



Together
we move



Case study Sweden

INTERFLO 150 - Kiruna mine

Bombardier is the main supplier of a fully automated system for train control and automation, to the world's most advanced underground mine, LKAB in Kiruna

With a body of iron ore that is four kilometres long, 80-100 metres thick and reaches a depth of more than two kilometres, the Kiruna mine located in the far north of Sweden has been in operation for over 100 years and is still producing magnetite iron ore vital to the Swedish export industry.

The operator of the mine, Luossavaara-Kiirunavaara AB (LKAB) has extracted more than a billion tons of magnetite iron ore from the Kiruna mine since 1899. It has recently been estimated that this is only half of the total reserves with ongoing exploration continuing

to identify further resources at depth. In 2010 Bombardier was selected to provide a driverless train control system, *BOMBARDIER* INTERFLO** 150 as a sub-contractor to Midroc Electro who will deliver a fully automatic process control and train transportation system, including power distribution and electrical installation, to LKAB.

Work on this project is being carried out at Bombardier's Rail Control Solutions offices in Stockholm and Gothenburg, Sweden.

24/7

operation possible.
Using the driverless train control system *INTERFLO* 150.

14

kilometres of track.
Equipped with *INTERFLO* 150 to automate loading and unloading of ore.



Bombardier's *INTERFLO* 150 solution incorporates moving block technology which allows shorter headways between trains and therefore greater capacity and better utilisation of track space. The solution also comprises a purpose-designed control system and onboard equipment for nine production locomotives and up to five service and maintenance vehicles.

In addition, the driverless system is fully integrated with the mine's loading and unloading systems. This enables automatic route setting and dispatch to direct the trains to the fullest chutes. It is estimated that the system, which operates continuously, will enable the extraction of 35 million tons of iron ore per year (100,000 tons per day), vastly increasing the output of the mine in a safe, reliable and cost efficient way.

INTERFLO 150 has been specifically designed for industrial and mining applications to increase the rate of extraction and improve the efficiency of the mine 24 hours a day, 365 days a year.

Investing to improve capacity

Kiruna's mining level in 1999 was at a depth of 775 metres. This has since increased to the next level down at 1,045 metres, which will support production until 2017. On 28 October 2008, LKAB approved the decision to construct a new, seventh main level (KUJ1365) at a depth of 1,365 metres, which will secure production for the next 15-20 years.

More than four million cubic metres of rock have been excavated for the new main level in the Kiruna mine, where our *INTERFLO* 150 solution has been installed on approximately 14 kilometres of track to automate the loading and unloading of ore.

Production will gradually be moved from today's level at a depth of 1,045 metres to 1,365 metres (KUJ1365). The first stage went into production in April 2013 with four more stages being planned to include additional process areas, rolling stock equipment and further signalling requirements which will be completed by 2017.

Moving block technology

As the home of the world's largest and most modern underground iron ore mine, LKAB is continually looking to improve the production capacity and efficiency of their systems by automating the collection and dispatch of iron ore.

Proven in freight and mining operations

Bombardier has a strong track record in providing *INTERFLO* 150 for over 13 years at some of the most prominent mining operations in the world. This includes the El Teniente copper mine in Chile which is the largest underground mining complex in the world. Our two systems installed in El Teniente are Esmeralda and Teniente 8, which is the main haulage for all the mines within the complex.

INTERFLO 150 has also been selected for the Grasberg Block cave in Indonesia which is the world's largest producer of gold and the third largest producer of copper. Combined with our world class engineers who have extensive experience in installing equipment in remote and challenging environments, we have the ability to meet production capacity targets.





Equipment installed (in the final stage)

Trackside equipment:

- Two train control centres (TCC)
- Dispatcher interface integrated in production control system
- Two separate dispatcher interfaces
BOMBARDIER EBI* Screen 1,400*
- Object controller system OCS 950 with 10 cabinets controlling 26 points and 7 derailleurs
- 57 *EBI* Switch point machines
- 180 balises
- 42 derailment detectors

- 10 load profile detectors
- Two interlocked gates for rubber tyre access
- Signal interface to the loading and unloading positions

Train-borne equipment:

- 9 production trains and birgit4 service trains each with:
 - ATP/ATO for *INTERFLO 150* (ATO only in production trains)
 - One driver machine interface (DMI)
 - WiFi communication equipment
- 9 last-car units checking the integrity of the production trains





Improved operation and productivity

- *INTERFLO* 150 interfaces with production administration and weighing equipment within the track, providing input to essential production statistics, as well as with the loading and unloading stations, automatic route settings and automatic dispatching.
- Automated train control ensures smoother operation of the train and decreased braking and acceleration which helps to reduce the wear on brakes, wheel sets, engines and tracks.
- The main train control centre is located in a new building outside the mine and controls the production. There is a second control centre located in the mine at the production level which is used for redundancy purposes. Interface to trackside objects is provided * via fibre-optic connections to the object controller cabinets located at various positions along the track area.
- 180 balises are installed on the track to provide the trains with position reference data. The balises are extremely durable and are designed to last in the field for 30 years without requiring preventive maintenance. Our balises have been tested to operate in harsh conditions and are proven to function faultlessly under 20 mm of iron ore or 10 mm of iron dust (a mixture of iron ore and grease).

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