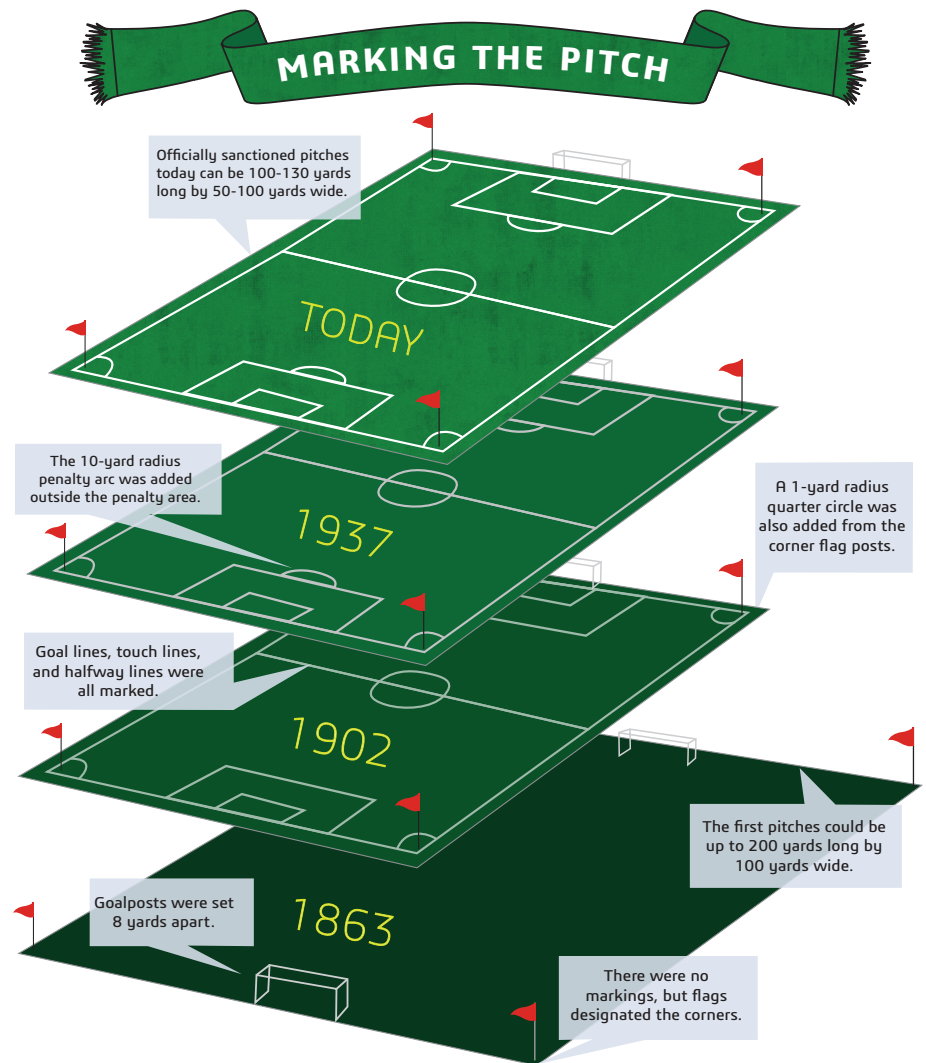
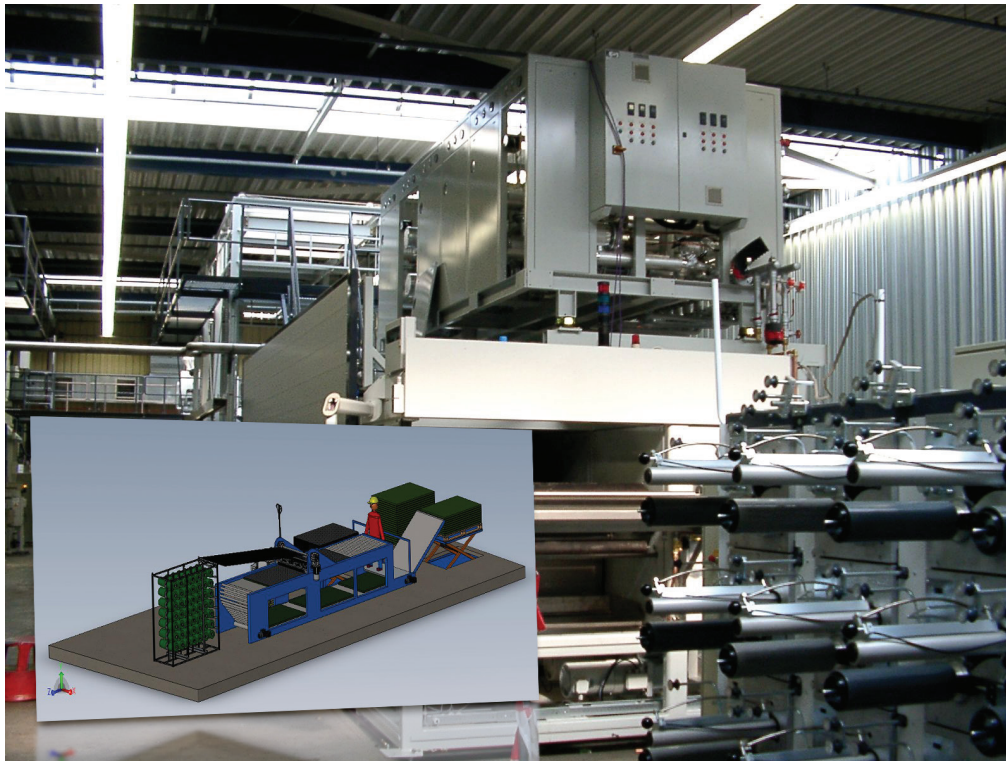


# THE TECHNOLOGY BEHIND THE WORLD'S GAME

Every four years, national football teams from across the globe clash to determine the best squad on the planet. For a month, fans are captivated by the action on the pitch to a point where life seems to be put on hold. For perspective on football's mass appeal, an estimated 1 billion people are expected to tune into the tournament's deciding game—almost 900 million more viewers than American football's most recent championship matchup.

Despite the staggering popularity of modern day football, the game emerged from humble roots. In 1863, Ebenezer Morley, "Father of the Association," summoned eleven London-based football clubs to the Freemasons' Tavern on Great Queen Street to design the rules of the game that we understand today. This meeting would result in the creation of The Football Association, the first group of its kind. While football has evolved over the last 150 years, the changes to the game itself pale in comparison to the technological advances that have emerged around the sport. From equipment and the turf to the stands and high-definition broadcasts, design and engineering have played a critical role in developing the modern game. Let's take a look at some of the on-field and in-stadium technologies behind the world's game.





**METAL machinebouwers bv**  
uses machines to create artificial  
fibers for synthetic and hybrid grass  
systems <http://www.metal.nl>

## ON-FIELD

If you find 90 minutes of running around on today's 100-yard-long pitch exhausting, stop and think about the marathon workout you'd have in 1863 when pitches were a gargantuan 200 yards long by 100 yards wide! With either size, there's a considerable amount of upkeep and costs required to manage a grass field. Maintenance and fiscal demands developed a need to invent artificial surfaces. In 1981, Queen's Park Rangers in London became the first professional football club to install artificial turf in its home stadium. While other teams quickly followed suit, footballers soon found that early artificial surfaces brought on odd bounces and an increased likelihood of injury. Eventually these side effects persuaded early adopters to return to natural grass.

The setback did not discourage engineers from going back to their CAD software. In 1996, hybrid grass systems, featuring millions of synthetic fibers injected into natural grass, were developed. Fast forward to the 2014 tournament in Brazil where hybrid grass systems have taken root at the Arena de Sao Paulo, the site of this year's opening match. These systems can take up to three times the wear and tear of natural grass and are installed in as little as three weeks. However, before the hybrid surface can take hold, its artificial roots are grown in CAD software. METAL machinebouwers bv, a Dutch machine design company, creates equipment responsible for the first stage in the installation process: creating the artificial fibers that will be planted into the ground. Once the fibers are installed, they are seeded with natural grass, which grows around the artificial surface resulting in a reinforced, uniform pitch.

When you're on the world stage, you can't leave things up to chance (no one wants to be responsible for having Lionel Messi carted off, courtesy of faulty turf). For that reason, football's governing body requires testing be applied to all surfaces. Dutch test equipment provider Deltec designs products to assess surfaces and ensure they're up to standard. These quality assurance assessments test turf surfaces against shock absorption and surface stability guidelines. As a testing company, Deltec is meticulous about its products making the grade. To be certain that the company's designs will function as desired, Deltec engineers its test equipment in state-of-the-art 3D CAD software.

## IN-STADIUM

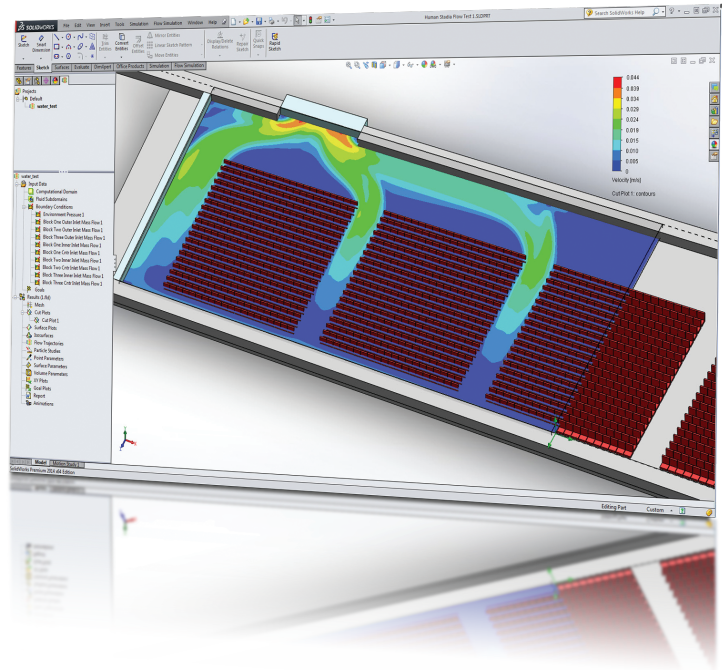
If a football match is played and no one is there to see it, did it really happen? For as much drama that unfolds on the pitch, the excitement and thrills only exist because fans are in the stands to bear witness. Without fans, the game would just be a group of players kicking a ball around. Unfortunately, football stadiums have a dark history. After a fatal 1989 stadium collapse that killed 96 spectators at Hillsborough Stadium in Sheffield, England, clubs took a hard look at fan safety and stadium design. English stadiums underwent dramatic safety revisions to prevent the overcrowding responsible for the Hillsborough disaster. As design technology evolved, so did stadium integrity, which led to a focus on overall fan experience. Look no further than Sao Paulo for proof. Featuring 75 bars, 13 VIP areas, two restaurants, wi-fi and a 170 by 20 meter LED video screen, Arena de Sao Paulo will be a shining example of how far stadium design has come since the 1980s.

In Brazil, fans won't be the only eyes fixated on the goal line. 30 years removed from 1984, Big Brother will make his presence known on football's biggest stage. For the first time in the tournament's history, technology will decide whether a ball crosses the goal line. GoalControl's goal-line technology will be installed in all twelve stadiums. The system consists of 14 cameras, seven for each goal, which are mounted on the stadium roof. GoalControl tracks the ball's movements in real-time by creating a 3D map. When the ball completely crosses the goal line, officials receive an instant notification via a wrist device. The implementation will hopefully make controversial calls, such as Geoff Hurst's 1966 game-winner and, more recently the blown call on Frank Lampard's score in 2010, a thing of the past.

Since the gathering of eleven clubs in 1863 to billions of viewers watching the tournament championship in 2014, football has established firm footing as the world's most popular game. Our experience in the stadium, everything from concessions to plumbing, begins with engineers focused on improving their craft. While on-field technological innovations often take a backseat to the Ronaldos, Maradonas, Pelés and Zidanes, that's the intention of their designers. The technology we use should exist in the background and enable footballers to decide the outcome on an even playing field. Luckily for spectators, we can now enjoy as the game plays out from luxury seats with connected devices at the ready to record the deciding strike. Thanks to dedicated designers and engineers, the sport will continue to evolve on the pitch and in the stands.

## FOR MORE INFORMATION:

**US and Canada 800 693 9000**  
**+1 781 810 5011**  
**[www.solidworks.com](http://www.solidworks.com)**



**Simulation technology** can demonstrate everything from stadium plumbing and structural integrity to how fans flow through the building, which is displayed in the above image.

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