


The 5G mine

OR

Why James Cameron is wrong

Peter Burman
Program Manager,
Boliden Mine Automation Program,
Boliden AB



Boliden Mines Technology 1 2014-05-08

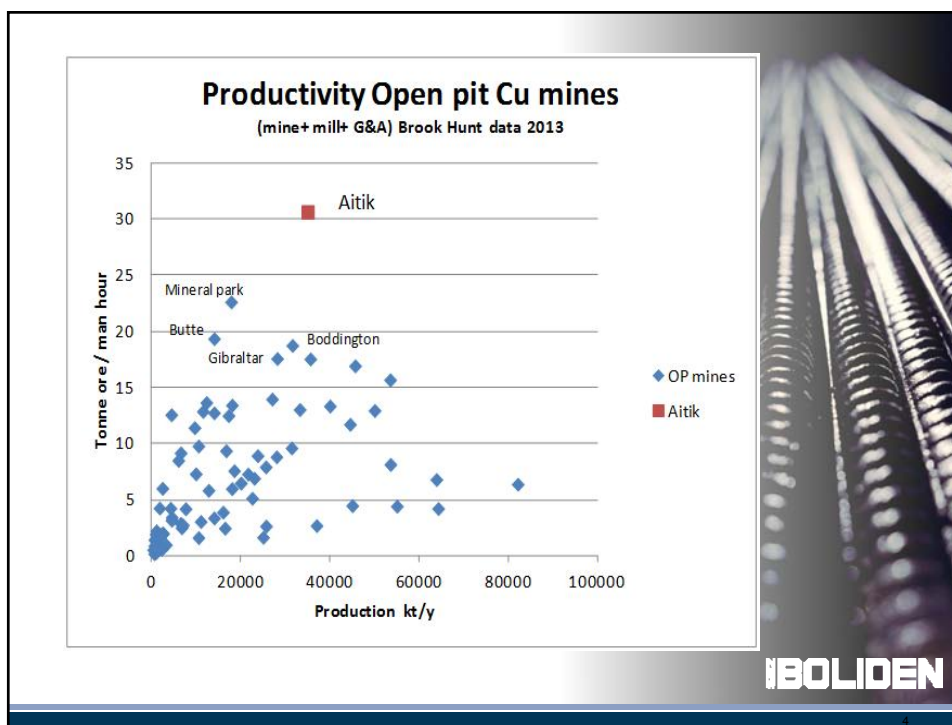
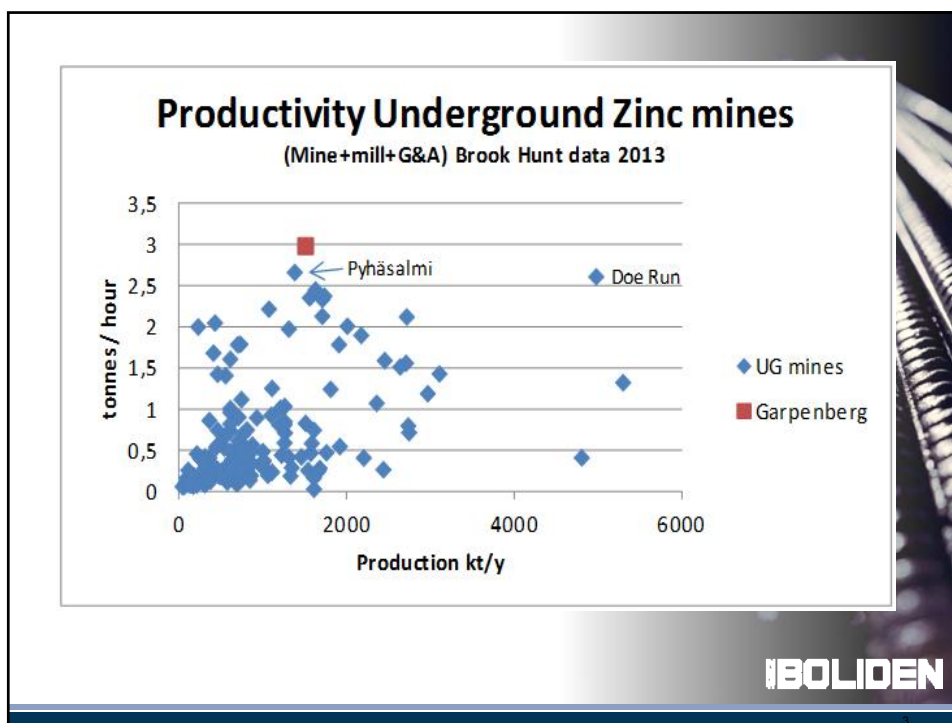
Key drivers for Innovation (in Sweden)

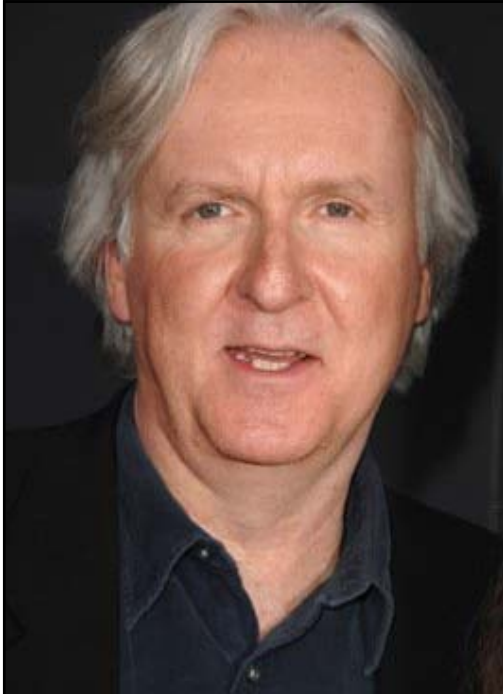
- High labor costs
- Strict environmental regulations
- Low tolerance for work related injuries

-> “Necessity is the mother of invention”



Boliden Mines Technology 2 2014-05-08







Why James Cameron is wrong

Or Next, Next Level of Mining

BOLIDEN

Boliden Mines Technology 5 2014-05-08

He could imagine the stories behind Avatar & Terminator



BOLIDEN

He could imagine Space travels and Cryosleep



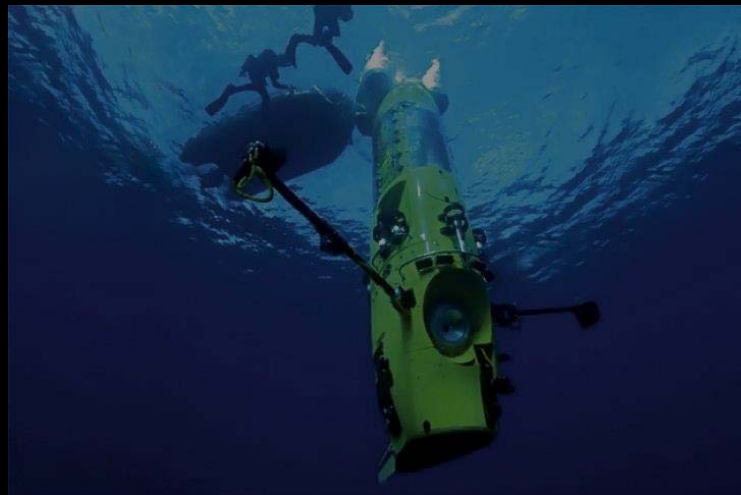
IBOLIDEN

Unit/Operation choose tab Insert/Header & Footer

7

2015-11-27

He was the first to dive into the Challenger deep in 52 years



IBOLIDEN

But he couldn't imagine ...



We know that James Cameron
is wrong ...

BOLIDEN

Next year, 2016:

- Volvo CE will start testing a remotely controlled wheel loader in Kankberg
- Volvo Trucks plan to test their first truck with a "autopilot" in Kristineberg
- Kankberg will be the first mine in the world with a 5G network.

BOLIDEN

Dig this: I operated a giant excavator from 2,500km away

An Oculus Rift VR headset and a 4G network in Spain let CNET's Roger Cheng control earth-moving heavy equipment in Sweden.

by Roger Cheng [@RogerWCheng](#) / March 5, 2015 10:09 AM PST

29 / 1.2K / 373 / 315 / [more](#) presented by [#DitchAndSwitch](#)



CNET Editor Roger Cheng controlling an excavator in Sweden – while at a conference in Barcelona.

Sarah Tew/CNET

VOLVO

Construction Equipment

ERICSSON

BOLIDEN

"Platooning" Trucks

Collective action



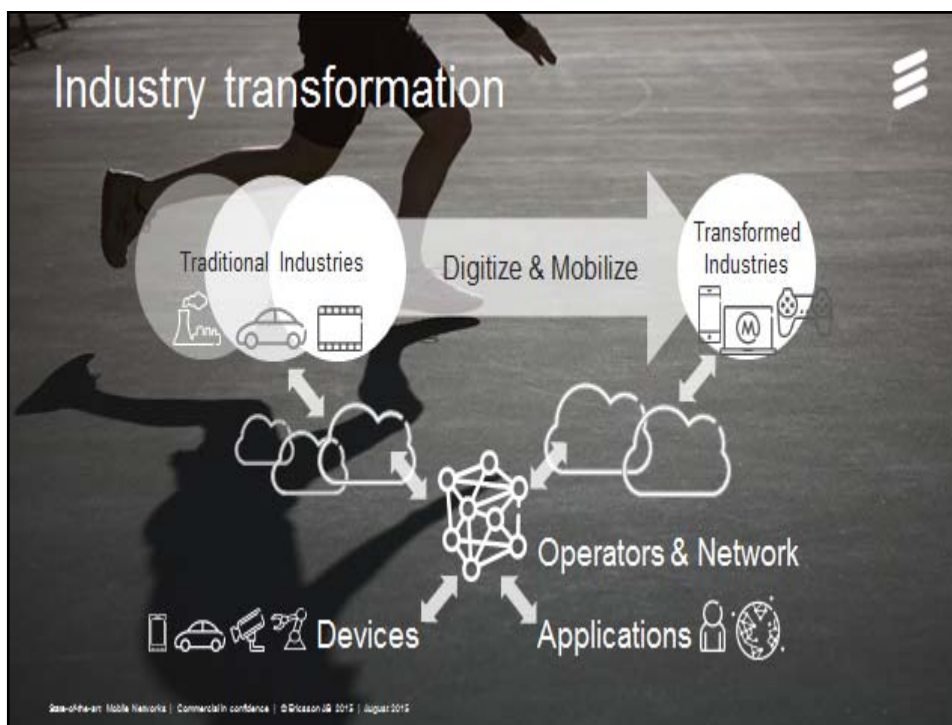
A recently completed European project led by Volvo has explored using cars and lorries simultaneously. Its platoons cruised at 85 km/h (50mph) with a gap between each vehicle of 6m. The study vehicles put in some 10,000 km of road



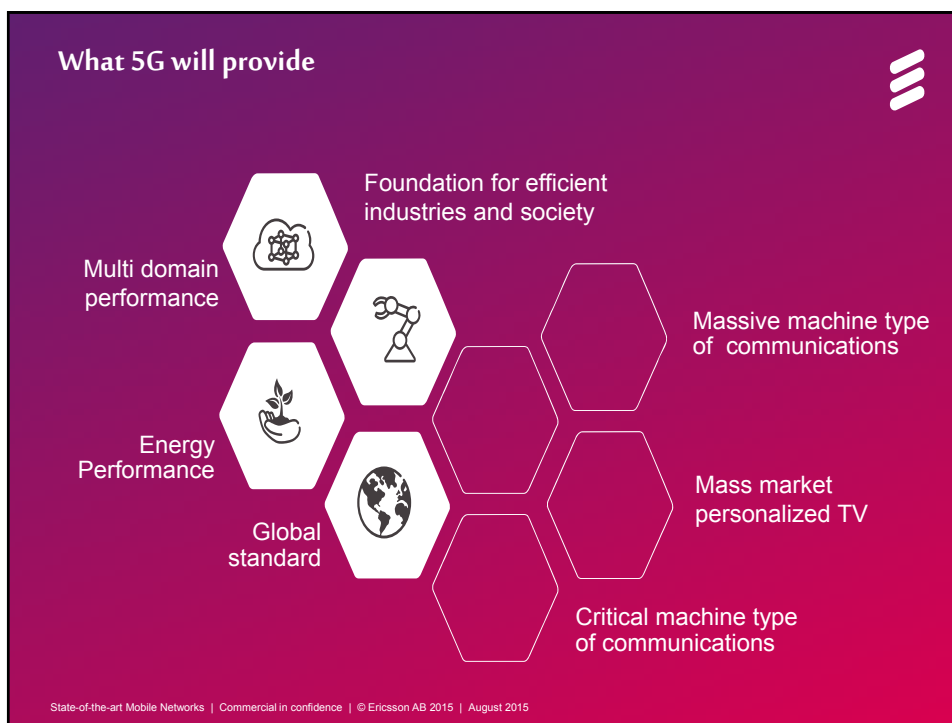
Boliden Mines Technology

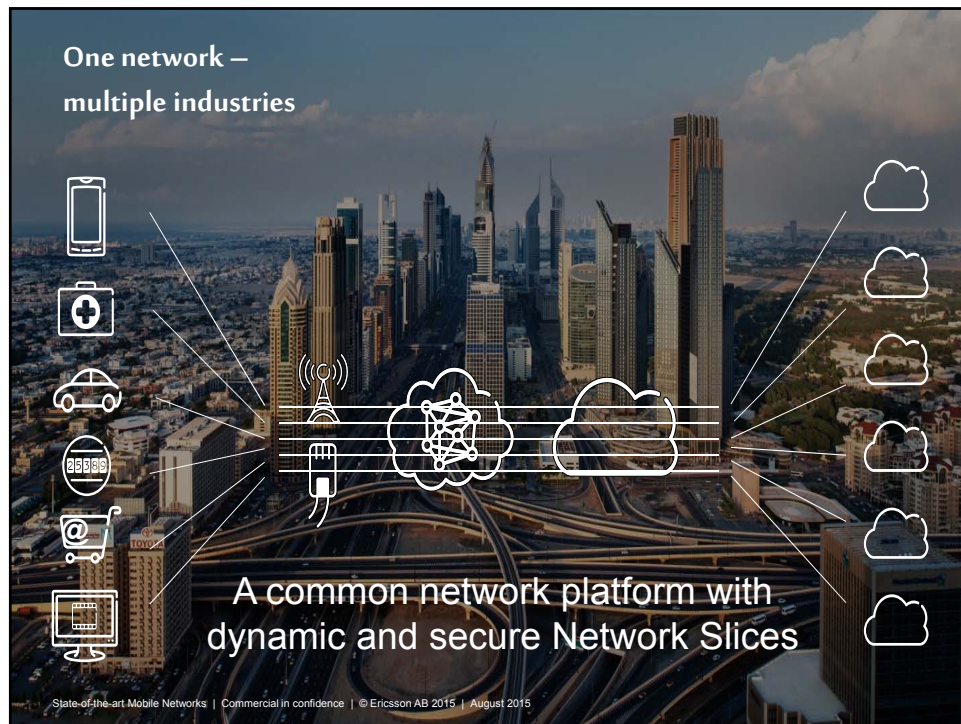
13

2014-05-08



5G+4G+IoT Mobile Networks | Commercial confidence | © Ericsson AB 2015 | August 2015





Cost

**Imagine a wireless network
generating coverage on a road
300 km long...**



BOLIDEN

Unit/Operation choose tab Insert/Header & Footer

19

2015-11-27

Why 5G

- | | |
|----------------------|------------------------------|
| ▪ Latency | Fördröjning (lagg) |
| ▪ Network Slices | Säkrad kvalité och prestanda |
| ▪ Energy Performance | Energieffektivitet |
| ▪ Cost | Kostnad |



BOLIDEN

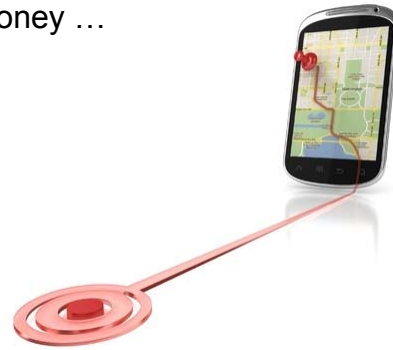
Boliden Mines Technology

20

2014-05-08

Emergency

It is not all about money ...

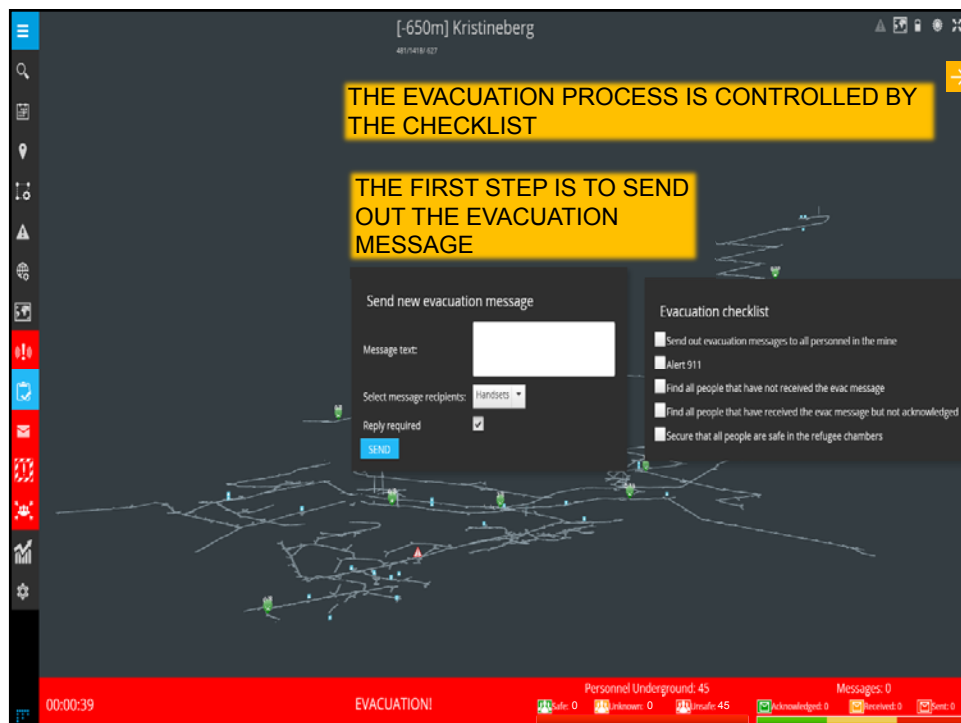
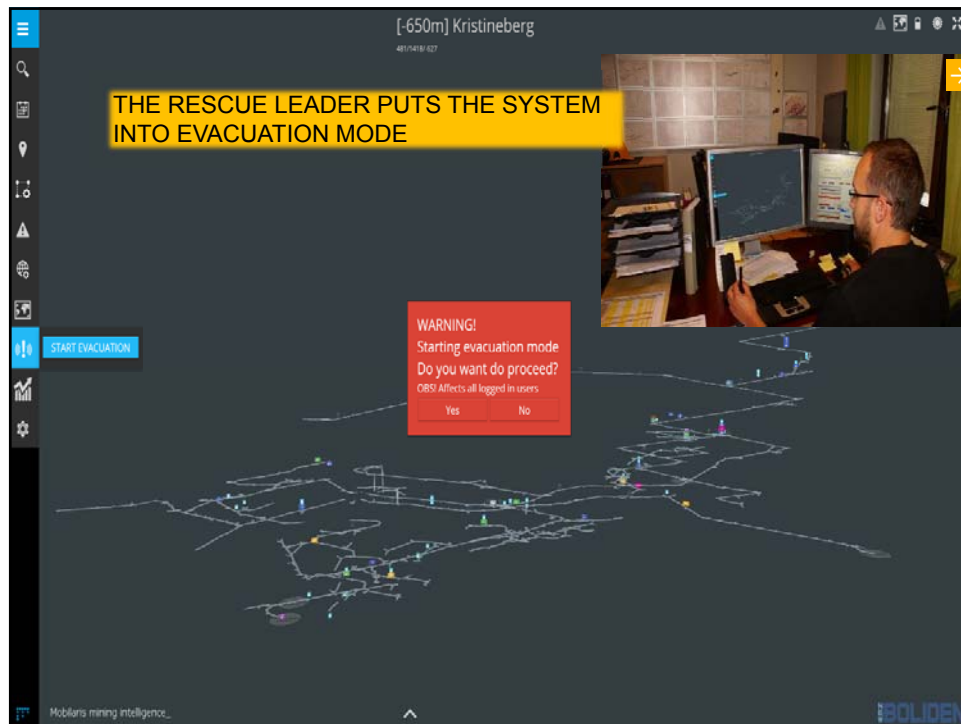


Technology, Boliden

21

2015-11-27





[650m] Kristineberg
48174181-127

THE FIRST STEP IS TO SEND OUT THE EVACUATION MESSAGE

Send new evacuation message

Message text: *** FIRE IN THE MINE!! EVACUATE !! ***

Select message recipients: HANDED

Reply required: ☒

SEND

Evacuation checklist

- ☐ Send out evacuation messages to all personnel in the mine
- ☐ Alert 911
- ☐ Find all people that have not received the evac message
- ☐ Find all people that have received the evac message but not acknowledged
- ☐ Secure that all people are safe in the refugee chambers

00:01:42 EVACUATION! Personnel Underground: 45 Safe: 0 Unknown: 0 Injured: 45 Acknowledged: 0 Received: 0 Sent: 0

[650m] Kristineberg
11271538-240

Evacuation checklist

- ☒ Send out evacuation messages to all personnel in the mine
- ☒ Alert 911
- ☐ Find all people that have not received the evac message
- ☐ Find all people that have received the evac message but not acknowledged
- ☐ Secure that all people are safe in the refugee chambers

THE NEXT STEP IS TO FIND THOSE PEOPLE WHO HAVE NOT RECEIVED THE EVAC MESSAGE

00:04:10 EVACUATION! Personnel Underground: 50 Safe: 2 Unknown: 8 Injured: 40 Acknowledged: 15 Received: 30 Sent: 5

Search results

Searched for:	Personnel unknown	found:	8
Edwin Bjellner	Telefon	2s	
Mikael Stenberg	Telefon	2s	
auto-registered (Ascom Tateco AB)	Telefon	4s	
Jane Djurf	Telefon	4s	
Susanne Linder	Telefon	6s	
Sune Stenwall	Telefon	7s	
Christer Andersson	Telefon	1m 52s	
Ulf Renström	Telefon	1m 52s	

Evacuation checklist

- ☒ Send out evacuation messages to all personnel in the mine
- ☒ Alert 911

Asset information

General	
NAME	Susanne Linder
MAIL	4657@krkunitcom.boliden.internal
PHONE NUMBER	4657
DESCRIPTION	auto-registered (Ascom Tateco AB)
TYPE	Telefon
STATUS	ONLINE
ADDRESS	
LOCATE	
FOLLOW IN MAP	
SEND MESSAGE	
MARK AS ME	

PIC ONE OF THEM, SUSANNE, AND FIND HER

THE LIST SHOWS PEOPLE THAT HAVE NOT RECEIVED THE EVAC MESSAGE, THEY MUST BE MANUALLY FOUND

00:05:37 EVACUATION! Personnel Underground: 50 Messages: 60

Evacuation checklist

- ☒ Send out evacuation messages to all personnel in the mine
- ☒ Alert 911

Asset information

General	
NAME	Susanne Linder
MAIL	4657@krkunitcom.boliden.internal
PHONE NUMBER	4657
DESCRIPTION	auto-registered (Ascom Tateco AB)
TYPE	Telefon
STATUS	ONLINE
ADDRESS	
LOCATE	
FOLLOW IN MAP	
SEND MESSAGE	
MARK AS ME	

LOCATE SUSANNE AND SEARCH FOR THE NEAREST COLLEAGUE TO HER

00:08:45 EVACUATION! Personnel Underground: 50 Messages: 60

[668m]
17071953/666

Search results

Searched for: telefon 17071953/666

Description	Type	Distance	Age
Robin Nyström	Telefon	10.0	9s
Inge Eriksson	Telefon	976.0	8s
Jane Djerf	Telefon	1156.0	9s
Dennis Bjurén	Telefon	2178.0	10s
Karl Eric Markösten	Telefon	2178.0	9s
auto-registered (Ascom Tateco AB)	Telefon	2219.0	8s
Ingela Grundström	Telefon	2228.0	10s
Susanne Linder	Telefon	2228.0	11s
Staffan Steinman	Telefon	3083.0	22s
Mattias Holmberg	Telefon	3083.0	12s
auto-registered (Ascom Tateco AB)	Telefon	3147.0	10s
Fredrik Larsson	Telefon	3147.0	8s
Viktor Löfdahl	Telefon	3147.0	12s
Peter Nilsson	Telefon	3482.0	9s
Johanna Solfeldt	Telefon	3557.0	9s
Tony Lundgren	Telefon	3789.0	8s

Send message to asset

MESSAGE

Robin Du måste hjälpa oss att hitta Susanne!

SEND MESSAGE CANCEL

Evacuation checklist

- ☒ Send out evacuation messages to all personnel in the mine
- ☒ Alert 911

Asset information

General Advanced

NAME Robin Nyström

MAIL 4836@kristineberg.mobilis.com

PHONE NUMBER 4836

DESCRIPTION auto-registered (Ascom Tateco AB)

TYPE Telefon

STATUS ONLINE

ADDRESS

LOCATE

FOLLOW IN MAP

SEND MESSAGE

MARK AS ME

EDIT RSS CHART

SELECT ROBIN WHO IS CLOSEST TO HER AND ASK HIM TO FIND HER

01:11:37 EVACUATION! Personnel Underground: 50 Messages: 50

Safe 45 Unknown 4 Inactive 1 Acknowledged 41 Received 4 Sent 5

[787m] Kristineberg
17071953/666

Evacuation checklist

- ☒ Send out evacuation messages to all personnel in the mine
- ☒ Alert 911
- ☒ Find all people that have not received the evac message
- ☒ Find all people that have received the evac message but not acknowledged
- ☒ Secure that all people are safe in the refuge chambers

AND SO THE EVACUATION CONTINUES UNTIL ALL ARE SAFE

mobilaris
Holding people together...

01:25:38 EVACUATION! Personnel Underground: 50 Messages: 50

Safe 50 Unknown 0 Inactive 0 Acknowledged 45 Received 0 Sent 5

In the beginning it was all dark ...

BOLIDEN

Thank You!



Boliden Mine Automation

For more info please contact: peter.j.burman@boliden.com

BOLIDEN

In the future

Drones



Augmented Reality



Cisco HALO



5G Networks



BOLIDEN