R/V Neil Armstrong SVC III, Acoustic Test Plan

**DRAFT**

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To fulfill the purposes of R/V Neil Armstrong Scientific Verification Cruises (SVC’s), we are proposing an acoustic test on the Alvin Canyon, which will be utilizing the following shipboard equipment and crew supports, so will provide a great opportunity to verify R/V Armstrong’s scientific capability.

a. Yo-Yo CTD casts and shipboard ADCP -- to obtain water column profiles in the canyon

b. Sub-bottom profiler -- to obtain sub-bottom sediment structure beneath the canyon seafloor

c. Multibeam sonar -- to measure the canyon seafloor bathymetry

d. Sonar synchronization system -- multiple acoustics tasks, including PIs’ acoustics transmission.

e. Ultra Short Base Line Navigation (HiPAP system) -- to navigate the shipboard sound source

f. Mooring deployment -- two hydrophone VLA moorings

g. Shipboard source deployment -- will hang our shipboard sources with the A frame

Our proposed test site, the Alvin Canyon, is just next to the OOI Pioneer Array Site, and one of the main activity on the SVC III is OOI mooring maintenance, which will be conducted during day time. The proposed acoustics task can be implemented at nights. This maximizes the use of the ship time.

(1) Personnel

1. Y.-T. Lin, Associate Scientist (WHOI)

2. Andrey Morozov, Research Specialist (WHOI)

3. Peter Koski, Research Engineer (WHOI)

4. David Barclay, Assistant Professor (Dalhousie)

5. Robert Mills, Engineer (JASCO Applied Sciences)

6. Dieter Bevans, Ph.D student (SIO, UCSD)

(2) Acoustical scientific goals

Underwater sound propagation can be significantly affected by physical oceanographic processes and marine geological features, both of which can be found in a submarine canyon area, so canyon acoustics has been one of our research directions in the acoustics group at WHOI. The attached figure shows a numerical model prediction of the 3-D acoustic focusing effect in a submarine canyon (Lin et al., 2015). One of the scientific goals of our test in the Alvin Canyon is to verify this 3D focusing effect. Furthermore, we would like to study the temporal variability of the sound field caused by the shelfbreak and canyon flow dynamics.



**3D focusing**

Figure 1. Three-dimensional and 2-D numerical models of sound propagation in the North Mien-Hua Canyon. A 0-dB point source transmitting 600-Hz CW sound is considered. The source depth is 61 m. Cylindrical spreading loss is factored out to reduce the dynamic range of sound intensity in the plot. The intensified spot shown in the 3D solution (b) is caused by the 3D acoustic focusing effect.

Reference: Y.-T. Lin, T.F. Duda, C. Emerson, G.G. Gawarkiewicz, A.E. Newhall, B. Calder, J.F. Lynch, P. Abbot, Y.-J. Yang and S. Jan, “Experimental and numerical studies of sound propagation over a submarine canyon northeast of Taiwan,” IEEE J. Ocean. Eng., vol. 40, pp. 237-249 (2015).

(3) Proposed acoustics tasks

Equipment

"Deep Sound" Acoustic receiver platform

AMAR Hydrophone VLA

SHRU Hydrophone VLA

Shipboard Sound Sources (400 and 900Hz)

PO Sensors

(a) First deploy two hydrophone VLA's for long term recording at the head of the canyon.

(b) at each night, we will deploy the Deep Sound platform for short term recording.

(c) Shipboard source transmission (400 Hz and 900 Hz; M-Sequence, LFM and tonal signals)

-- single station transmissions for 6+ hours with Yo-Yo CTD

-- multiple station transmission to form a couple of transects along and across the canyon (each station for 30 min with Yo-Yo CTD)

-- the source will be navigated by the USBL HiPAP system for precise positions.

(d) Shipboard ADCP, sub-bottom profiler and multibeam sonar will be ON.

Note Acoustic recordings and PO data should be shared among all of the acoustic group members.