METER
ENVIRONMENT

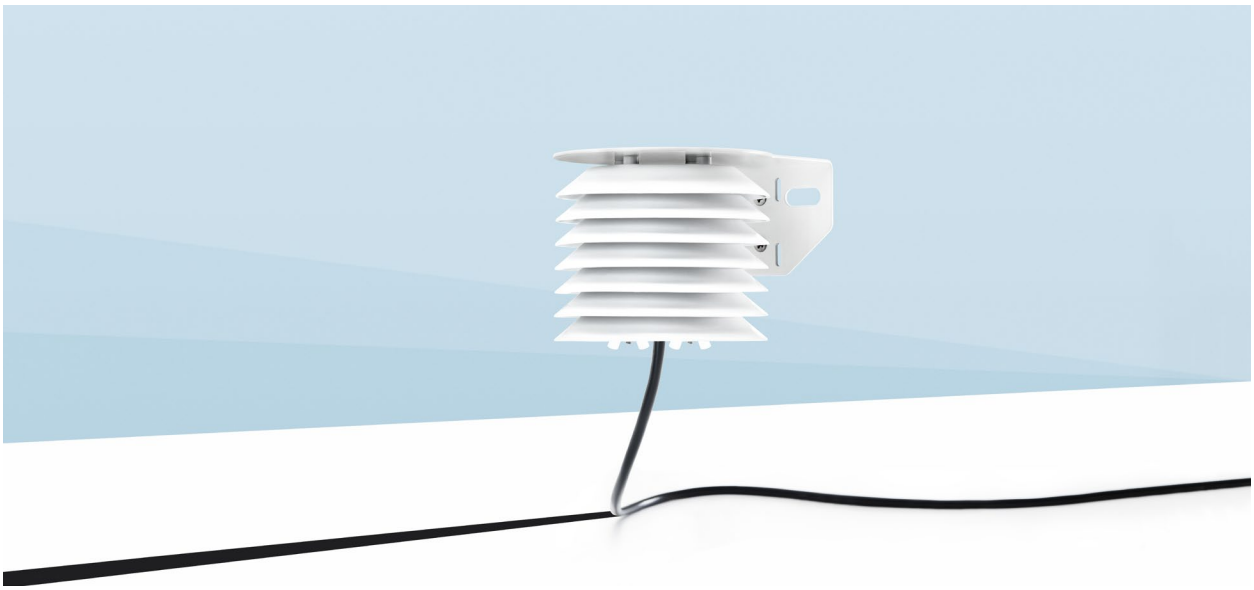
WHAT'S CAUSING THE HOME RUN SPIKE IN AMERICA'S FAVORITE PASTIME?

In baseball, the aerodynamic properties of the ball are critical. Pitchers rely on the ball to have a certain amount of lift so it can move in the air to the left or right based on how they throw a curveball. The ball can also speed up or slow down based on the amount of drag, or how much the air is resisting the ball's movement. Because of this, federations such as Major League Baseball want to ensure the ball doesn't change from year to year. In the past couple of years, a spike in home runs prompted the Major League Baseball federation to contract Washington State University sports science laboratory to help them better understand the aerodynamics of the ball. They want to know: did something change on the surface of the ball that allowed more home runs to be hit?

TINY CHANGES CAUSE BIG PROBLEMS

Even the slightest change in the surface of the ball, such as the seam height or the seam width, can have a large effect on the carry distance of the ball. Jeff Kensrud, assistant director of the WSU Sport Science Lab says, "These balls sometimes hit the wall 350 feet in the outfield, and if that ball would have travelled five more feet, it would have gone over the fence. That's why we're trying to quantify the aerodynamic properties of the ball so professional organizations can tell how far the balls are going to travel in the air when they're hit."

Kensrud says they have two experiments set up in the lab. One is an environmentally controlled chamber where they do all the bat and ball testing. He says, "We have to maintain 72 °F and 50% relative humidity 24 hours, 7 days a week because balls and bats change with temperature and humidity." The second experiment is an aerodynamic test lab where temperature and humidity are more challenging to control. They need to understand what the microclimate is because weather variables like temperature and barometric pressure are constantly changing, which can affect their calculations.



The ATMOS 14 measures barometric pressure, temperature, RH, and vapor pressure

To monitor these parameters, the team uses ATMOS 14 temp/barometric pressure/vapor pressure/and relative humidity sensors and a ZL6 data logger to get near-real-time feedback of what's going on in their Aero Testing Lab. Kensrud says, "Essentially, we have three sensors hooked up to the ZL6 logger at the beginning, the middle, and the end of our aerodynamic test tunnel. Every half hour, we'll check ZENTRA Cloud software and put that data directly into our computer so we have the most up-to-date weather information to ensure we're running our aerodynamic experiment correctly. The tunnel is 60 ft long, so we need to know if the temperature is the same throughout our testing station. A slight change in barometric pressure could alter our calculated coefficient of drag. Sometimes in a matter of a few hours a storm can roll in. And if we are checking that sensor regularly, then we can see drift in our coefficient of drag and we know it had nothing to do with the ball. It's just the barometric pressure in the city of Pullman changed."

HOW TESTS ARE RUN

To test the aerodynamic properties of the balls, the team projects balls into still air at up to 100 miles an hour. They then determine what the coefficient of drag and lift is, or how the balls behave in the airflow. And the team also tests bats. Kensrud says, "For 15 years, we've been the exclusive certification center for testing and certifying baseball bats for USA baseball, USA softball, NCAA baseball and most of the amateur baseball world. If you want to certify your equipment for play, it's going to come through our lab." For bat testing, researchers measure bat performance using real baseballs. The lab uses pneumatic air cannons that accelerate the ball from at rest up to about 140 miles an hour. The balls are released from the cannon and then impact the bat. Kensrud says, "It's as close as we can get in a laboratory to a real bat/ball collision on the field."

SENSORS HELP MAINTAIN PROPER TEST CONDITIONS

Kensrud says using the ATMOS 14 confirmed their hypothesis that there was sometimes a change in temperature over 60 feet in their concrete building where tests are performed. He says, "These sensors are constantly telling us if we have a temperature gradient and how severe it is. If you start out at 75 degrees at the beginning of the tunnel, but by the time you get to the end you're at 82 degrees, that could be a problem. Especially when you assume your temperature is constant. These sensors help properly monitor the temperature throughout the space and also give a very accurate barometric pressure reading in near-real time. That's critical for what we're doing because in this area we can get big storms coming in and out that can affect our measurements. If we have a change in barometric pressure or a temperature gradient of more than two degrees from the beginning to the end, we shut testing down to allow the space to acclimate. The data enables us to set up a go/no go approach to aerodynamic testing."

WHY BALL AERODYNAMICS MATTER

Kensrud says that this research is important to keep the ball constant. He says, "Some federations need to know when or if the ball has changed. Ball aerodynamics affect both pitching and hitting. The more precise our instruments are in monitoring, the more accurate the results are that we give to these Federations so they can make informed policy decisions on what to do with the ball, or how to keep the ball in spec for years to come."

WHAT'S THE FUTURE OF AERODYNAMIC SPORTS TESTING?

Kensrud says he'd love to continue testing for federations like Major League Baseball, but it would be fun to grow and expand into measuring the aerodynamics of other sports balls. He adds, "It's a bit of a stretch, but it wouldn't be impossible to think that one day we could be making some high-speed, in-flight, aerodynamic measurements for say, the aerospace industry. But that's not a contract. That's me putting my 'future cap' on."

You can learn more about WSU sports science lab testing here.

Discover the ATMOS 14 Temp/RH/Barometric Pressure/Vapor pressure sensor and the ZL6 data logger.

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