

Hoops 2.0: Inside the NBA's Data-Driven Revolution

By Erik Malinowski

OAKLAND, California — Outside Oracle Arena, it's a balmy 65-degree spring day. But up in the building's rafters, 80-odd feet above the hardwood floor, the air is crisp and the view vertigo-inducing.

They tell me the future of professional basketball is up here somewhere, but all I'm trying to do is step carefully along the 30-inch-wide catwalks without dropping my notebook on the performers below. They're busy rehearsing for their performance during the Golden State Warriors' final home game of the season, still some seven hours away.

"Well, you're going to have to look down if you want to see the camera."

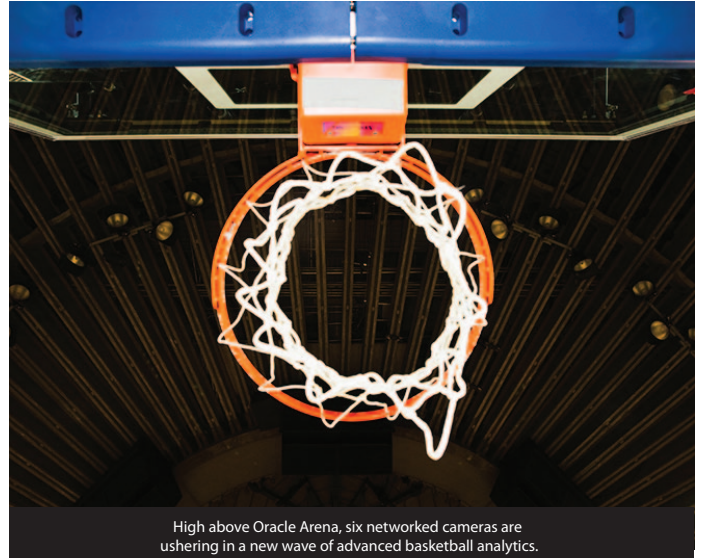
Travis Schlenk, the team's director of player personnel and resident stats geek, has already been up here three times this season, so you'd think this would be no big deal for him, but his sweaty palms are grasping the railing the same as mine. He's right, though. About six feet down, affixed to one of the giant concrete beams supporting the Oracle Arena ceiling, is a nondescript yet professional-looking videocam staring down at the eastern half of the court.

There are five more of these cameras strategically placed within Oracle Arena, and while a sellout crowd of 19,596 watched the hometown team destroy the playoff-bound Portland Trail Blazers by 24 points that evening, these eyes in the sky were streaming high-quality video to servers in the Midwest.

The system is called SportVU, named for the Israeli startup that developed the tech. Stats, the Chicago-based data-crunching outfit in charge of this whole operation, is hoping a six-team pilot program conducted this season will usher in a new era of advanced basketball analytics.

Forget box scores that just show rebounds, assists and shooting percentage. How about calculating dribbles per possession, or the miles each player runs in a half? These previously unquantifiable statistics, along with myriad others, are now a reality in today's NBA.

And while 80 percent of league teams still haven't wised up to the coming wave of data analysis, SportVU can boast three of this season's six division winners as clients, as well as upstart squads like the Warriors. With more teams seemingly ready to jump aboard next season, the basketball-analytics tide has decidedly turned. and the game may never be the same.



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From Science to Slam Dunks

Contrary to all indications, SportVU doesn't have its roots in sports at all. The firm was founded in 2005 by Miky Tamir, an Israeli entrepreneur who earned a Ph.D. in physics and worked for the Soreq Nuclear Research Center for 12 years. His speciality is in advanced optical recognition and image processing, and Tamir founded the company six years ago based on missile-tracking technology he had developed.

SportVU started out analyzing soccer games by recording ball and player motion more than a dozen times per second. The footage was piped through SportVU's proprietary algorithms to plot the data on a three-dimensional grid. What resulted were not only custom animations and tailored scouting reports, but also virtual reams of CSV data that could be further parsed by third parties.

SportVU made different kind of headlines during the 2008 U.S. presidential election when it provided CNN with its now-famous Jedi-like holograms of anchor Jessica Yellin during the network's coverage.

Stats — itself jointly owned by the Associated Press and Rupert Murdoch's News Corporation — had already been eyeing the startup for some time. Less than a month later, it bought out enough SportVU investors to take control of the company. The algorithm-development team stayed in Tel Aviv, while data management and processing was centralized in Stats' Chicago headquarters.

Once acquired, Stats executives knew they had to move beyond soccer. (This is the United States, after all, where soccer often rides the proverbial pine in favor of more popular activities.) Enter Brian Kopp, Stats' VP of strategy and development.

He's the guy saddled with the task of convincing any franchise willing to hear him out that the SportVU system really might change how the team plays the game. Kopp and his colleagues were left with the critical decision of deciding which sport best lent itself to the optical-recognition functionality SportVU was offering.

"Baseball is kind of a one-to-one game," Kopp says. "Yeah, there are some elements of the fielders, but most of what goes on is the pitcher-batter dynamic. And within all these other sports, there are so many other players involved, and the flow of the game is so important." And with companies like Northern California's Sportvision having already claimed that part of the analytics market with its successful PITCHf/x system, Stats looked elsewhere.

Football was soon ruled out as well, although Kopp maintains that it's "certainly something that we're working on." Before long, basketball emerged as the front-runner for SportVU expansion. With its consistent scoring, there'd be enough data points that the company was sure teams would be interested, and the relatively confining nature of the game — a regulation NBA court is only 94 feet by 50 feet — meant it would be simpler to film. (Oh, and the NBA is a \$4 billion industry, which probably helped matters, too.)



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Just one problem: Kopp had to convince NBA teams that it's a program worth joining. Without team participation, there'd be no data to collect and the effort would be fruitless. And besides, teams have had access to play-by-play data for decades: simple, textual rundowns that efficiently map how a game played out. A brief scan of a one-page printout as you're running into the locker room at halftime, and a knowledgeable coach can determine intermediate-level metrics like assist-to-field-goal ratio and turnovers-per-minute on the fly.

"You don't want to come in and say, 'Look at all this cool technology. Look at all this data it can spit out,'" Kopp says. "People think that's cool, but teams had one of two reactions. One is, 'That's great, but I don't understand what it means.' The other was, 'What am I going to do with that?'"



Kopp set out to approach those teams he felt would be most receptive to new technology: "It's not like we offered this to all 30 teams." Those charter members — guinea pigs? — were the Houston Rockets, billionaire Mark Cuban's Dallas Mavericks, the San Antonio Spurs and the Oklahoma City Thunder.

An encouraging start, but none are huge media markets. Who'd be the next big fish? LeBron James' Miami Heat? How about the Chicago Bulls, just a few miles from Stats headquarters? A well-timed, offhand conversation at a small Northern California college would soon determine all that.

Right Time, Right Now

As it happens, the Golden State Warriors weren't looking to become a part of the NBA's semisecret pack of data-minded revolutionaries. Hell, Warriors fans were just happy enough to be rid of despised former owner Chris Cohan, who sold the team last summer to venture capitalist Joe Lacob (a partner at Kleiner Perkins for 24 years) and film producer Peter Guber.

Lacob's 22-year-old son Kirk, the team's newly minted director of basketball operations, brought a fresh face and youthful energy to the front office, while Schlenk provided experience and contacts. But it another member of this forward-thinking triumvirate who started the whole process with Stats.

In mid-October, opening night for the 2010-11 season was still 11 days away when Pat Sund, the team's basketball operations coordinator and son of Atlanta Hawks general manager Rick Sund, found himself at the Northern California Symposium on Statistics and Operations Research in Sports. While there, taking in all the sports geekery one could

expect to encounter at tiny Menlo College, he bumped into Dean Oliver, a former director of quantitative analysis for the NBA's Denver Nuggets, who's since become ESPN's first-ever director of production analytics.

Oliver talked up the system to Sund, who took the info back to Schlenk and Kirk Lacob at Warriors HQ. Within weeks, the Warriors staff had contacted Stats and a technician was flown the 1,850 miles to scope out SportVU's potential West Coast testing ground.

But before all that could be finalized, Golden State had to prepare for the coming season. The team, coached by former Indiana University hero Keith Smart, went on the road to face the Houston Rockets, who had already enlisted as one of SportVU's first four teams. They'd be trying out the system in earnest for the first time that night.



One of the six SportVU-enabled cameras covering Oracle Arena.

The visiting Warriors won a 132-128 nail-biter, and though SportVU was collecting tracking data on them, Golden State didn't get detailed, customized reports uploaded to the team's FTP site the next morning the way Houston did.

Sure, Schlenk and Smart saw that All-Star guard Monta Ellis pumped in 46 points and newcomer David Lee had 17 points and 15 rebounds. But they weren't privy to the same kind of knowledge and analysis that Rockets general manager (and MIT grad) Daryl Morey and his crew had.

Two-and-a-half months later, that all changed.

Fun With Numbers

Time to fess up: It's not really about the cameras. You might think that a slick cross-continent video-delivery and data-analysis pipeline would depend much on the quality of the cameras it's using, but Stats brass doesn't think that.

In fact, they won't disclose the make and model of the cameras they use. For them, it's all about the data.

"The power of our system is in the software, not the hardware," Kopp says.

Indeed, it's this custom software, anchored by SportVU's proprietary algorithms, that parses the data being collected 25 times a second from each equipped arena. The software even deciphers and identifies every dribble and pass, based solely on optical movement of the ball and its relative distance to the players.

"Once we have the data ingested and processed, then we have a number of queries and programs we've written to generate those reports and those CSV files," Kopp says. "We've made it so that process is fairly automatic."

For all that comp-sci wizardry, the Stats crew has helped articulate and define gads of previously unseen metrics. Through the Warriors' first 14 SportVU-enabled home games at Oracle Arena, data showed that guards Monta Ellis and Stephen Curry were accounting for nearly 60 percent of the team's entire ball possession.

Curry, the team's point guard, had gotten 937 touches of the ball over that time, compared to 948 for Ellis, the team's leading scorer. More interesting for the Warriors was seeing that the team had a 51.5 shooting percentage off passes from Ellis compared to 44.6 percent from Curry.

Stats can also take the data and turn it into top-down graphical representations of how each segment of the game played out, for a perspective of the game and its flow never before seen by players and coaches.

Stats brought this kind of insight to every other client as well. Should Houston guard Kevin Martin shoot the ball after holding it more than four seconds? Probably not.

Is there more to San Antonio center Matt Bonner's remarkable three-point shooting this season than blind luck? Better believe it.

And let's just say veteran point guard Jason Kidd still protects the ball as well as he ever did when he was a rising star at the University of California at Berkeley.



There have been plenty of other new data points, ranging from points per touch to catch-and-shoot field-goal percentage to secondary assists per game, even how physically far apart the players are from their defenders during the game. But what are coaches today doing with it, and is the sport prepared for such a statistical overhaul? These are questions that remain to be answered.

"Everyone sees that there's going to be a lot of value here. It's just a matter of what that value is going to be," says Schlenk. He adds that while Smart and the Warriors' coaching staff have seen some of the SportVU reports, "they haven't really done a lot with it."

Beyond trying to sway entire coaching staffs, most of whom boast decades of combined NBA experience, just the mere implementation of the SportVU system can be tricky. Oracle Arena, which formally opened in November 1966, presented a unique design challenge. The setup requires that the six cameras be installed at specific points, so as to analyze the exact angles of gameplay as in other arenas.

In any modern venue, it's normally a simple installation that could be done by a single technician in an afternoon. But because of the unique interior of Oracle Arena, Stats had to go back and remap where the cameras would be installed. It settled on two central overhead cameras — one above each side of the center-court line — and a pair overlooking each side of the court from above the seating bowl.

To nearby patrons, as well as members of the press sitting just 10 feet below, they look like something akin to high-end security cameras. But to Warriors executives, coaches and fans, they represent something much more intangible: hope.

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Hoop Dreams

Of course, it's too late now for the beleaguered Warriors, who wrapped up this season at 36-46, 10 games out of the final Western Conference playoff spot. And with this NBA offseason heading into uncertainty because of a looming work stoppage, Travis Schlenk and his scouts may have more time than they'd prefer to pore over a half-season's chunk of data.

Kopp readily admits that teams are more than welcome to take those CSV files supplied by Stats and look elsewhere. If they can get more usefulness out of them from another company, so be it. "We've identified dribbles and touches and passes based on our own logic, but a team could say, 'No, I want to define it based on my logic.' But then they have to go through and build that logic in, and then they need to aggregate all that data into reports."

'We want to make sure we're giving coaches something that's useful. We don't want to give them something that's going to waste their time.'

That's exactly what Golden State hopes to do. Just a few hours before Schlenk took me high above the Oracle Arena court, he'd been in contact with a Southern California data-mining company that he believes could make good use of the team's raw data.

"We want to make sure we're giving coaches something that's useful. We don't want to give them something that's going to waste their time," Schlenk says. "All due respect, if you give them a sheet of paper that tells them how far a guy ran, is that really going to help them prepare? No. But by next year, and certainly once this season ends, we'll have a chance to dig into those numbers. And if we join up with this company, hopefully we'll be able to find something and say, 'This is important.'"

But greater penetration across the league will increase familiarity with the system, which will ultimately lead to wider acceptance, even among NBA lifers. Still, coaches may be surprised to learn how widespread it's become already. Because of the quirks of the NBA schedule and how it meshed with the Warriors' own SportVU implementation, Golden State ended up playing more than 40 percent of its games this season in SportVU-enabled arenas.

And Golden State did sport a .477 winning percentage after implementing SportVU, compared to .395 before. Concluding that the influx of daily reports and analysis had anything to do with that change would be speculative at best, but it does indicate that the team is improving talentwise, and the new management group seems open to the idea that analytics could be another component in rebuilding a once-dominant NBA franchise.

"We're very open to looking at new analytics and existing analytics," co-owner Joe Lacob told CSN Bay Area in a recent Q&A. "I just don't want anybody else to have any edge over me."

In fact, the most successful NBA franchise in history, the Boston Celtics, signed on just a month ago as the sixth SportVU-equipped team. For now, they're up 1-0 in their best-of-seven first-round playoff series against the New York Knicks.

SportVU clients San Antonio, Dallas and Oklahoma City make up three of the eight Western Conference playoff teams. Because of the info-sharing agreement among all the signatories, the Western Conference finals could get really analytical, if Dallas and San Antonio eventually face off with a trip to the NBA Finals on the line.



Next season, Kopp hopes to enable near-real-time functionality, so that the tracking data can be synced up to the play-by-play data in less than 30 seconds, providing a close representation and analysis of on-court play almost as it's happening. It's just one of several enhancements Kopp says the company has lined up, assuming there is basketball next season.

Once, Kopp couldn't help but let his inner geek out and refer to the 2010-11 season as "our beta season." And if the NBA and the players' union can work out a labor deal this summer, everyone should see this burgeoning analytics movement ready for release in time for fall.

Photos: Jon Snyder/Wired.com