Landing the loadout

Steelmaking coal loadout station equipped with indurad iLoadout radar system at Teck's Fording River Operations

Teck Resources recently announced its RACE21™ mining innovation team has supported an on-the-ground team in designing a new radar system to load railcars safely, efficiently and accurately. The iLoadout system was supplied by indurad - Paul Moore caught up with its Executive Director and Founder Reik Winkel about the technology and the advantages it brings in terms of functionality, performance and safety

Q Is it correct that iLoadout helps with both loading speed as well as preventing underloading? Firstly, why is such a significant speed increase possible with iLoadout?

A Lets break this up in three major success drivers, which are all based on our unique radar machine vision technology. First the reduction in underloading is facilitated by 2D/3D volumetric scanning close to the chute on the InGo side for residual and on the OutGo Side on full volume and we use this in a predictive control loop. Additional potential is unlocked with 3D surge bin scanning for buffer capacity. Finally, we include inflow iBelt volume scanning and compare this with belt & track scales in a smart density control loop. Secondly, the train speed has been driven up by providing proper locomotive collision avoidance as the chute is lowered for dust control and choke feed. We do this by using our Doppler speed radar and 'radar PE-Cells' and so model the virtual train movement. Thirdly, the reliability of our hardware to function in snow, dust and steam typically created by warm coal, whilst also being maintenance and cleaning free, provides transparency for things which are invisible to human eyes.

Q Secondly, is underloading a big problem in bulk minerals railcar loading and why?

A Not only underloading is a big issue - but also overloading and wrong load distribution. With underloading, train capacity is lost and this creates more transportation cost and more emissions. Overloading causes spillage and cleaning costs on tracks and has in addition caused derailments in many places in the world as tracks are usually decades old and at their axle load limit. Wrong load distribution with a variance between the front and rear bogies is a major risk that can also result in derailment.

Q Is radar the only real option for railcar loading or are other technologies like laser also used? Do they both have their own specific pros and cons?

A Laser is a perfect instrument for surveyors to use for high range scanning - the beam stays sharp over hundreds of metres - but this is not required for short range and for rough bulk surface scanning. When you go to Canadian mines, radar is really the only option. Hot humid coal is loaded in freezing weather causing steam with visibility of less than 1 m. Lasers reflect well and with steam being white, the dark coal behind is not visible any more. Fog causes the same issue. Within Australian coal, we have seen some installations with laser technology, however, auxiliary devices such as purge air are required to keep the lens clean - which need to be maintained and just mean there is an additional failure cause. Our first iron ore iLoadout automated at Vale Carajás in Brazil is still working with the original sensors supplied by us over 10 years ago and enables the train to carry 1 t of extra ore per car over 900 km to São Luis, so saving about every 100 th train - over a 10 year period that equates to about 500,000 t of saved CO_2 emissions.

Q What technology is currently used in railcar loading for railcar positioning and can this be improved with iLoadout?

A Key technology for positioning are photoelectric cells - referred to as 'PE-Cells' or light-barriers. However, these are discrete positioning information systems that commonly require 10-20 sensors to be installed - all with sensors and

Reik Winkel, indurad Executive Director and Founder

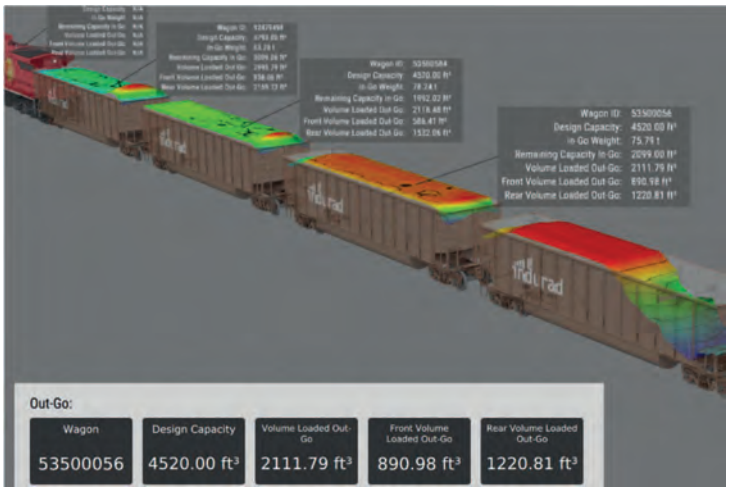
receivers - resulting in 30 sensors to be cabled, maintained and all representing points of failure. Besides, train dynamics due to the mass/spring effect can cause noise in the process. Cleaning them with water jets make them often even more dirty by splashing mud.

Q How widespread is iLoadout used in surface mine railcar loading today and can you give any examples?

A indurad has installed iLoadout all around the world. We have more than 50 installations globally from Siberia to Canada, Brazil, South Africa and Australia. For example, in Australia we have installed our technology in about 20 coal loading stations - half in NSW and half in Queensland - with more than 20 additional stations in iron ore - including all 14 stations of Rio Tinto and Roy Hill as well as a growing population at FMG and BHP. Another flagship project is Africa's largest train loadout at Exxaro's Grootegeluk mine which has been a greenfield project completed about two years ago.

Q Does it also optimise load distribution and if so how does it do this?

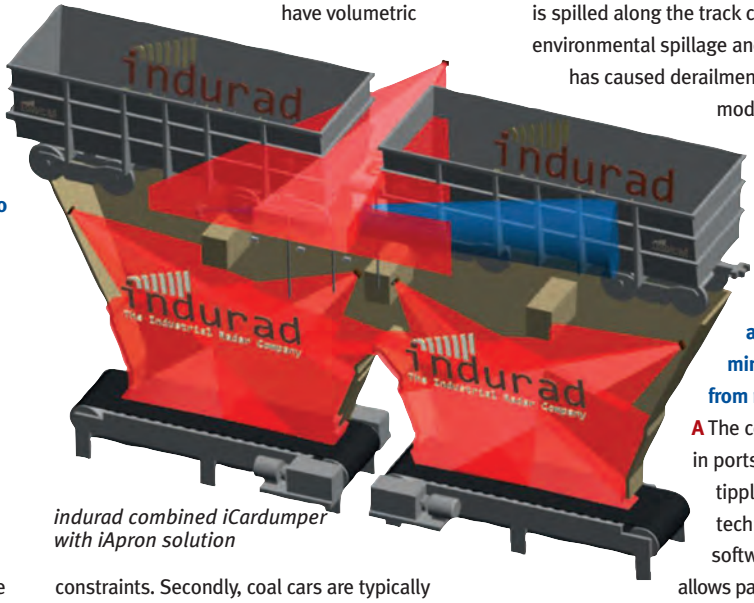
A The load distribution is key and it is a very complex function with many unknowns. For example, it depends on the accuracy of position, speed, bulk density, bulk flow, clamshell actuator accuracy and many more parameters. indurad attacks the problem from both sides: we increase the accuracy of the data using belt scale, belt volume, loading volume, track scale, speed measurement, position measurement, bulk angle of repose measurement etc to increase the predictive result. The second side with the volume distribution measures the actual bias left and considers the data for the next railcar - whereby track scales are typically a few railcar lengths out of the station causing a lot of latency and issues in control loops.



indurad iLoadout 3D HMI Visualisation

Q Equally how does it help to minimise spillage? Are open or faulty bottom dump doors a problem in bulk handling in mining?

A Spillage is caused if railcars are volume limited - this is often the case for coal - as being lighter than iron ore. But some iron ore cars have volumetric constraints. Secondly, coal cars are typically bottom or side dump cars - not requiring a wagon tippler at the port. This, however, means that the doors are often not properly locked and material is spilled along the track causing loss of product, environmental spillage and cleaning costs and has caused derailments. indurad has a module in iLoadout monitoring the door positions for preventive alerting.



indurad combined iCardumper with iApron solution

Q Is there also a use for iLoadout at ports and stockyards where minerals are unloaded from railcars?

A The counterpart of iLoadout in ports for car dumpers/railcar tipplers is iCardumper. The technology uses the same software framework and allows partially dumped ore car detection – so called PDOC. Besides that we monitor apron feeders under the dumping station for load control, reducing wear – plus we have other packages aimed at avoiding chute blockage plus of course outflow volume measurements with iBelt.

Q Has iLoadout been applied underground and if so what unique aspects are there with underground rail operations that have to be managed?

A indurad is working currently on the integration of an iLoadout system in underground block cave mining operations. Solving the spillage issues and reliability in automation are the key aspects - whereby loading accuracy is less important as haulage distances are short. As there are many more loading points underground, and the mine is not relying on a single loadout, there is less need for redundancy in layout. Thus we typically use less sensors to reduce the cost and interpolate more data as accuracy is no longer the key driver. IM

Close up of indurad iLoadout system for iron ore flood gate in Australia