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# Drivers and Technologies for Next Generation Digital Connectivity in Offshore O&G Production Facilities

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# Presenter Profile

- 25 years in submarine telecoms
- Masters in International Relations
- Founded WFN Strategies in 2001
- Publisher of Submarine Telecoms Forum magazine
- Mother's 3<sup>rd</sup> favorite son



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# Presentation Goals

- Explain how digital systems leading O&G to standardize on fiber optics
- Explore technical considerations in designing fiber optic systems
- Conclude how the industry can address unique requirements of offshore market

# O&G Motivators

- Necessity for digital systems
  - Real-time monitoring
  - Collaboration
  - Video surveillance
  - Work management systems
- Struggling to meet requirements



# Technical Solution

- Limits on size, capacity, reliability, distances and cost
  - Microwave has distance limitations
  - Satellite has cost and performance limitations
  - Submarine cables may be subject to external aggression
- Often require custom solution for individual hydrocarbon basins

# Improved Production

- Capacity, reliability, low latency and security provided by optical systems identified as key for improving production operations
- Multi-decade lifecycle and production rates justify fiber systems



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# Digital Implementation

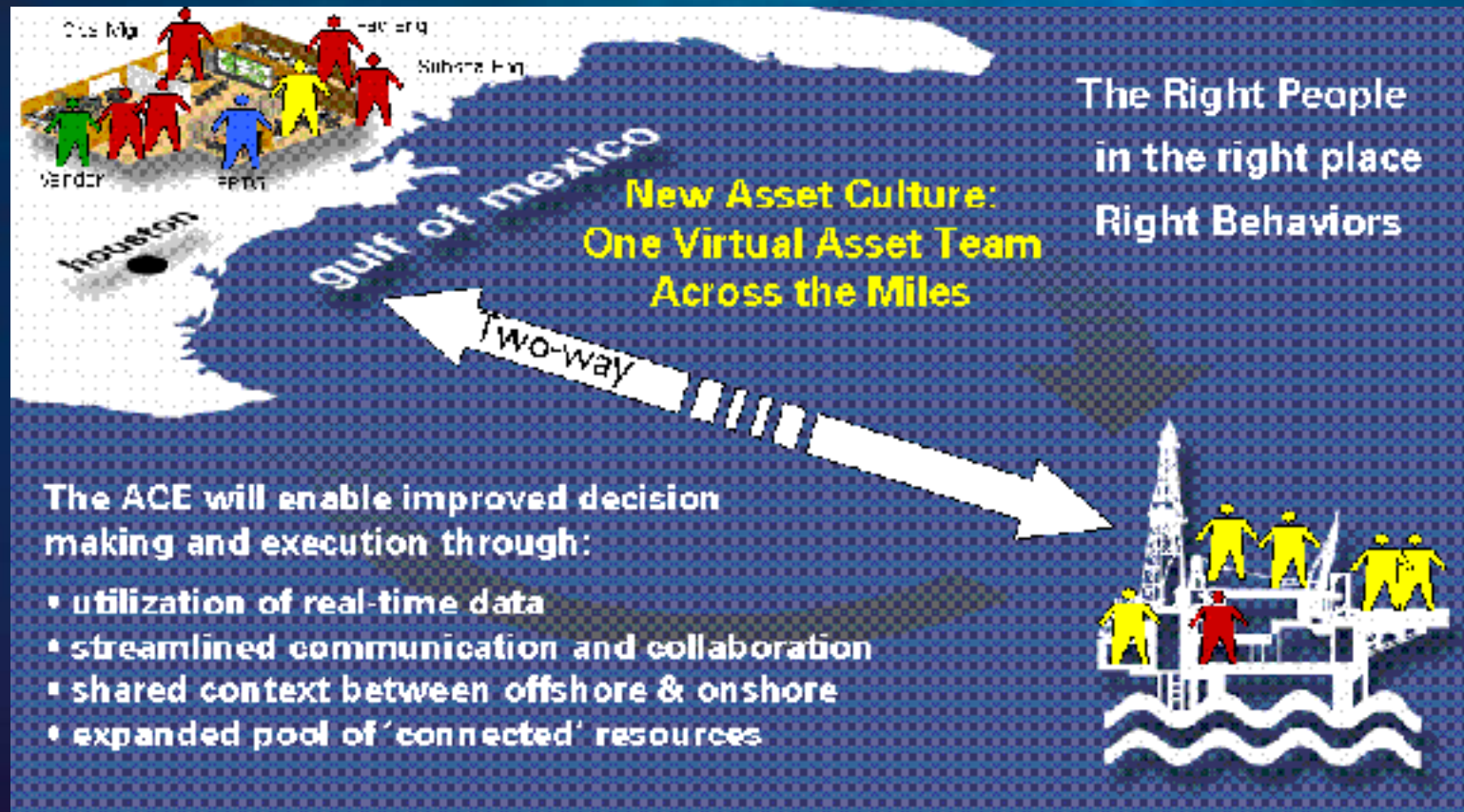
- Becoming strategic initiative within the oil industry
- Defined by extended reliability and sustained access to the high capacity digital infrastructure

# Fiber Challenges

- What technical model should be used?
- What is possibility of buying service versus build and operate?
- How will wet plant be maintained?
- What internal resources are required?
- What future considerations need to be included?



# Case For Fiber



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# Back-office Drivers

- Email, file sharing, etc. benefit in cost of operating and time to repair with centralized servers and data storage being located onshore
- Yet performance to large facilities can only be achieved with high end connectivity

# Operations Drivers

- Work management systems, document storage/management accessed from distributed workforces
- Responsiveness driven by high bandwidth to allow multiple sessions and low latency
- Handheld devices/wireless LAN used more continuously versus single end of shift downloading

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# Real Time Data Drivers

- Used to support both field optimization
- Monitors health of facility in order to initiate necessary interventions
- Data shared real-time both internally and suppliers
- Data collection multiple times a second

# Collaboration Drivers

- Between distributed and inter-discipline subject matter experts
- 24x7 high resolution video conference systems to “extend the control room”
- Video surveillance using fixed cameras or wearable computers



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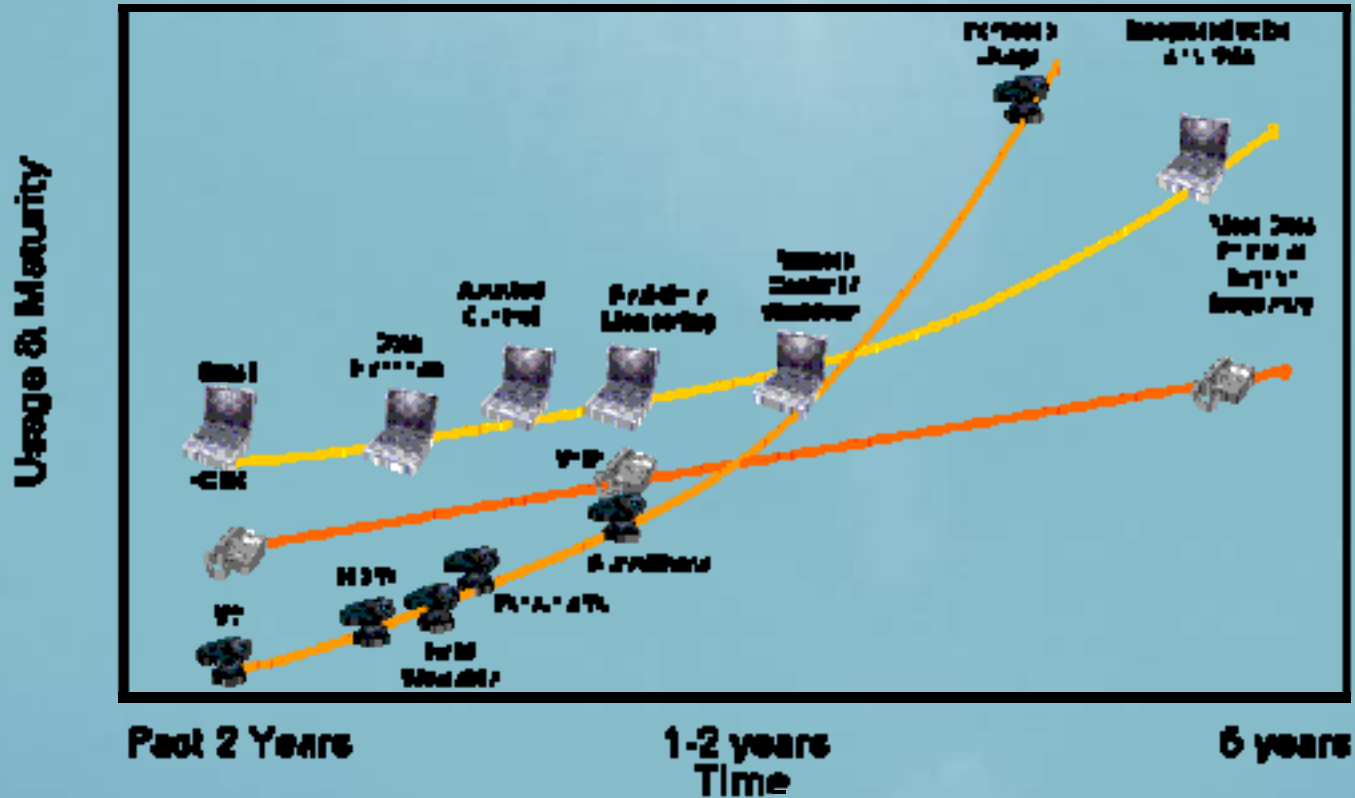
# Result of Increased Usage and Critical Performance Demand

- Large production assets no longer capable of extending digital capability with high latency ( $>200\text{ms}$ ) or low bandwidth links ( $<10\text{Mbps}$ )
- Large facilities will use  $>45\text{ Mbps} - 1\text{ Gbps}$  in near future as digital systems evolve

# Relative Growth of Technologies

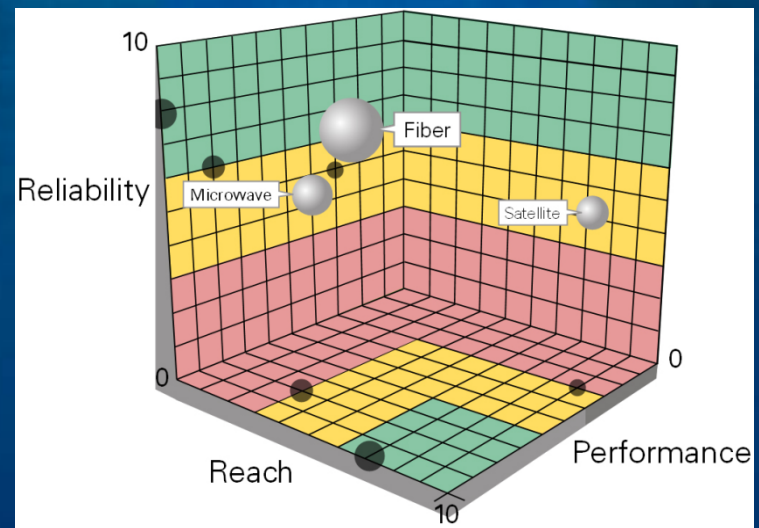
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# Basis for Fiber

- Available telecom technologies
  - Satellite
  - Microwave (including “broadband WiMAX”)
  - Fiber
- Fiber is the lead technology
  - Ability to reach nearly unlimited distances using subsea repeaters
  - Near unlimited bandwidth
  - Tolerance to poor weather



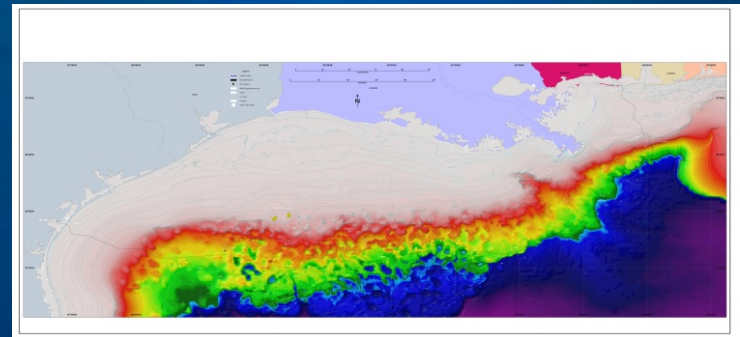


# System Development

- High level implementation and system design developed for the area, considering:
  - Basin system design
  - Technology plan
  - Engineering and procurement
  - Ownership model
  - Maintenance

# Basin System Map

- Line drawing showing immediate/future service areas while avoiding subsea congestion
- Landing points based on
  - Survivability to weather
  - Availability of terrestrial backhaul
  - Ease of marine approach



# Basin Considerations

- Where are the assets (company operated, partner operated, others)?
- Which assets are dependent on other assets (pipeline gathering stations)?
- How will the basin map evolve?
- What is the distribution and grouping of assets?

# Technology Plan

- O&G moving towards IP over “LAN extensions”
- Subsea repeatered systems and signal re-transmission at each platform achieve transmission distances
- Subsea-based system provides platform independence when power or longevity of “repeater stations” cannot be guaranteed

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# Technology Concerns

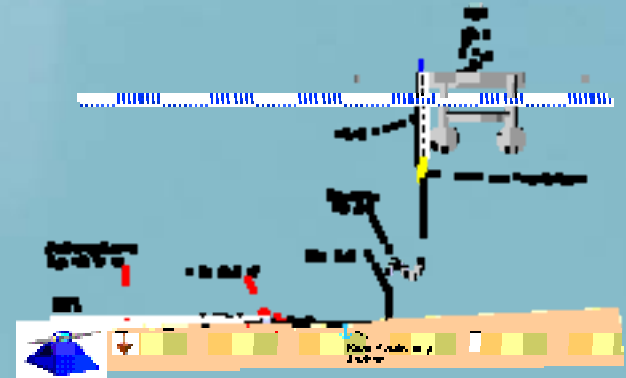
- What access layer protocol to use?
- SDH/Sonet-based solution or packet-based solution (Ethernet protocols)?
- What about end users, build and operate the network, security and space requirements, and network hardware cost?

# Engineering and Procurement

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- Front-end load engineering to ensure competitive procurement and effective contracting
- Model varies by country and complexity of environment
- Goal to balance risk on builder versus buyer



# Engineering & Procurement Risks

- Riser design (vessel movement, weather, water depth, vessel design), and costs \$1-3M each
- Pipeline crossings
- Preferred O&G engineering companies and procedures
- Final surveyed route, seabed clutter and other field developments



# Ownership Options

- Dedicated system
- Multiple company consumers
- Managed service



# Dedicated System

- Owned and operated by the dominant end user
- Typically employed when fiber access required in long term manner
- Critical to their business
- More ideal alternative models not readily available

# Multiple Company Consumers

- Multiple players desiring direct connectivity
- Useful for developing basin/questionable future assets locations
- Level of guaranteed ownership and access rights
- Cross company IRU completes network
- Initial supplier agreement or high interoperability to tie systems
- Maintenance consolidation

# Managed Service

- Poses several concerns
  - Fiber selling company needs to be established with previously guaranteed funding
  - Time to acquire customers and guaranteed income can vary drastically
  - Anchor “buyers” run risk of not achieving desired connectivity

# Ownership Benefits

- Owner(s) can sell extra connections and excess bandwidth to 3<sup>rd</sup> parties
- Ownership can evolve into consortiums, managed services, etc. as economics and risk allow

# Maintenance Options

- O&G owners require fast response
- Telecoms critical to effectively and safely operate platforms
- System must withstand failure through construction methods/redundancy in design (e.g., satellite)
- System restoration plan and preventative maintenance required

# Dry Plant

- Existing offshore telcos capable of operating, including
  - Licenses
  - Satellite backup
  - Terrestrial backhaul
  - System monitoring & fault isolation
  - Hardware replacement
  - Re-provisioning
  - Security and testing

# Wet Plant

- Not within offshore telcos immediate scope of capability
- Needs to be developed
- Often customized to provide, flexible maintenance suited to owners' needs



# Maintenance Balance

- Owner needs to balance major variables
  - Response time
  - Local content
  - Preventative maintenance
  - Logistics (vessels permits, technicians, depot and material shipments)
  - Cost of both base and repair operations



# Primary Maintenance Solutions

Options	Description	Response	Costs
Cable Maintenance Agreement	Regional service geared towards large carriers	Potentially slow due to priority	Pro-rata based on bandwidth/cable length. T&M Repair
Self Maintenance using Vessel of Opportunity	Contracted vessel(s) and cable repair skills	Medium with ability to reprioritize within owner's work demand	Low retainer costs; requires purchase of spare parts and tools
Contracted Maintenance	Contracted cable vessel owner	Uncertain – depends upon local of boat	High costs
Dedicated Vessel	Dedicated cable vessel and standby personnel	Fast – dedicated	Highest possible costs

# How Can We Help?

- O&G needs to make more efficient the internal development of fiber systems
- O&G ops/tech teams need to be focused on identifying/deploying systems and applications rather than implementing/managing subsea fiber

# O&G Needs

- Subsea fiber industry needs to become familiar with O&G operating model
  - Minimize system cost (lifting costs)
  - Maintenance opportunities (O&G fleets, VOO)
  - Space conscious (“tighter” packaging)
  - Future needs (Limited available topsides)

# O&G – The Future

- Difficult to estimate what tomorrow's requirements will be
- But any developments that make subsea fiber solutions more cost effective, flexible and readily deployable will add to the industry's embrace of this technology

