# GOING UNDERGROUND (SAFELY)

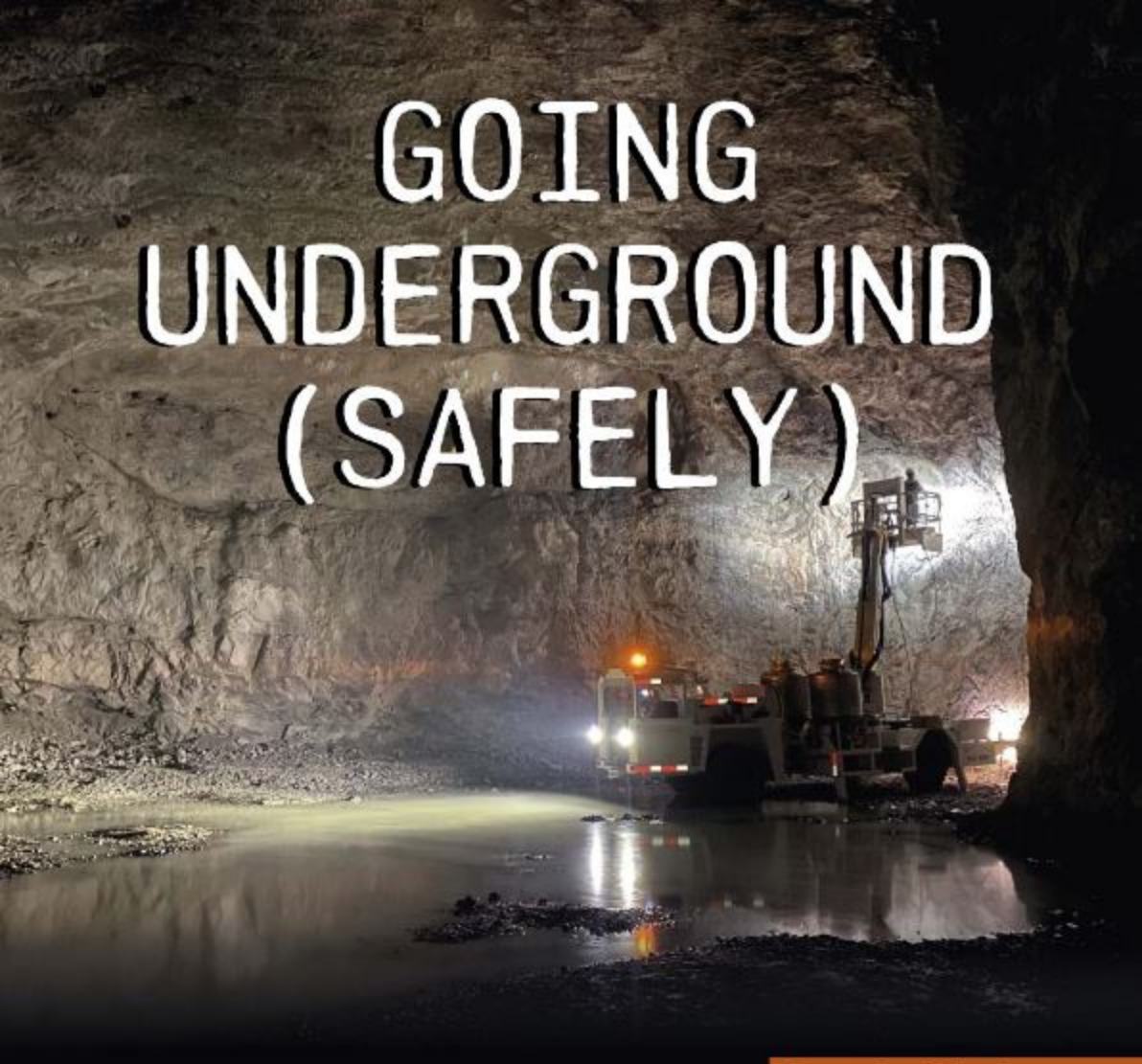

Image courtesy of Getman Corp.

**Mario Tremblay, Getman Corp.,** describes how safely and efficiently transporting explosives underground led to success for a Michigan mine.

When it comes to mining operations, the highest priorities are safety, equipment reliability, and productivity. While safety and productivity are optimum (but not always possible), they can be tied together completely when explosives are being transported underground.

Transporting explosives in larger quantities reduces the number of trips to the magazine or storage sites, thus reducing wear and tear on the equipment. Parts and maintenance costs associated with excessive travel include wear on tyres, brakes, transmissions, axles, and more. As fuel consumption decreases, so do emissions, resulting in improved air quality for miners.

Heavy equipment, such as load and haul, graders and scissor lifts, must travel the ramps daily, and as traffic increases, so does the potential for accidents. Therefore, minimising heavy equipment travel and time spent on this endeavour is critical.

Explosives are transported in various scenarios: from surface to underground magazine, from surface to

underground work areas, or from the magazine back to work areas. In some cases, the best (or often only) means of transporting the explosives is with an explosives charger. No matter the means of transport, additional equipment on ramps can lead to accidents.

## Transporting using dedicated equipment

To mitigate this probability, transporting the explosives with dedicated equipment designed to carry larger quantities helps reduce the frequency of explosives transport, and may increase productivity by up to 150%. When loading a large stope, it is best to keep the explosives charger in the stope and bring the explosives to it, limiting the number of trips by maximising the quantity transported. De-mobilising and re-mobilising an emulsion charger are time-consuming: the loading hose must be cleared and stored, initiating systems must be gathered and stored, and the area secured unless someone is left behind. Upon return to the stope, equipment must then be re-deployed.

Getman Corp. offers an option for emulsion transport in the form of a 1000-gal. (3785 l) tank mounted to a cassette. The cassette, equipped with a tank and a 3 in. diaphragm pump for transferring the emulsion, may be unloaded in the stope. The tank may be filled to provide as much as 11 000 lbs (5000 kg) of emulsion at 1.34 g/cc density. Cassettes may also be placed in a nearby underground magazine for day usage in development rounds. The cassette carrier may then be utilised for other work.

Another option includes Getman's dedicated emulsion transporter. This low-profile, manoeuvrable machine is equipped with two 750-gal. (2839 l) emulsion tanks providing as much as 16 700 lbs (7600 kg) of emulsion at a 1.34 g/cc density, as well as a 3 in. diaphragm pump for transfer into the explosives chargers underground. Contrary to explosives chargers returning to the magazine for refilling, this transporter can go to each charger for refill.

For mines that receive their emulsion in 20 ft ISO tanks, the company also has an ISO tank transport to carry the tank underground for storage.

Finally, for mines using ammonium nitrate/fuel oil (ANFO), the company has an ANFO transporter with a fully lined cargo space capable of carrying up to 80 bags (weighing 55 lbs [25 kg]). With this capacity, more than four 1000 lbs ANFO pots can be refilled, in order to avoid the chargers returning to the magazine. Alternatively, this transporter can take bags from the surface and bring them down to the underground magazine designated for ANFO storage.


Figure 1. Getman 1000 gal. emulsion cassette.


Figure 2. Emulsion transfer pump and fill port.

## Case study: Lundin's Eagle Mine, USA

### Background

Lundin Mining is a diversified Canadian base metals mining company with operations in Brazil, Chile, Portugal, Sweden, and the US. At Lundin's Eagle Mine in Northern Michigan, USA, an underground mine producing nickel and copper concentrates, Lundin has used Getman's Emulsion Transport Cassette for over two years.

Eagle Mine is an approximately 2000 tpd underground nickel-copper mine. The mine is relatively shallow, with ramp access from the surface to the Eagle mine orebodies. Mine services and infrastructure extend from the bottom of the Eagle orebody to the Eagle East orebody. Backfilling is undertaken using cemented and uncemented rockfill. Ore from the mine is stored in a covered coarse ore stockpile facility before transport by road approximately 105 km to the Humboldt mill.

The Humboldt mill is a former iron ore processing plant site that was converted and refurbished to process Eagle Mine ore. Ore is processed using a conventional three-stage crushing and single-stage ball mill process flotation, in order to produce separate nickel and copper concentrates. Tailings from the plant are deposited sub-aqueously in the adjacent former and repurposed Humboldt iron ore pit.

Nickel and copper concentrates are stored in a covered concentrate building on site before transport. The concentrates then travel via rail car directly to smelter facilities within North America or ports for shipment overseas.

Getman's relationship with Eagle Mine extends across several years following Eagle's investment in numerous Getman machines, including: scissor lifts, explosives chargers, pallet handlers, service lube pallets, and emulsion transport pallets.

Nolan Black, Project Superintendent for Cementation and Vendor Partner responsible for mine operations, asked Getman to propose a solution to limit the amount of travel required for explosives chargers to reload. Eagle Mine has surface storage for its emulsion located approximately 5 miles from the underground magazines. One-way travel, depending on working location in the mine, takes between 25 – 60 minutes.

### Requirements

Getman's challenge was to create an emulsion transport cassette for Eagle Mine's existing Getman cassette handler. With guidance from Black and his team, Getman engineers designed and manufactured the first emulsion transport cassette.

### Results

By using the emulsion transport cassette, Eagle Mine and Cementation cut up to four trips to the surface for every large stope, saving both time and money. Travel distance was reduced by 70% to 1.5 miles, instead of 5 miles, for the trip to the surface magazine when performing development or sill production rounds. Additionally, the benefits from the downstream effects of fewer trips to the surface led to both reduced traffic on the ramps and wear and tear on the equipment. Subsequently, Eagle Mine has purchased two additional cassettes to supplement its growing operations.

Eagle Mine continues to implement a strategy to do more with less by maximising the productivity of the Getman emulsion transport cassettes.

## Conclusion

Reducing traffic on ramps and keeping explosives chargers at work improves safety and increases productivity. High capacity emulsion loaders and transport vehicles offer these features and reduce time wasted in travel, as well as wear and tear on the mobile equipment. Whenever possible, limiting trips back and forth to the magazine is always best. GMR

## Note

Lundin and Eagle Mine information courtesy of Lundin Mining Corporation.