vehicle access (1 @ ea end of BPE)

BPE Vaporizer

6" SS LNG Inlet & Vapor Return (2 lines) Above ground on overhead racks

14" Warrant Inlet Pipe on existing pipe racks (1 line)

Tie into 14" fire water main

Alternate Configuration 14" PVC Warrant Outlet Pipe - Above grade

14" Warrant Inlet Pipe

800 HP gas fired Boilers (3 units)
Soon LNG Receiving Terminals Will Look Like This …
World Class Bishop Process™ Applications
Offshore Terminal Designs

• Bluewater Offshore
• EXMAR
• FMC
• Paragon Engineering
• Remora Technology
• SBM
SBM-IMODCO
Bishop Terminal™ ‘FRU’ Design

Source: SBM-IMODCO
SBM-IMODCO
Bishop Terminal™ ‘FRU’ Design

Security  Economy  Capacity

Source: SBM-IMODCO

<table>
<thead>
<tr>
<th>Carrier Capacity</th>
<th>125,000 **</th>
<th>m³³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length Overall (LOA)</td>
<td>290</td>
<td>m</td>
</tr>
<tr>
<td>Length Between Perpendicular (Lpp)</td>
<td>274</td>
<td>m</td>
</tr>
<tr>
<td>Breadth</td>
<td>44.2</td>
<td>m</td>
</tr>
<tr>
<td>Depth</td>
<td>25</td>
<td>m</td>
</tr>
<tr>
<td>Draft</td>
<td>11.0</td>
<td>m</td>
</tr>
<tr>
<td>Displacement</td>
<td>99390</td>
<td>Ton</td>
</tr>
<tr>
<td>Broadside Wind Area</td>
<td>6065</td>
<td>m²²</td>
</tr>
<tr>
<td>Bow On Wind Area</td>
<td>1450</td>
<td>m²²</td>
</tr>
</tbody>
</table>

** - Larger Vessels can be accommodated
Bluewater / Paragon Engineering
Offshore Bishop Terminal™ Design

Source: Bluewater Offshore
An Offshore ‘Mega’ Terminal
Solving The 15 Bcf/Day “Sidebar Task”

OTC 16152
Offshore Salt Caverns Enable a 'Mega' Sized LNG Receiving Terminal
M.M. McCall / Conversion Gas Imports, LP; J. F. Davis / Paragon Engineering Services, Inc.; M.H. Krekel / Bluewater Offshore Production Systems (USA), Inc.

Source: Bluewater Offshore
Remora Technology ‘HiLoad’ System
Offshore Bishop Terminal™ Design

Source: Remora Technology
Remora Technology ‘HiLoad’ System
Offshore Bishop Terminal™ Design

Source: Remora Technology

Security  Economy  Capacity
World Class Bishop Process™ Applications
Offshore Security + Economics + Scale

FMC SOFEC

SBM-IMODCO

Security  Economy  Capacity
Salt Caverns Bring New Scale Economies To LNG Receiving Terminals

<table>
<thead>
<tr>
<th></th>
<th>Conventional Tank Storage LNG Receiving Terminal</th>
<th>Salt Cavern Storage LNG Receiving Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal Costs</td>
<td>$500 - $700</td>
<td>$350 - $425</td>
</tr>
<tr>
<td>US$ Millions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Cost of Service</td>
<td>&gt; $0.30</td>
<td>&lt; $0.15</td>
</tr>
<tr>
<td>US$ / MMBtu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Consumed In Process</td>
<td>1.5% - 3.0%</td>
<td>0.35%</td>
</tr>
<tr>
<td>% of Throughput</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Send Out</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Bcf / Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Send Out</td>
<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Bcf / Day</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Offshore Bishop Process™ Applications
Salt Cavern-Based LNG Terminals

• Offshore Mega Terminals Rapidly Developing
• Evaluation of Multiple Sites Underway
• Government Procedural and Policy Issue Resolution Based on Anti-Terrorist & Energy Security Technologies
• Offshore Salt Property Rights not Defined - Could be Greatest Impediment to Implementation

Security  Economy  Capacity
DOE / NETL Cooperative Research
Offshore Site Characteristics

- Multiple Pipeline Connections to Both Gathering & Post Processing Pipelines
- Varying Water Depths and Conditions Dictate Ship System
- Less Than 2 Years Build Time
- 2+ Bcf/Day Takeaway Capacity
Take Aways …

• Compelling Advantages Over Tanks
• Solves Large Volume Problem
• Technical Validations Proceeding
• Commercial Applications in Play
• Questions & Discussion
Appendix Slides
Gulf of Mexico Shelf
World Class Infrastructure In A Mature Basin

Vermilion 179 “Freedom” Terminal

Security  Economy  Capacity
# Offshore Pipeline Capacities

**Gulf of Mexico**

<table>
<thead>
<tr>
<th>Pipeline</th>
<th>Capacity</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas Eastern</td>
<td>700 MMcf/d</td>
<td>200 MMcf/d</td>
</tr>
<tr>
<td>Bluewater</td>
<td>1.3 Bcf/d</td>
<td>N/A</td>
</tr>
<tr>
<td>Sea Robin</td>
<td>1.1 Bcf/d</td>
<td>400 MMcf/d</td>
</tr>
<tr>
<td>Gulfstream</td>
<td>1.0 Bcf/d</td>
<td>300 MMcf/d</td>
</tr>
<tr>
<td>Destin</td>
<td>1.6 Bcf/d</td>
<td>1.1 MMcf/d</td>
</tr>
<tr>
<td>HIOS</td>
<td>1.8 Mcf/d</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Land-Based Site

- LNG from nearby dock
- Seawater as heat source
- Close proximity of cavern not required