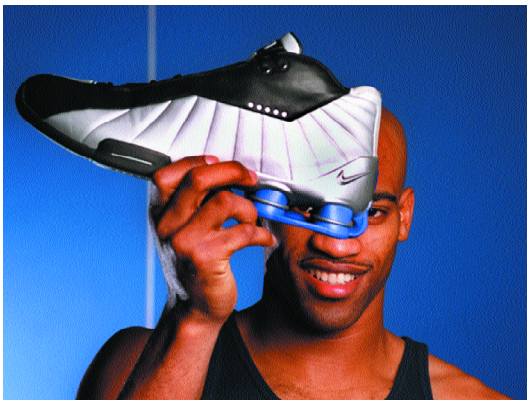


Seven doctors in a state of Shox

At the end of 2000, Nike Shox hit the TV screens of the USA. The principle behind the new concept, the most tested piece of footwear technology ever to come out of the Nike Sports Research Lab, is to add spring to the step of athletes, leading to improved performance without compromising protection or stability it is claimed. This article takes a look at some of the work done in the laboratory. The first shoe was aimed at basketball, the others that followed were for running and cross-training.

Mario LaFortune, a Ph.D who has been Nike Sports Research Lab director since 1996, leads a team of sixteen. Six of his colleagues also hold Ph.Ds in human biomechanics or related fields. The others hold Master's degrees in bioengineering, biomechanics or related fields. The team's kit (in this instance, machines and laboratory materials) is worth over $1.5 million. It's an indication of just how seriously one of the world's largest sports and fitness companies takes its development programme.

Nike's Footwear Advanced Research and Design department is housed on the first floor of the Mia Hamm building on the company's World Headquarters campus in Beaverton, Oregon. The department has two main facilities - the Nike Sports Research Lab (NSRL) and the Materials & Mechanical Test Lab.

Covering an area of 12,500 square-feet, the goal of the facility is to understand the needs of athletes and to incorporate its findings into developing high-performance footwear, while maintaining strict adherence to the company's three main aims of performance, protection and comfort.

The lab accomplishes these through biomechanical testing, and the ongoing measurement of consumer perceptions. NSRL is able to break down and analyse specific motions identified for specific sports, such as running, cutting, shuffling, braking, forward motion, backward motion, lateral movement, and jumping. A battery of technologically advanced equipment is used, including foot scanners, high-speed video, electromyography machines, Pedar in-sole pressure sensors and others.

Additionally the lab has at its disposal a variety of floor materials (hardwood for basketball, etc.) that allows a wide spread of sport playing environments to be replicated.

Impact

Making waves since 1984

The company has been experimenting with shoes and footwear for over 25 years - Nike Shox has been under development since 1984. One critical aspect of its development is a biomechanical test that measures impact forces. The subject wears a pair of the shoes fitted with seven reflective markers on the outside, or lateral side. The subject is then asked to run across a force plate set in the floor of NSRL. The plate is attached to a computer that measures the total load applied to the foot during running. At the same time, high-speed infrared video cameras capture the movement of the markers at 240 frames per second and record the data as the subject runs over the plate.

This data is co-ordinated with the signals from the impact plate to produce a set of three-dimensional 'kinematic co-ordinates' – reference points which map the positions of the shoe relative to the lower leg during running.

Electrodes

The Muscle Activity Test is equally sophisticated, using electro-sensitive sensors that are placed on the test subject's lower leg. According to NSRL researcher, Gordon Valiant, the electrodes measure the small electric currents of muscle activation. This signal is sent to a small amplifier that the subject wears in a fanny pack, and is then transmitted to a computer. The information is critical to quantify performance and protective function.

Pressure is measured with the use of a Pedar

Insole, which gathers data that helps plot and measure the loading of the plantar surface of the foot during the running motion. Once inserted into the shoe, the insole is wired to a computer that gathers the data. The information is used to tune the cushioning for different sports.

Similar kinds of range-of-motion tests are also done on treadmills and in the field.

The goal of the Lab is to ensure that materials, components and completed shoes meet the performance targets established by footwear designers and developers. The NSRL researchers work with athletes to find out what their performance needs are. The designers and developers then design components and select materials in an attempt to meet these needs. The M&M Lab evaluates new materials, new component designs and prototype shoes to determine if they meet the desired performance levels.

Components

The M&M Lab has over 40 different pieces of test equipment worth approximately $750,000 located in a 6,400 square-foot lab opened in 1999. Some of these items are standard materials-testing equipment. Other devices were custom made for use in the M&M Lab - its test engineers continually create additional custom test equipment for evaluating new components and designs.

Jeff Winston, the Director of the Material & Mechanical Test Lab, holds BS and MS degrees in mechanical engineering and has been on site for eight years, the first mechanical test engineer at Nike. Others who have joined his team since have brought a host of expertise in a variety of disciplines including aeronautical engineering.

Nike Shox underwent a series of mechanical impact tests designed to evaluate the heel and forefoot cushioning performance of athletic shoes. The typical impact test is designed to simulate the impact energy applied to a running shoe by a160-pound runner, running at a seven-minute mile pace. The test involves dropping a 17.2lb shaft onto a shoe or cushioning specimen to simulate the impact energy conditions that occur during the first 20-40 milliseconds of contact between the foot and the ground.

The Traction Tester evaluates the traction performance of various athletic shoe outsole designs on surfaces appropriate for that particular shoe. Traction performance is determined by measuring the friction forces developed while pulling a weighted shoe across the appropriate test surface, which is mounted to a high-precision force sensor. Traction tests can be performed in a straight line or in a rotational motion.

The Whole-Shoe Torsion Test is designed to measure the torsional stiffness of a shoe along its long axis. This is a fairly new test for Nike. If you grasp a shoe in the forefoot area with one hand and place your other hand on the heel area of the shoe, then rotate your hands in opposite directions, you are applying torsion to the shoe along its long axis. For some sports, some degree of torsional stiffness is desirable, but too much stiffness might be a problem. Nike uses this test to ensure that appropriate torsional stiffness levels are used in athletic shoes.

Durability

The Cushioning Durability Tester is designed to evaluate the durability of athletic shoe cushioning systems. Midsole foams compress over time as a function of use. This is generally assumed to cause a gradual reduction in the cushioning provided by the shoes. This test involves impacting a shoe cushioning system 300,000 times to approximate 500 miles of running use. Each impact approximates to the peak impact force applied to a running shoe during heel strike by a 150-160 pound runner wearing a men's size 9 shoe. The changes in thickness, stiffness and cushioning performance of footwear midsoles are measured.

Another test carried out in the M&M Lab, though not necessarily on the Nike Shox shoe, uses a device called the Swampwalker. It is used to evaluate the degree of waterproofness of shoes and boots. The Swampwalker has foot-forms that are instrumented to detect the presence of water. A foot-form is covered with a standard cotton sock and placed inside the shoe or boot to be tested. The boot is laced up and the foot-form assembly is mounted in place. The Swampwalker then moves the foot-form and boot in a walking motion inside a water-filled tank.

Yet a third form of testing is done before a shoe hits the market. For consumer perception testing and wear-testing, test subjects are often used to gather quantitative sensory information about the functional properties of footwear, using recognised scientific methodology. For Nike Shox, these testers had to meet certain criteria, like running three times a week, a minimum of 30 miles/week at an average training pace of less than eight minutes and thirty seconds for a mile.

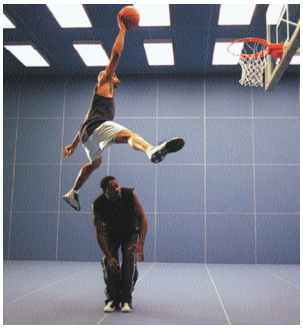
Experienced

Wear-testers are experienced athletes who are also chosen to use and abuse Nike Shox based on their abilities to discern subtle differences in materials and results. For example, potential wear-testers wearing only socks were asked to step on a variety of foam pieces, all with different densities, and asked to describe the differences. "You'd be amazed," says NSRL staffer Corinna Kupelwieser. "Some people can't tell the difference between any of them. Other people have super-sensitive feet."

NSRL will often screen as many as 100 potential wear-testers to select a final panel of 12. "It's time-consuming," Kupelwieser says, "but necessary for the rigorous and exacting testing that takes place at NSRL."

Once chosen, wear-testers will work through several months of testing and evaluating footwear product.

David Buirski



Nike Shox gives athletes the unique feeling of BOING in a new TV ad campaign that debuted in the US on Thanksgiving.