9:45

3aSP5. Source level measurements of a cavitation noise source in a water tunnel using a time reversal mirror. Christopher Barber (Appl. Res. Lab., Penn State Univ., P.O. Box 30, State College, PA 16804, dcb150@psu.edu) and Gerald C. Lauchle (Penn State Univ., University Park, PA 16802)

An experiment conducted in 2001 at the Penn State Garfield Thomas Water Tunnel demonstrated the use of a time reversal mirror to acquire acoustic measurements of a cavitation noise source. Preliminary results presented at the 142nd Meeting of the ASA (Fort Lauderdale, FL) indicated an improved capability to measure low signal-to-noise ratio (SNR) sources compared to measurements made using omnidirectional or sum-beam sensors. Final experimental results, including calibrated source level estimates, are presented and compared to results from conventional measurements. Key experimental findings regarding the capabilities and limitations of the technique, as well as applicability to acoustic measurements in other types of flow-facilities, are discussed. [Work supported by ONR Code 334, Naval Surface Warfare Center Carderock Division, and the Penn State Applied Research Laboratory.]

WEDNESDAY MORNING, 17 NOVEMBER 2004 WINDSOR ROOM, 7:55 TO 11:50 A.M.

Session 3aUW

Underwater Acoustics: Very High Frequency [0 (100 kHz)] Boundary Interactions

Gary J. Heald, Chair

DSTL, Naval Systems, Winfrith Technology Centre, Dorset, Great Britain

Chair's Introduction—7:55

Invited Papers

3a WED. AM

8:00

3aUW1. Mechanisms of seafloor scattering: Roughness vs discrete inclusions. Anatoily N. Ivakin (Appl. Phys. Lab., Univ. of Washington, 1013 NE 40th St., Seattle, WA 98105, ivakin@apl.washington.edu)

A model of high-frequency scattering from the seafloor is developed taking into account discrete inclusions in the sediments. The model allows prediction of bottom reverberation, given material parameters of the sediment and inclusions and the size–depth distribution of inclusions. The frequency-angular dependencies of the seabed backscattering strength for various types of the sediment and inclusions are calculated and discussed. An environmental data set obtained at SAX99 site (near Walton Beach, Florida), including the sediment particle size–depth distribution and the water–sediment interface roughness spectra, was used to compare contributions of volume and roughness components of the seafloor scattering. It is shown, in particular, that contribution of gravel and shell inclusions and coarse sand fraction in total scattering can be dominating (over roughness) at very high frequencies (about 100 kHz and higher) and grazing angles above critical (about 30 deg), while roughness at SAX99 site is likely a dominating mechanism of bottom scattering at lower frequencies and grazing angles below critical. A combined model, taking into account both roughness and volume discrete scattering, is shown to be a good descriptor of bottom reverberation in a wide frequency-angular range. Possibilities for inversion of various sediment parameters from backscattering data are discussed. [Work supported by ONR, Ocean Acoustics.]

8:25

3aUW2. Acoustic backscatter at very high frequencies from rough seabeds. Richard J. Brothers (QinetiQ, Bincleaves Technol. Park, Weymouth, Dorset DT4 8UR, UK), Gary J. Heald (DSTL, Winfrith, Dorset, DT2 8XJ, UK), Gary Robb, Timothy G. Leighton (Univ. of Southampton, Southampton SO17 1BJ, UK), and Justin Dix (Southampton Oceanogr. Ctr., Southampton, SO14 3ZH, UK)

Acoustic backscatter data were gathered from a variety of seabed types, both in the laboratory tank and in coastal waters. Data were gathered from sandy sediments in the tank, with a variety of characterized rough surfaces, using narrow-band pulses at frequencies between 100 and 950 kHz. Wideband data gathered at sea were obtained at frequencies between 80 and 650 kHz. Data gathered at sea from the Acoustic Range at QinetiQ Bincleaves included backscatter from the natural sandy seabed, but also scatter from several artificial sediments (sand, gravel, and pebbles) placed in a rotator. The latter equipment allowed acoustic interrogation of the same patch of seabed from multiple angles. Experimental data are compared with fluid, poroelastic, and discrete scatterer models, with a view to recommendations for the modeling of seabed backscatter in the frequency band 100 kHz to 1 MHz.