

GOAL-LINE TECHNOLOGY GETTING IT RIGHT

As the drone of the vuvuzela fades and the world recovers from the 2010 FIFA World Cup™ extravaganza in South Africa, one issue that will be on the lips of many a football fan around the world is whether goal-line technology has a place in the “beautiful game.” England player Frank Lampard’s disallowed goal against Germany in Bloemfontein on June 28 and various other controversial refereeing decisions at the FIFA 2010 World Cup™ are fuelling a long-standing debate about whether to introduce technology that can determine when a ball has crossed the goal line. The question officials have to answer, especially when a ball hits the cross bar and bounces down, is on which side of the line did the ball land? This article takes a look at two of the technologies that are possible candidates to support referees in officiating football matches.

Technology is now widely used to support umpiring and refereeing decisions in a range of sports. In tennis, it is commonly used to verify line calls, in cricket to back-up leg-before-wicket (LBW)¹ decisions and in rugby to verify tries. But in the world of football, the jury is still out on whether technology has a role in adjudicating the game.

A turning point?

FIFA, the world’s football governing body, has resisted the introduction of goal-line technology for some years. In March 2010, the International Football Association Board (IFAB), responsible for establishing the laws of the game, voted not to use the technology as they felt it was not good for the game. Following a number of controversial refereeing decisions at the 2010 FIFA World Cup™, however, FIFA has agreed to revisit the issue. Just days before the end of the tournament, FIFA General Secretary Jerome Valcke said, “I would say that it is the final World Cup with the current refereeing system.” He added, “The game is so fast, the ball is flying so quickly, we have to help them [the referees].”

Goal-line incidents have been the subject of great controversy and debate for many years. The most famous goal-line decision concerned the third goal scored by England (Geoff Hurst) in the 1966 World Cup final against West Germany. While 44 years ago the technologies available were limited, today the technological landscape is vastly different offering a range of possibilities that can assist referees in their decisions.

The two main candidate technologies for use in football are those produced by U.K. company

Hawk-Eye Innovations and German company Cairos Technologies AG.

Hawk-Eye: Tracking balls in flight

The Hawk-Eye system (PCT² application – PCT/GB 2000/004507), first developed in 1999 by Dr. Paul Hawkins, an expert in artificial intelligence, and Managing Director of Hawk-Eye Innovations, makes it possible to track the trajectory of balls in flight with a high degree of accuracy. The system is based on the principle of triangulation using the visual images and timing data provided by high-speed video cameras placed at six different locations around the area of play. This ensures that the goal is detected at times when players are huddled together at the goal mouth (for example, corners). As long as the ball is 25 percent visible, Hawk-Eye can track it.

Images are processed by a bank of computers in real time and sent to a central computer programmed to analyze a predefined playing area according to the rules of the game. This information is used to determine whether a ball has crossed a line or other rules have been infringed. In each frame sent from each camera, the system identifies the cluster of pixels that corresponds to the image of the ball. It calculates for each frame the three-dimensional position of the ball by comparing its position at the same instant in time on a least two cameras placed in different locations. A succession of frames builds up a record of the path along which the ball has travelled. The system generates a graphic image of the ball’s path and the playing area in real time and this information is readily available to judges, television viewers and coaching staff.

¹ The LBW rule is designed to prevent the batsman from using his body to stop the ball from hitting the wicket (and avoid being bowled out) rather than using the bat to do so. An umpire will make an LBW ruling under a range of circumstances and primarily when the ball strikes the batsman’s body (usually the leg) when it would otherwise have continued on to hit the batsman’s wicket (the stumps and bails).

² PCT – Patent Cooperation Treaty administered by WIPO

“As a player, and now as a TV commentator, I always dreamed of the day when technology would take the accuracy of line calling to the next level. That day has now arrived.”

Pam Shriver (TV commentator and former elite tennis player)



The system is even more astute than regular TV replays. A ball travelling at 60mph (97kph) moves at one meter per video frame on standard broadcast cameras which operate at 25 frames per second. Hawk-Eye uses cameras that operate at 500 frames per second making it possible to detect if a ball has crossed the goal line even for a fraction of a second.

The Hawk-Eye brand and simulation has been licensed to Codemasters, one of the oldest British video game developers, for use in sports video games and consoles.

Hawk-Eye was first used by U.K. broadcaster, Channel 4 during a Cricket Test Match between England and Pakistan on Lord's Cricket Ground in May 2001. It is now regularly used by network broadcasters in many high-profile sporting events.

The International Cricket Council (ICC), the international governing body of cricket, first trialed Hawk-Eye in the 2008/2009 winter season to verify controversial LBW decisions. The umpire was able to look at what the ball actually did up to the point at which it hit the batsman but could not look at the predicted flight of the ball thereafter.

Hawk-Eye was first used in tennis at the 2006 Hopman Cup in Perth, Western Australia. Players were allowed to challenge point-ending line calls and have them reviewed by the referees using the technology. It has now become an integral part of the adjudication process in elite tennis tournaments.

In the football stadium, Hawk-Eye's development began in earnest in 2006 with trials first at Fulham Football Club (FC) and then at Reading FC. The system has been independently tested by the English Premier League and IFAB. The latter had stipulated that the technology must be accurate to within 5mm and provide the required information to the referee in less than 0.5 seconds. Hawk-Eye meets each of these conditions.

“We think [Hawk-Eye's football system has] the right blend of simplicity and technology.”

FA Premier League Spokesperson

In an open letter to FIFA's President, Sepp Blatter, Dr. Hawkins says, "It is clear... that the technology fundamentally works and could be available for use within football if further in-stadia testing and development were permitted by IFAB and if there were decisive signals of intent to justify the investment in further testing."

The Cairos System - A microchip in a match ball

The second goal-line technology under consideration is that produced by German company Cairos Technologies AG in collaboration with Adidas. A number of international patent applications relating to this technology have been filed under the PCT.





The Cairos system involves embedding thin cables in the turf of the penalty area and behind the goal line. The electrical current that runs through the cables generates a magnetic field. A sensor suspended in the ball measures the magnetic fields as soon as the ball comes into contact with them and transmits data about the ball's location to receivers located behind the goal that relay the data to a central computer. The computer then determines whether the ball has crossed the goal line. If so, a radio signal is transmitted to the referee's watch within a split second.

Development began in 2006 and was first tested at the 2007 FIFA Club World Cup™ in Japan where it performed perfectly. At that time, Cairos teamed up with Adidas who "developed the suspension system for the ball, so that it keeps our chip safe inside the ball even when you kick the ball very hard," said Oliver Braun, Cairos' Director of Marketing and Communications. Adidas produced the test balls and those used during the FIFA Club World Cup in Japan.

One of the main concerns of those against using the new technologies is that of cost. They believe the costs of installation would be prohibitive and would create a two-tier system in football. Mr. Braun, however, explained that "Cairos bears the costs for the installation and will only charge the associations a percentage of what they pay the four referees for a match." As for Hawk-Eye, Dr. Hawkins, told Press Association Sport that his company would install its goal-line technology in every Premier League ground free of charge in return for rights to sell sponsorship around the system.

The verdict?

Only time will tell if the events of the past weeks prove to be a turning point in the use of these or similar technologies in the world of football. While the technologies are not 100 percent fool-proof, they are proving to be a useful tool for enabling umpires to better adjudicate and verify inconclusive incidents and promote fair play. Whatever FIFA's ultimate decision, it is clear that these technologies do have the potential to reduce human error and to make goal-line controversies a thing of the past.

The FIFA World Cup™ Trophy



The World Cup Trophy, one of the most recognizable trophies in the world, dates from 1970 and was crafted by Italian designer Silvio Gazzaniga. It is 36cm high, made of solid 18 carat gold and weighs 6.175kg. The year and name of each FIFA World Cup winner since 1974 is engraved at the base of the trophy.

The trophy, along with a number of other FIFA marks, is registered under WIPO's Madrid System for the International Registration of Marks, a cost-effective means of registering and subsequently managing trademark rights in multiple countries.