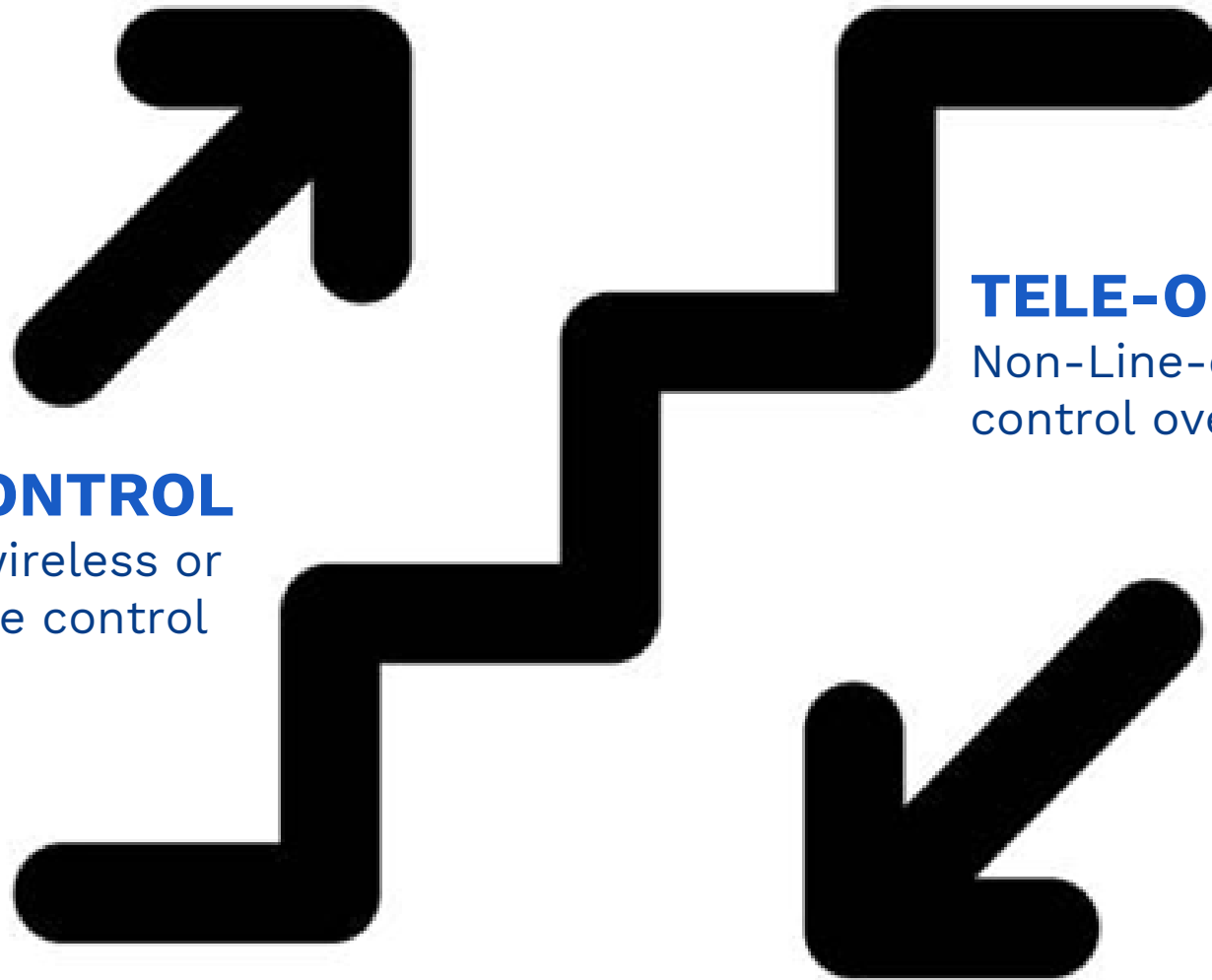


Automate for Safety

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FORT Robotics
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Steps to Full Autonomy



AUTOMATION

Automate difficult machine functions for safer operation by unskilled workers

REMOTE CONTROL

Line-of-Sight wireless or tethered remote control

TELE-OPERATIONS

Non-Line-of-Sight wireless control over Wifi / IP / LTE

FULL AUTONOMY

Mixed environment of human-operated and autonomous or tele-operated machines

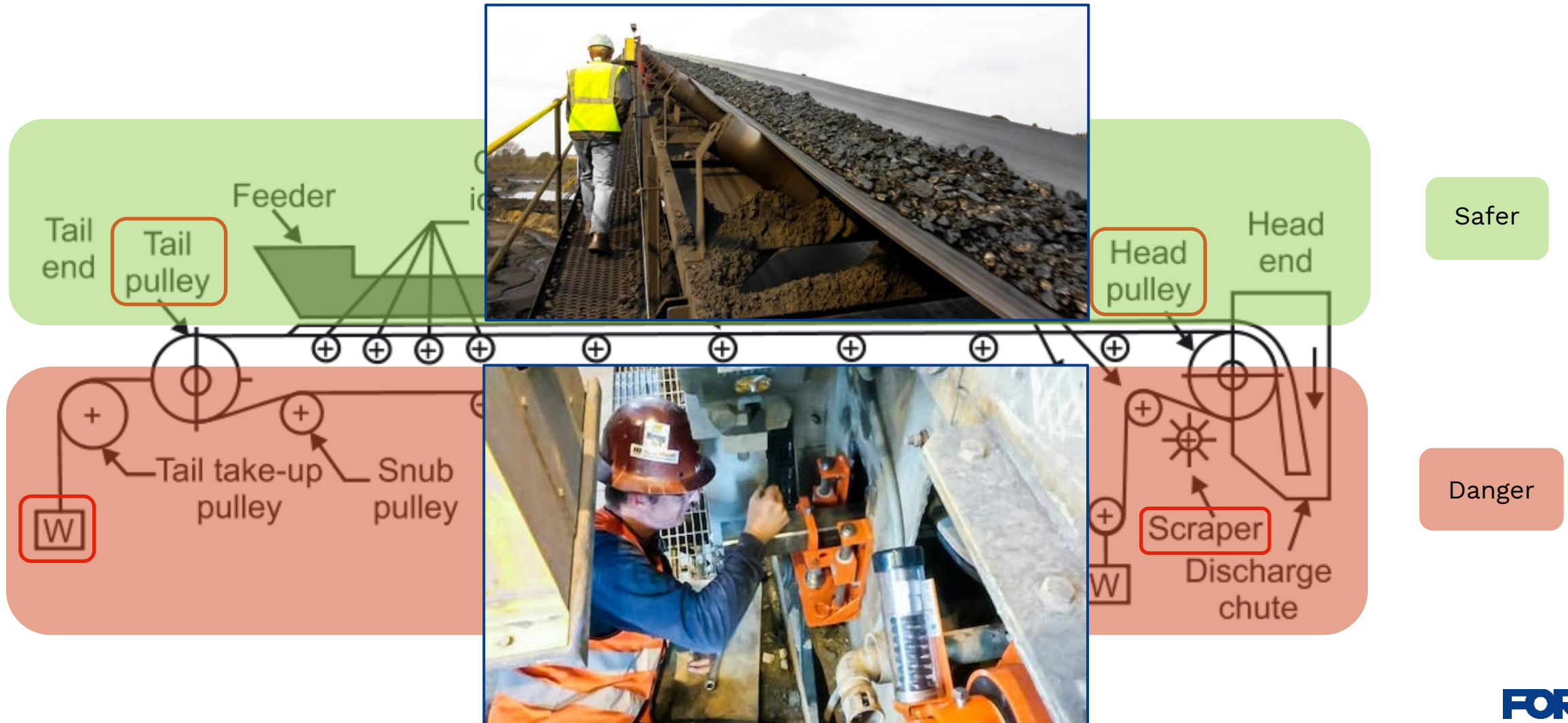
Bulk Material Handling Use Case

Automate for Safety



Bulk Material Handling – Conveyor Belt Maintenance

Safer & Dangerous Zones



Bulk Material Handling – Wireless Safety Solution

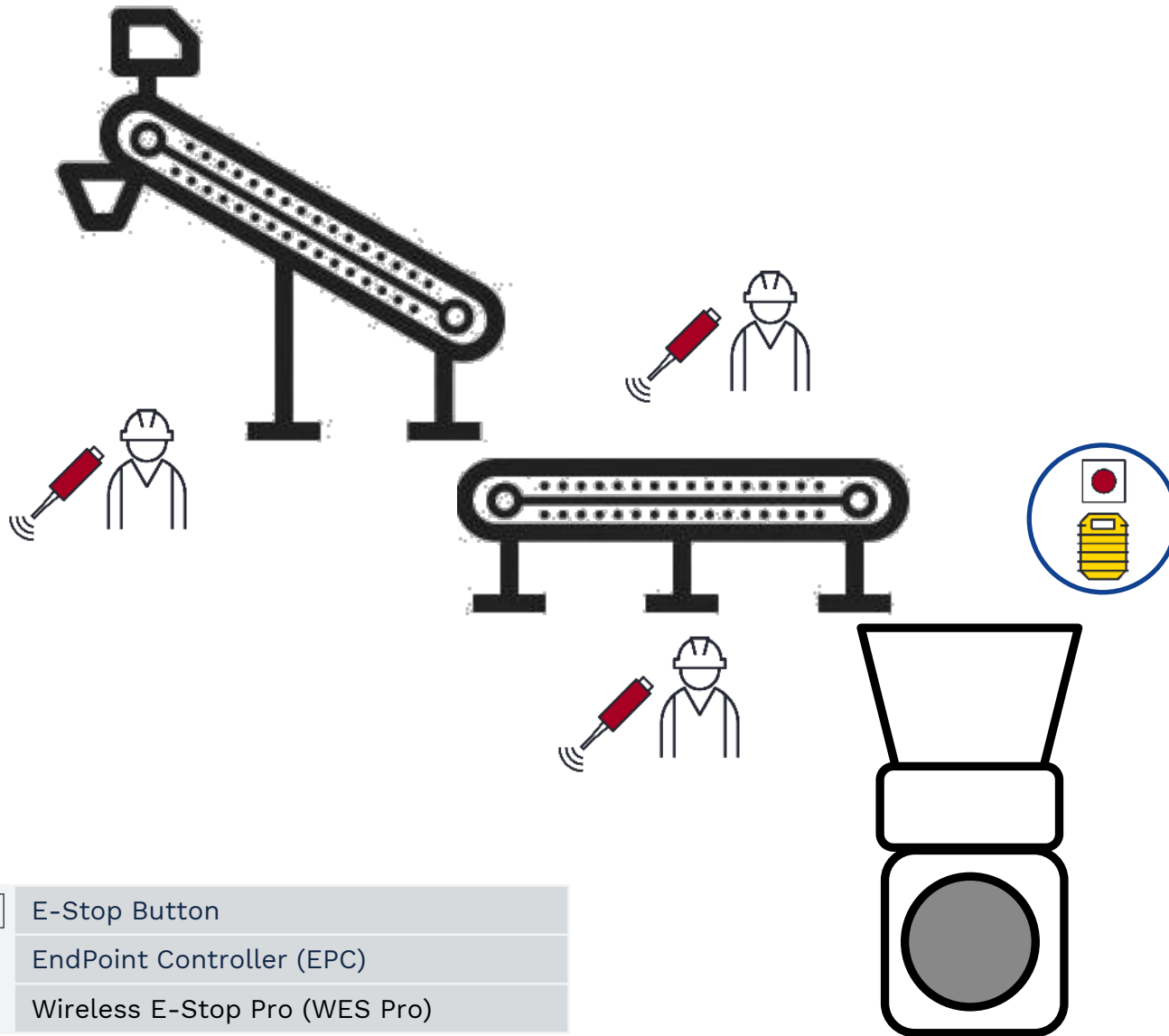


FORT Robotics suggested solutions:

- VSC/EPC equipped to conveyor control with personnel equipped with wireless e-stop as PPE
- Personnel can activate emergency stop in instances where LOTO was ignored and/or overridden
- Where unintended movement of belting during maintenance shut down occurs, e-stop is an added safety component
- Functionally safe due to ‘heartbeat’ communication between sender/receiver every 50 msec (20 Hz)



Mining: Bulk Material Handling



FORT Safety System (Pro Series)

The Maintenance Personnel

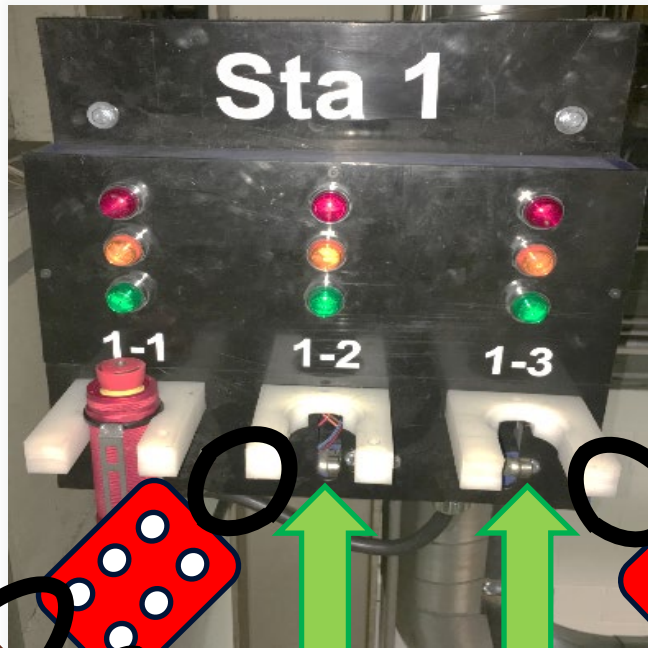
All maintenance personnel carry FORT Wireless E-Stop Pro (WES Pro) units. These units are paired to the conveyor safety system to stop the conveyor in an emergency.

The Conveyor

A FORT Endpoint Controller (EPC) is installed into the conveyor control system. If the EPC receives a safety signal activation it will activate the conveyor E-Stop system.

All wireless communications are over the local Wireless WiFi network.

Automate for Safety: Fundamental Process Change



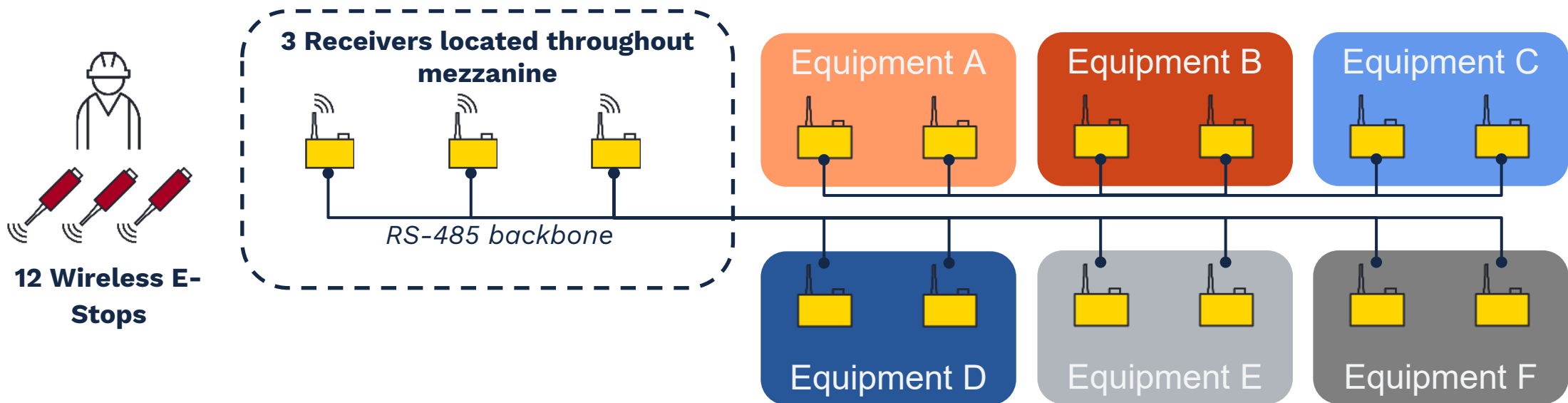
- E-Stops are stored in a custom-built cradle providing a physical switch with lockout so the safety signal cannot activate when the Wireless E-Stop is not in use
- Change to Standard Operating Procedure and required PPE for Maintenance personnel
- Opportunity for lower Insurance Premiums for site



Automate for Safety: Fundamental Process Change

Configuration:

- 12 Wireless E-Stops with 900 MHz ISM Radio
- 12 wired Vehicle Safety Controllers (VSCs) activate safety relays on equipment
- 3 Vehicle Safety Controller repeaters are hardwired to RS-485 backbone, repeating messages to all motor VSCs



Bulk Material Handling Use Case

Automate for Safety

- Future worksite will be filled with machines of all types being controlled in a variety of ways
- Operators and other skilled personnel will be redeployed and adapt to new environment
- Process changes are difficult but mandatory for Autonomy adoption
- Insurance Premiums could be lower if wireless e-Stop becomes part of SOP
- Steps to Full Autonomy will be gradual, taking place over decades not months

**Thank you for your time and attention.
Who has the first question?**

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