

V. Discussion – Deep Ocean Sensors and Technology

- Difference in sensor technology for global vs regional observational purposes
- Variation in platform needs (cabled junction box vs float)
- New sensors in development (prototype vs mature) and sensor readiness testing protocols

Comments and questions to prompt discussion –

Technology and sensor needs to feed into next iteration of science working groups

Technology for global vs regional observational purposes

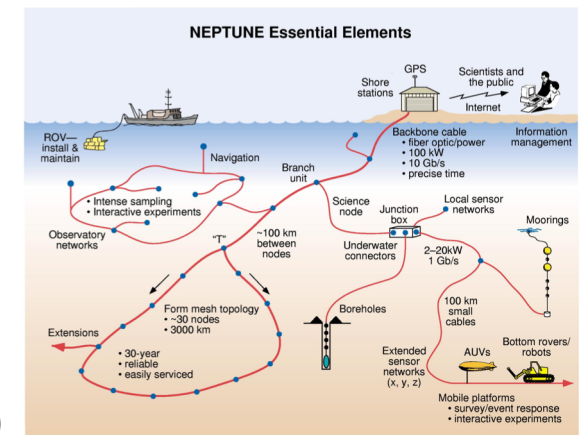
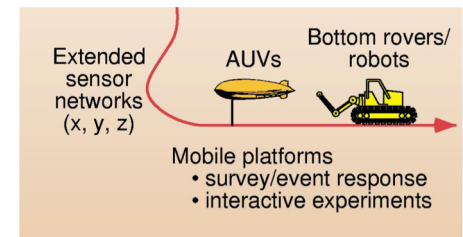
- Global usually implies large scale deployment, more units, simple, higher TRL, less expensive per unit. KISS. EOVs.
- These sensors deserve continuing improvement (cal stability, mass/volume, cost), while maintaining continuity.
- Regional implies more specialized, lower TRL/higher risk science, costly. EOVs + research units (mass specs, spectrometers, video, ESP, ...)
- Both require a mix of fixed and mobile platforms
- Challenges in the deep ocean: longevity, pressure resistance, power, communications and timing, miniaturization, corrosion, drift correction, and deployment, communications, recovery (or throw-away) costs.
- Continuing need to develop sensors for cabled, autonomous, robotic platforms, as costs << ships.

Sensor technology for global vs regional observational purposes

- Transition regional -> global ~ (pilot -> mature)
- New technology to reduce costs:
 - 3-d printing
 - Use buoyancy for p-cases
 - Use recovered p-cases (e.g., cables)

Platform needs – fixed and mobile

- Power ultimate constraint
- Cable systems for sustained measurements, enable sustained event and mobile
- A balance between fixed and mobile – Nyquist in x and t, mixed x,t, coherent vs incoherent arrays
- Need to increase spatial footprint:
 - AUV docking, routine missions (99%) – not sitting around for events, but sampling – Nyquist
 - AUV trucks to service autonomous instruments
- Mobile need navigation/positioning, comms – (gliders $\pm 80 / 700$ km) – incorporate tomography



NEPTUNE Feasibility Study, 2000

Platform needs – fixed and mobile

- From current discussions, what are some platform use cases?
- How does widespread repeat mapping of bottom fluxes rank?
- What is demand for sustained AUV use?
- What can be done to accelerate integration?
- What can be done to reduce o&m?
- “autonomous” power
- “small” fiber cables - PoF

New sensors in development and sensor readiness testing protocols

Example sensor types:

- Pressure (crystals-> amorphous solid/liquid; optical clocks: time and gravity!)
- Distributed Fiber Optic Sensing – strain and temperature – the power of the network (per acoustics)
- Lab on chip
- Mass spec, raman spectroscopy, LIBS,
- Bio-optical
- Turbulence
- Omics
- Deep, Hadal
- Optical and acoustic imaging
- Flow cytometry

New sensors in development and sensor readiness testing protocols

Questions

1. What existing sensors “deserve”/need improvement? Priority?
2. How best to extend capabilities / accuracy (per R. Feely)?
3. For previous examples – TRL(t)?
4. What new sensing concepts on horizon?
5. Is another X-Prize or similar needed/possible?
6. Adapt from different communities?
7. Sensor readiness – best practices?