

# **Sound Source Verification Testing**

A Discussion at the  
Arctic Stakeholder Open-water Workshop

April 6-9, 2009  
Anchorage, Alaska

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# Introduction

MMPA permits for Arctic open-water seismic surveys require industries to conduct SSV tests for all seismic sources and vessels using OBH recording systems prior to seismic surveys. A report on the SSV tests must be submitted within 5 days of completing the test.

Report includes:

- Empirical distances from the airgun array and other acoustic sources utilized during the seismic surveys to broadband received levels of 190, 180, 160, and 120 dB(rms) re 1  $\mu$ Pa, and
- radiated sounds vs. distance from the seismic and supporting vessels participating the survey.

# Purpose

- Establish more realistic safety zones based on empirical measurements of isopleths;
- Ground truth the modeled safety zones provided in industries' MMPA permit applications;
- Increase NMFS' understandings on overall anthropogenic noises from these activities, therefore, allowing us to make better assessments on the adverse effects from open water seismic surveys on marine mammals and subsistence activities in the region.

# Data Sources for This Presentation

- Shell Offshore Inc. 2006 90-day monitoring report by LGL Alaska Research Associates Inc., LGL Ltd. & Greeneridge Science Inc.
- Shell Offshore Inc. 2007 90-day monitoring report by LGL Alaska Research Associates Inc., LGL Ltd. & JASCO Research Ltd.
- Shell Offshore Inc. 2008 90-day monitoring report by LGL Alaska Research Associates Inc., LGL Ltd. & JASCO Research Ltd.
- ASRC Energy Services 2008 SSV Tests Report by JASCO Research Ltd.
- ConocoPhillips Alaska Inc. 2008 Acoustic Modeling by JASCO Research Ltd.

# Results 1: Modeling vs. Measurements

Table 1. Comparisons of Specified Received SPL between Modeled and Empirically Measured Values (distance in meters).

Received Level (rms) (dB <i>re</i> 1 $\mu$ Pa)	Location & Airgun Array					
	CPAI & ASRC Chukchi (2008) 4 x 10 in <sup>3</sup>		Shell Chukchi (2006) 3147 in <sup>3</sup>		Shell Beaufort (2006) 240 in <sup>3</sup>	
	<u>Modeled</u>	<u>Measured</u>	<u>Modeled</u>	<u>Measured</u>	<u>Modeled</u>	<u>Measured</u>
<b>190</b>	20	45	230	460	20	89
<b>180</b>	115	140	810	1,270	150	250
<b>170</b>	na	430	2,190	3,320	300	680
<b>160</b>	1,665	1,200	4,530	7,990	990	1,750
<b>120</b>	Na	23,000	25,9500	67,6200	35,980	22,220

# Results 2: SSV Tests in Different Years

Table 2. Comparisons of Airgun SSV Tests of Received Levels in Same Oceans in Different Years (distance in meters).

Received Level (rms) (dB <i>re</i> 1 $\mu$ Pa)	SOI Chukchi Sea 3147 in <sup>3</sup>			SOI Beaufort Sea 3147 in <sup>3</sup>		SOI Beaufort Sea 30 in <sup>3</sup> Mitigation gun	
	2006	2007	2008	2007 <i>Camden Bay</i>	2008 <i>Como Prospect</i>	2007	2008
<b>190</b>	460	450	544	757	24*	48	13
<b>180</b>	1,270	1,140	1,267	2,245	210	136	59
<b>170</b>	3,320	2,900	2,933	5,986	1,500	386	270
<b>160</b>	7,990	7,150	6,694	13,405	6,700	1,069	1,100
<b>120</b>	67,620	58,400	104,331	74,813	54,000	23,698	24,000

\*Data extrapolated from measurement at long distance.

# Results 3: SSV Tests for Vessels

Table 3. Comparison of SSV Tests of Received Levels from *MV Gilavar* in Different Years, along with Best Fits Models (distance in meters)

SSV Dates		<i>July 12, 2006</i>	<i>2007 (date unknown)</i>	<i>July 27-28, 2008</i>
Location		<i>Chukchi Sea</i>	<i>Camden Bay (Beaufort Sea)</i>	<i>Chukchi Sea</i>
Vessel Speed (knots)		<i>~12</i>	<i>4.6</i>	<i>3.8</i>
Best Fit Equation		$RL = 172.6 - 16.5\log R$	$RL = 173 - 13.3\log R - 0.00037R$	$RL = 169.1 - 12.4\log R$
Received Level (rms) (dB <i>re</i> 1 $\mu$ Pa)	<b>140</b>	<i>95 m</i>	<i>303 m</i>	<i>220 m*</i>
	<b>130</b>	<i>382 m</i>	<i>1,710 m</i>	<i>1,400 m</i>
	<b>120</b>	<i>1,541 m</i>	<i>9,660 m</i>	<i>8,800 m</i>

\* Extrapolated from minimum measurement range of 500 m.

# Conclusions

- Discrepancies between modeled & measured values of RL in both Chukchi and Beaufort seas for all airguns.
- Variations of sound propagation under different oceanographic regimes: more or less different propagation ranges for same airgun arrays in the same ocean basins in different years.
- Large variation of vessel noise propagation ranges from the same vessel (*MV Gilavar*) in different years.
- From the best fits models, sound source level of *MV Gilavar* seems to have little change over the years (169.1 – 173 dB *re* 1  $\mu$ Pa).



# Discussion

- SSV testing database for acoustic sources including vessels?
- If so, what needs to be included (source level, airgun configuration, etc)?
- When should a specific sound source be re-measured (change in location, annually, etc)?
- Cumulative vessel noise analysis? Total noise budget in the survey area?