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Business

Relays go nowhere without computers

Technology leads the way at Penn's track-and-field meet.

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When the 104th Penn Relay Carnival begins today at Franklin Field, technology will be an unbilled star attraction.

The University of Pennsylvania's three-day series of track-and-field competitions provides a showcase not only for athletic prowess, but also for some of the innovations to affect the world of amateur sports in recent years, many of which have revolutionized the way events are judged.

On the track, for example, a system of digital cameras, computer monitors and software determines the official finishing times in all running events except the road race, and immediately posts them on the scoreboard and the World Wide Web. And on the field, an electronic surveying device has displaced the tape measure as a way of determining how far the javelin, discus and hammer are thrown.

Those are just the more exotic ways technology is being used. As Penn Relays director Dave Johnson puts it: "You can't run this meet anymore without computers."

The Relays uses a photofinish system called Finishlynx to handle timing and posting of results for running events. Finishlynx is made by a Woburn, Mass., company, Lynx System Developers Inc.

At least two digital cameras are trained on each of the stadium's three finish lines. Each camera captures continuous pictures of the finish line, operating at 1,000 frames per second and automatically recording the time each shot was taken. The timer is activated by the starting gun.

Each camera is linked to a computer, where the digital images come out as very narrow vertical strips. The computer strings together thousands of

these strips into a single image. On the computer screen, the finished product looks like a snapshot of several runners captured at the same moment, but actually it is a series of pictures of only the finish line, with each point along the horizontal axis representing how the line looked at a given instant in the race.

Using a mouse, the computer operator determines each runner's finish time by running a crosshair over the image. The time index changes as the crosshair moves. Each runner's finish time is determined by where the crosshair first touches the runner's chest.

The system will send the finish times to the Franklin Field scoreboard almost instantaneously, and the results will also be posted automatically on the Penn Relays Web site.

This marks the sixth year the Finishlynx system has been used during the Penn Relays. It replaced systems that relied on instant cameras and film. The pictures were limited in size and took valuable time to develop, and timing mechanisms were accurate only to a hundredth of a second, as opposed to a thousandth of a second with the digital system.

"The big advantage is that [Finishlynx is] linked directly to a computer system," said Johnson, who has been affiliated with the relay carnival for nearly two decades. "The image and the data are all stored electronically. It can be manipulated; it's not a static report where you hand a piece of paper with numbers on it to a typist. . . . It's essentially going from an analog basis to a digital basis."

Newer to the relays is technology that uses a beam of light and a computer instead of a tape measure to determine distances in the javelin, discus and hammer throws. (Tape is still used in the shot put, because of the short throwing distances involved.)

The electronic measuring system works by triangulation, the method employed by land-survey crews.

The first point of the triangle is the radius point, which lies on the circle or arc where the athlete stands while making the throw.

The second point on the triangle is a fixed location on the field where an electronic sighting instrument is placed.

The third point of the triangle is the spot where the thrown item lands.

Immediately after the throw, a marker containing a prism is placed at the landing point. The person operating the sighting instrument then sends out a beam of infrared light to the prism to measure its distance from the instrument.

Because the distance from the radius point to the sighting instrument is

already known, once the distance from the instrument to the prism is determined, the third leg of the triangle -- the length of the throw -- can be calculated.

The measurement process takes just 10 to 15 seconds, according to John Boyd, whose Horsham firm, Boyd Instrument & Supply Co., supplies and operates the equipment, made by Topcon Corp., of Tokyo.

Boyd said the measurements were accurate to within 5 millimeters, or 0.19 inch. He said distance measurements obtained that way are truer than those obtained using fiberglass tape, because they aren't affected by slopes or dips in the ground.

Boyd said that some athletes had been skeptical about the system when it debuted at last year's relays, but that, by and large, it has been accepted.

Johnson added: "The better athletes have been exposed to it in Olympic trials, Olympic Games and sports championships. It's just a sign of technology catching up with things."

For More Information

Many Penn Relays results will be available immediately on the Internet at http://www.upenn.edu/relays/eventsandresults.html

To see a demonstration of the Finishlynx system, go to http://www.finishlynx.com/simulation.html