# BHARATHIDASAN UNIVERSITY
## Tiruchirappalli- 620 024
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**Programme: M.P.Ed., Physical Education & Yoga**

**Course Title  : Sports Technology**
**Course Code : 21MPE14EB**

## UNIT-1
## Sports Technology

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# what is Sports technology?

Sports technology combines the **excellence of engineering science, measurement and analysis, and sports science** to relate the playing, or use characteristics, of sporting equipment to the underlying principles of product design.
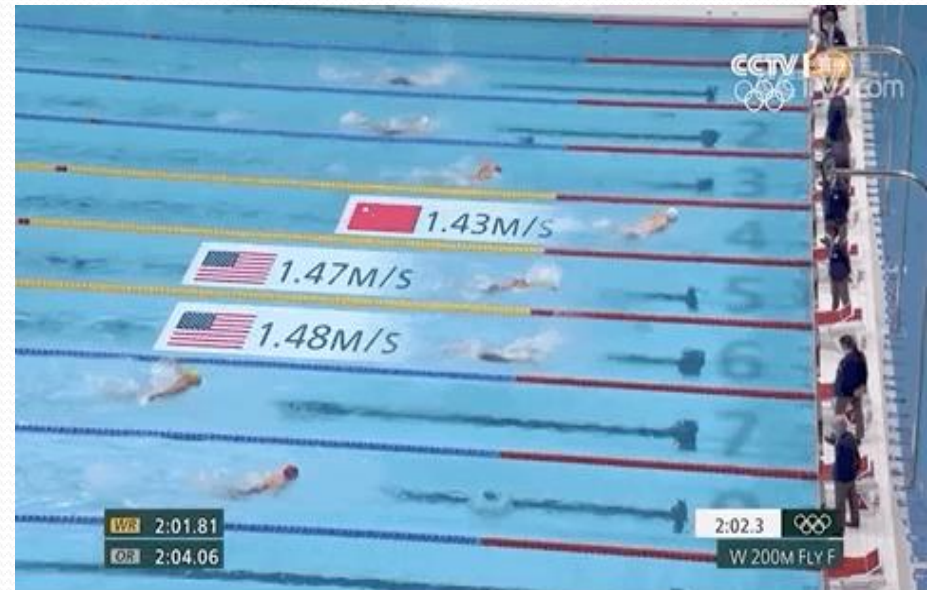
# Meaning of sports technology

*Sport technology represents a certain type of means to realize human interests and goals in sport.* Such technology ranges from body techniques, via traditional sport equipment used by athletes within competition, to performance-enhancing machines, substances, and methods used outside of the competitive setting.

# Definition of Sports technology

Technology is science or knowledge put into practical use to solve problems or invent useful tools.



GOAL-LINE TECHNOLOGY

# ADVANTAGES AND DISADVANTAGES OF SPORTS TECHNOLOGY

FOR ATHLETES

| ADVANTAGES | DISADVANTAGES |
| --- | --- |
| Better performance – marginal gains make the difference | Invades privacy |
| Better medical care results in fewer injuries or faster recovery from injury | Blurs lines between personal and professional time |
| Feedback from coaches is more focused, objective and helpful | Availability and cost – makes sport and success exclusive to wealthy people and countries |
| Improved kit is more comfortable, more efficient and safer | Tempts athletes and coaches into cheating or unfair practices |
| Part of a team, not isolated | Puts the sole focus on winning not athletic endeavor |

# For OFFICIALS

| Advantages | Disadvantages |
| --- | --- |
| Supports team approach so there is less pressure on individuals | Slows the game |
| Information can be shared easily and quickly and stored over time | Not available at all levels of competition |
| Decisions and scoring are more reliable and accurate | No longer trust people's decisions |
| There is increased confidence and trust in officials | Undermines respect for officials' knowledge and expertise |
| | Undermines honesty, integrity and the spirit of fair play |

| Advantages | Disadvantages |
|---|---|
| More engaged in the sport | Detracts from actual play |
| More informed about rules, players etc | Reduces the atmosphere at live events |
| Have a direct link to athletes | Reduces interest in grass roots events that aren't supported by technology |
| | Increases spectator/broadcaster costs |
| | Enables trolls to attack individual athletes |

| Advantages | Disadvantages |
|---|---|
| Increases participation | Detracts from intensity of physical activity |
| Promotes new and alternative opportunities | Reduces emotional wellbeing that comes from escaping digital pressures/routines |
| Supports less-wealthy sports to promote themselves | Increases costs to sports and participants |
| Leads to more coverage and revenue | Sponsors more interested in technology than sport or athletes |
| Adds glamour | |
| Improves safety | |

**Instant Replay**

Instant replay is an example of the remarkable technology being used in sports today. With this technology, officials are able to see exactly what happened, providing a second perspective on sports events.

Instant replay is used in games like cricket, American football, rugby, soccer, and even in combat sports. *However, FIFA banned instant replays on screens in sports arenas during the 2010 World Cup for fear that it might incite fans to behave untowardly.*

# Sensor Tools

Sensor tools are often used to analyze whether a goal is valid or not. It is often used in cases where the naked eye cannot truly tell if a ball went past the goal line. Different sports use varying sensor tools.

*For example*, cricket's Hawk-Eye technology analyzes sound to determine if the ball smashed into the bat before it was caught.

Hawk-Eye is also used to determine where the ball would have landed if it had not hit a player's foot. This establishes whether the ball was unfairly blocked from striking the wicket.

On the other hand, tennis sensor tools use laser beams to determine whether the tennis ball went out of bounds or not. *Sensor technologies help to accurately determine the position of the ball at a given time.*

Hawk-Eye technology, part of the Umpire Decision Review System, is **a complex computer system used to visually track the trajectory of the cricket ball**. The technology uses several cameras placed around the ground to create a 3-D image which shows how the ball will travel after it has hit the batsman.



ANIMATED SNICKOMETER

Umpire Decision : Out

ORIGINAL DECISION
OUT

OFFICIAL REVIEW
ROLEX
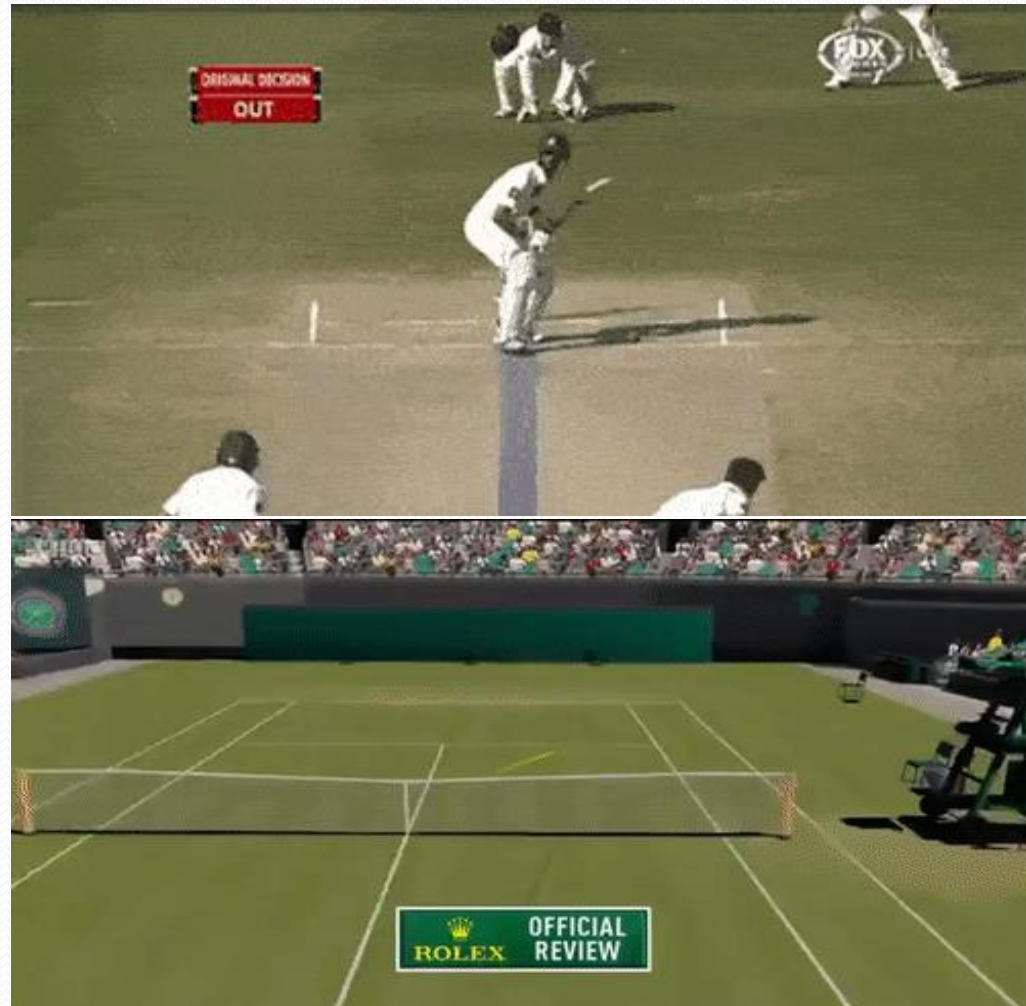
# Cricket and Technology...

## Hot Spot

- infra-red imaging system
- used to determine whether the ball has struck the batsman, bat or pad
- requires two infra-red cameras
- suspected snick or bat/pad event can be verified by infrared image which shows a bright spot where contact friction from the ball has elevated the local temperature.

## Snickometer

- invented by English computer scientist Allan Plaskett in the mid-1990s
- graphically analyses sound and video
- shows whether a fine noise, or snick, occurs as b passes bat

The Sony-owned Hawk-Eye system was developed in the *United Kingdom* by Paul Hawkins. The system was originally implemented in 2001 for television purposes in cricket. The system works via six (sometimes seven) high-performance cameras.

*The technology was first used by Channel 4 during a Test match between England and Pakistan on Lord's Cricket Ground, on 21 May 2001.* It is used primarily by the majority of television networks to track the trajectory of balls in flight.

In the winter season of *2008/2009 the ICC trialed* a referral system where Hawk-Eye was used for referring decisions to the third umpire if a team disagreed with an LBW decision.

In Serena Williams's quarter final loss to Jennifer Capriati at the *2004 US Open, Auto-Ref system was being tested during the match*.

In late ***2006 Hawk-Eye was tested by the International Tennis Federation (ITF)*** in New York City and was passed for professional use. Hawk-Eye reported that the New York tests involved 80 shots being measured by the ITF's high speed camera, a device similar to MacCAM.

The ***2007 Australian Open*** was the first grand-slam tournament of 2007 to implement Hawk-Eye in challenges to line calls.

The ***2007 Wimbledon Championships also implemented the Hawk-Eye system as an officiating aid on Centre Court and Court 1***, and each tennis player was allowed three incorrect challenges per set.

➢ ***2009 Australian Open, 2009 Indian Wells Masters,***

The Hawk-Eye system was one of the systems trialed by the sport's governors prior to the ***2012 goal-line technology (GLT) systems authorized by FIFA***. Hawk-Eye tracks the ball, and informs the referee if a ball fully crosses the goal line into the goal.

At the **2007 World Snooker Championship** the **[BBC](#)** used **Hawk-Eye for the first time** in its television coverage to show player views, particularly of potential snookers.

**On 4 July 2013, the Australian Football** League announced that they would be testing Hawk Eye technology to be used in the Score Review process.

**BWF(Badminton world federation) introduced Hawk-Eye technology in 2014 after testing other instant review technologies for line call decision** in BWF major events. Hawk-Eye's tracking cameras are also used to **provide shuttlecock speed and other insight in badminton matches.** Hawk-Eye was formally introduced in **2014 India Super Series tournament**.



GILCHRIST – WAGON WHEEL        102° (59)
● 1'S    ● 2'S & 3'S    ● 4'S    ● 6'S
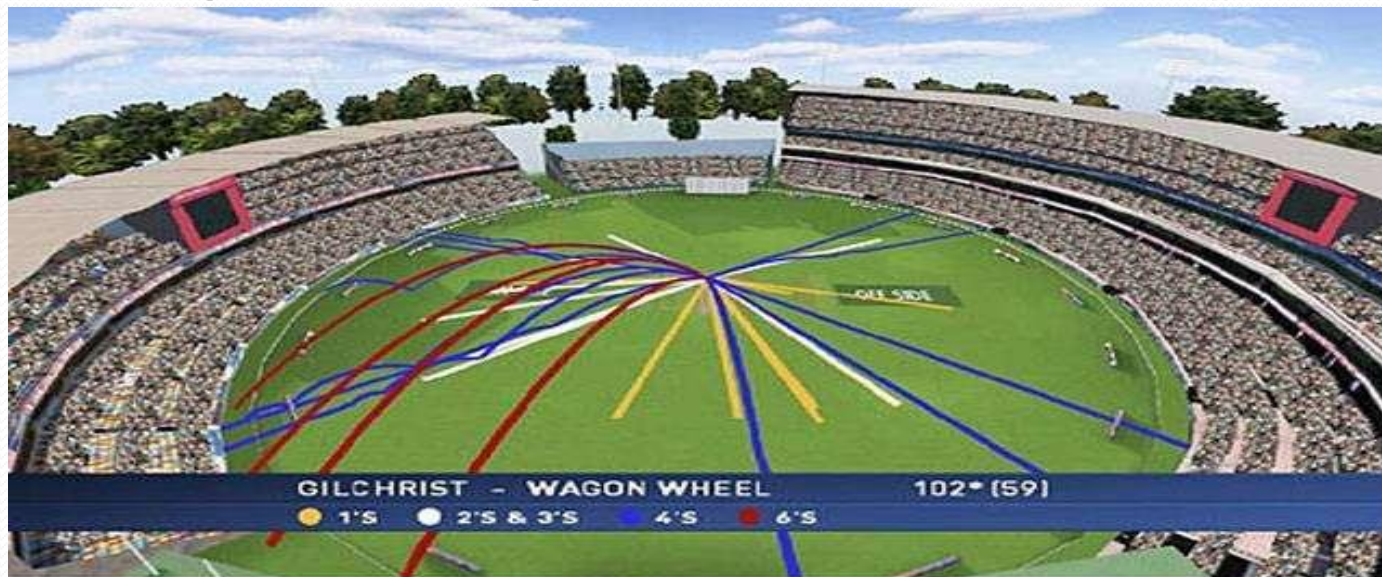
# Timing Systems

It means that differences in reaction time no longer affect the precision and consistency of a racing event. In many races today, the starter pistol is linked to a clock. Once the pistol goes off, the clock immediately starts timing the race. On the other hand, swimming uses a touch pad placed at the finish lanes as well as **wearable inertial sensors** to determine performance. Many racing events also use laser beams and photographs to determine winners.

# RFID Chips (RADIO FREQUENCY IDENTIFICATION)

RFID chips are often used to time individual contestants in an event. The devices use antennas that relay wireless signals. RFID chips are often used in long distance races to help broadcasters and viewers track the exact locations of contestants during a race.

**There are two types of chips used in races:**

- Active
- passive chips.

Active chips have an in-built battery or power source and can determine the exact time a participant crosses a specific line.

Passive chips can only be used with sensors placed in a mat because they do not have an in-built power source.

TAG

ANTENNA

READER

# EQUIPMENT DEVELOPMENT

Equipment manufacturers have developed devices to reduce injuries on athletes. In the 2010 season, special helmets were used in the National Football League after several players experienced concussion injuries. The helmets were designed to absorb shock caused by collisions and protect athletes from suffering head and neck injuries.





TPU CUSHIONING

VINYL NITRILE PADDING

TWO-LINER SYSTEM

# INSTRUMENT

## A tool or device for doing a particular kind of work
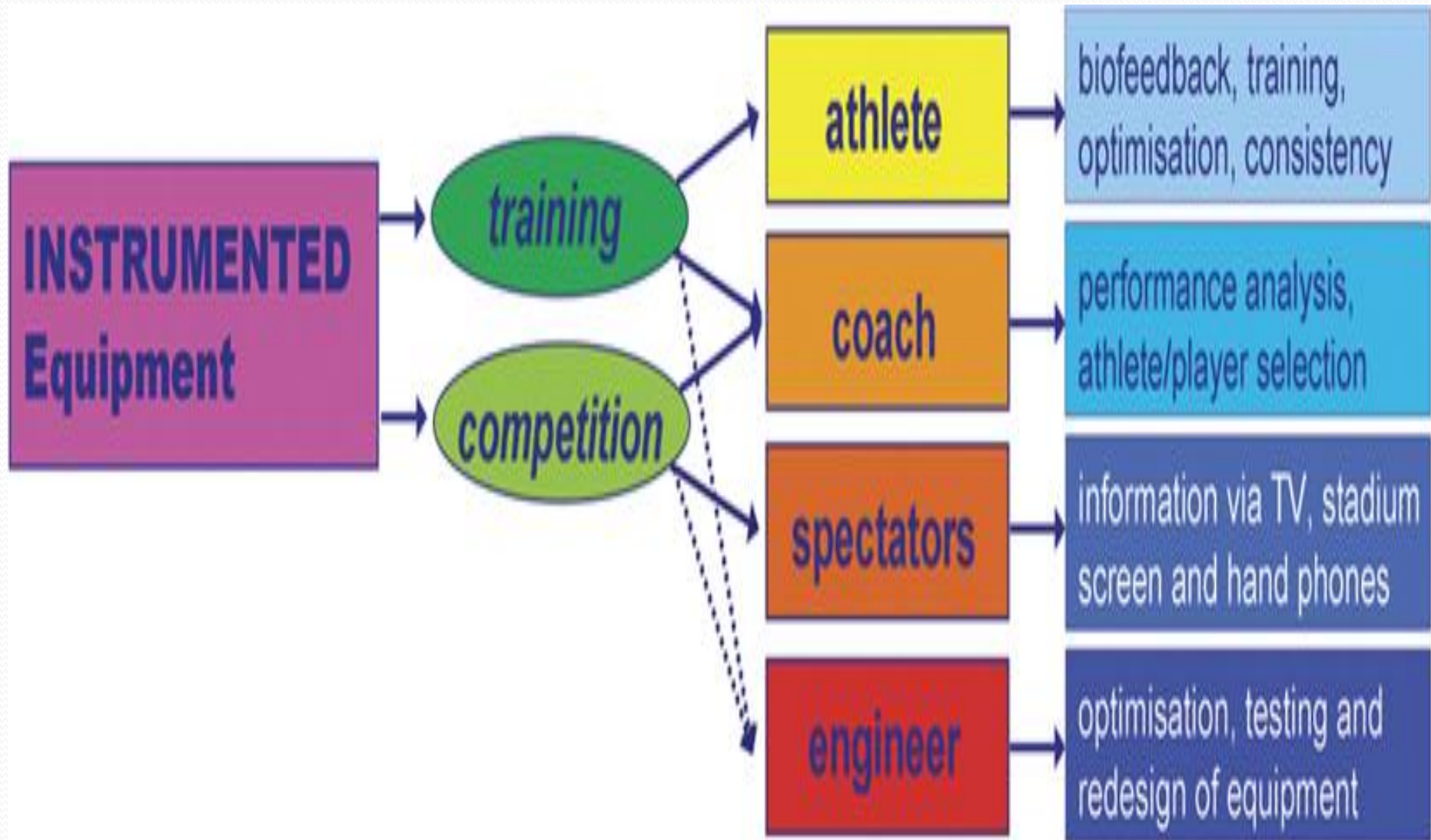
# PRINCIPLES OF INSTRUMENTATION

The purpose of adding instruments to sports equipment is primarily to *quantify performance* and to *optimize training*, and secondly for the entertainment of spectators.

## Design

The design of instrumented equipment is constrained by its size and mass and sometimes even by the material used. The selection of sensors, transducers, power supply, transmitters and microcontrollers depends on whether all required components fit into the equipment and do not alter its mass and moment of inertia.

# DATA STORAGE AND HANDLING

Data storage, transfer and basic signal processing is the initial step in preparing the data for analysis. Data can be temporarily stored in a small data logger or flash memory and transferred to the computer via USB port or via a transmitter wirelessly, or even immediately transferred (in real time) through wireless technology.

# Performance indicators

Performance indicators or parameters are those parts of the signal(s) which correlate with, and thus reflect and represent, the performance of the athlete.

In general, we distinguish between two different kinds of

(i)*performance indicators or parameters (ii) conventional parameters or advanced parameters.*

*Conventional parameters are those which are directly related to the performance, such as speed, and which are directly or indirectly measured in competitions.* The athlete who releases most muscle energy to the environment (definition of 'performance') and who minimises the loss of non-conservative energy (e.g. friction and aerodynamic drag) will have the highest kinetic energy and thus the shortest winning time.

Advanced parameters are those which result from the instrumentation itself these are new parameters which were not measurable before the era of instrumentation and were thus unknown. Each newly detected parameter has to be validated against existing and well-known conventional parameters to prove its applicability and importance.

*A multiple regression analysis relates all performance predictor variables to the criterion variable (e.g. winning time, jump height or maximal score) commonly used as the judging criterion in competitions.*

# Translating parameters

Performance parameters, conventional or advanced, have been identified, they need to be visualized graphically and translated to a 'language' which can be easily understood by athletes, coaches and even spectators.

For real-time monitoring, complicated graphs take too long to retrieve and understand the necessary information, such that effective use of, *for example, colour-coded graphical imaging allows quick decision making, in the style of at-a-glance diagnostics.*

# Smart equipment

The term 'smart equipment' refers to scenarios where the instrumented equipment 'knows more about the athletes than they themselves do' and provides invaluable extra information for the purpose of quantification of performance and optimization of training.

smart equipment is providing information at a level where the equipment replaces a sensory organ that is not simply missing but in fact never existed, and feeds the measured and processed signal back to the athlete.

# IMPACT OF SPORTS TECHNOLOGY

- Analysis of sport performance and enabling coaches to greatly improve the quality of feedback to players/athletes

- Increase accuracy in time measurements of sport performance

- Enabling referees, umpires and sport officials to make better decisions on rule infringements

- Improvements in the design of sport equipment and apparels

- Providing spectators with better viewing of sport performance