CCTV—5

中央电视台体育节目中心

体育英语教学节目

体育英语

Sports English

第二册

外语教学与研究出版社

FOREIGN LANGUAGE TEACHING AND RESEARCH PRESS

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编者的话

前几年法国政府做出了一个规定：为了法语的纯洁，所有公共场所的招牌都必须用法文标注。法语是否因此得到纯洁我不知道，知道的只是在那里连点个菜都麻烦。

我也希望2008年参加北京奥运会的外国人都会说中国话，但是这个希望肯定不会成为现实，所以作为东道主我们只好去将就一下客人，所以也就有了《体育英语》这个节目和这本书。

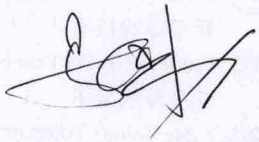
对有些人来说，语言是一种艺术，但对于大多数人来讲语言只是交流的工具。我们这个节目并不是系统地教大家学英语，而是告诉大家体育的东西在英语里怎样表达，告诉大家奥运会里最需要的是哪些英语。这个节目和教材不可能使学习者通过“托福”考试，却可以使具有一定英语水平的人将他们学过的英语用于体育，用于2008年的北京奥运会。

根据以往奥运会的经验，当地志愿者的热情与能力对于在那里举行的奥运会是至关重要的。热情在我们中国是不用担心的，但是能力之中就含有表达的能力，而英语是没有办法一蹴而就的。愿意在2008年北京奥运会中担任一名志愿者的人，《体育英语》可以是一个帮助你实现梦想的工具。

《体育英语》这个节目当然不仅仅是为了帮助志愿者，实际上凡是喜欢中央电视台体育频道的观众都不太可能绕过体育中的英语，特别是在今后几年。因为奥运会的关系，所有国际体育协会都要在2008年之前在北京举行热身赛，体育频道将会制作和播出其中的大部分赛事。当我们播出国内赛事的时候，当然会使用中文字幕和中文的介绍。但是当我们的信号传向全世界的时候，只能使用全世界目前通行的英文。所以知道一点某个项目的英语表达方式，一定会给中国的体育电视观众带来些许方便。

《体育英语》这个节目的初衷是支持北京申办奥运会，所以在这第一部分中主要介绍奥运会的知识。当梦想成真之后，这个栏目也就顺理成章地成为了要播出到2008年的节目，因此对今后的内容我们会根据2008年的需要设计，会延伸到中国生活的各个方面，将北京生活和国际体育连接得更加紧密。

在这个节目播出之后，我们收到许多观众的询问，希望看到重播，希望得到教材。为了满足这部分观众的要求，我们将节目中的核心内容集中到这本书和随书所赠的VCD里，希望能够给每一个需要的观众一点帮助。



马国力

中央电视台体育节目中心 主任

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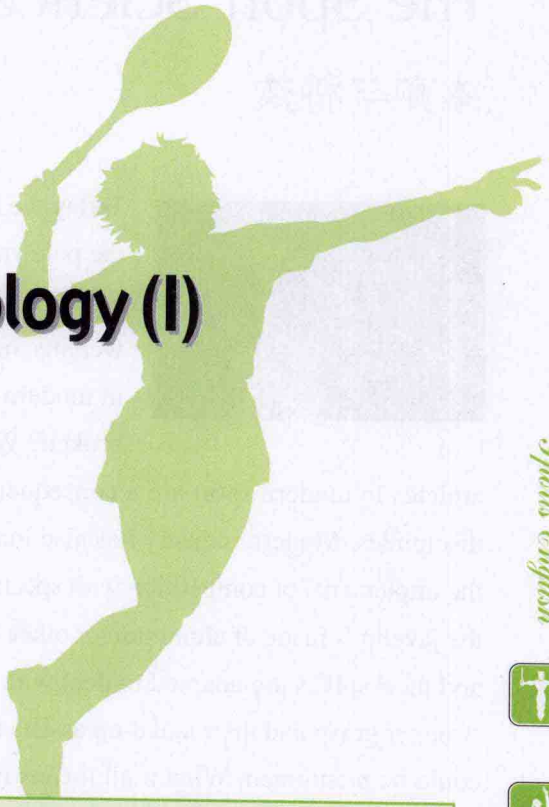


The Sport Science and Technology (I)

体育与科技(一)

None of this has changed, in spite of the fact that thousands of years have passed. The same desires and yearnings to triumph as in yester year, to write feats in the sands of competitions, to become the all-round champion, not only still exist, but have attained extraordinary significance in our day.

This is due to the development manifested by athletes in their different specialities and the vital contribution that science and technical developments have made in general to competitors, implements and personal equipment.

Our starting point must be a concrete fact: the results of modern sports are a consequence of the unstopping development of science and technology. Without this unquestionable contribution, which is decisive at all levels, the results in modern sports would never have been achieved.

尽管过了几千年，什么都没变。对成功的向往和渴望，一如昨日般强烈。在比赛中一展技艺、赢得冠军的想法今天仍然存在，而且具有非凡的意义。

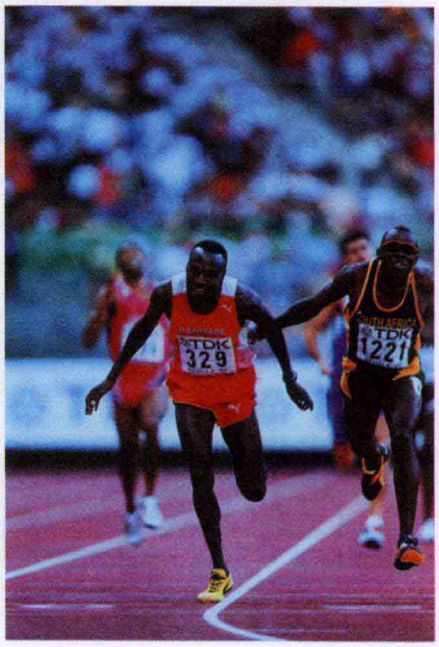
由于运动员们在不同领域内的进步以及科技发展对运动员、体育器材以及个人装备所做的重大贡献才使得这些想法成为可能。

我们的起点一定是一个具体的事实：现代运动的结果就是科技不断发展的结果。没有科技在不同层次的决定性的贡献，就绝不可能取得现代运动的佳绩。

The Sport Science and Technology

体育与科技

Today we are used to the sight of the javelin being thrown more than 100 meters; the pole vaulter clearing the bar at a height of almost six meters; sprinters breaking the 10 second barrier; and weightlifters lifting dumbbells with extremely heavy weights, more like machines than men. So, how do these astonishing performances in modern-day sport happen and why do already outstanding records keep getting broken? We can use one unavoidable fact as a starting point: the achievements of athletes in modern sport are a consequence of the correct application of science and technology to each of the disciplines. Modern industry has also made its contribution to the unstoppable progress of sport, manufacturing the implements of competition with special sensitivity and skill, making them all easier to use. Today, for instance, the javelin is made of aluminum or other light materials; pole vaults are built with fiberglass alloys; running shoes and their spikes are adapted to deal with any scenario or weather conditions; the modern dumbbells allow for a stronger grasp and their make-up assists in a faster and more efficient thrust. There are many more examples that could be mentioned. What it all means is that sport is constantly evolving and that while the behavior and skill level of its participants will always count for a lot, off the field of competition, a very significant contribution is being made by science and technology and the ability of individuals and companies to come up with new inventions.



今天，我们已经习惯看到投掷100多米的标枪；撑杆跳高运动员跃过高达六米的横杆；短跑健儿们突破10秒大关；举重运动员举起其重量只有机器才能承受的哑铃。那么，现代体育中这些惊人的表现是怎样产生的呢？为什么这些已很惊人的记录却不断地被打破呢？毋庸质疑，运动员们在现代体育中所取得的成就是科学与技术在各个领域中正确应用的产物。同时，现代工业为体育竞技生产出灵敏度高且具有特殊技巧的运动器材从而让运动员使用起来更加容易，这对体育运动的不断进步做出了贡献。比如，现在的标枪是使用铝或其他轻材料制成的；撑杆是玻璃纤维合成的；跑鞋和鞋钉能适应任何场地或天气状况；便于抓举的哑铃能够快速而有效地增强推力。这样的例子举不胜数，所有这些使我们得到一个结论：体育是不断发展的，这不仅在很大程度上归功于体育参与者的表现和竞技水平，还归功于赛场之外科技、个人和企业生产新产品的能力对其做出的巨大贡献。

More About Sports Science

Sports Science 体育科学

体育科学是建立在生物科学和社会科学基础上的综合性、交叉性的专业技术科学。其科学体系包括自然科学、社会科学、人文科学、管理科学等门类。

Sports science has typically included a number of scholarly subdisciplines, including exercise physiology, motor learning and behavior, biomechanics, sports psychology, sports history, and sports philosophy. These areas are all linked by the researchers' common interest in sports performance. The major developments in sports science are a relatively modern phenomenon, linked to the rapid advances in medicine, computer science technology, and engineering over the past 20 years.

自然科学类	社会科学类	人文科学类	管理科学类
exercise physiology	sports generality	sports psychology	management science
运动生理学	体育概论	运动心理学	体育管理学
sports medicine	sports philosophy	exercise training	sports economics
运动医学	体育哲学	运动训练学	体育经济学
exercise biochemistry	sports ethnics		systems engineering
运动生物化学	体育伦理学		系统工程学
exercise anatomy	sports sociology		sports information
运动解剖学	体育社会学		体育信息学
exercise biomechanics	law of sports		sports statistics
运动生物力学	体育法学		体育统计学
exercise nutriology			
运动营养学			
exercise bionics			
运动仿生学			

Supercompensation 超量恢复(超量补偿)

The underlying physiology is simple. The healthy, desirable stresses induced by overload from intensive training or climbing shock the local muscles and connective tissue into a traumatized state of temporary regression. Our body's natural adaptive reaction is to respond to this by preparing itself to cope with similar stresses so that next time it can do a better job. It does this by means of muscular hypertrophy (growth) and adaptations of the

neuromuscular pathways (the link between muscles and the nerves which fire them) as well as a whole host of complex processes which enhance the efficiency of the specific energy systems required for that type of training. So next time you climb you will be stronger, fitter, faster and better. This process of adaptation is known as Supercompensation.

Muscle Glycogen 肌糖原

Carbohydrates that are stored in the body's muscle tissue are referred to as muscle glycogen. Muscle glycogen is essential in sports performance, endurance, and the conversion of fat to energy. The more muscle glycogen available during sustained exercise, the greater the potential for improved endurance. Sustained exercise requires available muscle glycogen. Different sugars have different effects on muscle glycogen depletion rates. Glucose and other high glycemic sugars and carbohydrates like maltodextrins, provide a quick spurt of energy. This triggers the release of insulin and increases the depletion of muscle glycogen. This negative biochemical chain reaction also suppresses the conversion of fat to energy, which can cause an athlete to "hit the wall". In the average person it causes stimulation of fat-storage, increased size of fat cells, weight gain, lack of energy, blood sugar swings and exacerbation of development of diabetes and other blood sugar disorders.

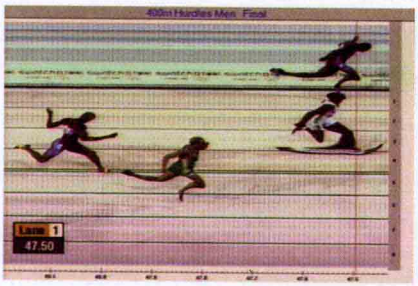
KEY WORDS 重点词汇

training	训练	sports medicine	运动医学
exercise training	运动训练学	exercise biochemistry	运动生物化学
muscle glycogen	肌糖原	exercise anatomy	运动解剖学
exercise physiology	运动生理学	sports psychology	运动心理学

Hand Timing and Photo Finish

手计时和终点摄影

The most powerful natural law of sport is that there should always be a winner. Hence the obsession with counting the tenths, hundredths and thousandths of a second, so that everything can be given an order and a place in the hierarchy of achievement. Sport has benefited from leading-edge technology for thousands of years. The ancient Greek judges made their decisions on the spot with only their eyes to help them. To make things easier though only two competitors would run at a time, and one of these would be eliminated. The Greeks also realized the importance of controlling the start. The use of timing in sport came during the French Revolution, thanks to an accomplished astronomer, Alexis Bouvard, during "military maneuvers", he decided for the first time to try to quantify performance. With the aid of two nautical watches, he succeeded in timing runners to a tenth of a second. Almost a century later, in 1878, E.J. Muybridge invented the automatic stopwatch. In order to measure the speed of a horse, he set up a trip wire at the start and finish of a race track. Around 1880, the Canadian academic Father Mcload, from Montreal, was able to time athletes to a hundredth of a second with a graphic recording device.



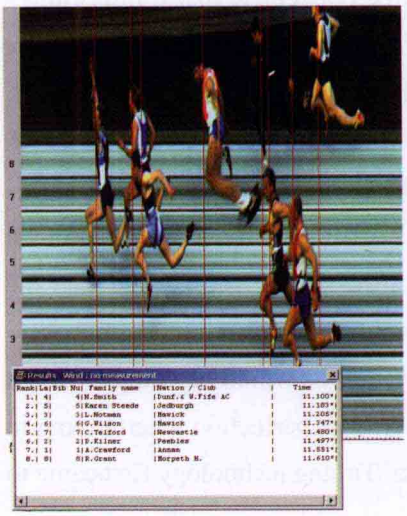
In the 1932 Olympic Games in Los Angeles, timing to the hundredth of a second became routine thanks to the "Two Eyes Camera" invented by Gustovus T. Kirby. Finishes were recorded by a camera filming at 128 frames per second. Times were displayed on three concentric discs, providing a synchronous document of the runners' movements. In athletics there have been many cases since 1932 where the photo-finish has proved invaluable. It was a photo-finish that separated the American Eddie Tolan and Ralph Metcalfe on the finish line of the 100m at the Olympic Games in Los Angeles. Everyone agreed that it looked as if Metcalfe had won, but the judges declared Tolan the winner after looking at the photo-finish picture. As the rules stood, the race ended when the whole of the athlete's torso was over the finish line. Metcalfe, being the stronger of the two, had lost the race by throwing his chest out.

In 1948, the photo-finish arrived at the Olympic Games in London. Two years later this would be complemented by a quartz clock for timekeeping. Another step along the road towards precision and, perfection when timing to the thousandth of a second was rigorously applied at the 1952 Games in Helsinki. Timing technology first came to

the swimming pool for the 1968 Olympic Games in Mexico City. Touch panels that were insensitive to waves and atmospheric conditions (change in pressure of temperature) were introduced, and automatic timing was used for the first time. Electronic starting platforms were introduced in 1970. In 1972, for the Olympic Games in Munich, starting blocks with pressure detectors appeared for the first time in the athletics events. False starts could at last be effectively monitored. Russia's explosive sprinter Valery Borzov was used as a yardstick: a false start would be detected if an athlete moved between the final command of the starter and a tenth of a second thereafter. And what about the future? Soon in every sport microscopic electronic chips attached to athletes' bodies will perform the task of timing and identification perfectly.

体育运动最有力的自然法则就是总有胜者。这迫使人们计时要精确到十分之一秒、百分之一秒，甚至千分之一秒，这样才能分出顺序和名次。千百年来，体育运动的进步就得益于前沿科技的发展。古希腊的裁判们根据他们眼睛在现场所看到的情况判定出胜者，为了方便裁判，每次只有两名赛跑运动员进行比赛，并且要从中淘汰一个。古希腊人也意识到了控制起跑的重要性。体育运动中的计时是从法国大革命时期开始的，亚利克西斯·包沃德是一位卓有成就的天文学家，在军事训练中，他首次尝试用计时的办法来量化士兵的表现。他用两只航海表成功地将跑步者的计时精确到了十分之一秒。在约一个世纪后的1878年，伊·吉·墨布瑞发明了自动跑表。为了测量马的速度，他在赛马跑道开始和结束处安装了拌线。大约在1880年，加拿大蒙特利尔的神父迈克罗德，通过一个绘图记录装置精确计时到百分之一秒。

到1932年的洛杉矶奥运会，精确到百分之一秒的计时已是司空见惯的了。这是由于古斯塔夫斯·科比发明了"两只眼睛的摄影机"。在比赛终点的情况被每秒可拍摄128个画面的终点摄影计时器记录下来。时间显示在三个同心的轮盘上，同步记录运动员的运动。终点摄影自1932年启用以来，在许多次比赛中都证明了它的价值是不可估量的。在洛杉矶奥运会的100米短跑比赛中，正是终点摄影为美国选手艾迪·托兰和罗夫·迈特可菲决出了胜负。看起来好像是迈特可菲赢了，但裁判根据终点摄影照片判定托兰获胜。因为根据规则，全部躯干先过终点线者为胜，迈特可菲虽然比托兰强壮，但却因胸部落后而屈居第二。



1948年，伦敦奥运会上出现了终点摄影计时。两年后，石英表应用于计时。这是对终点摄影的一次很好的补充。精确到千分之一秒的计时被严格应用到1952年赫尔辛基奥运会，是计时朝着精确和完善迈出的又一步。计时技术在游泳比赛中的应用始于1968年的墨西哥城奥运会。本届奥运会上首次采用不再对波浪和气流敏感的触摸板，自动计时也开始启用。1970年出现了电子起跑平台。1972年慕尼黑奥运会的径赛项目中第一次在起跑器上安装了压力探测器，起跑犯规被有效地监测出来。在这次比赛上，前苏联短跑选手鲍佐夫被当作衡量标准：如果一个运动员在发令后的十分之一秒之前移动，将被判做犯规。将来会用什么计时呢？在不远的将来，放在运动员身上的电子芯片将起到很好的计时和识别作用。

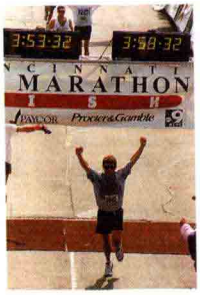
More About Hand Timing and Photo Finish

Competition Rules of Sports Organizations 很多体育组织的竞赛规则

Two alternative methods of timekeeping shall be recognized as official:

- *Hand timing;*
- *Fully Automatic timing obtained from a Photo Finish system.*

Competition Rules in Track and Field of IAAF 国际田联的田径竞赛规则



In the case of hand timing, a sufficient number of timekeepers for the number of competitors entered shall be appointed, one of whom shall be designated the Chief Timekeeper. He shall allocate duties to the Timekeepers. These Timekeepers shall act as back-up Timekeepers when fully Automatic Photo Finish equipment is in use.

When fully Automatic Photo Finish equipment is used, a Chief Photo Finish Judge and at least two Assistant Photo Finish Judges shall be appointed.

For all hand-timed races on the track, times shall be read to the next longer 1/10th of a second. The times for races partly or entirely outside the stadium shall be converted to the next, longer full second, i.e. for the Marathon 2:09:44.3 shall be returned as 2:09:45.

If the hand of the watch stops between two lines indicating the time, the longer time shall be accepted. If a 1/100th second watch, or an electronic manually operated digital timer, is used, all times not ending in zero in the second decimal shall be rounded to the next longer 1/10th second, i.e. 10.11 shall be read as 10.2.

Stopwatch 秒表

Timing was first introduced in the 1912 Stockholm Games with the use of hand-operated mechanical stopwatches. As these depended on human judgement and reactions, to click on a start/stop button with the thumb or finger, their accuracy was limited to 1/5th of a second. This might not sound much, but over a 100m race, which takes about 10 seconds, this is equal to an error of two meters.

The automatic stopwatch was introduced at the 1932 Los Angeles Games and improved accuracy to 1/10th or 0.1 of a second (one decimal place). A wire was placed across the finish line and when knocked by the winning runner, it triggered the stopwatch to stop timing. Also introduced in these Olympics was the use of newsreel film of each race with an in- built chronograph (time-measurer) to help decide the winner if two athletes seemed to cross the line and thus trigger the wire at the same time.

Quartz Clock 石英表

Quartz clocks existed well before the 1960s. Inventing a quartz wristwatch was a task of miniaturization, requiring low-power, low voltage integrated circuits, miniature quartz crystal oscillators, small batteries, micromotors, and electronic displays. All of these components had to be specifically developed, requiring contributions from several diverse disciplines.

Electronic Timing Devices 电子计时设备

In electronic timing devices, an electrical current causes a quartz crystal to vibrate at an amazingly constant rate. This in turn controls a display of numbers. Electronic timing devices are extremely accurate and reliable. They were first used in the 1972 Olympics in Montreal and improved accuracy to 1/100th or 0.01 of a second (i.e. two decimal places). Today they are actually capable of measuring to within 1/1000th of a second, 10 times the required accuracy under the rules!

When the electronic starting gun fires, an electrical current passes through a copper wire cable to a timing console, triggering it immediately to start timing the race.

A photo-finish camera (first introduced in the 1948 Games but in its modern form only in the last decade) scans the finish line up to 2,000 times per second and sends an electrical message to the timing console to signify when each runner's torso crosses the line.

Now, timing device systems used video images and digital clocks to monitor the times ran by the athletes. A "slit video" system is positioned in line with the finish line and scans this image 2,000 times every second. This is linked to the starting pistols and blocks, and digital clocks which enable us to measure time to the nearest thousandth of a second.

In the 1992 Barcelona Games, over 100 kilometers of cabling was used to link up all the various timing devices, which brought the video images to the spectators and officials.

Starting 起跑

在田径比赛中，计时是从 starting gun（发令枪）发出的响声或闪光开始，直到运动员的躯干的任何部分抵达终点线垂直平面的瞬间为止，注意 trunk（躯干）的概念是不包括头、颈、臂、手、脚的。

The competitors shall be placed in the order in which any part of their bodies (i.e. torso, as distinguished from the head, neck, arms, legs, hands or feet) reaches the vertical plane of the nearer edge of the finish line as defined above.

In any race decided on the basis of the distance covered in a fixed period of time, the Starter shall fire the gun exactly one minute before the end of the race to warn competitors and judges that the race is nearing its end. The Starter shall be directed by the Chief Timekeeper and, at exactly the appropriate time after the start, he shall signal the end of the race by again firing the gun. At the moment the gun is fired to signal the end of the race, the Judges appointed for that purpose shall mark the exact spot where each competitor touched the track for the last time before or simultaneously with the firing of the gun.

Electronic Starting Gun and Starting Blocks 电子发令枪和起跑器

The electronic starting gun and starting blocks act in two ways to make sure the race start is a fair one for all athletes:

● *The modern electronic starting gun allows all the athletes to hear the sound at exactly the same time. The gun is connected by copper wires to speakers at each of the starting blocks. This is especially important in races like the 400m sprint, where the athlete in the outside lane starts right around the curve from where the starting gun is fired!*

● *To prevent any advantage to an athlete who accidently starts to move before the gun is fired, the aluminium starting blocks also contain electronics that activate when the runner suddenly lurches forward, putting pressure on the pad. The difference between the moment the starting signal is given and the first movement is called the "reaction time measurement".*

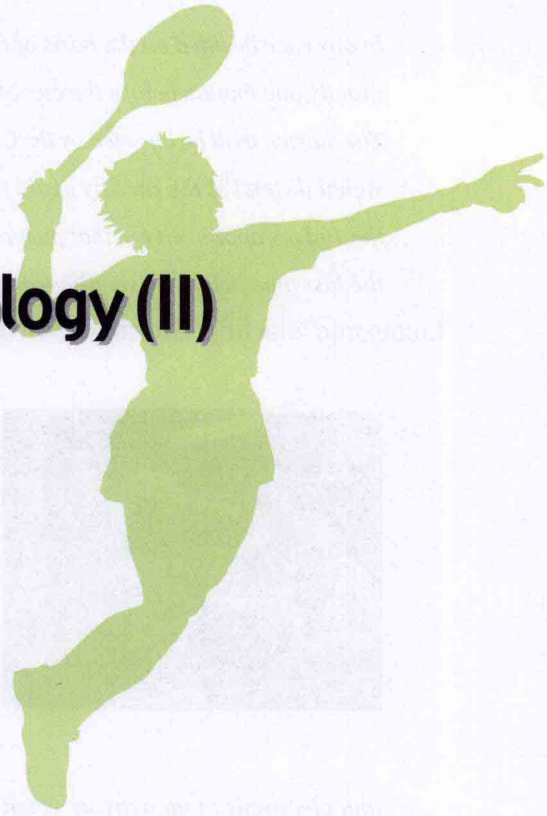
Touch Board 电动计时触板

The removable plate (on the end of pools) that is connected to an automatic timing system. A swimmer must properly touch the touch pad to register an official time in a race.

KEY WORDS 重点词汇

automatic electric timing	全自动电子计时	start	起跑
photo-finish filming	终点摄影记时器	fly	抢跑
hand timing	手计时	false start	起跑犯规
starting gun	发令枪	starting block	起跑器
trunk	躯干	touch board	电动计时触板

Chapter 16



The Sport Science and Technology (II)

体育与科技(二)

With the relentless pursuit for excellence in a wide range of sporting activities, there has been an increasing emphasis on the development of new materials for sports equipment. Sports equipment manufacturers in areas like cycling, golf, and skiing often rely on the performance advantages obtained from advanced materials. In fact, materials developed for aerospace and other high technology areas are being used for sporting goods, and in some cases, new materials see their first application in sports equipment. Development and engineering of new materials for sporting goods presents unique challenges and opportunities for the materials scientist.

在大范围的体育活动中，随着对完美的不懈追求，体育设备所使用的新材料的开发越来越受到重视。像自行车、高尔夫和滑雪项目的体育设备生产厂家常常依赖于先进材料的性能优势。实际上，为航空和其他高科技领域开发的材料正应用于体育产品中。而且在某些情况下，新材料会首先应用于体育设备中。体育产品中新材料的开发和应用为材料科学家们提供了前所未有的挑战和机遇。

Materials in the Sport

体育中的材料科学

The origins of pole vaulting go back to prehistoric times, and almost certainly had the practical application of crossing streams or ditches. When track and field athletics began to be organized on a competitive basis in the mid-19th century, pole vaulting for height and pole vaulting for distance were events in some competitions. Poles were made from locally available timber, including ash, hickory, cedar, and fir. Three iron spikes were often attached to the base of the pole. There are references to bamboo poles in a book published in 1855, and bamboo poles were in fact used for the first time in the 1900 Olympics Games. Because of safety considerations and their lighter weight, bamboo poles came into general use by about 1920. Later in the United States, when bamboo became scarce during World War II, aluminium and Swedish steel poles (both hollow) began to be used despite the fact they were heavier. Herb Jenks, an engineer from the United States, is credited with developing the first fiberglass pole as a result of research on fiberglass fishing rods. The story goes that in 1960 he had just built a new deep-sea fishing rod, more than three meters long and more than 25.4mm in diameter. Jenks'son, a junior high school vaulter, borrowed one of these poles or rods for a practice vault and surpassed his personal best. Jenks later set up his own plant producing "Cata-Pole". Otherwise, while fiberglass construction has improved, its composition is not much different than that first developed by Jenks in the 1960s. Fiberglass poles, because of their flexibility, have assisted in the development of the "catapult" technique.

撑杆跳可以追溯到史前时期，那时主要实际用于跨越河流和沟壑。19世纪中叶田径运动开始成为竞技比赛时，撑杆跳高和撑杆跳远就是其中的比赛项目。那时，撑杆由当地出产的木料制成，如岑木、山胡桃木、杉木、枞木等，通常这些撑杆的下部都装有三个铁钉。最早以竹杆作为撑杆的记载出现在1855年出版的一本书中。1900年，竹杆作为撑杆才第一次在奥运会上使用。到了1920年左右，竹杆因其安全性能好、重量轻而被广泛应用。后来，由于二战期间美国竹子短缺，于是出现了沉重的铝制撑杆和瑞典的钢制撑杆（两者都是中空的）。美国工程师赫博·甄克斯在研究玻璃纤维鱼杆时，发明了玻璃纤维撑杆。据说在1960年，甄克斯刚研制出三米多长、直径超过25.4毫米的新型深海鱼杆，他在初中当撑杆跳运动员的儿子，借了一根"鱼杆"来训练，结果取得了他个人最好的成绩。后来，甄克斯建立了自己的工厂，生产"卡塔撑杆"。尽管玻璃纤维的技术不断地进步，但就材料构成而言与20世纪60年代甄克斯首次研制出的撑杆区别不大。"弹弓式"技巧就是借助于玻璃纤维撑杆的良好弹性才出现的。

More About Materials in the Sport

Men's World Record of Pole Vault 男子撑杆跳高记录的变迁

First over 4m:	4.02	Marc Wright(USA)	1912
First over 15ft:	4.57	Cornelius Warmerdam(USA)	1940
First over 5m:	5.00	Brian Sternberg(USA)	1963
First over 5.50m:	5.51	Kjell Isaksson(SWE)	1972
First over 6m:	6.00	Sergey Bubka(UKR)	1985
First over 20ft:	6.10	Sergey Bubka(UKR)	1991
Subsequent record progression:	6.14	Sergey Bubka(UKR)	1994

Materials of Pole 撑杆的材料

Pole vaulting has completely changed due to the use of plastics, in both the actual vault and the landing, which cushions the athlete's fall. Poles were once made from bamboo, a material that is naturally long and straight. Later poles were made from steel or aluminum pipe, but were not ideal because of their lack of flexibility.

Today, the poles are constructed from fiberglass and other plastics. Plastic gives the pole the strength and flexibility it needs, giving the athlete a shallower angle —a detail that can increase the height of a competitor's vault. Without this flexibility, the athlete would act as a pendulum. A competitor would have to travel 40 miles per hour to reach modern pole vault heights with the old, rigid pole. With a plastic pole, the speed is loaded into the pole, allowing the athlete to achieve much greater heights at the same speed. These innovations have allowed modern pole-vaulters to reach heights of up to 19 feet (5.79m), with the best competitors flirting with 20 feet (6.09m).

As pole-vaulters are able to vault higher and higher, the need for a safe landing becomes more important. Sand landing pits have been replaced by mats constructed from thick, absorbent polyurethane plastic foam and covered with PVC plastic on a thick vinyl base. The polyurethane absorbs energy from the landing, and helps the athlete to land safely.

Materials of Racket 网球拍的材料

Early tennis was seen as a game of finesse. The first racket was made from wood. Later laminated wood was introduced. Henry Head revolutionized tennis racket using fiberglass. Shortly after, Prince designed an