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## Unique technology provides 3D reproduction of the recovery of bulk solids at the Port of Tubarão's stockyard

This year, Vale began its first tests of a stockyard bucket wheel reclaimer simulator. This unique technology provides a detailed 3D reproduction of the process of retrieving solid bulk goods, exactly as it is undertaken in practice by the reclaimer machines installed at the stockyard at the Port of Tubarão, a company port located in Vitória (Espírito Santo, Brazil). Developed in partnership with US company GlobalSim, the simulator is designed to train professionals to operate this type of equipment. Vale has invested around US\$ 1.5 million in the technology, which the company plans to deploy at its other port terminals across the world as of 2012.

In a completely adapted cabin, the software simulates the retrieval of iron ore, coal and pellets in different scenarios ranging from adverse weather conditions, such as strong rain or wind, to restrictions or defects in the reclaimers. In a virtual reality environment, the simulator also considers all of the reclaimers' characteristics, such as speed of rotation, elevation and motion. In addition, the software makes it possible to simulate two machines operating on the same pile of bulk products, the setting off of alarms, and overload situations, in line with the type of operation practiced by the student.

According to Vale's general manager of Port Innovation and Development, Gustavo Mucci, the students' performance in operating the equipment will be evaluated by the system itself, which stores the scores obtained during each training session. "In this way, we can track the development of future operators and pinpoint where improvements need to be made", he says.

To ensure that the actions carried out in the reclaimer simulator are as close to reality as possible, another innovation incorporated in the equipment is the mathematical modeling of all the products handled on Vale's stockyards, such as iron ore, pellets, coal and coke. "This enables the simulated recovery rate to be similar to the real one, making the simulator even more realistic for students", explains Mucci. Bucket wheel reclaimers, which reach up to 39 meters in height, are machines used to retrieve bulk materials at stockpiles at Vale's mines and port terminals.

Besides simulating how reclaimers operate, the software provides a detailed picture of the entire stockyard at the Port of Tubarão, the world's biggest exporter of iron ore and pellets. At Vale's other operational areas where the tool will be used, the respective stockyards will be simulated, so that students in the simulation booth see the same images they will see when operating the actual reclaimers.

### Innovating in employee training

In addition to the reclaimer simulator, a number of other tools for training workers have been developed as part of Vale's investment in logistics innovation and development:

#### Off-highway truck simulators

As the name indicates, these tools simulate the operation of the giant off-highway trucks used at Vale's mines. The simulators, resembling super video games, permit total interaction between the student and the images shown on the screens, which reproduce mining environments. Seated on the simulator's chair, students find themselves in a perfect

reproduction of an off-highway truck cabin, with a virtual space ahead that accurately simulates the mining area where they will be working. In this system, students can feel what it is like to operate a truck both during the day and at night, in fog and rain. The sound and light alerts are also authentic reproductions.

### Train simulators

Designed to develop and enhance the know-how of locomotive engineers (known as train drivers in the UK and some other countries) on the Vitória-Minas Railroad (EFVM), Vale's train simulators reproduce everyday railroad operations. The technology is installed at the Vale Engineering Center, which is also home to a portable simulator for use in railroad engineering research, and simulators of LOCOTROL distributed power system trains (which have locomotives distributed between train cars). To make the environment as realistic as possible, the Engineering Center has a replica of a locomotive cabin, complete with an onboard computer, control panel, accelerator and brake, among other features, as well as a screen at the front of the cabin reproducing the EFVM's tracks.

To simulate locomotive operations in an ever more realistic manner, Vale has started testing a new simulator, developed in partnership with the University of São Paulo's Polytechnic School. Installed at the Engineering Center in Vitória, the equipment, which has taken an investment of around US\$1.3 million to develop, provides an accurate 3D reproduction of Vale's railroads, as well as enabling simultaneous training via a virtual railroad network. The aim is to train locomotive engineers using a completely Brazilian state-of-the-art technology, which will result in safer operations, fuel savings and reduced wear and tear in locomotives and train cars.

### Dynamic helpers

Dynamic helpers are extra locomotives designed to couple with moving trains to help them up steep hills. Previously it was necessary to stop the train to add on the helper engine before continuing onward, but now the procedure takes place in motion, by means of a dynamic coordination process. It is estimated that using this technology cuts fuel consumption by up to 5%, given that trains use the most fuel when they brake and stop.

The system uses lasers to align couplings. The helper waits on a siding beside the main track. Once the train has gone past, the helper "chases" it along the main line, they synchronize their speeds and then couple while in motion. The operation takes place automatically, with the locomotive engineer monitoring it rather than performing it manually.

### Online mapping

The technology employed in online mapping is based on the use of 3D laser scanning equipment installed on the booms of stockyard machines. These scanners collect images and send them to a central server that processes information on the profile and volume of stockpiles. The system then generates 3D images and relays them to a computer in the port's control center. In all, US\$ 270.000 has been invested to implement the pilot project and develop the technology.

This unprecedented technology will further improve the operational safety of stockyard movements, raise loading productivity and enhance the quality of inventory data collection.

### More information



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