“Sensing the Oceans:
Practical & operational considerations of adding sensors to submarine telecommunications cables”

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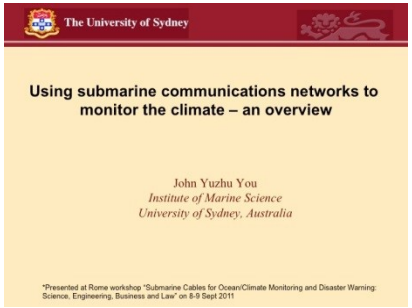
Agenda

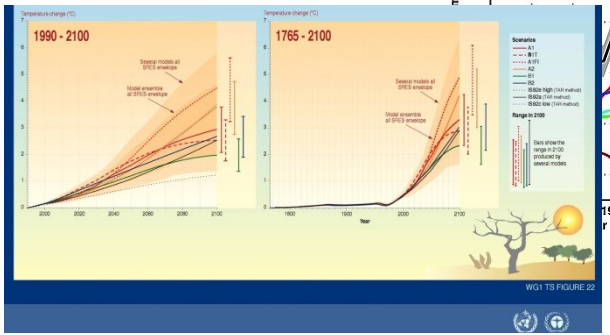
- Introductions (Who am I?)
- Why we are here?
- What's the issue?
- Progress & Plans of the JTF
- Challenges and Opportunities
- Summary and Close

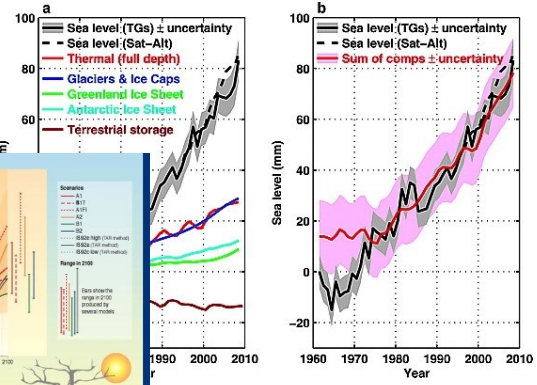
My perspective comes from

- Almost 30 years in global telecommunications
- Most as developer, owner and operator of cables
- Last five as a technology developer and vendor
- Experienced this sector from supply and demand
- Driven new operating models for cable systems
- Brought new subsea technology to market
- Connecting continents, cultures and communities

How did this begin?







Science and Society: Global Ocean Health

- *Key ocean health issues*: Include global warming, acidification, extinctions and loss of biodiversity
- *Long-term disruptions:* Ocean temperature is key factor, particularly related to future changes with global warming and sea level rise
- *Short-term disruptions:* Extent and impact of periodic seabed and coastal destruction, and ecosystem modification, by tsunamis and slope failures
- *Monitoring:* Health and status of marine environment could be monitored in real-time on a global basis through a new generation of ocean micro-observatories

Accelerating Ocean Exploration

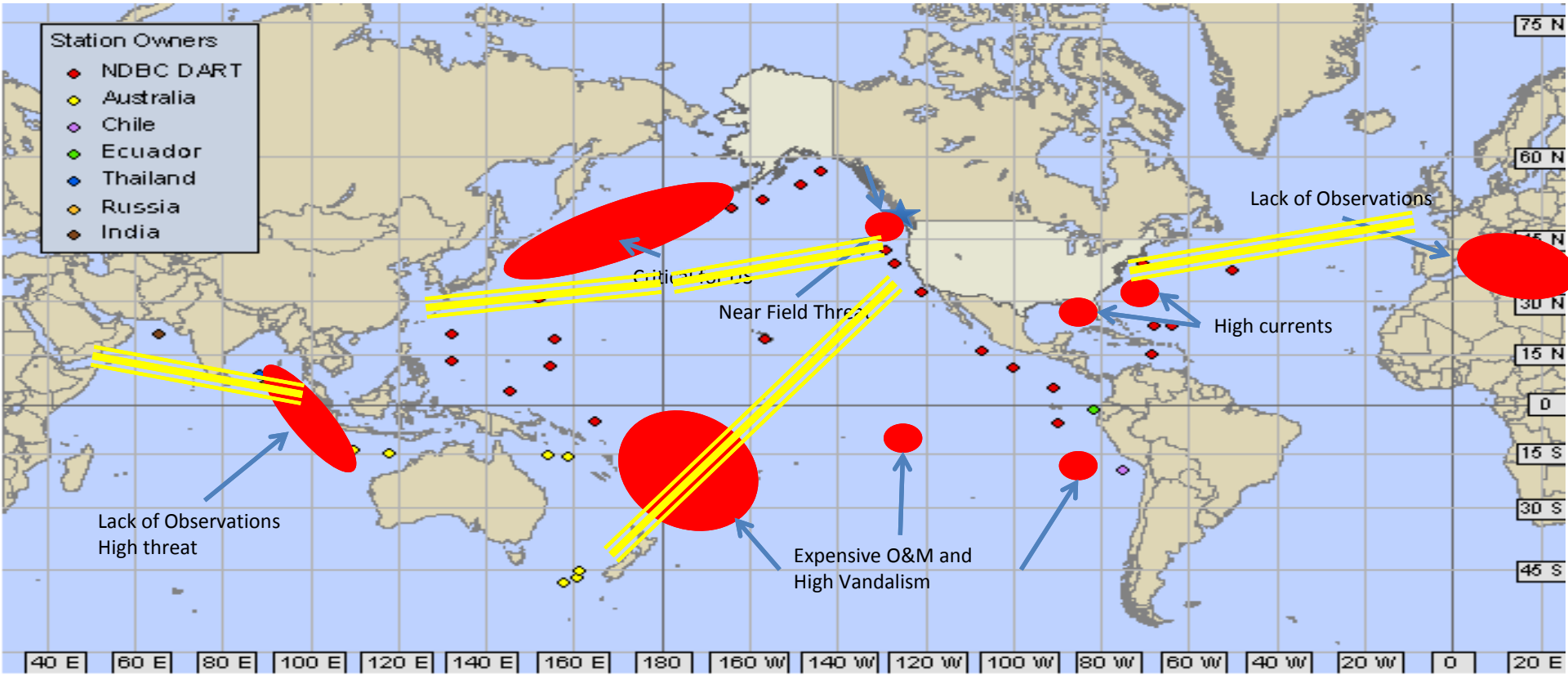
Marcia McNutt, Editor-in-Chief of Science. August, 2013 editorial:

"Recently, however, exploration has taken on a more urgent imperative: to record the substantial changes occurring in largely undocumented regions of the ocean. With half of the ocean more than 10 kilometers from the nearest depth sounding, ecosystem function in the deep sea still a mystery, and no first-order baseline for many globally important ocean processes, the current pace of exploration is woefully inadequate to address this daunting task, especially as the planet responds to changes in climate. To meet this challenge, future ocean exploration must depart dramatically from the classical ship-based expeditions of the past devoted to mapping and sampling."

Summary – what is required?

- Sensors:
  - ✓ Pressure
  - ✓ Temperature
  - ✓ perhaps Acceleration
- Widely spaced locations okay
- Even-spaced fixed locations
- Real time data - important
- No site visits after deployment

Where do we need to measure?



Establishing the JTF

- ITU, WMO and UNESCO IOC organized the 1st Workshop on Using Submarine Telecommunications Cables for Ocean and Climate Monitoring and Disaster Warning which took place in September 2011, in Rome, Italy.

- This workshop closed with the adoption of a Call to Action inviting ITU, UNESCO IOC and WMO to establish and coordinate a ***Joint Task Force***:

"To develop trans-ocean mini observatories to measure seafloor temperatures and hazards over several decades"

The JTF Initiative: the future

The deep ocean is largely unknown….

- How could submarine cables be used as a real-time global network to monitor climate change and provide tsunami warnings?
- A new generation of regional scientific cabled ocean observatories is emerging at selected sites, but with a need and opportunity to extend observations and monitoring over much wider area of the global oceans.
- Submarine telecommunication cables equipped with sensors to measure key variables (e.g. water temperature, pressure and acceleration) on ocean floor are viewed as vital to monitor climate change and to provide tsunami warnings.

JTF Structure: established six committees

- Executive (Chris Barnes/David Meldrum)
- Science and Society (Rhett Butler)
- Engineering (Chris Meinig > now Bruce Howe)
- Business Model (Michael Costin/Antoine Lecroart)
- Legal (Kent Bressie)
- Publicity, Outreach &Marketing (Nigel Bayliff/Peter Phibbs)
- Secretariat support provided by ITU, ½ person per year

Annual workshops (Rome ‘11, Paris ‘12, Madrid ’13)
Planned for Singapore ’14, to coincide with Industry event
Monthly Executive and regular Plenary global conference calls

JTF Members: 90 from 50 organisations

- Alcatel-Lucent
- AQEST
- Arctic Fibre Inc
- Axiom
- BT Design
- Bureau of Oceans, Environment and Science, U.S. Department of State
- Climate Associates
- David Ross Group
- ETH-Zurich
- European Seas Observatory NETwork (ESONET)
- Fiberhome Technologies Group
- France Telecom
- France Telecom Marine
- Fujitsu
- Gartner Inc.
- GNS Science
- Huawei Marine Networks CO.,LTD
- Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and connected Seas (ICG/NEAMTWS)
- Intergovernmental Oceanographic Commission of UNESCO
- International Cable Protection Committee (ICPC)
- International Telecommunication Union (ITU)
- International Tribunal for the Law of the Sea
- Istituto Nazionale di Geofisica e Vulcanologia (INGV)
- Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM)
- Libya, Ministry of Communications and Informatics
- Mallin Consultants Ltd.
- Ministry of Foreign Affairs, Greece
- Nansen Environmental and Remote Sensing Center
- NASA
- National Authority for Management and Regulation in Communication of Romania
- National Oceanic and Atmospheric Administration (NOAA)
- NEC Corporation
- Netherlands Institute for the Law of the Sea, Utrecht University School of Law
- Nexans Norway AS
- Ocean Observations Panel for Climate (OOPC)
- Puertos del Estado, Spain
- Scottish Association for Marine Science (SAMS)
- Scripps Institution of Oceanography
- Sea-Bird Electronics
- Sea Risk Solutions LLC
- Swiss Maritime Navigation Office (SMNO)
- TE SubCom
- Teledyne ODI / Teledyne Oil & Gas
- Telefónica
- Telefónica International Wholesale Services
- UN Office of Law and Sea (DOALOS)
- University of Hawaii
- University of Milano-Bicocca
- University of Stockholm
- University of Sydney
- University of Tokyo
- University of Victoria
- University of Washington
- U.S. Geological Survey
- Vrije Universiteit Brussels
- Woods Hole Oceanographic Institution (WHOI)
- WILTSHIRE & GRANNIS LLP
- World Meteorological Organization (WMO)
- World Ocean Council (WOC)
- Zimbabwe National Water Authority

JTF 2011: Objectives of the Task Force

Short term objectives:

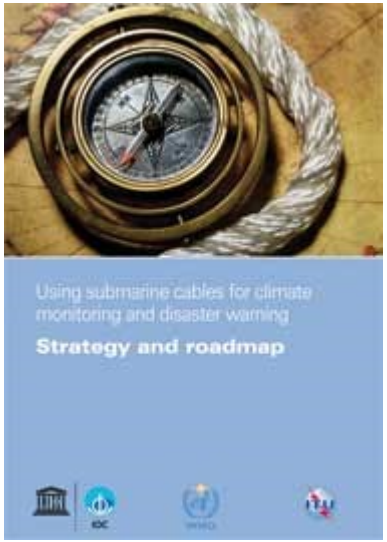
- Define needs
- Investigate technical feasibility
- Sketch out pilot project:
  - ✓ Build trust and confidence
  - ✓ Demonstrate impact
- Estimate costs
- Identify partners
- Report back to next workshop

Long term objectives:

- Draw up business model
- Study legal aspects
- Enable the availability of submarine repeaters equipped with scientific sensors for climate monitoring and disaster risk reduction

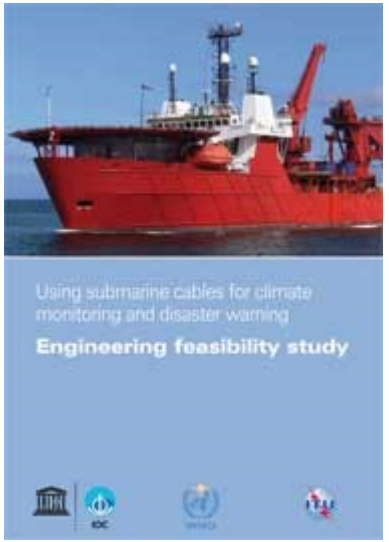
JTF 2012: Three reports released

Rhett Butler



Kent Bressie

Peter Phibbs



JTF 2012: Evaluation of the JTF initiative

Pro:

- Distributed seabed sensors across oceans have unique value
- Without such sensors we cannot fully understand ocean processes
- Submarine telecommunications systems offer a platform for these sensors
- Supporting such sensors would be a positive gesture by system owners and suppliers

Con:

- Changes to repeaters are a serious issue
- Commercial and legal issues will be system specific
- Who pays is unresolved

JTF 2013: Technical feasibility

- Appears technically feasible at this stage
- Iteration to match science goals with telecom requirements
- Next steps
  - ✓ Detailed technical requirement document to be produced (Mallin study)
  - ✓ Continue to pursue ongoing improvements in sensors (Sci/Soc & Eng Comms + industry)

JTF 2013: Commercial feasibility

- Call for funding to vendor community – partial success
- $24,000 collected from three parties, further four declined
- Additional funds sought to enable both studies
- Business Models being studied to identify potentials
- Estimates of 4-8% increase in cable construction costs
- Next steps
  - ✓ Detailed study needed to identify potential sources of pilot and development funds (funding study)

JTF 2014: Pilot – Green Cable Initiative

- A wide network of micro-observatories could be established at many places across the world's ocean floors to measure these important parameters accurately over several decades
- The initiative addresses two main issues: a) need for sustained climate-quality data from sparsely observed deep oceans and continental slopes, but extending into coastal waters; and b) desire to increase the reliability and integrity of the global tsunami warning networks
- Presently, plans are being developed to launch a pilot project with active involvement of cable industry players and existing ocean observatory researchers

JTF 2014: Snapshot Update

- This JTF initiative has real merit, responding to urgent societal needs
- To be successful it requires:
  - ✓ technical support from industry – in place, needs some funding
  - ✓ cooperation from owners and suppliers – starting, further encourage
  - ✓ iteration between scientists and industry – due mid-year
  - ✓ initial funding for proof of concept (pilot project) – study about to start
  - ✓ operation business model once concept is proven and costs are known
- These new global data are critical for understanding and managing ocean health, ecosystems, and for mitigation strategies for future climate change and natural hazards

Challenges & Opportunities

- Macro Needs and Solutions are now well known
- Permit challenges could be overcome
- Strategy, Legal & Engineering papers are clear
- Sensor Design is showing convergence
- Vendors can develop, manufacture and deploy
- Design, Development and Deployment

- all have a common issue

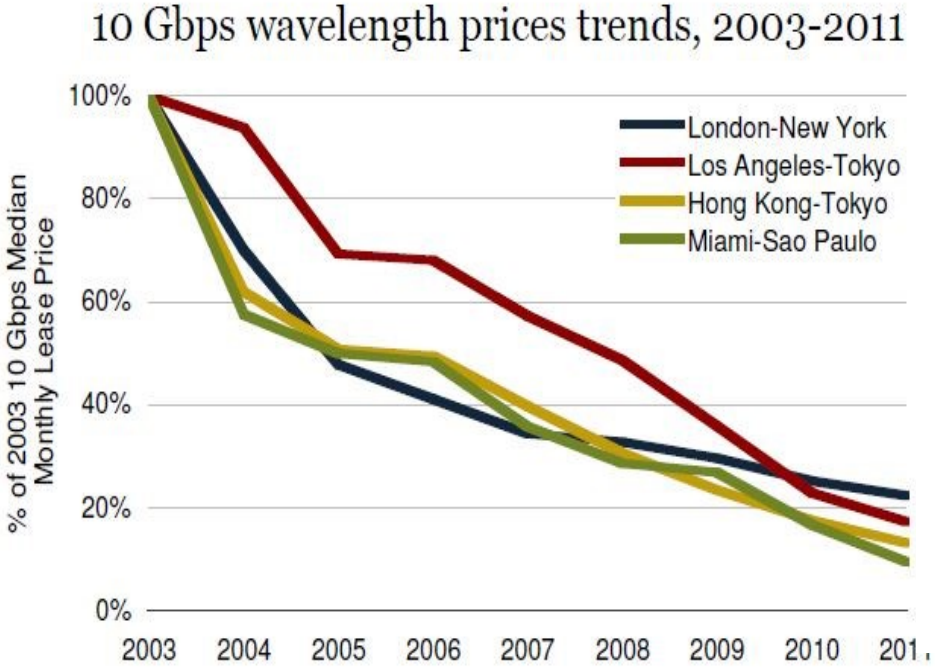
"Show me the money" – Funding

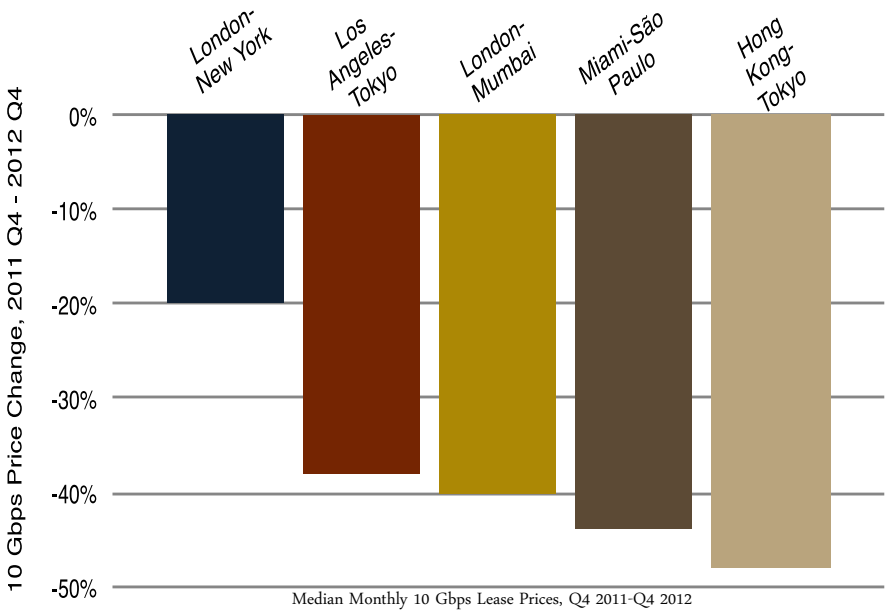
Shouldn’t “Industry” absorb the cost

- Early thoughts that owners & vendors may fund
- Commercial pressures – rise of free internet
- Significant price erosion for international carriers
- Oil & Cu/Fe rises causing margin squeeze in supply
- LON-NYC ring 1999; close to $1bn > 2.4Tb
- Same Scope 2013; conservatively $300M > 60Tb
- Cable developers want to minimise build costs

“no pot of gold to fund science and research”

Shouldn't "Industry" absorb - Carrier view





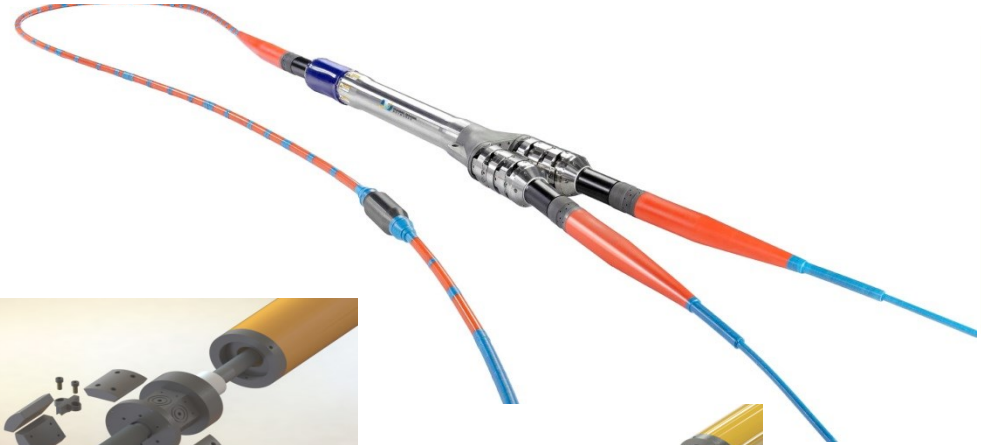
Source: Telegeography

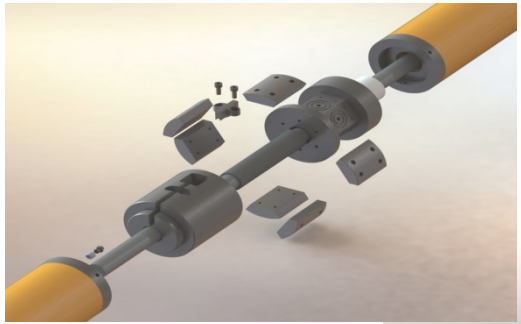
What about Technical Challenges?

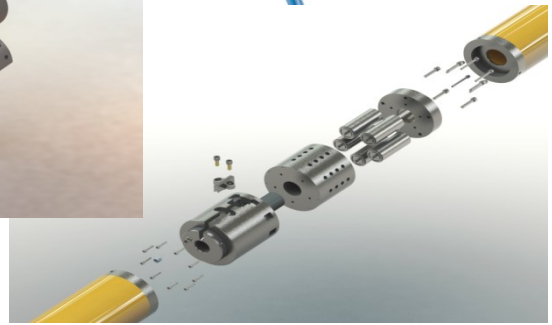
- Mechanical is easy to solve, connectivity harder
- Bringing data back on-shore is a key factor
- Loss of in-band capacity is a huge revenue threat
- Out-of-band could be ‘something for nothing’
- Low impact will enhance chances of acceptance

  “Money is the key issue, again – what contribution?”

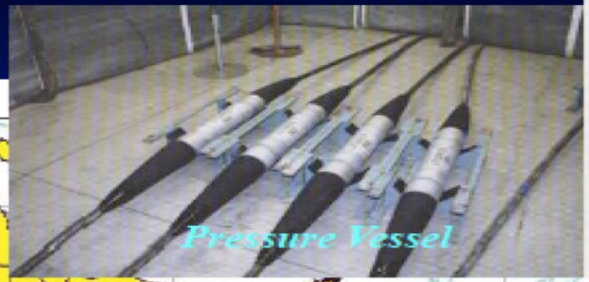
Technical Challenges can be handled

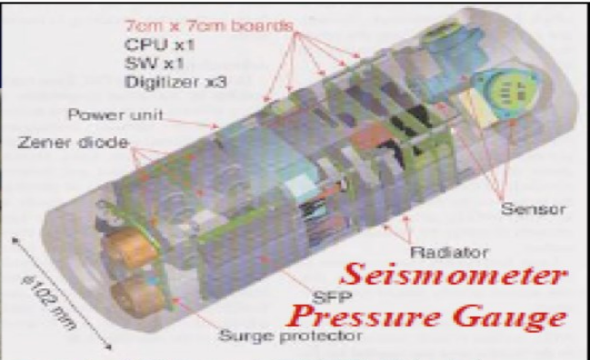


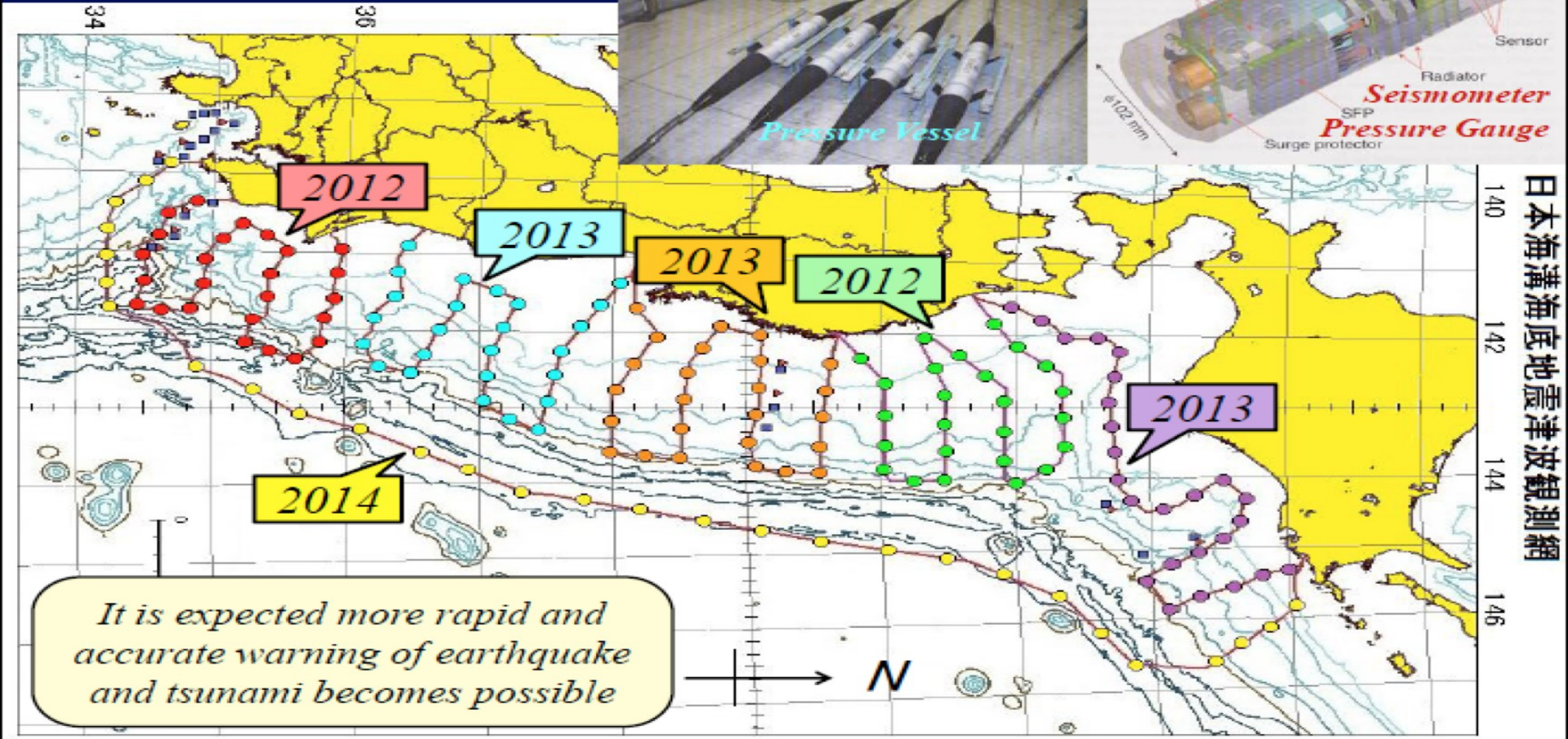




Ocean bottom cabled network along Japan trench







It is expected more rapid and accurate warning of earthquake and tsunami becomes possible

Is there ANY money at all?

“It is good to be green & good to be seen”

- Philanthropists? – regional development funds
- World Bank –funds for inter-regional activities
- Development Banks – life-saving, green project
- Green credentials attractive – Oil & Gas companies
- Insurance Market – prediction and prevention monies
- Study these potential sources formally and build a ‘desire to fund’ from this community

Challenge for the JTF and community

- Search out the funds and potential investors
- Coordinate and collaborate for a universal solution
- Continue to raise awareness, educate and publicise
- Educate governments to facilitate permits and funding

"*A small group of thoughtful people could change the world. Indeed, it's the only thing that ever has." – Margaret Mead, 1981*

- You are already part of this small, thoughtful group –

Thank You

Links and further information

- ITU/WMO/UNESCO-IOC Joint Task Force
  http://itu.int/ITU-T/climatechange/task-force/sc/index.html

- ITU-T and climate change
  http://www.itu.int/ITU-T/climatechange

- The Secretariat of the ITU/WMO/UNESCO IOC Task Force is provided by ITU and can be contacted at: greenstandard@itu.int