21世纪高职船舶系列教材

SHIJI GAOZHI CHUANBO XILIE JIAOCAI

船舶工程专业

造船专业英语

ZAOCHUAN ZHUANYE YINGYU

主编 彭公武
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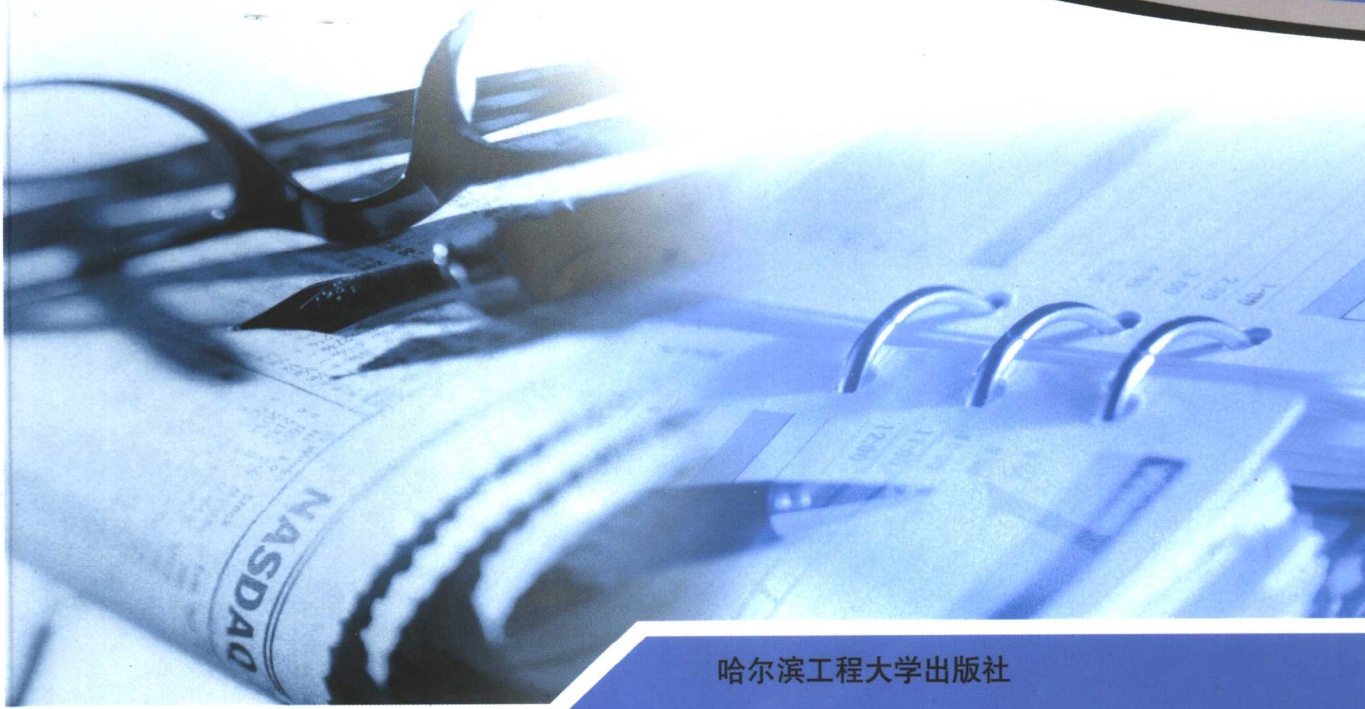

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内容简介

本书用英文较为全面系统地介绍了船舶工程的相关内容，主要包括：船舶理论概述、船舶英语对话、船舶工程常用英语三大部分。文章后附有相关的课外阅读资料及专业词汇。

本书强调实用性，文章及课外阅读内容难度不同，可以作为船舶工程技术专业的高职高专学生教材，也可供船舶工程专业的本科学生及相关技术人员参考。

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（按姓氏笔画排序）

前言

造船专业英语

ENGLISH FOR SHIPBUILDING

随着改革开放的不断发展，我国造船工业大踏步地进入了国际市场，外语在企业外向型经济中的地位和作用日益突出。对于船舶工程技术专业的学生而言，掌握相关的专业英语知识，提高运用专业英语的能力，是今后职业生涯中不可或缺的。为此，我们编写了这本《造船专业英语》教材，奉献给即将投身于我国造船事业的广大学生。

编者在收集大量专业英语相关资料的基础上，精心摘选了实用性强的文章及部分段落，重新编辑整理，最后形成本书。本书分为三大部分，涉及到船舶理论概述和实践应用内容，其中船舶理论概述部分包括船舶类型及特征、船舶主尺度、船体结构、船舶性能、船厂设施、船舶制造、船舶建造工艺、船舶设备、船舶系统、涂装、焊接、试航、船级社、船舶检验与维护、修船英语实例等内容；实践应用内容包括船舶英语对话及船舶常用语两部分，其中船舶常用语部分采用中英文对照方式编写，可以作为课后练习或船厂英语口语参考使用。希望读者在阅读本书的同时注意理论联系实际，增强专业英语翻译能力和口语的表达能力，从而提高船舶工程专业英语的综合水平。

参加本书编写工作的人员是：武汉船舶职业技术学院的彭公武（编写第 1～6 课、第 29～30 课）、刘颖妍（第 7～12 课、第 24～28 课、第 32 课）、李庆宁（编写第 13～21 课）、张世升（编写第 22、23、31 课），全书由彭公武统稿。武汉船舶职业技术学院的陈长江教授在百忙中审阅了全书并提出了宝贵的修改意见。

在本书的编写过程中，北海重工集团的崔成章老师、江苏科技大学的刘永涛老师提供了部分相关资料和友情支持，在此一并表示感谢！

由于编者水平有限并且经验不足，所编教材必有疏漏之处，敬请读者批评指正！

编　者

2006 年 4 月

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Part One Ship Introduction
船舶基本介绍

Lesson 1 The Ship—its Functions, Features and Types
船舶功能，特征及类型

Merchant ships exist to carry cargoes across the waterways of the world safely, speedily and economically. Since a large part of the world's surface, approximately three-fifths, is covered by water, it is reasonable to consider that the merchant ship will continue to perform its function for many centuries to come. The worldwide nature of this function involves the ship, its cargo and its crew in many aspects of international life. Some features of this international transportation, such as weather and climatic changes, availability of cargo handling facilities and international regulations, will be considered later.

The ship, in its various forms, has evolved to accomplish its function depending upon three main factors—the type of cargo carried, the type of construction and materials used, and the area of operation.

Three principal cargo-carrying types of ship exist today: the general cargo vessel, the tanker and the passenger vessel. The general cargo ship functions today as a general carrier and also, in several particular forms, for unit-based or unitized cargo carrying. Examples include container ships, pallet ships and 'roll-on, roll-off' ships. The tanker has its specialized forms for the carriage of crude oil, refined oil products, liquefied gases, etc.. The passenger ship includes, generally speaking, the cruise liner and some ferries.

The type of construction will affect the cargo carried and, in some generally internal aspects, the characteristics of the ship. The principal types of construction refer to the framing arrangement for stiffening the outer shell plating, the three types being longitudinal, transverse and combined framing. The use of mild steel, special steels, aluminium and other materials also influences the characteristics of a ship. General cargo ships are usually of transverse or combined framing construction using mild steel sections and plating. Most tankers employ longitudinal or combined framing systems and the larger vessels utilize high tensile steels in their construction. Passenger ships, with their large areas of superstructure, employ lighter metals and alloys such as aluminium to reduce the weight of the upper regions of the ship.

The area of trade, the cruising range, the climatic extremes experienced, must all be borne in mind in

the design of a particular ship. Ocean-going vessels require several tanks for fresh water and oil fuel storage. Stability and trim arrangements must be satisfactory for the weather conditions prevailing in the area of operation. The strength of the structure, its ability to resist the effects of waves, heavy seas, etc., must be much greater for an ocean-going vessel than for an inland waterway vessel.

Considerations of safety in all aspects of ship design and operation must be paramount, so the ship must be seaworthy. This term relates to many aspects of the ship: it must be capable of remaining afloat in all conditions of weather; it must remain afloat following all but the most serious damage; and it must remain stable and behave well in the various sea states encountered. Some of the constructional and regulatory aspects of seaworthiness will be dealt with in later lessons. Stability and other design aspects are explained in detail in Naval Architecture for Marine Engineers, by W. Muckle (Newnes-Butterworths, 1975).

The development of ship types will continue as long as there is a sufficient demand to be met in a particular area of trade. Recent years have seen such developments as very large crude carriers (VLCCs) for the transport of oil, and the liquefied natural gas and liquefied petroleum gas tankers for the bulk carriage of liquid gases. Container ships and various barge carriers have developed for general cargo transportation, bulk carriers and combination bulk cargo carriers are also relatively modern developments.

Several basic ship types will now be considered in further detail. The particular features of appearance, construction, layout, size, etc., will be examined for the following ship types:

(1) General cargo ships.

(2) Tankers.

(3) Bulk carriers.

(4) Container ships.

(5) Passenger ships.

Many other types and minor variations exist, but the above selection is considered to be representative of the major part of the world's merchant fleet.

1.1 General Cargo Ships

The general cargo ship is the 'maid of all work', operating a worldwide 'go anywhere' service of cargo transportation. It consists of as large a clear open cargo-carrying space as possible, together with the facilities required for loading and unloading the cargo (Figure 1.1). Access to the cargo storage areas or holds is provided by openings in the deck called hatches. Hatches are made as large as strength considerations will allow to reduce horizontal movement of cargo within the ship. Hatch covers of wood or steel, as in most modern ships, are used to close the hatch openings when the ship is at sea. The hatch

covers are made watertight and lie upon coamings around the hatch which are set some distance from the upper or weather deck to reduce the risk of flooding in heavy seas.

One or more separate decks are fitted in the cargo holds and are known as tween decks. Greater flexibility in loading and unloading, together with cargo segregation and improved stability, are possible using the tween deck spaces. Various combinations of derricks, winches and deck cranes are used for the handling of cargo. Many modern ships are fitted with deck cranes which reduce cargo-handling times and manpower requirements. A special heavy-lift derrick may also be fitted, covering one or two holds.

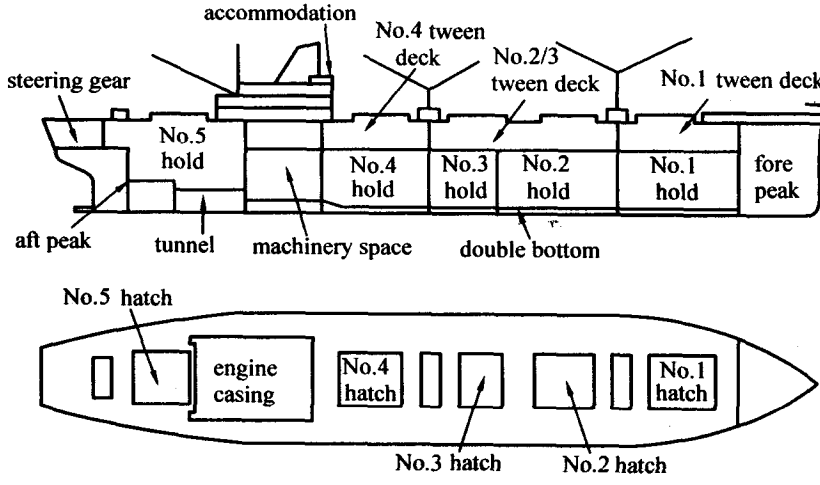

Figure 1.1 General cargo ship

Since full cargoes cannot be guaranteed with this type of ship, ballast-carrying tanks must be fitted. In this way the ship always has a sufficient draught for stability and total propeller immersion. Fore and aft peak tanks are fitted which also assist in trimming the ship. A double bottom is fitted which extends the length of the ship and is divided into separate tanks, some of which carry fuel oil and fresh water. The remaining tanks are used for ballast when the ship is sailing empty or partly loaded. Deep tanks may be fitted which can carry liquid cargoes or water ballast.

The accommodation and machinery spaces are usually located with one hold between them and the aft peak bulkhead. This arrangement improves the vessel's trim when it is partially loaded and reduces the lost cargo space for shafting tunnels compared with the central machinery space arrangement. The current range of sizes for general cargo ships is from 2,000 to 15,000 displacement tons with speeds of 12 ~ 18 knots.

Refrigerated general cargo ship

The fitting of refrigeration plants for the cooling of cargo holds enables the carriage of perishable foodstuffs by sea. Refrigerated ships vary little from general cargo ships. They may have more than one tween deck, and all hold spaces will be insulated to reduce heat transfer. Cargo may be carried frozen or chilled depending upon its nature. Refrigerated ships are usually faster than general cargo ships, often having speeds up to 22 knots, and they may also cater for up to 12 passengers.

1.2 Tankers

The tanker is used to carry bulk liquid cargoes, the most common type being the oil tanker. Many other liquids are carried in tankers and specially constructed vessels are used for chemicals, liquefied petroleum gas, liquefied natural gas, etc..

The oil tanker has the cargo-carrying section of the vessel split up into individual tanks by longitudinal and transverse bulkheads(Figure 1.2). The cargo is discharged by cargo pumps fitted in one or more pump rooms either at the ends of the tank section or sometimes in the middle. Each tank has its own suction arrangement which connects to the pumps, and a network of piping discharges the cargo to the deck from where it is pumped ashore. No double bottom is fitted in the cargo-carrying section of an oil tanker. Fore and aft peak tanks are used for ballast, with often a pair of wing tanks situated just forward of midships. These wing tanks are ballast-only tanks and are empty when the ship is fully loaded. Small slop tanks are fitted at the after end of the cargo section and are used for the normal carriage of oil on loaded voyages. On ballast runs the slop tanks are used for storing the contaminated residue from tank-cleaning operations.

Large amounts of piping are to be seen on the deck running from the pump rooms to the discharge manifolds positioned at midships, port and starboard. Hose-handing derricks are fitted port and starboard near the manifolds. The accommodation and machinery spaces are located aft in modern tankers. The range of sizes for oil tankers at present is enormous, from small to 700,000 deadweight tons. Speeds range from 12 to 16 knots.

Liquefied gas tankers

Liquefied gas tankers are used to carry, usually at low temperature, liquefied petroleum gas (LPG) or liquefied natural gas (LNG). A separate inner tank is usually employed to contain the liquid and this tank is supported by the outer hull which has a double bottom.

LNG tankers carry methane and other paraffin products obtained as a by-product of petroleum drilling

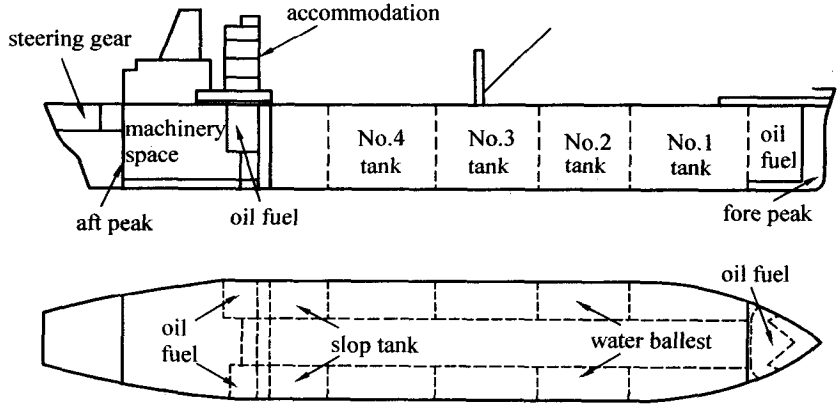

Figure 1.2 Oil tanker

operations. The gas is carried at atmospheric pressure and temperatures as low as − 164 ℃ in tanks of special materials, which can accept the low temperature. The tanks used may be prismatic, cylindrical or spherical in shape and self-supporting or of membrane construction. The containing tank is separated from the hull by insulation which also acts as a secondary barrier in the event of leakage.

LPG tankers carry propane, butane, propylene, etc., which are extracted from natural gas. The gases are carried either fully pressurized tank operates at 18 bar and ambient temperature, the fully refrigerated tank at 0.25 bar and − 50 ℃. Separate containment tanks within the hull are used and are surrounded by insulation where low temperatures are employed. Tank shapes are either prismatic, spherical or cylindrical. Low temperature steels may be used on the hull where it acts as a secondary barrier.

Displacement sizes for gas carriers range up to 60,000 tons, with speeds of 12 ~ 16 knots.

1.3 Bulk Carriers

Bulk carriers are single-deck vessels which transport single-commodity cargoes such as grain, sugar and ores in bulk. The cargo-carrying section of the ship is divided into holds or tanks which may have any number of arrangements, depending upon the range of cargoes to be carried. Combination carriers are bulk carriers designed for flexibility of operation and able to transport any one of several bulk cargoes on any one voyage, e.g. ore or crude oil or dry bulk cargo.

The general-purpose bulk carrier, in which usually the central hold section only is used for cargo. The partitioned tanks which surround it are used for ballast purposes either on ballast voyages or, in the case of the saddle tanks, to raise the ship's center of gravity when a low density cargo is carried. Some of

the double-bottom tanks may be used for fuel oil and fresh water. The saddle tanks also serve to shape the upper region of the cargo hold and trim the cargo. Large hatchways are a feature of bulk carriers, since they reduce cargo-handling time during loading and unloading.

An ore carrier has two longitudinal bulkheads which divide the cargo section into wing tanks port and starboard, and the center hold which is used for ore. The high double bottom is a feature of ore carriers. On ballast voyages the wing tanks and double bottoms provide ballast capacity. On loaded voyages the ore is carried in the central hold, and the high double bottom serves to raise the center of gravity of this very dense cargo. The vessel's behaviour at sea is thus much improved. Two longitudinal bulkheads are employed to divide the ship into center and wing tanks which are used for the carriage of oil cargoes. When ore is carried, only the center tank section is used for cargo. A double bottom is fitted beneath the center tank but is used only for water ballast. The bulkheads and hatches must be oiltight.

Large hatches are features of all bulk carriers, to facilitate rapid simple cargo handling. A large proportion of bulk carriers do not carry cargo-handling equipment, because they trade between special terminals which have particular equipment for loading and unloading bulk commodities. The availability of cargo-handling gear does increase the flexibility of a vessel and for this reason it is sometimes fitted. Combination carriers handling oil cargoes have their own cargo pumps, piping systems, etc., for discharging oil. Deadweight capacities range from small to 150,000 tons depending upon type of cargo, etc.. Speeds are in the range of 12 ~ 16 knots.

1.4 Container Ships

The container ship is, as its name implies, designed for the carriage of containers. A container is a re-usable box of 2,435 mm by 2,435 mm section, with lengths of 6,055 mm, 9,125 mm and 12,190 mm. Containers are in use for most general cargoes, and liquid-carrying versions also exist. In addition, refrigerated models are in use.

The cargo-carrying section of the ship is divided into several holds which have hatch openings the full width and length of the hold. The containers are racked in special frameworks and stacked one upon the other within the hold space. Cargo handling therefore consists only of vertical movement of the cargo in the hold. Containers can also be stacked on the hatch covers where a low density cargo is carried. Special lashing arrangements exist for this purpose and this deck cargo to some extent compensates for the loss of underdeck capacity.

The various cargo holds are separated by a deep web-framed structure to provide the ship with transverse strength. The ship section outboard of the containers on each side is a box-like arrangement of wing tanks which provides longitudinal strength to the structure. These wing tanks may be utilized for

water ballast and can be arranged to counter the heeling of the ship when discharging containers. A double bottom is also fitted which adds to the longitudinal strength and provides additional ballast space.

Accommodation and machinery spaces are usually located aft to provide the maximum length of full-bodied ship for container stowage. Cargo-handling gear is rarely fitted, as these ships travel between specially equipped terminals for rapid loading and discharge. Container ship sizes vary considerably with container-carrying capacities from 100 tons to 2,000 tons or more. As specialist carriers they are designed for rapid transits and are high powered, high speed vessels with speeds up to 30 knots. Some of the larger vessels have triple-screw propulsion arrangements.

1.5 Passenger Ships

The passenger liner, or its modern equivalent the cruise liner, exists to provide a means of luxurious transport between interesting destinations, in pleasant climates, for its human cargo. The passenger traveling in such a ship pays for, and expects, a superior standard of accommodation and leisure facilities. Large amounts of superstructure are therefore an essential feature of passenger ships. Several tiers of decks are fitted with large open lounges, ballrooms, swimming pools and promenade areas.

Aesthetically pleasing lines are evident with usually well-raked clipper-type bows and unusual funnel shapes. Stabilizers are fitted to reduce rolling and bow thrust devices are employed for improved maneuverability. Large passenger liners are rare, the moderate-sized cruise liner of 12,000 tons displacement now being the more prevalent. Passenger-carrying capacity is around 600, with speeds in the region of 22 knots.

Vocabulary

merchant ship	商船	general cargo vessel	杂货船
tanker	液货船,油船	passenger vessel	客船
mild steel	低碳钢	alloy	合金
fresh water	淡水	oil fuel	燃油
stability	稳性	trim	纵倾
strength	强度	ocean-going vessel	海船
inland water vessel	内河船	bulk carrier	散货船
container ship	集装箱船	cargo	货物
hatch cover	舱口盖	watertight	水密

coaming	舱口围板	weather deck	露天甲板
tween deck	中间甲板	knot	节
winch	绞车,起货机	deck crane	甲板起重机
double bottom	双层底	displacement	排水量
refrigerated general cargo ship	冷藏杂货船	derrick	(船上起重用的)吊杆式起货设备
LNG(liquefied natural gas)	液化天然气	LPG(liquefied petroleum gas)	液化石油气
pump-room	泵舱	port	左舷
starboard	右舷	methane	甲烷
paraffin	石蜡	propane	丙烷
butane	丁烷	propylene	丙稀
single-deck	单层甲板	ore carrier	矿砂型散货船
bulkhead	舱壁	oiltight	油密
cargo-handling gear	货物装卸装置	transverse strength	横向强度
longitudinal	纵向的	triple-screw propulsion	三螺旋桨动力装置
stabilizer	减摇鳍	bow thruster devices	艏侧推装置
large passenger liner	大型客班轮	maneuverability	操纵性

Additional reading

Ships Categorized

Introduction

The forms a ship can take are innumerable. A vessel might appear to be a sleek seagoing hotel carrying passengers along to some exotic destination; a floating fortress bristling with missile launchers; or an elongated box transporting tanks of crude oil and topped with complex pipe connections. None of these descriptions of external appearance, however, does justice to the ship system as a whole and integrated unit—self-sufficient, seaworthy, and adequately stable in its function as a secure habitat for crew and cargo. This is the concept that the naval architect keeps in mind when designing the ship and that provides the basis for subsequent discussions, not only in this chapter but throughout the entire book.

In order to discuss naval architecture, it is helpful to place ships in certain categories. For purposes of this text, ships are classified according to their means of physical support and their designed purpose.

Ships Typed According to Means of Physical Support

The mode of physical support by which vessels can be categorized assumes that the vessel is operating under designed conditions. Ships are designed to operate above, on, or below the surface of the sea, so the air-sea interface will be used as the reference datum. Because the nature of the physical environment is quite different for the three regions just mentioned, the physical characteristics of ships designed to operate in those regions can be diverse.

Aerostatic support

There are two categories of vessels that are supported above the surface of the sea on a self-induced cushion of air. These relatively lightweight vehicles are capable of high speeds, since air resistance is considerably less than water resistance, and the absence of contact with small waves combined with flexible seals reduces the effects of wave impact at high speed. Such vessels depend on lift fans to create a cushion of low-pressure air in an underbody chamber. This cushion of air must be sufficient to support the weight of the vehicle above the water surface.

The first type of vessel has flexible "skirts" that entirely surround the air cushion and enable the ship to rise completely above the sea surface. This is called an air cushion vehicle(ACV), and in a limited sense it is amphibious.

The other type of air-cushion craft has rigid side walls or thin hulls that extend below the surface of the water to reduce the amount of air flow required to maintain the cushion pressure. This type is called a captured-air-bubble vehicle(CAB). It requires less lift-fan power than an ACV, is more directionally stable, and can be propelled by water jets or supercavitating propellers. It is not amphibious, however, and has not yet achieved the popularity of the ACVs, which include passenger ferries, cross-channel automobile ferries, polar-exploration craft, landing craft, and riverine warfare vessels.

Hydrodynamic support

There are also two types of vessels that depend on dynamic support generated by relatively rapid forward motion of specially designed hydrodynamic shapes either on or beneath the surface of the water. A principle of physics states that any moving object that can produce an unsymmetrical flow pattern generates a lift force perpendicular to the direction of motion. Just as an airplane with(airfoil)produces lift when moving through the air, a hydrofoil, located beneath the surface and attached by means of a surface piercing strut, can dynamically support a vessel's hull above the water.

Planing hulls are hull form characterized by relatively flat bottoms and shallow V-sections(especially

forward of amidships) that produce partial to nearly full dynamic support for light displacement vessels and small craft at higher speeds. Planing craft are generally restricted in size and displacement because of the required power-to-weight ratio and the structural stresses associated with traveling at high speed in waves. Most planing craft are also restricted to operations in reasonably calm water, although some "deep V" hull forms are capable of operation in rough water.

Hydrostatic support

Finally, there is the oldest and most reliable type of support, hydrostatic support. All ships, boats, and primitive watercraft up to the twentieth century have depended upon the easily attained buoyant force of water for their operation.

This hydrostatic support, commonly recognized as flotation, call be explained by a fundamental physical law that the ancient philosopher-mathematician Archimedes defined in the second century B.C. Archimedes'Principle states that a body immersed in a liquid is buoyed up(or acted upon)by a force equal to the weight of the liquid displaced. This principle applies to all vessels that float(or submerge) in water—salt or fresh. And from this statement the name of the ships in the category are derived; they are generally called displacement hulls.

Although this ship type is very familiar, its subcategories warrant special discussion. For example, in some vessels reasonably high speed must be combined with the ability to carry light cargo or to move more comfortably in rough water than a planing hull. High-speed planning hull characteristics can be modified to produce a semidisplacement hull or semiplaning hull. These compromise craft, of course not as fast as full-planing hulls but faster than conventional displacement hulls, must have more power and less weight than the latter. Such types are obviously the result of "tradeoffs".

The example cited above lies between clear-cut physically defined categories—it is not a good example of a variation of a true displacement-type ship. The latter must be recognized primarily as a displacement vessel, and its variations depend primarily on the distribution of buoyant volume – the extent of the depth and breadth of the hull below the water.

The most ubiquitous type of displacement ship can be generally classified as the common carrier, a seagoing vessel. It may be employed for passenger service, light cargo-carrying, fishing by trawling, or for hundreds of other tasks that do not require exceptional capacity, speed, submergence, or other special performance. It is the most common and easily recognizable type of ship, with moderate displacement, moderate speeds, moderate to large lengths, and moderate capacities. It usually embodies the maximum in cruising range and seaworthiness. It is the "ship for all seasons". It is the standard to which all other ship classifications in the displacement category may be referred.

The closest relative to this standard vessel, which plays a crucial role not only in world commerce but