船舶工程

专业英语

SPECIALITY ENGLISH FOR FUNDAMENTALS AND CONCEPTS IN SHIPBUILDING ENGINEERING

（第二版）

黄德波　主编

HEUP 哈尔滨工程大学出版社

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内 容 简 介

本书内容包括船舶设计、原理、结构、生产建造、造船经济等方面。读者通过对本书有关造船学的主要方面的英文文献的学习，可提高相关专业英语的阅读、理解及运用水平。

本书可作为高等院校船舶与海洋工程专业学生的专业英语教材，也可作为相关专业工程技术、研究人员的培训或自学材料。

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第二版前言

21 世纪是海洋世纪，作为海洋大国的中国，2015 年已成为世界第一造船（吨位）大国，但要成为造船业和海洋技术强国，还需要大力提高相关的科学与工程技术水平，船舶工程学即是所需重要相关学科。为了新知识与信息的获取、国际技术的交流，除了基本英语的掌握之外，良好的专业英语的阅读、理解等运用能力对于从事船舶工程有关科学与建造技术的人员是不可或缺的；有关教学与自学需要船舶专业英语教材、读本，本书是为此目的而编写的。

船舶工程学是一个较大的系统学科，涉及船舶等水面与水中载体及结构物的力学性能、设计与建造等多方面学科知识，内容广泛，其有关专业英语的基本内容无法在此书中面面俱到；编者从描述专业基础知识、原理概念、历史发展等较经典的著作以及其他文献中选材，择其要义段落，附上主要生词与术语的解释，编成本书。

书中简要涉及船舶设计（概念，船舶分类，船型主尺度，船形及参数，船级社等）；船舶基本原理（稳性，阻力，推进，运动与操纵，船模试验等）；船舶结构（结构部件的功能，结构性能与线型的关系，船舶强度，结构应力结构完整性等）；船舶生产建造（造船过程，计划与进度制订，船厂与设施，船舶 CAD 与 CAM 等）；以及少量造船经济内容（造船工业现状，成本估算与合同管理等）。

编者相信，学习本书有助于读者掌握有关船舶工程专业英语的基本的词汇和句法，从而提高相关专业英语文献的理解与应用水平。

本书主要是作为有关专业本科生教材编写；教师可按具体专

业要求和教学时数安排,适当选择其中主要部分内容进行教学,其他部分可作为课后阅读材料。本书也可供从事船舶与海洋工程方面的科技专业人员作为自学读物。

编者水平有限,书中难免有错漏,望读者指正。

编　者

2017.1.5 于哈尔滨工程大学

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PREFACE

Introduction to Naval Architecture

Naval architecture also known as naval engineering, is an engineering discipline dealing with the engineering design process, shipbuilding, maintenance, and operation of marine vessels and structures. Naval architecture involves basic and applied research, design, development, design evaluation and calculations during all stages of the life of a marine vehicle. Preliminary design of the vessel, its detailed design, construction, trials, operation and maintenance, launching and dry-docking are the main activities involved. Ship design calculations are also required for ships being modified (by means of conversion, rebuilding, modernization, or repair). Naval architecture also involves formulation of safety regulations and damage control rules and the approval and certification of ship designs to meet statutory and non-statutory requirements.

Main subjects

The word " vessel " includes every description of watercraft, including non-displacement craft, WIG craft and seaplanes, used or capable of being used as a means of transportation on water. The principal elements of naval architecture are:

Hydrostatics

Hydrostatics concerns the conditions to which the vessel is subjected to while at rest in water and its ability to remain afloat. This involves computing buoyancy, (displacement) and other hydrostatic properties, such as trim (the measure of the longitudinal inclination of the vessel) and stability (the ability of a vessel to restore itself to an upright position after being inclined by wind, sea, or loading conditions).

Hydrodynamics

Hydrodynamics concerns the flow of water around the ship's hull, bow, and stern, and over bodies such as propeller blades or rudder, or through thruster tunnels. Resistance—resistance towards motion in water primarily caused due to flow of water around the hull. Powering calculation is done based on this. Propulsion—to move the vessel through water using propellers, thrusters, water jets, sails etc. Engine types are mainly internal combustion. Some vessels are electrically powered using nuclear or solar energy. Ship motions – involves motions of the vessel in seaway and its responses in waves and wind. Controllability (maneuvering)—involves controlling and maintaining position and direction of the vessel.

Structures

Structures involves selection of material of construction, structural analysis of global and local strength of the vessel, vibration of the structural components and structural responses of the vessel during motions in seaway.

Arrangements

Arrangements involves concept design, layout and access, fire protection, allocation of spaces, ergonomics and capacity.

Construction

Construction depends on the material used. When steel or aluminium is used this involves welding of the plates and profiles after rolling, marking, cutting and bending as per the structural design drawings or models, followed by erection and launching. Other joining techniques are used for other materials like fibre-reinforced plastic and glass-reinforced plastic.

Science and Craft

Traditionally, naval architecture has been more craft than science. The suitability of a vessel's shape was judged by looking at a half-model of a vessel or a prototype. Ungainly shapes or abrupt transitions were frowned on as being flawed. This included rigging, deck arrangements, and even fixtures. Subjective descriptors such as ungainly, full, and fine were used as a substitute for the more precise terms used today. A vessel was, and still is described as having a 'fair' shape. The term 'fair' is meant to denote not only a smooth transition from fore to aft but also a shape that was 'right.' Determining what is 'right' in a particular situation in the absence of definitive supporting analysis encompasses the art of naval architecture to this day.

Modern low-cost digital computers and dedicated software, combined with extensive research to correlate full-scale, towing tank and computational data, have enabled naval architects to more accurately predict the performance of a marine vehicle. These tools are used for static stability (intact and damaged), dynamic stability, resistance, powering, hull development, structural analysis, green water modelling, and slamming analysis. Data is regularly shared in international conferences sponsored by RINA, Society of Naval Architects and Marine Engineers (SNAME) and others. Computational Fluid Dynamics is being applied to predict the response of a floating body in a random sea.

(摘自 Wikipedia, the Free Encyclopedia, 2016)

术语解释

vessel	船,舰,运输器,容器
subject	主题,研究对象
subject to	经受……
stability	稳性
hull	船体,壳
bow/stern	艏/艉
propeller blade	螺旋桨叶片
rudder	舵
thruster	推力器
tunnel	管道,隧道
propulsion	推进
water jet	喷水推进器
internal combustion	内燃
seaway	水道,航道
maneuver	操纵

global	总体的，全球的
local	局部的，当地的
strength	强度
trial	试验，实船试验
WIG(Wing In Ground)	地效应船
arrangement	布置
concept design	概念设计
layout	安排，布放
fibre reinforced plastic	纤维强化塑料
glass-reinforced plastic	玻璃强化塑料
access	访问，接近
ergonomics	人类工程学
capacity	舱容，载运能力
craft	技艺，船舶
to be more craft than science	与其说是科学，不如说是技艺
prototype	雏形，原型
ungainly	难看的，粗陋的
flawed	有缺陷的
rigging	索具，起重装置
full, and fine	丰满，与纤细（细长）的
correlate	相关
static stability (intact and damaged)	静稳性（完整与破损的）
green water	甲板上浪
slamming	抨击，拍击
RINA Royal Institution of Naval Achitects	（英）皇家造船工程师学会
SNAME Society of Naval Architects and Marine Engineers	船舶与海洋工程学会
random	无规则的，杂乱的

Chapter 1　Ship Design

Lesson 1　Introduction

1.1　Definition

The term basic design refers to determination of major ship characteristics affecting cost and performance. Thus, basic design includes the selection of ship dimensions, hull form, power (amount and type), preliminary arrangement of hull and machinery, and major structure. Proper selections assure the attainment of the mission requirements such as good seakeeping performance, maneuverability, the desired speed, endurance, cargo capacity, and deadweight. Furthermore, it includes checks and modifications for achievement of required cargo handling capability, quarters, hotel services, subdivision and stability standards, freeboard and tonnage measurement; all while considering the ship as part of a profitable transportation, industrial, or service system.

Basic design encompasses both concept design and preliminary design. It results in the determination of major ship characteristics, permitting the preparation of initial cost estimates. In the overall design process, basic design is followed by contract design and detail design. Contract design, as its name implies, develops plans and specifications suitable for shipyard bidding and contract award. Well prepared contract plans and specifications will be clear and in sufficient detail to avoid costly contingency items and protect bidders from obscure or inadequate description of requirements. Detail design is the shipyard's responsibility for further developing the contract plans as required to prepare shop drawings used for the actual construction of the vessel.

An understanding of the entire design sequence is essential to anyone seeking to develop a basic design. The four steps involved are illustrated in the Design Spiral, Evans (1959) as an iterative process working from mission requirements to a detail design, Figure 1.1. These steps are amplified further below:

(1) Concept Design

The very first effort, concept design, translates the mission requirements into naval architectural and engineering characteristics. Essentially, it embodies technical feasibility studies to determine such fundamental elements of the proposed ship as length, beam, depth, draft, fullness, power, or alternative sets of characteristics, all of which meet the required speed, range, cargo cubic, and deadweight. It includes preliminary light ship weight estimates usually derived from curves, formulas, or experience. Alternative designs are generally analyzed in parametric studies during this phase to determine the most economical design solution or whatever other controlling parameters are considered determinant. The selected concept design then is used as a talking paper for obtaining approximate construction costs, which often determine whether or not to initiate the next level of development, the preliminary design.

(2) Preliminary Design

A ship's preliminary design further refines the major ship characteristics affecting cost and performance. Certain controlling factors such as length, beam, horsepower, and deadweight would not be expected to change upon completion of this phase. Its completion provides a precise definition of a vessel that will meet the mission

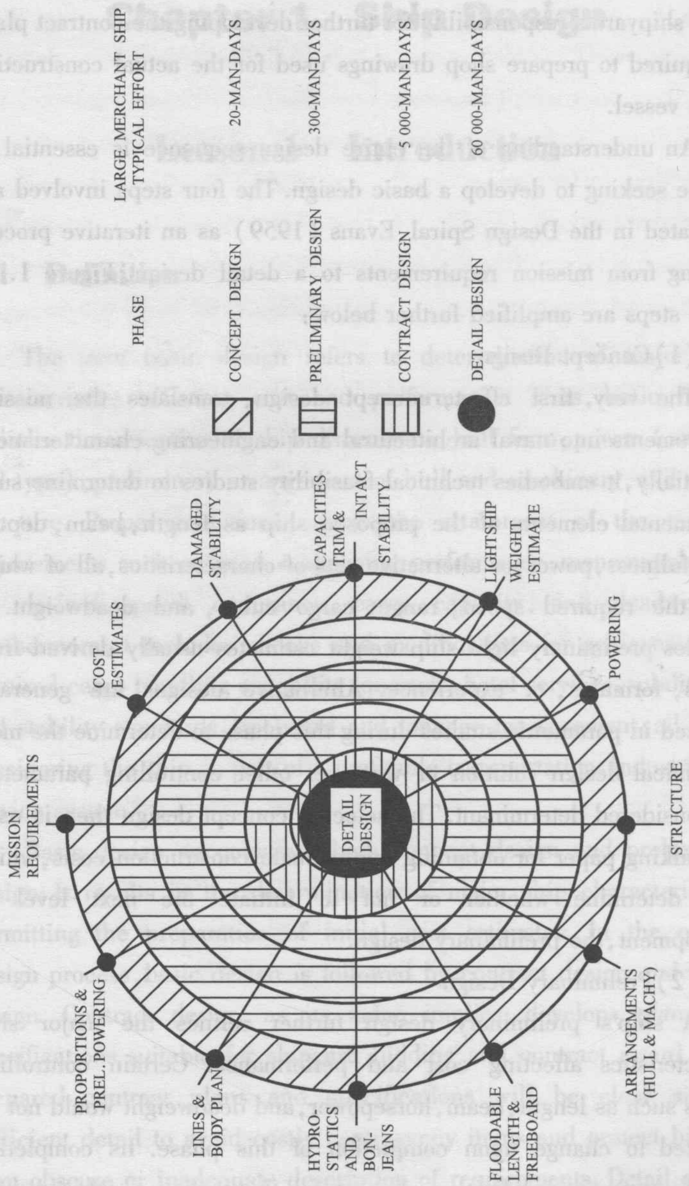

Figure 1.1 Basic design spiral

requirements; this provides the basis for development of contract plans and specifications.

(3) Contract Design

The contract design stage yields a set of plans and specifications which form an integral part of the shipbuilding contract document. It encompasses one or more loops around the design spiral, thereby further refining the preliminary design. This stage delineates more precisely such features as hull form based on a faired set of lines, powering based on model testing, seakeeping and maneuvering characteristics, the effect of number of propellers on hull form, structural details, use of different types of steel, spacing and type of frames. Paramount, among the contract design features, is a weight and center of gravity estimate taking into account the location and weight of each major item in the ship. The final general arrangement is also developed during this stage. This fixes the overall volumes and areas of cargo, machinery, stores, fuel oil, fresh water, living and utility spaces and their interrelationship, as well as their relationship to other features such as cargo handling equipment, and machinery components.

The accompanying specifications delineate quality standards of hull and outfit and the anticipated performance for each item of machinery and equipment. They describe the tests and trials that shall be performed successfully in order that the vessel will be considered acceptable.

Table 1. 1 shows a typical list of plans developed in the contract design of a major ship. Smaller, less complex vessels may not require every plan listed for adequate definition, but the list does provide an indication of the level of detail considered in contract design. Table 1B is a list of the typical sections covered in a commercial ship

specification.

Table 1.1 Typical Plans Developed During Contract Design Stage

Outboard Profile, General Arrangement
Inboard Profile, General Arrangement
General Arrangement of All Decks and Holds
Arrangement of Crew Quarters
Arrangement of Commissary Spaces
Lines
Midship Section
Steel Scantling Plan
Arrangement of Machinery – Plan View
Arrangement of Machinery – Elevations
Arrangement of Machinery – Sections
Arrangement of Main Shafting
Power and Lighting System – One line diagram
Fire Control Diagram by Decks and Profile
Ventilation and Air Conditioning Diagram
Diagrammatic Arrangements of all Piping Systems
Heat Balance and Steam Flow Diagram – Normal Power at Normal Operation Condition
Electric Load Analysis
Capacity Plan
Curves of Form
Floodable Length Curves
Preliminary Trim and Stability Booklet
Preliminary Damage Stability calculations

(4) Detail Design

The final stage of ship design is the development of detailed