

Inventory monitoring measures up

Accurate inventory management is a critical step in cost analysis

By Timothy Erdman

When taking inventory of biomass material in a multi-story, high-bin tank or silo, plant personnel often have a challenge on their hands. Can a single-point measurement provide an accurate inventory reading? Probably not. Typically, a material's surface is uneven. So how to determine what's level and what's not? And it's not just the level of material that needs to be determined, but also its volume.

Every time a bin measurement is off by just a percentage point, the error can be worth thousands of inventory dollars, according to BinMaster, a manufacturer of bin level indicator and control systems. As both raw material costs and the corresponding inventory carrying costs escalate, a sound inventory management system (IMS) becomes increasingly vital to a company's fiscal bottom line.

These modern inventory "tools" are like today's word processing software replacing the Underwood typewriter. Systems like 3DLevelScanner and SmartBob not only replace the old-fashioned method of tape measure. They also minimize a serious hazard – preventing operators from accidentally – sometimes tragically – falling from silo ladders.

BinMaster's 3DLevelScanner can be used to measure wood chips and other kinds of biomass. The non-contact device also measures materials like sand, cement, limestone, flour, soy meal and distiller's grains, as long as the material is at least 12 lbs per cubic foot, in order for the scanner to read it accurately.

What about dust?

"Few solids exist which don't generate a significant amount of dust," said Mike Mossage, 3DLevelScanner product manager for the Lincoln, Neb., firm.

Unfortunately, a dusty environment is a fact of life in just about every storage vessel. That can be problematic for other technologies, like radar and ultrasound, where the signal can get "confused" and send back an inaccurate reading. The 3DLevelScanner improves on that drawback, but its low-frequency signals allow it to "penetrate" and "ignore" the dust.

Multiple point measurement

The scanner's sensor is acoustically based.

"It operates between 2 KHz and 10 KHz," Mossage said. "Other sound-based devices operate in a low frequency range as well, but they give you a single-point level of measurement. The 3DLevelScanner operates on this low-frequency spread, which is the audible range. It can determine not only the time it takes for echoes to bounce off of surfaces — it can also figure out the angle."

The method is based on triangulation, similar to what your GPS is, Mossage said.

"It maps the material's surface," he added. "It takes the peaks and valleys into account, giving you a very accurate

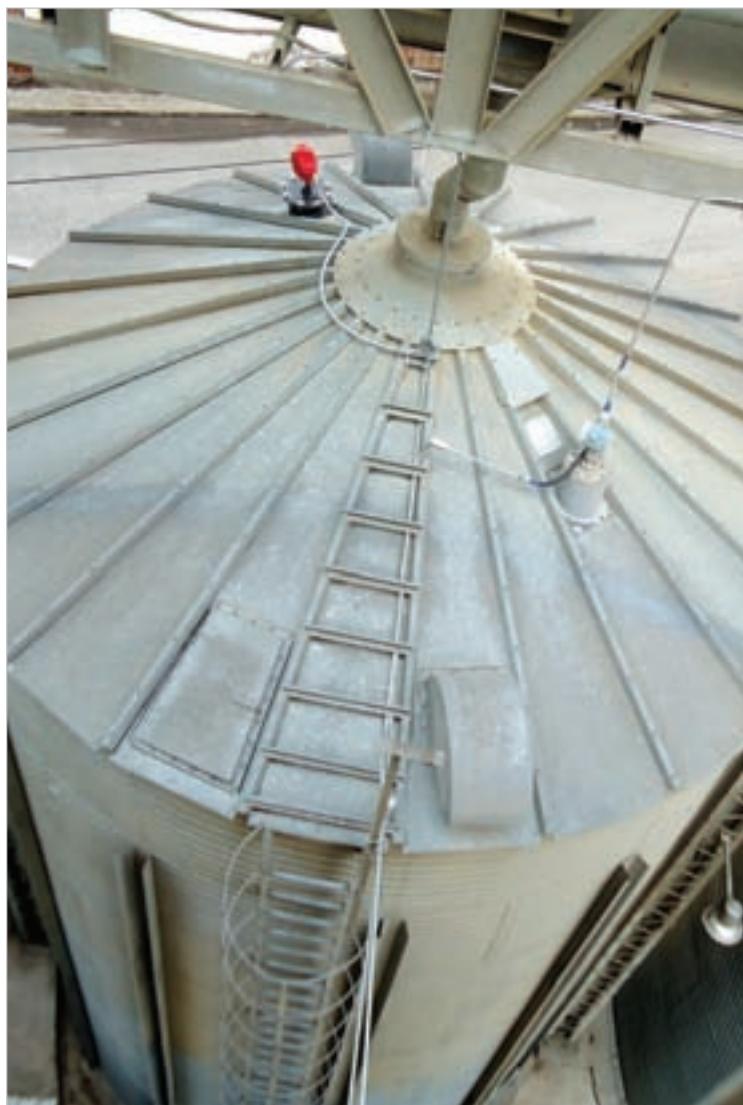


Figure 1. The 3DLevelScanner installed on a corrugated steel bin used for wood pellet storage.

volume reading."

The scanner actually maps the material's topography and takes those peaks and valleys to give an accurate volume, Mossage said, in addition to the three-dimensional representation, "so that you can see the material's 'cone up' and 'cone down,' side wall buildup, things like that. In that low-frequency range, it works well in heavy dust. The scanner is reliable and repeatable."

Data is given in minimum, maximum and average levels.

The system's redundancy is based on three independent, self-cleaning transducers. Covering each transducer is an aluminum alloy membrane, encapsulated in a Teflon-like material, making it very slick, "so that no material sticks to it in the first place," Mossage said, adding that acoustic pulses

also can make the sensor vibrate and help shake any nearby material loose.

When it comes to assimilating the data, the operator has options. An available software package in 3D visualization for a PC provides those average, minimum and maximum point levels, as well as the volume.

“There’s also a 4 to 20 mA analog output signal that you can run from the device,” Morsage said. “This can be pulled into a plant automation system like a PLC or DCS, and it will monitor levels in the same manner.

Vibrating rods

BinMaster also has what it calls its “point level” products.

“Those basically will tell you when your bin is empty and when it’s full. It’s more of a process control,” Morsage said.

The firm’s latest vibrating rod type technology is geared for high temperatures. Called the SHT, or Super High Temperature, the rod features a piezo system specifically developed for higher process temperatures up to 250°C (484°F).

The SHT’s durability relies in part on a reinforced membrane, as well as an insulation tube on its piezo system. This tube insulates the electronics from excessive heat. The stainless steel probe and electronics are mounted inside an enclosure made from IP66 and IP67 aluminum alloys for added protection. The device has been in demand for biomass and wood bioenergy for materials like wood pellets.

“Our vibrating rod technology and rotary level indicators are used in biomass applications, mainly wood pellets,” Morsage



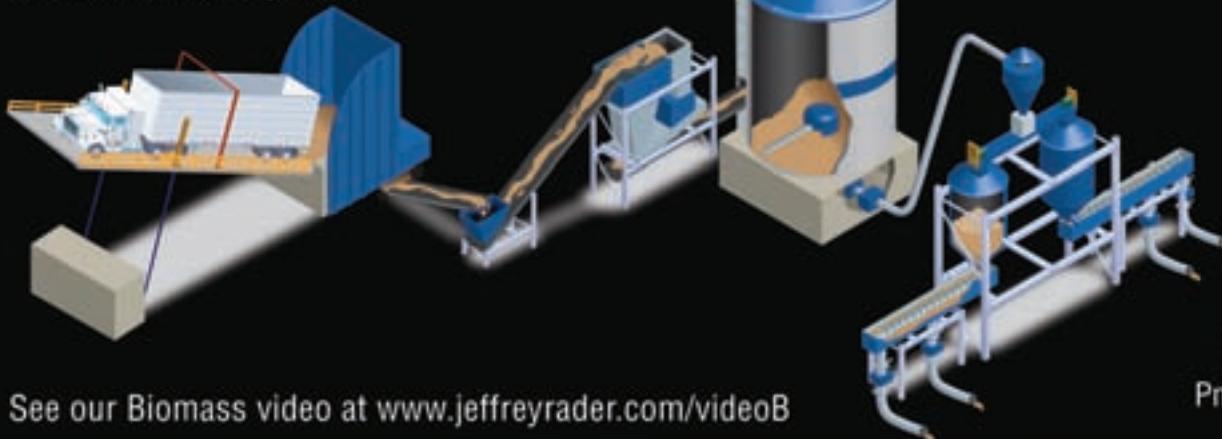
Figure 2. The scanner can be used on large diameter silos such as 105’ and greater since it measures multiple points of the material surface.

said. “We’ve done a little bit with switchgrass as well, which is an extremely light material.

“For inventory management there, we’ve used our SmartBob, sometimes referred to as a yo-yo system because it has a sensor probe that’s attached to a high-quality air draft cable. It’s mounted on top of the bin, and the probe just descends until it comes into contact with the material. When

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Figure 3. The user can view real-time data for multiple bins on a single screen using MultiVision software from an office.

it feels a little slack, it takes a measurement, than retracts. The concept is similar to somebody dropping a tape measure, except that it's more reliable and repeatable. You just remove the factor of human error."

SmartBob's sensor works like an automatic measuring tape, but without the danger of climbing bins to take measurements. The sensor can be set at predetermined intervals according to the desires of the operator, regardless of

Post-aerating with Tank Connection

The biotechnology firm Biothane states that anaerobic treatment is a proven, energy-efficient way to clean brewery wastewater.

"Low energy use, a small reactor surface area, lower chemical usage and no sludge handling costs are advantages of this technology over aerobic alternatives," according to the Camden, N.J., company. "Furthermore biogas is produced during anaerobic treatment, which can be used by the brewery as a renewable energy source to replace part of the fossil fuel use."

A division of Veolia Water, Biothane was recently selected for construction of a wastewater facility as part of a distillery in St. Croix, Virgin Islands. Three reactors – each 136' in diameter, 5 stories high, and with a 4 million gallon capacity – will use a base setting ring (BSR) design, topped by a floating membrane cover. For the distillery's 120,000 gallon post-aeration tank, the firm has contracted with Tank Connection. The Parsons, Kan., firm, noted for its rolled, tapered panel bolted tank design and LIQ Fusion 7000 FBE™ coating system, will provide complete turnkey field installation. The service will utilize a synchronized, hydraulic screw jack process, enabling field crews to install liquid storage tanks at grade level.

whether that interval is once every hour or once a day.

Probe applications

An updated version is the SmartBob II. When the latter is located at the top of the silo and asked to take a measurement, the motor releases a pulley-drawn stainless steel aircraft cable. As a weighted sensor probe descends to the material's surface, the remote takes a measurement of the drawn cable. A microcontroller counts pulses from an internal encoder at 80 pulses per foot. As the probe contacts the material's surface, measurement data is transmitted. The pulses stop, causing the motor to reverse itself, retracting the probe.

Financial benefits

An accurate inventory management system can mean the difference between money well spent and money spent needlessly. Using a tape measure or other previous form of measuring in all likelihood will not get you any kind of money-saving accuracy. For example, volume data can have varying results when measurements taken across a bin differ

by several feet. Another inventory variance can occur when measuring the same point in the bin, regardless of whether the cone is up or down.

On the cost-prevention side, accurate measurement can help prevent a silo's collapse. BinMaster notes that early detection using its 3DLevelScanner can help the operator avoid excessive damage to the silo and surrounding structures. This also serves to help keep insurance costs under control. Another advantage is theft detection. Continuous monitoring under precise conditions can help detect unexplained variations and pursue a follow-up investigation.

"We have used the 3DLevelScanner with good success in wood chips and pellets at several biomass facilities," Mossage said. "The wood applications can be very dusty, and the scanner's low frequency technology penetrates dust reliably. Also, depending on the moisture content, the chips and pellets may hang up on the bin's sides, so multiple-point mapping is a big benefit as well."

Habit over reason?

"Devices like these help keep people off the tops of silos," Mossage said. "People doing things the old fashioned way, like dropping a tape measure, won't get the kind of accuracy because, again, they're just taking a level of a single point in their silo. Then again, there are people dying every year climbing bins and silos, especially in bad weather."

With the availability of today's technology, avoiding unnecessary accidents – let alone inventory accuracy – is reason enough to be using an advanced acoustic-based level measurement systems. 🌿

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