

# THE TECH

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INSTRUCTORS AND STUDENTS IN COURSES XIII AND XIII A

### WARSHIP DESIGN AND CONSTRUCTION

By WILLIAM HOVGAARD.

The course in warship design and construction being laid out with the special purpose of preparing young naval officers for duties as Naval Constructors, pre-supposes a general knowledge of warships and seamanship, of the life on board ship, of the service in the navy, and of the installation and use of artillery and torpedoes. In fact, not only must the designer of warships be a constructor, but he must understand the requirements of the nautical and military service of the navy. Most of the freak designs, which have been brought out, and, in many cases, realized at great cost, have been made by men unacquainted with these requirements.

The design of warships differs essentially from that of merchant ships. While the greater part of the displacement of a merchant ship is taken up by a dead weight carried as cargo, the corresponding weight in a warship is carried as a complex armament and system of protection, and the systems of ventilation, heating, drainage, communication, and also all living accommodations are of a completeness only equalled in high-class passenger steamers. Hence the greater complexity of warships as compared with merchant vessels.

Moreover, the design of merchant vessels, and, in particular, their structural arrangements and details, are determined almost absolutely by the rules of the classification societies, which give the scantlings of every important member of the structure, once the principal dimensions and size of the ship are settled. In warships, no such rules or tables are given for the guidance of the designer. Each dimension and scantling has to be determined by the designer independently, based on experience and precedent, aided by calculations wherever practicable. In many cases, however, the problems occurring in the structure of warships are too complex to permit of exact calculations. Empirical formulae expressing a comparison of certain main features may often be used, but, in many cases, nothing but an interpolation between the scantlings used in ships of similar type and size is left to the designer. Therefore, judgment and experience counts for more in warship design than in most other branches of engineering.

Probably in no other branch of engineering has there been such a variety of types proposed, and carried into practice, as in the construction of warships. The complexity of the requirements of the service has led to an almost bewil-

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### COURSE IN NAVAL ARCHITECTURE AND MARINE ENGINEERING

By C. H. PEABODY.

The course in naval architecture and marine engineering offers instruction to those who expect to be ship-builders, ship-designers, ship-managers or marine-engine builders (including marine steam turbines). The long and cumbersome title is forced on us by the commonly accepted use of the terms which historically connect the building of the old wooden sailing ship with the construction of the modern steel steam-ship. When built of wood, houses and ships have many resemblances and in medieval titles both were picturesque. The architect was then designer and master-builder. However it may be with the architect, the naval architect must not lose the quality of being master-builder and that quality must include both structure and propelling power. Again, at the transition from sail to steam the naval architect accepted the steam engine as designed and built by the engineer. The ship carpenter worked in wood and the machinist in iron and the line of demarcation was clear. But the shape and structure of the hull had to be modified to meet the new conditions of propulsion and the machinery had to be developed to meet the conditions of service; both are now made of steel, and the lines of demarcation depend on custom. By custom the design of a ship and the machinery is intrusted to a naval architect and a marine engineer, but the designs so overlap that harmonious results can be attained only by close association and is best attained when there is one master-builder who decides all.

This discussion might appear to be merely curious if not idle, did it not in a measure deal with common impressions, which tend to narrow the conception of the work of the department. The course as will be seen by inspection of the schedule in the catalogue is a broad course; its application is so far limited as man's interests on shore are more extensive than at sea.

To those who intend to enter the course it may be said that the best preparation is a good all round training as afforded by our first and second years. In order to succeed one must be able to do his mathematics and drawing with reasonable facility; but that is true for any engineering course. Of the later work, the applied mechanics and steam-

engineering are as much professional work as in naval architecture itself.

The lectures on naval architecture deal with displacement and stability, with the determination and application of the power required for propulsion, and with the theory of waves and their influence on the steadiness and safety of a ship at sea.

The lectures on marine engineering deal with the development of power by reciprocating engines and by steam turbines, and with the size and proportions requisite for strength and stiffness of their machines. Also with the vibration produced by engines and methods of avoiding or reducing such vibrations.

In the drawing room each student design a sailing yacht and a steamship, making all the customary calculations for displacement, stability and strength, including also a launching problem. The design is accompanied by lectures on ship construction and kindred subjects. In the drawing room there is made also a design of an engine for the steamship design.

The course for naval constructors differs from the regular course in that it more extensive, more advanced and in that a large amount of attention is given to warship design. The increased time assigned to this course makes it possible to give more attention to marine engines and to marine steam turbines, and also to give an extended course in electrical engineering. Graduates from Course XIII and others having equivalent preparation can take graduate work in naval architecture leading to the degree of master of science, including waship design.

The department has been fortunate in that from the liberal policy of the Corporation and by the generosity of friends of the Institute, it has been possible to provide books and instruments freely and to maintain instruction in cutting models and in mould loft work. Also lectures have been obtained by prominent men in the profession both in this country and abroad. Last year a course of lectures were given by Mons. E. Bertin, Chief Constructor (retired) of the French Navy, the lecture being given in French, but with the advantage that a type-written English translation was placed in the hands of the students. This year a course is announced to be given on alternate days, beginning May 10, by Mr. Sidney W. Barnaby, a well-known English naval architect, as has already been noted in a previous issue of this paper, and the author of a standard work on Marine Propellers.

### SHIP CONSTRUCTION AND SHIP DESIGN

By W. S. LELAND.

The professional work of Course XIII begins with the second term of the second year with a course of lectures dealing with the processes of ship building and the lay-out and equipment of ship yards.

This course is intended to familiarize the student with the essential elements of ship building and awaken his interest, to such an extent, that he will spend his summer months at work in some ship yard. Such summer work is of great benefit because it not only brings the student closely in touch with the practical work but aids him greatly in his professional studies of the third and fourth years.

Building slips, crane service, machine tools used in ship work, pneumatic tools, mould loft, bending frames, erecting and in fact all other fundamental processes of the actual layout of leading ship yards both here and abroad are fully discussed.

This course is followed by a trip through the more important ship yards along the Atlantic Coast if the class so desires. The importance of such a trip cannot be over-estimated, for it gives the student an opportunity to compare the different methods of our leading yards and see for himself the conditions under which they have to work.

This course is followed in the second term of the third year by a course of lectures covering the details of ship construction, the stresses existing in the hull and the best disposition of material to resist the strains.

In the fourth year this work is made to fit in with the actual drafting work of the ship design.

These lectures are illustrated frequently by lantern slides, and the department is fortunate in having several good-sized models showing various details of construction. These models are made of wood and correctly show to scale the relation of plates, angles and rivets, giving the student a far better conception of such details than could be had merely from drawings.

The actual design of a steamship begins in the latter part of the first term of the third year and continues through the remainder of the third year and throughout the fourth year.

The preliminary dimensions of a vessel to fulfil certain requirements are determined, the general arrangement laid out to a small scale and an approximate draft of the lines made to

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