Obsessing About Rope

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1

What I Wanted To Know

- What types of rope were used, where & why?
- What twist directions were used & where?
- How many twists per foot?
- What sizes of rope were used & where?

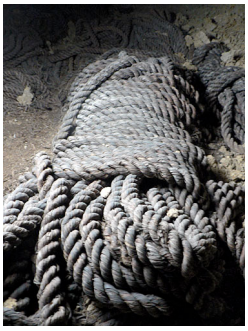
2

Information Sources

- David Steel - *The Art of Rigging* – 1794
  - Section of *Elements and Practice of Rigging And Seamanship*
  - Updated in 1800 (S1-1880) & 1806 (S2-1806)
- George Biddlecombe – *The Art of Rigging* – 1848
  - Authorized update & revision of Steel (B-1848)
    - Republished with corrections in 1925
  - Includes comprehensive tables of rigging lines
- Peter Force – *Tables* – 1826
  - Comprehensive tables of rigging & more of US Navy ships
    - www.sobco.com/ship_model
- Many other sources

3

Rope is not a new concept



Egypt – 1,800 BCE

HMS Invincible – 1758

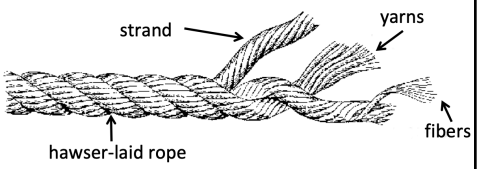
Mary Rose –1514

Egypt – 300-500 BCE

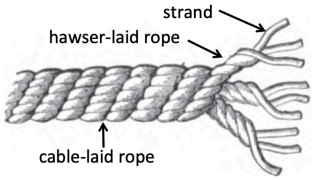
4

Rope 101

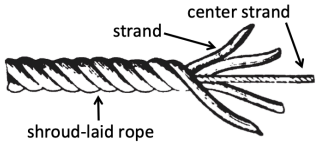
- Hawser-laid
  - Yarns are made up of fibers
  - Yarns twisted together to make strands
  - 3 strands twisted together to make a rope



- Cable-laid
  - 3 hawser-laid ropes twisted together to make a rope



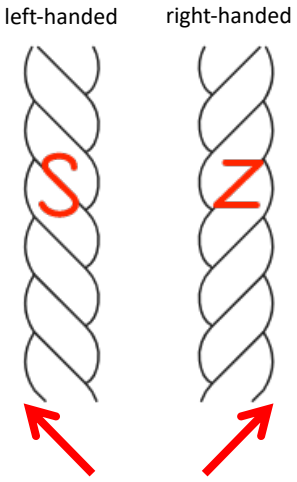
- Shroud-laid
  - Same as hawser-laid but 4 strands
  - Has 5th strand in center to fill void



5

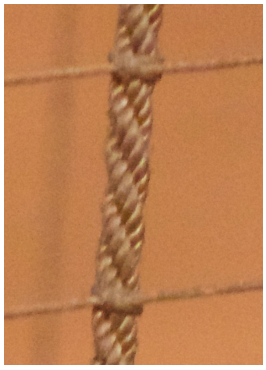
Direction of Twist

- Ropes can have left-handed (S) or right-handed (Z) twists
- Directions reversed at each layer
  - e.g., to get right-handed rope the yarns need to be left twisted to make the strands which are right twisted to make the rope
  - e.g., making a cable-laid rope from 3 right-handed hawser-laid ropes requires twisting them left to create a left-twisted cable-laid rope



6

Cable-Laid v Left-Handed



Cable-laid rope

left-handed rope

From U.S. Naval Academy Museum

7

Details

- This presentation focuses on rope for ships built between 1500 and the mid 1800s

  The *Flying Cloud* was 1851
- Rope measured by circumference

8

Running Rigging

- Running rigging was right-handed 3-strand hawser-laid rope, except:

  Lower & topsail braces were left-handed 3-strand hawser-laid rope*

  More pliable than right-handed and less likely to kink**

  *Tacks, main and fore, … are cable-laid and tapered in the making****

  *Main Mast sheets, cabled – 6 *****

*Luce – *Textbook of Seamanship* – 1884 – pages 139-140
**Luce - *Textbook of Seamanship* – 1884 – pages 22-23
***S2-1806 page 47 (same for sheets, page 66)
****Force – *Tables* – 1826 – page 10

9

Running Rigging, contd

- Many sizes of running rigging on a big ship

  1.25”, 1.5”, 1.75”, 2”, 2.5”, 3”, 3.5”, 3.75”, 4”, 5”

  (Biddlecombe)

  1.5”, 2”, 2.25”, 2.5”, 2.75”, 3”, 3.25”, 3.5”, 3.75”

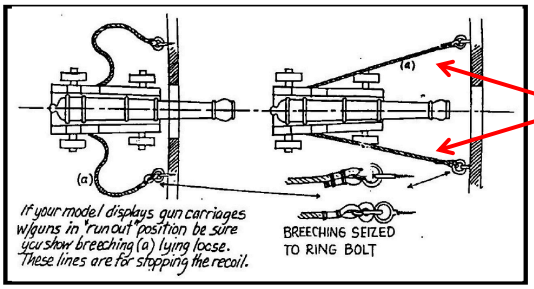
  4”, 4.5”, 5”, 5.5”, 6”, 6.5”, 7”

  (Force)

10

Miscellaneous Rigging

- Gun gear – (breeching rope) left-handed 3-strand hawser-laid*
  - Softer and more easy to handle
  - Though not as durable



*Burney – *The Boy's Manual of Seamanship & Gunnery* – 1871 – page 127

11

Standing Rigging

- Mixture of hawser- and cable-laid rope
  - Disagreements as to what was what
  - *Main, fore, and mizzen, topmast, and some topgallant-mast, stays are cable laid**
  - *Dead-eyes are then turned into the lower end of the shrouds, left handed (being cable-laid rope) ***
  - *Shrouds sometimes are cable-laid: but are now generally shroud or hawser-laid.****

*S1-1880 page 61
** S1-1800 page 88
**Lever – *The Young Sea Officer's Sheet Anchor* - 1853

12

More Standing Rigging

*Shrouds, stays and tackle-pendants were often (perhaps I should say "usually") "cable-laid **

*Four-stranded rope is now but little used except for lifts, preventer-parrels, Jacob's ladders and rigging laniards.***

*Mizzen Top Gallant Mast shrouds, cabled - 3"****

- Most references do not mention type of rope used in a particular application

  Force is an exception e.g, all shrouds & stays are "cabled"

  So I assume 3-strand hawser-laid rope was used if not otherwise noted

*Anderson – *Rigging of Ships in the Days of the Sprit Topmast* – 1927 – page 84
**Luce – *Textbook of Seamanship* – 1884 – page 23
***Force, *Tables* – 1826 – page 15

13

Cable-Laid Shroud

- From the wreck of the *Invincible* (1758)

14

Standing Rigging, contd.

- Many sizes of standing rigging used on a big ship

  2.25”, 2.50”, 2.75”, 3”, 3.25”, 3.5”, 4”, 4.5”,
  5”, 5.25”, 6”, 6.5”, 7”, 8”, 8.25”, 10.5” & 11”

  (Biddlecombe)

  2.5”, 3”, 3.5”, 3.75”,4”, 4.5”, 5”. 5.5” 6”, 7”, 7.5”
  8”, 9”, 10”, 11”, 12.5”, 13”, 18.5”, 19”

  (Force)

15

U.S. Naval Academy Museum

- About 35 relevant models

  Rigging repaired on most, so an unreliable indicator

  Except *St George* – original 1701 silk rigging
- 32 have left-handed stays

  14 clearly cable-laid
- 13 have left-handed shrouds & backstays

  Some cable-laid
- Key models?

  St. George

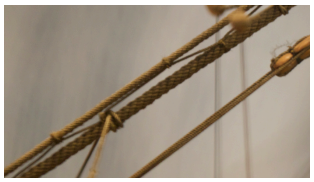
  Cable-laid stays, right-handed shrouds & backstays

  3 POW models

  Cable-laid shrouds, left-handed stays & backstays

16

Some examples



St. George - stay

Portland – shrouds & backstay

POW Victory - shrouds

Boyer/Emeriau POW – shrouds & backstay

17

Museum of Fine Arts, Boston

- 7 relevant models & 1 etching (1784)
- 7 have left-handed stays
  4 clearly cable-laid
- 5 have left-handed shrouds & backstays

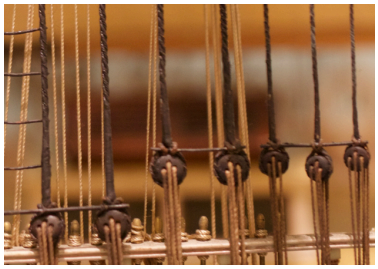
Glorioso – shroud & backstay

18

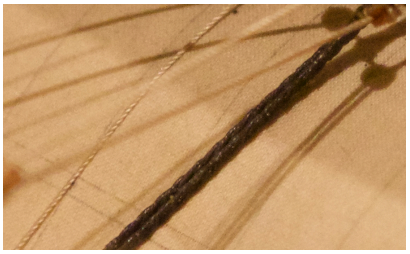
Some Examples

Valkenisse – shrouds & backstays

Portsmouth– stay



Flying Cloud – shrouds & backstays



Flying Cloud – stay

19

More Valkenisse

20

Why Cable-laid?

- Weaker, but watertight

  *Cable-laid … Rope, …, is left handed rope of nine strands and is so made to render it impervious to water, but the additional twist necessary to lay it up seems to detract from the strength of the fibre, the strength of plain laid being to that of cable-laid as 8.7 to 6; besides this, it stretches considerably under strain.**

  *Cable-laid rope … consists of three hawser-laid ropes, laid up together left-handed. It is so laid up to exclude water, but is about one-third weaker than hawser-laid rope of the same size. ***

*Luce – *Seamanship* – 1863 – page 22
**Henderson – *Seamanship* - 1907

21

Why Cable-laid?, contd.

- Use cable-laid for standing rigging that was hard to replace because it was less subject to rot and so would last longer?

22

Twists per foot

- Could only find one reference

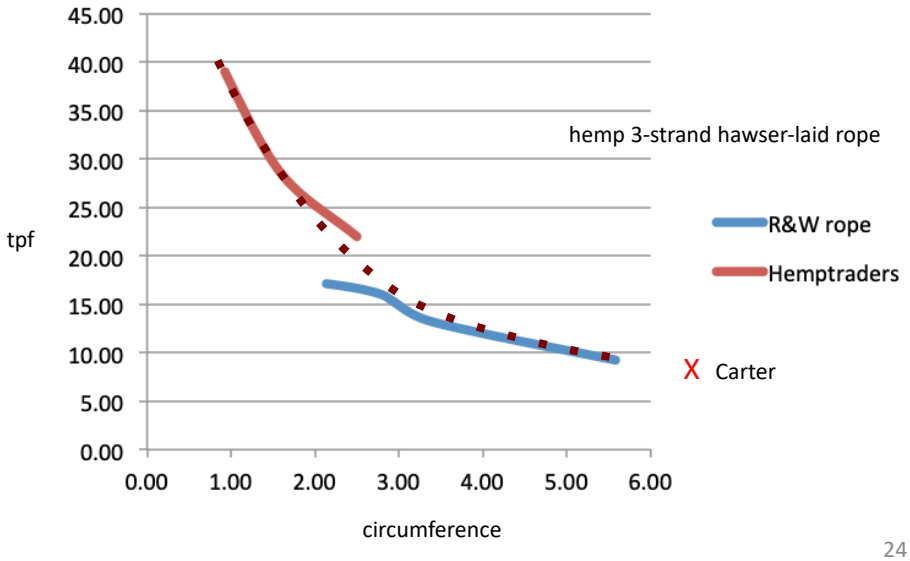
  The number of turns per foot twist required to close strands into a firm rope is inversely proportioned to the diameter or circumference of the rope. It may conveniently be calculated on the basis of eight turns per foot for a rope 2 inches in diameter. *

  (2" diameter = 6.28" circumference)

*Carter – *Modern flax, hemp and jute spinning and twisting* -1907 - page 171

23

My Own Measurements



24

For My *Flying Cloud*

- Running rigging: all 3-strand hawser-laid rope
  Mostly right-handed (some braces & main sheets/tacks left-handed)
- Standing rigging:
  Shrouds, stays & backstays cable-laid rope
  Rest: 3-strand right-handed hawser-laid
- Twists per scale foot based on the samples of hemp rope
- Not using shroud-laid rope
  Some of the right-handed shrouds on the models might have been shroud-laid rope but I did not find enough evidence that the *Flying Cloud* would have used it

25

QUESTIONS?

26

EXTRA MATERIAL

27

Tapered Rope

TACKS, main and fore, are cable-laid, and regularly tapered from about 10 yards from the knot to the end; when finished they should be half the circumference at the end as at the knot; they are tapered by cutting away two threads from each strand in every two yards, (or more, according to the length,) from the beginning of the taper to the end. Twelve fathoms and one foot of yarn, when warped, are allowed for each strand in a tack 8 fathoms long, and so in proportion for any length. The single foot is allowed for the knot at the head.

Steel – The Elements and Practice of Rigging and Seamanship – 1794 – page 61

28