Knot News

International Guild of Knot Tyers – Pacific Americas Branch

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Physicists Twist Water into Knots

Ron Cowen

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More than a century after the idea was first floated, physicists have finally figured out how to tie water in knots in a laboratory. The gnarly feat, described today in *Nature Physics*, paves the way for scientists to experimentally study twists and turns in a range of phenomena – ionized gases like that of the sun's outer atmosphere, superconductive materials, liquid crystals and quantum fields that describe elementary particles.

Lord Kelvin proposed that atoms were knotted "vortex rings" – which are essentially like a tornado bent into closed loops and knotted around themselves, as Daniel Lathrop and Barbara Brawn-Ciniani write in an accompanying commentary. In Kelvin's vision, the fluid was the theoretical 'aether' then thought to pervade all of space. Each type of atom would be represented by a different knot.

Kelvin's interpretation of the periodic table never went anywhere, but his ideas led to the blossoming of the mathematical theory of knots, part of the field of topology. Meanwhile, scientists also have come to realize that knots have a key role in a host of physical processes.

Creating a knot in a fluid bears little resemblance to tying a knot in a shoelace, say Dustin Kleckner and William Irvine, physicists at the University of Chicago in Illinois. The entire three-dimensional (3D) volume of a fluid within a confined region, such as a vortex, must be twisted. Kleckner and Irvine have now created a knotted vortex using a miniature version of an airplane built with a 3D printer.

During an airplane's flight, a wing induces a rotational or vortex-like motion of air currents that gives lift to an airplane. When a wing at rest suddenly accelerates, it creates two vortices of air circulating in opposite directions. The researchers submerged their tiny wings in a tank of water and gave it a sudden acceleration to create a knotted structure.

Capturing images of the knot was another technical tour-de-force. Fluid dynamicists often use colored dye to trace the motion of fluids, but Kleckner and Irvine injected tiny gas bubbles into the water that were drawn to the center of the knotted vortex by buoyancy forces. A high-speed laser scanner capable of producing CT-scan views of the fluid at 76,000 frames per second enabled the researchers to reconstruct the 3D arrangement of the bubbles, thus revealing the knots.

"The authors have managed a remarkable achievement to be able to image these vortex knots," says Mark Dennis, an optical physicist at the University of Bristol UK, who has made knotting vortices from light beams. The new study, he adds, transforms abstract notions about physical processes involving knots into testable ideas in the laboratory.

"Knotted vortices are an ideal model system for allowing us to study the precise way in which knots untie themselves in a real physical field," says Irvine.

Knotted vortices show up in several branches of physics. Particle physicists, for example, have proposed that 'glueballs', hypothetical agglomerations of gluons – the elementary particles that bind quarks to form protons and neutrons – are tightly knotted quantum fields.

And in January, scientists reported evidence of 'unbraiding' or relaxation of knotted magnetic fields that may help transfer heat to the Sun's corona, or outer atmosphere, explaining why plasma in this region in much hotter than the Sun's surface.

One of the real benefits of Membership in the Pacific Americas Branch is having access to our library of knot, knotting and knot-related books. By any standard it is a *very* impressive collection and borrowing from it is free for the asking.

Our librarian, José Hernández-Juviel will get any book (or books) out to you promptly and he even includes an addressed return envelope. The complete Library List is reprinted here to remind everyone again of what we have to offer and to encourage everyone to make use of this resource.

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Canes

Roy Chapman

My past articles were about tools and skills but now I would like to focus more on projects.

Here are two walking sticks I made in 1999 from ski poles. Alice's cane is gold and mine is black and green.

The gold staff is varnish on gold mason twine. The staff with black coachwhipping is boat soup on tarred nylon.

Alice's cane

Roy's cane

Alice uses hers every time she leaves the house – since her hard fall and injury in September 2011 her stick goes with her everywhere.

Varnish dries quite hard, a bit brittle, very weather proof and with no easy or safe solvent for removal. When varnish is damaged the stuff must be removed by sanding, scraping, using very harsh chemicals or extensive prayer.

When your shellac is damaged denatured alcohol washes it away, heals the wound, and prevents build up of future coats. Folks do "hot coal" varnish to build that deep liquid look on woodwork but I find on know work that can flex, the stuff checks, cracks and gets worn looking pretty fast. Shellac suffers too but a quick brush down with alcohol and the least touch up and it is like (or even better) than new. I think polyurethane is very different from varnish for our purposes. I think for refinishing Granny's rocker there may be no difference.

A friend and customer who summers here on Whidbey Island and winters in Oregon owned my "lust boat" for a few years. It was a caravel hull, double ended canoe yawl, two masts with a cuddy cabin. There was not a spot of paint on the boat. Each year the owner would spend some days sanding and scraping, starting with electric power tools and ending with lots of hand work and sanding. Then spend another day rolling on varnish (with, yes, a roller) and without much adieu, while still "hot", putting on a second coat. The boat would spend the long summer in the ocean. It always looked fresh as Spring Time and sailed sleek as a seal. I don't think anything but varnish can do that. In winter it would go to Oregon to sail on the odd days and then come back again to Whidbey.

I use McCloskeys Spar Varnish. A little goes a long way. I use Bullseye Shellac. I use Stockholm Pine Tar from Bill Rickman. I use both boiled and raw linseed oil. Boiled formerly meant boiled but now it means it has a chemical drying agent, which is not nearly as good. For Granny's rocker I use a wipe on poly finish, I'll get you the name.

Peter's wooden yawl in Penn Cove

A Hard Lesson

Hooey Michaels

There I was, along a mountain trail with two friends and their pack animals, in the Rocky Mountains of Colorado. It was a very long time ago, and it was my very first pack trip. The two friends were new friends and I didn't know their capabilities on a pack trip, but the pack animals were theirs, so I assumed they had experience. At that time my own experience was limited, so I couldn't tell how little they knew. Assumptions can be dangerous.

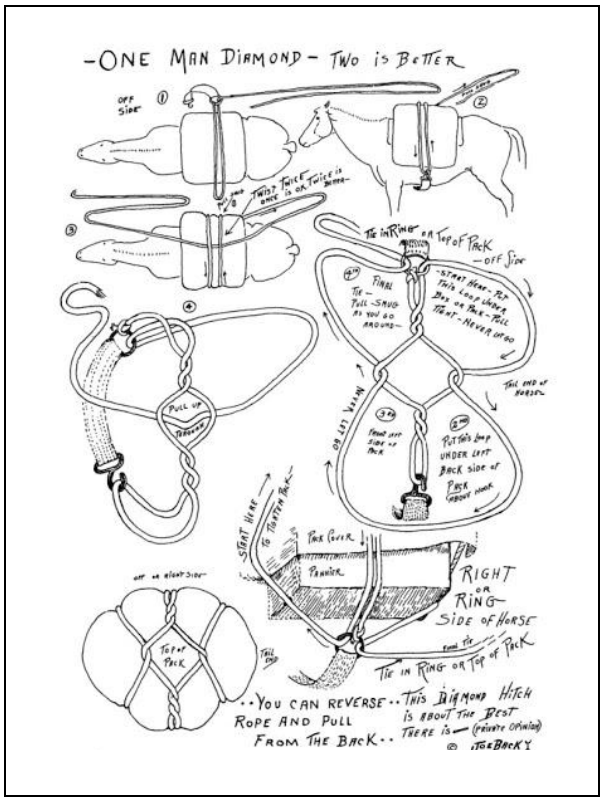
Throwing a Diamond Hitch

Anyway, a few days into the trip there were several entirely avoidable mishaps that came up, and I was having serious doubts about being there with the company I was keeping. At that point I was on alert for the next mishap to arise. And it did. We were nearing the timberline on the way up to the continental divide when one of the pack animals, a young hinny named Midnight, decided to head back to the barn… that's horseman's lingo for running off and heading home. Not a good situation to be in, since that pack animal had all our food supplies.

There were no riding animals on this trip, and we were walking along leading the pack animals, so I made sure to keep a tight hold on the lead rope 20 feet long, much longer than a lead rope should be, and I had it folded into the palm of my hand, rather than allow the hinny the full length of it to wander. It is common practice around livestock to carry all excess rope folded in the palm, rather than carrying a coil. The other pack animal was a donkey. His name was LBJ and he was older, well trained and well behaved, but that does not necessarily mean he had a calming effect on the hinny. A hinny is known for being a difficult animal to manage under most conditions. The reason I believe to be human fault, but the result, in this case, was just the same.

She began by getting ahead of me and picking up the pace. I pulled back to no effect. I was getting pulled. Then I was pulled faster… to where I was at a run and could not keep up because it was all downhill and I was already tipping forward, trying to stay vertical and not get jerked over and dragged. Her weight and strength, along with my inexperience, allowed the situation to get out of control, and I was losing. She ran right past a tree, but I managed to go left past the tree and let loose the folds of lead rope and just grip the very end of it. When she reached her end of the lead rope my grip held, and the tree friction brought her to an ungraceful stop. Knocked her on her ass and took the wind out of her. Could have broken her neck as well, but it didn't – knocked me on my ass too. A hard lesson, but I did manage to regain control of the situation.

If there is a moral to all this, it is that when entering a dynamic situation, know who is entering it with you… and dynamic problems usually require dynamic solutions.



The Diamond Hitch

[For further reading about packing please see *Horses, Hitches and Rocky Trails* by Joe Back from Johnson Books, 1959, 1987 – Editor]

USS Midway CV-41
Museum Knot Board
Emory Bishop

Here are some pictures of how Emory Bishop created a knot board for the *USS Midway* moored in San Diego, California.

- The outer border is made up of five braided sennits.
- The outer most braid is a 6 strand square sennit sitting on top of a 28 strand flat sennit.
- The flat sennit is next to a 28 strand modified Russan sennit with a 6 strand round sennit separating the two 28 strand sennits.
- The inner most braid is a 6 strand doubled round sennit.

Each corner seam is covered with a 3 lead 6 bight Ocean Plat and a 3 lead 6 bight Thump Mat made into a ball is sitting on top.

Making 18 feet of the 28 strand sennit

Cutting the sennits at a 45 degree angle using a hot knife

Trial design and cord selection

The shadow box is a mahogany center with a pecan outer frame. The frame is slotted to receive a Plexiglas cover. The box is 3 feet by 5 feet.

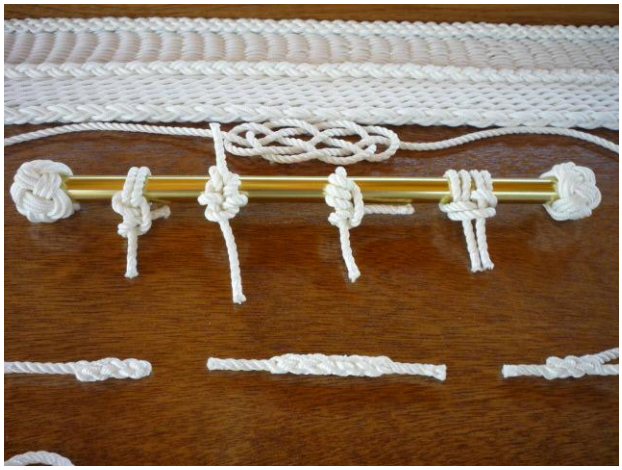
Checking the layout

Final sennit installation and covering the corner seam
The top overlay knots is a doubled Royal Carrick Bend
The bottom overlay knot is a doubled interwoven Royal Carrick Bend

The *USS Midway* brass plaque was used as a center theme with two brass anchors and two halyard snap shackles

26 knots were selected and placed equal distance apart
A 3 lead 6 bight Thump Mat was placed above the plaque and a 3 lead 5 bight flat Turk's Head below

The brass items were tied together using ¼ inch 3-strand nylon cord with eye splices at the ends



The center items were tied together using a series of loops and 4 modified Masthead Knots

Completed knot board with name tags and plexiglass cover in place of honor aboard the *USS Midway*

Sampling of some more knotted creations by our own PAB member – Emory Bishop

Covered stanchion for an original 1947 sailboat

Grapevine Hitching with 6 lead by 5 bights Turk's Head

USS Midway CV-41 main ship's bell rope

White bell rope for portable ship bell used for formal ceremonies when a bell is needed to ring aboard high ranking dignitaries and guests

Lanyard to hang on a yacht helm to cover the center retaining bolt when not in use

One of a kind Bos'n Pipe Lanyard for an 85 year old retired BMC