

爱上科学

Science

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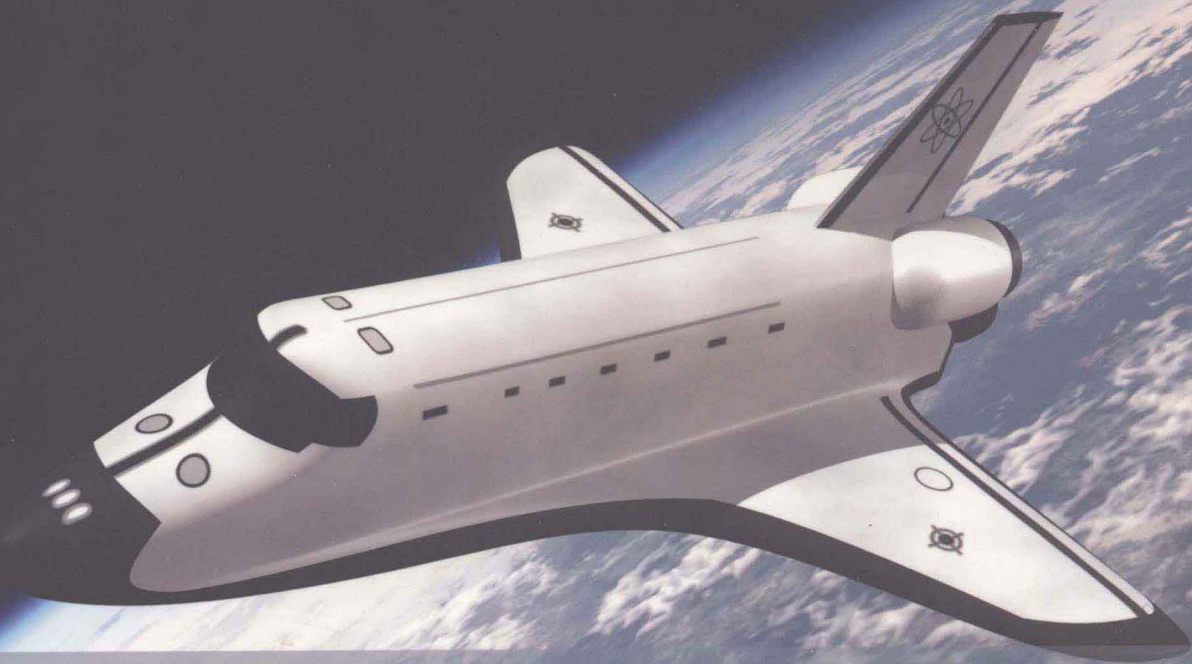
爱上科学

INTRODUCING • 科技与发明系列
INVENTION AND TECHNOLOGY

航空与航天

AIR AND SPACE 双语版

[英] Tom Jackson 编
张辉 译
熊雪亭 审



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POSTS & TELECOM PRESS

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内容提要

《爱上科学》系列科普丛书为读者全面地讲述了科学知识和原理，以通俗的文字、生动的图表为特色，每本书介绍一个或几个主题。从日常生活中有趣的现象出发，引导和培养读者学习的兴趣，扩宽读者的视野，同时还可以帮助读者学习英语词汇、练习英语阅读。丛书涵盖物理、化学、生物、科技与发明这4个系列。适合对科学知识感兴趣的广大科普爱好者阅读。

本书是科技与发明系列中的一本。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提高创新能力以及发明意识。

本书展示了航空与航天技术的发展与进步，以其时代发展为线索，先后介绍了热气球、螺旋桨飞行器、喷气式飞机，以及火箭、卫星、航天飞船、空间站、载人登月技术等，详尽地介绍了它们的发展史、原理以及各自的特点。书中含有“科学词汇”栏目，提取每章重点知识词汇。同时还有“试一试”栏目，包含丰富有趣的家庭小实验，有助于提高大家的动手能力。

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丛书序

这是一个科技新时代，我们曾经认为遥不可及的科学，时刻围绕在我们身边。你是否曾经怀疑过所谓的“2012，世界末日”，或者好奇过在地下高速飞驰的地铁，抑或每天都在关注着PM2.5……这说明科学已然走进了你的生活。学习科学，分享科学，爱上科学，让我们共同聆听来自科学的声音。

《爱上科学》系列科普丛书是一套引进版系列科普丛书，译自英国大型出版商棕熊图书（BROWN BEAR BOOKS）有限公司出版的著名系列科普图书《Facts At Your Fingertips》，其独特的科学解读视角、生动的科普画面、优美的图文设计，得到了欧洲读者的青睐，尤其是得到了欧洲青少年的极大欢迎。本丛书为读者全面地讲述了各个领域的基础科学知识和基本事实，以精彩的主题、通俗的文字、生动的画面为特色，从我们身边的素材和现象出发，激发和培养读者学习的兴趣。

丛书涵盖物理、化学、生物、科技与发明四大系列。物理系列阐释和说明了物理学知识及其发展史，包含对物理学发展史许多重大的物理发现以及著名的物理学家的介绍。化学系列主要阐释现代化学的基本概念，涵盖化学反应、有机化学、生物化学、金属、非金属、分子、原子、物态等多方面内容。生物系列主要阐释生命科学的基本概念，并探讨有关生物学的各个方面，包括植物学、微生物学、动物和人类、遗传学、细胞生物学以及生命形式等。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提升创新能力以及发明意识。

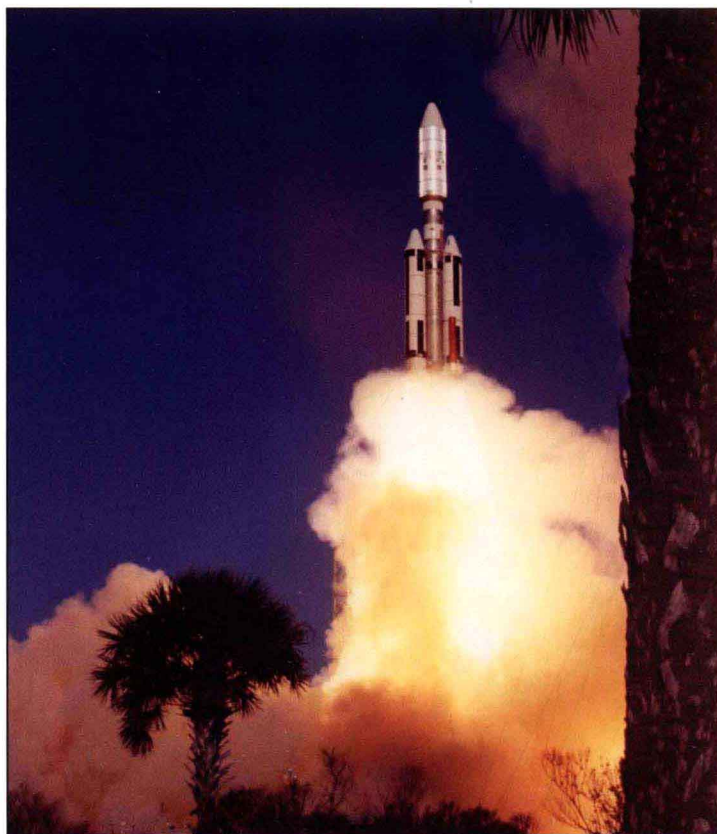
本丛书还具有中英双语的独特设计，让读者在阅读中文时，能对照性地阅读英语原文，为他们提高科学领域的英文阅读能力以及扩展科学类英语词汇量提供了很好的帮助。

丛书中还有“试一试”栏目，该栏目包含了丰富有趣的家庭小实验，为大家在生活实践中验证科学知识提供了更多的选择。

学无止境，让我们一起爱上科学！

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FLYING WITHOUT WINGS

For centuries people have looked skyward, casting an envious eye at the birds and dreaming of a day when they too could fly.

The first attempts at flight used craft that could fly because they were lighter than the air itself—hot-air balloons, for example. Powered flight of heavier-than-air craft came much later.

Before that could happen, however, advances needed to be

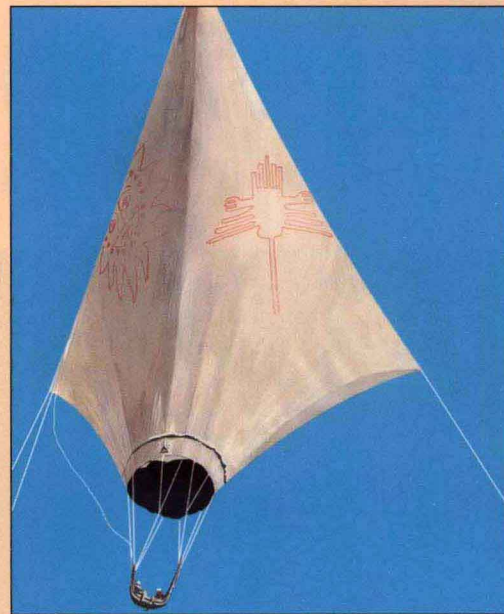
made in understanding the nature of gases, including the air. Through the work of such pioneers as Anglo-Irish chemist Robert Boyle (1627–1691) people came to realize that different gases had different weights, and that the gas contained in a

Hot-air balloons are difficult to steer, and they move wherever the wind takes them. However, many people take a flight in a hot-air balloon to enjoy the spectacular views.



THE FIRST BALLOONISTS?

Between 500 B.C. and A.D. 900, the people of the Nazca culture drew huge figures on the desert plains, near the coast of Peru in South America. Many of these gigantic pictures of animals are only visible from the air. Some scientists believe that this ancient culture knew how to fly in balloons to view the images. Nazca potters often decorated their pots with pictures of balloons and kites, and Nazca textiles show pictures of flying men. In the 1970s Nazca fabrics were tested by a modern balloon-making company. The company found that the traditional fabrics had a tighter weave than the material the company made themselves, making them ideal for hot-air ballooning. In 1975 the International Explorers Society of Miami made their own balloon, *Condor I*, based on Peruvian designs and materials. The balloon was filled with hot smoke produced by burning dry wood. Scorched circles of rock found near the giant artworks might have been created by similar fires centuries ago. *Condor I* rose 380 ft (116 m) into the air and descended safely after several minutes. This does not prove that the ancient Peruvians knew how to fly but shows that it was a possibility.



A two-man crew tested *Condor I*, sitting on a cradle made from bundles of reeds.

"bubble" would rise if it was lighter than the gas outside the bubble.

The Montgolfier brothers

On a sunny June day in 1783, French brothers Joseph-Michel Montgolfier (1740–1810) and Jacques-Étienne Montgolfier (1745–1799) unveiled their new invention in the marketplace in Annonay, southern France. The brothers burned straw and wood under a specially designed bag and thrilled onlookers, who watched open mouthed as the Western world's first hot-air balloon soared 3,000 ft (910 m) into the air. A few months later they repeated the display in front of the French king and queen,

BALLOONS IN EAST ASIA

More than 2,000 years ago, Chinese children played a game that created tiny hot-air balloons. Historical records explain that children placed a few dry twigs inside empty eggshells and then set the twigs alight to send the eggshells flying. Centuries later, in the 1200s, the Mongol people from the wide open plains of Central Asia would launch a dragon-shaped hot-air balloon to mark rallying points. The first ascent of a hot-air balloon in the Western world, however, did not occur until about 500 years later.

几个世纪以来，人们一直仰望着天空，羡慕地望着空中飞过的鸟儿，并梦想着有一天自己也可以在天空中翱翔。

人们第一次飞行实验所用的都是一些可以飘起来的飞行器，因为它们要比空气更轻一些，如热气球。比空气重的能够进行动力飞行的飞行器很晚才

被设计出来。

然而，在飞行器出现之前，人们需要了解气体的性质，包括空气。以英裔爱尔兰化学家罗伯特·波义耳（1627—1691）为代表的先驱者的研

热气球很难驾驶，风往哪个方向吹，它就会往哪个方向飞行。虽然如此，仍有很多人乘坐热气球环游世界，来欣赏壮观的景色。



第一位热气球驾驶者

公元前500年到公元900年期间,纳斯卡文明的人会在靠近南美洲秘鲁海岸的沙漠平原上绘制巨型图案。很多这种巨型的动物图案只有在空中才可以看到。一些科学家认为这种古代文明知道怎样乘坐热气球飞到高空来观看这些巨型图案。纳斯卡的陶艺家们常常会用气球和风筝来装饰他们所制作的陶器,并且纳斯卡的纺织品上也会有飞人的图案。20世纪70年代,纳斯卡的织布被一家现代热气球制造公司试用。这家公司发现这种传统的织布比他们所制造的织布编织得更紧密,这使得这种织布成为理想的热气球制造材料。1975年,迈阿密国际探险家协会在秘鲁人的设计和材料的基础上制作他们自己的热气球——秃鹰1号。这个热气球中充入的是燃烧干木头产生的热气。在巨型艺术品附近发现的烧焦的圆形石头有可能是几个世纪前由同样的火灼烧而成。秃鹰1号上升到了380英尺(116米)的高空中,并在几分钟后安全降落。虽然这些迹象并不能证明古代秘鲁人知道怎样飞行,但是可以说明有这样一种可能性。



两位驾驶员坐在用芦苇束制成的摇篮中测试秃鹰1号热气球。

究,使人们开始认识到不同的气体有不同的密度,如果气泡内的气体要比气泡外的气体轻,那么气泡就可以飘起来。

孟戈菲兄弟

在1783年6月的一个晴天,法国的约瑟夫·米歇尔·孟戈菲(1740—1810)和雅克·艾蒂安·孟戈菲(1745—1799)兄弟在法国南部安诺内的一个集市上将他们的新发明公布于世。兄弟俩在经过特殊设计的袋子下面燃烧稻草和木头以驱动热气球,当西方世界第一个热气球飙升到3 000英尺(910米)

东亚地区的热气球

早在2 000年以前,中国的孩子玩的一种游戏促成了一种小型热气球的诞生。据史料记载,孩子们将一些干树枝放进蛋壳中,然后将树枝点燃,这样就可以使蛋壳飞起来。若干世纪以后的13世纪,来自中亚开阔平原的蒙古人放飞了一种龙形的热气球来设置集合地点。然而,直到约500年后,西方世界才出现第一个升空的热气球。

FLYING WITHOUT WINGS

only this time they also sent a few farm animals in a basket under the balloon. A few months later balloons were carrying humans high into the air for the first time.

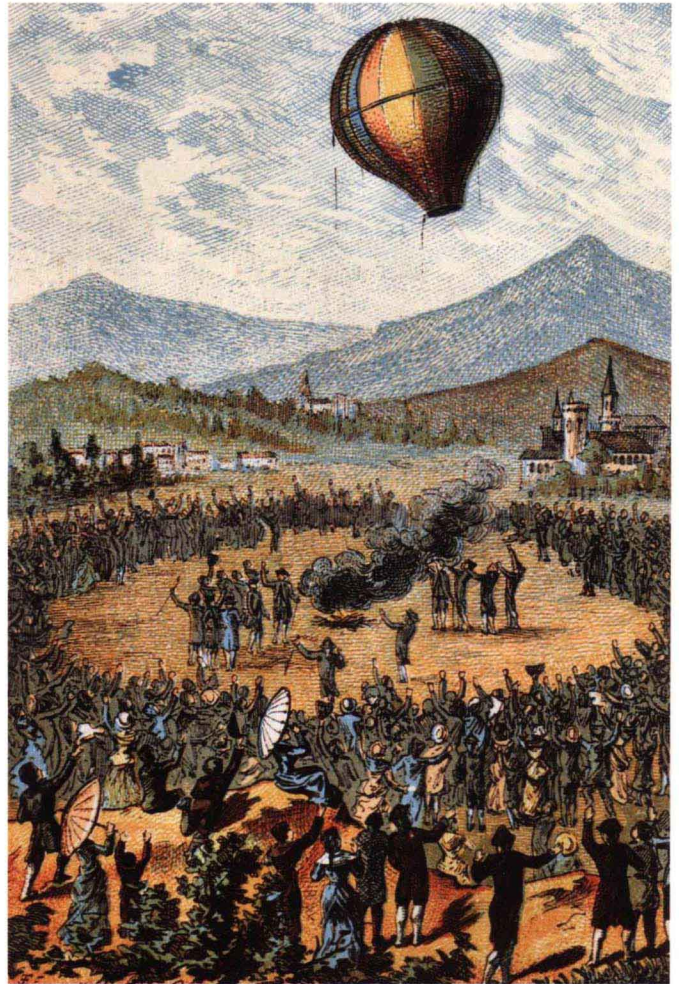
The birth of the airship

It was not possible to steer the earliest hot-air balloons. There was no power source small enough and light enough to fit in a balloon's basket. Balloons were at the mercy of the winds, unless they were tethered to the ground.

The advantages that could be gained by having a free-floating, controllable balloon were obvious. As the 19th century came to a close, every military power that could afford such a program was rushing to build a "ship of the air." Considering the pioneering efforts of the French, it is not surprising that a Frenchman, Henri Giffard (1825–1882), was the first person to

THE FIRST HUMAN FLIGHT

The Montgolfiers' 1783 demonstration in Versailles sent a sheep, a duck, and a chicken into the air. (The animals returned safely but failed to make it beyond Christmas dinner.) It was watched by Marquis d'Arlandes (1742–1809) and his good friend François Pilâtre de Rozier (1757–1785) who then set about becoming the first people to take to the skies in a free-floating hot-air balloon. On a crisp, clear November day in 1783, the two men ascended into the skies over Paris in a Montgolfier balloon. Their 5.5 mile (9 km) journey above the city caused an uproar at the time. When the balloon eventually landed in a field on the outskirts of Paris, a group of peasant workers dropped to their knees in prayer, believing the two adventurers to be angels sent by God.



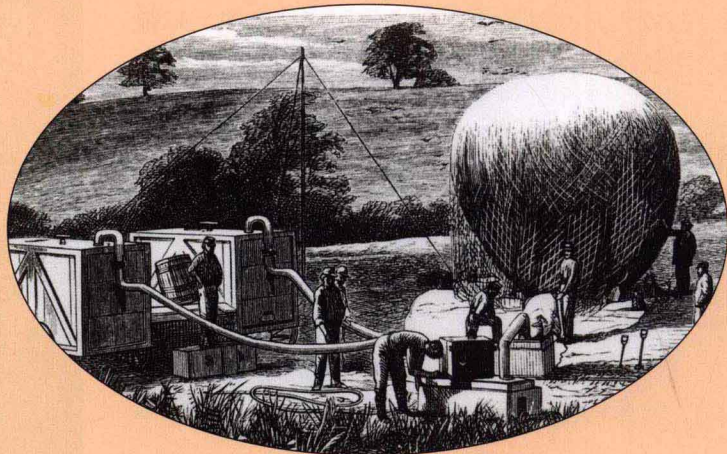
The flight of the Montgolfier brothers' first balloon in Annonay, France, was watched by a large audience.

create such an aircraft.

As early as 1852, Giffard designed and built the world's first "dirigible" (from the French *diriger*, meaning "to steer"). Rather than use a normal balloon-shaped bag, Giffard used an elongated cigar-shaped bag full of hydrogen. His ship was

PUTTING BALLOONS TO WORK

While balloons provided entertaining diversions from the routine of 18th-century life, they appeared at first to have no practical use. One man, however, soon realized that he could use tethered balloons to his advantage. French general Napoleon Bonaparte (1769–1821), who later became the emperor of France, formed the world's first ever military airborne division. Known as the *Aérostiers*, this intrepid group of tethered balloonists gave the French Army an advantage by revealing the exact location of an enemy's troops. For much of the following hundred years tethered balloons were used in this capacity by many armies, including both sides during the American Civil War (1861–1865).



A hydrogen balloon, known as Intrepid, is inflated by a surveillance unit during the American Civil War. A spotter aboard the balloon gave reports on the movements of the enemy force.

powered by a steam engine weighing 350 lb (150 kg), so Giffard had to use a gas bag 144 ft (44 m) long. He started out from Paris on his first flight and traveled 17 miles (27 km), reaching a top speed of 6 mph (10 km/h).

Unfortunately for Giffard, however, his craft was fated always to be underpowered. Although his dirigible was a significant improvement on the ordinary balloon, any aircraft possessing a top speed of 6 mph was always going to be uncontrollable in wind speeds of 7 mph (11 km/h) or more. This situation improved in 1872 when German engineer Paul Haenlein fitted the recently invented (and considerably lighter) internal-combustion engine to a dirigible. To save weight, Haenlein used the super-light hydrogen gas in the balloon as fuel, although this did reduce the distance the craft could travel before it began to lose height. In 1883 French brothers Albert Tissandier

and Gaston Tissandier became the first people to power a dirigible with an electric motor.

WORDS TO KNOW

- ❖ **Atom:** The smallest units in a substance.
- ❖ **Dense:** A description of how much mass is packed into a substance.
- ❖ **Hydrogen:** A highly flammable gas that is lighter than air.
- ❖ **Internal-combustion:** The engine system used in cars and trucks.

的高空时，观众们个个都惊得目瞪口呆。几个月后，他们在法国国王和王后面前重复展示了这个热气球试验，这次他们还在气球下悬挂的篮子中放入了一些家畜。又过了几个月，他们设计的热气球就第一次搭载人类升空了。

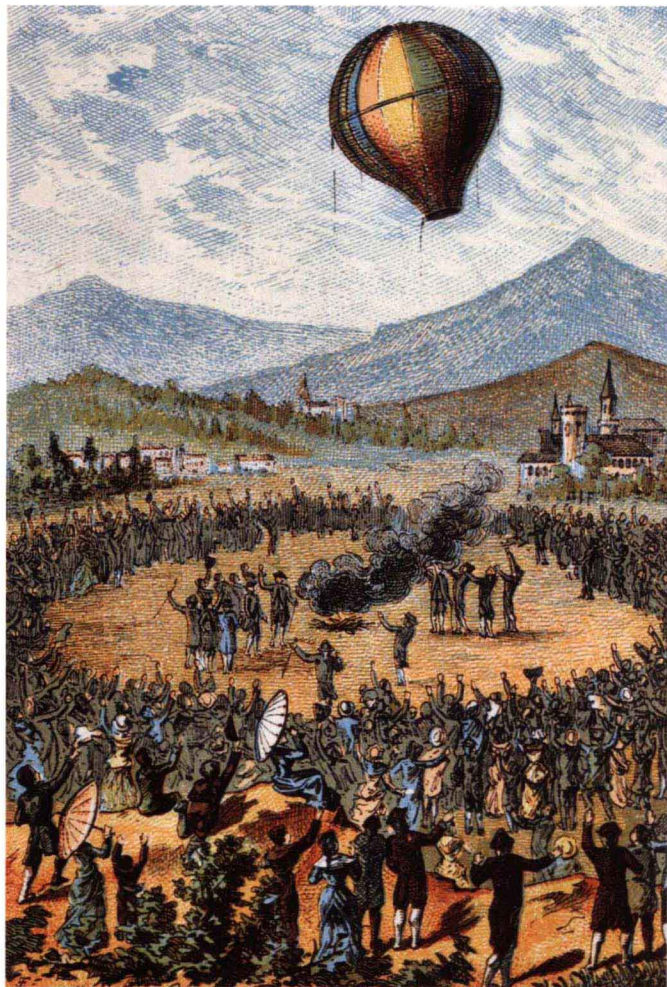
飞艇的诞生

早期的热气球是无法掌控飞行方向的。那时还没有足够小和足够轻的动力源装配到热气球的篮子中去。热气球会任凭风摆布，除非用绳子将其固定在地面上。

可控的热气球有一个明显的优势就是可以自由飞行。随着19世纪的临近，每一个能够负担起这个

第一次人类飞行

1783年，孟戈菲兄弟在凡尔赛做了一次飞行实验，他们将一只羊、一只鸭和一只鸡送到了空中（这些动物后来都安全返回地面，但是并未在圣诞晚餐之前返回）。这些都被马奎斯·阿兰德斯和他的法国朋友弗朗索瓦·皮拉特尔·德·罗齐尔（1757—1785）看到了，阿兰德斯和罗齐尔后来成为第一位乘坐自由漂浮的热气球升到空中的人。在1783年11月的一个秋高气爽的日子，阿兰德斯和罗齐尔乘坐孟戈菲兄弟设计的热气球成功地上升到了巴黎上空。他们在巴黎上空飞行了5.5英里（9千米），这一举动在当时引起了很大的轰动。当他们在巴黎郊区着陆时，附近的一群农民工看到后，都向他们下跪祈祷，以为这两位探险家是上帝派到人间的天使。



孟戈菲兄弟设计的第一个热气球在法国的安诺内升空飞行，有很多观众围观。

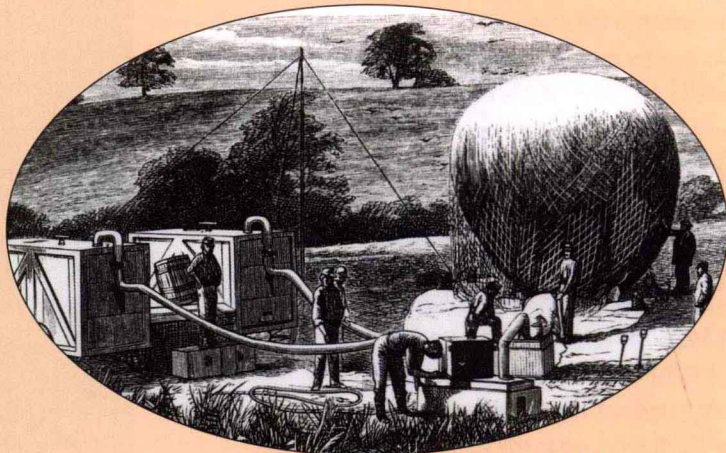
计划的军事力量都争相制造“空中之艇”。鉴于法国是制造热气球的先锋力量，法国人亨利·吉法尔（1825—1882）成为第一个制造出这种飞艇的人就不足为奇了。

早在1852年，吉法尔就设计和制造了世界上第一艘可驾驶的飞艇（来自于法语diriger一词，是

使热气球飞起来

虽然从18世纪开始,热气球就在生活中提供了各种娱乐消遣,但它们第一次出现时并没有什么实际用途!

然而,有一个人很快就意识到他可以用固定住的热气球作为自己的优势。这个人就是法国将军拿破仑·波拿巴(1769—1821),他后来成为法国的君主,他成立了世界上第一个军事航空部门。他们就是鼎鼎有名的浮空飞行员,这个英勇的热气球驾驶员小组通过观察敌人军队的精确位置,给法国军队提供了很大的便利。在接下来的几百年中,固定气球的这个功能一直被很多军队使用,其中美国内战(1861—1865)时期,双方都使用了热气球。



美国内战时,一个侦察单位正在给氢气球充气。一个观察员登上气球并报告敌人军队的一举一动。

“驾驶”的意思)。吉法尔没有用常规的球形袋子来制造飞艇,而是用的充满氢气的细长的雪茄形状袋子来制造的。他所制造的飞艇用了一个重约350磅(150千克)的蒸汽发动机来提供动力,所以吉法尔不得不使用一个长达144英尺(44米)的袋子。他第一次的飞行是从巴黎启程的,总共飞行了17英里(27千米),最高时速达到6英里/小时(10千米/小时)。

然而不幸的是,吉法尔的飞艇注定永远是缺乏动力的。尽管他的飞艇与普通飞艇相比有了很显著的改进,但是当风速达到7英里/小时(11千米/小时)或更高时,任何飞艇达到最高时速6英里/小时(10千米/小时)时都会失控。1872年,德国工程师保罗·亨莱茵将最新发明的、非常轻的内燃机装备到一艘飞艇上,进而改进了这种情况。为了减轻飞

艇重量,莱茵向气球中充入超轻的氢气作为燃料,但是这样做却大大减少了飞船在下降之前可以飞行的距离。1883年,法国的艾伯特·蒂桑迪尔和加斯东·蒂桑迪尔兄弟成为第一个使用电动机驱动飞艇的人。

科学词汇

- ◆ **原子**: 组成物质的最小单位。
- ◆ **密度**: 某种物质单位体积内所含物质的质量数。
- ◆ **氢气**: 一种比空气轻的极易燃烧的气体。
- ◆ **内燃机**: 一种将热能转化为机械能的发动机。

FLYING WITHOUT WINGS

Zeppelins

The greatest dirigible designer was Count Ferdinand von Zeppelin (1838–1917). Zeppelin had been a cavalryman in the Prussian (German) army and a volunteer for the Union Army in the American Civil War. While in the United States he flew in hot-air balloons and devoted the rest of his life to building bigger and better flying machines. Zeppelin added a lightweight frame to the gas bag, making it more rigid, so that the dirigible would remain controllable at the higher speeds.

On July 2, 1900, Zeppelin took his early "airship" on its first flight, over Lake Constance in Germany. The flight lasted just 17 minutes before *Luftschiff Zeppelin One* (LZ-1), dropped to the surface of the lake. It was to be another eight years before Zeppelin's first truly successful flight, with LZ-4. At the time LZ-4 was the largest airship in the skies. It was an incredible 446



THE HYDROGEN BALLOON

Hot air was not the only thing being used to inflate balloons in 1783. The French physicist Jacques-Alexandre Charles (1746–1823) took to the air with fellow Frenchman Nicolas Robert just six months after the Montgolfier brothers first demonstrated their hot-air balloon. Using a balloon that had been filled with hydrogen (the lightest of all gases), the two men must have wondered what they had let themselves in for when their craft shot nearly one mile (1.6 km) up into the sky. Charles and Robert eventually returned safely to the ground, and despite their early scare made many more flights.

The Graf Zeppelin (LZ-127) made 590 flights between 1928 and 1937 and traveled more than a million miles in its lifetime. It was broken up in 1940.

ft (136 m) long and required 500,000 cubic ft (14,000 m³) of hydrogen to get off the ground. On July 4, 1908, LZ-4 traveled at a continuous 40 mph (60 km/h) for 12 hours over Switzerland. At last, practical, powered, controllable air travel had arrived.

Between 1910 and the outbreak of World War I in 1914 about 34,000 people had their first taste of air travel in a Zeppelin airship. The war spurred on airship construction, and Germany led the world in airship design and construction at this time, building 88 military airships. London, England, had the dubious honor of being the first city to be attacked from the air when a group of "zeppelins" made a raid.