TECHNICAL PERFORMANCE SPECIFICATION FOR
Acoustic Line Arrays

1.0 SCOPE

This specification establishes the requirements for a 96-channel Horizontal Line Acoustic Array (HLA) with documentation and options for an additional 96-channel Horizontal Line Array, 2 each 32-channel Vertical Line Acoustic Arrays (VLA) and up to 200 hydrophone/Preamplifiers. These arrays are to be used with existing data acquisition systems operated by the Signal Processing Branch, Code 7120, Naval Research Laboratory. It is required that array connector mate with existing Seacon, MINP-76#22-FCR, connectors and hydrophones be electrically compatible with the existing data collections systems. The wiring of the array connector must conform to the existing system's electrical configuration as defined in Appendix A, Table 1.

2.0 ARRAY REQUIREMENTS

2.1 Array Electromechanical Requirements:

a. Mechanical Strength: The array shall have a working strength of at least 500 Newton's force and a breaking strength of at least 2000 Newton's force.

b. Mechanical Terminations: Separate electrical and mechanical terminations shall be used to provide strain relief for the electrical connector and to enable the electrical connectors to be connected and disconnected while maintaining a working strength tension on the assembled mechanical terminations. Mechanical terminations shall be provided at both the head end and the tail end of the array. Yale grips are acceptable as a mechanical termination. The exact location of the head end mechanical termination will be provided at award of the contact, it shall be between the connector and the first hydrophone.

c. Pressure Vessel Electrical Connector Orientation: The electrical connector mating with the pressure vessel shall be at a right angle (orthogonal) to the cable. The maximum distance from the front end of the connector to the back of the cable shall be 7 inches plus or minus ½".

d. Hydrophone Connector: Each array hydrophone breakout connector shall be a Seacon RMF-2-FS, with a locking sleeve. The number 1 connector pin will be the positive lead for high sensitivity modes.

e. Cable Jacketing: The cable shall be sheathed in a Kevlar jacket braid. The composite cable and Kevlar jacket shall be over woven with an outer polyester jacket braid to provide some protection for the Kevlar braid.

f. A pressure proof cap shall be supplied for each Seacon MINP connector in the array. The cap shall be depth rated to the operation depth of the connector.

3.0 Horizontal Line Array (HLA):

The horizontal array fabrication shall use free-flooded cable technology. The array shall consist of sets of 32, #24 insulated twisted pairs, each pair overjackted with urethane, terminated into a SEACON MINP-76#22-CCP connector. The connector wiring will be as specified, depending on hydrophone position, in Appendix A, Table 1. The government strongly desires that all hydrophone breakouts be made during the fabrication of the cable at the manufacturer's facility. Hydrophone location breakout during the cable manufacture will increase the integrity of the cable, a desire feature. Hydrophone locations shall be as specified in Appendix B table 2. Each hydrophone shall be enclosed in a plastic sleeve and be attached to the array cable using a polyester sock. The Naval Research Laboratory will either provide, GFE, 96 HTI-90-PC hydrophones or exercise an option for HTI-94 hydrophones with preamps, up to a total of 200 hydrophones.

a. Operational Depth: The array shall function and meet all specifications when deployed in the ocean to any depth less than or equal to 500 meters.

b. Inter-channel crosstalk: The signal crosstalk figure, within a cable, measured between any pair of acoustic signal channels shall be no greater than -45 decibels. Thus if a 1-volt root mean square signal is supplied by a sensor on any signal channel with no signals applied by the sensors on other channels, the crosstalk to these other channels shall be no greater than -45 dB re 1 volt root mean square.

c. Array configuration;
This configuration shall consist of three separate segments, which when laid side by side provide a 650 meter array aperture. The first segment, A, shall consist of hydrophones 1 through 32 and have a length of 44 meters, including a 3-meter tail at the end. The second segment B shall consist of hydrophones 33 through 64 and be 87 meters long, including a 3-meter tail at the end. The third segment C shall consist of hydrophones 65 through 96 and be 671 meters long, including a 3-meter tail. The government desires that Segment C be tapered to 16 pairs after hydrophone number 80 in Appendix B Table 2. Tapering is desirable since it will reduce the array weight and minimum-bending radius. Proposers may suggest methods of achieving the tapered configuration. Within a segment the hydrophone locations shall be within +/- 5cm of the locations defined in Appendix B Table 2.

4.0 Optional Horizontal Array: The offeror shall propose 1 additional Horizontal Line Array in accordance with the specifications in paragraph 3.0.

5.0 Optional Vertical Arrays: 2 each

a. General: Each array shall have no fewer than 32 hydrophones. The vertical array fabrication shall use free-flooded cable technology. Each array shall comply with applicable specifications as defined in section 2.1 The vertical array shall be wired per Appendix A, Table 1, Connector A.

b. Array length; The length of the array, measured from the end connector to the supporting float attachment point will not be less than 50 meters and will not exceed 125 meters. The length will be provided by the Contracting Officer's representative (COR) upon contact award, the final length being defined by use of an option for additional cable length.

c. Hydrophone positions and spacing: The location of each of the hydrophones along the array will be specified by the COR upon contract award. The sensing elements of the hydrophones will be located at these positions to a tolerance of +/-5 centimeters.

d. Operational Depth: The array shall function and meet all specifications when deployed in the ocean to any depth less than or equal to 500 meters.

e. Inter-channel crosstalk: The signal crosstalk figure measured between any pair of acoustic or engineering signal channels shall be no greater than - 45 decibels. Thus if a 1 volt root mean square signal is supplied by a sensor on any signal channel with no signals applied by the sensors on other channels, the crosstalk to these other channels shall be no greater than -45 dB re 1 volt root mean square.

f. Fairing: The array shall be faired along its entire length with a haired fairing. The length of these fairing strands shall be at least 3 times the cable diameter. The linear density of the fairing shall conform to customary industry practice for effective reduction of strum.

6.0 Hydrophones

6.1 GFE Hydrophones: The government will supply, if Hydrophone/Preamplifier option is not exercised, 96, HTI-90-PC hydrophones for the HLA. These hydrophones are encased in a 2.5" by 9.5" round plastic housing.

6.2 Hydrophone/Preamp Option:

a. Hydrophones:
As an option the government may select the purchase of up to 200 HTI-94 hydrophones with built in preamps or a hydrophone having equivalent salient electrical and mechanical specifications. This option shall include the encasement of the hydrophones, with built-in preamplifier, in a plastic housing for mounting in the hydrophone polyester sock, see section 6.2b. The hydrophones with preamp shall have a maximum sensitivity of –180dB re: 1 V/uPa, when the number 1 pin is positive. A minimum sensitivity of -220 dB re: 1 V/uPa, when the polarity of the supply voltage is reversed: i.e. pin 1 is negative. Bandwidth shall be 5 Hz to 25 kHz.

b. Preamplifiers:
All hydrophones shall have built-in signal preamplifier with a differential two-wire current-source signal output/power input. Conversion of the current-source signal to a voltage signal (for instance, by a resistor) shall take place within a government existing signal conditioning electronics unit. The government conditioning electronics have a differential input and provide the pre-amp with +/- 12 volts supply voltage, using the differential signal lines to supply the power to the preamp. The pre-amp will provide a gain change of -40dB when its supply voltage applied to the hydrophone pins is reverse. The pre-amp shall have a single pole high pass filter with a 3 dB break point at 40 Hz.

c. Hydrophone/Preamplifier self Noise
The self-noise of the combination as referenced to 1 micro Pascal per root Hz shall be equal to less than the Table below:

Frequency Hz	Noise dB
10	54
100	42
1000	42

7.0 Optional Additional VLA Cable
Additional VLA cable up to 300 meters shall be quoted as an option. This option shall be used to increase the length of the VLAs to between 100 to 125 meters.

8.0 Deliverables:

8.1 Base Award:

CLIN 0001 1 each 96-channel HLA
CLIN 0002 Documentation defining the cable connector wiring
Calibration documentation for hydrophones if exercised
8.2 OPTIONS

CLIN 0003 1 each 96-channel HLA
CLIN 0004 2 each 32 channel VLA
CLIN 0005 200 each Hydrophone/Preamplifiers
CLIN 0006 300 Meters VLA Cable

9.0 Standard Commercial Warranty shall be provided

APPENDIX A

Table 1

CONNECTOR DESIGNATION AND WIRING REQUIREMENTS

MINP pin#	Connector A Channel #	Connector B Channel #	Connector C Channel #	Polarity	
1	1	33	65	Pos	
2				Neg	
3	2	34	66	Pos	
4				Neg	
5	3	35	67	Pos	
6				Neg	
7	4	36	68	Pos	
8				Neg	
9	5	37	69	Pos	
10				Neg	
11	6	38	70	Pos	
12				Neg	
13	7	39	71	Pos	
14				Neg	
15	8	40	72	Pos	
16				Neg	
17	9	41	73	Pos	
18				Neg	
19	10	42	74	Pos	
20				Neg	
21	11	43	75	Pos	
22				Neg	
23	12	44	76	Pos	
24				Neg	
25	13	46	77	Pos	
26				Neg	
27	14	46	78	Pos	
28				Neg	
29	15	47	79	Pos	
30				Neg	
31	16	48	80	Pos	
32				Neg	
33	17	49	81	Pos	
34				Neg	
35	18	50	82	Pos	
36				Neg	
37	19	51	83	Pos	

38				Neg	
39	20	52	84	Pos	
40				Neg	
41	21	53	85	Pos	
42				Neg	
43	22	54	86	Pos	
44				Neg	
45	23	55	87	Pos	
46				Neg	
47	24	56	88	Pos	
48				Neg	
49	25	57	89	Pos	
50				Neg	
51	26	58	90	Pos	
52				Neg	
53	27	59	91	Pos	
54				Neg	
55	28	60	92	Pos	
56				Neg	
57	29	61	93	Pos	
58				Neg	
59	30	62	94	Pos	
60				Neg	
61	31	63	95	Pos	
62				Neg	
63	32	64	96	Pos	
64				Neg	
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					
76					

APPENDIX B
TABLE 2
Segment, A

Hydrophone Positions

Hydrophone Number	Hydrophone Array Position (meters)	Hydrophone Connector Assignment	
MINP-CP-76	0		
1	10	Connector A	
2	11	Connector A	
3	12	Connector A	
4	13	Connector A	
5	14	Connector A	
6	15	Connector A	
7	16	Connector A	
8	17	Connector A	
9	18	Connector A	
10	19	Connector A	
11	20	Connector A	
12	21	Connector A	
13	22	Connector A	
14	23	Connector A	
15	24	Connector A	
16	25	Connector A	
17	26	Connector A	
18	27	Connector A	
19	28	Connector A	
20	29	Connector A	
21	30	Connector A	
22	31	Connector A	
23	32	Connector A	
24	33	Connector A	
25	34	Connector A	
26	35	Connector A	
27	36	Connector A	
28	37	Connector A	
29	38	Connector A	
30	39	Connector A	
31	40	Connector A	
32	41	Connector A	
Tail	44		

Table 2

Segment B
Hydrophone Positions

Hydrophone Number	Hydrophone Array Position (meters)	Hydrophone Connector Assignment	
MINP-CP-76	0		
33	42	Connector B	
34	43	Connector B	
35	44	Connector B	
36	45	Connector B	
37	46	Connector B	
38	47	Connector B	
39	48	Connector B	
40	49	Connector B	
41	50	Connector B	
42	51	Connector B	
43	52	Connector B	
44	53	Connector B	
45	54	Connector B	
46	55	Connector B	
47	56	Connector B	
48	57	Connector B	
49	58	Connector B	
50	59	Connector B	
51	60	Connector B	
52	61	Connector B	
53	62	Connector B	
54	64	Connector B	
55	66	Connector B	
56	68	Connector B	
57	70	Connector B	
58	72	Connector B	
59	74	Connector B	
60	76	Connector B	
61	78	Connector B	
62	80	Connector B	
63	82	Connector B	
64	84	Connector B	
Tail	87		

Table 2
Segment C
Hydrophone Positions

Hydrophone Number	Hydrophone Array Position (meters)	Hydrophone Connector Assignment	
MINP-CP-76	0		
65	86	Connector C	
66	88	Connector C	
67	90	Connector C	
68	92	Connector C	
69	94	Connector C	
70	96	Connector C	
71	98	Connector C	
72	100	Connector C	
73	102	Connector C	
74	104	Connector C	
75	106	Connector C	
76	108	Connector C	
77	110	Connector C	
78	112	Connector C	
79	114	Connector C	
80	138	Connector C	
81	170	Connector C	
82	202	Connector C	
83	234	Connector C	
84	266	Connector C	
85	298	Connector C	
86	330	Connector C	
87	362	Connector C	
88	394	Connector C	
89	426	Connector C	
90	458	Connector C	
91	490	Connector C	
92	522	Connector C	
93	554	Connector C	
94	586	Connector C	
95	618	Connector C	
96	650	Connector C	
Tail	653		

Table 2
Segment