MARS Observatory

Monterey Accelerated Research Site

RVOC – Chris Grech, April 2009

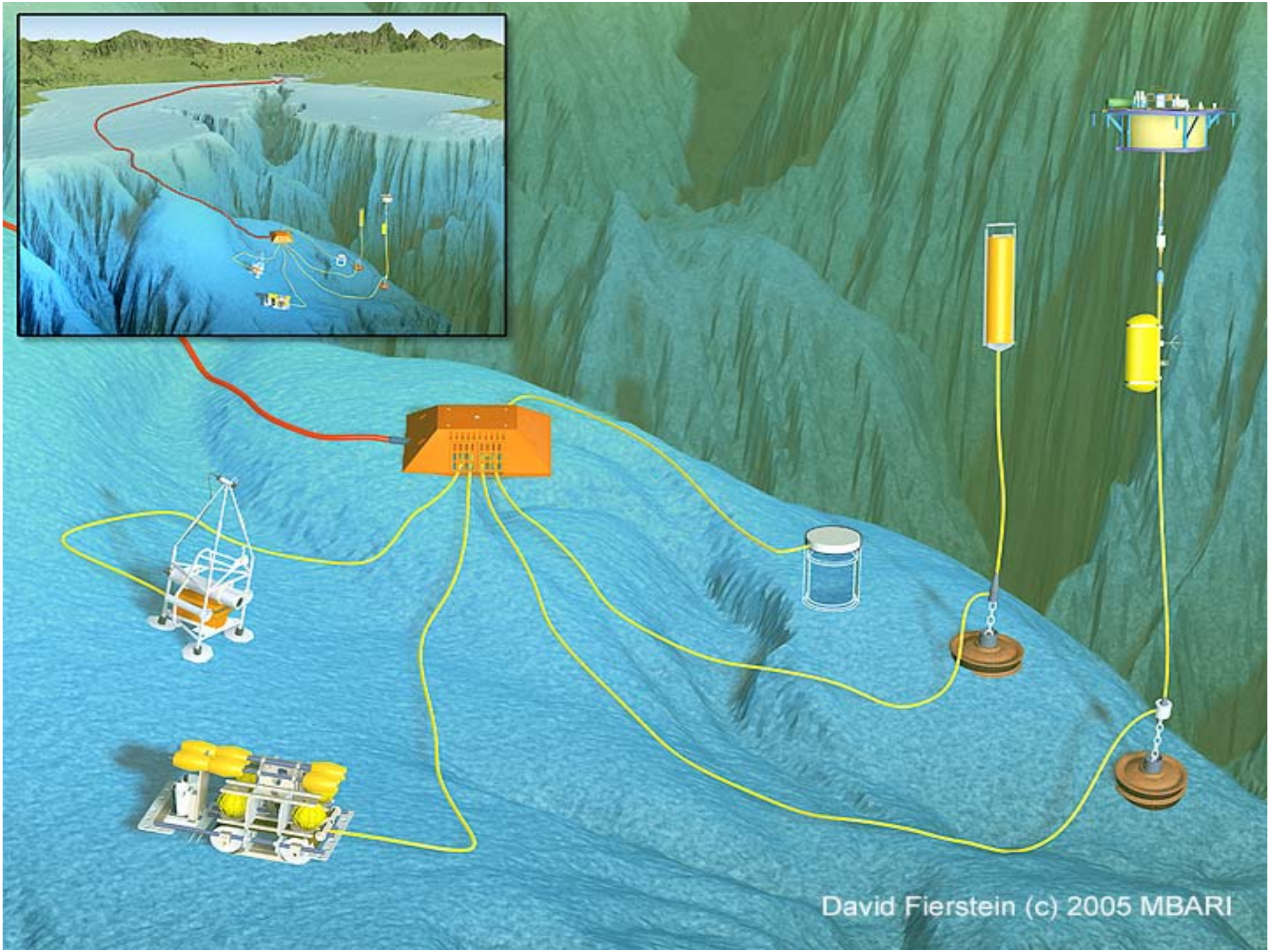
The Purpose of MARS

MARS is the test-bed cabled observatory for the National Science Foundation's Ocean Observatory Initiative

- Provides a test bed for instrument developers testing new scientific instrument technology
- Provides a facility for low cost instrument "endurance" testing
- Provides a prototype for the development of technology infrastructure for future observatories.
- Provides an opportunity to test ROV maintenance, deployment and recovery protocols for ocean observatories

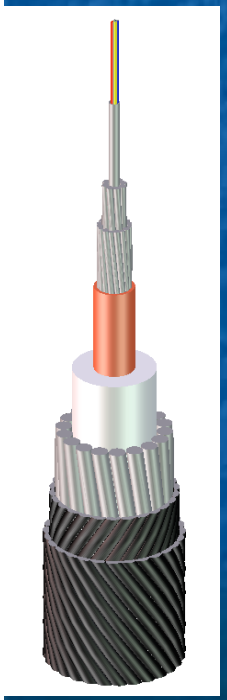
What is MARS?

- 62 km of fiber optic cable
- Single undersea node at .9 km depth
- 100 Mbits per second data rate
- 10 kW of power to 8 instrument ports
- Capability of placing instruments on “extension cords”
- Serviced using *Ventana* ROV

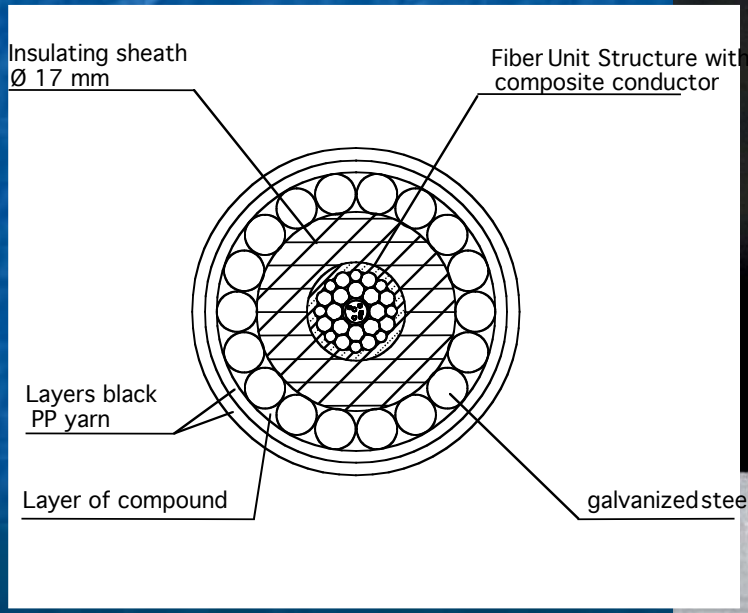

David Fierstein (c) 2005 MBARI

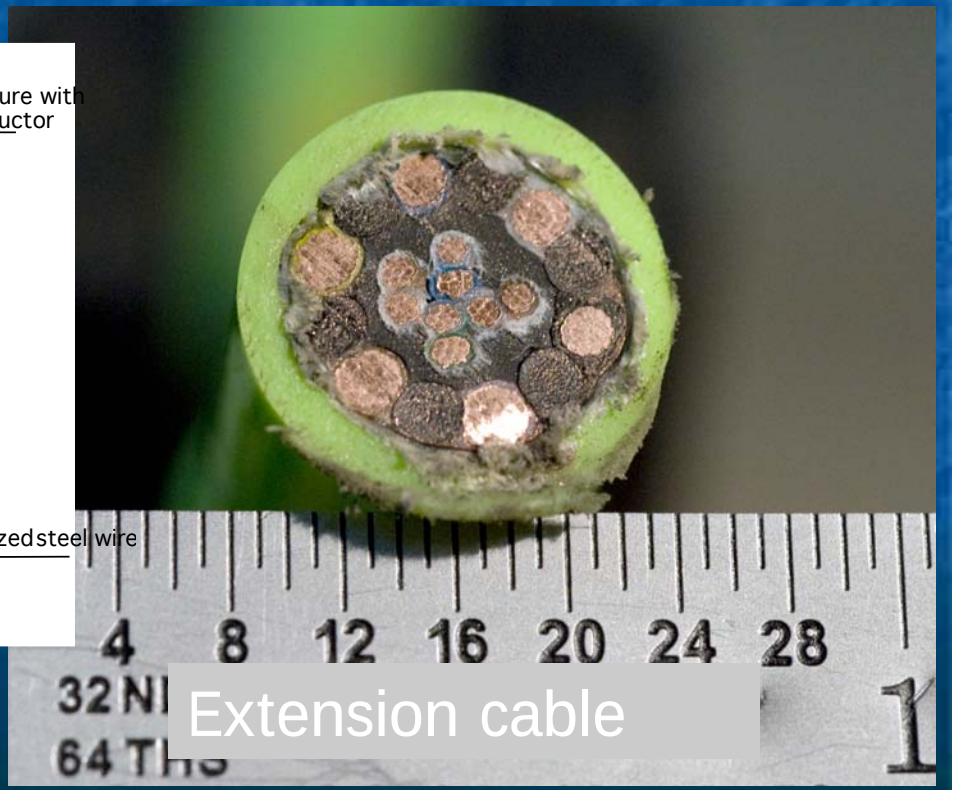
MARS cables

Ocean Design Connectors



Primary MARS cable 1.3 inch diameter



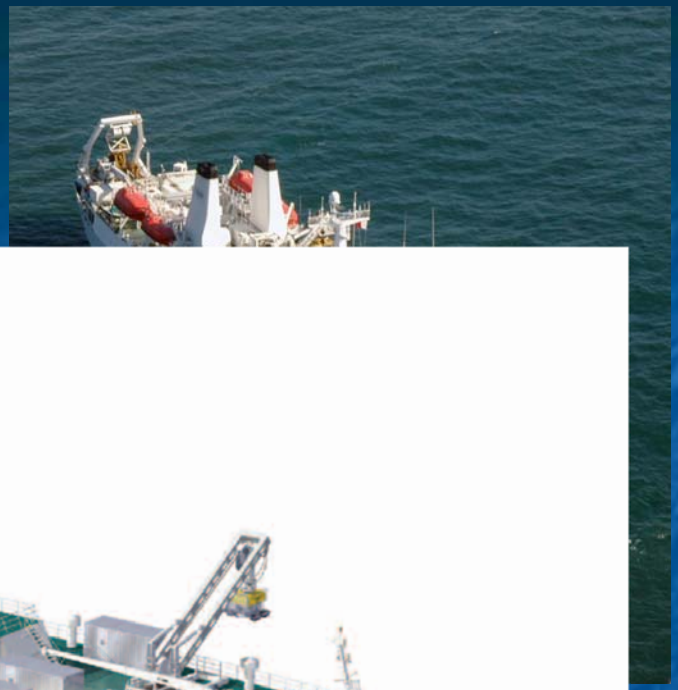


Extension cable

Sub-Sea Observatory
Marine Operations and Maintenance

- Pre-installation Surveys
- Initial Installation
- Science Sensor Installation
- At-sea Maintenance

Tyco Telecommunications
C.S. Global Sentinel



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Cable storage tank

- 30 ft. tall x 40.5 ft. wide (38,400 cu. ft.)
- One of three cable main storage tanks
- Nearly the size of the MBARI test tank
- Four more smaller auxiliary tanks (1,450 cu. ft.)

Cable Installation Equipment

ROV Jetting System

1.5 m maximum burial depth

Jetting tubes retracted

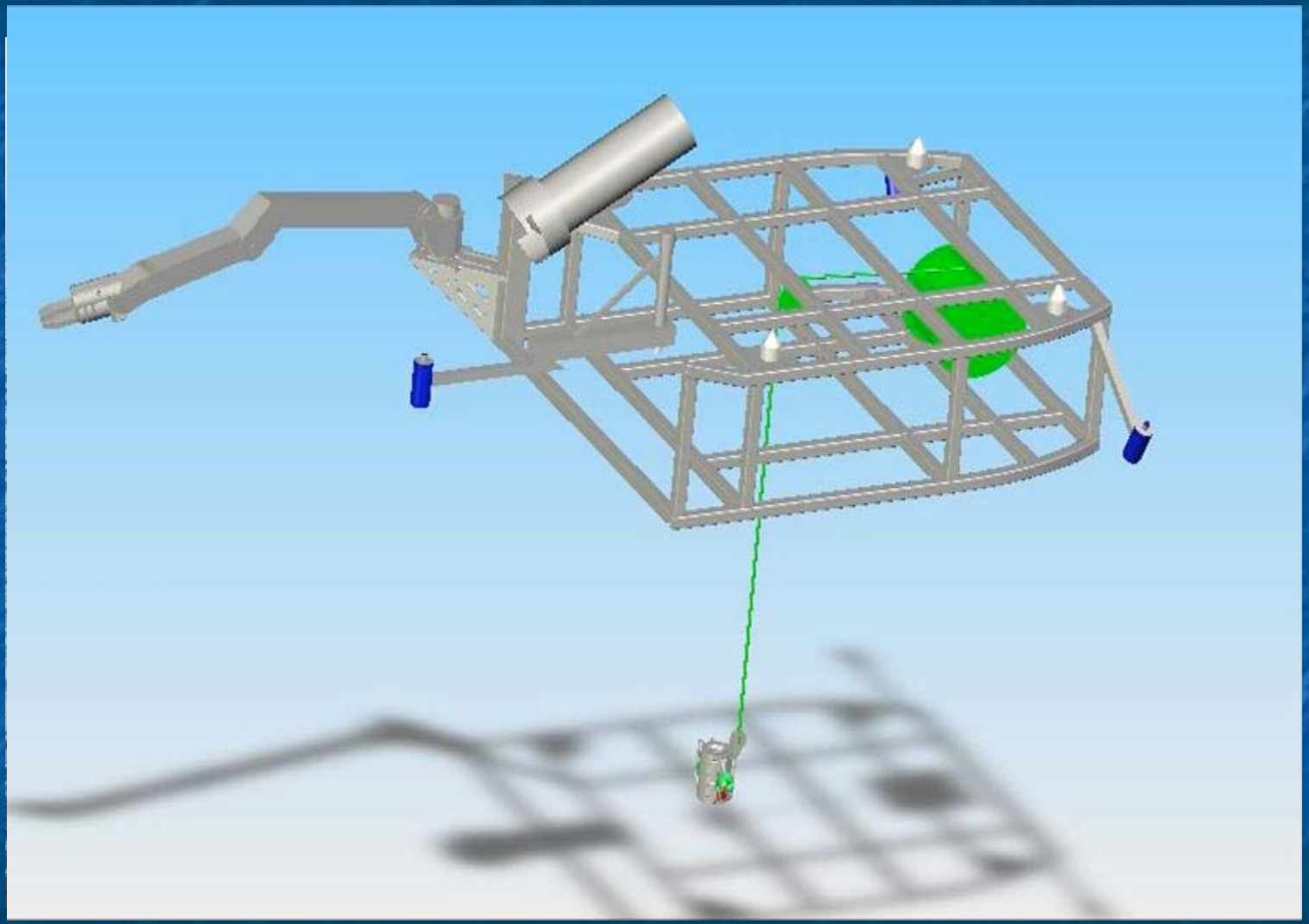
Jetting tubes deployed

MARS Offshore node

TRF
8100lbs

Electronics Package
5000lbs negative in air
200lbs positive in water

MBARI MARS Maintenance

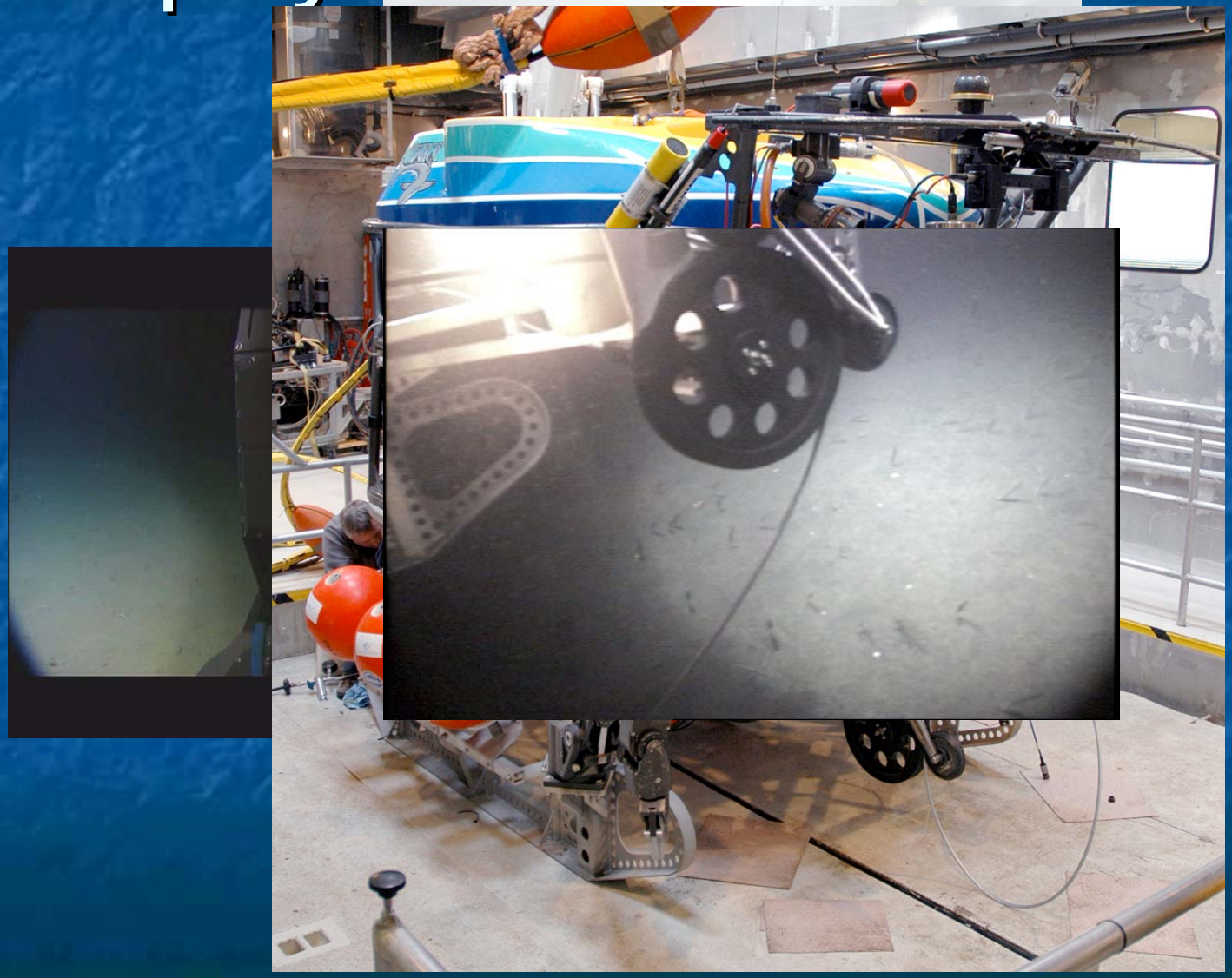


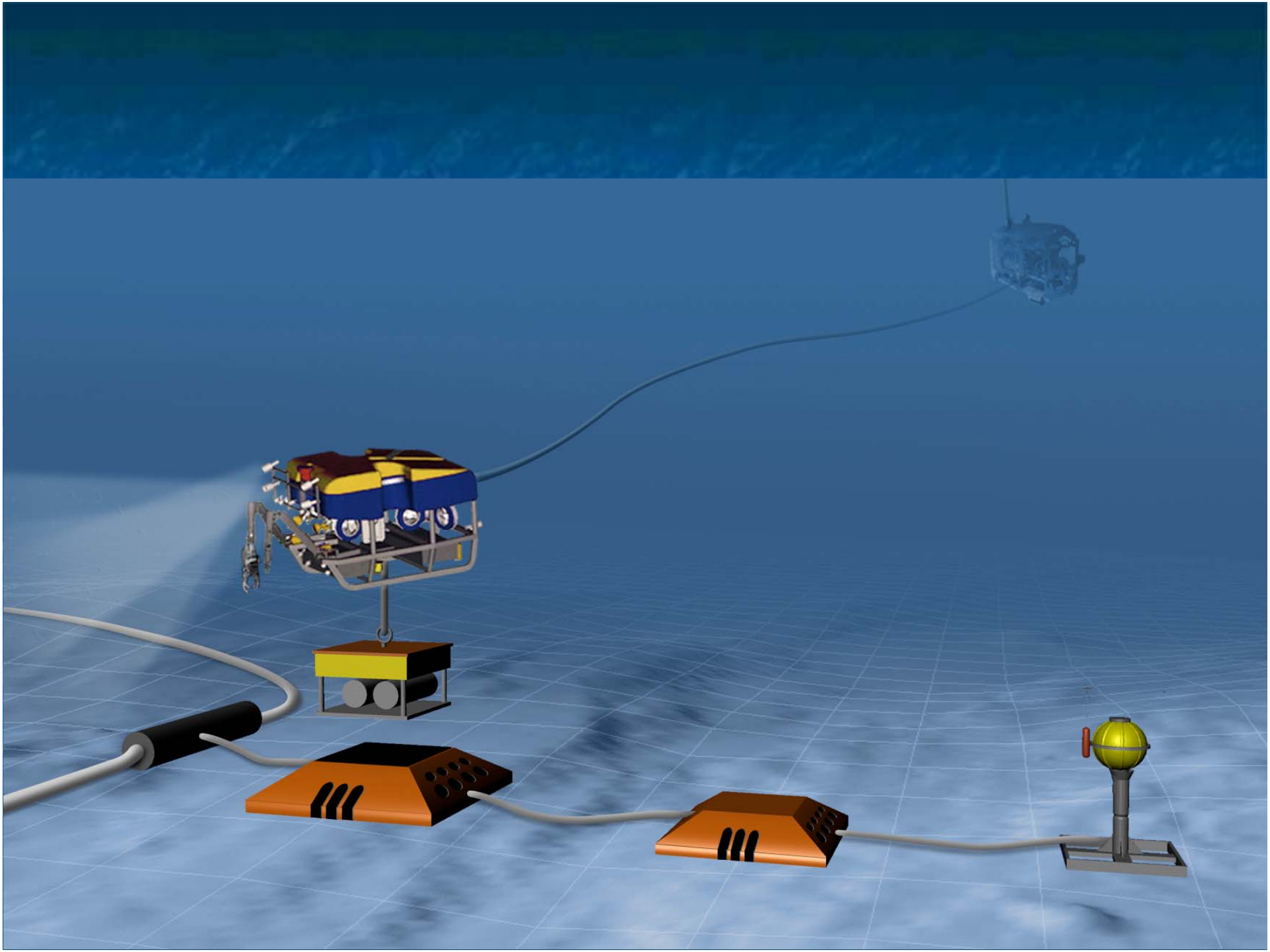
Electronics Node Deployment

ROV / Vessel Task List

- Deploy and Recover the Science Node
- Testing the Science ports
- Deploying Instrument Packages
- Interconnecting Instrument Packages
- Permit requirements for cable route surveys

Deployment of Extension Cables

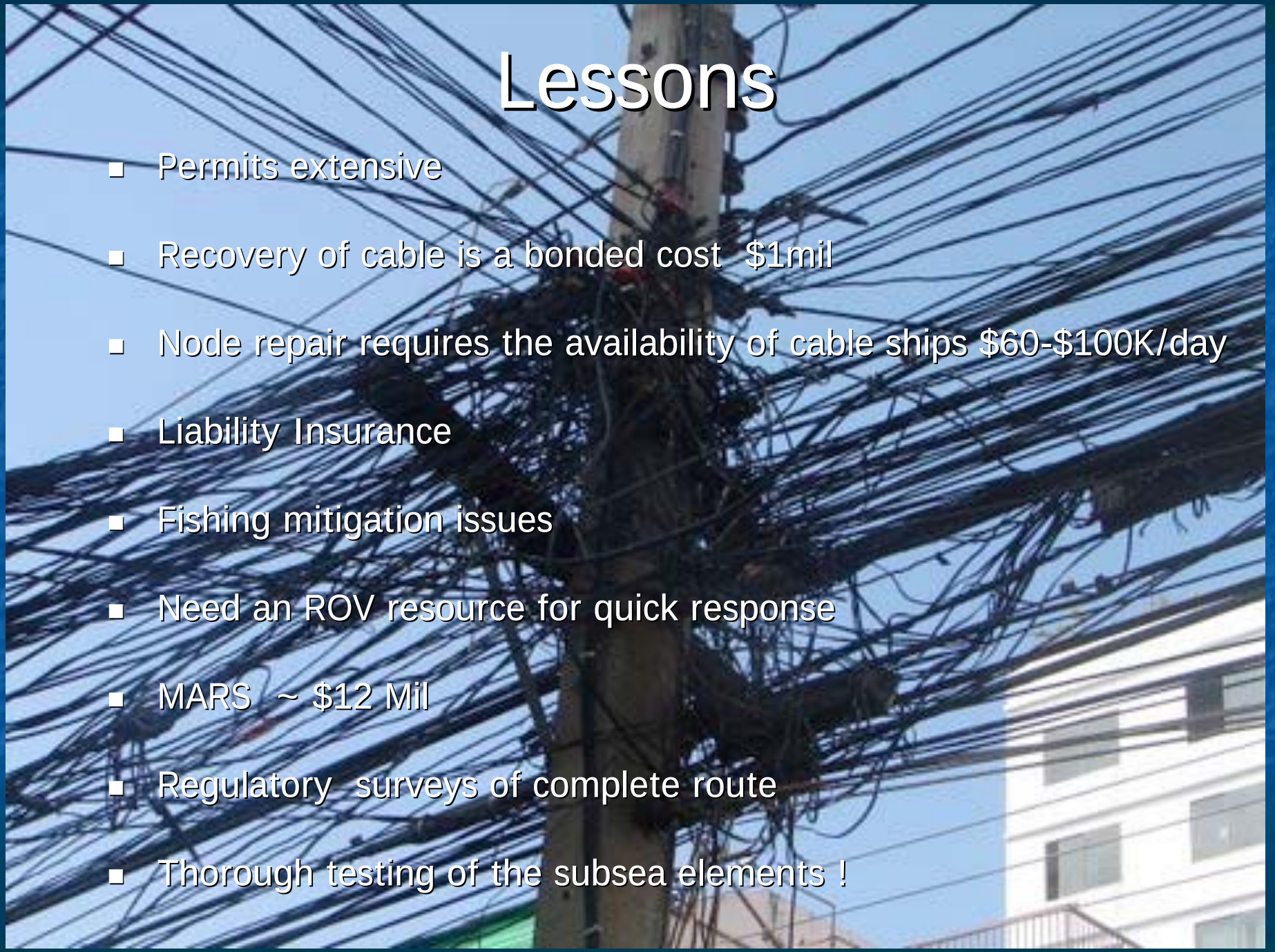




Extension cable deployments

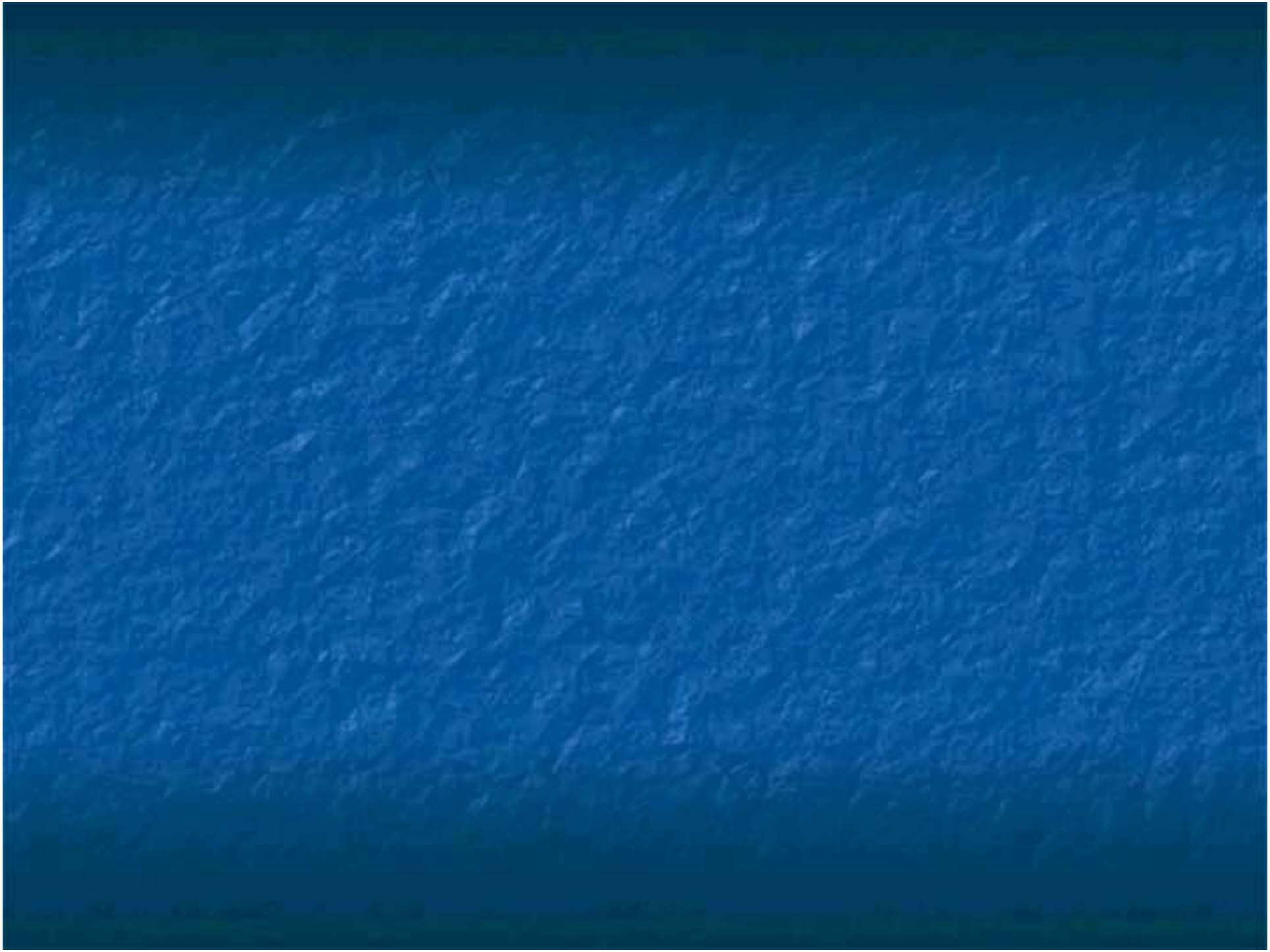
EXTENSION CABLES

- For observatories where sites of interest are distributed
- Extension cables can provide 10/100Base-F over 100+ km extension cables, 10 kW at 50 km and 5 kW at 100 km
- Academic ROVs can lay ~5 km extensions in areas not accessible using surface ship deployments
- UNOLS ships can lay 100+ km extension cables
  - New equipment spreads will be required
  - Ship modifications would be helpful
  - Crew training is critical
- Extension cable examples
  - ~$1M just to install a “full functionality” 100 km extension cable using a “free” UNOLS vessel – 5 kW and 100 Mbits/second
  - ~$75K to install a “minimal functionality” 5 km extension cable using a “free” academic ROV and vessel – 200 Watts and 100 Mbits/second



Lessons

- Permits extensive
- Recovery of cable is a bonded cost $1mil
- Node repair requires the availability of cable ships $60-$100K/day
- Liability Insurance
- Fishing mitigation issues
- Need an ROV resource for quick response
- MARS ~ $12 Mil
- Regulatory surveys of complete route
- Thorough testing of the subsea elements !



MARS/NEPTUNE PRIMARY SCIENCE PORT

- 400 and 48 VDC
  - 25 Amps maximum
- 10/100Base-T Ethernet
  - TCP/IP, FTP, FTP streams, ...
  - NTP of order 10s of millisecond accuracy
- 1 pulse per second clock
  - Of order 1s of microsecond accuracy
- Available at main nodes, secondary nodes and at the end of extension cables

Fleet Support of Observatories

EXTENSION CABLES

- Short haul (<100m), low power, high bandwidth
  - All copper - Relatively cheap
  - ROV deployable
- Short, high power, high bandwidth
  - All copper but more of it
  - May require ship deployment
- Medium haul (<4 km), high power, high bandwidth
  - Copper (lots of it!) and fiber
  - Requires SIIM to convert electrical signals to optical
  - Probably requires ship deployment
- Other combinations?
  - High power, high bandwidth, long haul (~100 km)
  - Sea water return?