New Tools for Undersea Networks

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New Tools for Undersea Networks

Outline

Sharing one Undersea Infrastructure:
Background, Motivation & Risks

Technology Building Blocks

Network Opportunities

Challenges & Trade-offs

Observations & Conclusions

New Tools for Undersea Networks

Could different undersea communication markets share the sea & "the same network":

- Telecommunications (High speed & high capacity)
- Oil & Gas (lower capacity, monitoring & control functions)
- Scientific Research (lower capacity, monitoring & some control)
- etc.

- Technology Challenges – Power & Data connectivity & independence

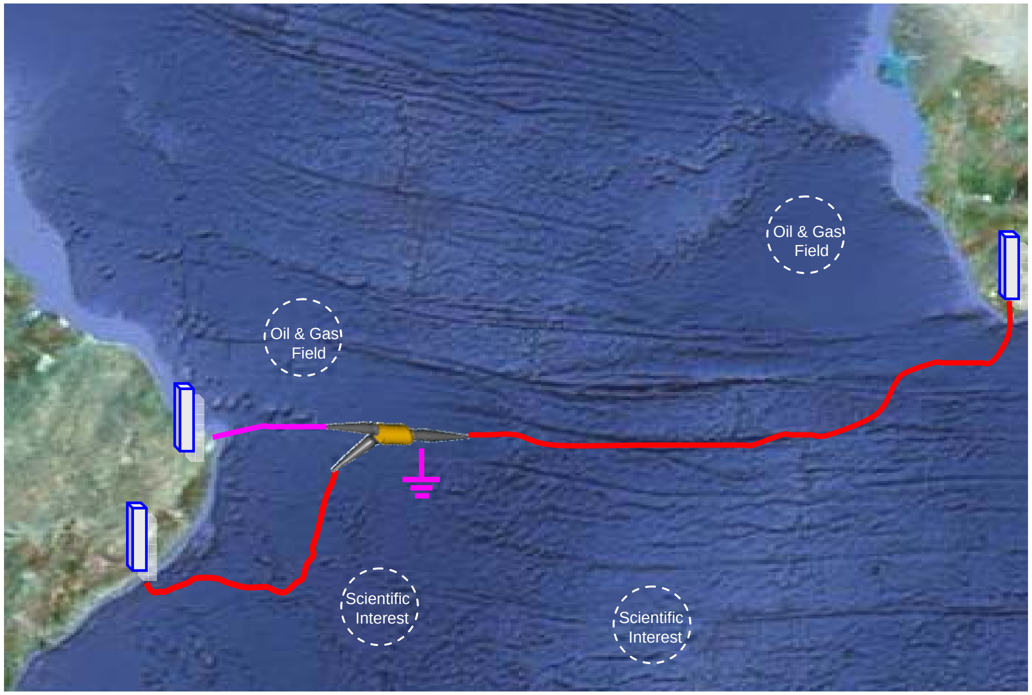
- Cost Challenges – Additional initial costs

- Commercial Challenges – Ownership rights and priorities

- Operation & Maintenance Challenges – Interdependence, Sparing & Restoration

New Tools for Undersea Networks

Technology Challenges – Power & Data connectivity & independence



Modern Transoceanic Undersea
Telecommunications Network

Telecom Network Characteristics:

High Reliability
High Capacity (Terabits/sec)
High Voltage (15KV)
Powering the main trunk from two terminals
Small number of fibers (< 20)
Rapid Deep Water Installation (up to 7 knots)
Rapid Repair (24 hr dispatch)

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Technology Challenges – Power & Data Topology

	Telecom Network	Oil & Gas Network	Scientific Network
Topology of Data	Data Transmission across Oceans	Data Transmission from Oil & Gas Fields	Data Transmission across vast ocean areas
Capacity needs	**Terabits** – 100's of wavelength @ 40/100G Concentrated between few landings	**Gigabits (nom.)** most – Distributed between platforms	**Megabits (nom.)** – Distributed between sensors
Power needs	5 – 15 KV at low amperage (1-2 Amperes)	1 – 5 KV at low amperage	1 – 3 KV at medium amperage

Tools for Undersea Networks

Undersea Telecommunications Hardware – The Classics

Cable – Trunk & Branch Cables

Joints & Couplings

Amplifiers – Optical

3-Port Branching Unit – Power & Optical Add/Drop

Undersea Specialized Hardware

Dual Conductor Cable (DCC)

4-Port Branching Unit

Dynamic Riser Cable – Hanging vertically with no lateral support

Static Riser Cable – Supported vertically

Rig Termination – Supports the dynamic load of the Riser Cable

Platform Hang-Off Device (PHOD) – Interface to the platform

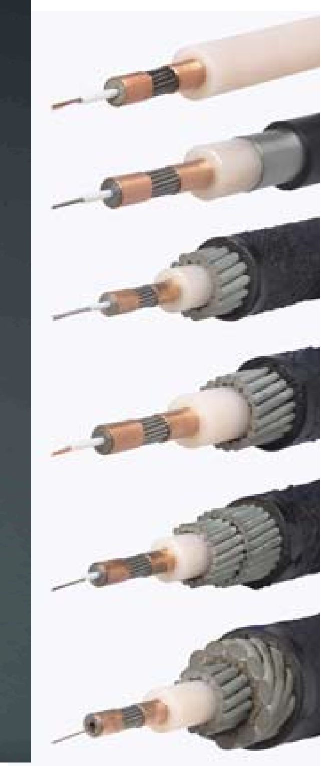
Fusible Link – Emergency Fuse

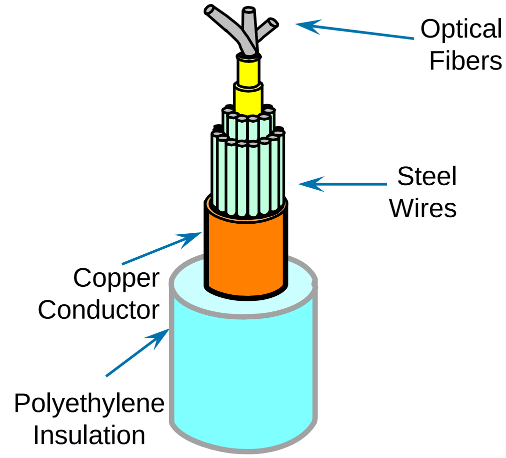
Fiber Distribution Canister – Wet mate gateway

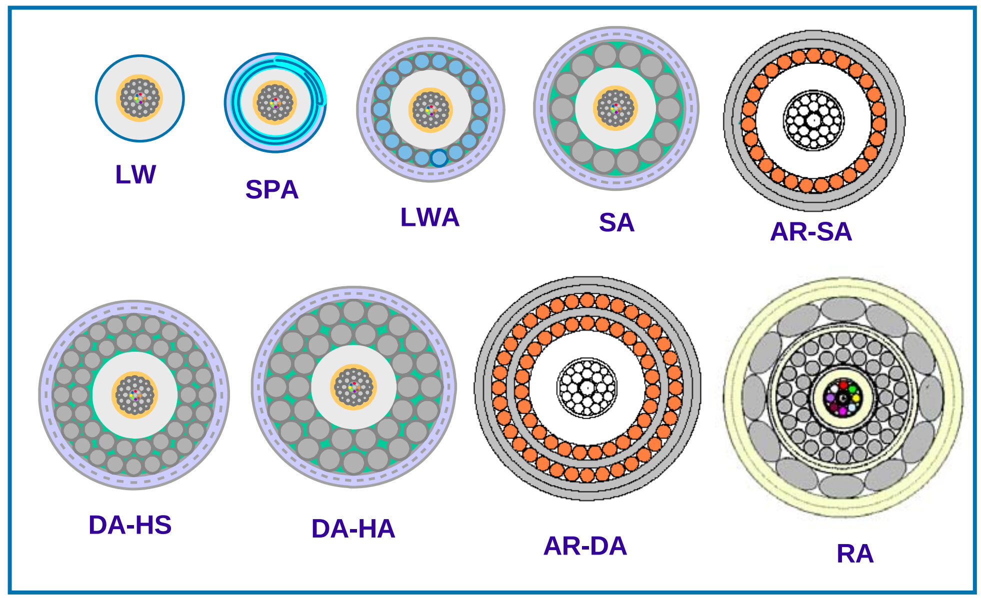
Essential Synergies – Both sets of hardware are needed to inter-connect oil & gas or sensor fields

Undersea Hardware - SL Cables

Armorless & Armored Cables
Dynamic Riser Cables
Dual Conductor Cables



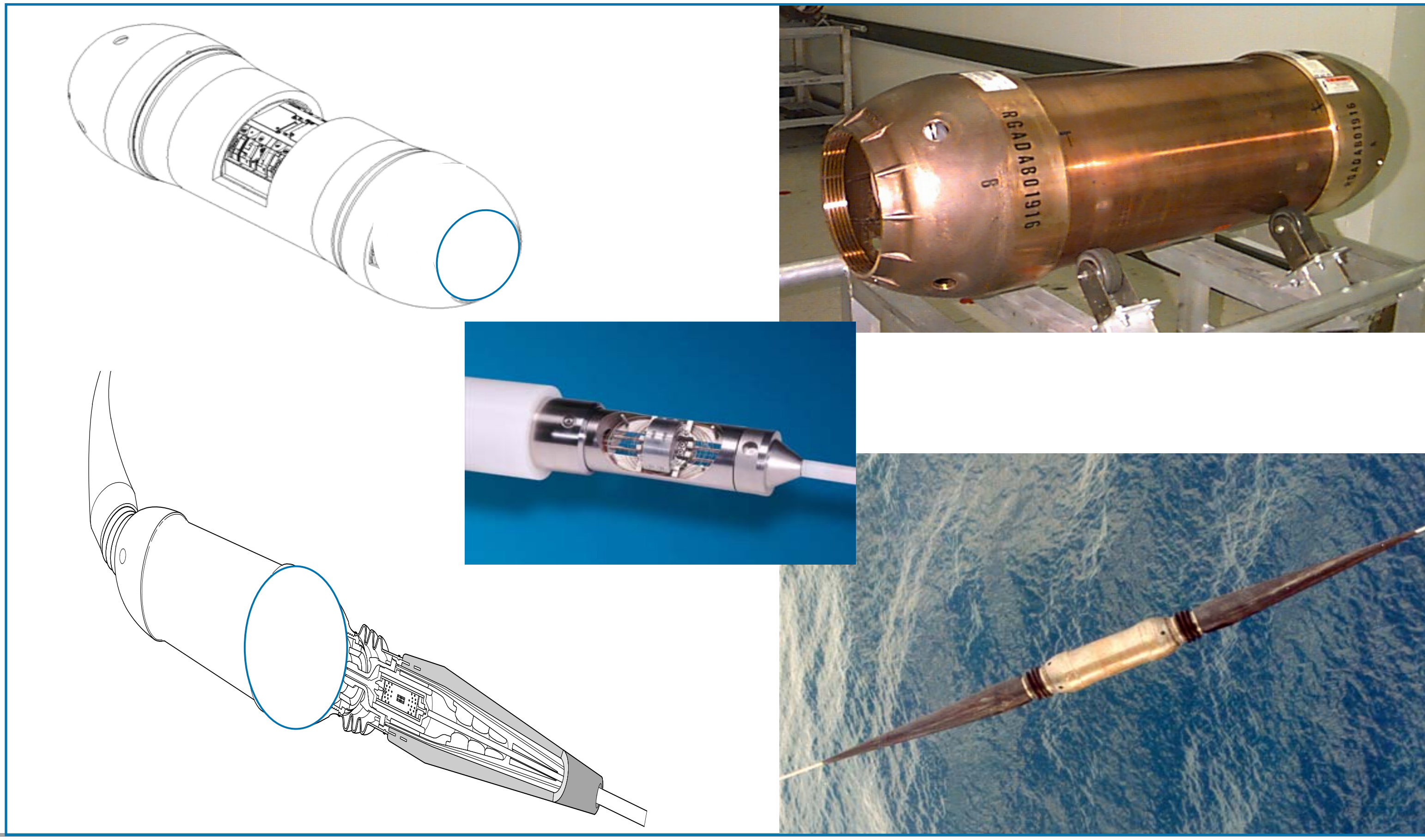




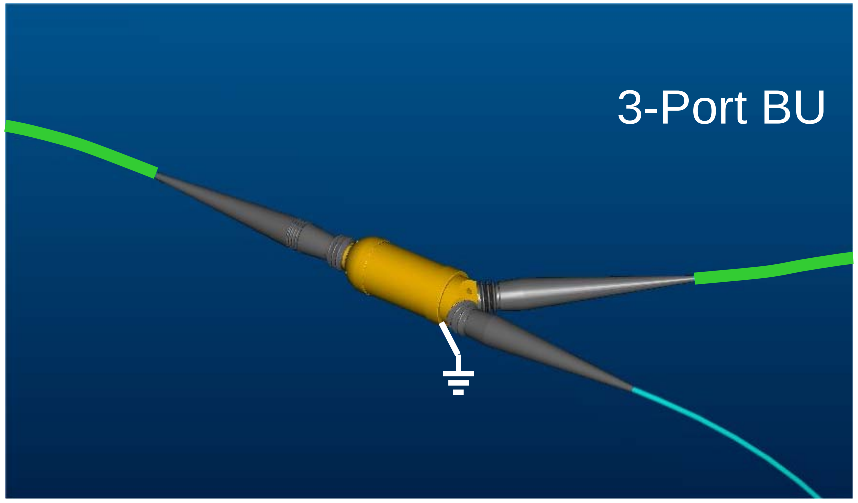
Undersea Hardware - SL Amplifiers

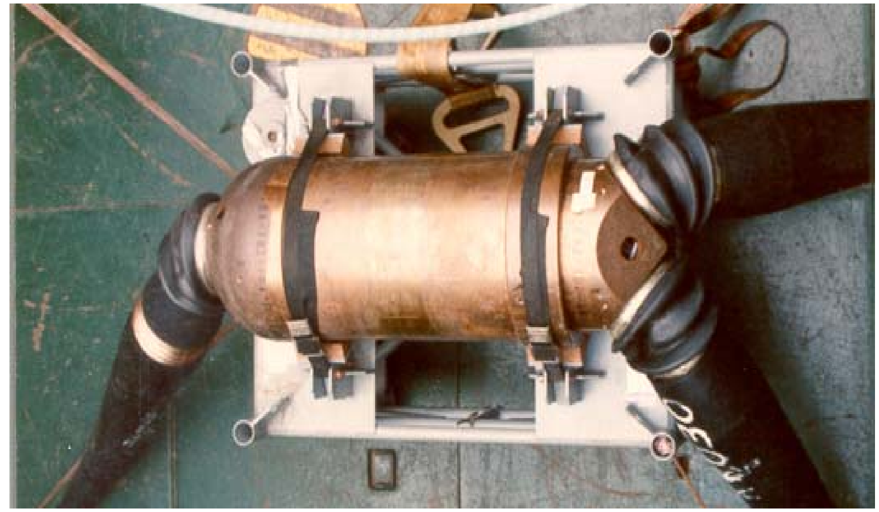
Optical Amplifiers

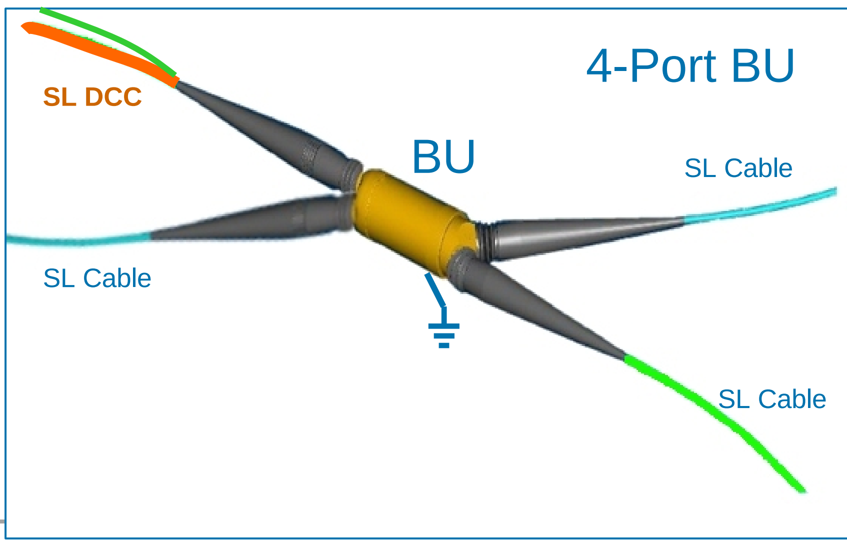
Joints & Couplings



Undersea Hardware - SL OADM Branching Units



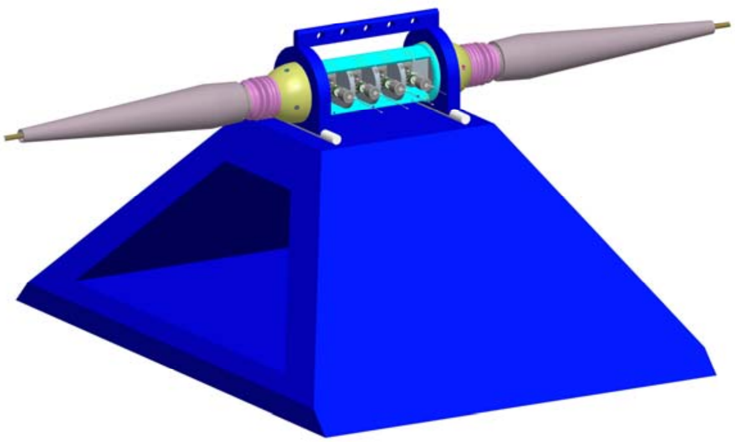


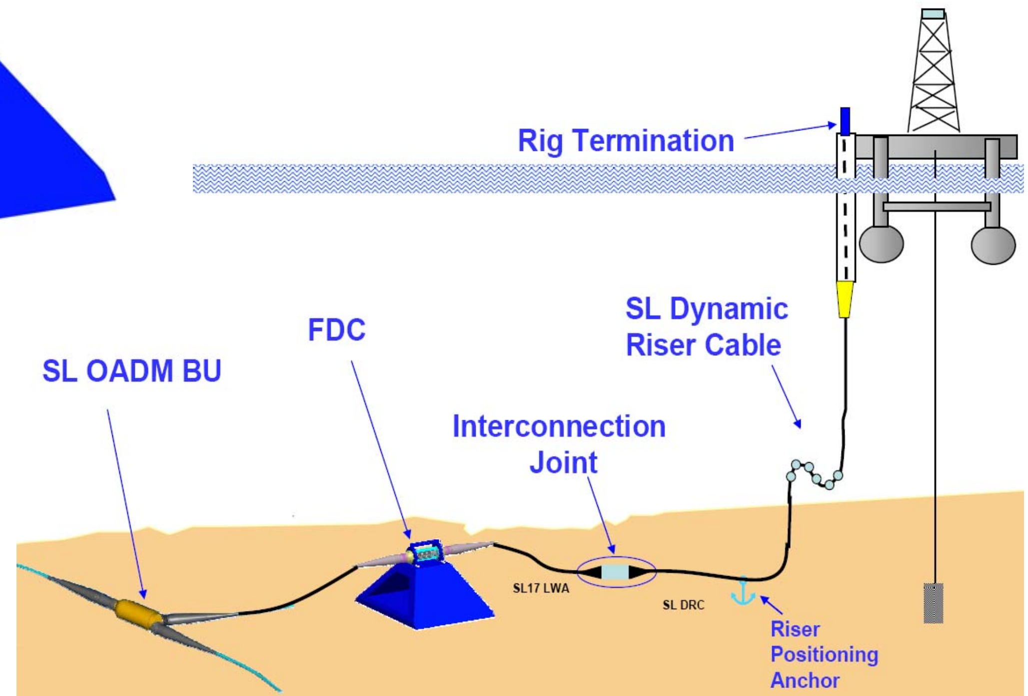


Undersea Hardware - SL Fiber Distribution Canister

Integrated Wet Mate Gateway

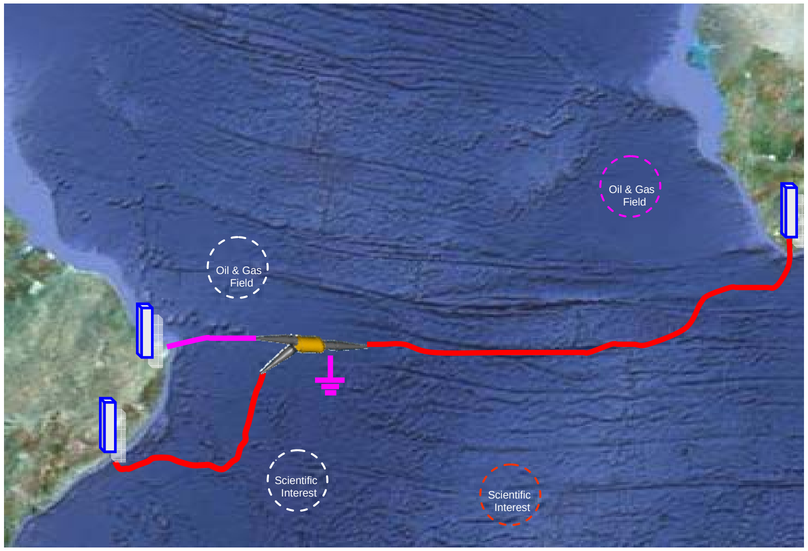
Allows future network expansions





Tools for Undersea Networks

Using the previously highlighted hardware, Data & Power connectivity & "independence" could be accomplished

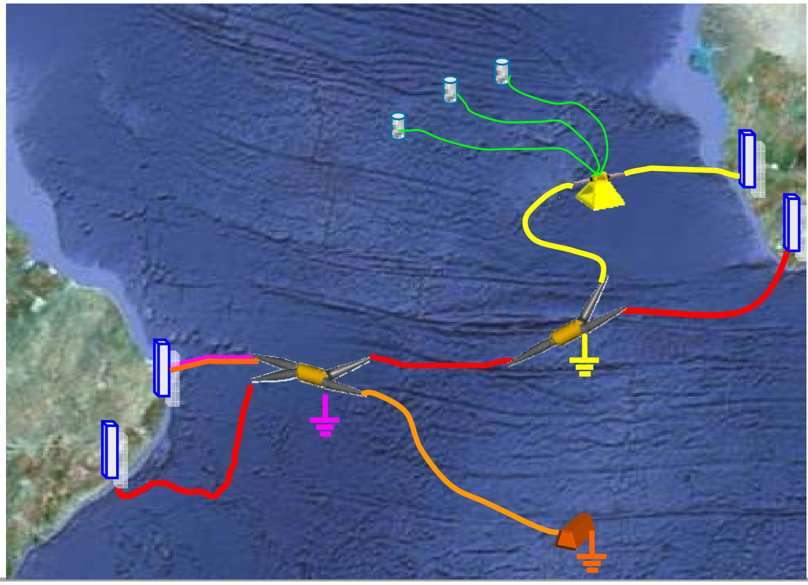


Dual Conductor Cable

4-Port Branching Unit

SL OADM BU

Fiber Distribution Canister, etc.



Challenges & Trade-Offs

1. As more non-telecommunication functions are added to the telecom network infrastructure, the downtime risk increases due to the natural topology of these functions (volcanoes, fault lines, etc.), as well as the associated electro-optic failures

2. Added risk to the telecom network would need to be mitigated and compensated for through additional hardware and redundancies

3. Expenses to reduce the risk could be substantial as the following would be needed:

    a. Mechanical isolation from the network through fusible links and greater distance isolation from the telecom network
    b. Power isolation from the telecom network
    c. Fiber and data isolation from the telecom network

4. Installation planning needs to take into account the inter-dependencies of the additional hardware needed for the non-telecom functions

Conclusions & Observations

• Primary function of an undersea telecom network is to push vast amount of data between population centers through large data pipes with minimal energy under the sea

• Non-telecom markets collect small distributed data and could use appreciable energy to operate sensors, lights, etc.

• Although many technical challenges have been addressed, balancing these two conflicting needs would have to be done if networks are to be shared

• Providing reliable powering schemes that can meet the objectives of the different users continues to be worked by many in the industry

• Ownership rights and priorities would have to be addressed to define the boundaries and interfaces between the different users

• Operation & Maintenance Interdependence forces a new and different Repair, Sparing & Restoration philosophy than owners are used to today