

## THE SCIENCE OF SOFTBALL

*By Dawn Hibbard*

For most, opening day of baseball and softball season is the official start of summer. For Dr. Dan Russell, associate professor of Applied Physics at Kettering University, it's more like a test lab for his research into the physics of the "sweet spot," "sting" of bats and another way to make teaching Physics fun for students.

Russell has used Physics to help manufacturers tune the "sweet spot" in composite and aluminum hollow bats used in softball, and he is currently doing research that may benefit the United States Specialty Sports Association (USSSA) and the Amateur Softball Association (ASA), the two primary governing bodies for softball in the country, to develop performance testing to certify composite game bats.

"Two things are currently impacting bat manufacturers," said Russell, "problems with the testing process to certify bats and the underground business of altering bats." The most significant problem with the test used to certify bats is that the manufacturers of softballs can't produce standardized balls. Slight variations in softballs result in some not having a tight enough tolerance for use in bat testing. "Players won't notice any difference in the field," Russell said, "but the lack of uniformity in softballs results in a huge variability in the test."

The current method the ASA uses for testing softball bats to determine their performance is called ASTM-F2219. This is a high-speed test for softball and baseball bats that verifies whether or not the science used in producing a particular bat is correct and meets current standards. Previously, to certify legal bats produced by manufacturers, the ASA utilized a slower speed test similar to the

bat performance factor (BPF) test still used by the USSSA, Russell said. "But eventually, companies figured a way around the tests and made bats that outperformed the test," he said. The ASTM-F2219 test became mandatory in 2004.

Russell believes there may be an alternative to high speed impact test using manufactured softballs. His research focuses on alternative test methods that are more repeatable and don't involve using a ball at all. "The ASA wants a test that will duplicate conditions in the field as closely as possible," he said, "some researchers are working on standardizing the ball, but I'm working on testing without a ball."

Altering bats to improve or hide performance capabilities is another problem for manufacturers of softball bats. "It's a big money market," said Russell of bat altering. "There are four levels of national championships in softball and teams are ranked based on performance and skill," he said. "Some guys are willing to pay \$300 to \$400 on a bat they will only use in one game to win a championship."

Composite and aluminum bats used in softball are hollow, which causes them to have what is called trampoline effect. Because it is a hollow cylinder, the bat compresses when struck by a ball. "It can squish like a spring, like jumping on a trampoline," said Russell. A wooden bat can't compress because it's solid.

The current test to determine if a bat has been altered or is legal for championship play involves putting bats in a vice and applying pressure to measure their spring factor. The testing method isn't totally accurate according to Russell and bat manufacturers are concerned that many bats will be disqualified based on inaccurate test results.

Russell has a proposal in to the Sporting Good Manufacturers Association to analyze and compare testing methods, and develop an accurate and consistent testing method to certify bats at championship games

that is cost effective and easy to use.

In addition, Russell and colleagues Dr. Lloyd Smith of Washington State University (WSU) and Dr. Alan Nathan of the University of Illinois at Urbana-Champaign developed "Bat-Ball 101," a course addressing the fundamentals of bat-ball impact and the science used in the development of current bat and ball test methods to help bat manufacturers meet USSSA and ASA regulations and still produce high performance bats.



*Dan Russell displays the pendulum test using one of the bats undergoing testing in the Acoustics Lab.*

Engineers, vice presidents and other leaders from bat manufacturers such as Easton, Louisville Slugger, Worth, DeMarini, Rawlings, Miken and Diamond as well as engineers from various bat-testing labs have attended the course.

The professors research relates to the science of bats and balls forms a perfect triangle for communicating information on the new tests, Russell said. His contribution for Bat-Ball 101 focuses on why certain bats perform the way they do. Smith describes the methods behind bat and ball testing, while Alan examines the science behind the new rules.

Russell plans to stick with the composite bats for his church league games and leave the wood to the pros. Is he tempted to test drive one of the "illegal" bats to improve his batting average? "No, I'm just out there to have some fun," he said.