

The background of the entire page is a photograph of an underground copper mine. A large yellow haul truck is the central focus, its bed filled with dark, lustrous copper ore. The truck is positioned on a dirt and rock floor, with a rough, rocky wall in the background. The lighting is dramatic, highlighting the texture of the rock and the metallic sheen of the ore.

# teleo@p

A S S I S T   A U T O

UNDERGROUND COPPER MINE  
CHILE - 2021



**CASE STUDY**

## ABSTRACT

The purpose of this case study is to examine the benefits of HARD-LINE's TeleOp Auto and TeleOp Assist used on an **underground LHD (Load Haul Dump)** at a Pucobre-owned mine in Copiapó, Chile. TeleOp Auto and Assist are added features to TeleOp's base system. TeleOp allows tele-remote operation of heavy machinery from a control station in a safe area on surface or underground, regardless of distance, while the Auto mode enables autonomous driving functions on LHDs, trucks, and locomotives; Assist allows the operator in TeleOp mode to do hands-free steering. HARD-LINE technology has been used in Chilean mines since the 1990s, however this is the first time **TeleOp Auto and Assist** have been applied in Chile.

## INTRODUCTION

This relationship between Pucobre and HARD-LINE has existed since 1999 with the installation of line-of-sight remote controls. In 2020, both companies decided to implement a strategic alliance, formalizing a partnership to advance automation and autonomy in underground mining operations.

The introduction of HARD-LINE's Semi-autonomous and Auto-assist technology in 2020 was implemented in phases that best suited the mine's timelines and needs. Pucobre identified that the use of these combined technologies would allow the introduction of a new mine design with enhanced productivity, safer operations, and lower costs.

Figure 1. Two operators utilizing TeleOp Auto in their safe and secure Control Room.



## APPLICATION

The first TeleOp system was installed in a test area at Pucobre in September 2020. Testing was carried out over the period of six months, during which an extensive time study was conducted. The data was easily downloaded from the on-board computer systems software, where distances and speeds were automatically collected. The data was compiled by a third-party consultant, Mr. George McIsaac P.Eng. PhD.

Different scenarios were tested - varying speeds, distance travelled, gear used, and autonomous mode, in order to find the right combination to meet the mine's production demands.

The network setup and teardown times were also studied to determine if additional networks were needed, so that the setup could be done prior to moving into a new production area and reduce the downtime of this process.

Figure 2. A landscape view of Copiapó, Chile.



Figure 3. The scoop of a remote-controlled LHD underground at Pucobre.



## CONCLUSION

With the termination of the test, Pucobre is going to implement several more TeleOp systems in its new stope design with significantly less development. By increasing the fleet and the mobility of the network systems, different number of headings could be exploited at the same time, meeting and/or exceeding production goals that have been set by the mine to make the project successful.

The success of this partnership with Pucobre and HARD-LINE demonstrates the ability to adapt the technology and new requirements, to meet specific goals.

Figure 3. Pucobre's mining operations center.



## PRODUCTIVITY

- Increased Profitability
- Enhanced production
- Improved work efficiency
- Operation during shift change
- User-friendly software

## SAFETY

- Reduced fuel consumption in transporting personnel
- No exposure to dust, flying rock, diesel fumes, and noise
- Sustainable parts in remote can be fixed

## WORK / LIFE BALANCE

This system prioritizes safety and productivity, allowing operators to comfortably control equipment from ground level to save lives.

- Operators removed from underground dangers
- Minimized travel risks
- Traffic control



## SUPPORT

24 Hour service & support



## CONTACT

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Figure 4. Mina Dron building near mine site.

