FLORIDA ATLANTIC UNIVERSITY
P.O. BOX 3091
BOCA RATON, FLORIDA 33431-0991

25th Anniversary
'A Year of Discovery'
1989-90

COLLEGE OF ENGINEERING
DEPARTMENT OF OCEAN ENGINEERING
(407) 367-3430

26 March 1992

Dr. Joseph H. Kravitz
Code 1125G
Office of Naval Research
800 North Quincy Street
Arlington, VA 22217-5000

Dear Dr. Kravitz,

This letter is the final technical report for Grant No. N00014-90-J-4134 which expired 27 September 1991. This grant was entitled the "Development of a 600 Meter Chirp Sonar." The chirp sonar is a digital FM reflection profiler that generates high signal to noise, quantitative data useful for imaging the seabed and estimating sediment properties. The objective of this project is to develop a chirp sonar for the Naval Oceanographic Office which will conduct subbottom surveys providing acoustic reflection data in conjuction with coring surveys that provide physical property data. The data sets will be used to develop and verify sediment classification models. After the models are developed, they can be used to generate world wide maps of sediment properties from chirp sonar data.

Datasonics, Inc. was selected to manufacture the chirp sonar because it was the only company experienced with manufacturing the chirp subbottom profiler. A 2000 meter long towing/signal cable was shipped from NavOcean to Datasonics so the vehicle interface could be fabricated and the entire sonar system calibrated. The sonar and cable were delivered to the Naval Oceanographic Office at the Stennis Space Center during July 1991. An at-sea test is scheduled for the sonar in mid April 1992 off the coast of Hawaii.

Dr. Schock visited Stennis Space Center on 13,14 November 1991 to check the performance of the sonar. During the initial checkout, a bad solder joint that prevented transmission was located and corrected. With the sonar mounted 5 meters below the surface and transmitting at the surface the dynamic range(S/N) of the surface reflection was measured to be 33 dB at full power using the 20 ms 2-10 kHz transmit pulse and the manufacturer's calibration. The dynamic range should be at least 60 dB to ensure accurate quantitative measurements for sediment property analysis in imaging subbottoms structures with widely varying reflection amplitudes. Dr. Schock measured the impulse response of the sonar and attempted to recalibrate the sonar. The recalibrated sonar provided a dynamic range of approximately 39 dB at full power.

The system response was analyzed at Florida Atlantic University. Figure 1 is the impulse response of the sonar and the 200 meter cable generated by exciting the transmitter with the impulse in Figure 2. As seen in Figure 1, the response measurement was very noisy. It was difficult to obtain a clean response pulse because of pulse elongation generated by the cable, coupling between the transmitted and received pulse in the cable, sound reverberating within the vehicle and reflections off the side of the tank.

Figure 3 is a plot of the windowed impulse response and Figure 4 is the corresponding magnitude of the system transfer function. Figure 4 shows that the system can be operated between 2 kHz and 14 kHz.

We provided an advance copy of some of the results to Mr. Clay Whittaker, the cognizant engineer at NavOcean, and recommended that he work with Datasonics to determine a fix for the coupling problem. For example, the shield in the cable might not be properly grounded.

We also recommended that when the sonar returns from Hawaii that we visit Stennis and troubleshoot the calibration problems. Probable solutions to the problems described above include

1)adjusting the termination impedance of the cable,

2)opening the acoustic window of the vehicle, and installing sound damping material in the vehicle to reduce reverberation within the vehicle

3)checking cable grounds

4)verifying the sonar is operating linearly by making narrowband response measurements to check for leakage caused by nonlinearities of the electronics and transducers.

We will continue to work with Mr. Whittaker to obtain the desired sonar performance required for acoustic sediment classification.

Sincerely,

Steven G. Schock
Assistant Professor

Lester R. LeBlanc
Professor

cc: ONR, GIT
NRL, Code 2627
DTIC

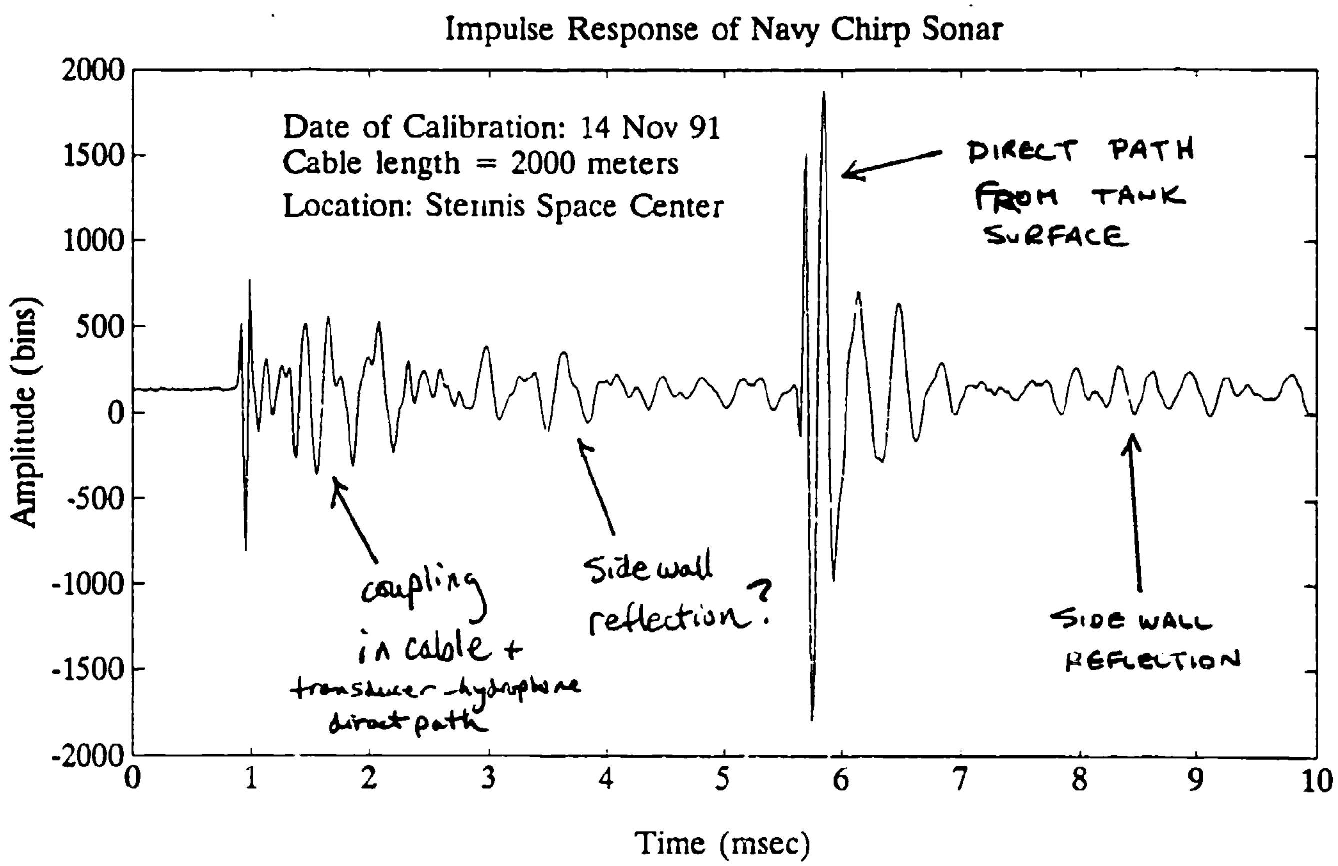

Figure 1

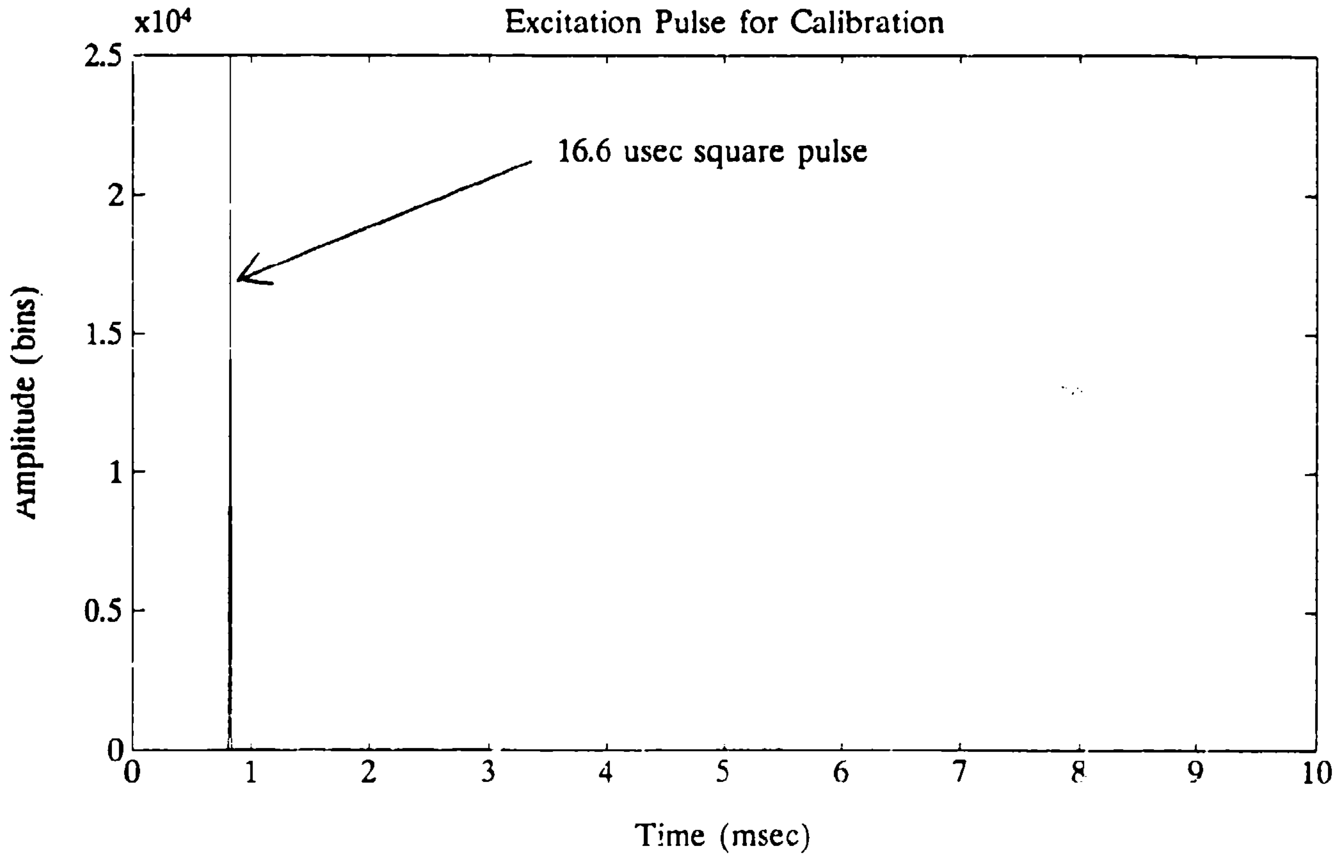

Figure 2

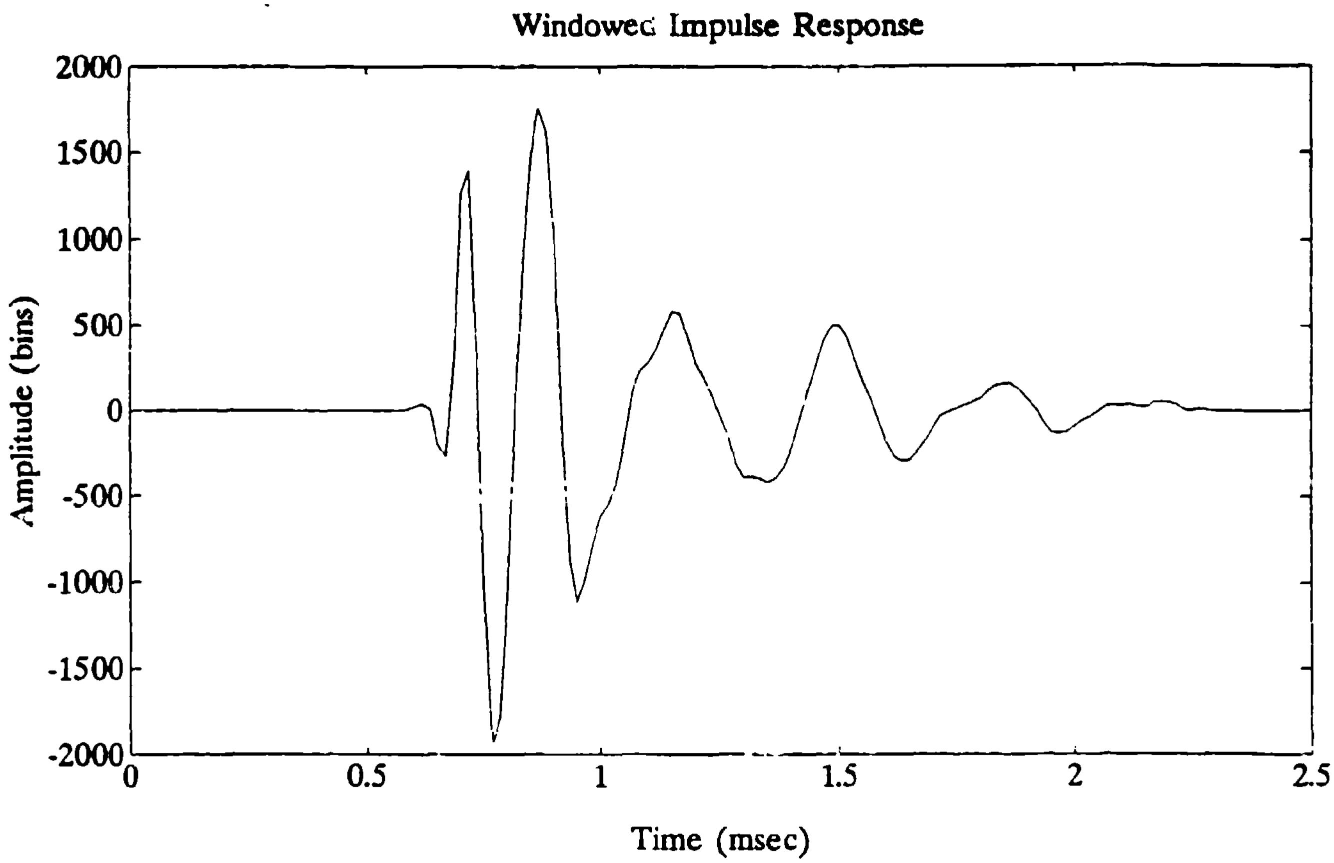

Figure 3

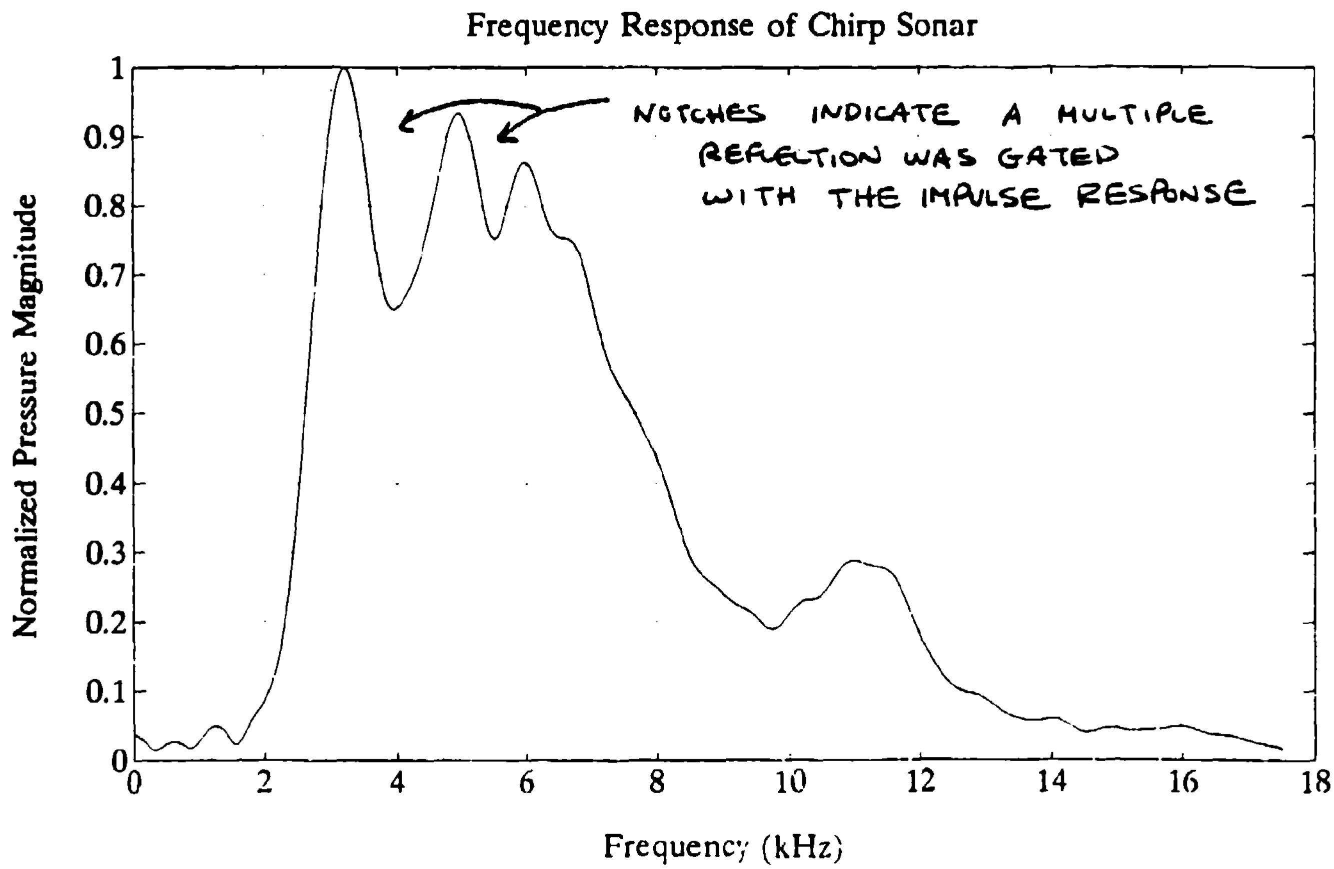

Figure 4