

ASA S12 Committee on Noise
Working Group (WG) 47 – Underwater Noise Measurement of Ships

Second Meeting June 6, 2007, 5:30 pm
ASA Conference, Salt Lake City Hilton

MEETING MINUTES
REVISION 1 – 07/03/2007
Prepared by Michael Bahtiarian

These minutes were prepared by the Committee Chair (Michael Bahtiarian) with an audio tape of a portion the meeting and limited written notes. To be fair to all committee members, no specific individuals (other than the Chair), have been identified in the minutes because of the Chair's unfamiliarity with all the participants voices.

The second meeting of Working Group 47 was held at date, time and location noted above. The agenda for the meeting is on the last page of these notes. There were eleven attendees at the meeting of which six are members of the Working Group. The attendee list is on second to last page of these notes.

Mr. Bahtiarian started the meeting with introduction and all attendees introduced themselves and reasons or interests in attending. The chair summarized the first meeting held in Washington DC, but minute from that meeting were not presented for review or anything like that. ASA Standards manager sat in on the first part of the meeting and spoke about administrative issues relating to development of an ANSI Standard.

The Mission Statement was presented as final document that is no comments were solicited by the chair. One attendee (Joe Pope) asked if the Mission Statement was approved. The chair did not have mission statement approved and will inquire if it needs to be approved with ASA.

The discussion on the various grades started. Dave Vendittis provided discussion on sound propagation of data he reviewed and analyzed using AMP-15 (see attachment at the end of the minutes). The purpose of this data is to help determine appropriate distances between hydrophone and ship and appropriate water depths. A summary of all the technical points will not be given due to length of this discussion.

The group discussed measurement range distance (horizontal from ship to hydrophones). Their was debate whether this standard would result in true "source levels". For now the term is being used loosely to define the result of the proposed measurement. Current standard is to report levels at 1 meter measured from far field. Dave Vendittis stated that adjustment from 1m to nearfield would be questionable. He suggested levels be reported at 100m and then adjusted to 1m by simple addition of 40 dB $\{20 \times \log(100/1)\}$. However, in deep water these errors are much less.

The meeting continued (tape recording ended) with discussion on range distance, water depth, and distance correction methods. The values for these three elements for the three grades are shown on the attached Grades Matrix.

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With appropriate depths and decibel accuracy (yet to be confirmed), distance correction of spherical spreading could be used for Grades A, B & C.

The minimum water depth was first proposed to be based on ship length. This would allow standard to be applicable to small and large ships (i.e. patrol boats to cruise liners). It was proposed that Grade A would be 5x ship length, Grade B would be 1x ship length and Grade C was ½ times ship length. Grade A was selected to be as deep as possible to meet Navy desires. Grade C was selected to be as shallow as possible to reduce test complexity and cost. Grade B was believed to be adequate.

It was proposed that range distance (ship to phones) would be 1x ship length for all grades. This distance is minimum to achieve acoustical definition of far field, but also close enough to maximize signal. It was further proposed that when ranging ships a plus or minus 10% would be allow for each run. Lastly, Dave Vendittis suggested that accuracy of Grade B be increased to 2-3 dB.

The meeting ended at 8pm. Chair promised to prepare minutes and send around to all attendees for comments before greater Working Group. The next meeting was not discussed.

Minutes Prepared By
Michael Bahtiarian
Chair Working Group 47

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Grades Matrix

Revision 3 – Dated May 18, 2007

Cells Shaded- Recently Revised

GRADE	A	B	C
GRADE NAME	Precision Method	Engineering Method	Survey (in-situ) Method
Expected Use/Application	Contract requirements Conformance (Note 1)	Contract Requirements Conformance (Note 1) Annual Check-Up	Annual Check-Up
Expected User/Type of Ship	Navy Non-Combatant NOAA Quiet R/V's	UNOLS R/V Commercial ships Navy/NOAA	UNOLS R/V's Commercial ships
Grade Driving Factor	Accuracy	Best Accuracy for Cost	Cost (Note 2)
Measurement Units	Lp dB re 1 μ Pa		
Source Level Correction	1 meter from far-field		
Distance Correction Method	Spherical Spreading	Spherical Spreading	Spherical Spreading
Measurement System Accuracy	$\pm 1\frac{1}{2}$ dB	$\pm 2\frac{1}{2}$ dB	± 4 dB
Measurement System Repeatability	$\pm 1\frac{1}{2}$ dB	$\pm 2\frac{1}{2}$ dB	± 4 dB
Frequency Response, Primary	10 to 50,000 Hz	10 to 25,000 Hz	100 to 10,000 Hz
Frequency Analysis, Primary	1/3 octave band	1/3 octave band	1/3 octave band
Frequency Resolution, Primary	23%	23%	23%
Frequency Response, Secondary	10 to 5,000 Hz	Optional	Optional
Frequency Analysis, Secondary	Narrowband	Narrowband	Narrowband
Frequency Resolution, Secondary	1 Hertz	Any	Any
Maximum Hydrophone Sensitivity	???	???	???
Hydrophone Frequency Response	???	???	???
Minimum Number of Hydrophones	Three	Two	One
Minimum Water Depth	5x Ship Length	1x Ship Length	$\frac{1}{2}$x Ship Length
Minimum Measurement Distance	1 x ship length $\pm 10\%$		
Distance Ranging Accuracy	± 3 meters	± 10 meters	$\pm ??$ meters
Deployment Requirements	No limitations. May use bottom mounted hydrophones.	Small craft, such as crew boat. No divers shall be required.	Small "launch" such as RHIB. No divers required.
Weather/Sea Conditions	\leq Sea State 2 ??	\leq Sea State 1	\leq Sea State 0
Auxiliary Measurements	Sound Velocity Profiles	???	???
Other Factors	Account for cable strum and sea surface affects.	Account for cable strum and sea surface affects.	None
Calibration	Hydrophones field calibrated and Insert Voltage (i.e. full system calibration)	Hydrophones field calibrated	Hydrophones, factory calibration acceptable
Hydrophone Position	Beam Aspect	Beam Aspect	Beam Aspect

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MEETING ATTENDEES

WG Member	Name	Company	Email
X	David Vendittis	Florida Atlantic University	dvendittis@aol.com
X	Mae Seto	Defense R&D Canada	Mae.seto@drdc-rddc.gc.ca
	Joe Pope	Pope Engineering Company	Pope236@aol.com
	Ann Bowles	Hubbs Seaworld	abowles@hswri.com
X	Jim Miller	University of Rhode Island	miller@uri.edu
	Rex Andrew	APL/Univ. Washington	randrew@apl.washington.edu
	Seibert Murphy	Progeny Systems	Seib_m@yahoo.com
	Ted Bradley	NSWC Carderock Div	Edward.bradley@navy.mil
X	Kevin O'Neill	NSWC Carderock Div	Kevin.oneill@navy.mil
X	Michael Bahtiarian	Noise Control Engineering	mikeb@noise-control.com
X*	Susan Blaeser*	ASA Standards Manager	asastds@aip.org

* Ex-officio Member, Attended for Introduction Only

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Second Committee Meeting
June 6, 2007, 5:30-7 pm
ASA Conference Salt Lake City
Hilton Salt Lake City Center, Suite 326

AGENDA

1. INTRODUCTION

Committee members to discuss their need/interest in the standards committee and define what topics/parameters they want it to address.

2. SUMMARY FIRST MEETING

Chair to review meeting minutes from first meeting & discuss other outreach since March 27th meeting.

3. MISSION STATEMENT

Final version of the mission statement to be presented, see attached.

4. UNDERWATER SOUND PROPEGATION PRESENTATION

Dr. Dave Venditis (Florida Atlantic University) to make presentation on underwater sound propagation research he has conducted.

5. FULL DISCUSSION ON GRADES MATRIX

Revision 3 of the Grade Matrix attached. This was emailed to the committee on May 4th with no comments to date. Items open for discussion are highlighted in yellow and include:

- a. Distance correction methods
- b. Frequency Response
- c. Minimum Water Depth
- d. Minimum Measurement Distance
- e. Distance Ranging Accuracy

6. NEXT STEPS/SCHEDULE

Work on completing the Grades Matrix over the summer. Finalize at meeting in fall in Boston or DC area. Up for discussion.

Mission Statement

Revision 1 – Dated April 15, 2007

The mission of the ASA Standards Committee, Working Group 47 (WG47), “*Underwater Noise Measurement of Ships*” is to develop a commercial standard describing the instrumentation systems and methodologies for the measurement of a vessel’s underwater noise signature. The standard shall have the following attributes:

1. The standard will have multiple “Grades” of measurement, each with a stated applicability, test methodology, instrumentation accuracy, system repeatability and complexity. Such issues can be directly and indirectly related to cost of performing the measurement. However, the standard as such, cannot and will not directly address cost.
2. For all “Grades”, the standard will only be applicable to surface vessels, either manned or unmanned. This standard will not be applicable to submerged vessels or aircraft (either manned or unmanned).
3. All “Grades” will be achievable with commercial-off-the-shelf (COTS) technology for all aspects of methodology, instrumentation and data processing.
4. The Standard will impose NO underwater noise limits and make NO comments on what is acceptable or unacceptable for any application.
5. The Standard will NOT address issues related to the following: vessel self-noise, diagnostic measurements, noise reduction techniques, environmental consequences of noise, effects of noise on marine life or passive underwater noise monitoring. While such matters are certainly related, these issues are typically considered outside the scope of a measurement standard.

ANALYSES OF DATA ACQUIRED USING AMP-15

PROBLEM: Mine-vulnerability signatures acquired for the same ship at different ranges were different

MAIN REASONS: Measurements made in near field and bottom losses were different

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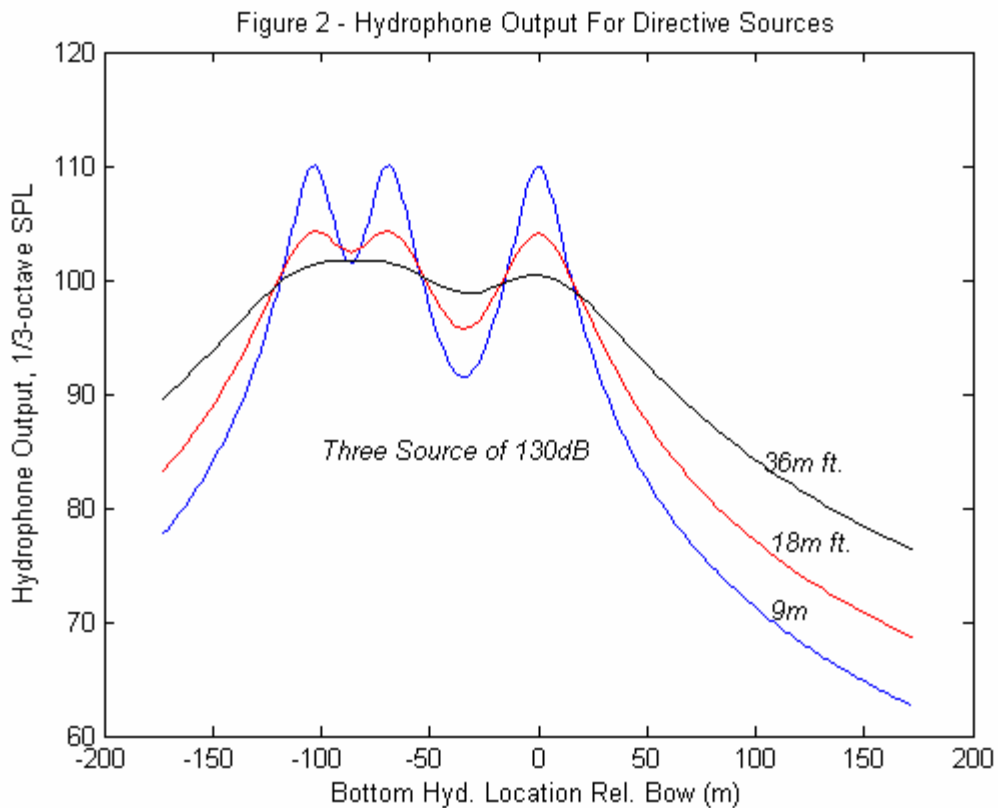
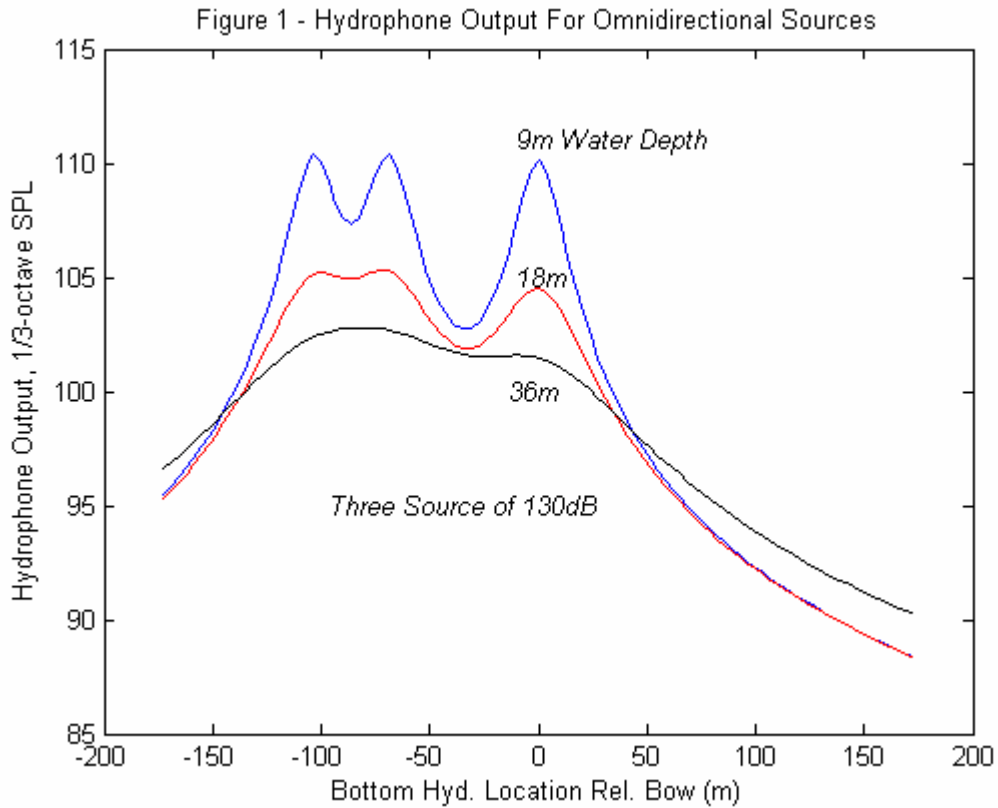


Figure 3 - Directionality of 400-Hz Radiation From a Merchant Ship

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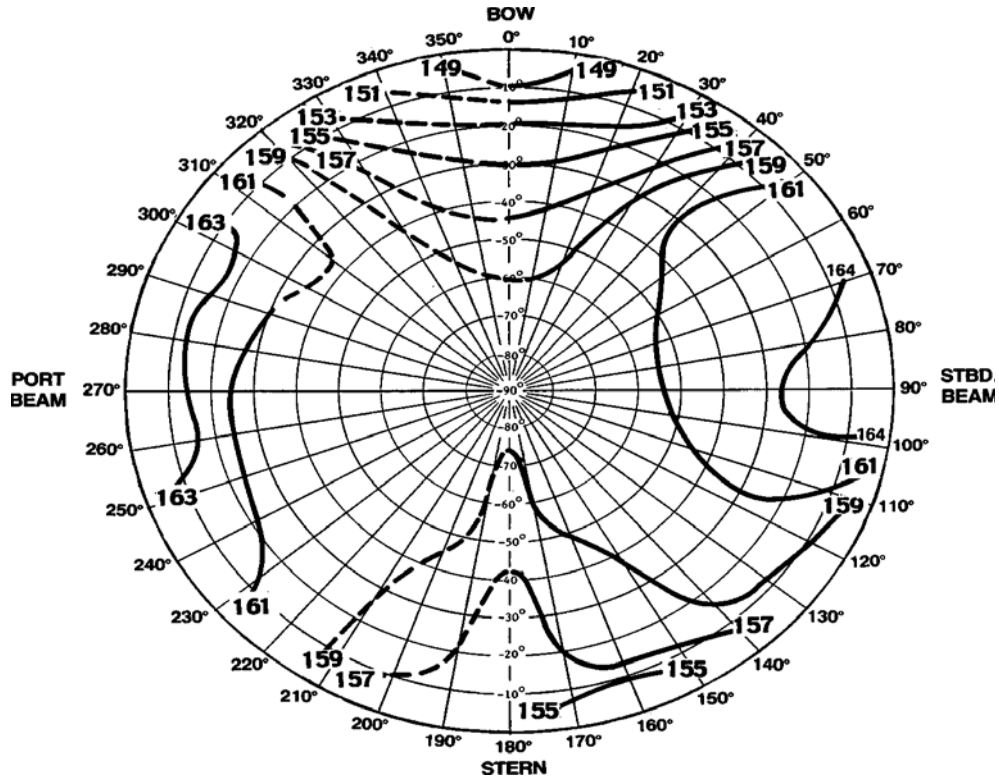
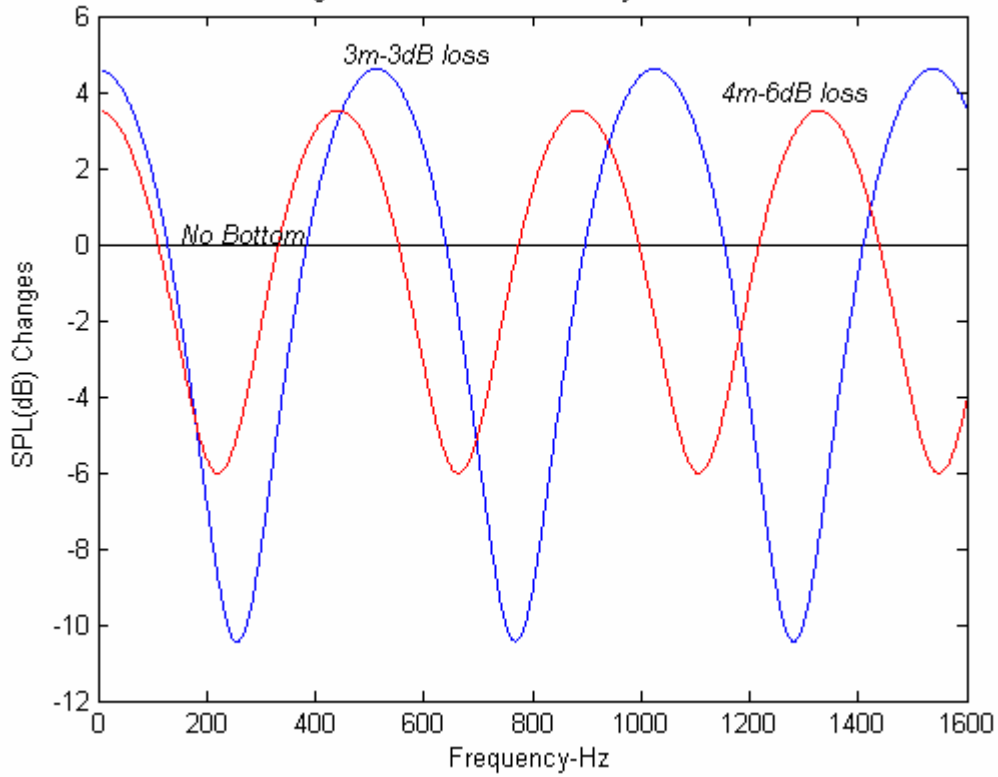
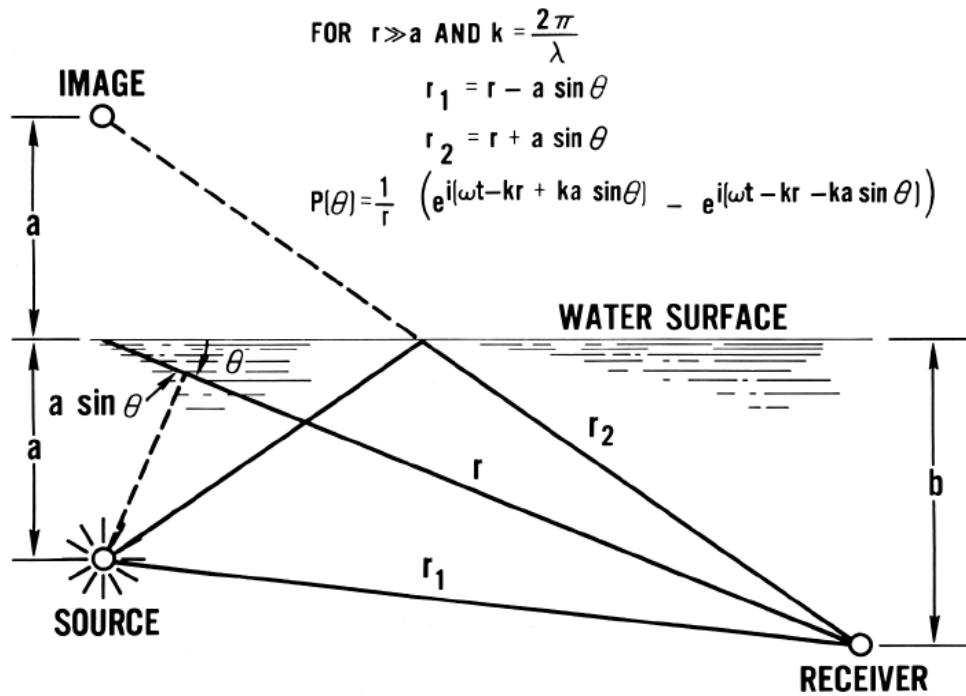
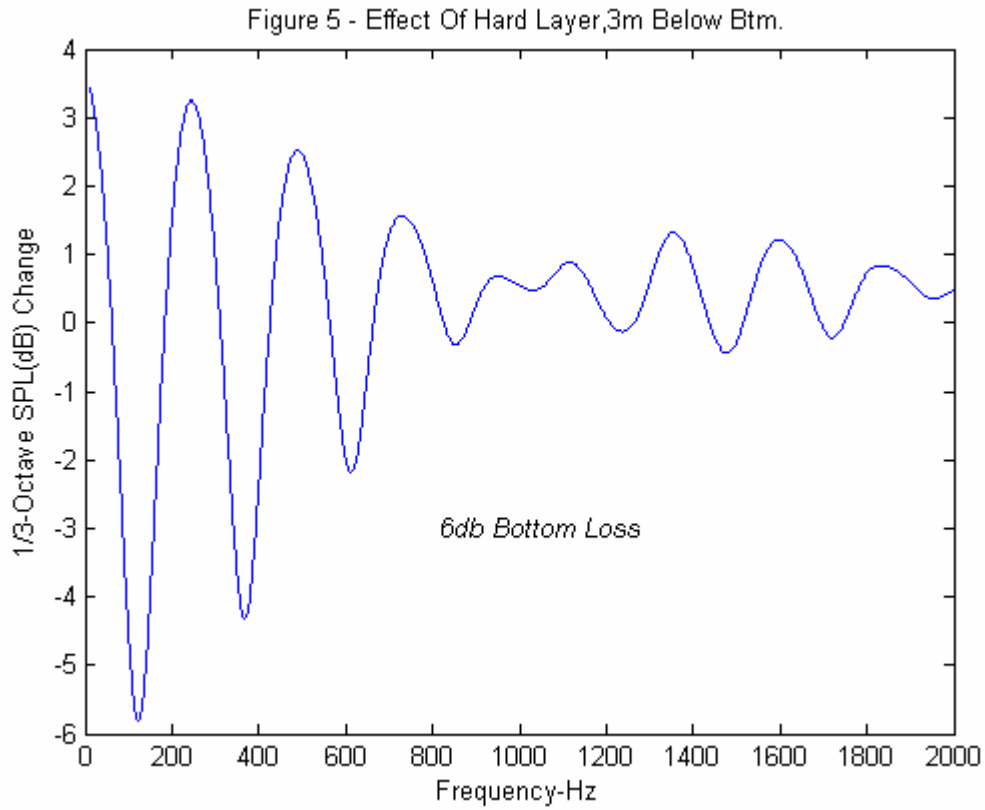


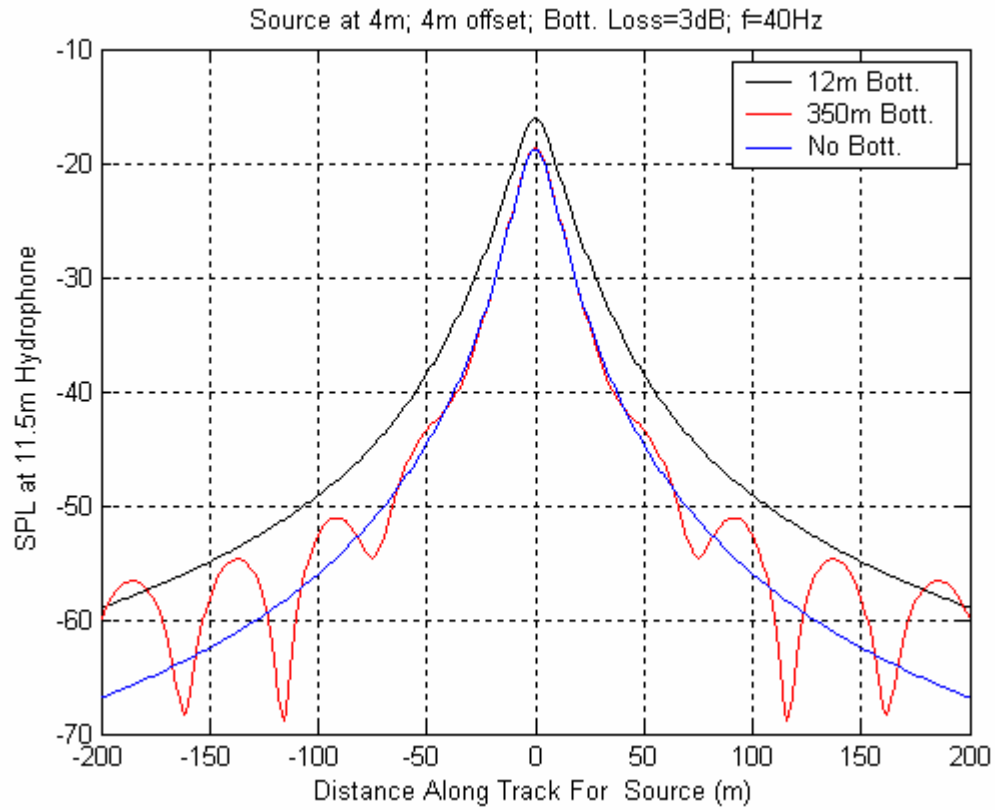
Figure 4 - Effects Of Hard Layers-3m&4m



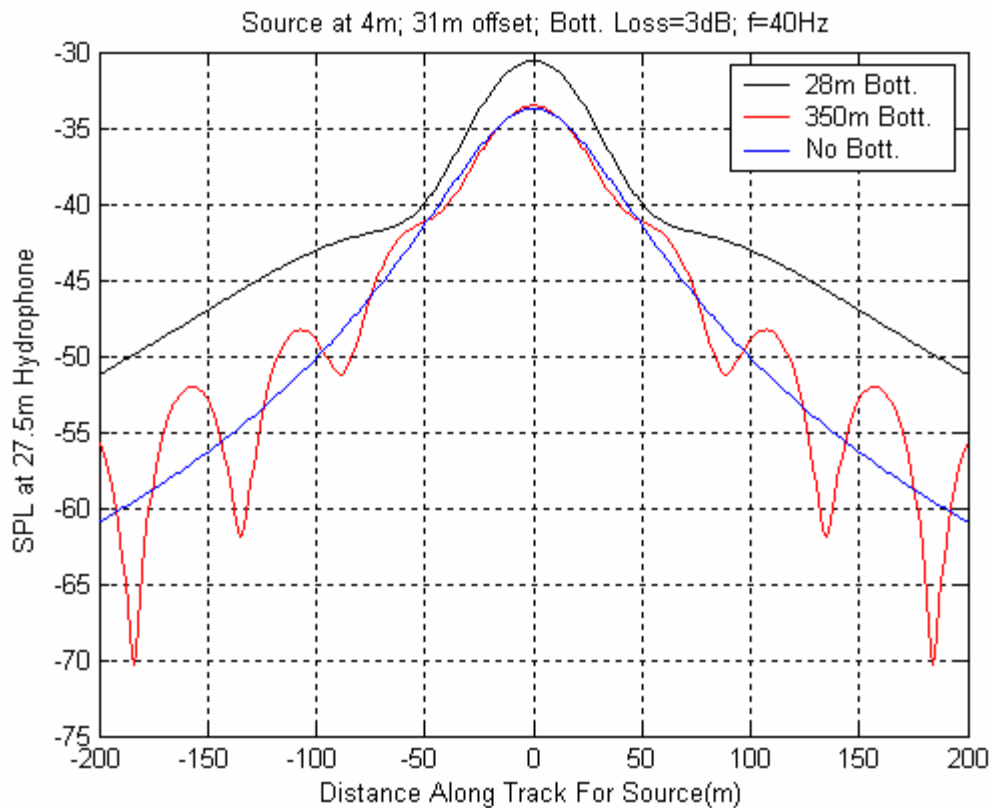
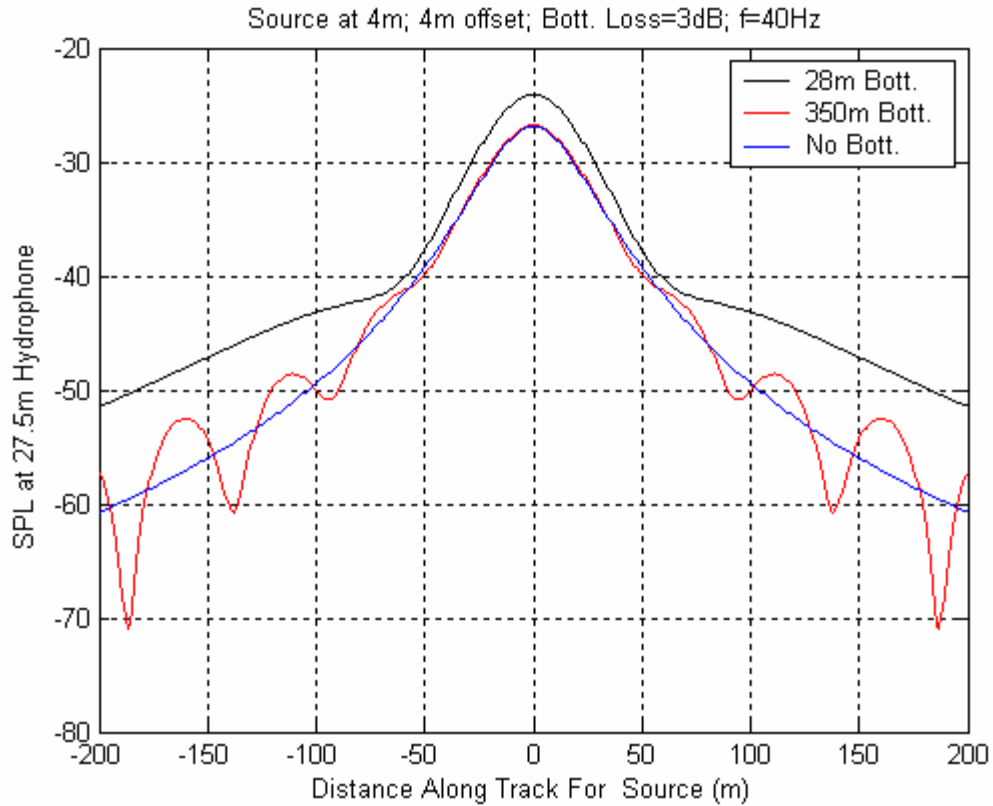
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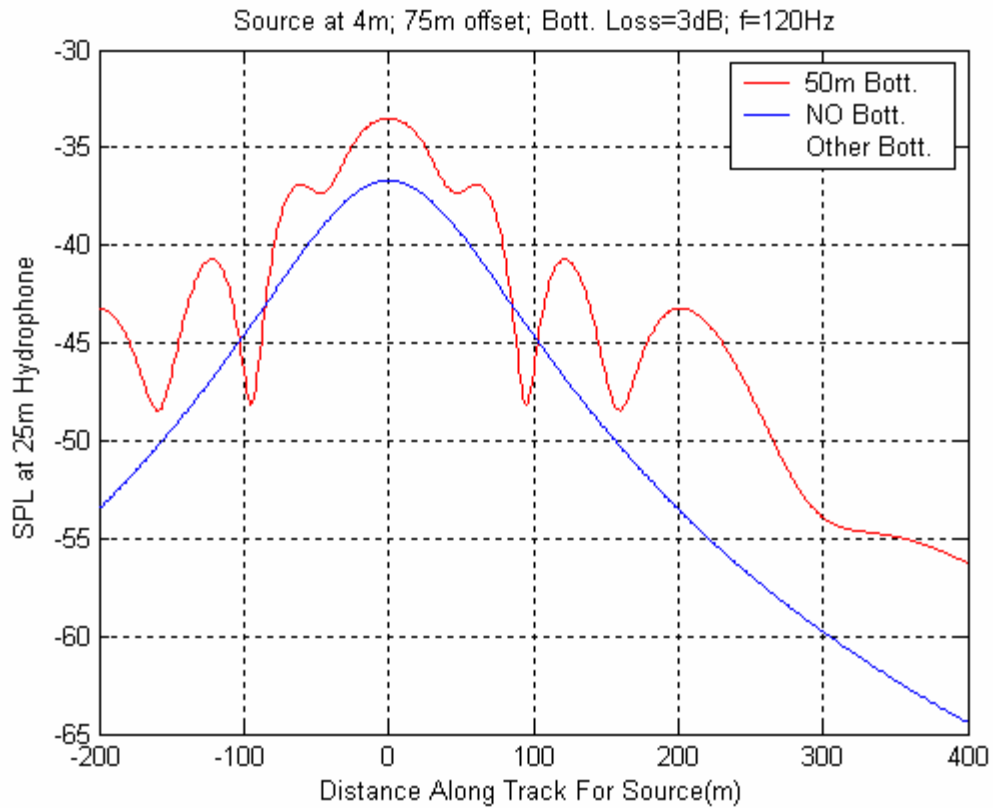
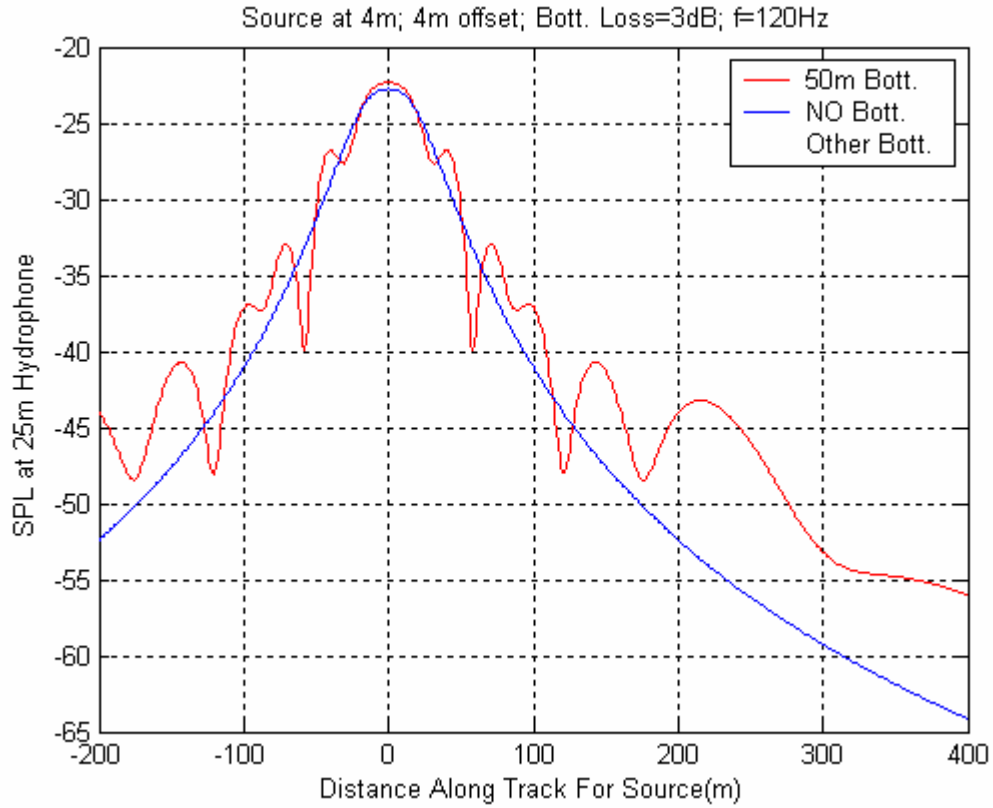
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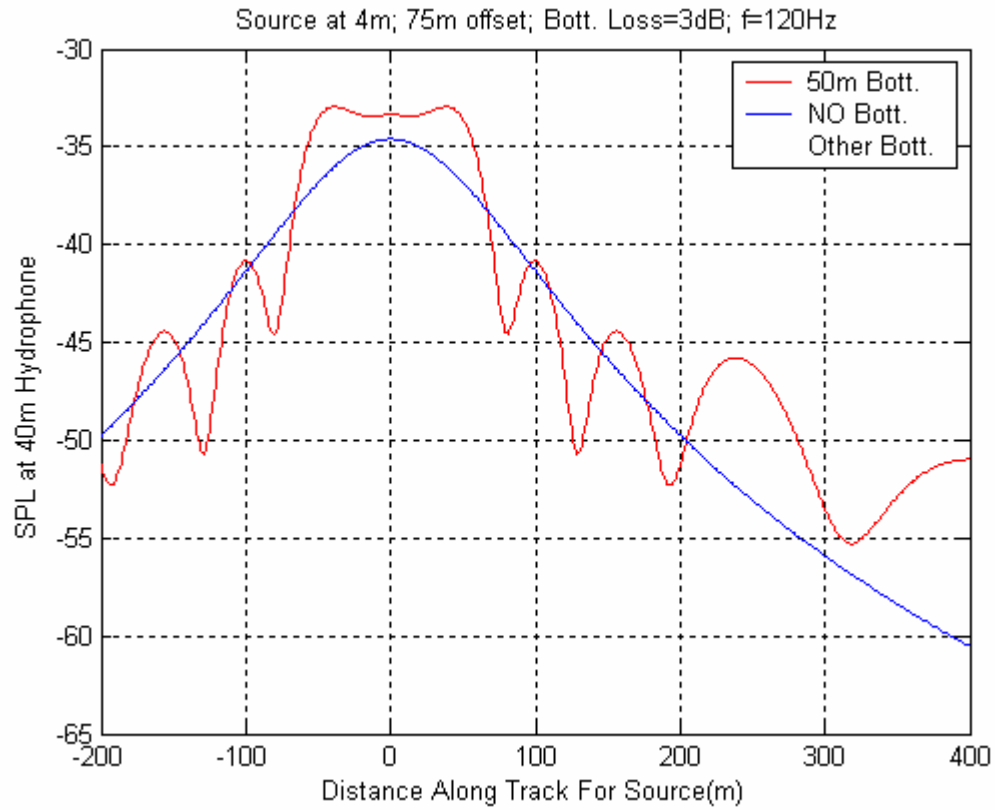
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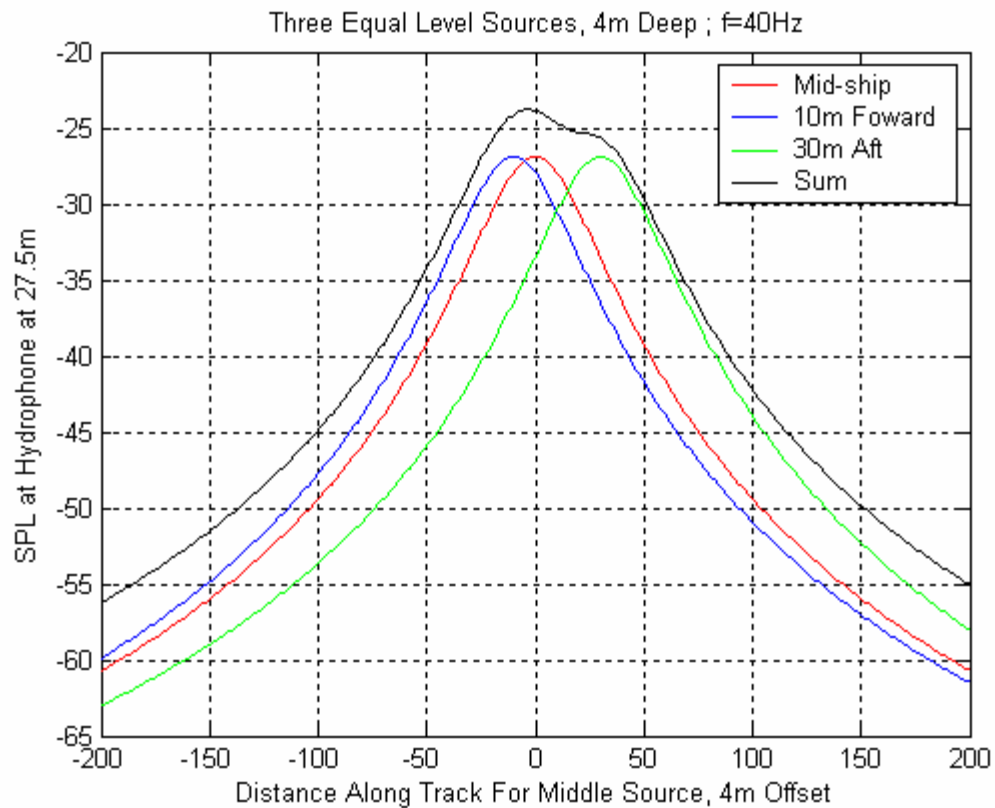
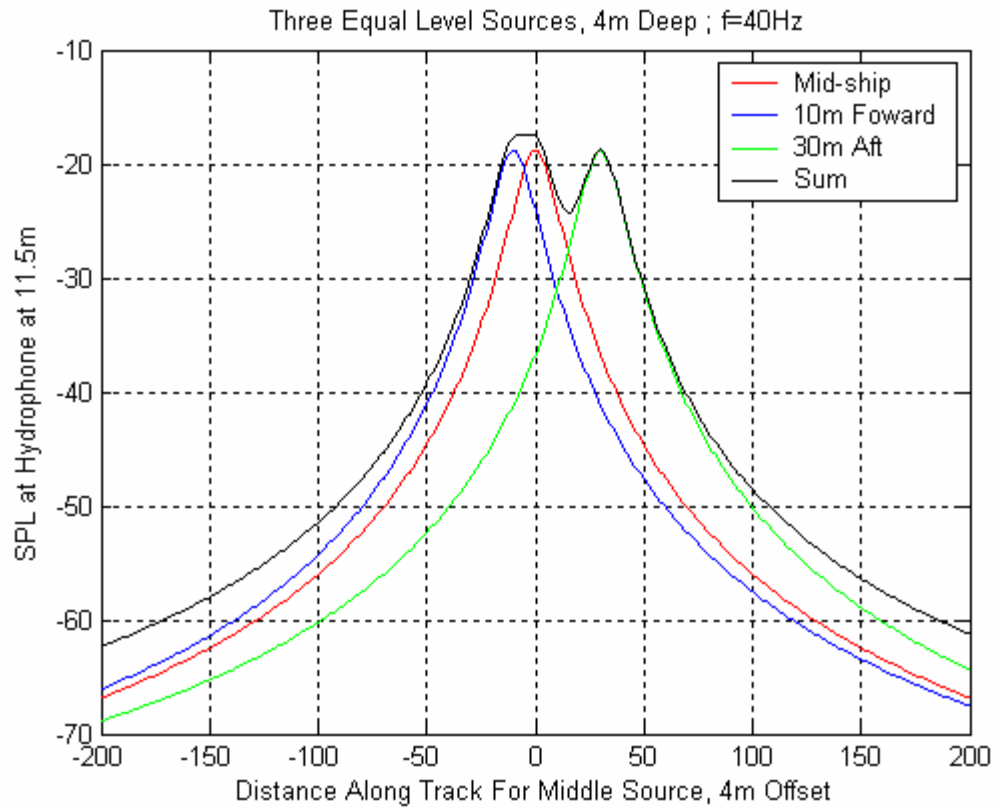
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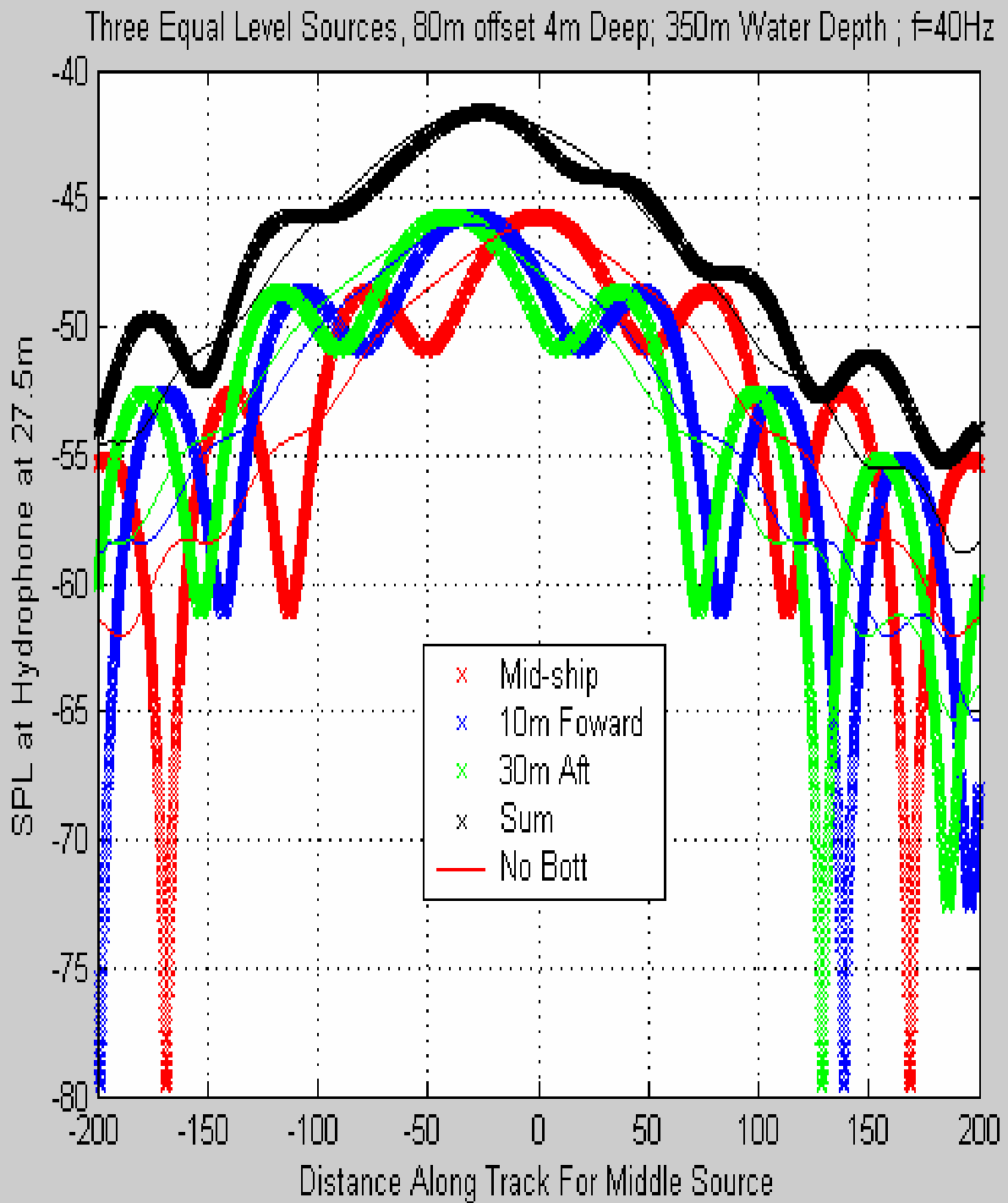
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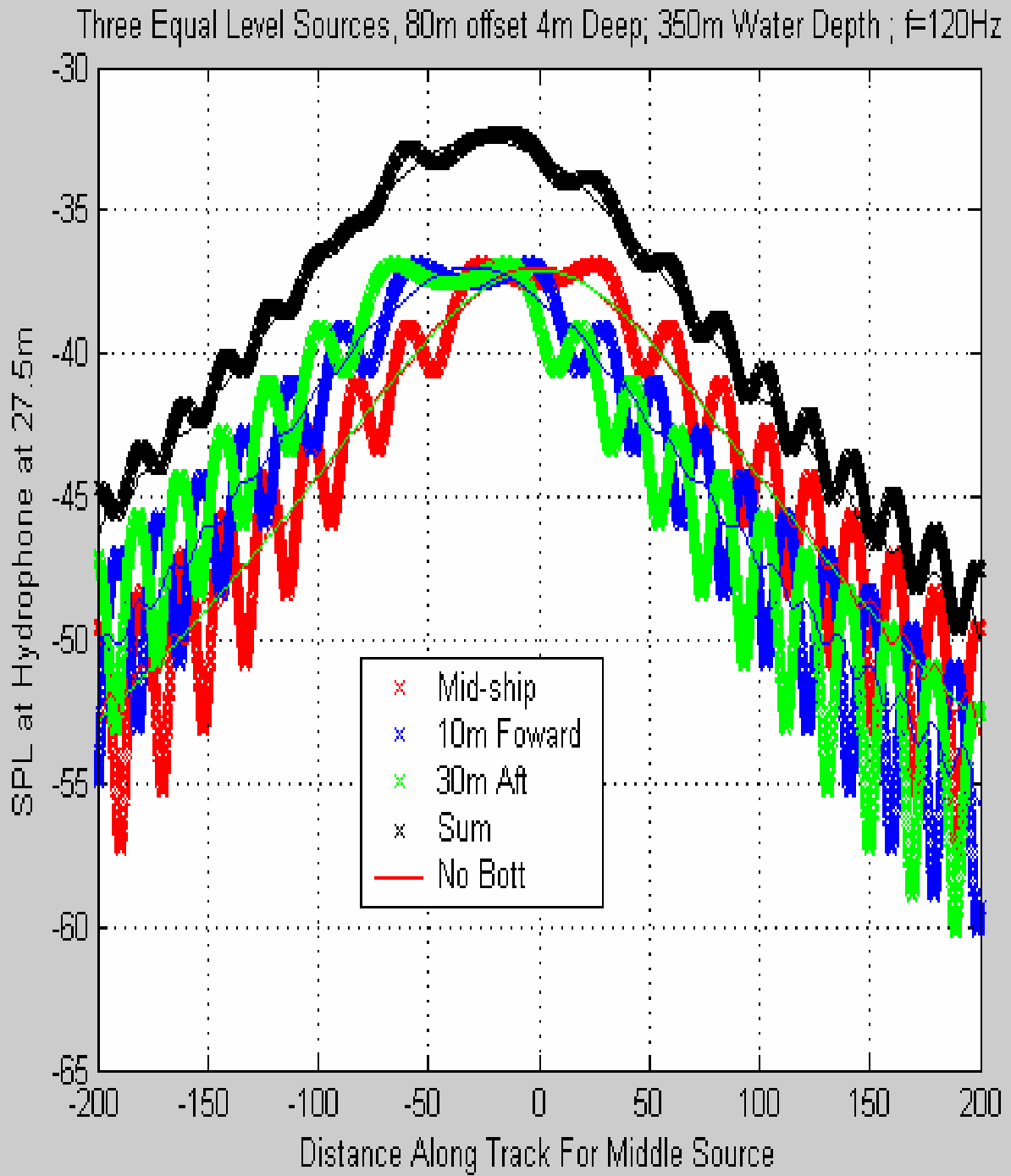
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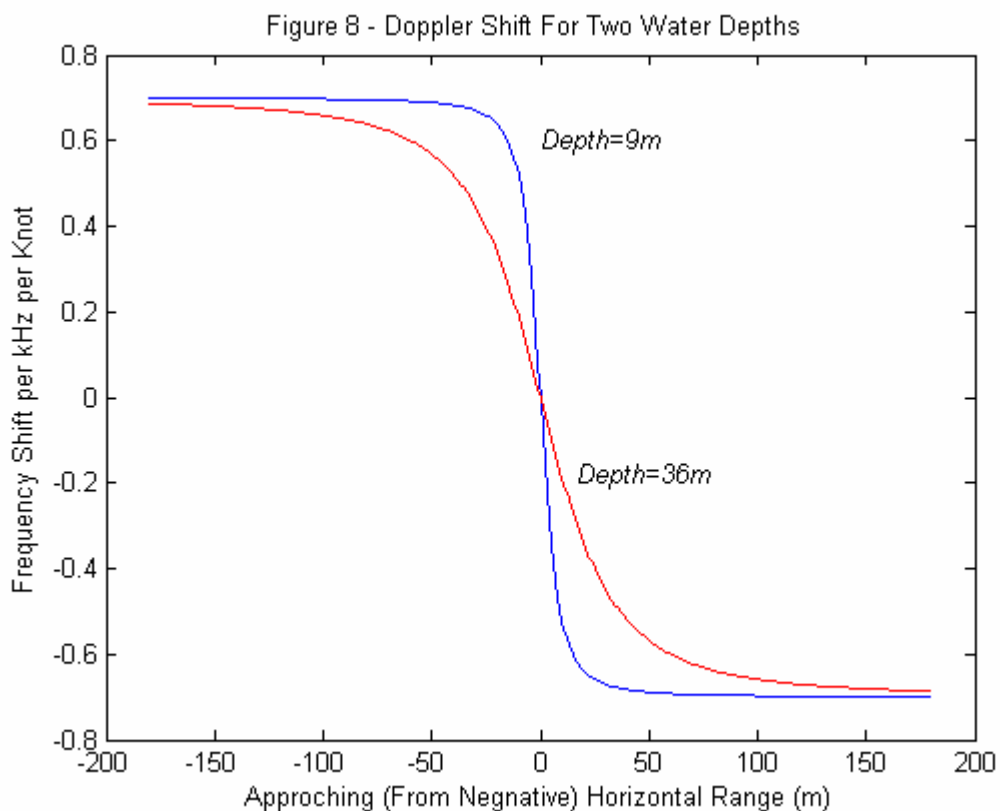
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REFERENCES:

¹C. S. Clay and H. Medwin, *Acoustical Oceanography* (John Wiley & Sons, New York, 1977)

²R. J. Urick, *Principles of Underwater Sound* (McGraw-Hill, New York, 1983)

³I. E. Kinsler and A. R. Frey, *Fundamentals of Acoustics* (John Wiley & Sons, New York, 1962)

⁴P. T. Arveson and D. J. Vendittis, “*Radiated noise characteristics of a modern cargo ship,*” *J. Acoust. Soc. Am.* **107**(1), 118-129 (2000)