船舶与海洋工程专业规划教材

船舶与海洋工程专业英语

陆伟东 连 琏 主编

ENGLISH IN SHIP AND OCEAN ENGINEERING

上海交通大学出版社

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内 容 提 要

本书共有10个单元，内容涉及船型、性能、结构、控制、设计、建造、试航、离岸工程、水下工程和法规与规范。每一单元内有翻译讲座、习题和范文，最后还附有试卷样本、自测试卷和总词汇表。本书可用作大专院校船舶与海洋工程专业学生用专业英语教材，也可供广大造船工作者阅读和参考。

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序

自从我国改革开放以来，国际交流日益增多；特别是八十年代初我国造船工业进入国际市场后，科技和业务的交往更趋频繁。在这种大背景下，外语特别是英语人才的需求尤为迫切。船舶与海洋工程专业学生应该具有较高的外语水准，这是社会和行业对高等院校提出的人才要求和培养任务。

船舶与海洋工程学科自 1980 年以来一直为大学三年级学生开设专业英语课程，四年级学生则结合毕业设计布置原版文献阅读。为此需要有一本综合性较强、信息量较大的专业英语教材，对学生进行培训，为毕业设计阶段的英文资料阅读和以后从事科学研究或工程实践打下坚实的基础。

《船舶与海洋工程专业英语》一书在过去二十多年来已几经修改和补充，迄今形成了"专业内容全面，词汇覆盖宽广，分析语言结构，训练翻译技巧"的特色。这本书由校内印刷到公开出版，学生会有一本更好的教材，在行业内也会扩大读者群，增加收藏性。

本书编者陆伟东和连琏教授，多年从事船舶与海洋工程专业的教学和科学研究工作，也曾多年担任《船舶与海洋工程专业英语》主讲教师。这些都为本书的编写提供了良好的条件和丰富的素材。可以相信，本书会让船舶与海洋工程专业学生和广大造船工作者得益匪浅。

张圣坤

2009 年 1 月

前　言

本书根据上海交通大学船舶与海洋工程专业教学大纲编写，为学生提供约10万词的阅读量和约1 000个专业词汇；并通过习题练习，希望学生的英译中速度能达到每小时350个词汇。

本书的阅读材料选自国外原版教材或专著，系统收入了造船专业各学科的主要章节，还编排了离岸工程、水下工程和船舶检验的导论性章节，组成10个单元，技术内容完整。每一单元安排讲座，内容涉及科技文章英译中的翻译技巧、如何撰写文章摘要和科技短文的英文写作方法，还配有习题和范文，使教材更为实用。

本书由上海交通大学船舶海洋与建筑工程学院专业英语教学小组教师编写，阅读内容的选编和注解由陆伟东和连琏共同担任，讲座内容由陆伟东编写。

由于水平有限，本书难免有欠妥之处，欢迎读者批评、指正。

编者

2009年1月

Contents

Unit 1 Ship Types

Part A

The development of ship types over the years has been dictated very largely by the nature of the cargo. The various designs can, to some extent, be divided into general cargo, bulk cargo and passenger vessels.

The general cargo carrier is a flexible design of vessel which will go anywhere and carry anything. Special forms of the general cargo carrier include container ships, roll-on/roll-off ships and barge carriers. Bulk cargo may be liquid, solid, or liquefied gas and particular designs of vessel exist for the carriage of each.

Passenger-carrying vessels include cruise liners and ferries. Many special types of vessel exist which perform particular functions or are developments of particular aspects of technology. These include multi-hull vessels, hydrofoil and hovercraft.

These various ship types will now be examined in further detail.

General cargo ships

The general cargo ships have several large clear open cargo-carrying spaces or holds. One or more separate decks may be present within the holds and are known as "tween decks". These provide increased flexibility in loading and unloading and permit cargo segregation as well as improved stability[1]. Access to these holds is by openings in the deck known as hatches.

Hatches are made as large as strength considerations permit in order to reduce the amount of horizontal movement of cargo within the ship. Hatch covers are, nowadays, made of steel although older vessels used wood. The hatch covers must be watertight and rest upon coamings around the hatch. The coamings of the upper or weather deck hatches are a reasonable height above the deck to reduce the risk of flooding in heavy seas.

Some form of cargo handling equipment is always fitted which may take the form of derricks and winches or deck cranes. Deck cranes are fitted to many vessels since they reduce cargo handling times and manpower requirements. Some ships have a special heavy-lift derrick fitted which may serve one or more holds.

A double bottom is fitted along the ship's length and is divided into various tanks. These tanks may be used for fuel or lubricating oil, fresh water or ballast sea water. Fore and aft peak tanks are also fitted and may be used to carry ballast or to suitably trim the ship. Deep tanks are often fitted and can be used to carry liquid cargoes or water ballast. The water ballast tanks may be filled when the ship is only partially loaded in order to provide a

sufficient draught for stability and total propeller immersion.

There is usually one hold aft the accommodation and machinery space. This arrangement improves the trim of the vessel when it is partially loaded. The range of size for general cargo ships is currently from 2,000 to 15,000 displacement tones with speeds from 12 to 18 knots.

Refrigerated cargo ships

The refrigerated cargo ship differs from the general cargo ship in that it carries perishable goods. A refrigeration system is therefore necessary to provide low temperature holds for these cargoes. The holds and the various 'tween decks are insulated to reduce heat transfer. The cargo may be carried frozen or chilled and various holds may be at different temperatures according to the cargo requirements.

This type of vessel is usually faster than a general cargo ship, having speeds up to 22 knots. It is essentially a cargo liner having set schedules and sailing between fixed terminal ports. Up to twelve passengers may be carried on some of these vessels.

Container ships

A container is a re-usable box of 2,435 mm by 2,435 mm section, with lengths of either 6,055, 9,125 or 12,190 mm[2]. Containers are now used for most general cargoes and liquid-carrying versions also exist. Refrigerated versions are also in use which may have their own independent refrigeration plant or be supplied with cooled air from the ship's refrigeration system.

The cargo-carrying section of the ship is divided into several holds each of which has a hatch opening 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 is therefore only the vertical movement of the containers by a special quayside crane. Containers may also be stacked on the flush top hatch covers. Special lashing arrangements are used to secure this deck cargo.

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

The accommodation and machinery spaces are usually located aft to provide the maximum length of full-boded ship for container stowage. Cargo-handling equipment is rarely fitted, since these ships travel between specially equipped terminals to ensure rapid loading and discharge. Container ship sizes vary considerably, with container carrying capacities from 1,000 to 2,500 TEU's or more. The twenty foot equivalent unit (TEU) represents a 20 ft (6,055 mm) "standard" container. Container ships are much faster than

most cargo ships, with speeds up to 30 knots. They operate as liners on set schedules between fixed ports.

Roll-on/roll-off ships

This vessel was originally designed for wheeled cargo, usually in the form of trailers. The cargo could be rapidly loaded and unloaded by stern or bow ramps and sometimes sideports for smaller vehicles. The loss of cubic capacity due to undercarriages and clearances has resulted in many roll-on roll-off vessels being also adapted to carry containers[3].

The cargo-carrying section of the ship is a large open deck with a loading ramp usually at the after end. Internal ramps lead from the loading deck to the other 'tween deck spaces. The cargo may be driven aboard under its own power or loaded by straddle carriers or fork lift trucks. One or more hatches may be provided for containers or general cargo and will be served by one or more deck cranes. Arrangements may be provided on deck for stowing containers. Some roll-on roll-off (Ro-Ro) vessels also have hatch covers to enable loading of lower decks with containers. Where cargo (with or without wheels) is loaded and discharged by cranes the term lift-on lift-off (Lo-Lo) is used.

The ship's structure outboard of the cargo decks is a box-like arrangement of wing tanks to provide longitudinal strength. A double bottom is also fitted along the complete length. The accommodation is located aft and also the low-height machinery space. Only a narrow machinery casing actually penetrates the loading deck. Sizes range considerably with about 16,000 dwt (28,000 displacement tonne) being quite common. High speeds in the region of 18~22 knots are usual.

Barge carrier

This type of vessel is a variation of the container ship, instead of containers, standard barges are carried into which the cargo has been previously loaded[4]. The barges, once unloaded, are towed away by tugs and return cargo barges are loaded. Minimal or even no port facilities are required and the system is particularly suited to countries with vast inland waterways. Two particular types will be described, the LASH (Lighter Aboard Ship) and the SEABEE.

The LASH ship carries barges, capable of holding up to 400 tonne of cargo, which are 18.75 m (61.5 ft) long, 9.5 m (31 ft) beam and 3.96 m (13 ft) deep. About eighty barges are carried stacked in holds much the same as containers with some as deck cargo on top of the hatch covers. The barges are loaded and unloaded using a traveling gantry crane capable of lifting over 500 tonne. Actual loading and discharge takes place between extended "arms" at the after end of the ship. The ship structure around the barges is similar to the container ship. The accommodation is located forward whereas the machinery space is one hold space forward of the stern. LASH ships are large, in the region of 45,000 deadweight tonnes, with speeds in the region of 18 knots.

The SEABEE is somewhat larger than the LASH ship and carries thirty-eight barges. Each barge may be loaded with up to 1,000 tonne of cargo and is 29.72 m long, by 10.67 m beam and 3.81 m depth. The barges are loaded on board by an elevator located at the stern. They are then winched forward along the various decks.

Deck hatch opening does not exist and the decks are sealed at the after end by large watertight doors. Two 'tween decks and the weather deck are used to store the barges. The machinery space and various bunker tanks are located beneath these 'tween decks.

The machinery space also extends into the box-like structure outboard of the barges on either side of the ship. The accommodation is also located here together with several ballast tanks. A barge winch room is located forward of the barge decks and provides the machinery for horizontal movement of the barges. The SEABEE is physically about the same size as the LASH ship but with a slightly smaller deadweight of 38,000 tonnes. The speed is similarly in the region of 18 knots.

Despite their being specialist vessels both LASH and SEABEE can be used for other cargoes. Each can be used to carry containers and the SEABEE will also take Ro-Ro cargo. Other variations of barge carriers have been proposed such as the barge carrying catamaran vessel (BACAT). Tug-barge systems have also been considered where the "Ship" is actually a number of linked barges with a separable propulsion unit[5].

Oil tankers

The demand for crude oil is constantly increasing. Oil tankers, in particular crude carriers, have significantly increased in size in order to obtain the economies of scale. Designations such as ULCC (Ultra Large Crude Carrier) and VLCC (Very Large Crude Carrier) have been used for these huge vessels. Crude oil tankers with deadweight tonnages in excess half a million have been built although the current trend (1985) is for somewhat smaller (100,000~150,000 dwt) vessels. After the crude oil is refined the various products obtained are transported in product carriers. The refined products carried in these vessels include gas oil, aviation fuel and kerosene.

The cargo carrying section of the oil tanker is divided into individual tanks by longitudinal and transverse bulkheads. The size and location of these cargo tanks is dictated by the International Maritime Organization Convention MARPOL 1973/78. This Convention and its Protocol of 1978 further requires the use of segregated ballast tanks (SBT) and their location such that provide a barrier against accidental oil spillage. An oil tanker when on a ballast voyage must use only its segregated ballast tanks in order to achieve a safe operating condition.

The arrangement of a 105,000 dwt crude oil tanker which satisfies these requirements is as follows. The cargo carrying tanks include the seven centre tanks, four pairs of wing tanks and two slop tanks. The segregated ballast tanks include all double bottom tanks beneath the cargo tanks, two pairs of wing tanks and the fore and aft peak tanks. The cargo is discharged

by cargo pumps fitted in the aft pump room. 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[6].

Considerable amounts of piping are visible on the deck running from the after pump room to the discharge manifolds positioned at midships, port and starboard. Hose-handling derricks are fitted port and starboard near the manifolds. The accommodation and machinery spaces are located aft and separated from the tank region by a cofferdam. The range of size for crude oil tankers is enormous, beginning at about 20,000 dwt and extending beyond 500,000 dwt. Speeds range from 12 to 16 knots.

Product carriers are oil tankers which carry the refined products of crude oil. The cargo tank arrangement is again dictated by MARPOL 73/78. Individual "parcels" of various products may be carried at any one time which resulted in several separate loading and discharging piping systems. The tank surface is usually coated to prevent contamination and enable a high standard of tank cleanliness to be achieved after discharge. The current size range is from about 18,000 up to 75,000 dwt with speeds of about 14～16 knots.

Bulk carriers

The economies of scale have also been gained in the bulk carriage of cargoes such as grain, sugar and ore. A bulk carrier is a single-deck vessel with the cargo carrying sections of the ship divided into holds or tanks. The hold or tank arrangements vary according to the range of cargoes to be carried. Combination carriers are bulk carriers which have been designed to carry any one of several bulk cargoes on a particular voyage, e. g. ore or crude oil or dry bulk cargo.

In a general-purpose bulk carrier, only the central section of the hold is used for cargo. The partitioned tanks which surround the hold are used for ballast purposes when on ballast voyages. The upper, or saddle, tanks may be ballasted in order to raise the ship's centre of gravity when a low density cargo is carried. This hold shape also results in a self-trimming cargo. During unloading the bulk cargo falls into the space below the hatchway and enables the use of grabs or other mechanical unloaders. Large hatchways are a particular 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 a center hold which is used for ore[7]. A deep double bottom is a particular feature of ore carriers. Ore, being a dense cargo, would have a very low centre of gravity if placed in the hold of a normal ship. This would lead to an excess of stability in the fully loaded condition. The deep double bottom serves to raise the centre of gravity of the very dense cargo. The behaviour of the vessel is thus much improved. On ballast voyages the wing tanks and the double bottoms provide ballast capacity. The cross-section would be similar to that for an ore/oil carrier.

An ore/oil carrier uses two longitudinal bulkheads to divide the cargo section into centre

and wing tanks which are used for the carriage of oil cargoes. When a cargo of ore is carried, only the centre tank section is used for cargo. A double bottom is fitted but is used only for water ballast. The bulkheads and hatches must be oiltight.

The ore/bulk/oil (OBO) bulk carrier is currently the most popular combination bulk carrier. It has a cargo carrying cross-section similar to the general bulk carrier. The structure is, however, significantly stronger, since the bulkhead must be oiltight and the double bottom must withstand the high density ore load. Only the central tank or hold carries cargo, the other tank areas being ballast-only spaces, except the double bottom which may carry oil fuel or fresh water.

Large hatches are a feature of all bulk carriers, in order to facilitate rapid simple cargo handling. Many bulk carriers do not carry cargo-handling equipment, since they trade between special terminals which have special equipment. Where cargo handling gear is fitted (geared bulk carriers), this does make the vessel more flexible. Combination carriers handling oil cargoes have their own cargo pumps and piping systems for discharging oil. They will also be required to conform to the requirements of MARPOL 73/78. Deadweight capacities range from small to upwards of 200,000 tonnes. Speeds are in the range of 12～16 knots.

Part B

Liquefied gas carriers

The bulk transport of natural gases in liquefied form began in 1959 and has steadily increased since then. Specialist ships are now used to carry the various types of gases in a variety of tank systems, combined with arrangements for pressurising and refrigerating the gas.

Natural gas is found and released as a result of oil-drilling operations. It is a mixture of methane, ethane, propane, butane and pentane. The heavier gases, propane and butane, are termed "petroleum gases". The remainder, which consists largely of methane, is known as "natural gas". The properties, and therefore the behaviour, of these two basic groups vary considerably, thus requiring different means of containment and storage during transportation.

Liquefied natural gas tankers

Natural gas is, by proportion, 75. 95% methane and has a boiling point of −162℃ at atmospheric pressure. Methane has critical temperature of −82℃. This means that it cannot be liquefied by the application of pressure above this temperature. A present of 17 bar is necessary to liquefy methane at −82℃. It is not, therefore, possible to liquefy the gas at normal temperatures.

Liquefied natural gas carriers are designed to carry the gas in its liquid form at

atmospheric pressure and a temperature in the region of −164℃. The ship design must therefore deal with protecting the steel structure from the low temperature, reducing the loss of gas and avoiding its leakage into the occupied region of the vessel.

Tank designs are divided into three categories, namely self-supporting or free-standing, membrane and semi-membrane. The self-supporting tank is constructed to accept any loads imposed by the cargo. A membrane tank requires the insulation between the tank and the hull to be load bearing. Single or double metallic membranes may be used, with insulation separating the two membrane skins. The semi-membrane design has an almost rectangular cross-section and the tank is unsupported at the corners. Each arrangement uses a double hull type of construction with the space between being used for water ballast.

A liquefied natural gas carrier may use semi-membrane tanks. The cargo carrying section is divided into five tanks of almost rectangular cross-section, each having a central dome. The liquid holding tank is made of 9% Ni steel while the secondary barrier is made of stainless steel. These two are supported and separated from the ship's structure by insulation which is a lattice structure of wood and various foam compounds.

The tank and insulation structure is surrounded by a double hull. The double bottom and ship's side regions are used for oil or water ballast tanks whilst the ends provide cofferdams between the cargo tanks. A pipe column is located at the centre of each tank and is used to route the pipes from the submerged cargo pumps out of the tank through the dome[8]. The discharge piping is led along the decks to manifolds located near midships port and starboard. The accommodation and machinery spaces are located aft and separated from the tank region by a cofferdam. Liquefied natural gas carriers are being built in a large variety of size up to around 130,000 m^3 (approximately 64,000 dwt). Speeds range from 16 to 19 knots.

Liquefied petroleum gas carriers

Petroleum gas may be propane, propylene, butane or a mixture of each. All three have critical temperatures above normal ambient temperatures and can be liquefied at low temperatures at atmospheric pressure, normal temperatures under considerable pressure, or some condition between. The ship design must, therefore, protect the steel hull where low temperatures are used, reduce the gas loss, avoid gas leakage and perhaps incorporate pressurised tanks.

Tank design again divided into three main types, namely fully pressurised, semi-pressurised partially refrigerated and fully refrigerated atmospheric pressure arrangements[9]. The fully pressurised tank operates at about 17 bar and is usually spherical or cylindrical in shape. The tanks usually penetrate the upper deck.

Semi-pressurised tanks operate at a pressure of about 8 bar and temperatures in the region of −7℃. Insulation is required around the tanks and a re-liquefaction plant is needed for the cargo boil-off. Cylindrical tanks are usual which may penetrate the deck somewhat.

Fully refrigerated atmospheric pressure tank designs may be self-supporting, membrane or semi-membrane types as previously described for liquefied natural gas tankers. The liquefied tank designs operate at temperatures of about −45℃. A double-hull type of construction is also used for this type of vessel.

A liquefied petroleum gas carrier can use semi-membrane tanks. The cargo carrying section is divided into five tanks. Tank 1 and 5 are used for the exclusive carriage of liquid butane with the remainder being used for either butane or propane. The butane-only tanks are self-supporting whereas the butane/propane tanks are of the semi-membrane type. The tank insulation in all cases uses polyurethane foam although the propane carrying tanks also employ a lattice structure of wood. The propane tanks are refrigerated to about −10℃. At these lower temperatures the inner hull is employed as the secondary barrier.

The double hull construction, cargo pumping arrangements, accommodation and machinery location are all similar to a liquefied natural gas carrier. A re-liquefication plant is, however, carried and any cargo boil-off is returned to the tanks after liquefying. Liquefied petroleum gas carriers are being built in sizes up to around 95, 000 m^3 (approximately 64,000 dwt). Speeds range from 16 to 19 knots.

Passenger ships

Passenger ships can be considered in two categories, the luxury liner and the ocean-going ferry. The luxury liner is dedicated to the luxurious transport of its human "cargo". The ocean-going ferry provides a necessary link in a transport system between countries. It often carries roll-on roll-off in addition to its passengers.

Luxury passenger liners are nowadays considered to be cruise liners in that they provide luxurious transport between interesting destinations in pleasure climates[10]. The passenger is provided with a superior standard of accommodation and leisure facilities. This result in large amount of superstructure as a prominent feature of the vessel. The many tiers of decks are fitted with large open lounges, ballrooms, swimming pools and promenade areas. Aesthetically pleasing lines are evident with well-raked clipper-type bows and unusual funnel shapes. Stabilisers are fitted to reduce rolling and bow thrusters are used to improve manoeuverability. The cruise liner ranges in size up to passenger-carrying capacities of around 1,200 (45,000 gt) although a few older large vessels are in service. Speeds are usually high in the region of 22 knots.

Ocean-going ferries are a combination of roll-on roll-off and passenger vessels. The vessel is therefore made up in three layers, the lower machinery space, the car decks and the passenger accommodation. A large stern door and sometimes also a lifting bow providing access for the wheeled cargo to the various decks which are connected by ramps. The passenger accommodation will vary according to the length of the journey. For short-haul or channel crossings public rooms with aircraft-type seats will be provided. For long distance ferries cabins and leisure facilities will be provided which may be up to the standard of cruise

liners. Stabilisers and bow thrusters are also usually fitted to ocean-going ferries. Size will vary according to rout requirements and speeds are high at around 20～22 knots.

Ships of special type

Many special types of ships have been developed in recent years. It is not proposed to discuss further variations relating to the cargo carried.

The special types considered in the following paragraphs are the result of developments in technology and are hovercraft, hydrofoil boats and multi-hull ships.

Hovercraft

The hovercraft introduces a new principle as far as ships are concerned. A normal ship is supported by the hydrostatic pressure acting on the immersed surface. In the hovercraft the support is generated by an air cushion created by blowing air out of a curtain or skirt surrounding the boat, and pressure is built up which supports the craft. Propulsion is usually, but not necessary, by means of airscrews.

The effect of the air cushion is to reduce the resistance to the motion through the water so that higher speeds are possible for a given expenditure of power. The system has been used successfully in cross-channel services between UK and the Continent. The behaviour of ships of this type in rough weather is being satisfactorily resolved, in particular for cross-channel and other short-haul routes.

The hovercraft is commercially employed as a passenger ferry on a variety of short-haul routes. The structure consists of a central buoyancy tank with outer box structures which support the diesel engines and fans. The passenger seating is located above this structure with the control cabin one deck higher. Ducted propellers and rudders are located aft to provide forward propulsion. Centrifugal lift fans driven by diesel engines create the cushion. Air jet driven bow thrusters are provided to improve manoeuverability. Current and projected designs provide for passenger carrying capacities of up to 1,000 persons at speeds up to 70 knots.

Hydrofoil boats

Hydrofoil boats make use of the same principle involved in the flight of aircraft. Hydrofoils are attached to the bottom of the ship by means of struts, and when the ship moves through water a lift force is generated just as occurs when an airplane wing moves through the air.

By correct adjustment of the angle of incidence of the hydrofoil the lift can be made to be just equal to the weight of the ship, which is raised clear of the water. The resistance is thereby reduced, being then only equal to the drag of the hydrofoils[11]. The result is that high speeds are possible without using unduly large powers.

Like the hovercraft, the hydrofoil boat has been used for service in sheltered waters but

it is likely that considerable problem would exist in really rough water. Both types of craft have stability problems which are peculiarly their own. The extension of the use of hydrofoil craft to the open sea would probably encounter the same problems as hovercraft.

Multi-hull ships

These are usually catamaran or occasionally trimaran arrangements using two or three hulls placed to one another and some distance apart, connected by a bridge structure. The type of craft so produced has considerable transverse stability and also a large deck area is obtained. The hulls in a ship of this type would be very much narrow than the hull of a normal ship and this could reduce the wave-making resistance. By suitable positioning, in a fore and aft direction, of a third hull between the two outside hulls, an interference effect is possible which could further reduce the resistance. This would permit higher speeds than in a conventional ship.

A particular design of this type is a displacement vessel with a deep draught called SWATH (Small Waterplane Area Twin Hull). Twin torpedo-shaped hulls are fully submerged with streamlined fins or struts supporting the upper platform of deck. This type of vessel is currently being developed for passenger carrying and also to provide a stable platform for ocean research vessels.

Conclusion

In the foregoing sections some of the problems encountered in the design of ships have been discussed broadly and some of the types of ships, which have been developed over the years, have been described. The list is by no means complete but sufficient has been said to illustrate the considerations which affect design and type.

Notes

1. These provide increased flexibility in loading and unloading and permit cargo segregation as well as improved stability. 句中第一个 and 连接两个介词宾语，第二个 and 连接两个谓语 provide 和 permit，as well as 连接两个动词宾语。整句可译成：这些中间甲板增加了装货与卸货的灵活性，有利于分隔货物以及改善稳性。

2. A container is a re-usable box of 2,435 mm by 2,435 mm section, with lengths of either 6,055, 9,125 or 12,190 mm. 集装箱尺寸原为英制，端面为 8 英尺×8 英尺，长有 20 英尺，30 英尺和 40 英尺三种。整句可译为：集装箱是可反复使用的箱子，宽度和高度为 2 435mm×2 435mm，长度为 6 055，9 125 或 12 190mm 三种。

3. The loss of cubic capacity due to undercarriages and clearances has resulted in many roll-on roll-off vessels being also adapted to carry containers. 句中 result in 意为“导致”；注意词性转换。整句可译成：由于车架下空间和上部间隙损失了装载容积，因而许多滚装船也设计成适于装载集装箱。

4. This type of vessel is a variation of the container ship, instead of containers, standard

barges are carried into which the cargo has been previously loaded. 第二句中 which 引导的定语从句，修饰 barges。两句可译成：这种船是集装箱船的派生船型，但它装载的不是集装箱，而是预先装了货的标准驳船。

5. Tug-barge systems have also been considered where the "Ship" is actually a number of linked barges with a separable propulsion unit. where 引导的定语从句修饰 systems。整句可译成：拖-驳系统也可以看作是这样的系统：系统中的"船舶"实际上是一些相连接的驳船，配备一个可分离的推进单元。

6. 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. and 连接两个句子；注意两个定语从句的译法。整句可译成：每个油舱都有自己的吸油装置，它与油泵相连，一组管路将货油输送到甲板，再从甲板泵送上岸。

7. An ore carrier has two longitudinal bulkheads which divide the cargo section into wing tanks port and starboard and a centre hold which is used for ore. 第一个 and 连接两个后置形容词，第二个 and 连接两个介词宾语 wing tanks 和 a centre hold，注意两个定语从句的译法。整句可译成：运矿船有两道纵向的舱壁，从而将载货区域分隔成左右舷的边舱和一个中央货舱；中央舱用于装载矿砂。

8. A pipe column is located at the centre of each tank and is used to route the pipes from the submerged cargo pumps out of the tank through the dome. to rout 为动词不定式，后面的介词短语 from...，out of ... 及 through... 均作其状语。整句可译成：在每个液货舱的中心位置均设一根管形立柱，用来布置管路，使管路从潜没的液货泵起，沿立柱经中央气室通过液货舱。

9. Tank design again divided into three main types, namely fully pressurised, semi-pressurised partially refrigerated and fully refrigerated atmospheric pressure arrangements. 注意 arrangements 系复数，为三种类型合用的中心词，应增译。整句可译成：液舱设计同样分为三种主要类型，即全压式结构、半压半冷式结构，以及全冷常压式结构。

10. Luxury passenger liners are nowadays considered to be cruise liners in that they provide luxurious transport between interesting destinations in pleasure climates. in that 为书面语，意为"既然"，"因为"。整句可译成：因为豪华型客班船在宜人的气候里为旅游胜地之间提供高档的运输服务，所以现在通常作为旅游班轮。

11. The resistance is thereby reduced, being then only equal to the drag of the hydrofoils. 句中 being then... 为分词独立结构，可看作句子。整句可译成：阻力由此而减小，那时仅等于水翼的阻力。

Lecture 1 The Criterion of Translation

翻 译 标 准

1. 英译中目标

翻译是将一种语言的意义转换成另一种语言表达出来。