N00236.001317
ALAMEDA POINT
SSIC NO. 5090.3

5090
Ser 1831.4/L6264
13 Jun 1996

From: Commanding Officer, Engineering Field Activity, West, Naval Facilities Engineering Command
To: Distribution

SUBJ: ACOUSTIC IMAGING TASK, UCB DELIVERY ORDER 004 SEDIMENTS CHARACTERIZATION AND TREATABILITY STUDY, NAS ALAMEDA, ALAMEDA, CALIFORNIA

Encl: (1) Request for Expedited Approval to Conduct Acoustic Imaging Task, Berkeley Environmental Restoration Center, 07 June 1996

1. Enclosure (1) is a request for early review and approval on the Acoustic Imaging task under Delivery Order (DO) 004 Sediments Characterization and Treatability Study at NAS Alameda. The DO 004 work plan is being prepared under Navy Contract N62474-94-D-7430 by the Berkeley Environmental Restoration Center (BERC).

2. The Acoustic Imaging task will provide information on the sediments in the Seaplane Lagoon and near the West Beach Landfill Wetlands that will be beneficial in planning upcoming investigations. The proposed efforts are similar to a site survey and do not include handling of contaminated soils or water.

3. Please review the request and contact me by phone, fax or e-mail with your response. If necessary, I will arrange a conference call to answer questions or concerns.

4. Any questions can be directed to me at telephone 415-244-2539, FAX 415-244-2654, or e-mail address "khspielman@efawest.navfac.navy.mil".

Original signed by

KEN SPIELMAN
By direction of
the Commanding Officer

Distribution:
NAS Alameda (Attn: Mr. Steve Edde)
California Department of Toxic Substances Control (Attn: Mr. Tom Lanphar)
California Regional Water Quality Control Board (Attn: Ms. Gina Kathuria)
U.S. Environmental Protection Agency (Attn: Mr. James Ricks)

Blind copies to:
1831, 1831.1, 1831.2, 1831.3, 1831.4, 1831 file
Admin Record (w/3 copies)
Chron, Green
Activity File: NAS Alameda (File: L6264KS.DOC) ab

1317

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

BERKELEY ENVIRONMENTAL RESTORATION CENTER
3114 ETCHEVERRY HALL # 1750

COLLEGE OF ENGINEERING
BERKELEY, CALIFORNIA 94720-1750

To: Mr. Ken Spielman, RPM, EFA West 7 June 1996

From: Dr. James Hunt, UCB, Principal Investigator for Sediments Treatability Study, Delivery Order No. 4, Navy Contract No. N62474-94-D-7430.

Subject: Request for expedited approval to conduct Acoustic Imaging Task at the Seaplane Lagoon and in bay at southern and eastern periphery of seawall at West Beach Landfill Wetlands, NAS Alameda.

This memo is to request your assistance in gaining the expedited approval of the Navy and regulatory agencies for the Berkeley Environmental Restoration Center (BERC) to conduct an Acoustic Imaging field study at the above locations. BERC would like to begin this field activity on June 24.. Acoustic Imaging is a geophysical technique (see below), and involves no invasive or physical site changes (that is, no physical probes, coring, drilling, sampling, or construction.) The acoustic imaging task is included in the Sediments Characterization and Treatability Studies Work Plan that is now being prepared by BERC under Delivery Order No. 4 of the above mentioned contract, referred to as "Fast Track Environmental Cleanup: A NAS Alameda-University of California Partnership". This Work Plan is now nearing completion, but obviously cannot be submitted, reviewed and revised before the June 24 date. Later this summer the remainder of the BERC effort will commence after the Work Plan is approved.

Dr. Pat Williams of UC Berkeley will be the lead investigator for the acoustic imaging activity that will determine the depth of bedded sediments in these areas. As noted above, Dr. Williams needs to begin this work by June 24, 1996. The acoustic imaging task is already planned as the first task of the proposed Work Plan. The information from the acoustic imaging task is critical for the upcoming investigation to be conducted by BERC, and also for investigations by PRC EMI this summer as part of their CLEAN contract activities.

In brief, Acoustic Imaging consists of generating sound waves and then monitoring their reflection off the subsurface sediment layers. The field procedure uses a 24-foot boat with a 10-foot barge containing sound wave generating equipment that is towed 6-feet behind the boat. Dr. Williams and his two-person crew are experienced in the imaging procedures, and are safety trained for using the high voltage equipment the procedures use. Acoustic imaging does not use any explosive devices or explosive materials for sound wave generation. Dr. Williams expects that the boat will be in the lagoon for two days, and measurements at the seawall periphery will require another two days. The acoustic imaging procedures, including health and safety measures, are presently in the Work Plan that is being prepared. A more complete description of the Acoustic Imaging task is included as Attachment A.

Please contact Dr. Bill Mabey at BERC (643-2075), Dr. Pat Williams at UCB(486-7156), or Dr. Jim Hunt at UCB (642-0948) regarding any the information required or for persons that we must contact directly. Thank you for your help in this effort.

Attachment A
Memorandum to Ken Spielman, 7 June 1996

Acoustic Imaging of Sediments
Seaplane Lagoon and West Beach Landfill Wetlands

Objectives:

1) Characterize fine details of shallow stratigraphy and morphology:

a) depositional processes including evidence of episodicity (i.e. punctuation: hiatus) of natural sedimentation in the upper 40 feet of section.

b) erosional processes including evidence of the presence or absence of features of natural erosional and slope-failure processes in the upper 40 feet of section.

c) the bathymetry, geometry and stratigraphy of engineered features.

2) Provide an objective rationale for sedimentation rates to be extrapolated across the site(s).

3) Enhance and constrain interpretive vertical lithology mapping and characterization of major sediment units and candidate fast-path transport features in the upper 100 feet of section.

4) Incorporate acoustic imaging data and lithological borehole data to construct pre-base geography and paleogeography models in order to predict lateral geometries, extent and variability of major sediment units.

Approach:

Very High Resolution (VHR) acoustic profiling provides an economical and rapid means for direct imaging of substrate geometry and character. Management of contamination in the shallow marine environment presents difficult options, and requires a high quality understanding of the dynamics of sedimentation: i.e. 1) the site's sedimentary history; 2) natural and man-caused forces that may disrupt the site in the future: and 3) discovery of the map and sectional pattern of continuing sedimentation. VHR is useful for determination of the lateral continuity of sediment horizons and for detection of sediment anomalies including buried and near-surface channels, shoals, scours and dumps.

New VHR imaging techniques have been field proven in our studies of the essentially continuous young sedimentary section of San Francisco Bay. This field program has demonstrated a greatly improved capability for VHR seismic reflection profiling in the detection, characterization and interpretation of structural and sedimentary features in marine, lake, and river environments.

The VHR marine profiling technique is uniquely capable for detailed studies of sedimentation and sediment disruption. VHR profiling enables the investigation, with remarkable detail, of environmental and paleoenvironmental records contained in very young sedimentary deposits. The usefulness of VHR profiling in studies of sedimentary

Selenium concentrations beneath San Francisco Bay has been proven in our close collaboration with UC Berkeley's Center for Isotope Geochemistry in a Bay-sediment coring program. Applications of VHR profiling include recovery of: 1) the lateral continuity of contaminated sedimentary layers and their preceding analogs: and site histories of: 2) flood and substrate scour; 3) slope stability; 4) active faulting. Mode of sedimentation may be determined. i.e. bed-transported vs suspension transported units. Energy of sedimentation controls the grain size in a given sediment horizon. Storm events of various kinds (tide, flood) strongly control sediment supply and current. Coarse grained and fined grained horizons produce distinctive acoustic signatures. Features produced by sediment scour and man-caused disturbance also yield well to VHR imaging. The punctuation of sedimentation by rapid deposition during storm events followed by longer periods of slow- or non-deposition produces a sediment profile that can often be traced across an area extending for many hundreds of meters. Distinctive marker horizons, produced by small. but abrupt vertical change in acoustic velocity can be traceable for large distances.

The activities to be undertaken in the acoustic imaging portion are designed to support the physical characterization of lithologies and substrate geometries along the marine perimeter of NAS Alameda. The complex physical, biological, and chemical stratification of NAS Alameda sediments makes the spatial characterization of these properties considerably challenging. Acoustic reflection imaging can provide excellent subbottom images in shallow-water environments. The sensitivity of acoustic reflection imaging techniques to the presence of gas in sediment is a crucial variable in the applications and outcome of this study. Gas produces a bright reflection on acoustic images. This provides a means of detecting sites of methanogenesis in shallow-water estuarine environments. Where substrates have been disturbed by large-scale erosional. mixing or dredging processes, the continuity of the methanogenic layer is disrupted. Methanogenic processes are also strongly associated with native peat-substrates. The geometry of gas reflectors can thus be useful for interpretation of the substrate types, and their chemistry, biota, and history. Conversely, gas-charged sediments inhibit the imaging of deeper substrates. Deeper substrate geometries. i.e. ancient erosional surfaces and riverine deposits. marine depositional and erosional features, and deep dredge and fill features can be masked by the sediment gas. These deeper features may only be locally and discontinuously imaged if sediment gas is pervasive at NAS Alameda. In our experience, dredge and marine erosional processes tend to remove gas-charged sediments, and provide "windows" through which deeper strata are imaged.

Methods:

VHR profiling involves the transmission, sensing, and recording of sound energy emitted from an acoustic source towed behind a vessel. VHR profiling has proven to be uniquely capable for instrumental studies of Holocene bay mud. The combination of VHR profiling, GPS navigation, and Macintosh-hosted image interpretation and map preparation provides a powerful marine geological system for the study of shallow marine deposits. The maximum recording depth of the VHR system acquired is about 300 feet and the majority of our VHR records reach depths of 40 to 50 feet. This allows visualization of the entire Holocene section in San Francisco Bay, and enables recording of most or all of the Holocene section in most marine, estuarine and lacustrine settings.

Challenges for acquisition and interpretation of seismic reflection data from the shallow marine environment include the masking, attenuation and scattering of seismic energy by various kinds of environmental noise, entrained gas, and coarse lithologies. Interpretation can be difficult where submerged objects, out-of-line obstructions, and seismic multiples complicate the seismic records. Entrained gas can produce bright reflectivity in otherwise unreflective horizons. Criteria have been developed for the objective evaluation of high resolution marine data.

The VHR instrument produces a source pulse containing energy at frequencies ranging from 3 to 10 kHz. Unique to this VHR system. return energy is captured with a separate hull-mounted, laterally-shielded receiver. The fidelity of this equipment proved to be superb in soft sediment areas with low bottom roughness.

Survey navigation will be controlled and recorded using the *Pelagos Phrognav navigation system.* Differential GPS survey methods will be used to obtain survey locations. GPS coordinates will be determined using *Ashtec* M-12 GPS receiver in conjunction with a land-based GPS receiver and radio link. The land-based systems data stream is merged with that of the roving GPS system, and real-time differential GPS corrections are obtained. This navigation system will provide survey accuracy of a few feet .

Since high confidence results are required in this study, acoustic imaging data will be gathered at two levels of resolution. Two seperate acoustic receiving systems, will be simultaneously recorded. This strategy allows the direct comparison of overlapping shallow and intermediate depth surveys. The first receiving system is a *Seistec* inverted cone receiver, designed for extremely fine-scale imaging to a nominal depth of 40'. The inverted cone geometry provides good sound gathering, and helps to shield its receivers from environmental noise. The Seistec receiver will be recorded along with a multi-element *ITI* towed-cable receiver. The ITI receiver is capable of imaging to depths of 100 feet or more. The multi-element cable receiver provides good signal-to-noise reduction. and the cable's "hydrophone" receivers are the most sensitive available. The two channles of data will be recorded using an extremely fast Polaris Imaging *Eoscan* digital recording system. The accoustic source is a *Seistec* magnetostrictive "boomer". The boomer has a bandwidth of 2 - 7.5 KHz. These freqencies can be expressed 7 - 75 cm wavelengths. Magnetostrictive "Boomers" have been in use for more than 20 years as shallow imaging sources. Their wide and high frequency range makes them a good choice for the NAS Alameda study.

Survey:

The survey area is illustrated in Figure 1 (to be provided). Two shore-parallel survey tracks will be recorded around the western and southern perimeters of NAS Alameda Site 2, the West Beach Landfill, with a total line length of about 24.000 feet. Two shore-perpendicular survey lines will be recorded across the entrance of the Sea Plane Lagoon with a total length of about 12,000 feet. Two shore-parallel survey lines will be recorded outside of the entrance to Sea Plane Lagoon with a total length of about 12.000 feet.The area of the Sea Plane Lagoon will be surveyed on a grid pattern designed to cross borehole locations in and near the Lagoon. Spacing of survey lines within the lagoon will be determined after essential survey targets have been established in cooperation with interested NAS Alameda investigators. Dimensions of the Lagoon area are approximately 2000 x 2000 feet, thus a survey grid recorded on 400-foot centers would produce about 20.000 feet of lineal subbottom recordings. Total length of the project survey is thus approximately 68,000 feet. This project is budgeted to obtain all surveys during a single field program. In order that imaging results can be used to optimize overall project results field operations are designed with sufficient flexibility to allow the survey grid to be modified as needed to survey around obstructions, and to allow us to quickly design local surveys across areas of interest.

Field data will be compiled with available borehole and historical data to produce maps of "original. historic and existing" topography. These "snapshots" will enhance our ability to establish portray relationships between the imaging and the borehole data. Lithological sections will be produced in conjunction with the borehole data. and these combined data will be interpreted to produce a spatial model of the geometry, lithology and origin of substrate features. and to infer substrate conditions.

Team members:

PI or Co-PIs: Dr. Pat Williams.

Collaborators: Dr. Nick Sitar. Dr. Rich Clymer