National Tidal Energy Platform

Concept Proposal

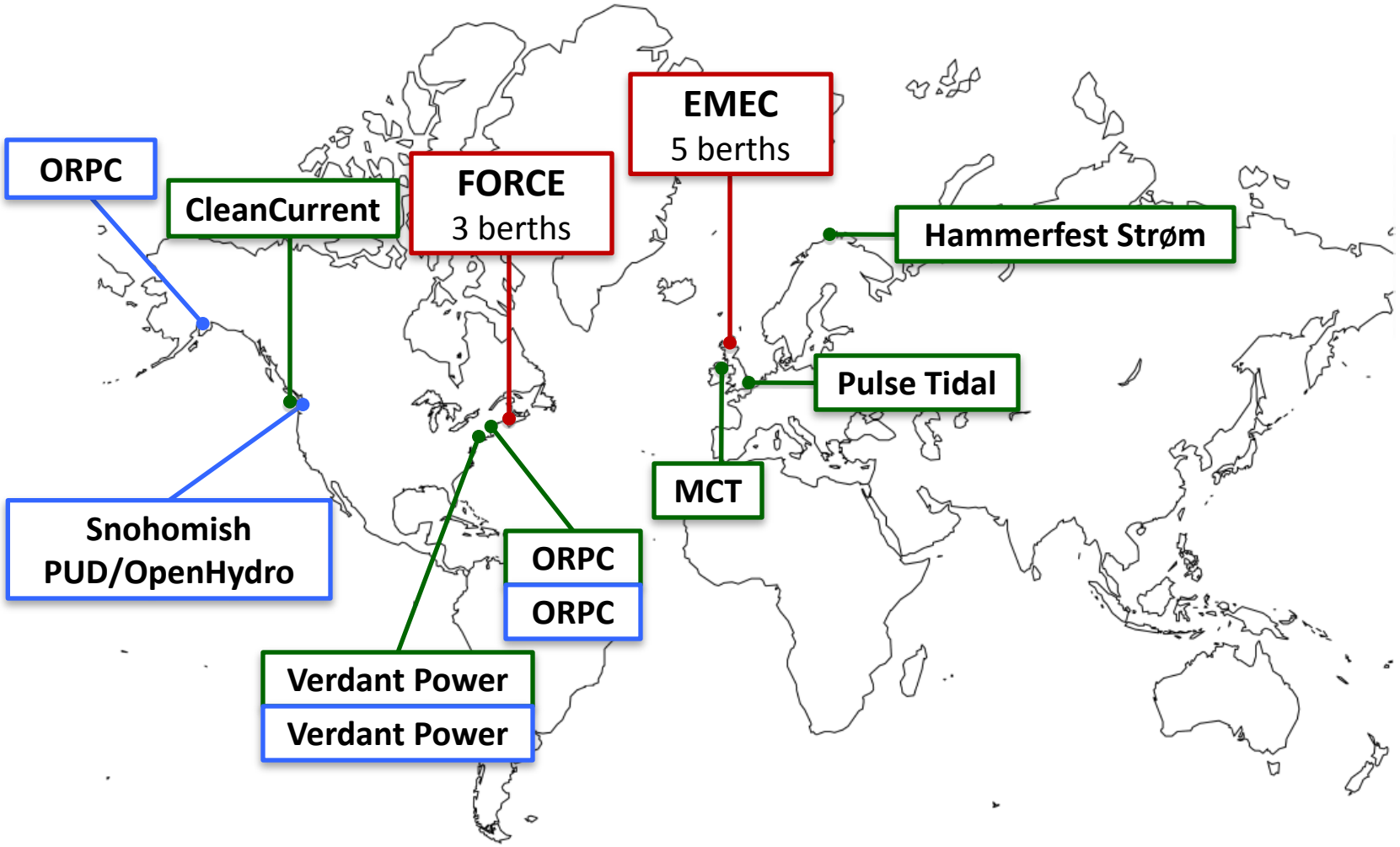
Marine Hydrokinetic Testing Needs and Existing US Capabilities

September 9, 2010

Need for a National Test Site

- Lack of at-sea test facilities for tidal energy is a major barrier to technology innovation.
- Regulatory process currently weights *ad hoc* testing towards environmental monitoring.
- A truly integrated test platform must address technology readiness, environmental effects, and cost effectiveness.
- Opportunity for US to show worldwide leadership
  - Existing worldwide facilities only partially meet requirements.
  - Existing worldwide facilities are at resource and geographic extremes.

Device Testing Lessons

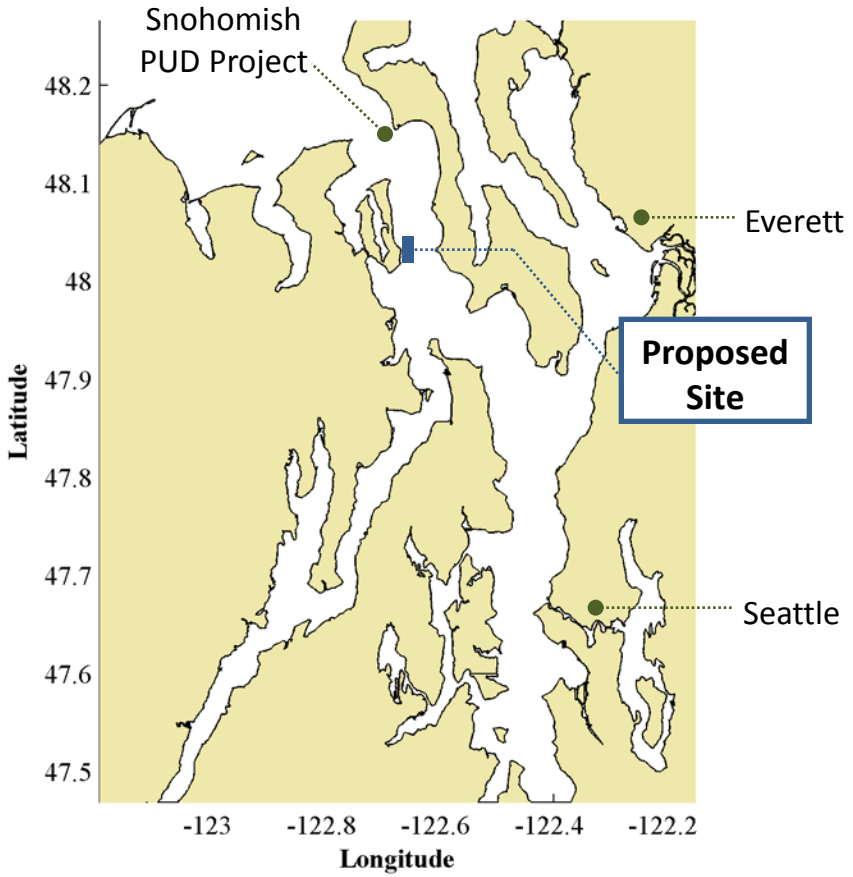


Test Platform Goals

- Provide a fully **instrumented and permitted platform** for testing tidal energy conversion devices.
- Provide **objective performance evaluations** of tidal energy devices in realistic conditions.
- Provide **comprehensive environmental monitoring** to study potential environmental effects of tidal energy conversion.
- **Accelerate commercialization** by reducing development cost and uncertainty.

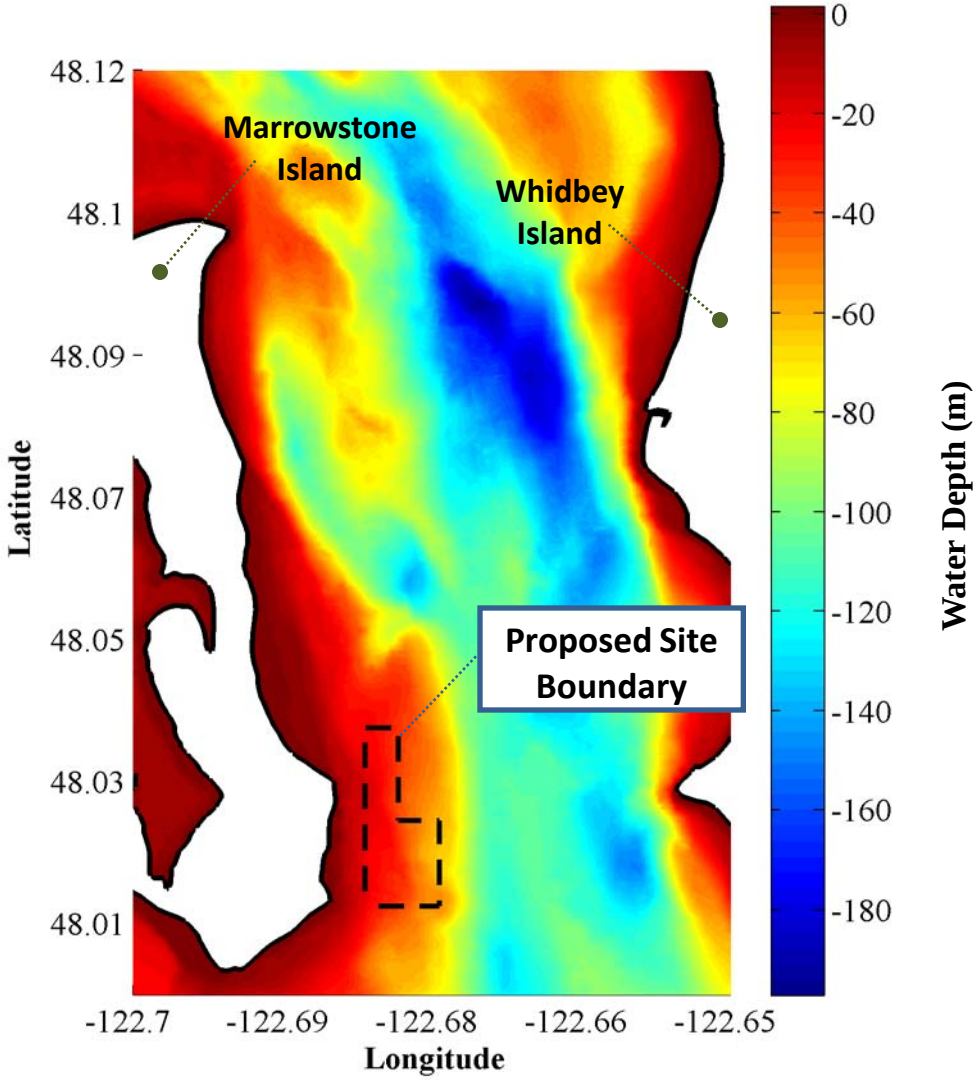
Site Selection Criteria

- Energetic tidal resource, *but* a logical transition from lab to field
- Capability to test a range of device scales and technology readiness levels
- Proximity to electrical grid
- Proximity to maritime operation and manufacturing capabilities
- Outside of federal shipping lanes
- No conflict with pilot or commercial deployment plans



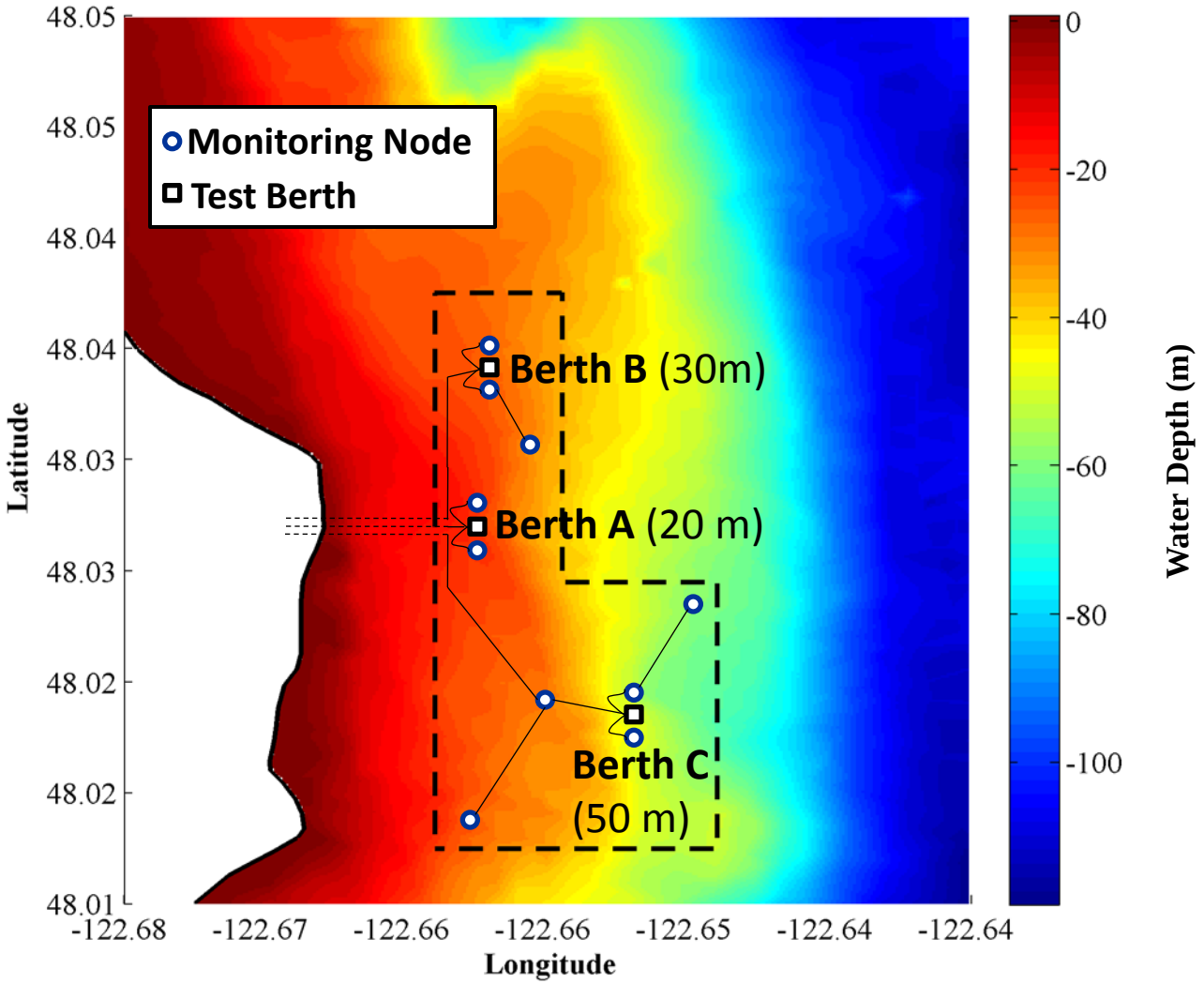
Site Characteristics

- Realistic hydrokinetic resource
  - —Peak currents ~ 2.5 m/s
  - —Kinetic power density ~ 0.5 kW/m^2
- Depth ranges from 20 to 50m over 1km distance
- Full range of aquatic species present
  - —Fish
  - —Marine mammals
  - —Diving seabirds



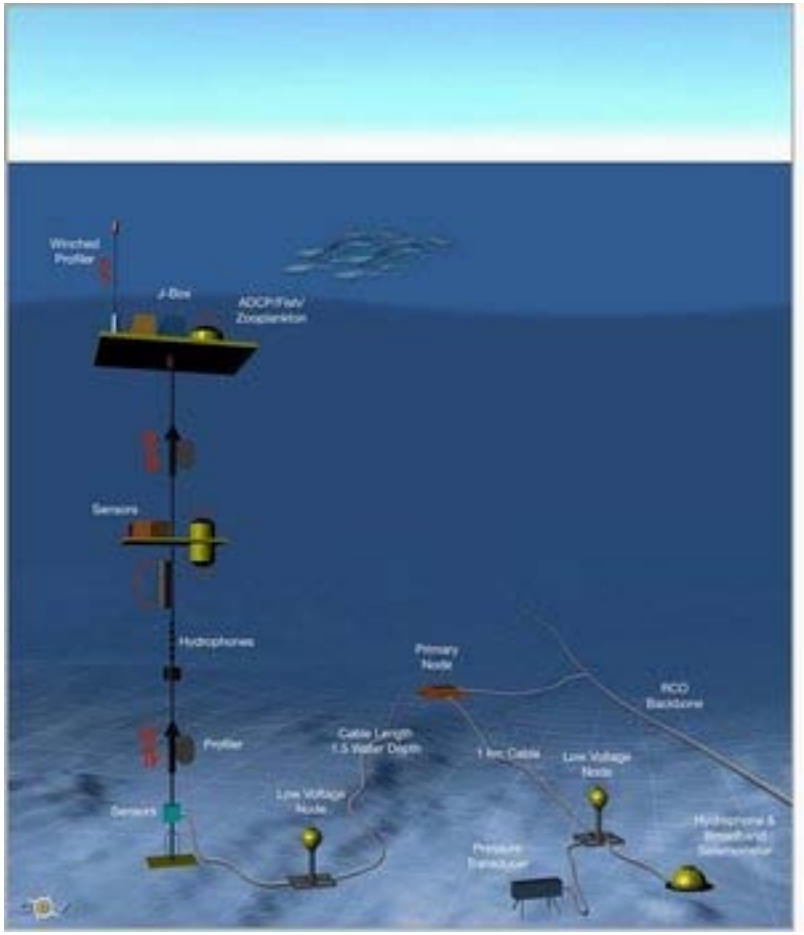
Infrastructure Concept

- Grid connection
- Environmental and performance monitoring nodes
- “Plug and Play” foundation for Berth A
- Power and data “socket” for Berths B and C



Leveraging Infrastructure Development

- Build on NSF Ocean Observing Initiative
- Fiber optic to Ethernet: real-time observations
- Robust nodal architecture, "daisy chain" interconnections
- Simple retrievals for service/upgrade (independent from tidal device maintenance)
- Potential to integrate proven technologies next to beta

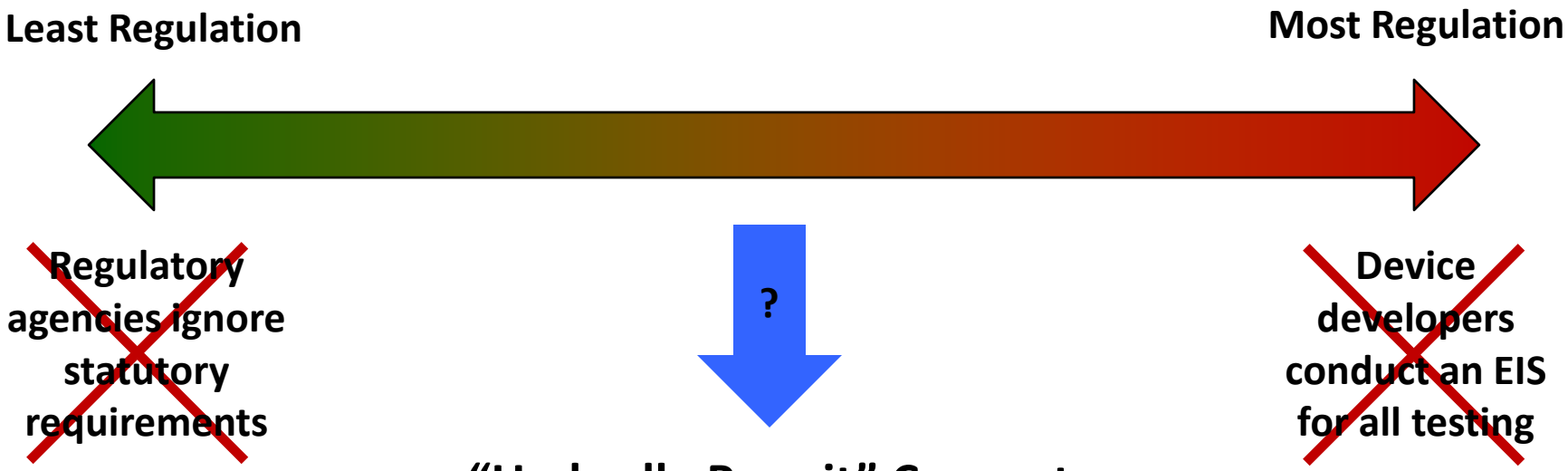


UW-APL Regional Scale Nodes project

Instrumentation Gaps

	Status	Example Gap
Site Characterization	Evolving	Species-specific presence and absence
Device Performance	Evolving	High fidelity measurements of rotor inflow conditions
Environmental Monitoring	Nascent	Effects of turbine on individuals to a range of tens of meters

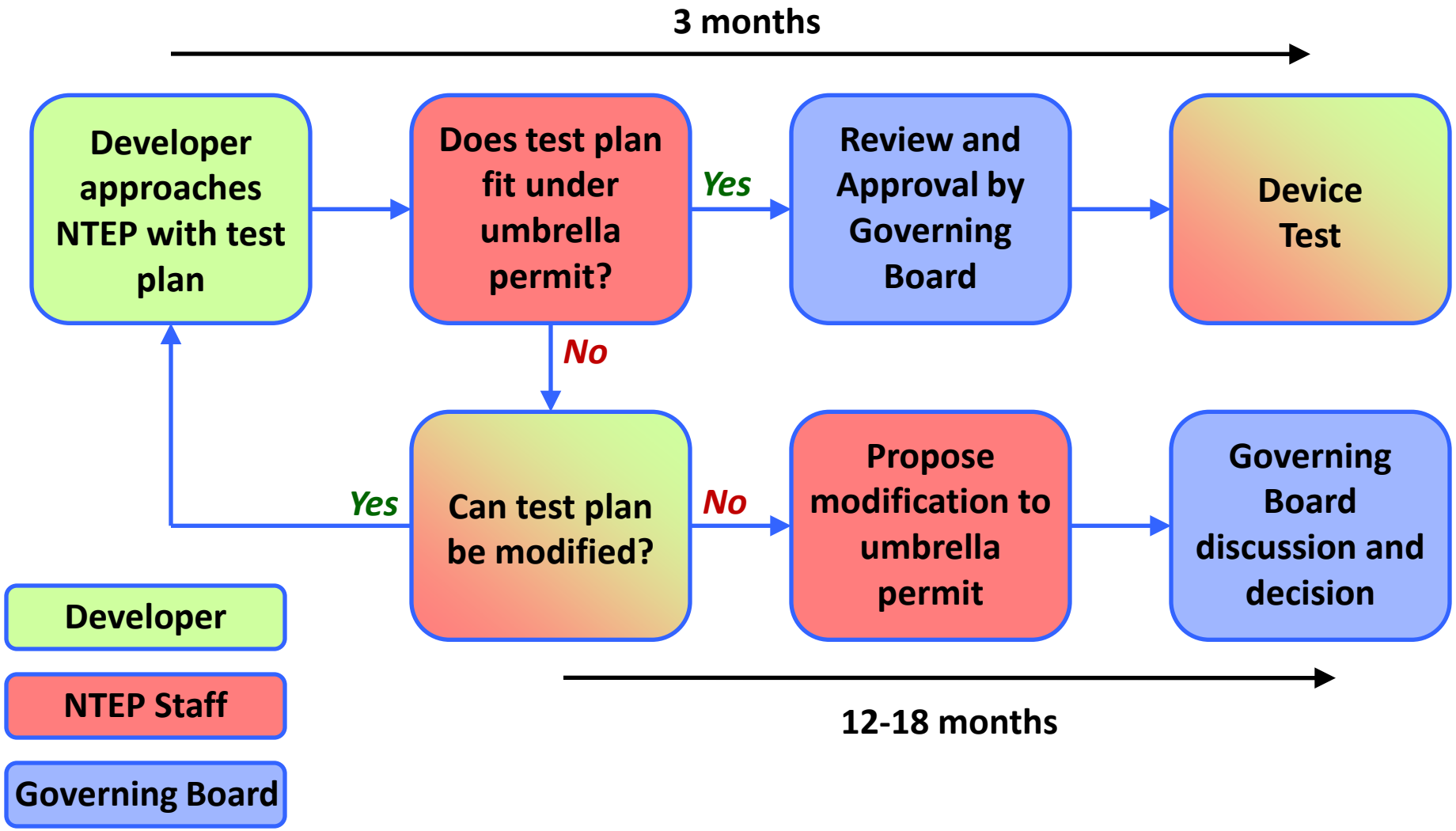
Permitting for Facility Operation



"Umbrella Permit" Concept

- Permit tests which fall under an umbrella of defined parameters (rotor RPM, duration of testing, seabed disturbance, etc.)
- Maintain regulatory review of planned test activities to ensure compliance with umbrella permit
- Include adaptive management framework to modify umbrella permit, if necessary

Umbrella Permit Implementation Goal



Utility-Scale Test Platform Economics

Public Funds
(State and Federal)

- Baseline characterization
- Permitting
- Design
- Construction
- Operations start-up
- Decommissioning (bond)

$10-$30M

User Fees

- Testing operations and personnel
- Infrastructure upgrades
- Infrastructure replacement

$1-$2M/yr

Collaborations to Reduce Cost

- Given limited public funds and industry capitalization, collaboration between test platforms is required to reduce costs.
- **Infrastructure** required for power take-off and data transfer will be common across technologies. Some monitoring instrumentation will also be cross-platform.
- **Permitting barriers** will be common for all platforms, but each will have specific, local considerations.
- **Standardized test protocols** for performance and environmental monitoring, to the extent possible.
- Creative approaches to securing **intellectual property**, while disseminating lessons learned to the broader community.