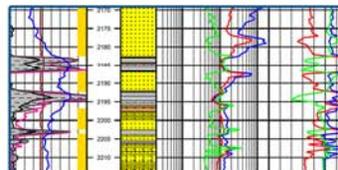
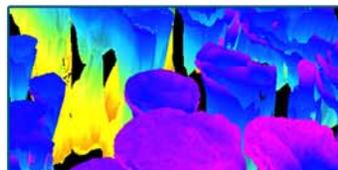
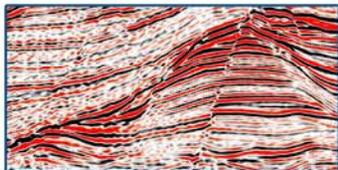


TGS

2013 Chukchi Sea 2D Seismic Program

National Marine Fisheries Service
2013 Open Water Meeting

March 5-7, 2013

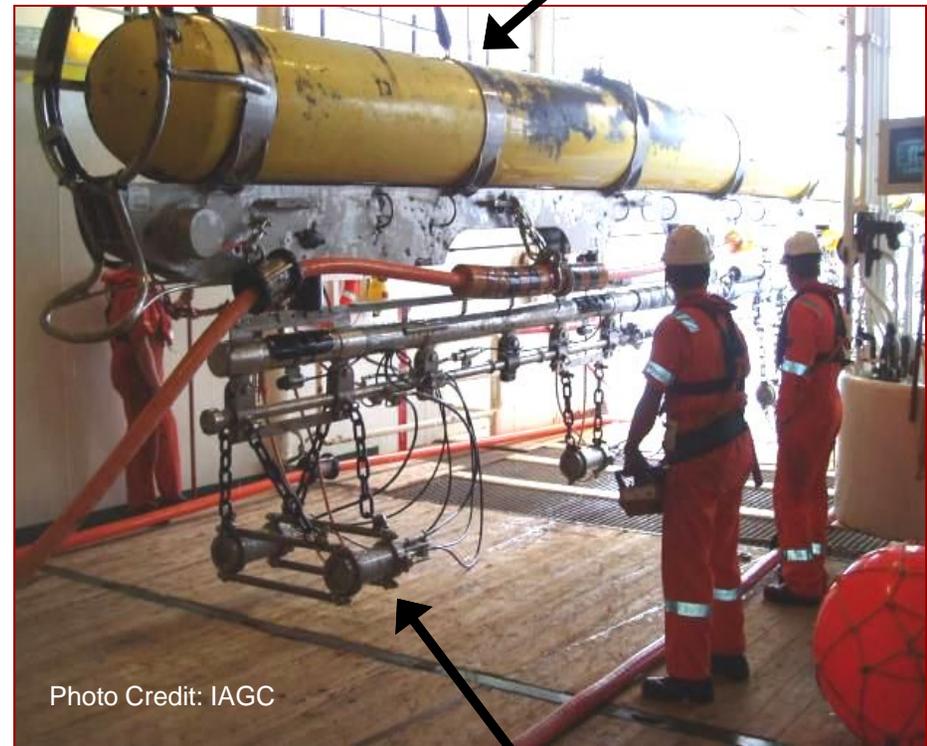


Introductions

- Steve Whidden, TGS, Program Manager
- Troy Nelson, TGS, Regulatory & Stakeholder
- Brad Torry, TGS, Canada and Alaska - Managing Director
- ASRC Energy Services, Alaska Inc. (AES)
 - Elizabeth Benson, AES Project Manager
 - Megan Blee, AES Marine Scientist
 - Samantha Simpson, AES Environmental Scientist/Fisheries Biologist
 - Inuuteq Stotts, AES Stakeholder Coordinator
 - Robin Demoski, AES Stakeholder Coordinator
 - Mari Smultea, SES Marine Scientist (Subcontractor to AES)
 - Dave Steckler, Entiat River/Mysticetus software

TGS 2013 2D Seismic Survey

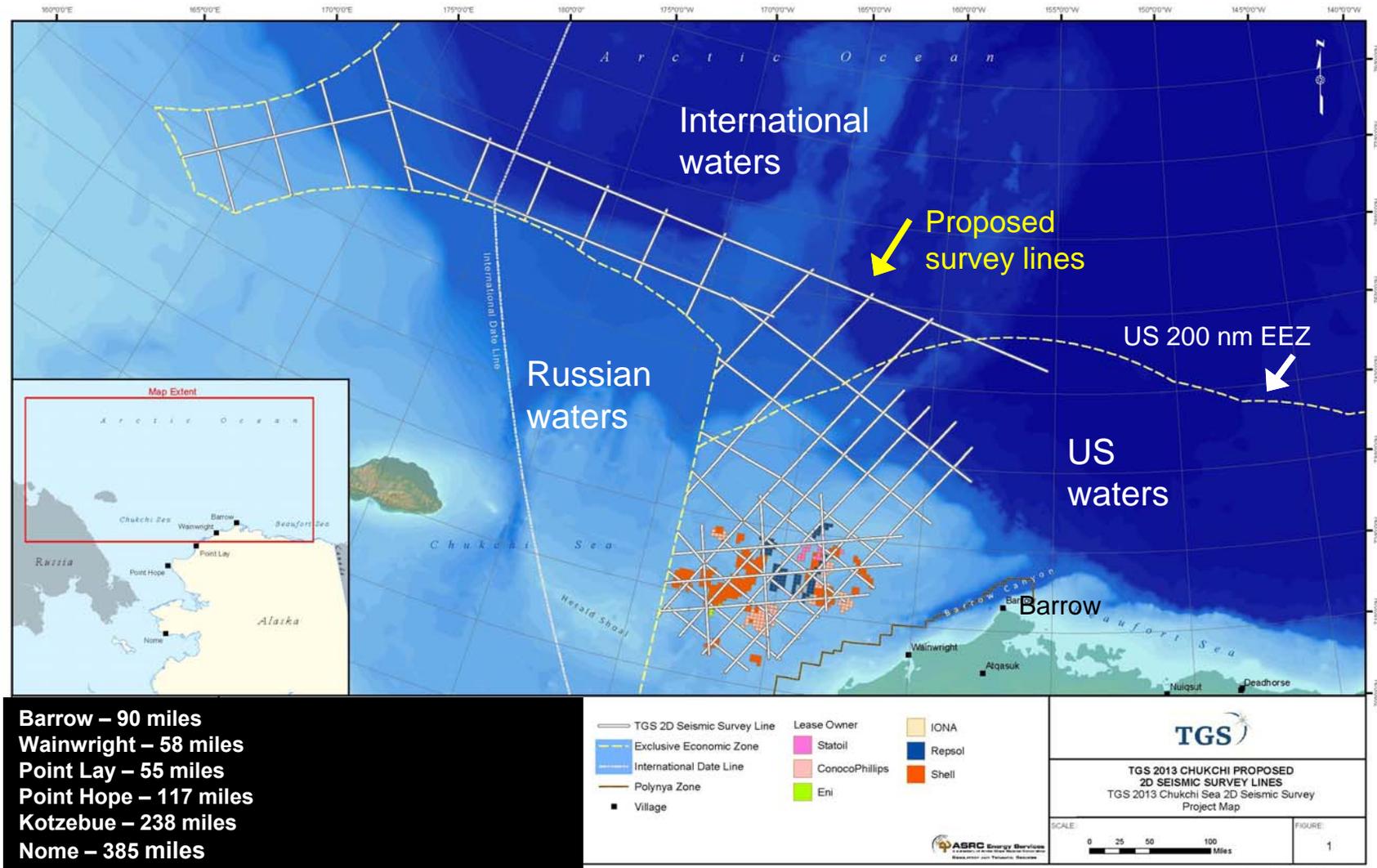
1. Survey location & schedule
2. Monitoring and mitigation
3. Consultations with stakeholders



Float

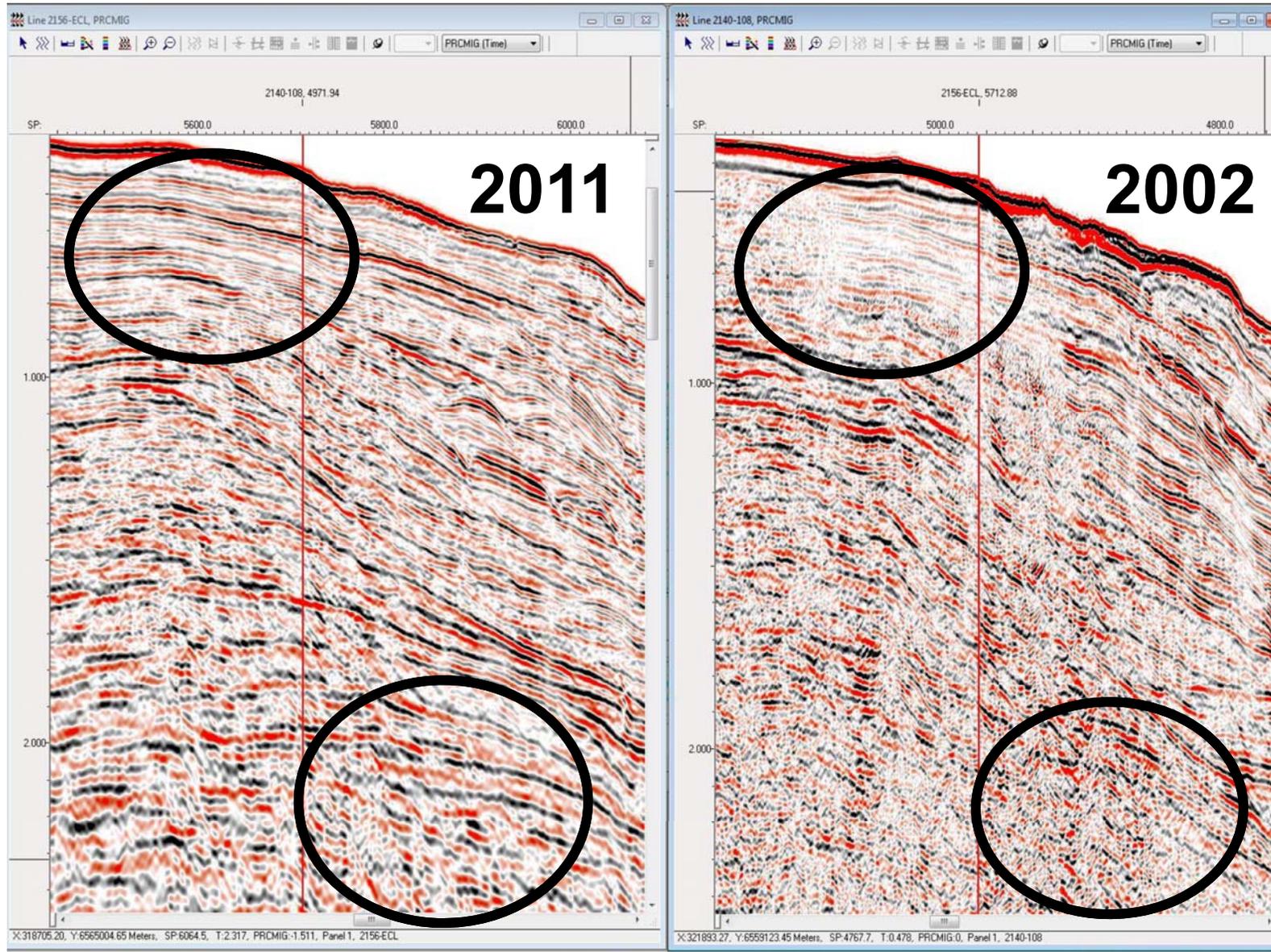
Seismic
sound source

2013 Survey Location



Barrow – 90 miles
 Wainwright – 58 miles
 Point Lay – 55 miles
 Point Hope – 117 miles
 Kotzebue – 238 miles
 Nome – 385 miles

New Seismic Acquisition v. Older Data



Survey Schedule

US Waters	International Waters
<ul style="list-style-type: none">• Start between mid July and mid August• Seismic: 35 days• Operational period: 45-60 days• Complete survey lines closest to Alaska shore first (July – August)	<ul style="list-style-type: none">• Start mid to late September or early October• Seismic: up to 33 days• > 200 nautical miles from Alaska coastline

Project Vessels

(1) Seismic Survey Vessel: *Aquila Explorer* (or similar)

- 5-mile-long (8 km) seismic receiver cable
- 3,280 in³ seismic source (reduced from 4,100 in³)

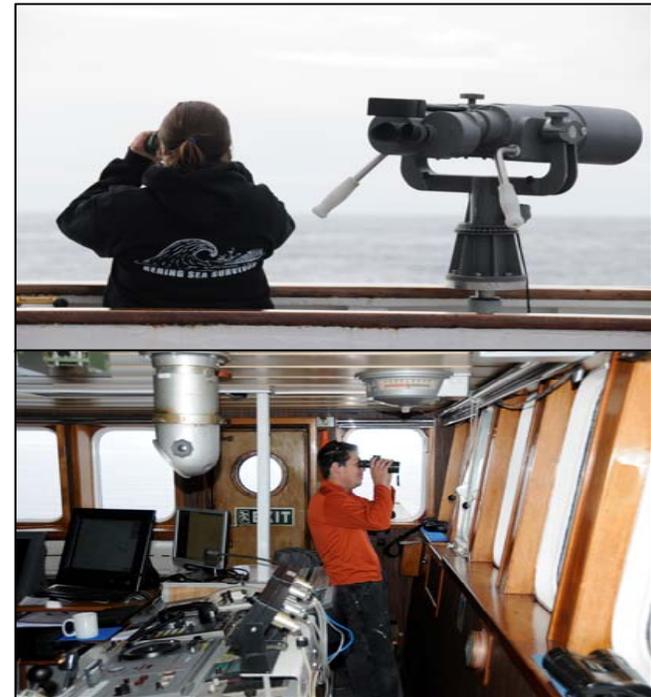


(2) Scout / Monitoring Vessel (TBD)

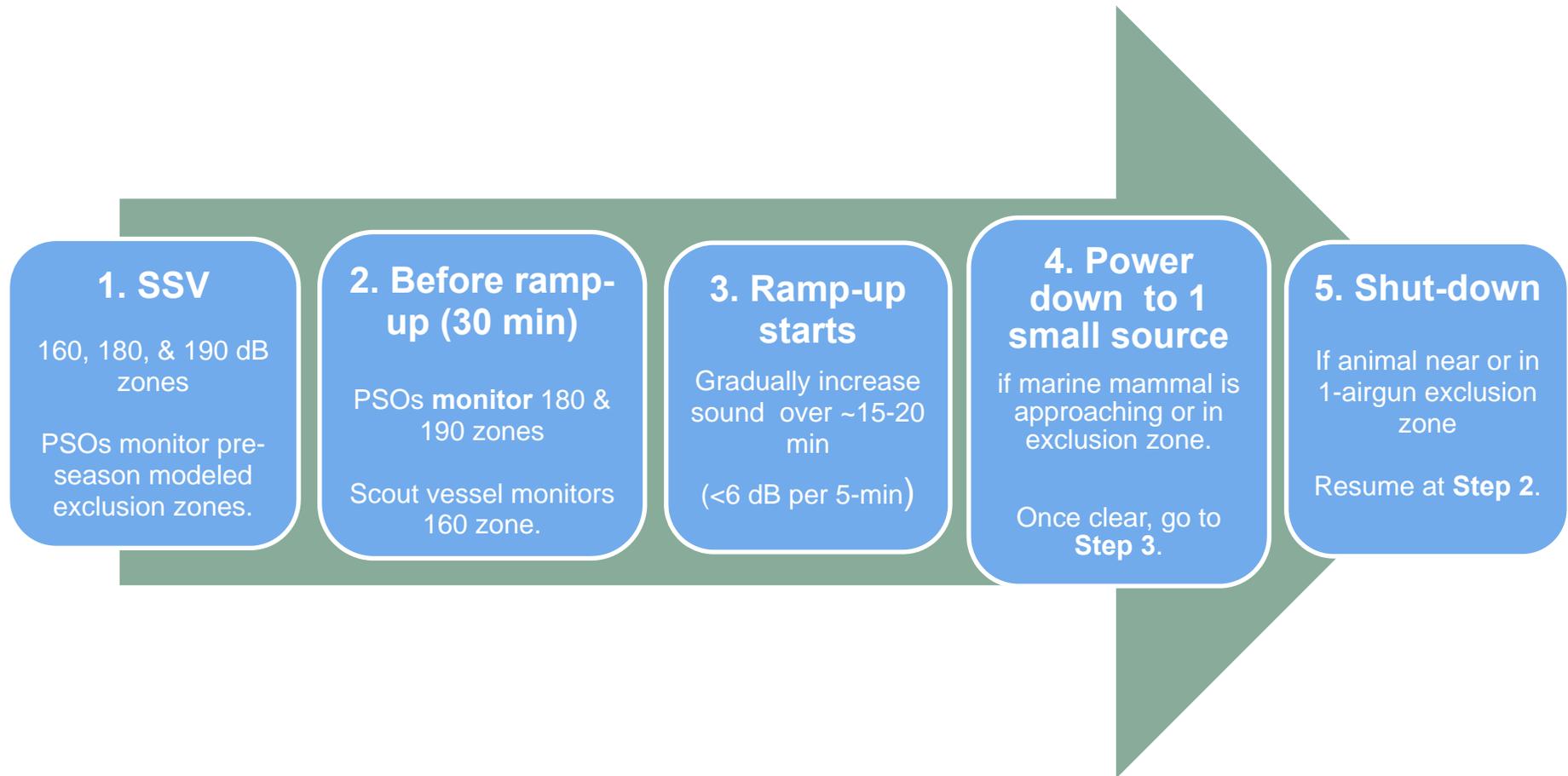
- Operate in advance of survey vessel
- Assist for emergency / equipment failure

Standard Monitoring and Mitigation

- **Vessel-based Protected Species Observers (PSOs)**
 - On both vessels
 - Iñupiat PSOs & TK
 - Scientific PSOs
 - Big-eye binoculars
 - Night-vision devices
- **Sound source verification**
- **Power-down, ramp-up, shut-down, speed/course alterations**
- **Communication Center**
- **2013 CAA**



Standard Mitigation Steps

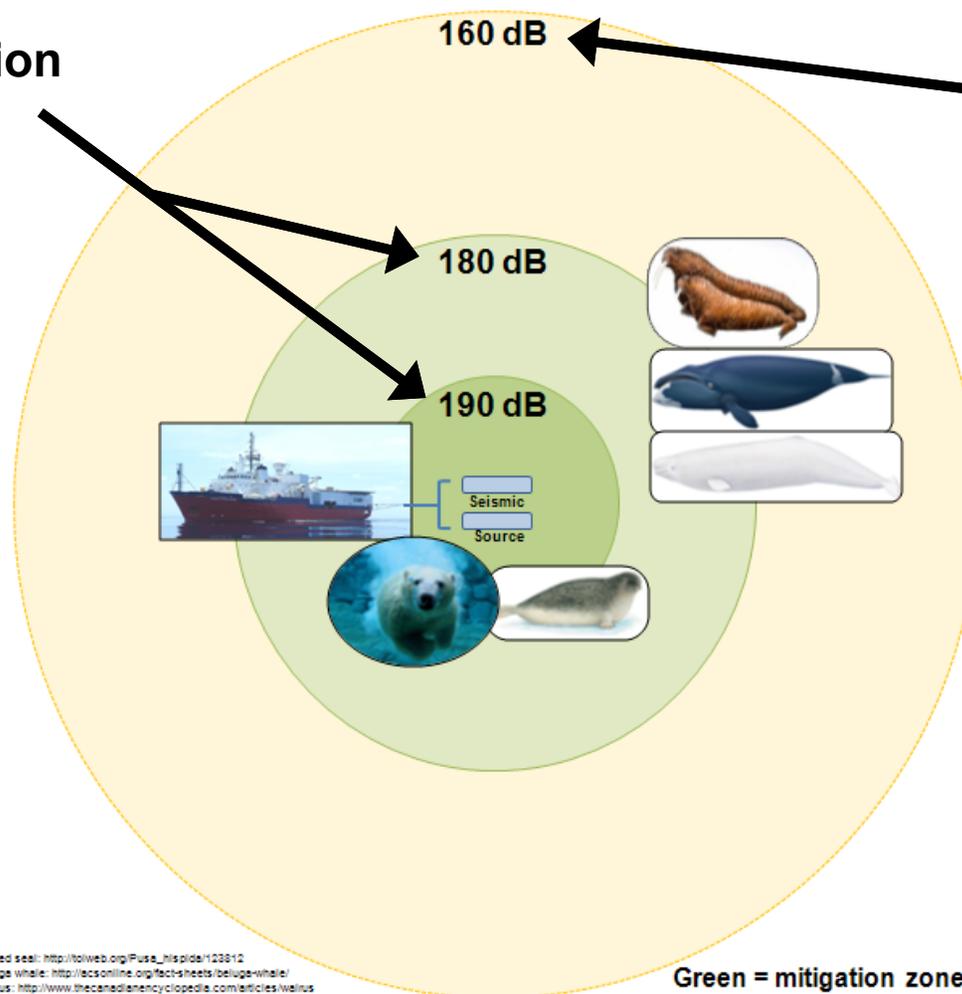


*If animal observed dead, dying, injured, or in distress SHUT DOWN immediately. Contact NMFS.

NMFS Pulsed Sound Exposure Regulations – Chukchi Sea

“Level A” mitigation zones

“Level B” behavior disturbance



Ringed seal: http://olweb.org/Pulse_his/slide/123812
Beluga whale: <http://ecsonline.org/fact-sheets/beluga-whale/>
Walrus: <http://www.thecanadianencyclopedie.com/articles/walrus>
Bowhead Whale: http://www.bbc.co.uk/news/10340277/bowhead_whale
Polar bear: <http://www.animals.w.com/wallpaper/Polar-bear-Swimming-under-Water.r/>

Green = mitigation zone
Orange = monitoring zone



Sound Source Radii

- JASCO modeled mitigation zones for 3 water depths
- Distances 10% higher than modeled for 4,100 in³ array

Sound Level (dB re 1μPa, rms)	NMFS Regulated Mitigation Radii (m)		
	Depth: 17-40 m	Depth: 40-100 m	Depth: >100 m
190	810	710	430
180	2,400	2,600	2,400
160	9,600	12,000	18,000
<i>120 dB regulated for continuous sounds</i>			
120	170,000 m	155,00 m	170,000 m

Sound Level Comparisons to NMFS Zones

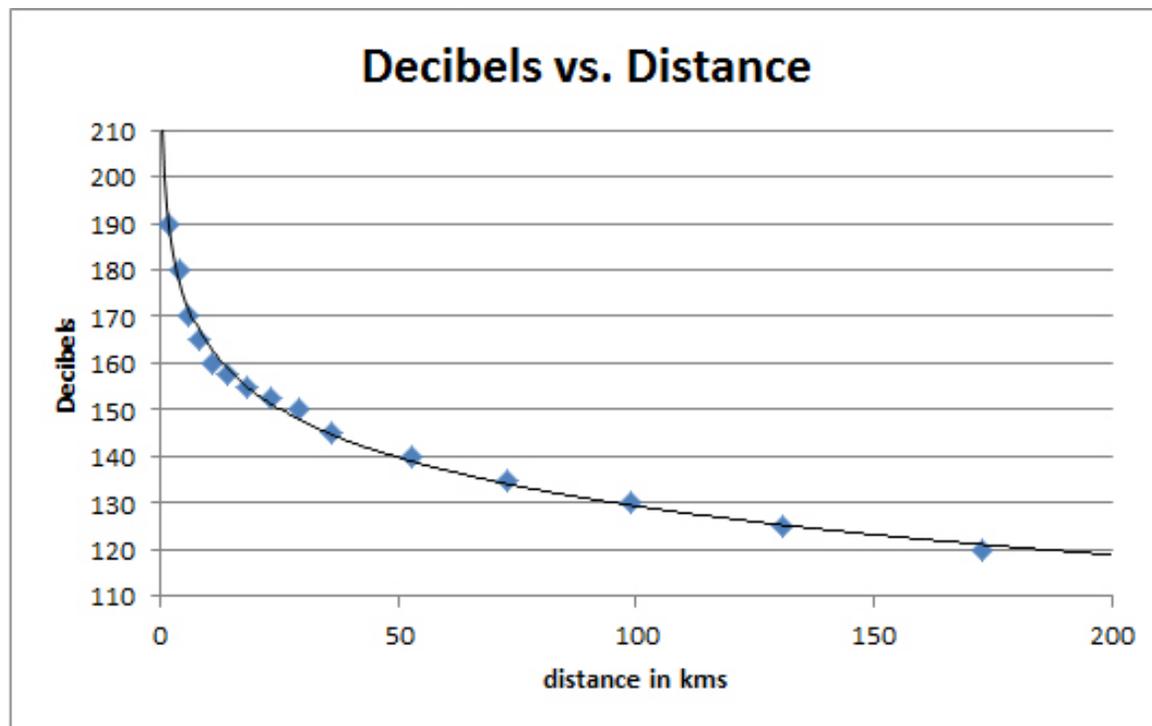
Underwater Sound Levels in decibels (dB)*	Sound Source
206-225	Beluga whale
193	Icebreaking
190	NMFS monitoring criteria for polar bear & seals
128-189	Bowhead, fin, gray whale
180	NMFS monitoring criteria for whales & Pacific walrus
162	Chainsaw/skidoo
160	NMFS monitoring criteria for large groups of whales
151	Fishing vessel
122	Normal human conversation
60	Ambient noise, sea state zero (0)

* dB re 1 μ Pa [rms]

Sources: Richardson et al. 1995, Richardson 2005, Tervo et al. 2012; <http://www.acousticecology.org/oavalidtocompareairwater.html>;
<http://www.dosits.org/science/soundsinthesea/commonsounds/>; <http://www.arc.id.au/SoundLevels.html>

Project Seismic Sound Characteristics

- Intermittent pulses (~ every 11 seconds)
- Brief duration (~ < 3 milliseconds at the source position)
- Directed to sea floor
- Broadband, but low-frequency dominated
- Sound level drops quickly with distance



Mitigation by Design

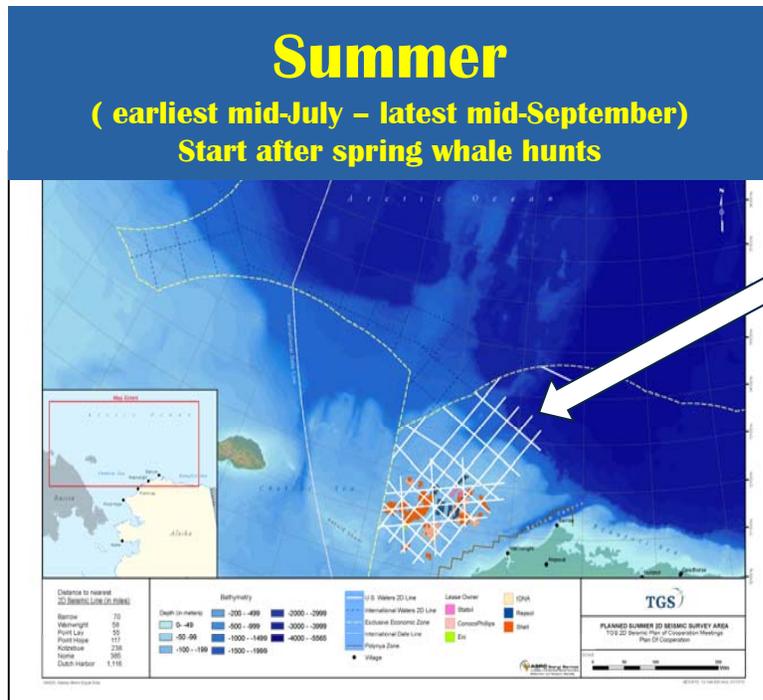
LOCATION

- Survey lines outside main whale migration corridors
- Fall operations $> 72^{\circ}$ N & >200 nm NW of Barrow
- Closest community 55 miles (Point Lay)
- Do near shore lines first, then move offshore

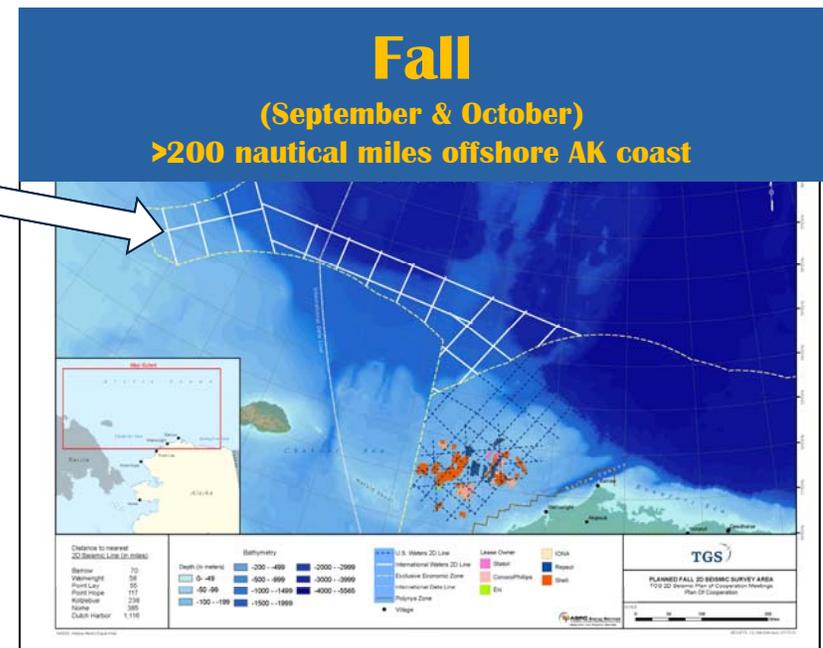
TIMING

- Operations start after spring whale hunts
- During fall, operations far offshore (>200 nm)

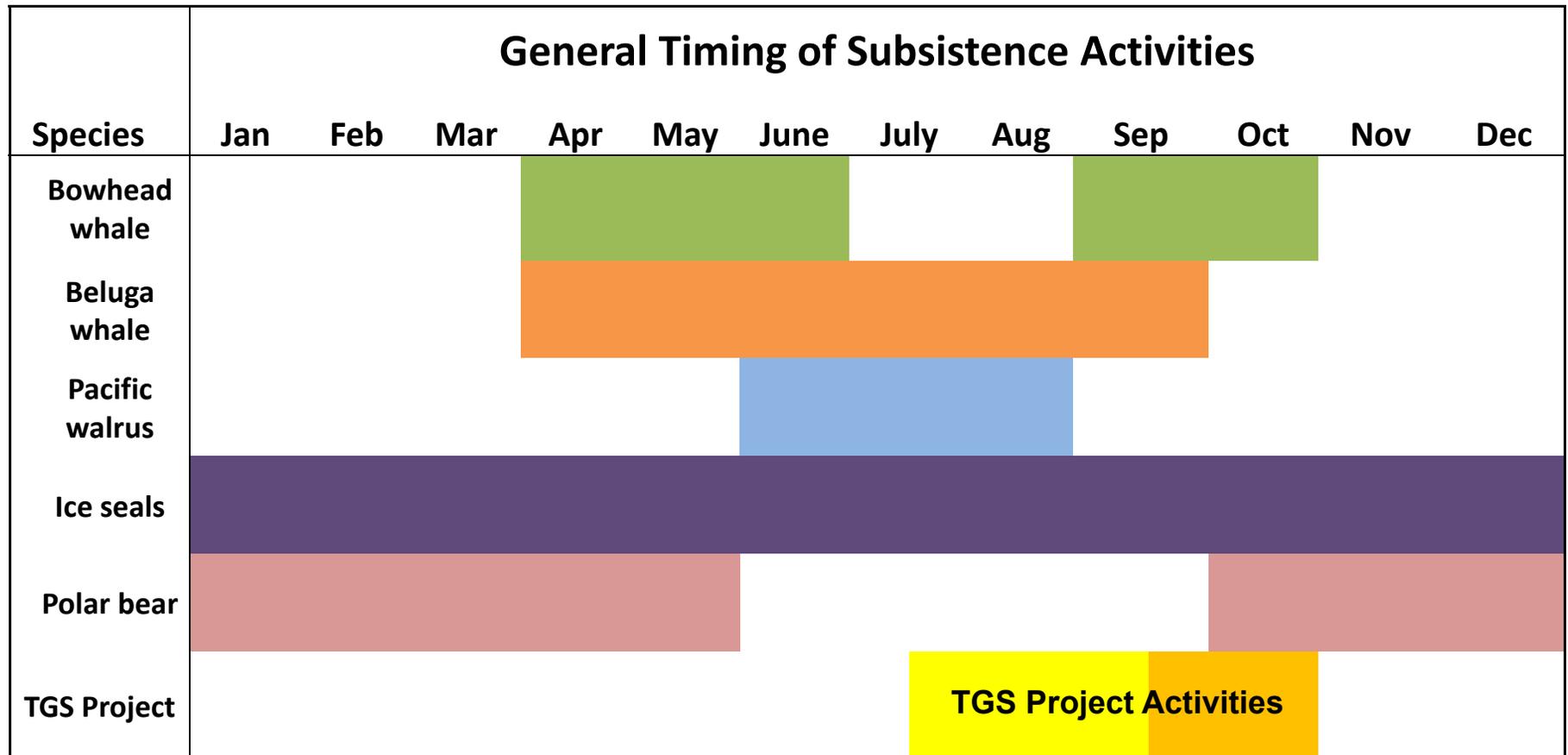
Location and Timing of TGS Project



White Lines
=
Seismic lines to survey each
season



Timing of TGS Project Relative to Subsistence Activities



Source: Bacon, Joshua J., Taqulik R. Hepa, Harry K. Brower, Jr., Michael Pederson, Tommy P. Olemaun, John C. George, and Bernie G. Corrigan. 2009. Estimates of Subsistence Harvest for Villages on the North Slope of Alaska, 1994 – 2003. North Slope Borough, Department of Wildlife Management, Barrow.

Mitigation by Design (cont'd)

SOUND

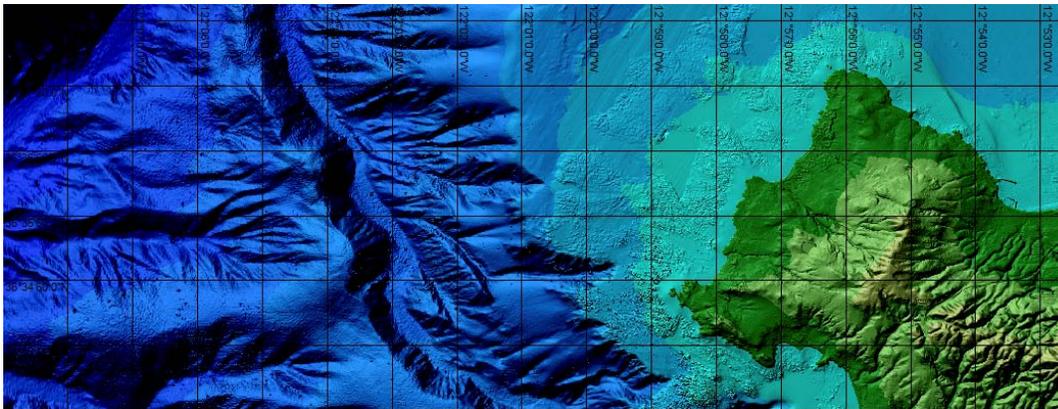
- No multi-beam sonar or sub-bottom profiler
 - Only standard vessel fathometers
- Only 1 small source element operating during line changes
 - ~5-12 hr
- Reducing number of seismic pulses during line changes

ADDITIONAL TECHNOLOGIES

Mysticetus™ all-in-one Survey System

Automatic high resolution mapping

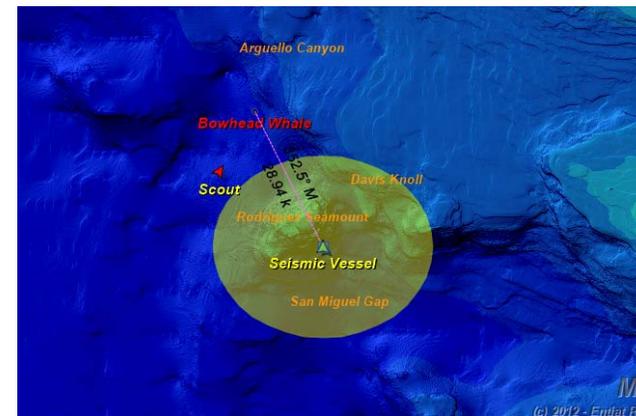
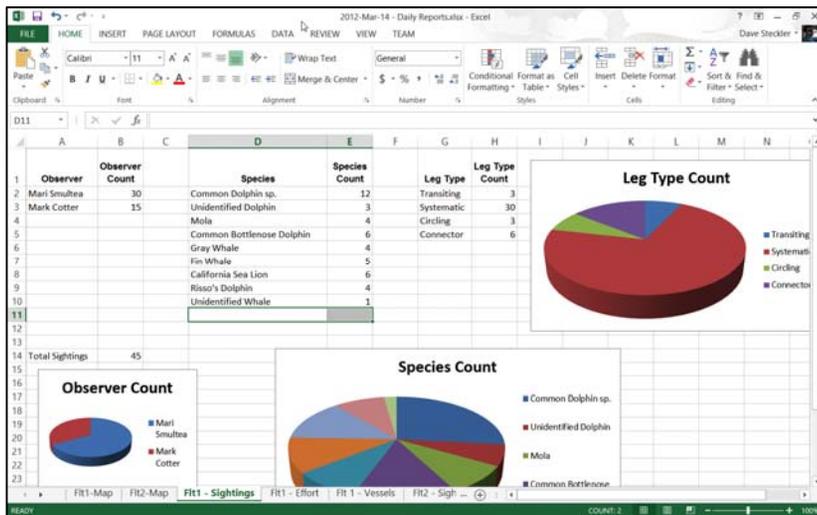
Simple, user-configurable data entry



Unique Chronol ID	Time	Plane Pos	plane alt_ft	Decl Angle	Abs Brg	Distance
13	2009-Ju...	32°55'39.4"N 117°21'28.4"W	1025 ft	27°	74°	0.68 k
14	2009-Ju...	32°49'50.6"N 117°21'36.9"W	1232 ft	30°	285°	0.74 k
15	2009-Ju...	32°56'39.8"N 117°20'27.2"W	1011 ft	16°	55°	1.08 k
16	2009-Ju...	33°00'26.2"N 117°23'53.4"W	929 ft	22°	53°	0.74 k
17	2009-Ju...	33°12'27.1"N 117°35'16.8"W	1481 ft	49°	57°	0.59 k
18	2009-Ju...	33°09'12.9"N 117°30'41.6"W	1423 ft	34°	172°	0.76 k
19	2009-Ju...	32°46'59.6"N 117°27'51.5"W	936 ft	46°	343°	0.39 k
20	2009-Ju...	32°55'20.0"N 117°21'3.7"W	1153 ft	14°	303°	1.39 k
21	2009-Ju...	32°57'31.5"N 117°21'6.3"W	978 ft	15°	150°	1.11 k
22	2009-Ju...	32°54'25.7"N 117°19'50.6"W	1581 ft	69°	66°	0.51 k
23	2009-Ju...	32°53'55.1"N 117°20'44.8"W	1517 ft	28°	33°	0.96 k
24	2009-Ju...	33°10'49.3"N 117°29'39.7"W	798 ft	14°	63°	0.97 k
25	2009-Ju...	32°41'26.7"N 118°17'25.8"W	691 ft	32°	168°	0.39 k
26	2009-Ju...	32°40'28.2"N 118°22'35.8"W	658 ft	28°	173°	0.42 k

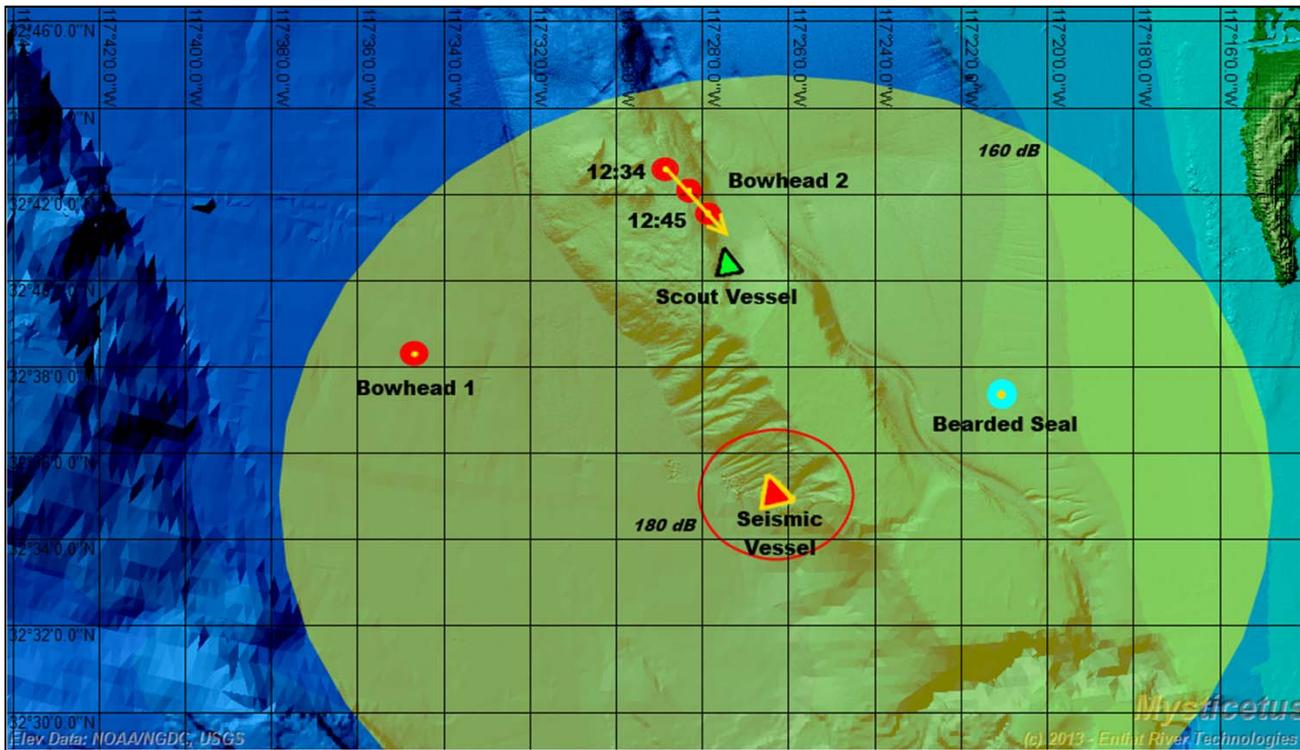
Configurable, one-click summary reports in Excel

Real-time multi-vessel tracking and seismic display (next slide)



More Effective Mitigation Technology

AIS Real-time Mapping System using Mysticetus™



AIS – Automatic Identification System



- One “AIS–A” transceiver and antenna **on each vessel**
- 12.5 Watt Radio – Effective range ~24 nm
- Display sightings in real time on both vessels
 - Aid in monitoring exclusion zones

NMFS Panel Review Recommendations

(Received Feb 26, 2013)

Recommendation	TGS Response
Reduce sound emissions	<ul style="list-style-type: none">• Reduced array size 4100 to 3280 in³• Pulses separated by 40-60 vs. 12 sec on turns• Turn off fathometers when safe to do so
Share sightings, tracks & sound data	<ul style="list-style-type: none">• Upload data to public website OBIS-SEAMAP• Integrate with other 2013 studies as possible• Send agencies digital sighting/effort data
Constant PSO comms – both vessels	Real-time AIS multi-vessel map display <i>Mysticetus</i>
Add far-field monitoring component	Evaluating remote acoustic recorders N of 72N
Re-evaluate beluga take estimates	Will re-evaluate (beluga & bowhead)
Use 2013 NMFS aerial data for baseline take estimates	<ul style="list-style-type: none">• Agree; will coordinate with NMFS/NMML• DISTANCE to analyze density
Scout vessel survey ahead of seismic	Agree

Consultation and Outreach 2012 – 2013

- October 2012 – North Slope Borough Planning Commission & NSB Leadership
- November 2012 – BOEM Resource Evaluation Meeting
- December 2012 – Village Leadership Meetings, AEWC 4th Q Meeting, BOEM Environmental Evaluation Section Meeting
- January 2013 – NMFS Peer Review Meeting – IHA
- February 2013 – AEWC Convention
- January & February 2013 – Plan of Cooperation Meetings
 - Barrow, Wainwright, Point Lay, Point Hope, Kotzebue
- March 2013 – NMFS Open Water Meeting
- Spring 2013 – Updates to NSB Planning Commission & Wildlife Dept.
- Fall/Winter 2013-2014 – Post-season outreach with communities
- March 2014 – NMFS Open Water Meeting – Post-season reporting

Current Project Status and Progress

- Ongoing engagement with affected subsistence communities
- Implementing Plan of Cooperation
- Participating in AEWC 2013 CAA

- Responding to NMFS comments on IHA
- Updating NMFS IHA and 4MP
- Submitting USFWS LOA and 4MP
- Submitted BOEM G&G and Plan of Operations
- Developing 2013 PSO program



Thank you

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