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Pacific Northwest NATIONAL LABORATORY

# Quantitative Evaluation of Four Flow Shield Designs

9/14/2022

Emma Cotter

Alexandrea Barker, James McVey, Garrett Staines, Erin Walters, Linnea Weicht, and Joseph Haxel

# What is Flow Noise?

Low-frequency pseudosound caused by flow advected over a hydrophone transducer

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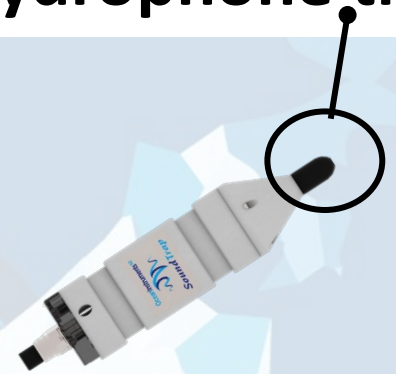
Low-frequency pseudosound caused by flow advected over a **hydrophone transducer**



# What is Flow Noise?

Low-frequency pseudosound caused by **flow advected over** a hydrophone transducer

Pressure fluctuations due to turbulence or flow interaction with hydrophone

# What is Flow Noise?

Low-frequency **pseudosound** caused by flow advected over a hydrophone transducer

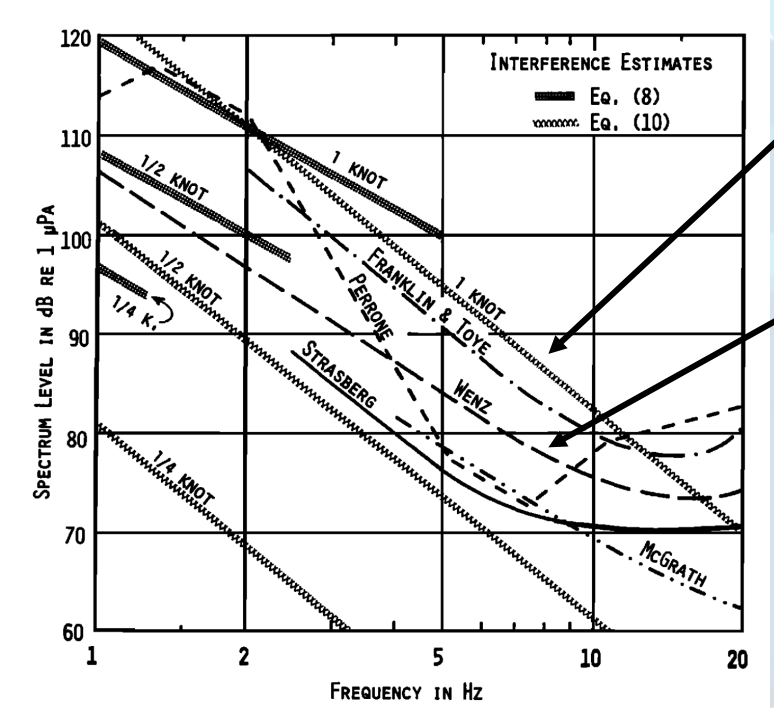
Non-propagating sound

# What is Flow Noise?

< 1 kHz

**Low-frequency** pseudosound caused by flow advected over a hydrophone transducer

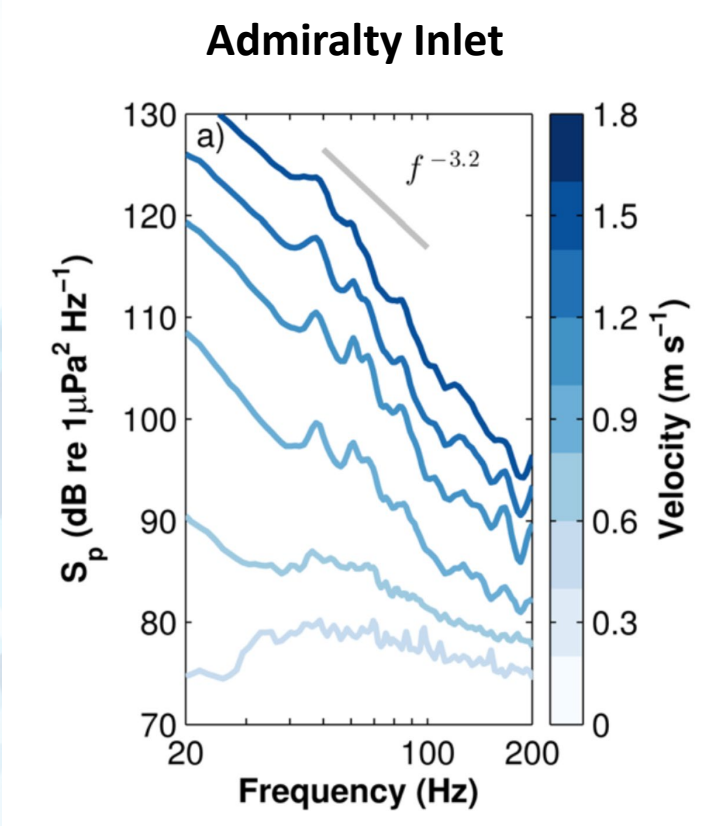
# What is flow noise?




Flow noise at 0.5 m/s

Ocean ambient noise

**Strasberg 1979**




**Bassett et al 2014**

# Flow Noise Mitigation

## Drifting Platform

Photo credit: Ocean Sonics

## Stationary Platform

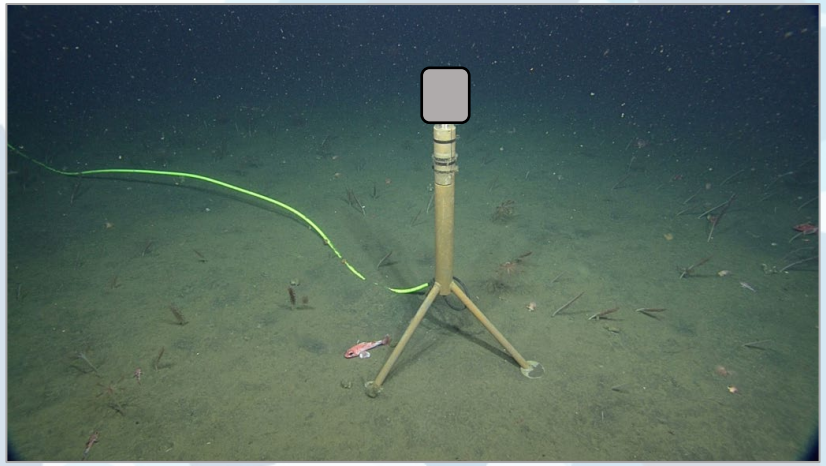


Photo credit: MBARI

# Flow Shield Designs

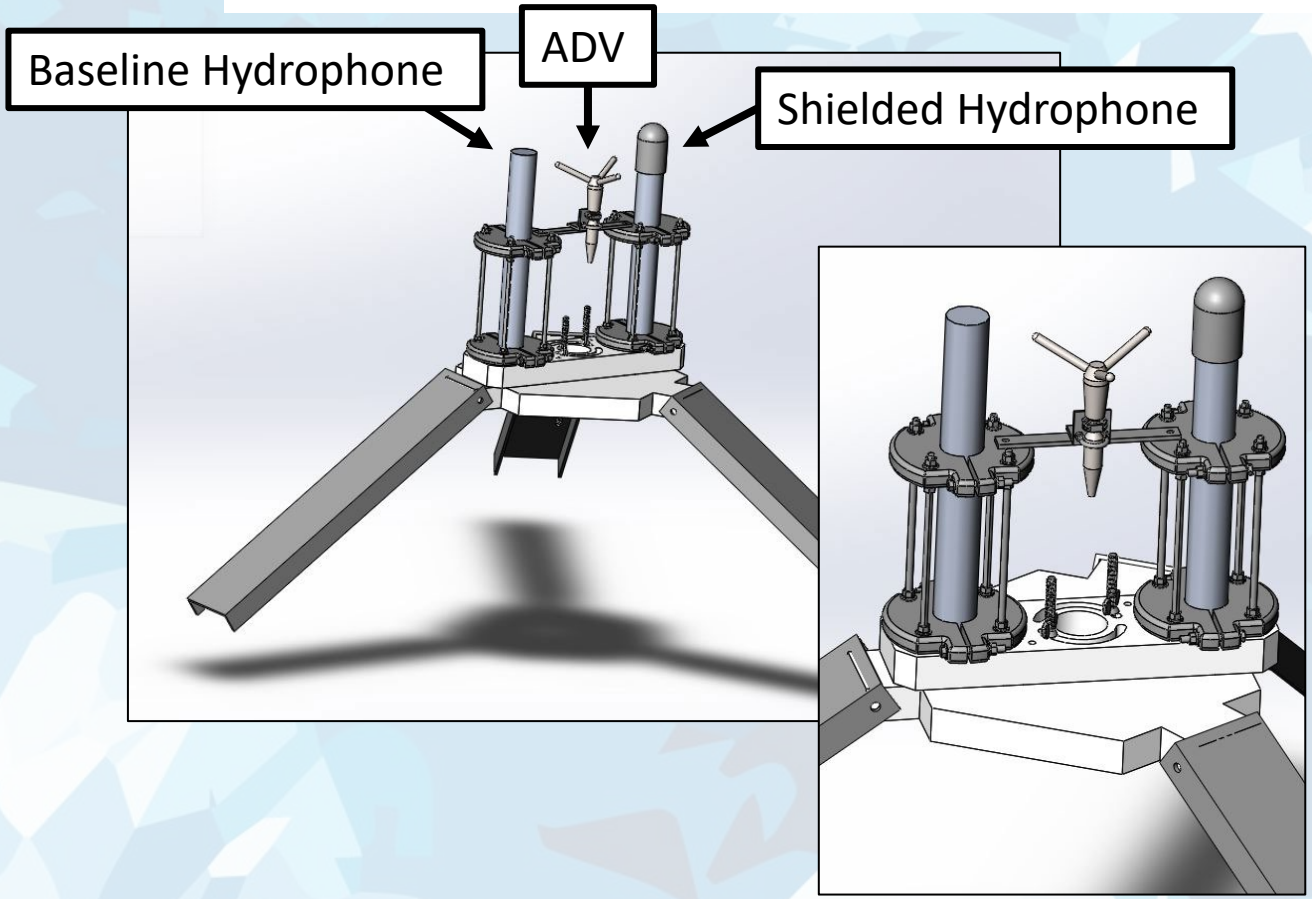
Nylon


Ballistic Nylon


Foam


Oil-filled

# Experimental Design

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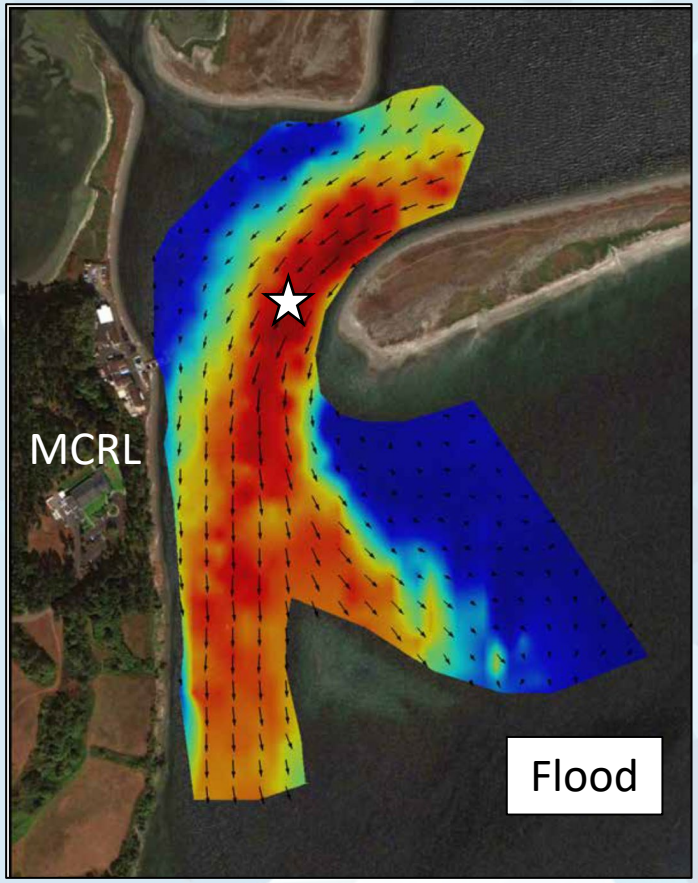
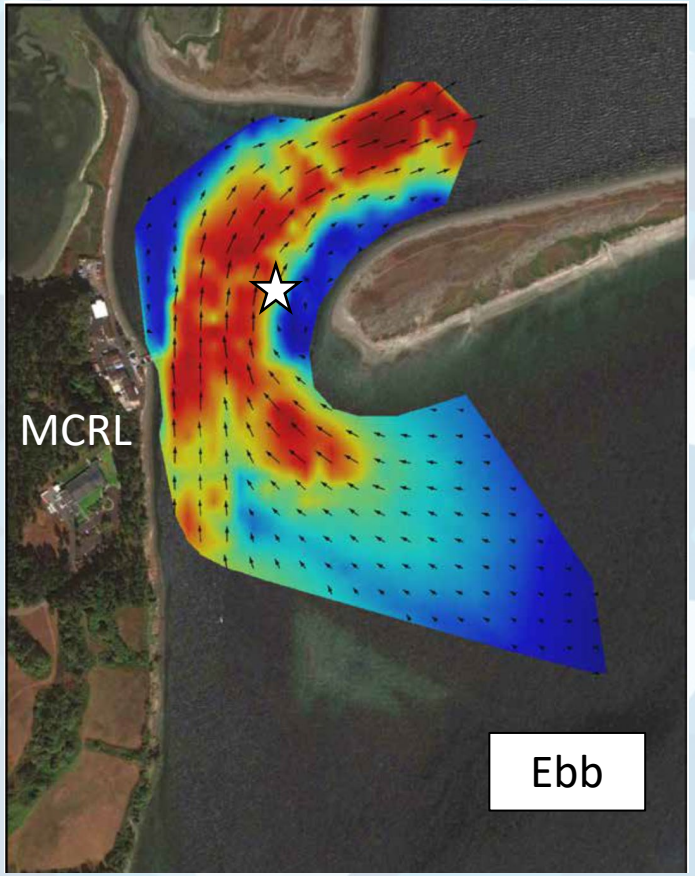


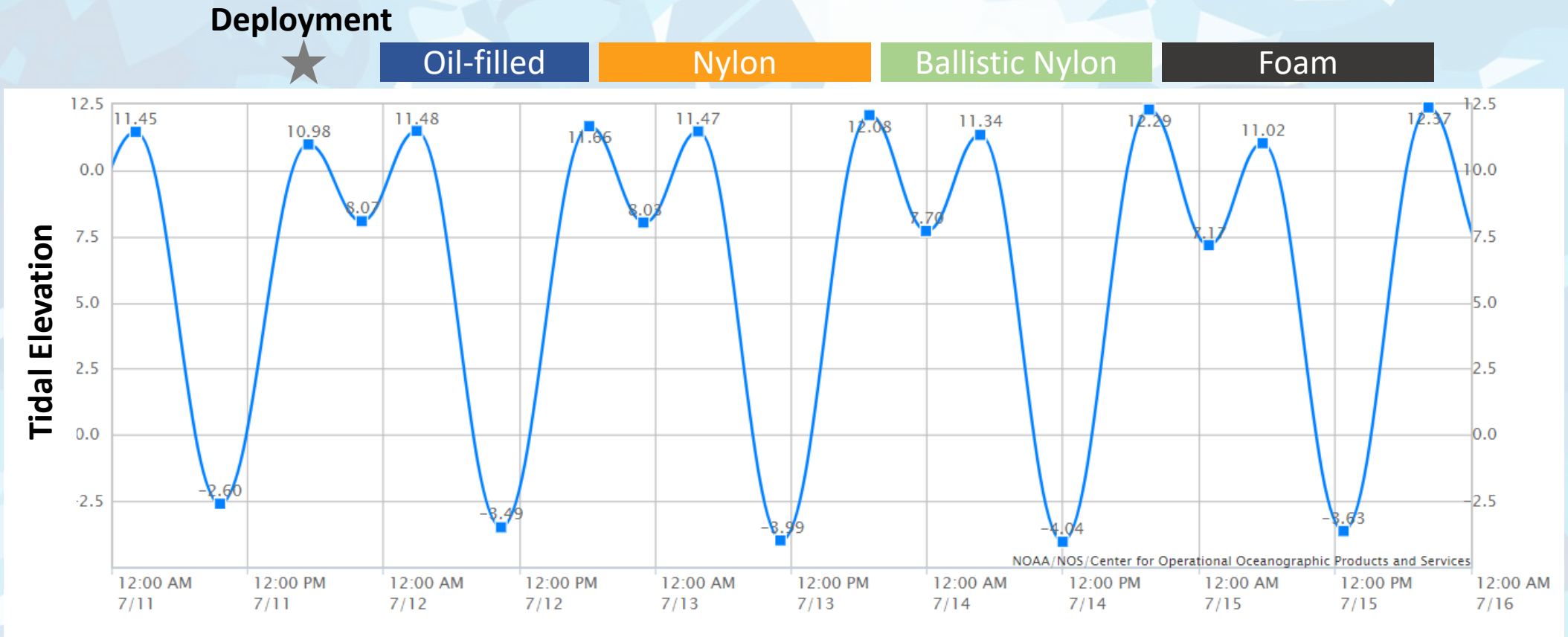





Normalized Velocity

*ADCP Survey data from Harding et al 2016*

# Experimental Design



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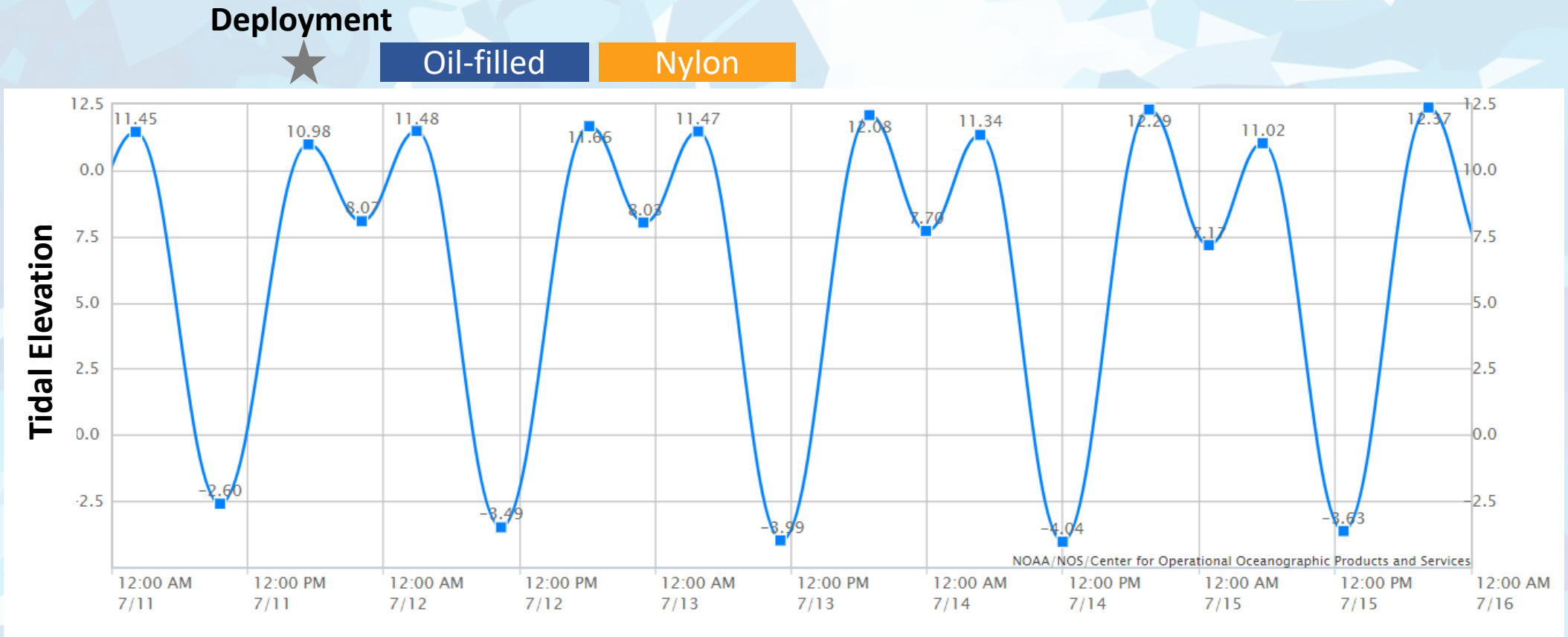

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# Quantitative Evaluation of ~~Four~~ Two Flow Shield Designs

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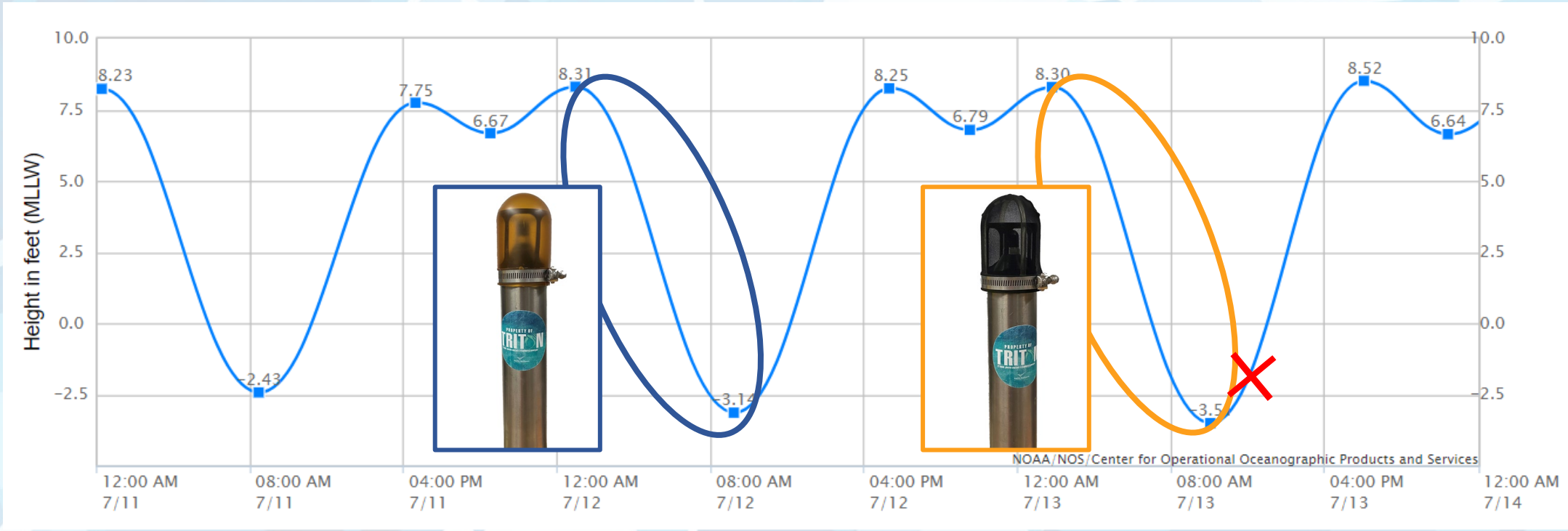
# Experimental Design

Deployment ★

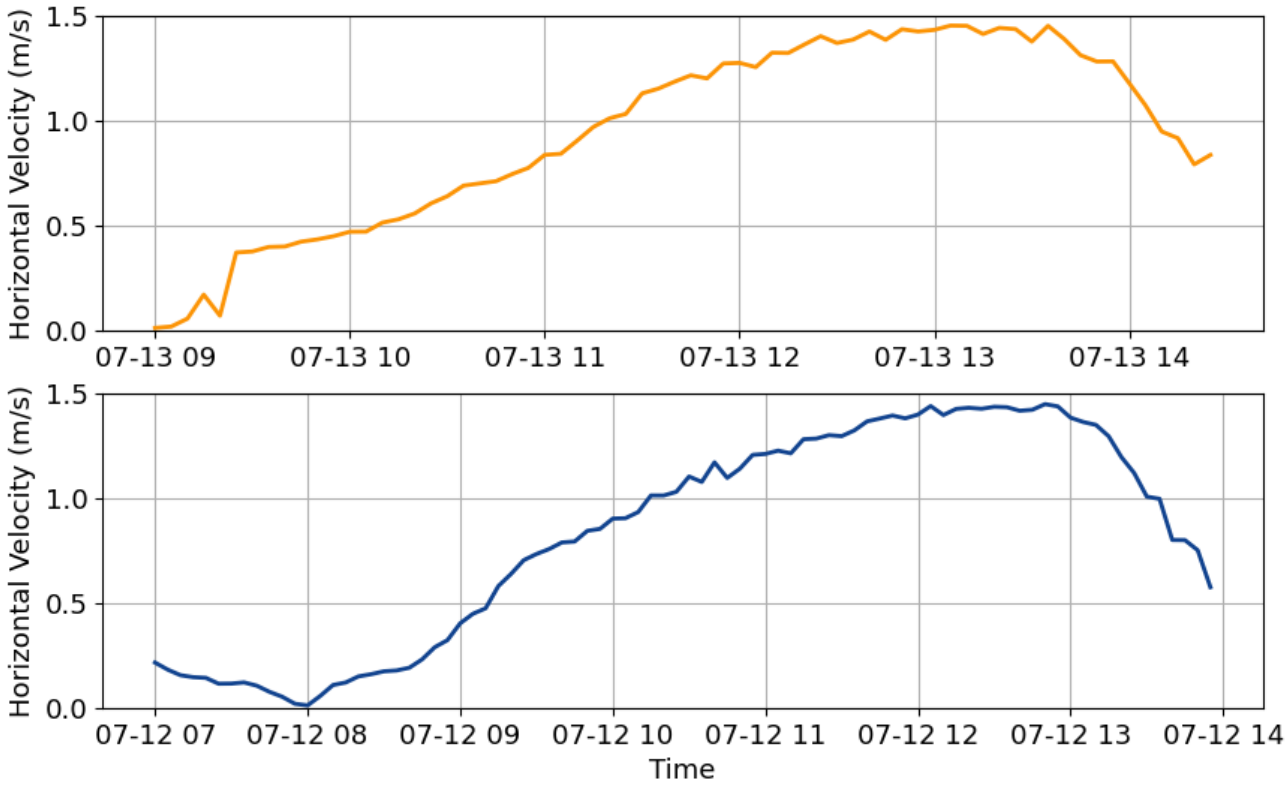
Oil-filled

Nylon

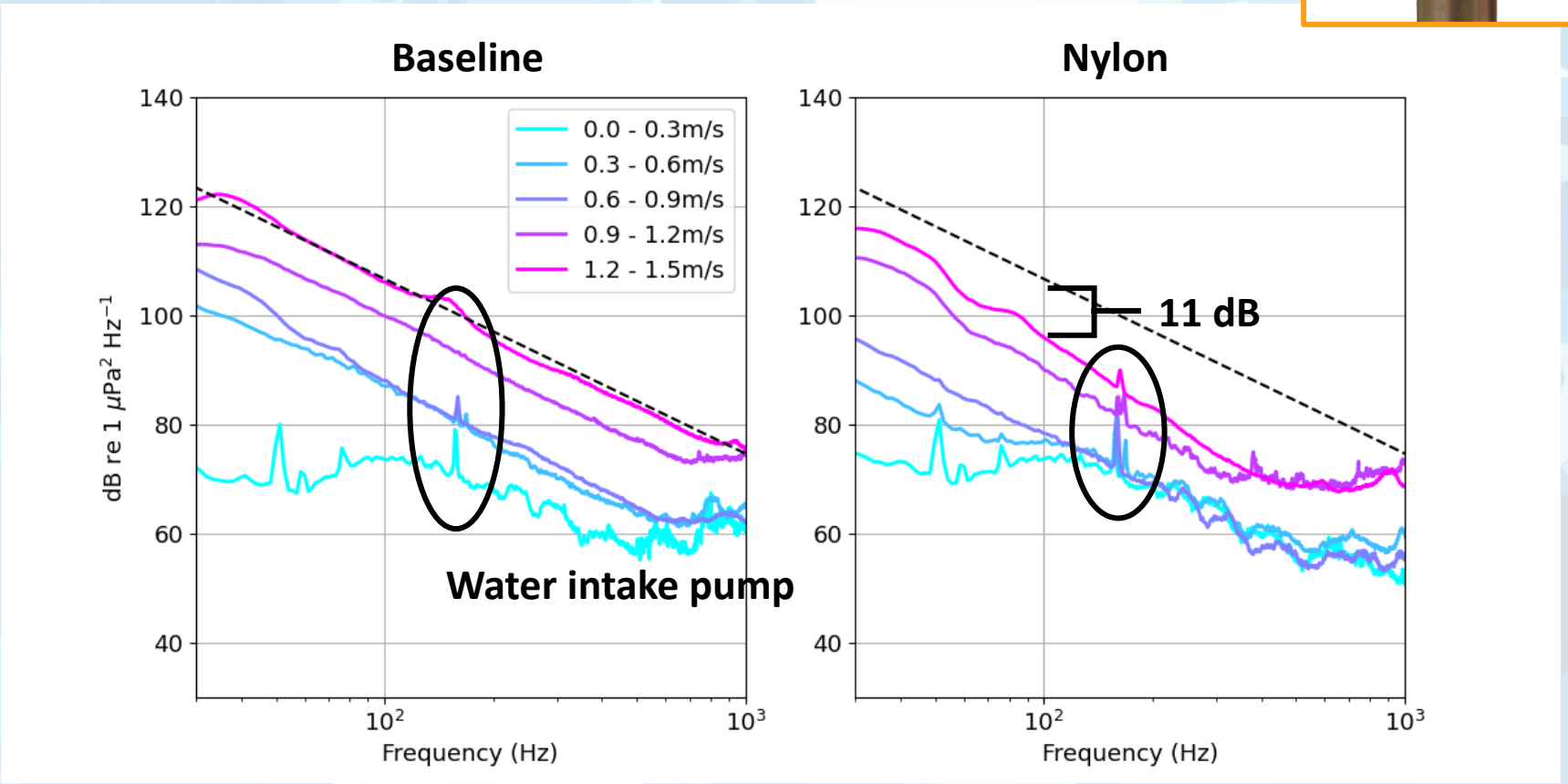


# Velocity Data

* 5-minute averages



# Results: Flow noise mitigation

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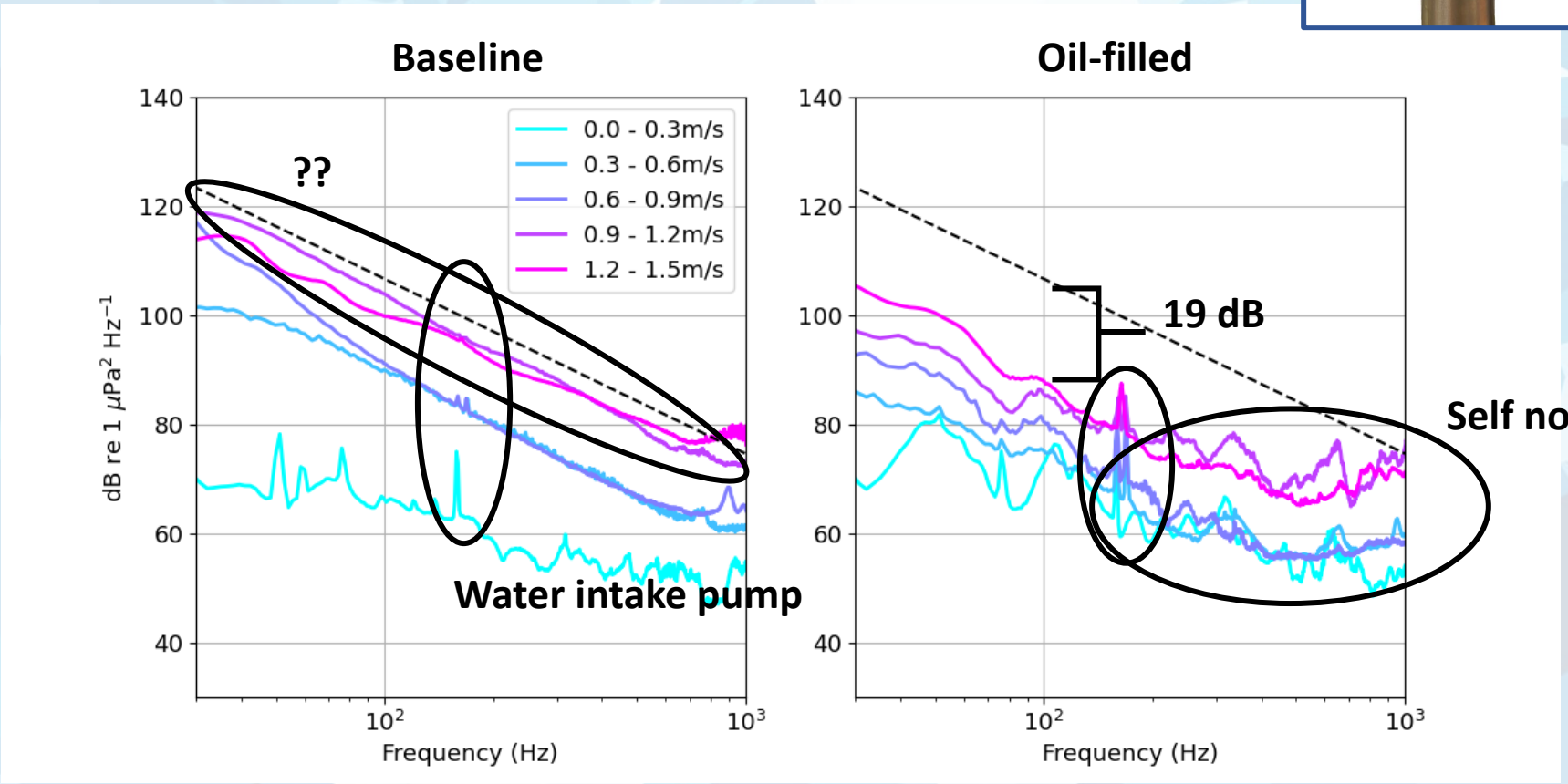
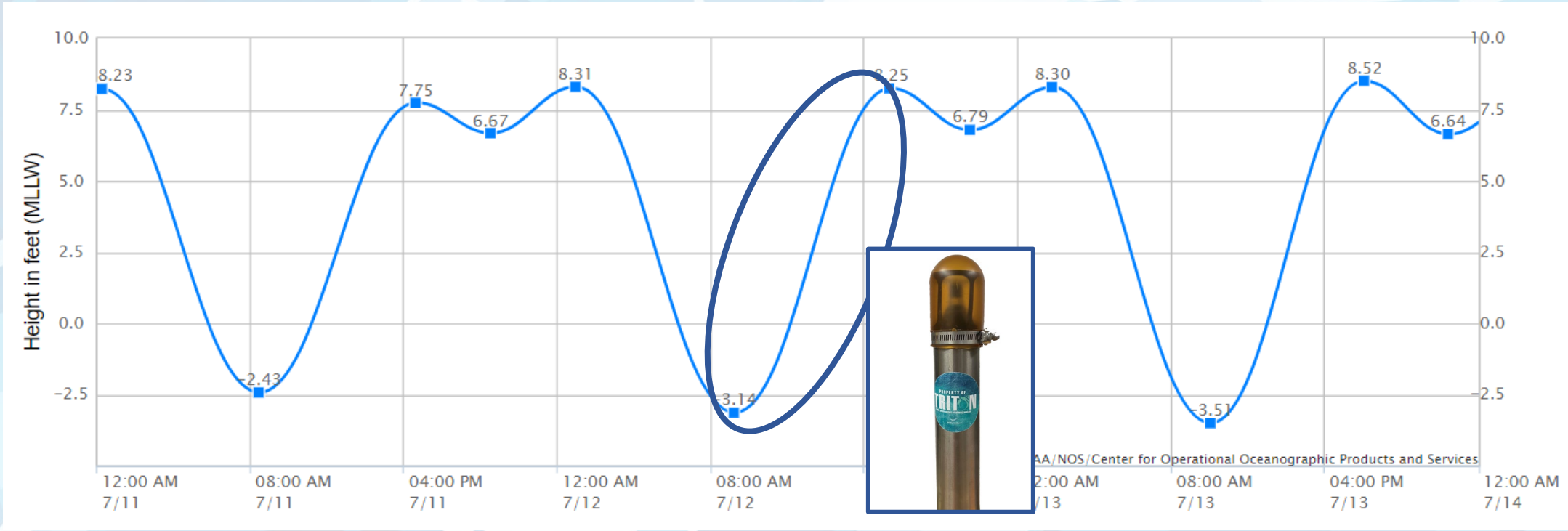


# Results: Flow noise mitigation

Deployment ★

Oil-filled

Nylon



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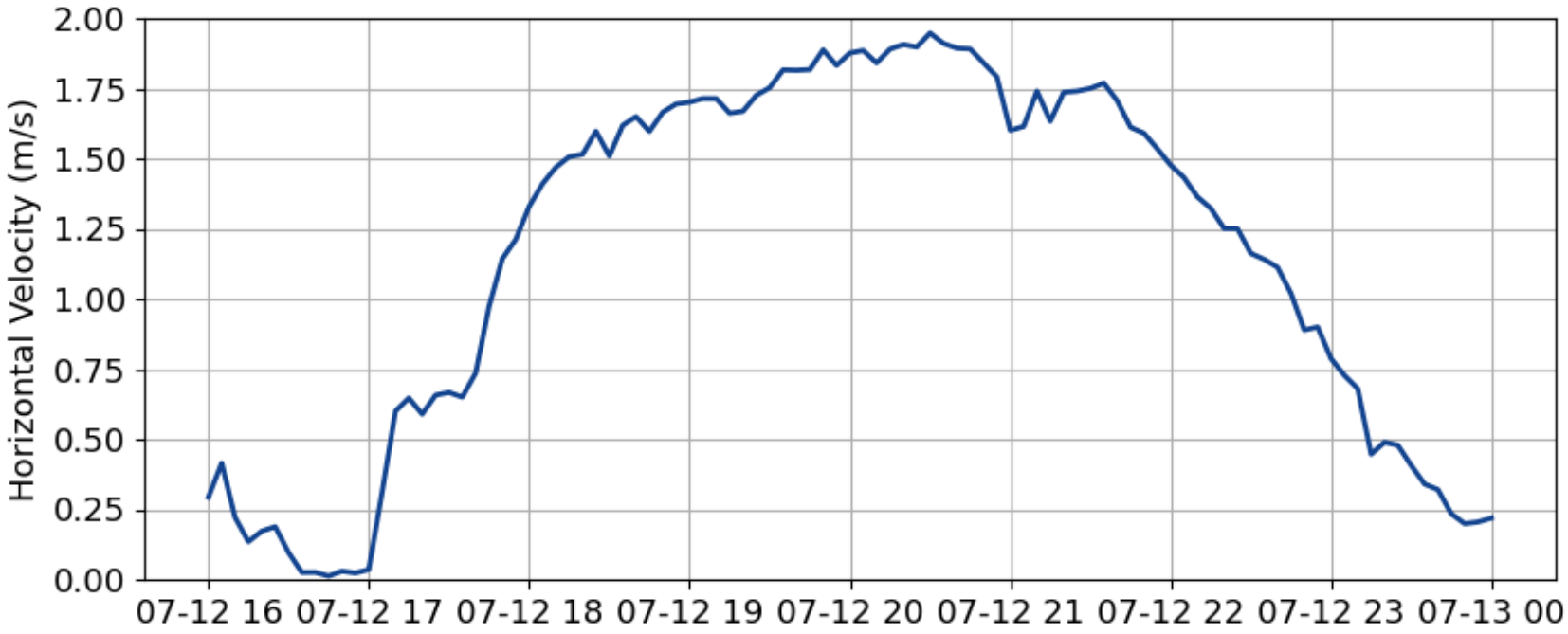

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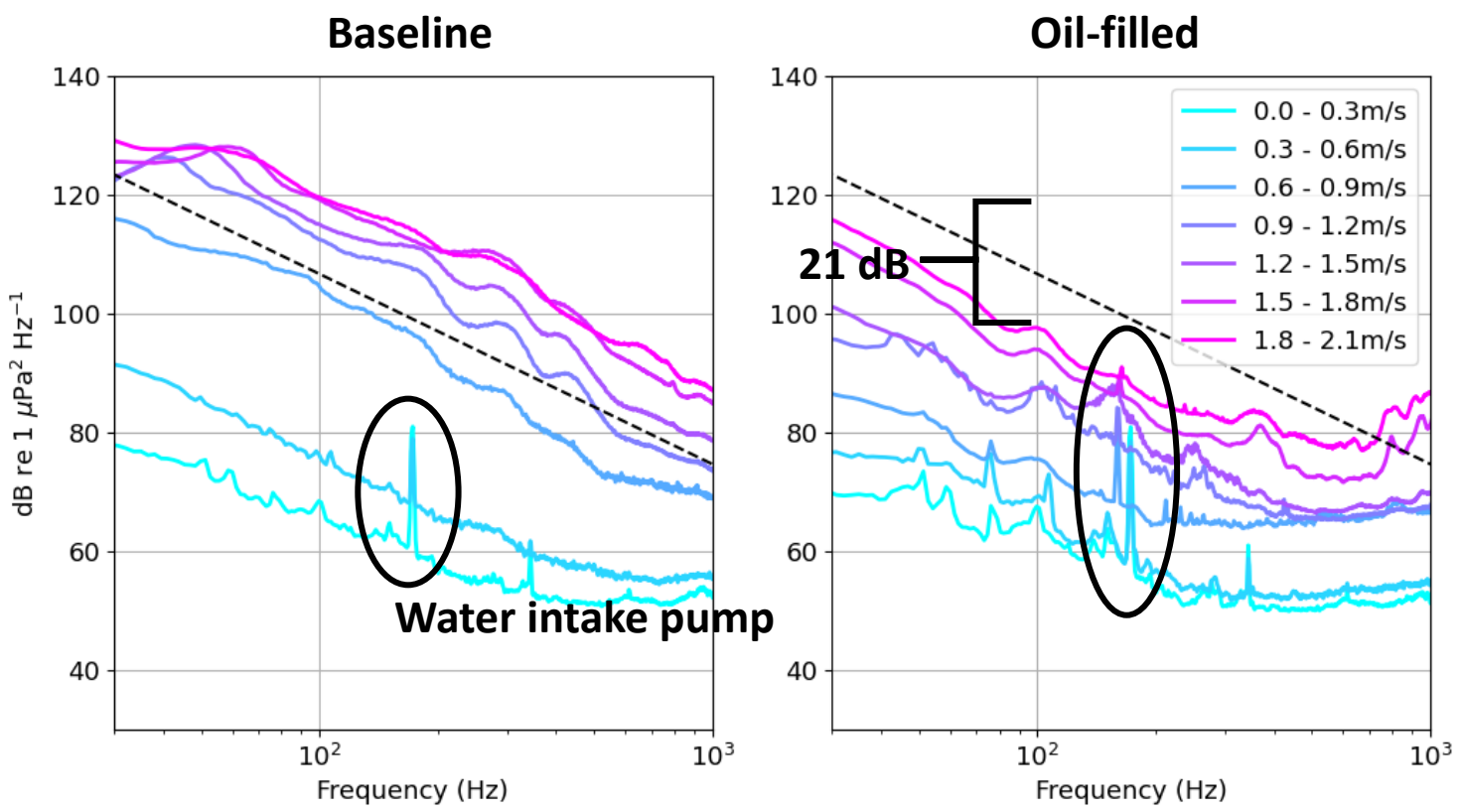


# Conclusions

- Nylon flow shield reduced flow noise by 11 dB at 100 Hz at 1.3 m/s
- Oil-filled flow shield reduced flow noise by ~20 dB at 100 Hz, but more investigation is needed
- Flow noise isn’t the only challenge for acoustic measurements in tidal channels

# Acknowledgements


- John Vavrinec, Lenaig Hemery, Sue Southard, and Xiaoqin Zang (PNNL)
- Chris Bassett (UW APL)
- X-Flow Energy

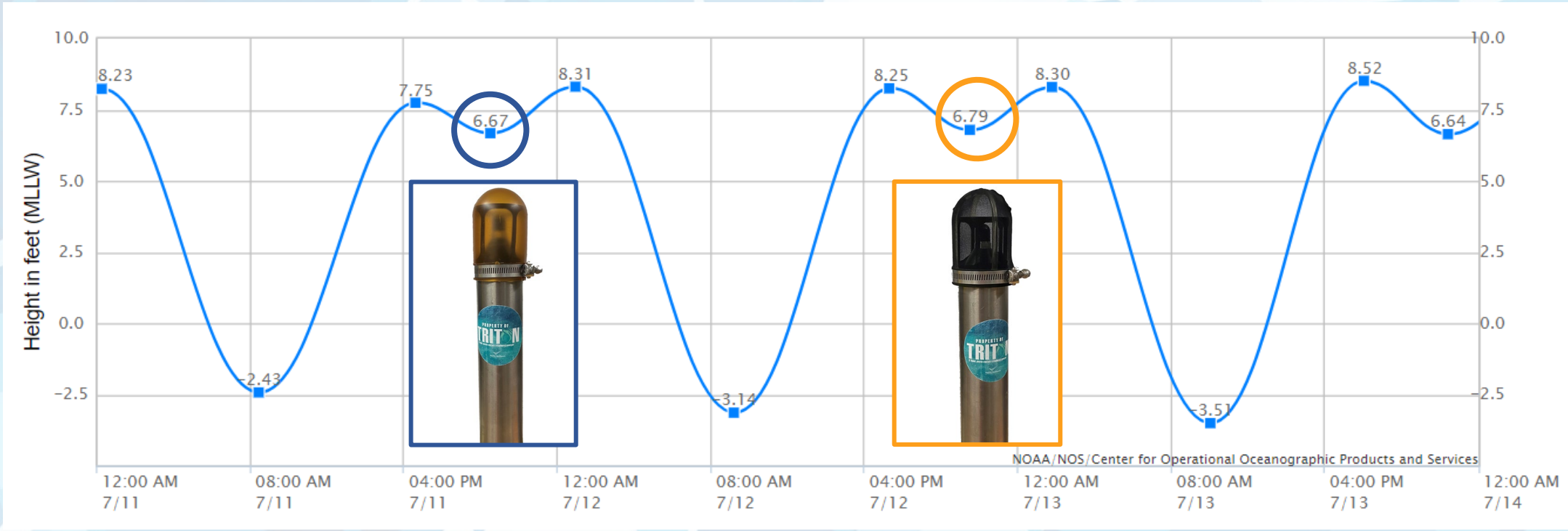

# Questions?

# Results: Attenuation

Deployment ★

Oil-filled

Nylon



# Results: Attenuation