



GEPHONE TESTING AND CALIBRATION

WHOI Ocean Bottom Seismograph Laboratory

Geophone Testing and Calibration



- The 3-component geophones (Geospace® GS-11D) used in the WHOI short-period OBS are tested and calibrated prior to shipping for an experiment. The geophone pressure housings are opened, and the gimbal system and geophone wiring visually inspected. The housings are then sealed, and the geophones are then tested *in-situ*. We use a commercial system, called “Bird Dog 3” from Seismic Source® to measure coil resistance, impedance, sensitivity, distortion, polarity, and total damping.
- On the left, Tim Kane tests a geophone package on the WHOI pier. The Bird Dog system is portable, and we repeat these tests dockside post shipping and prior to sailing.



As the information is displayed on the screen in Bird Dog		
Cable	Sensor Conn Pin	Element
CH1	2	Vertical
CH2	5	EW
CH3	3	NS

Bird Dog Test System

Main Menu

Geophone Test
Project
Settings

Geophone Test
Current Project
Sohn_Yellowston
Selected Device
131 Ver: 10.26

Clear
Start
Add / Repeat
Stop
Save Results

Serial Number
Auto increment
Start with 45

Seismic Source Co
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Geophone Type GS_11D_4K
Natural Frequency 4.5 Hz

☒ Single
☐ String
Serial 1 X Parallel 1

☐ Manual
☒ USB Sensor
☐ Portable Sensor
Temperature 21.3

☒ Frequency 4.5 Hz
☒ Damping 0.698
☒ Sensitivity 2.09 V/in/s

Result	Error	Pass	Result	Error	Pass	Result	Error	Pass
4.52 Hz	0.5%	Pass	0.664	-4.9%	Pass	2.168	3.7%	Pass
4.72 Hz	4.9%	Pass	0.623	-10.7%	Pass	2.144	2.6%	Pass
4.87 Hz	8.1%	Pass	0.58	-16.9%	Pass	2.073	-0.8%	Pass

Tolerance +17.0 % / -17.0 %
Tolerance +20.0 % / -20.0 %
Tolerance +10.0 % / -10.0 %

☒ Resistance 3294.7 Ohm
☒ Impedance 6400.0 Ohm
☒ Distortion

Result	Error	Pass	Result	Error	Pass	Result	Error	Pass
3269.7 Ohm	-0.8%	Pass	6460.1 Ohm	0.9%	Pass	0.65 %		Fail
3299.6 Ohm	0.1%	Pass	6387.7 Ohm	-0.2%	Pass	0.92 %		Fail
3336.0 Ohm	1.3%	Pass	6272.3 Ohm	-2.0%	Pass	0.79 %		Fail

Tolerance +5.0 % / -5.0 %
Tolerance +20.0 % / -20.0 %
Tolerance 0.2 %

☐ Polarity Positive
☐ Leakage
☒ Low Drive Z 6400.0 Ohm

Pos	Neg	Result	Result	Error	Pass
---	---	---	6478.3 Ohm	1.2%	Pass
---	---	---	6408.9 Ohm	0.1%	Pass
---	---	---	6227.3 Ohm	-2.7%	Pass

Tolerance 1000 kOhm
Tolerance +20.0 % / -20.0 %

Test Completed

The Bird Dog test system measures geophone resonant frequency, total damping, voltage sensitivity, coil resistance, impedance and harmonic distortion. The measured values are logged automatically to a comma-separated variable (CSV) formatted file for QA/QC and archiving.

Bird Dog Test System Output

Reece_Testing

Search Sheet

Home Insert Page Layout Formulas Data Review View

Paste

Calibri (Body) 12

Wrap Text

General

Conditional Formatting Format as Table Cell Styles

Insert Delete Format

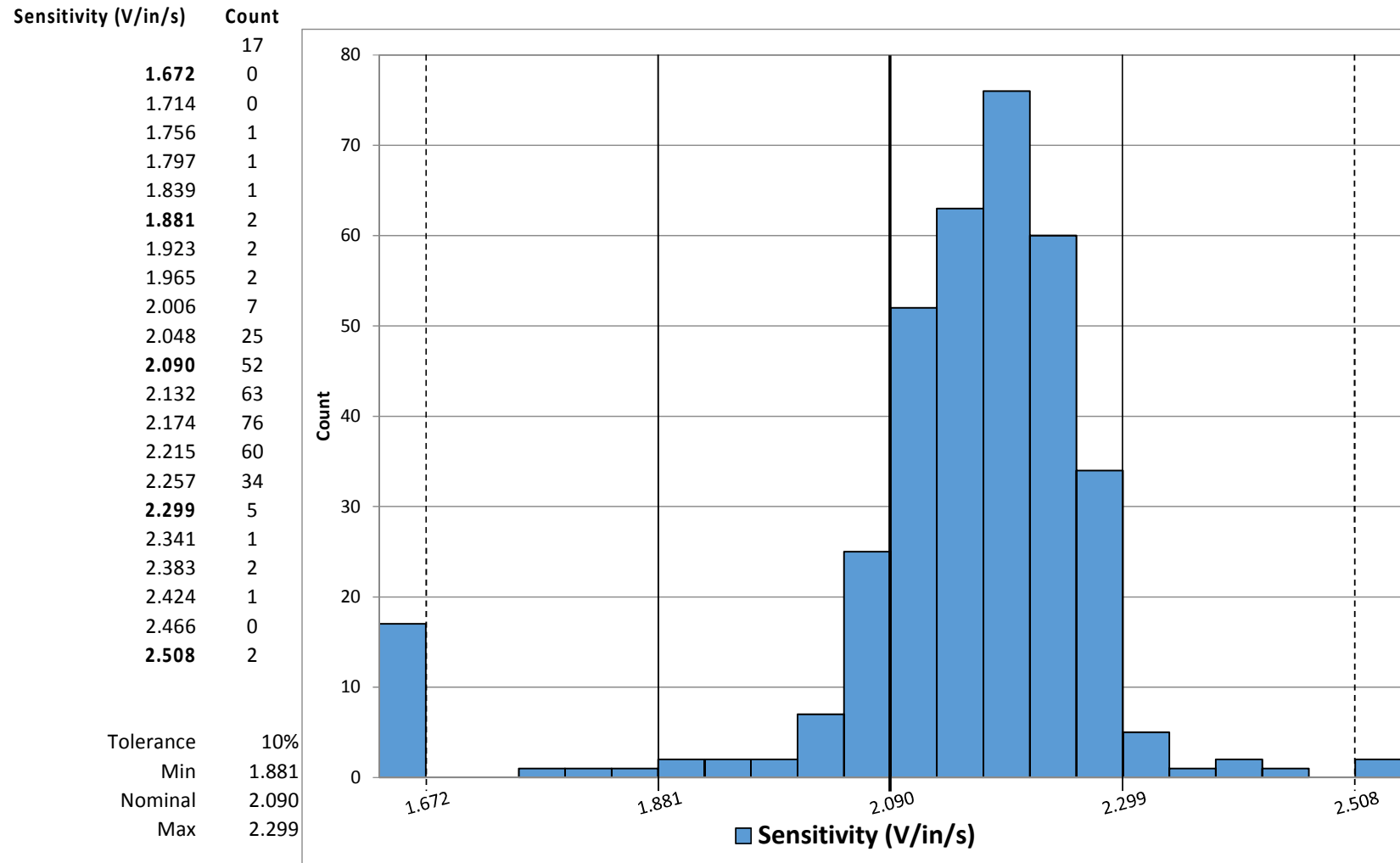
A1

fx Index

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Index	Rec#	GeoType	Ch	SerialNum	Record DateTime	String	Temp	Comment	Freq	Damp	Res	Sens	Imp	Dist	LowDrv	Leakage	Polarity
2																		
3	1	666	GS_11D_4K		1 sn04_reece	1/2/16 11:17	Single	19.1	.28_distortion_	4.24	0.693	3258.6	2.11	6324.6	0.18			Positive
4	2	666	GS_11D_4K		2 sn04_reece	1/2/16 11:17	Single	19.1	.28_distortion_	4.79	0.568	3278.9	2.074	6445.2	0.18			
5	3	666	GS_11D_4K		3 sn04_reece	1/2/16 11:17	Single	19.1	.28_distortion_	4.04	0.693	3306.5	2.091	5957.5	0.28			
6	4	670	GS_11D_4K		1 Test Sensor 1	1/2/16 13:42	Single	21.8	Use_the_under	4.16	0.72	3291.7	2.13	3059.9	0.17			
7	5	670	GS_11D_4K		2 Test Sensor 1	1/2/16 13:42	Single	21.8	Use_the_under	5.07	0.586	3263.6	2.131	3126.5	0.24			
8	6	670	GS_11D_4K		3 Test Sensor 1	1/2/16 13:42	Single	21.8	Use_the_under	4.18	0.702	3338.3	2.112	2888	0.15			
9	7	671	GS_11D_4K		1 32	1/2/16 14:22	Single	20.4	Failed-resistance	4.96	0.668	3249.9	2.255	6649	0.4			
10	8	671	GS_11D_4K		2 32	1/2/16 14:22	Single	20.4	Failed-resistance	4.92	0.7	5625.7	2.255	8726.6	7.22			
11	9	671	GS_11D_4K		3 32	1/2/16 14:22	Single	20.4	Failed-resistance	4.82	0.644	3227.2	2.104	6334.2	0.47			
12	10	675	GS_11D_4K		1 32	1/2/16 14:29	Single	20.4	Impedance_fail	4.79	0.648	3244.6	2.2	6647.2	0.13			
13	11	675	GS_11D_4K		2 32	1/2/16 14:29	Single	20.4	Impedance_fail	4.89	0.68	3287.7	2.235	6780.4	0.28			
14	12	675	GS_11D_4K		3 32	1/2/16 14:29	Single	20.4	Impedance_fail	4.73	0.645	3232.9	2.109	6327.4	0.46			
15	13	677	GS_11D_4K		1 17	1/2/16 14:35	Single	20.2	Distortion_Fail	4.15	0.669	3295.3	2.115	6412	0.28			
16	14	677	GS_11D_4K		2 17	1/2/16 14:35	Single	20.2	Distortion_Fail	4.5	0.792	3252.9	2.295	6426	0.12			Negative
17	15	677	GS_11D_4K		3 17	1/2/16 14:35	Single	20.2	Distortion_Fail	4.86	0.65	3284.6	2.178	6509.9	0.41			Positive
18	16	678	GS_11D_4K		1 12	1/2/16 14:38	Single	20.3	Failed_Distortio	4.98	0.568	3278	2.18	6609.4	0.15			
19	17	678	GS_11D_4K		2 12	1/2/16 14:38	Single	20.3	Failed_Distortio	4.76	0.728	3288.7	2.276	6624.8	0.34			
20	18	678	GS_11D_4K		3 12	1/2/16 14:38	Single	20.3	Failed_Distortio	4.38	0.58	3301	2.019	6219.8	0.22			Negative
21	19	681	GS_11D_4K		1 2	1/2/16 14:41	Single	20.4	Failed_Dampin	4.82	0.547	3292.3	1.99	6249.8	0.28			Negative
22	20	681	GS_11D_4K		2 2	1/2/16 14:41	Single	20.4	Failed_Dampin	4.78	0.608	3291.5	2.134	6499.5	0.29			
23	21	681	GS_11D_4K		3 2	1/2/16 14:41	Single	20.4	Failed_Dampin	4.55	0.623	3281.2	2.115	6436.3	0.39			
24	22	687	GS_11D_4K		1 14	1/2/16 14:54	Single	20.1	Failed_Impedanc	4.28	0.688	3310.5	2.146	6485.1	0.18			Negative
25	23	687	GS_11D_4K		2 14	1/2/16 14:54	Single	20.1	Failed_Impedanc	4.56	0.74	3288.7	2.293	6871.6	0.32			
26	24	687	GS_11D_4K		3 14	1/2/16 14:54	Single	20.1	Failed_Impedanc	4.54	0.625	3293.6	2.079	6184.7	0.19			
27	25	688	GS_11D_4K		1 5	1/2/16 14:56	Single	20.2	Failed_Distortio	4.57	0.641	3301.1	2.128	6391.3	0.33			
28	26	688	GS_11D_4K		2 5	1/2/16 14:56	Single	20.2	Failed_Distortio	3.83	0.74	3298.8	2.089	6498	0.36			
29	27	688	GS_11D_4K		3 5	1/2/16 14:56	Single	20.2	Failed_Distortio	4.94	0.642	3301	2.219	6545.7	0.51			

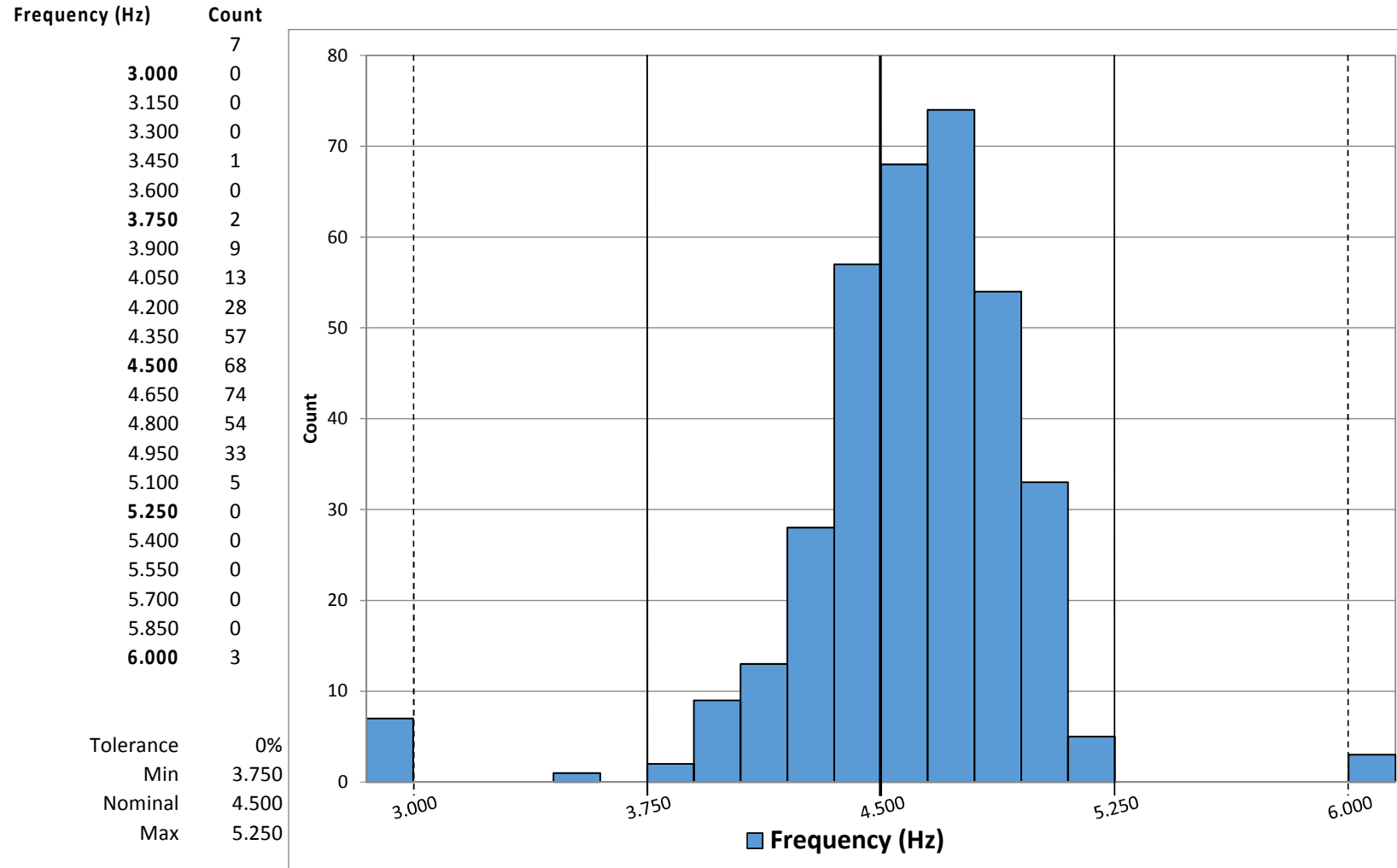
A portion of Bird Dog output acquired during the first pass of geophone testing carried out at WHOI for the CREST (P.I. Reece) experiment.

Histograms for all recorded WHOI OBS Bird Dog testing (2015 – present)



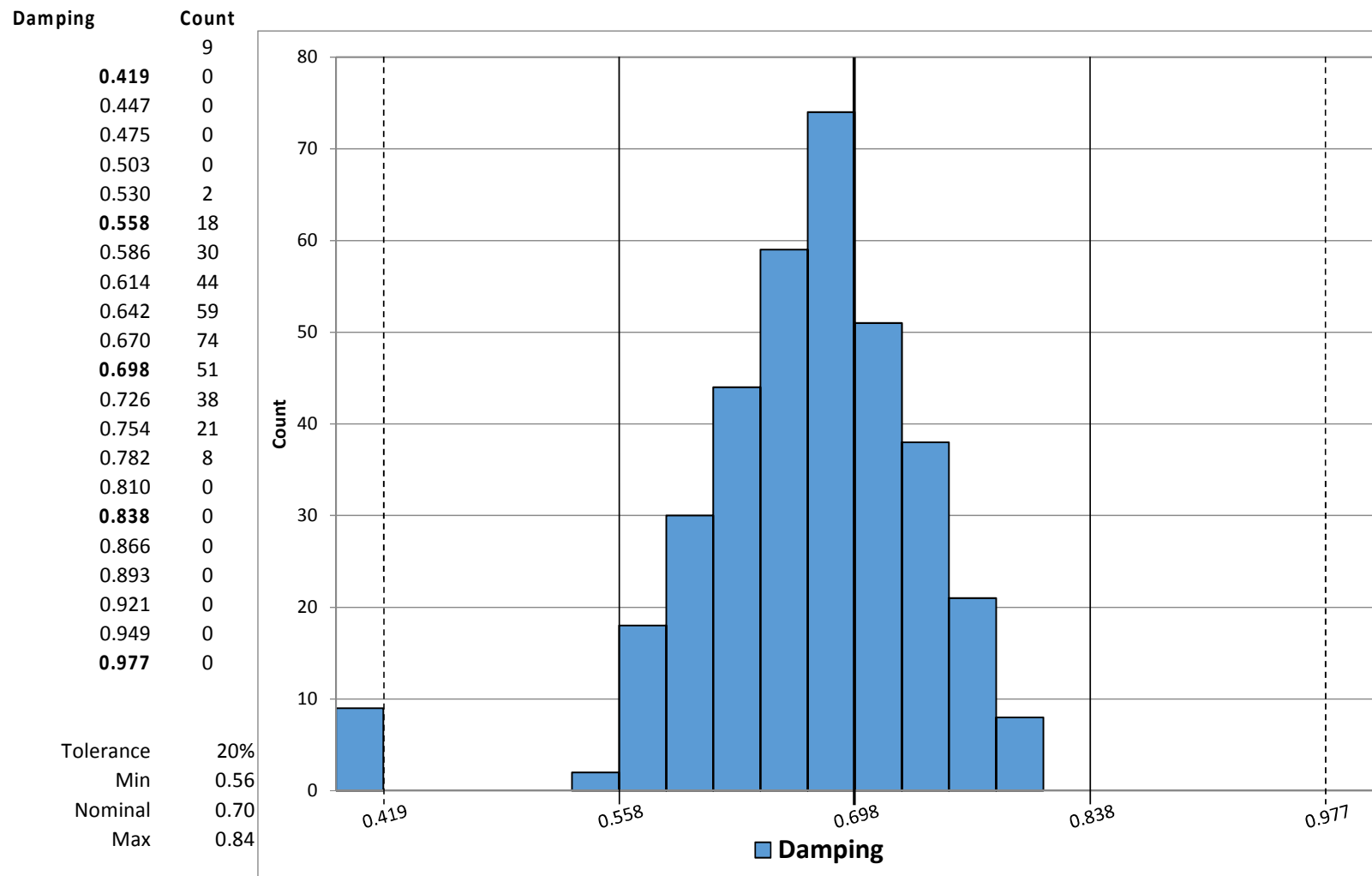
The Bird Dog test results can be readily analyzed for trends. Here we show a histogram of measured sensitivity from tests conducted prior to the Santorini (P.I. Hooft), CREST (P.I. Reece), and Yellowstone (P.I. Sohn) experiments. The measured sensitivity values cluster slightly higher than the manufacturer's quoted value of 2.09 V/inch/second.

Histograms for all recorded WHOI OBS Bird Dog testing (2015 – present)



Histogram of geophone resonant frequencies from tests conducted prior to the Santorini (P.I. Hooft), CREST (P.I. Reece), and Yellowstone (P.I. Sohn) experiments. The measured values cluster slightly higher than the manufacturer's quoted value of 4.5 Hz.

Histograms for all recorded WHOI OBS Bird Dog testing (2015 – present)



Histogram of damping (total) values from tests conducted prior to the Santorini (P.I. Hooft), CREST (P.I. Reece), and Yellowstone (P.I. Sohn) experiments.