

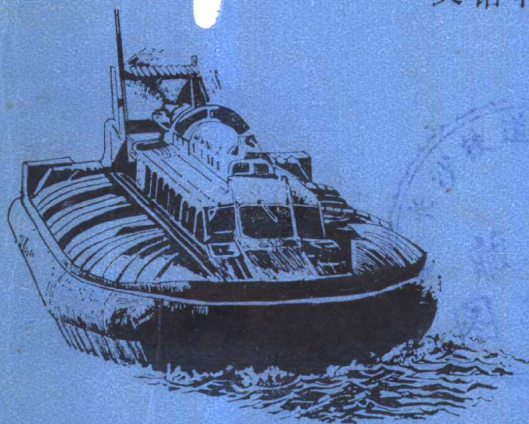
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Hovercraft

英语科普注释读物



气垫船

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The Hovercraft

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征 原 注释

上海译文出版社

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注 释 者 的 话

本书是英国科普丛书 How It Works 中的一个分册。原文由 E.S. Hayden 撰写,介绍新型的运载工具——气垫船的原理、性能、基本结构及用途。

本书文字比较浅近,对较难的句子结构、习惯用法和专业用语我们作了注释,可供广大科技工作者、中小学英语教师和有关专业学生阅读。

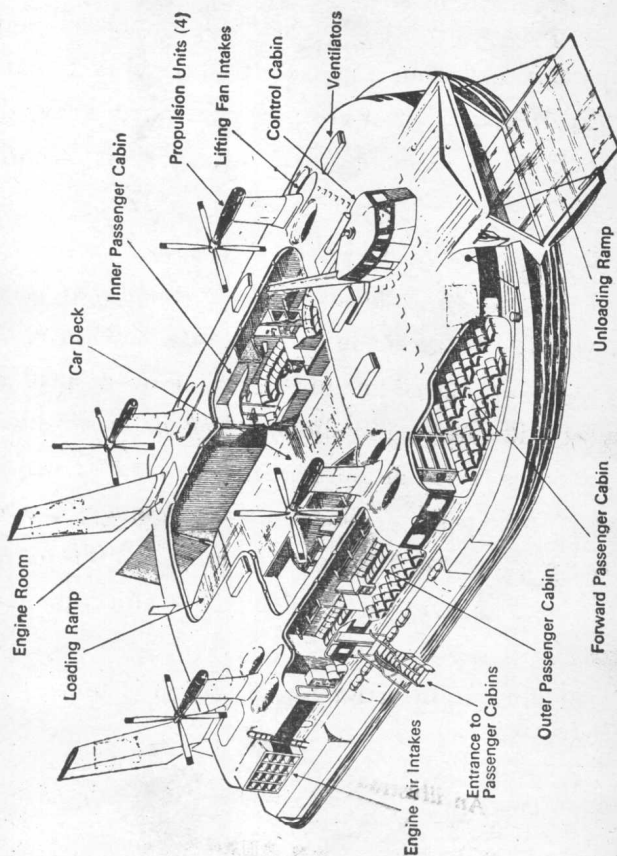
在注释过程中我们曾得到有关专业技术人员的大力协助,谨在此表示感谢。限于水平,注释中难免有不妥之处,希望读者批评指正。

一九七九年九月

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A cut-away diagram of a Cross-Channel Hovercraft



How It Works — the Hovercraft

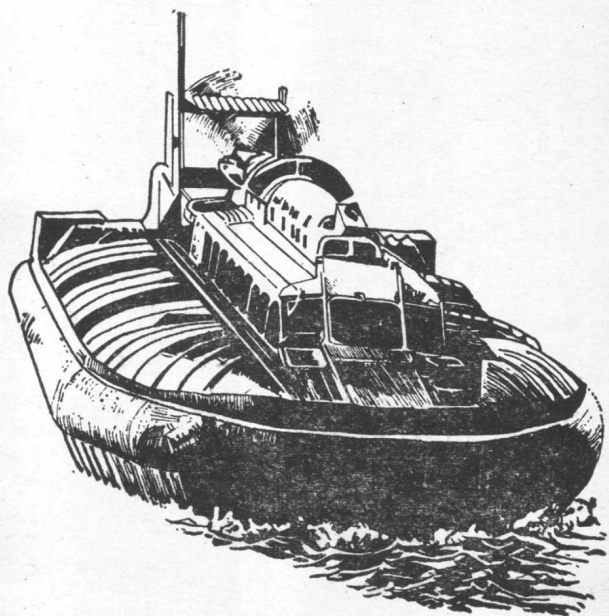
The hovercraft¹ is an entirely new form of transport, and is quite different from any wheeled vehicle², ship or aeroplane. However, the hovercraft combines many of the capabilities of all three; it can carry heavy loads over land³, it can operate on the sea and it is airborne in operation.

Hovercraft hover, or ride, on a cushion of air and so they are sometimes called air cushion vehicles or ground effect machines.⁴ If a vehicle can be made to float on a cushion of air, it can easily be moved in any direction by a small force. However, it could easily be moved off its course⁵ by wind or waves, so an accurate system of control is needed to move it from place to place safely. Generally, a hovercraft has no physical contact with the surface over which it is travelling,⁶ so the controls must be aerodynamic—rather like aircraft controls.

An illustration of an SRN6, which is now in regular

1. 气垫船。(曾译为气垫器、表面效应器、腾空艇、翱翔艇、飞翔船等, 现在统称为气垫船。) 2. 轮式运载工具。 3. 在陆地上运行。 4. 气垫船在气垫上垫升运行或行驶, 因而有时就把它叫作气垫器或地面效应器。注意: hovercraft 是单复数同形的名词, 这里用作复数。句中的 they 是指 hovercraft。 5. 偏航。 6. 一般地说, 气垫船与其运行的表面没有实际的接触。over which it is travelling 是由“介词 over + 关系代词 which”引导的限制性定语从句, 修饰 surface。

*passenger-carrying service*⁷, is shown below. The main features of its design and their method of operation are described in the following pages.



7. 承担定期的客运业务。

Early Experiments: High Pressure Air Pads

Over the years, two separate lines of thought developed regarding the application of the 'hover' principle to vehicles.¹ One envisaged the support of a vehicle on 'pads' of high-pressure air², the other envisaged its support on a 'cushion' of low-pressure air³.

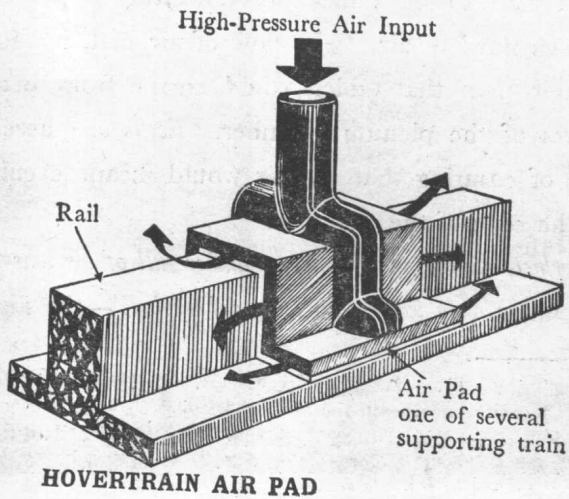
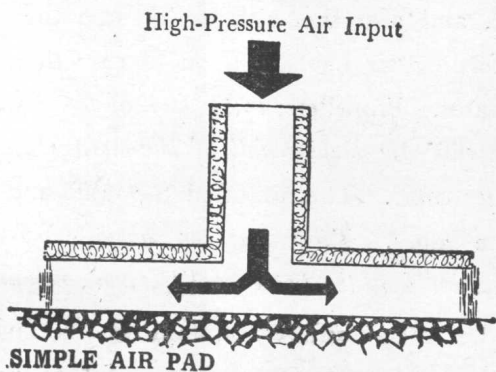
It was at first thought that pads of high-pressure air could possibly replace wheels, the wheels of, say, a motor car.⁴ However, two main difficulties became apparent. The first was that with pads of high-pressure air, it proved difficult and wasteful of power to lift the car high enough for it to travel over any but the smoothest surface.⁵ The second difficulty was that of propulsion: as soon as physical contact with the ground was severed, a new method of propulsion had to be devised to replace that usually supplied by the wheels.

Because of⁶ these problems, the hovercar concept has tended to be confined to the hovertrain⁷. Rails provide an ideal smooth surface for the high-pressure air pads, and also overcome the problem of steering. The vehicle is

1. 多年来,在“垫升”原理应用于运载工具方面,形成了两种不同的设想。2. 高压气垫。3. 低压气垫。4. 开始时认为,高压气垫能取代车轮,比如说取代汽车车轮, it was (is) ... that ... 是强调结构,其非强调的语序应为 At first thought, pads of ... car. 5. 第一个主要困难是,用高压气垫把汽车垫升到足以能在任何不太光滑的表面上运行,很不容易,而且也消耗功率,从句中的第一个 it 是形式主语,其真正的主语是后面的不定式短语 to lift the car ... surface,第二个 it 指 the car. 6. 因为。7. 气垫车的概念往往仅限于气垫列车。

then ideally suited for propulsion by some form of aero engine or some type of *electrical induction motor*⁸.

Diagrams below show the simple high-pressure air pad, and the type of air pad that could be used for hovertrains.



8. 感应电动机.

The Air-Cushion — or 'Plenum Chamber'

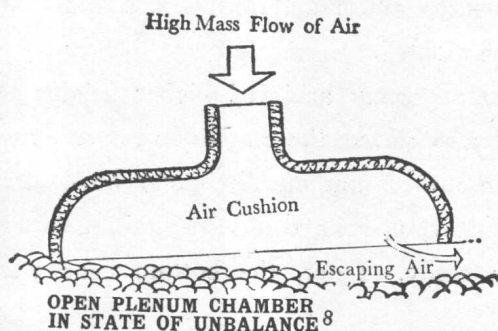
The idea of supporting a vehicle on a cushion of air developed from early attempts at producing *vertical take-off aircraft*¹, and also the wish to increase the speed of boats by feeding air beneath them to ease their passage over the water. Propellers, *in the form of fans*,² were used to provide 'lift' by *keeping full of low-pressure air a cavity underneath the craft*³. The air lifted the craft and escaped around the edges. *This cavity, or chamber, was called a 'plenum' chamber from the Latin word 'plenum', meaning 'full'*.⁴

In order to successfully maintain lift, the engine and propeller had to be sufficiently powerful to provide a 'high mass flow' of air. The flow of air had, in fact, to be greater than that which could escape from beneath the edges of the plenum chamber. *Even so*,⁵ there was no way of ensuring that the air would escape evenly all round the edge of the chamber.

*A vehicle resting on a plenum chamber full of air was rather like you sitting on a large, very soft, rubber ball*⁶—the slightest

1. 垂直起落飞机。 2. 风扇形状的。 3. 使气垫器下面的空腔充满低压空气。 a cavity underneath the craft 是 keeping 的宾语, full of low-pressure air 是宾语补足语。 4. 这个空腔或室称为“气室”, 源出于拉丁字“plenum”, 意思是“充满”。(气室也称增压室。) 5. 虽然如此。 6. 运载工具悬浮在充满空气的气室上, 很象一个人坐在一个非常柔软的大皮球上。句中 resting on... air 是分词短语, 修饰 vehicle, you sitting on... ball 是“代词+动名词”的动名词复合结构, 作介词 like 的宾语。

state of unbalance could cause you to *roll off*⁷. The slightest state of unbalance could cause one edge of the plenum chamber to dig into the ground, whilst most of the air escaped from the other side.



7. 滚下来。 8. 非平衡状态时气室敞开。

The Momentum Curtain

*The plenum chamber type of hovercraft*¹ showed the most promise of successful development, but it had problems of stability and required tremendous power to maintain a reasonable *hover height*². Some of the early types used *high-pressure air jets*³ to balance, or 'trim', the craft, and these were controlled from the cabin. However, stability of the hovercraft on its cushion of air still remained a real problem.

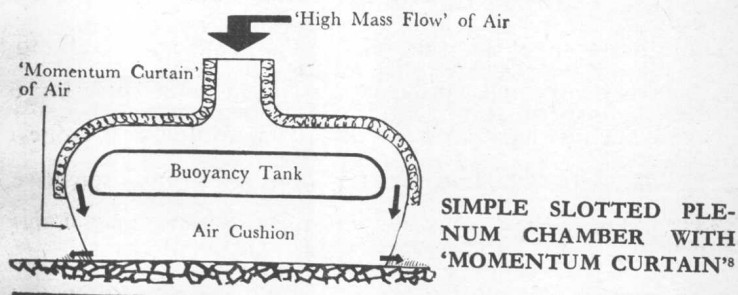
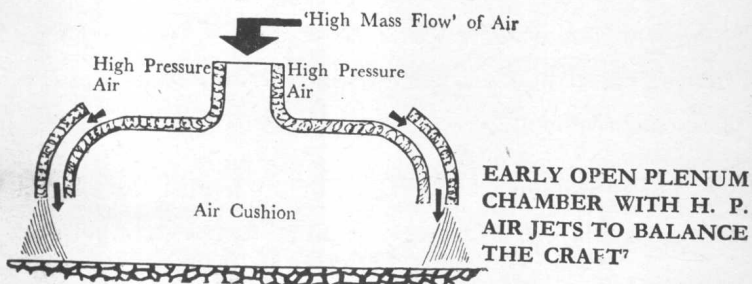
To solve these problems, a plenum chamber with a *momentum curtain*⁴ was developed. The plenum chamber was almost filled with a box-like structure, *thereby forming a slot round the plenum chamber wall*⁵ and which was, of course, open at the bottom edge. A curtain of flowing air, which inclined inwards and maintained the air-cushion, could therefore be created.

This arrangement achieved higher heights with less power. It also solved the stability problem, as the air flow to the momentum curtain could be controlled by the commander, and he could maintain balance of the craft quite easily. Later, the bottom edge was closed

1. 气室式气垫船. 2. 垫升高度. 3. 高压空气射流. 4. 动量(气)幕. 5. 从而在气室壁周围形成了一道槽. "thereby + 分词短语" 在句中用作状语, 表示结果.

and slots provided for the passage of air. (See top drawing, Page 11.)

The box structure in the plenum chamber had the added advantage that it could be made watertight, and thereby form a buoyancy tank on which a hovercraft could float when at rest on water.⁶



6. 气室的箱形结构还有另外一个优点, 即能保持水密性, 因而成为一个浮力舱, 气垫船停在水面上时, 就可浮在这个舱上. that it could ... on water 是同位语从句, 和 advantage 同位. 从句中的 it 指 the box structure, 动词 could be made 和 (could) form 是并列的. on which ... on water 是同位语从句中的定语从句, 修饰 a buoyancy tank. (参见第2页注6) when at rest on water 是省略了主语 it (hovercraft) 和谓语动词 was 的状语从句, 修饰谓语动词 could float. 7. 早期的用高压空气射流平衡气垫船的敞开型气室. 8. 具有“动量幕”的简单的有槽气室.

Skirts

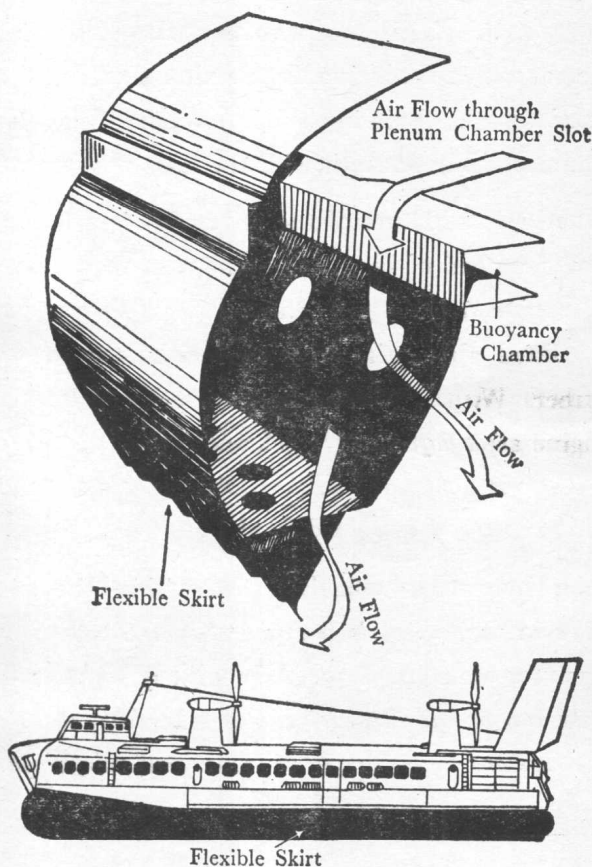
*Workable hovercraft can be built using a plenum chamber employing the momentum curtain technique.*¹ In fact, the first one to cross *the English Channel*² used this system. However, *the hover height was still too low unless great, and uneconomical, power was used*³. Simple obstacles *such as*⁴ quite small waves, or a *tide-formed*⁵ ridge of shingle on a beach, could prove inconvenient.

These problems *led to*⁶ the development of the 'skirt'. This is a shaped, flexible skirt fitted below the bottom edges of *the plenum chamber slot*⁷. *As the hovercraft lifts, the skirt extends below it to retain a much deeper cushion of air.*⁸ The development of the skirt enables a hovercraft to maintain its normal operating speed through quite large waves. It also enables it to pass over boulders or ridges.

The skirt of a hovercraft is one of its most sensitive parts. The design must be just right, *or an uncomfortable*

1. 实用的气垫船可应用动量幕技术的气室来建造. using ... momentum curtain technique 分词短语作状语. 注意: 在科技英语中, 分词短语的逻辑主语, 有时和句中的主语并不一致, 这种情况只要不引起误解是允许的. 2. 英吉利海峡(位于英国与法国之间). 3. 垫升的高度仍然甚低, 除非使用不经济的巨大动力. 4. 诸如. 5. 由潮汐冲积而成的. 这是“名词+过去分词”组成的合成形容词. 6. 导致. to 是介词. 7. 气室槽(气道). 8. 当气垫船垫升时, 围裙向气垫船下方延伸以保持较厚的气垫.

ride results⁹. Also, excessive wear of the skirt can occur¹⁰ if its edges are flapping up and down on the surface of the sea.



9. 否则乘坐时就会不舒服。这里的 results 是谓语动词。10. 也会产生围裙过度磨损的情况。

Main Construction

As with any vehicle, fuel is wasted when moving any unnecessary weight.¹ This is particularly true of an airborne vehicle, and therefore aircraft techniques of construction are used in the building of hovercraft. This ensures maximum possible strength with the least possible weight.

The basic structure of the hovercraft is a flat-topped plenum chamber of oval or rectangular shape, and the cabin, engine, *control gear*² and *plenum chamber air intake*³ are all fitted above the floor formed by the top of the plenum chamber. With single-engined vehicles, the air intake and engine are *at the rear*⁴, and the *passenger or freight compartment*⁵ is forward. *The air intake is as high as possible to avoid the entry of spray and dust.*⁶

The buoyancy tank is fitted within the plenum chamber so that there is a space over the top of it and an air slot around its edges. *The whole of the space through which the cushion air flows is finished with flush-headed rivets, smooth bends and smooth edges to ensure an uninterrupted air*

1. 任何一种运载工具,如果带多余重量运行,就会浪费燃料。在“连词 as + 介词短语”结构中,主语、谓语动词习惯省略。 2. 控制(变速)齿轮,控制系统。 3. 气室进气口。 4. 在艉部。 5. 客舱或货舱。 6. 进气口尽可能高些,以避免水雾和灰尘进入。