

Once the best possible *reference* path, orbit or trajectory is computed and furnished in the form of a Space Almanac to the space navigator, they will be in a position to make use of the timepiece and the sextant. In some respects, space navigation will be easier than sea or air navigation. The skill of the space navigator will be needed to detect, at the earliest possible moment, any divergence from the reference trajectory, and then to apply the needed *small* force in the proper manner and let it, by acceleration over as long a period as needed, keep his craft as close as possible to his 'course', which in effect is in the Almanac.

Consider a liner taking departure from Ambrose light, and equipped with a range finder, and a bearing compass which could supply accurate ranges and bearing across the Atlantic. The navigator would say he had it made! Using the centre of the Earth in the star field as a lighthouse, and the stadimetric distance from it as described by Major Henry, do we not have exactly the same situation? Of course, we are down to bare bones, and omit many details, yet the principles involved are quite clear. What we now need is some *skilled* space navigators. Doubtless, some tired space navigator will do the equivalent of 'reversing variation' and end up in perpetual orbit, yet it is certain that others will accomplish efficient space navigation and 'bring them back alive'.

The space navigator will doubtless be supplied with computers, slide rules, and other aids to navigation, but he should not attempt to turn into an electronic computer, but rather make full use of his own miraculous computer—the brain.

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## The Binnacle at the Conn

*from* Commander W. E. May, R.N.

(National Maritime Museum)

It may be unexpected to some to find that among all the unsolved problems in the history of the magnetic compass there is a shortage of information on the form and arrangement of binnacles during the eighteenth and first part of the nineteenth centuries. The cupboard type of binnacle designed to take one or two steering compasses, according to the size of the ship, is pretty well documented for it is described in most of the books on navigation published in the French and English languages from the middle of the seventeenth century. There are also drawings in some books and there is a watercolour in the National Maritime Museum which shows the steering binnacle on the deck of His Majesty's Ship *Deal Castle* about 1775. This is however the only deck scene of the period known to me which does show a binnacle and very few binnacles appear in contemporary ship models.

It is with the second binnacle that the mystery really occurs. The early French writers tell us that a large ship had more than one binnacle but I do not find a

similar statement in an English book until 1764. It is probable that large British warships carried several binnacles for there is a Navy Board order of 1779 which *reduces* the number of binnacles allowed to ships of the second rate to two. The second binnacle was said to be for the use of he who conned the helmsman but there is no mention of its form or where exactly it was placed. In 1696 Lieutenant Edward Harrison referred to 'the upper or lower betackle' and in 1813 Captain A. P. Hollis says that in the *Achille* he had a binnacle 'on the Fore part of the Poop Deck'. Apart from these vague references there is nothing, not even an oil painting or print, to show us the position of the conning binnacle at the time.

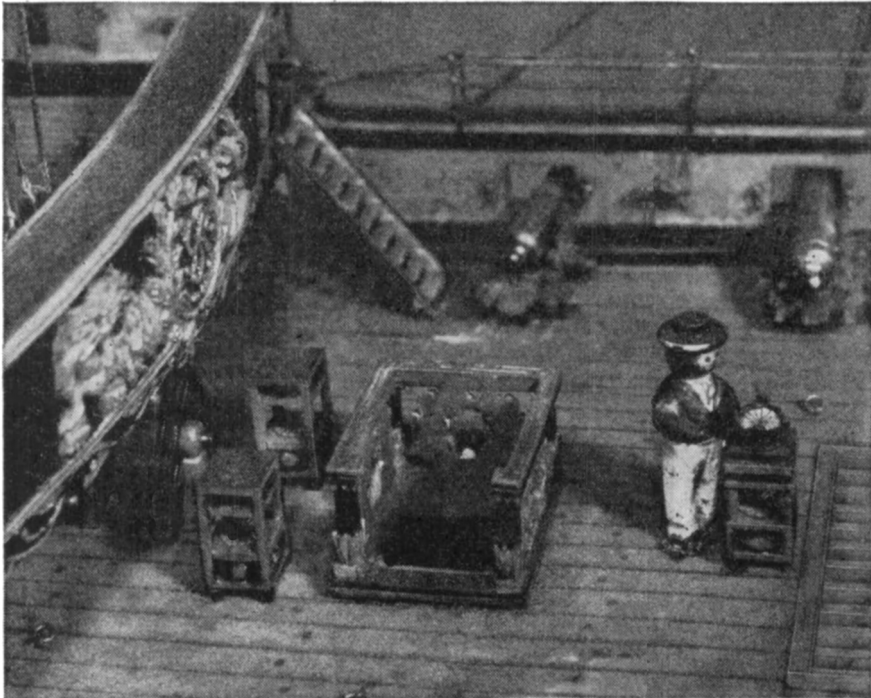


FIG. 1. The binnacle at the Conn

When it comes to the French Navy we are better off, being indebted to the French Prisoner of War Models. These fascinating little models were made from bone or wood by prisoners during the wars with France. Although they are often provided with English names and ensigns these features were only added to make the models more saleable in this country. The model maker would actually follow his recollections of a vessel of roughly similar force in the French Navy. The models are made to show the greatest possible detail and many of them show binnacles; indeed among over twenty which I examined recently nearly half exhibited a binnacle at the conn.

The accompanying photograph shows a deck scene on board one of these models, now in the National Maritime Museum. The name on the stern is *Impregnable* but the contemporary ship of this name mounted 90 guns instead of

the 110 exhibited by the model and in addition much of the detail is obviously French. The scale is  $1/120$ , or  $1/10$  in. to the foot, so that the little sailor is only about half an inch in height. It will be noted that a pair of binnacles replaces the single cupboard type with its compass at each end. This arrangement seems to have been adopted rather earlier by the French Navy than by our own. It is shown in the model of a French vessel captured in 1803 and twin binnacles were on board the *Tonnant* and *Vengeur* in 1818. The former of these two vessels was built at Toulon in 1791 and was taken at the Nile in 1798. Her original binnacles may well have remained. The *Vengeur*, despite her name, was built in England in 1810.

The photograph also shows the binnacle at the conn, about twelve feet forward of the steering binnacles. All three are identical in design. The compass is fitted below half height and can be seen from all sides. Perhaps removable shutters were supplied for fitting when required. In the top of each binnacle is a shelf; no doubt the stowage for watch glasses &c. described in the various books. There does not seem to be any arrangement for lighting the compass. The cupboard type binnacle had a lamp or candle in a central compartment between the two compasses.

A very interesting point about the conn binnacle is that an azimuth compass is standing upon it. All the evidence available is to the effect that the azimuth compass was portable and was brought up for use when required, being then placed in a convenient spot, usually the top of the binnacle. It was Captain Matthew Flinders who recommended that the azimuth compass should *always* be used on the binnacle to avoid differences of deviation which would be encountered if varying positions were used.

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## Navigating in the Offshore Powerboat Race

*from* Captain J. O. Coote, R.N. (Ret.)

WHEN the Offshore Powerboat Race was first held in 1961, navigators made the painful discovery that conventional methods of coastal pilotage were useless in a comparatively light, high-performance powerboat being driven to its limit.

Taking part in the race is like driving a Mini-Cooper over a frozen ploughed field in intermittent fog from London to York, the same distance as the course from Cowes to Torquay. Chart-work is out of the question. It is physically impossible to lay off a bearing or read a course. Furthermore, the figures and symbols are too small to be read, and, as often as not, the chart gets blown overboard. Radio bearings are unobtainable over the engine interference. A hand-bearing compass cannot be held steadily enough. Parallel rulers, dividers, pencils and the navigator's notebook end up in the bilges.