



A novel approach to measurement of underwater sound levels in a dangerous tidal fjord using a miniature self-contained acoustic recorder

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# TURNAGAIN ARM, ALASKA: BEAUTIFUL BUT DEADLY





# **BAD PRESS**



# Winds and tides can concoct a deadly brew in Alaska's Turnagain Arm

Author: Craig Medred ④ Updated: July 6 🛗 Published July 11, 2013

# 3 rescued from rock at Alaska's Turnagain Arm

By The Associated Press Fairbanks Daily News-Miner Jun 6, 2012 🗨 (0)

# Turnagain Arm Mudflats Dangerous to Belugas, Beachcombers

2:06 a.m. EST, August 23, 2012 | By Blake Essig, Channel 2 News



# **COOK INLET BELUGA**



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#### **"WINDY CORNER" HIGHWAY STRAIGHTENING**



#### TRADITIONAL OFFSHORE RECORDING METHODS UNSUITABLE





#### GENERAL-PURPOSE ACOUSTIC RECORDING TAG



Spotted dolphin photo by Robin Baird, Cascadia Research. NMFS Scientific Research Permit No. 731-1774.



#### ACOUSONDE<sup>™</sup> 3A TECHNICAL



- 22.1 cm long, 3.2 cm diameter
- 262 g (with battery, in air; 86 g in seawater)
- Low-power hydrophone recording band 20 Hz 9.3 kHz
- HF hydrophone option; max sample rate 464 kHz
- Up to 3000 m operating depth (pressure xcdr limited)
- 208 MHz (max) 32-bit ARM9 core with 32-bit bus
- Adjustable clock speed and core voltage
- DMA-based data acquisition and storage
- 3D compass, 3D accelerometer, temperature, pressure
- Data retrieved via USB drag-and-drop



## REMOTELY OPERATED RECORDING PLATFORM?



- Stability in rough conditions
- Buoyant enough to support Acousonde recorder
- Propulsion can tow Acousonde against current
- Range sufficient to minimize near-shore effects
- Low cost
- ...Remote-control boat?

#### INEXPENSIVE REMOTE RECORDING PLATFORM - #1













# INEXPENSIVE REMOTE RECORDING PLATFORM - #2



- Traxxas "Blast" R/C speedboat
- 60 cm long, 15 cm beam
- Remote-control range approx 300' (91 m)
- 16 knot top speed (third-party estimate)
- Room for miniature DGPS receiver/logger inside hull
   \$160



#### TESTING STABILITY AND HYDROPHONE TOW CAPABILITY







#### DEPLOYMENT EXAMPLE (EBBING)







# STUDY GOAL: *MINIMUM* LEVELS AT DIFFERENT TIDAL CONDITIONS



DATA:

- 50 to 80 m from shore
- 1 m depth
- Drift period 40 s to 4 min depending on currents
- PROBLEMS:
  - Local impulsive noise and periodic strumming
  - Potential road & aircraft noise artifacts
- SOLUTIONS (POSTPROCESSING):
  - Analyzed 40 Hz 9.3 kHz (filter LF effects)
  - Analyzed using sliding 0.3-s window (filter impulses)
  - Use minimum results found

MINIMUM BROADBAND LEVELS 40 Hz – 9.3 kHz	
TIDAL CONDITION WINDY CORNER	BROADBAND SPL dB re 1 µPa
Max recorded in Cook Inlet by Blackwell & Greene (2003) - flooding	121
Flooding, near peak flow	108
Ebbing, near peak flow	103
Low tide	81
High tide	74
Min recorded in Cook Inlet by B&G (2003) – high tide	70
Windy corner measurements made at 1-m depth B&G flooding at 10.5-m depth, B&G high tide at 6-n	n depth



# CONCLUSIONS



- Potential blasting sounds may be more audible underwater in Turnagain Arm than originally expected
- Toy boats are fun!
- But the toy boat *did not make this study possible;*
- Rather, the *miniature recorder* made this study possible to be done with a platform as simple and inexpensive as a toy boat
- Therefore, miniature acoustic recorders are even more fun than toy boats.



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# http://www.acousonde.com