IV.—Sails and Oars in the *Aeneid*

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The ships in which the Trojans sailed to Italy were not Homeric but Augustan, designated as biremes and triremes, and the *Aeneid* gives us our best account of the actual handling of such ships in realistic weather conditions. They were primarily sailing vessels, which used oars only in entering and leaving port and in serious emergencies. With wind in a favorable direction they could sail over two hundred miles per day; with the wind ahead they could sail as close to the wind as any ships before the era of our American clippers.

Vergil's *Aeneid* gives us a fascinating combination of careful antiquarian research and vivid, impressionistic description of the life of Augustan Rome. Dido's great banquet was not borrowed from the *Odyssey* (except for Iopas' entertainment) but from the author's own experience. Similarly it is not sufficient to call attention to the anachronism involved in the mention of anchors and bronze rams in connection with Aeneas' fleet: the ships were biremes of contemporary naval type, as different from the black ships of Homer as a modern schooner yacht is from the Mayflower. More importantly, the seamanship employed is of the highest order, described by a man who understood it thoroughly, either from practice or unusually keen observation. It therefore behooves the historian of navigation to read the *Aeneid* for a detailed account of the performance of ancient vessels under varying conditions of wind and weather, and it is correspondingly appropriate for the classicist to check with naval engineers for some details as to equipment and mathematically estimated efficiency.

For the purposes of our study exact determination of the size of Aeneas' ships is not essential, but a general idea of their characteristics may be gained from an American admiral's description of a trireme of the Augustan fleet:[1]

[1] Wm. Ledyard Rodgers, *Greek and Roman Naval Warfare* (Annapolis, 1937) 514, 516. He illustrates a trireme with an unusual arrangement of rowers, discredited by our own author's description of superimposed banks: cf. *Aen.* 5.120, terno consurgunt ordine remi. These ships which took part in the race were triremes, but most of the ships were biremes (1.82). Since fleet operations are limited to the speed of the slowest, we must consider the whole fleet as biremes and reduce the estimated horsepower by $\frac{1}{3}$

Length (waterline)	103 ft.	Estimated horse power	14[2]
Beam	17 "	Speed under oars:	
Draft	3.1 "	for a short spurt	7.3 knots
Displacement	81 tons	for 2 hours with full crew	4.8 "
Complement		for longer period	2 to 3 knots (progress was impossible with head winds)[3]
rowers	108		
others	115		
total	223	Speed under sail	0 . . . 10 knots[4]

As to speed under oars, it might be stated that it was very unusual for a fleet to keep rowing for a whole day, and when it did, 50 miles a day was the record. The higher speeds attainable with full crews were apparently not used except in battle.[5] The ancient warship,

(unless we make the questionable assumption that the biremes were so much smaller that they had a comparable ratio of power to area of "wetted surface").

[2] The estimated horsepower is properly given for a 2 hour run. The corresponding horsepower required for the speed of a spurt is 32.25, which gives us .3 H.P. as the power exerted per man in a period comparable to that of a boat race. The figure for this is .33 H.P.: cf. Gilbert C. Bourne, *A Text-book of Oarsmanship* (Oxford, 1925) 38 f. But energy is applied more efficiently in a racing shell with its sliding seats and extremely low hull than in any boat or ship with fixed thwarts and sides high enough to make it seaworthy, so that our figures probably err in being too high.

It must be assumed that in long missions under oars the rowers would work in shifts, reducing the horsepower to 7 or less. Cf. Chester G. Starr, Jr., *The Roman Imperial Navy* (Ithaca, 1941) 52; W. W. Tarn, *JHS* 25 (1905) 145 note 24. For a higher, "momentary" horsepower, see below note 18.

[3] The inability of ancient warships to row against a strong wind is shown in the record of Pliny the Elder's mercy mission to the neighborhood of Mt. Vesuvius (Plin. *Epist.* 6.16.12, 17). The party was marooned at Stabiae because of a fresh on-shore breeze — not strong enough to merit comment when utilized as a fair wind to make the crossing from Misenum. Another possible explanation of their difficulty is the reasonable supposition that naval ships on a peaceful mission may not have carried a full complement of rowers.

[4] Rodgers, *op. cit.* 52, 53; cf. below, note 26.

[5] For accounts of rowing see Appian 4.71; 5.101. Elsewhere the slowness of fleet movements indicates that commanders resigned themselves to travel at rates permitted by the wind. Rodgers, *op. cit.* 536: Antony and Cleopatra took three days to sail from Actium to Taenarum, 183 miles, at a rate of 2½ knots. The wind was fair (*Aen.* 8.707 f.) but presumably light. During the Second Punic war a Roman fleet took 4½ days to travel from Pisa to Marseilles via the Ligurian coast, cf. Polybius 3.41.4. The distance is 228–254 miles depending on whether they followed the shore or cut straight across, the speed 2 to 2½ knots. Since this is a region of northwesterly and northerly winds, it may be presumed the ships were tacking. However if either of these fleets had chosen to use its auxiliary power as modern yachtsmen do, they could have rowed during lulls in the wind and halved their time. For the winds near Marseilles, see *Sailing Directions for the Mediterranean*, Vol. II[3], H.O. 152 (United States Government Printing Office, Washington, D. C., 1941) 33. In references to books of this series I will use the conventional abbreviation H.O. A significant line in Aristophanes' *Frogs*, 1076, suggests that in the Athenian navy this change to virtually complete reliance on sail for everything except actual battle drills came about in his

when considered as a means of transportation, was not an oar-propelled galley but a sail boat with auxiliary power. That power was not made available by the simple pushing of a button, but involved gruelling exertion by human beings — never mere slaves — so that we might presume it would be used sparingly. This is precisely the situation we find in our best account of a naval mission, Vergil's *Aeneid*.

The rig of these Augustan naval vessels is nowhere explicitly described, but if we may judge from scattered references and illustrations of a later period, they were single masters with one large square sail and a small one set as a jib on a smaller spar slanted forward like a bowsprit.[6] Some merchant vessels set a triangular sail between the yard and the tip of the mast (a rafee),[7] but navy rig may have been somewhat simplified because mast and sail were designed for removal during battle. The representations on which we must base our judgment indicate a very moderate sail area, but one feature of their fitting bespeaks high efficiency, the system of brails run vertically through rings on the forward side of the sail and controlled by a pair of ropes leading aft to the helmsman.[8] Their function was twofold, to make possible a quick reduction of sail area, as in tacking, and to allow adjustment of the sail's contour. When the lines were drawn taught the sail was relatively flat, for sailing into the wind or with a strong wind; when the brails were slackened the sail bellied out like a spinnaker to give added power in light, favorable airs.

Turning to our record of the use made of this equipment, let us first see what they did with their oars. The most frequent mention of their use occurs in descriptions of entering and leaving port. This is natural because of the berthing technique they followed, with ships beached stern to, an anchor thrown from the bow and a line fastened ashore.[9] When they "set sail," the first maneuver

generation, and that it resulted from a protest on the part of the crews, ἀντιλέγει. See my article, *CW* 41 (1946) 247, note 13.

[6] For *dolon* or *artemon*, see C. Torr in *DS* s.v. "navis," 38; Baumeister *Denk.* III taf. LX; cf. *Acts* 27.40. See also Grant Showerman, *Rome and the Romans* (New York, 1934) illustration p. 478 (a mosaic from Ostia).

[7] Cf. Plin. *H.N.* 19.4; Seneca, *Medea* 318–328 (cited below, note 22).

[8] See Torr in *DS*, *loc. cit.* figs. 5294 f.; Seneca, *De Ira* 2.31.5.

[9] *Aen.* 6.3–5: Obvertunt pelago proras; tum dente tenaci
ancora fundabant navis, et litore curvae
praetexunt puppes.
Cf. 3.266–268, 277 (= 6.901), 667; 4.573–583; 5.773.

was to dislodge the sterns from the beach by violent rowing, which our author describes in a recurrent Homeric tag.[10] In most of these passages, including those cited from the *Odyssey*, the context shows that the rowing or churning was soon followed by sailing; it is presumed that the reader will understand that the rowing may have carried the ships only a few hundred feet, and that they proceeded to their destination under sail.[11] On the occasion of their final departure from Drepanum they left their berths without raising their masts, perhaps putting on a show like that of the Athenian fleet setting out for Sicily (Thuc. 6.32.2). But they proved that they were true sailors by setting their sails at a point where it would appear one mile more of rowing would have saved them the necessity of three or four miles of sailing.[12] Certainly they used their power no more than modern yachtsmen do in clearing harbor with boats a fraction of the size of Aeneas'. In contrast it might be mentioned that the last of our square-rigged freighters were towed far out to open sea before unfurling their sails.

For the rest, it may be said that our ancient sailors used their auxiliary power very much as modern ones do, to save time when becalmed or to save themselves in situations of serious danger. With reference to the first, we must bear in mind both that the use of "power" involved unpleasantly hard work and that living conditions were so extremely primitive[13] that tediously slow runs, especially if prolonged through the night, would be avoided whenever possible. But even when they were apparently anxious to make time, as when they reached the east coast of Sicily, they rejected the alternatives of a quiet evening row or of drifting in a calm:

[10] With 3.289 f. cf. *Od.* 4.579 f.; 9.103 f. See also *Aen.* 3.668, 4.583, 5.778.

[11] If the wind was in a favorable direction, sails might be raised before they set out, cf. *Aen.* 3.267, 668; 4.574. In their flight from the Cyclops it may be assumed that they continued rowing some distance (3.668), but even then their panicky impulse was to sail off in whatever direction the wind would carry them (682 f.), and they were using both means of propulsion together.

This procedure of beaching instead of anchoring I had always thought of as a primitive survival until I read a description of a similar technique employed by Swedish yachtsmen (Alfred F. Loomis, *Yachting*, 82 [Dec. 1947] 46.) The modern practice differs from that of the ancients in only two respects: because present day vessels are deeper astern, they beach bow to, and they use engines instead of oars to beach and draw off.

[12] See below, 59.

[13] A general lack of cooking facilities is indicated by the promptness with which they lighted fires when they reached shore, cf. *Aen.* 1.174–176; 6.6 f. The men slept on bare thwarts, 5.837.

". . . the wind went down with the sun and we headed for the shore" (3.568 f.).[13a] They showed the philosophical patience of old-time sea dogs, as we see in this log entry at the end of their stormy passage from Crete to the Strophades, 3.205–208: "At last on the fourth day land appeared on the horizon, mountains showed in the distance, then the curling smoke of habitations. The sails fall, we reach up for our oars; straightway the sailors bend to it, churn the sea to foam and sweep over the deep blue sea." Even when hunger may have been added to the discomfort of sleeping on bare thwarts, oars were apparently used only when they were close enough to shore to discern the smoke of kitchen fires, perhaps within a mile.

Throughout the rest of this long cruise it may be that Vergil simply leaves it to his readers to assume that oars would be used when the wind died out, but one gains a general impression that exasperating calms were avoided by careful choice of the time for sailing. Palinurus "catches the wind in his ears,"[14] the fresh southwester "calls again to the deep" (5.764); "we set sail (from Selinus) when winds were vouchsafed us" (ventis datis, 3.705). They faithfully offered prayers both to and for winds,[15] and Celaeno even suggested that proper calling upon the winds was a condition for the successful completion of their voyage (3.253). When their piety or their patience had reaped its reward it was foolhardy to "delay the wind" (3.474, 481). Such watching — with or without the praying — has been a prime factor in the coaster's life throughout the ages: the sailor considers sailing as work, and so aims to reach his destination not in the shortest possible time, but with the least possible time spent at sea. St. Paul's trip from Syracuse to Puteoli is a perfect illustration of the technique (*Acts* 28.13): "And from thence we fetched a compass and came to Rhegium: and after

[13a] Cf. 7.6–8, 23, 25–30. Since the wind was of proper strength (6) and fair (23), they sailed through the night. When the wind went down at sunrise, they rowed to the mouth of the Tiber, little more than the distance from which Aeneas sighted the grove which marked it (29).

[14] 3.514. As one faces the wind, it causes a slight "ringing" in the ears, so that by turning one's head and observing the intensity of the sound in each ear one gets a fair gauge of both its direction and its intensity; cf. *Aen.* 4.562, ". . . nec Zephyros audis spirare secundos?" Wetting the lobes of the ears (or wetting a finger) would be quite unnecessary if the wind were strong enough to encourage a sailor to put to sea. Cf. Servius and Knapp on *Aen.* 3.514. Unwashed cheeks are, of course, man's primary weathervane; cf. Eugene S. McCartney, *CW* 42 (1949) 107 f.; but I suspect we all subconsciously use our ears as anemometers to gauge velocities over 4 or 5 miles an hour.

[15] Cf. 3.118, 120, 528 f.; 5.211, 722 f. Celaeno even suggested that proper calling upon the winds was a condition for the successful completion of their voyage, 3.253.

one day the south wind blew and we came the next day to Puteoli." By turning back in disgust at the light head winds they may have lost 50 miles distance in 24 hours, but by covering the whole 175 miles in a single day they saved themselves 17 hours of work — and had a thrilling experience to recount to their grandchildren.

Elsewhere we find oars used as supplementary power in stormy weather either to hold a course close hauled or to avoid the danger of being swamped by following seas when running before the wind. The first situation is described at the beginning of the fifth book, 15–22: ". . . he orders the crew to shorten sail and bend to the oars, trims the sheets and speaks thus: 'Noble Aeneas, I couldn't reach Italy in this weather if Jupiter himself should guarantee it. The wind is whistling on our bow as it rises from the west, and the air is condensed into cloud.[16] We can't row against it or hold so close a course.'" Present day yachtsmen frequently use their engines under similar circumstances to maintain a satisfactory rate of progress to windward, but Palinurus' statement reflects the fundamental weakness of the square rig, especially when used with a high sided vessel of shallow draft. The next few lines of our description indicate that this westerly which was too strong for them when taken at any other angle merely enabled them to set the waves to dancing when they went with it.

In the two other storms described in the *Aeneid* oars were used to avoid the fate which befell the one ship lost during the journey, swamped by a following sea.[17] Characteristically Vergil does not give us this information in the description of the storms themselves but in a supplementary allusion in the fifth book, during the boat race. The words are put into the mouth of one of the captains (191–193): "Now put the strength into it, the spirit you did in the African Syrtes, the Ionian Sea and the following seas of Malea." Literally, "Now row for dear life."

In the famous storm of the first book we are not told just when they took to the oars, but their use is self-evident from the fact that they broke — in the most obvious of maneuvers, when a gust

[16] In spite of this quaint expression as to the origin of clouds, I prefer Palinurus' description to that of our sailor's handbook, H.O. 152.508, "Cumulonimbus clouds to the northwestward are precursors of westerly winds."

[17] "Pitch poling" is a term for this type of accident, caused by a wave striking the ship at an angle and causing it to spin around and capsize. Vergil's description is complete and accurate, since the capsizing of Orontas' ship is to be inferred from the scattering of crew and wreckage.

of wind from dead ahead caught their sails aback and left them dead in the water (1.102–104). The modern sail boat will almost automatically assume the one safe position in such an emergency, straight into the wind, and the cautious sailor can take down his sails at leisure and proceed under power in any direction he desires; for the most moderate auxiliary engine can maintain headway against a strong wind in a manner impossible with oars. The very fact that oars broke in this emergency indicates to me that they were not designed primarily for such use but for the modest exertion required to propel vessels a short distance in a dead calm.[18]

When the Trojan fleet struck Charybdis they used their oars to make a sudden tack — and to pull out of a dangerous current.[19] This routine maneuver is so complicated for any square-rigged vessel that execution of the necessary orders would require a minute or more with a well-trained crew. Such an interval might have proved disastrous had it not been for the fact that our ships had another recourse in their oarsmen seated on the thwarts, ready for instant action.[20]

To summarize, we may say that this fleet of warships, which was definitely Roman rather than Trojan, used its auxiliary power to effect a great economy in beaching instead of anchoring in port, and to save themselves from disaster in violent storms. There is positive evidence that they traveled when the wind blew, none that they ever embarked for an objective when conditions for rowing were favorable, i.e. when there was no wind. When the wind failed them at sea they were apparently more inclined to accept the delay in the spirit of the merchant-sailor, for whom it was inevitable, than to press on under power like modern spoiled children of the machine.

[18] When a boat is at rest or making stern-way oarsmen may pull continuously with a force of 200 lbs. or more, actually exerting more than a horsepower for a few seconds. This gives our trireme a "momentary" H.P. of 100 or more, which served as a vital safety factor, though it has no bearing on a possible cruising speed.

[19] Vergil's mention of foaming waves agrees with the modern account of the *taglio*, a transverse tide rip "conspicuous on account of its breakers," H.O. 152.538. Such a current carrying one toward a lee shore would be disconcerting, to say the least. Benjamin D'Ooge, *CJ* 4 (1908) 8, belittles the dangers of Charybdis by describing an uneventful trip through the straits in a small boat. But the phenomena are real enough to receive several pages of description in the Sailing Directions. Aeneas was unlucky in striking the spot at the wrong moment, since the *taglio* lasts only a short time during the turn of the tidal current.

[20] Cf. 3.510, sortiti remos; 4.573, considere transtris.

It becomes clear, then, that the *Aeneid* is a record of travel under linen, and that Vergil was thoroughly acquainted with all its techniques. Unfortunately as much cannot be said for the commentators on his work, ancient and modern. Servius establishes the tradition by his comment on a beautiful description of tacking, to the effect that they had to change their sails from one side to the other because of the "shifting character of the wind" (on 5.830). And when we are told that Anchises sacrificed a white lamb to the Zephyrs in preparation for a southerly run (3.120), a fine American scholar observes that the word Zephyr cannot have its usual meaning since "the west wind would not help one much in a voyage from Delos to Crete." We do live in a mechanically advanced age, and it is sometimes a task to project our thinking back to simpler times, but we don't need to project ourselves back to the time when the first of our neolithic ancestors made the thrilling discovery that a skin held at the proper angle would propel his raft at right angles to the wind as well as with it. Indeed, as far as performance is concerned, we would do better to compare the sailing vessels of the ancient world with the old coasting schooners still carrying lumber — and vacationists — up and down our shores. On the other hand, we must bear in mind the fact that their ships were square-rigged, with yards to set and trim as well as sheets. They "set their sail-draped arms" (3.549) and "turned their horns in unison first this way and then that" (5.831 f.) by dint of lusty heaving on braces; an order to shorten sail sent men scrambling aloft to fantastically precarious positions on sixty or seventy foot yards.[21] Even the handling of sheets called for strength and agility, especially in sailing against the wind: *pedem facere* connotes not only the trimming of the after sheet but carrying the other one the full length of the ship to secure it at the bow.[22] In sailing with the wind (*a puppi*, as Vergil describes it, *a popa*, as Columbus did),[23] the Roman did not simply let out a single sheet as we do; he let out both the sheets of each sail a trifle, to allow it to pull upward,

[21] *DS* 4.1, fig. 5293.

[22] Seneca, *Medea* 318–328, "Tiphys dared spread canvas on the broad sea and set new laws for the winds, now filling the sail with its full curve, now catching a blast from the side by carrying forward the foot of the sail; now safely setting the yards half way up the mast, now fastening them at the top, when the eager sailor wants the whole wind, and pink rafees flutter at the masthead." Seneca goes Vergil one better in modernizing his description by giving the Argo a "topsail."

[23] Samuel Eliot Morison, *Admiral of the Ocean Sea* (Boston, 1942) I, xxv.

and paid out the brailing ropes, described above, to make it catch the wind like a spinnaker. "Pay out (or shake out) the free ropes" (*Aen.* 3.267, 682, 683; 8.708), "give free rein to the fleet" (6.1) are terms applied to this process. These billowing sails, like those of more recent full rigged ships, have had a perennial appeal to the world's artists for one very simple reason: they are functional. And the record of ancient performance under optimum conditions fully bears out our impression of adaptation of form to purpose.[24] To cite one example from the *Aeneid*, the Trojan fleet made a run of about 170 miles, from Drepanum to a point near the rocks of the Sirens, in 20 hours or less,[25] at a speed which equals that established as a record in numerous sailings of the race from Long Island to Bermuda.[26] It is significant that this grand finale of the Trojans'

[24] See, e.g., H. de Saussure, *RA* Ser. 6.10 (1937) 90–105; Cedric A. Yeo, *TAPhA* 77 (1946) 231 f. The locus classicus on this subject is Pliny's effusion as to the woes man has brought upon himself by the misuse (?) of the humble flax, *H.N.* 19.3 f. The informants cited in four out of seven instances are state officials, and since provinces rather than ports are named as destinations in others, it is probably to be inferred that all were made by men of similar status. Furthermore Puteoli and Ostia are named as basing points, stations of the Misene fleet maintained for transportation of such officials: cf. Chester G. Starr, *op. cit.* (above, note 2) 17 note 23. The Roman navy was sail-propelled and held all the records; no wonder the seamen, *velarii*, received double pay: *ibid.* 56 note 22.

Pliny professes not to be giving maximum speeds, and actually states that the fastest of the runs he describes were made in gentle winds, *lenissimo flatu . . . mollissimo flatu*. This is of course arrant nonsense, since ships which could make 8½ knots in a "gentle" breeze would be remarkable indeed! The passage deserves complete elucidation, but for the present I may say that he was such a landlubber at the time he wrote book 19 of his history that it is quite unlikely he knew the real Mediterranean records even of his own time.

[25] 5.830–836. I am assuming that the fleet started one hour after sunrise and that Aeneas took Palinurus' place three hours before sunrise (fere mediam . . . metam, 835) the next morning, at a point 10 to 15 miles off the coast of Italy.

The fact that the effort required in steering was so little as to make it possible for the helmsman to fall asleep, in itself speaks well for the balance of these ships; Vergil's implication that considerable time elapsed between Palinurus' accident and Aeneas' observation of it is almost too good to believe (5.862–868), though it might be observed that from Palinurus' point of view an interval of a minute would have left him 600 feet behind if the ship was traveling at 6 knots. On a modern yacht such a mishap would be followed within a few seconds by a noisy slatting of sails which would bring the whole crew on deck.

[26] W. H. Taylor, *Yachting* 83 (June 1948) 53: 212 miles per day. The ancient record, as far as I have been able to discover, is somewhat faster than this, 10 knots, but it was established in a run of only eleven hours instead of three days; Liv. 45.41: Profectus ex Italia classem a Brundisio sole orto solvi, nona diei hora cum omnibus meis navibus Corcyram tenui. Rodgers, *op. cit.* 53 note 57, very properly points out that this passage was made in June, so that nine Roman hours equal eleven of ours. The distance is 110 miles. It is unfortunate that we have only the time of the slowest

enterprise was initiated with the assurance of Neptune's special favor and the appearance of the most favorable omens, so that we may assume that the weather was just what they wanted. This leads us to the observation that ancient sailors were not all of the timid variety, but had something of the spirit which inspires the racing enthusiasts depicted in our Sunday Supplements as hanging over the sides of their frail craft to keep them upright — or of the congregation lustily proclaiming, "Blest be the tempest, kind the storm, which drives us nearer home."

It will be countered at once that it is no great achievement to design a hull that can be driven at a good clip before the wind, but that ability to sail in any direction, especially with the wind ahead, is the true criterion of efficiency. We must admit that in the development of this ability naval engineers have made more progress in the last hundred years than in the preceding twenty-five hundred. The high-masted, deep-keeled racing yacht is as much a product of modern science as the aeroplane, and the Romans definitely lived in a horse and buggy era. But as man's faithful friend carries him uphill and down, so the ancient sailing vessel plodded or galloped where it was bidden, whether the wind was astern or "on its bow." The artist of our Ostian mosaic represents this fact by showing two vessels sailing in opposite directions with the same wind, the one with it partially astern, the other with it ahead. Seneca paints a word picture of the same dual principle in the sailor's life by describing the two ways in which sheets were set, since only with the wind ahead would it have been necessary to "set the tack," *pedem facere*.[27] Just how close to the wind a skipper of those days could

member of the fleet instead of the fastest. I should say that if the vessels were all of the same design it would have been a close race if they arrived within a space of half an hour, which would indicate a rate of 10.5 knots, 250 miles per day for the winner. Speed is usually calculated as a factor of the length of a boat (proportional with the square root), so ancient warships had an advantage over modern racing yachts, now limited to 70 feet waterline length for racing. However if boats were rated by actual size, i.e. displacement, our old triremes are comparable with modern yachts and could apparently travel fully as fast on most points of sailing, with winds of less than storm velocity.

The world's record for speed under sail was established by an American clipper ship in 1854, but she was a ship of 2000 to 2500 tons displacement, 30 times as large as ancient warships, and so able to carry sail in a full gale. See Romola and R. C. Anderson, *The Sailing Ship* (New York, 1926) 191.

[27] See above, note 22. In the mosaic from Ostia (Showerman, *loc. cit.*, above note 6) the ship to the right has "made a foot," *pedem fecit*, and her sail is trimmed much too "close" to be sailing with wind simply abeam. Indeed she could well be

lay his course, and how fast he could sail in such a direction, are the questions we should like to answer.

The evidence from which we must attempt to formulate our answers is discouragingly meagre and vague, meagre, in part at least, because the competent sailor avoids the time-wasting routine of tacking whenever he can, vague because the habit of thinking in mathematically accurate terms seems to be a recent acquisition of the human race. However by correlating statements of ancient writers with known facts as to the weather in certain localities it is possible to reach some tentative conclusions. Thus when we read that the 500 mile trip from Byzantium to Rhodes was made in five days, whereas the reverse journey took ten, we may reasonably attribute the difference to the fact that north winds prevail in that area of the Aegean.[28] This leads to an estimate that they could sail within 60° of the direction from which the wind blew, traversing two sides of an equilateral triangle to make good the length of one. Evidence that ancient ships sailed practically as fast with the wind partially ahead as with it astern[29] confirms our general impression of their efficiency and makes this estimate as to their ability to "point" into the wind seem conservative. If this is so, they were definitely more efficient than any European sailing vessels before the clipper ship era, practically equal to the clippers and modern commercial schooners, inferior only to the modern yacht.[30]

sailing as close to the wind as our evidence from the *Aeneid* gives us reason to conclude ancient ships did; see below, 56. Another factor in our picture deserves note: one of the vessels has the plain bow of a merchantman, the other the distinctive curve of a warship. With unassailable logic the artist informs us that the sea-going ships of the Mediterranean were either naval or non-naval and that any wind that blew hit some of them coming, some going.

[28] De Saussure, *op. cit.* (above, note 24) 93–96:

Byzantium to Rhodes	@ 4 knots:	Marc. Diac. *Vita Porphyr.* 54 f.
Rhodes to Byzantium	@ 2 " :	" " " " 37
Narbonne to Utica	@ 4 " :	Sulpicius Severus, *Dia.* 1.3
cf. Alexandria to Massilia	@ 2 " :	" " " 1.1 (West and northwest winds prevail from Alexandria to Sicily, H.O. 154 A. 33.)

See also above, note 5.

[29] E.g. from Ostia to Spain @ 143 miles per day (6 knots): Plin. *H.N.* 19.4.
" " Narbo @ 170 " " (7 knots): ibid.
These speeds are not too great to allow for actual tacking, but winds in this area are prevailingly westerly, especially northwesterly, so that we must almost assume that much of the distance was sailed "close hauled." See H.O. 152.578–580 (40% to 42% of observations from westerly directions).

[30] S. E. Morison, *op. cit.* (above, note 23) xxiv. He specifies five points (56°) as the nearest a modern fore-and-aft commercial schooner or clipper ship could "lay up

Again we may turn to the *Aeneid*, where we find two passages which shed more light on our subject than the heavy tomes of geographers and natural "scientists." They are the casual account of the Trojans' run from Actium to Buthrotum, and the fuller description of their second departure from Drepanum. The first is as follows (3.284, 285, 289–293): "Meanwhile the sun in its orbit changes the season and icy winter roughens the water with its north winds. . . . Then I bid them leave port and take their places on the thwarts. In rivalry the crews strike the water and sweep over

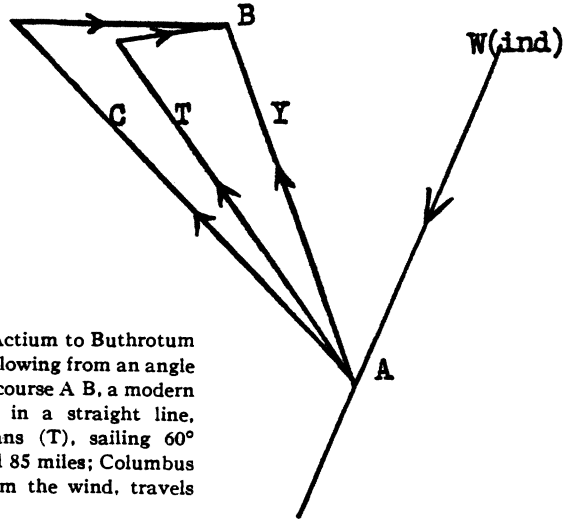

FIG. 1 Run from Actium to Buthrotum
With the wind blowing from an angle 45° from the desired course A B, a modern yacht (Y) proceeds in a straight line, 60 miles; the Trojans (T), sailing 60° from the wind, travel 85 miles; Columbus (C), sailing 67½° from the wind, travels 111 miles.

the deep. Straightway we pass the lofty peaks of the Phaeacians, skirt the shore of Epirus, enter the harbor of Chaonum and approach the high-walled city of Buthrotum." In the Adriatic Sea "north" winds are prevailingly northwesterly (H.O. 152.32 f.), with some variation to east of north, but even if the wind had been from due north, it could have been counted on to draw somewhat off shore, so that by hugging the coast they could have avoided some tacking.[31] The distance is 60 nautical miles (see Fig. 1), the time almost surely a single working day of 12 hours, the net speed 5 knots. Since it is improbable that even so skilled a sailor as Palinurus could have

to the wind"; four points (45°) or better for the modern yacht; six points (67°) as the best Columbus' ships could count on.

[31] Cf. *Acts* 27.4, 7. Ships sailed "under Cyprus," i.e. in the lee of Cyprus, and "under Crete" to get a more favorable slant of the wind.

found eddies of wind which would have been more than 45° from his course (i.e. north-northeast instead of north-northwest), we must conclude that they did some tacking, perhaps covering 85 miles at an average speed of 7 knots. The crew of a modern yacht, designed to sail closer to the wind and to sail faster with the wind ahead than astern, might have eaten their lunch in Buthrotum; but Columbus would have had to make a night landing.

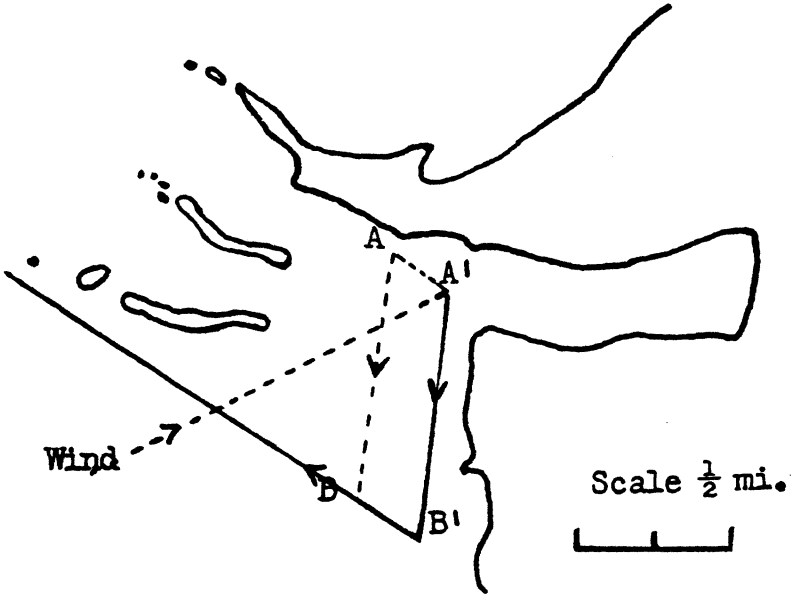

FIG. 2. Drepanum Harbor

The ships rowed from the inner harbor to positions represented by the line A A', tacked in the direction A' B', then "laid their course" B' B. If they had tacked at an angle more than 60° from the wind, they could not have made the first long tack parallel to the shore. The fleet maneuver may be understood if we assume that ships lined up abreast along A A', so that when they came about they were "in line ahead," with Palinurus (at B) in the lead. (The effect of coordination could have been produced in other ways: mine is just one possible explanation.)

Reference has already been made to the 170 mile run from Drepanum to Italy, simply to show that ancient ships could make good time when they had a good "chance." But our realistic, concise description of how they covered the first mile of that trip conveys more information as to ancient sailing than reams of statistics as to sheer speed. Here are Vergil's lines (5.827–834): "At this delight thrills the mind of Aeneas who had been anxious

before: promptly he orders all masts stepped, the arms draped with sails. Together they all fastened their tacks, as one they set their sails now to the left, now to the right; in unison they turn their lofty horns first this way then that; a fair wind carries the fleet on its course (fert sua flamina classem). At the head Palinurus leads the close file, all the rest bidden to keep up to his course. . . ." The wind is described as fair (777) for the northeasterly run to Italy, but the harbor itself faces west, so that the wind was ahead till they passed its outer islands. It is also spoken of as southerly, (Auster, 764) but westerlies are prevalent along this shore (H.O. 152.494), so that southwest or west-southwest may be assumed as its direction.[32] Indeed when we put the problem in diagrammatic form (Fig. 2) the latter direction is the only one which fits the conditions. If the wind had been due south, there would have been no need of any tacking; if it had been south of southwest they could not have cleared the outer harbor in one tack; if the wind had been due west — Vergil would not have called it "south." Examination of the chart suggests one other all-important conclusion: if they cleared by taking only one tack — a long one to the left, i.e. to the south — in any wind described as "southerly," they had to sail within 60° of the wind. Equally important is the evidence that the crews of these Liburnians, masquerading as Trojans, were hard-bitten, windjamming sailors prepared to sail two or three miles to save a mile of rowing.[33]

To Vergil, of course, this is all incidental; his interest is centered on the coordination of the ships' tacking (una . . . pariter . . . una). It was a fleet maneuver, closely timed on orders from the flagship, as such a difficult and laborious operation would have to be to avoid collisions. It may be visualized as a right face, in which the ships started abreast, aligned in the direction of their second tack, so that when they came about they were in a file

[32] This is in agreement with the situation during the boat race in this harbor: the wind was fair for their return from Palumbo Rock, 5.212.

[33] If it was simply a matter of tacking at an angle of 60° from the wind they sailed twice the rowing distance. But I suspect that in order to have safe room for tacking they took a longer, more open route than would have been necessary for rowing, and so at least trebled the distance. The shorter routes, between the point of Sicily and the nearest of the finger-shaped islands, and between the two islands themselves, are today too shallow for any navigation, but Vergil's clear statements that the boats in the race had an island on their left as they went out (5.162 f., 169 f.) indicate that in his time there was sufficient water, at least between the two islands. If this is true, the sailing distance was at least three times the rowing distance.

"following the leader," "in line ahead." But whatever the exact formation, we can imagine the beauty of the picture and appreciate the consummate skill with which the huge fleets of the civil wars must have been handled.

Any sailboat worthy of the name can tack, but any sailor worthy of the name employs the utmost ingenuity to reach his destination without tacking. The most obvious devices for attaining this end are to wait for a head wind to change,[34] or to utilize favorable variants in the wind along a lee shore.[35] Another such device by which the sailor outwits nature is taking advantage of the alteration of wind direction at different times of the day. Sea and land breezes are as characteristic of the Mediterranean as of our own coastal waters, and the *Aeneid* confirms the simple meteorological phenomenon we may have observed from a hotel porch. When the Trojan fleet was sailing down the eastern coast of Sicily, presumably with a favorable northerly or northeasterly wind (cf. H.O. 152.539, 552), the wind left them at sunset. Next morning, when terror at the sight of the Cyclops drove them to shake out their sails in whatever direction the wind would carry them (3.682 f.), a southerly wind carried them back north. However, almost as soon as they came to the realization that they must reverse their course a north(east) wind from Pelorum came to their rescue. This is not poetic fancy but the natural result of the sun's shining on a great land mass like Mt. Aetna.

Vergil's integrity as a reporter of natural phenomena is only exceeded by his ability to enhance the drama of a situation by the realism of its setting. His account of Aeneas' hasty departure from Carthage is a case in point, incorporating accurate knowledge of the land and sea breezes of the locality. Present day mariners read this account of conditions at Tripoli (H.O. 154 A.34): "The southerly land breeze usually begins at 8 or 9 p.m., and continues light until sunrise when it shifts to west. After a calm interval, the cool northeast to east northeast breeze sets in, freshens at noon and falls at sunset."[36] Dido tells us that northerly winds prevailed at the time of Aeneas' departure (4.310), and Vergil himself says Aeneas

[34] Cf. *Acts* 28.13, cited above, 50.

[35] See above, note 31. It is also true that most boats sail faster in the relatively smooth water found near such a shore.

[36] Cf. H.O. 151.43 for reference to a similar phenomenon at Tunis. As to the daytime winds of the locality see H.O. 152.572 (northwest winds are twice as frequent as north and northeast winds at Bizerta).

was sailing a sea "darkened with the north wind" when he looked back to see the burning pyre (5.1). However, Mercury had appealed to a canny seaman's judgment late in the night by calling on him to hear "the fair Zephyrs breathing" (4.562). By taking advantage of this late phase of the land breeze the fleet cleared port expeditiously without tacking or rowing. When Dido saw them shortly after sunrise headed off together on the same tack,[37] they had presumably caught the northerly sea breeze (5.1) which would carry them on their course (close hauled) but would be dead against pursuing Carthaginian vessels. There was no thrilling dash across the foaming deep; the fleet Dido saw from her window may have been little more than a mile from the harbor, becalmed in the lull between the land and sea breezes, but she was beaten in an elementary yacht-racing situation: they were to windward and she would have to traverse twice the distance they had traveled to reach their position. The queen committed suicide with her lover's ship in clear view, and Aeneas needed no binoculars to see the smoke rising from her pyre.

My analysis is of course something "to be continued," but I trust enough has been said to indicate that Vergil very definitely knew his way around the Mediterranean and was acquainted with all the problems of the sailor. There is no odor of the lamp in his account of wind and weather — as there is in mine — and in the general brightness of his picture of the sea I think we may discern a fondness for its life. But whether he sailed for pleasure or literary profit — or for his health — his fictional account of Aeneas' journey possesses a higher degree of truth than the factual record of experience from less gifted observers. His description of routine sail-handling rings true, his meteorological observations check consistently with our scientific data. His ships were fast, but no faster than others of his own time and before; in fact their speed was only what one would expect of large vessels in a strong wind. With a true insight into the primary problem of sailing, that of making progress against the wind, he gives us a vivid picture of a simple tacking situation in a specific area, from which we can form a defi-

[37] Aequatis velis, 4.587. They were not sailing directly before the wind, with both sides of the sails filled equally (cf. Conington and Knapp *ad loc.*), but close hauled in a north wind, or with a westerly wind abeam, unless the words "north" and "west" mean "south" in the *Aeneid* — and in the British *Mediterranean Pilot*. Vergil is describing a scene like a good yacht race, the sails of the nineteen ships all set alike.

nite estimate of the efficiency of ancient ships. We cannot cite "historical" evidence to prove the point conclusively, because historians lacked the knowledge or the interest to supply us with the necessary details. But Vergil's account is internally consistent, since ships as efficient as those which sailed from Drepanum harbor could make any run close-hauled without undue delay which would demand the author's attention. Furthermore his account is corroborated by the circumstantial evidence of recorded voyages which were probably made close-hauled, and by the general deductions one might draw from the volume of sail-borne traffic in the Mediterranean. It must also be remembered that he is describing the performance of the finest, fastest ships of his day, the *naves longae* whose very name suggests trim lines, and whose primary purpose was fast, reliable communication rather than freight-carrying. A hint of how Vergil may have gained familiarity with naval seamanship is contained in the familiar story of his fatal illness, which struck him when he was accompanying Augustus on his return from Greece to Brundisium. We may be sure that this trip was not made aboard any old freighter that happened to be sailing in that direction but on a trim Liburnian, manned by the best crew in the Mediterranean. Is it not probable that Vergil's status in Augustan society was such that he had frequent opportunities for such deluxe travel with friends in official positions? It would not lower my opinion of the Augustan regime to suppose that some junketing was allowed, and that crews of the navy were kept in training to supply data for a great epic.