

# ***Progress Report on Comparisons of East China Sea Bottom Scattering Strengths at Low Frequency***

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# Report Documentation Page

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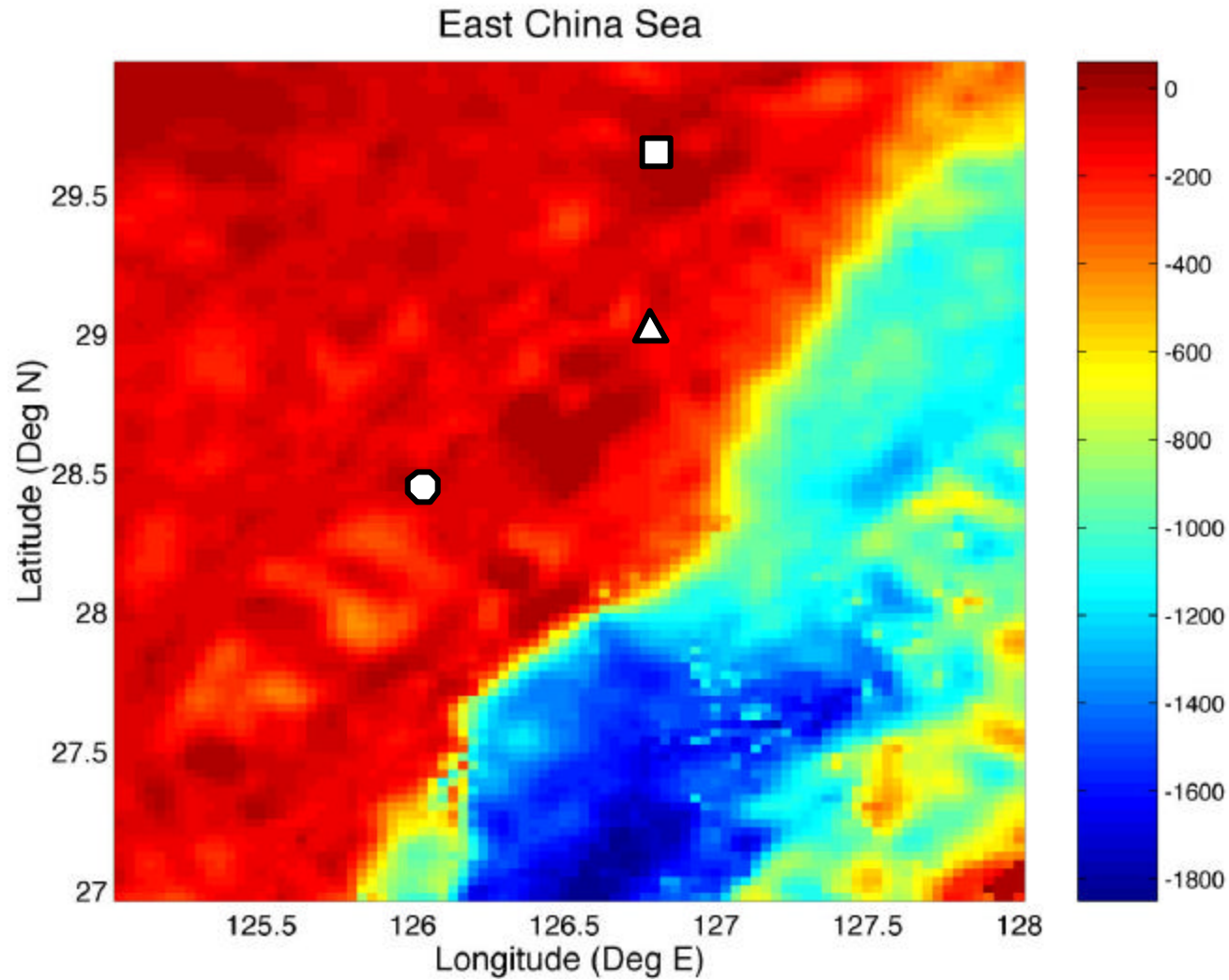
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# ECS Bottom Scattering Strength Determinations

- ASIAEX
  - *Date:* August 2001
  - *Location:* 29°39'N 126°49'E
  - *Source Weight/Depth:* 1 kg/50 m
  - *Receiver Depth:* 5-90 m (30 element VLA)
  - *Geometry:* Monostatic reverberation
- Navy Test #1
  - *Date:* September 1998
  - *Location:* 28°30'N 126°00'E
  - *Source Weight/Depth:* 2 kg/50 m
  - *Receiver Depth:* 45 m (nominal) (64 element HLA)
  - *Geometry:* Bistatic reverberation
- Navy Test #2
  - *Date:* 1998
  - *Location:* 29°05'N 126°43'E
  - *Source Weight/Depth:* 0.8 kg/18 m
  - *Receiver Depth:* 27 m
  - *Geometry:* Monostatic reverberation

# Bottom Scattering Strength Measurement Sites

- ASIAEX
- Navy #1
- △ Navy #2



# Bottom Scattering Strength Estimation

- Method 1 (ASIAEX, Navy Test #2): Extract scattering strength from reverberation intensity
  - Scale reverberation level for source energy and 2-way transmission
  - Adjust for area contributing to instantaneous reverberation level

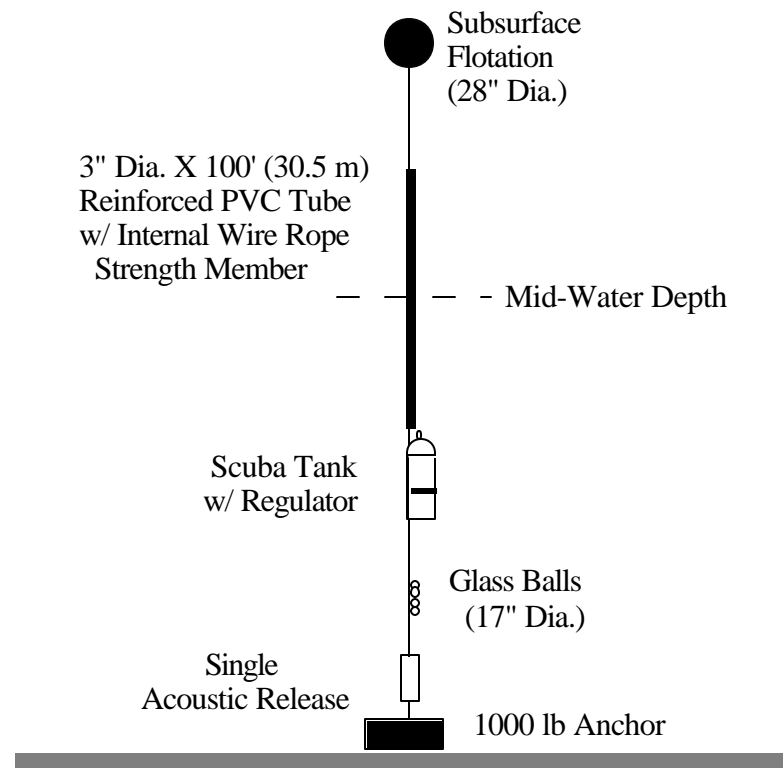
## *Issues/Assumptions:*

- Source level known vs frequency & measurement range
- Transmission known vs frequency & range
- Method 2 (Navy Test #1): Compare bottom target strength & target strength of reference target
  - Compare energy scattered from near-bottom known target with energy scattered from bottom near target
  - Adjust bottom target strength for contributing area

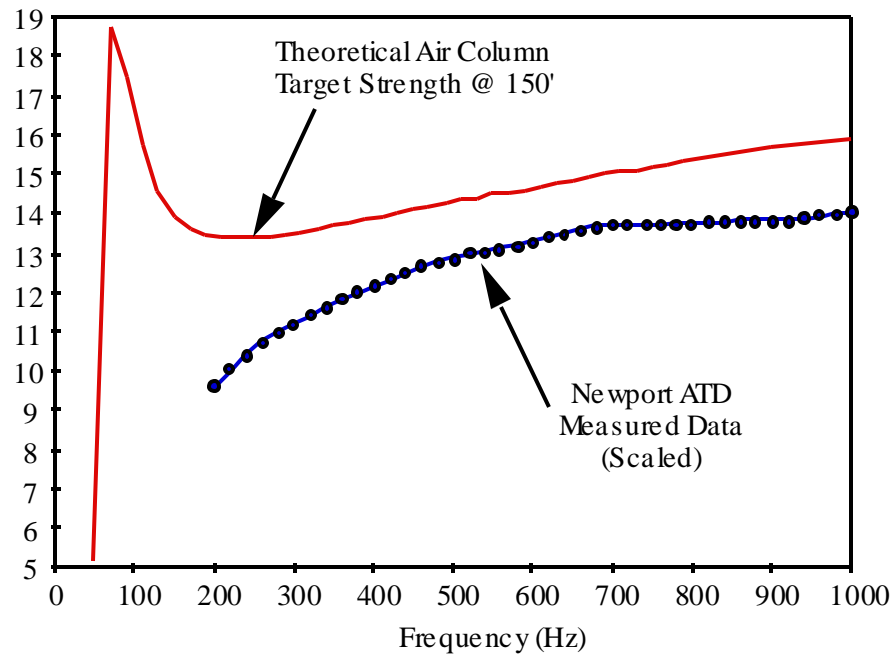
## *Issues/Assumptions:*

- Same transmission to target & bottom
- Reference target strength known vs frequency
- Both methods typically assume scattering region homogeneity & isotropy

# Passive Reflector Schematic



# Passive Reflector Target Strength









# Summary & Conclusions

- Three separate estimates of East China Sea low frequency integrated bottom scattering strength have been compared
  - Two measurements - ASIAEX & Navy test#2 - were made at closely spaced sites (56 km separation) using same method
    - estimates agree closely
  - One measurement - Navy test#1 - was made at a removed site (140 km separation from ASIAEX) using different method
    - estimates differ from ASIAEX & Navy test#2 results
- Several questions of physics are being probed, the interaction of which affect the interpretation of the scattering strength determinations
  - Source level range dependence expected
    - Consequence of explosive source & nonlinear propagation characteristics
  - Monotonic decrease of scattering strength with range expected
    - Consequence of high angle stripping & scattering strength grazing angle dependence
  - Maximum  $f^3$  dependence of scattering strength expected
    - Consequence of Born approximation scattering applied to sub-bottom scatterers

# Plans

- Complete analysis of bottom scattering strength
  - Refine frequency dependency arguments
- Research sub-bottom characterizations for ASIAEX/Navy test#2 sites and for Navy test#1 site
- Undertake construction of scattering strength model