

March 18, 2017

Volume XIII, Number 29

In this issue:

Ping

Plan of the Day

Spotlight

Jenne James
Bethany Lacroix

Madness Update

Classifieds

Meridian Passages

Central Pacific Edition
M/V Mermaid Vigilance
Contact: Ops Center

Editor in Chief:
Dave Jourdan

Contributors:
Spence King
Marika Lorraine
Sue Morris

Director of
Photography:
Bill Mills

Complaints:
Cap'n Joe

Layout:
Bethany Jourdan

NAUTICOS, LLC
For unofficial use only

Mantup Publishing

Sound Advice

Is There an Echo in Here?

The amazing images we are seeing from the ocean floor are derived from echoes of sound bouncing off the undersea terrain and returning to our sonar. Making sense of this information depends critically on the speed of sound in the water. This varies quite a bit depending on conditions, so the REMUS is equipped with a CTD (Conductivity-Temperature-Depth) sensor that is used to calculate sound speed. Although we are only interested in the speed near the bottom, the sensor operates as soon as it hits the water and so will give us measurements all the way down. We took the opportunity to look at this "sound velocity profile" to see what it might tell us.

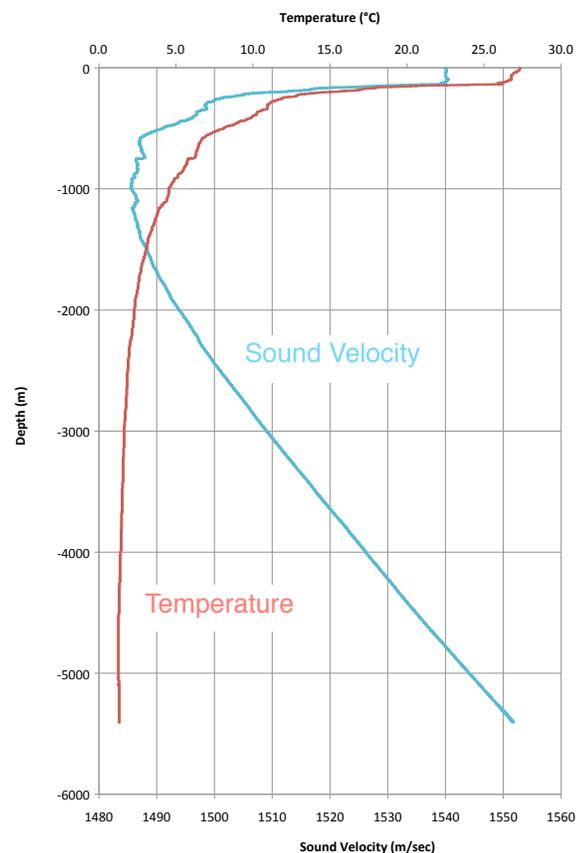


Under standard lab conditions, sound travels about 1,560 meters per second in seawater (much faster than the 340 meters per second in air). That's just about a mile per second. But it varies quite a bit as the elasticity* of the water changes in response to changes in temperature, depth, and to a lesser extent, salinity. The biggest effect is temperature, which has a very complicated influence on elasticity due to the unique structure of the H₂O molecule. With most fluids, sound speed decreases with temperature, but with water it actually increases by about 3 m/sec for every 1 °C increase. Sound speed also increases with depth (because the pressure increases and changes elasticity) by about 1.7 m/sec for every 100 m change in depth.

The plot on this page shows how the measured temperature and calculated sound velocity changed as the REMUS descended to the depths on one of its missions. This is a classic profile. The temperature at the surface was a balmy 27.5°C (82°F), but dropped sharply to

*Elasticity is the ability of a material to resume its original shape after being stretched or compressed.

about 5°C just 1,000 m down. By the time REMUS reached 5,500 m it was a bone chilling 1.3°C, just above freezing. Influenced by the temperature, the sound velocity dropped sharply down to the first 1,000 m. At that point, the relentless increase in pressure with depth took over as the temperature stabilized, and



the sound velocity rose back to and above its surface value. (Salinity effects were also calculated but were small.) The sound speed changed by more than 4% over this range.

Besides its effect on the sidescan sonar, changes in sound velocity cause the paths sounds travel to vary, much like a lens alters the path of light. As a wave of sound passes through the water, some parts of the wavefront move faster than others causing the sound to bend away from areas of higher velocity.

continued...

Plan of the Day March 18, 2017

- 0900** SEA School, Ops. Ctr.: Tom D.
- 1000** Daily Progress Meeting: Ops Ctr.
- 1100** Nauticos All Hands: Ops. Ctr.
- 1330** Est. REMUS recovery.

Continuing to recognize those who help from ashore, today we Spotlight **Jenne James**, who first met Dave Jourdan about 12 years ago when he gave a local lecture about his deep-sea



adventures. She went home hooked, and tried to figure out where the heck he kept his ROV in the tiny harbor full of lobster boats in Cape Porpoise, Maine. In the following years, the James and Jourdan families have worked and played together on all kinds of

projects on land and water. Jenne is supporting our project by coordinating ashore activities including travel and communications, and was invaluable help to Spence getting us off the ground & out to sea. She says, "It's exciting to be part of the team on this current EEDE mission; I first went to college for oceanography or astrophysics, but along the way switched to fine arts, so I'm enjoying working amidst the behind-the-scenes details!"



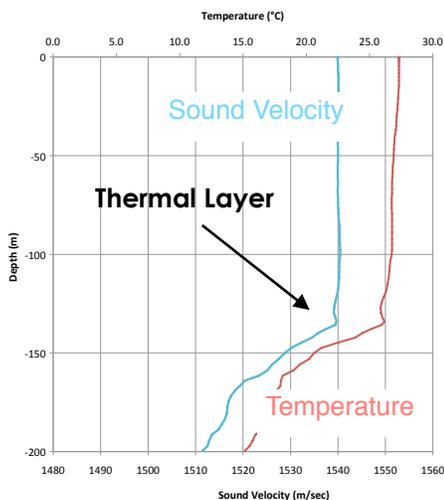
creates and manages the websites and the daily email communications to our subscribers, edits photos, and draws maps and other artwork to support the project. She also did the layout for the book *The Deep Sea Quest for Amelia Earhart* and created the illustrations. She says, "I'm glad I got the opportunity to go out to sea in 2006 and am missing you guys out there this time!" — Marika Lorraine

Bethany Jourdan Lacroix is from Maryland and lives in Gorham, Maine with her husband, Justin, and 2 children, 4 months and 3.5 years. She got involved with Nauticos/EEDE because she knows this guy, namely Dave Jourdan who is her father. Bethany is essential to our mission and connecting our work with everyone back home. With a degree in Media Arts, she



...continued from page 1.

A particular consequence of this can be seen if we look at the shallower (first 200 m depth) of this plot. Mixing of surface water warmed during the day to deeper regions, and subsequent cooling at night, will typically cause an "isothermal" (constant temperature) layer near the surface, or even a temperature "inversion," where it gets warmer as one goes deeper, to a point. This can occur in tropical waters thanks to intense solar heating and strong wave action. Below that layer, the temperature will drop as described earlier.



This thermal layer can cause large variations in sound wave propagation. Submariners take advantage of this as a submarine lurking just below the layer can be "hidden" from sonars listening at the surface, since its sounds will bend to greater depths. On the other hand, a ship on the surface may escape the attention of the submarine below the layer since its sounds may remain confined to shallower regions. In some cases, the sound can be trapped in a "surface duct" and propagate for many miles horizontally, while making not a whisper below the layer.

MERMAID MARCH MADNESS

Stay tuned for exclusive updates and check results against your bracket. The lucky winner of each round will be allowed to pick the location of the next REMUS search mission.

LATEST RESULTS: Round One is done! "MacGyver" McCoy remains in the lead with 32 points. Close abaft are Marika and Alan with 29, and in sole possession of next place is "Spider" King with 28. In the goat locker are Cap'n Joe and "Hollywood" Mills who have 20 points each. Neither have budged the "Give a Hoot" meter.

MERMAID CLASSIFIEDS

PERSONALS 100

THERE IS NO TRUTH to the rumor that *Mermaid* will be dropping us in Australia on the way to Singapore. However, the current exchange rate is US\$1 = AUD\$1.30.

WANTED 200

STORIES for *Meridian Passages*. Sea, land, or air stories welcome. Dave 4031.

LESSONS LEARNED, lessons not learned, lessons learned and forgotten, lessons ignored. For *EEDE Final Report*. Spence 4051.

FOR SALE 400

Majuro Vacations. Sun. Beaches. Golf. Make reservations now. 555-CST-AWAY.

Shrunken Cups. A selection of generic little pre-shrunken cups available for a small gummy bear fee. One per customer, please. Sue (who else) at 3344.

LOST & FOUND 500

LOST: Pride. Not doing so well on the Mermaid March Madness Pool. "Numbers" Greg.

Place New Ads by Friday – ed.