

Automation of Stacker/Reclaimers for Bulk Materials

3D Reclaim Control

- Real-time capable, obscurant penetrating scanner
- Full virtualization of the control system
- 1500 nm wavelength laser, easily penetrating even dense fog or dust
- No need for a control PC on the machine
- Automated stacking and reclaiming even for difficult stockpile geometries – also after landslides during rainfall or manual processing by e.g. dozers

Customers

Westshore Terminals facility at Roberts Bank, Canada – North America's largest and most advanced coal terminal – and numerous customers all around the globe operating bulk export / import terminals, mine sites as well as stockyards at power plants or steel making facilities.

3D Reclaim Control

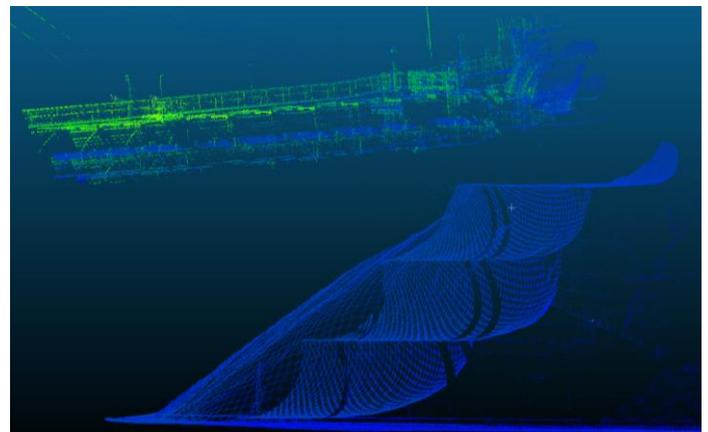
iSAM built the first fully autonomous stacker/reclaimer in the Port of Hamburg in 2000. To date, there is still no better alternative to the fundamental technology behind the system – 3D LiDAR and RTK GPS.

However, for the recent upgrade of Westshore Terminals facility at Roberts Bank, Canada – North America's largest and most advanced coal terminal – iSAM elevated it to a new level of speed, performance and capability using the best technology available today. The key improvements are a real-time capable, obscurant penetrating 3D scanner and the full virtualization of the control system, eliminating the need for a control PC on the machine.

The new 3D LiDAR delivers 200.000 points/second, focused around the bucket wheel thus allowing true 3D reclaim control. While volumetric reclaim control has been part of the system since 2011, the new high-speed scanner allows a much better handling of "landslides" close to the bucket wheel. Furthermore, it uses a 1500 nm wavelength laser, easily penetrating even dense fog or dust.

The higher scan rate would normally require a much more powerful processing unit right on the machine where it would be exposed to high vibration levels and other environmental influences. But at Westshore, only the sensors themselves are out on the machine – all the processing takes place on a virtualized and fully redundant ESXi server which is located in the

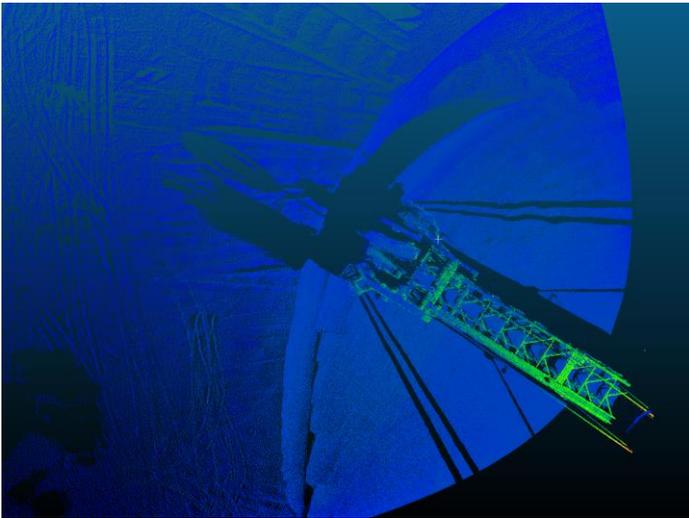
central data center. Apart from minimizing system downtime due to fewer components on the machine, the central location allows a much easier accessibility and maintenance of the system.



3D scan data from a single scanning system mounted on top of the machine apex (side view of machine boom and bench profile, ground to top layer)

Terrain Model

Using state-of-the-art scanner technology combined with a link to the latest multi-constellation GPS receivers allows generating a terrain model with a high degree of accuracy in real time. The terrain model is the basis for calculating individual movement commands for the three movement axes of the stacker/reclaimer. Algorithms stored in the system secure the optimized stacking of stockpiles and ensure a strategic reclaiming of the material. This results in high and constant outputs without overloading the stacker/reclaimer. The real-time terrain model guarantees that even stockpiles that have been stacked unconformable in manual mode or trimmed by wheel loaders may be reclaimed automatically.



3D scan data from a single scanning system mounted on top of the machine apex (top view of machine boom, bench profile and even dozer imprints on top of pile)

Optimized Scanner Mounting Location

The 3D scanner detects bulk materials from a distance of more than 200 m. Therefore, it is possible to mount the scanner on machine's apex - away from the zone of dust emissions and vibrations around the bucket wheel.

Easy-to-Use Operator Interface

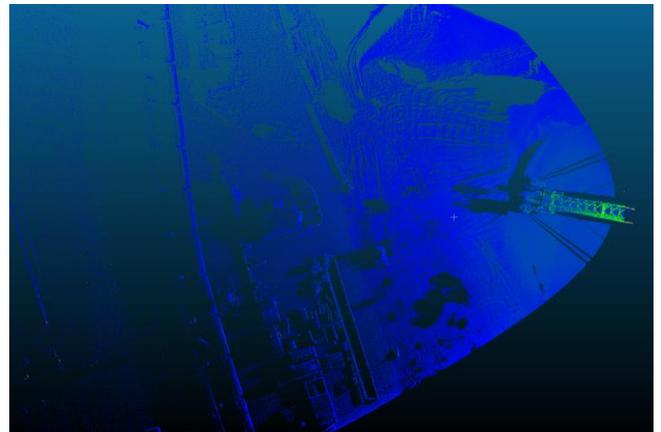
To define a job order, the operator in the central control station just needs to enter the storage location, the amount of material as well as the desired strategy for stacking or reclaiming. After release of the operation, the stacker/reclaimer moves to the calculated starting position autonomously and handles the order. During reclaiming, first cuts and changes of cuts are carried out completely automated, without the "air digging" often seen with conventional automation approaches during the first slews or turnaround points.

Blending Orders

The system also has advanced blending capabilities which allow reclaiming of a single order with multiple reclaimers at a controlled ratio. This ensures that an optimized blending mix is created by incorporating the individual machine performance into a high-level flow controller. Combined with an advanced conveyor load controller - which tracks the product throughout the facility - and autonomous train or ship loaders, this solution allows for a fully automated export process chain.

Highlights

- Automated 24/7 operation under virtually any weather conditions
- No loss of time due to additional scanning runs; permanent update of the terrain model
- Output comparable to values that can be achieved in manual mode with qualified and experienced operators
- Short return on investment due to
 - optimized stockyard utilization as a result of flat-surfaced, trapezoidal stockpiles with an almost perfect layout ensuring optimum reclaiming performances
 - less "air-digging" and bucket wheel overloads resulting in homogenous material flow during reclaiming
- Automated stacking and reclaiming even for difficult stockpile geometries – also after landslides during rainfall or manual processing by e.g. dozers
- Operation of several stacker/reclaimers by one person from a central control station; minimum stress for the operator because of a high degree of automation
- Less wear and tear because mechanical performance limits are respected in automated mode
- Neat representation of the overall stockyard with color coding for the stockpile heights; support for an easy terrain and job planning
- Reduced environmental impact (e.g. dust emissions and energy consumption) by automatically minimizing the distance between boom and stockpile



3D scan data from a single scanning system mounted on top of the machine apex (top view of machine boom, administration buildings and passing train in ~200 m distance)

Facts

Customers:	<ul style="list-style-type: none"> ■ Westshore Terminals facility at Roberts Bank, Canada and numerous customers around the globe 	Software:	<ul style="list-style-type: none"> ■ iSAM Stacker/Reclaimer Automation ■ iSAM Conveyor Load and Blending Controller
Industries:	<ul style="list-style-type: none"> ■ Bulk material export and import terminals ■ Mining and bulk product processing facilities 	Data output:	<ul style="list-style-type: none"> ■ Fieldbus/Ethernet to machine PLC ■ Variable interface to 3rd party planning system
Hardware:	<ul style="list-style-type: none"> ■ 3D LiDAR scanner with obscurant penetration ■ RTK GPS system for machine positioning 	Visualization:	<ul style="list-style-type: none"> ■ iSAM 3D Stockyard Model ■ iSAM S/R Visualization