The Element of **Possibility**™

Wireless applications for Alcoa operations

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Alcoa
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Our Values

Alcoa

Alcoa

OUR VALUES

Act with Integrity

Operate with Excellence

Care for People

Alcoa Corporation – a proud 128 year history

- Inventors of the original aluminium process
- World's largest bauxite mining portfolio and a leading alumina producer
- 2017 sales revenue at **$US11.7 billion**
- Award-winning sustainability leadership

Three segments across the aluminium value chain

BAUXITE

Geographically dispersed mines with a premier low-cost position

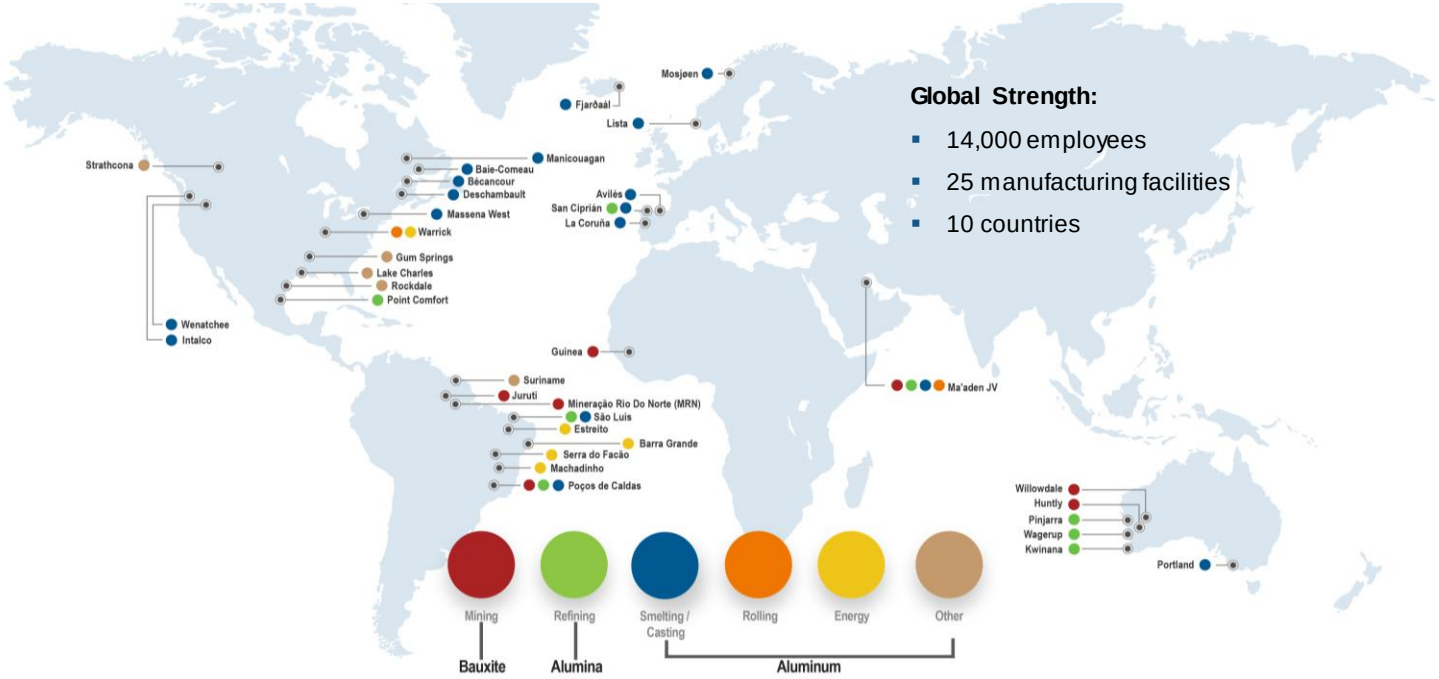
ALUMINA

Eight refineries on five continents with access to growth markets in Asia, Middle East and Latin America

ALUMINIUM

Global aluminum producer with a proven ability to drive technology advancements

Alcoa Corporation - global portfolio



Global Strength:

- 14,000 employees
- 25 manufacturing facilities
- 10 countries

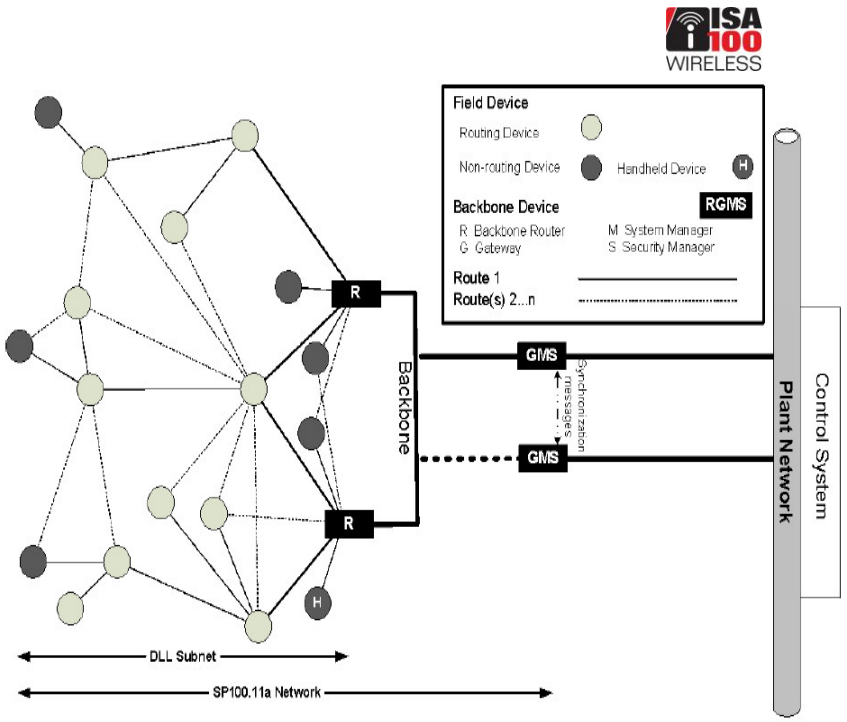
Wireless as an enabling technology Vision

- Objective
  - Provide a engineered, secured, managed & integrated wireless network into Alcoa Alumina refineries process areas.
  - Supporting ISA100 Wireless™ instruments and sensors
  - Supporting mobile operators using handheld devices
  - Allow for wireless connectivity of PCS/EHM equipment that is either remote or mobile
  - Enabling IIOT and IOT in the future
- Benefits
  - Reduce capital expenditure of installing hardwired process/condition monitoring instruments or sensors
  - Speed of deployment
  - Mobility of sensors and instruments to be moved around to troubleshoot or perform trials as required
  - Support mobile operators out in the refinery process areas
  - Monitor moving equipment now possible with standard devices
  - New opportunities waiting to be found…

ISA100 Wireless™ – Technology Brief

The ISA100 Wireless standard

- The ISA100 Wireless standard is an open communications protocol
- The Standard is flexible to supporting a wide range of application layer and sensor layer protocols, i.e. Profibus, HART, Fieldbus Foundation, etc.
- The Standard uses the OSI seven layer model for design basis, leveraging existing standards and interfaces
- The ISA100 Wireless standard incorporates a two-layered security methodology at Link Layer and Transport Layer
- Physical and data link layers use the IEEE 802.15.4 radio standard referencing the 2.4 GHz frequency band for global deployment
- Allows users to define sensor star topology or mesh networks, providing user flexibility of security or battery life



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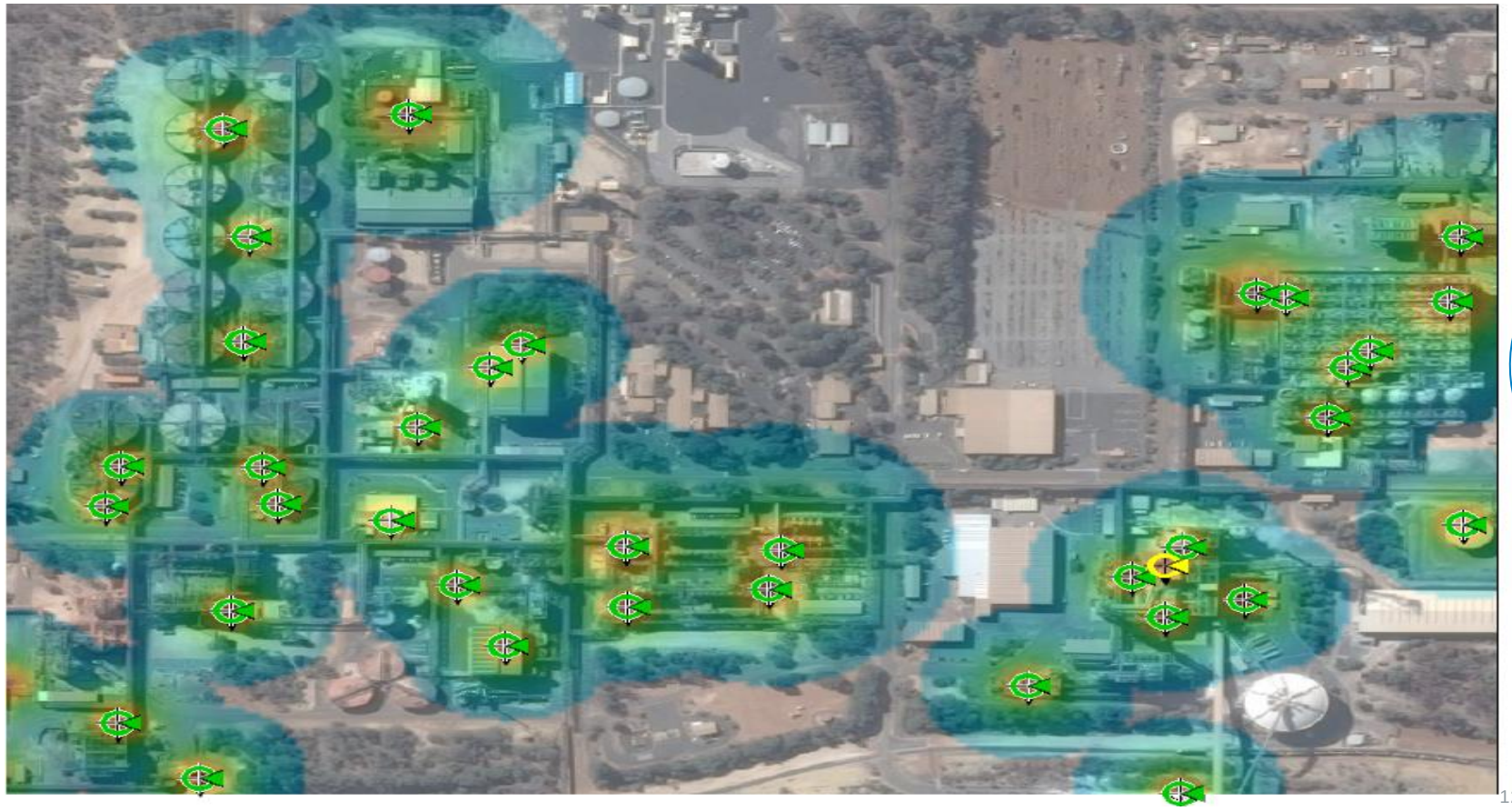
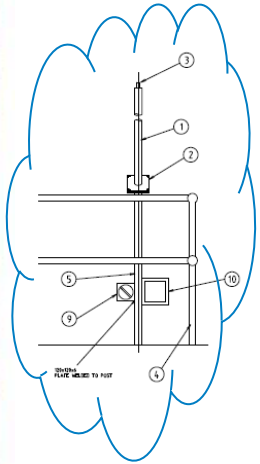
Typical process area heat map coverage





Mounting pole details

Installation challenges

- Upfront engineering and site survey
  - Perform site survey and engineering study
  - Build in security and robustness upfront for Wi-Fi access and ISA100 network segregation
  - Build in wireless training and awareness with site stakeholders(Wireless means different things to different people)
  - People change management (Wireless is not a plug and play/pray solution)

- Instrument quality 110VAC power supply
  - Limited existing 110VAC circuits available
  - Developed engineering solution to harvest 110VAC from existing field instrumentation
  - Providing power segregation to wireless access point to maintain wireless coverage in the event of a power outage to any single 110VAC circuit
  - Don't under estimate cost and complexity for powering up field mounted wireless Access Points

- Physical installation
  - Utilised existing lighting break back poles for mounting wireless access points, for easy and safe access during maintenance
  - Access points installed high up on existing building without requiring additional dedicated towers
  - Wireless coverage redundancy was achieved to allow for single access point failure
  - Meshing access points where never more than 1 hop away from a root access point. Installing fibre to every access point in a brown field installation is expensive.

Developing industry specific ISA100 Wireless instrument

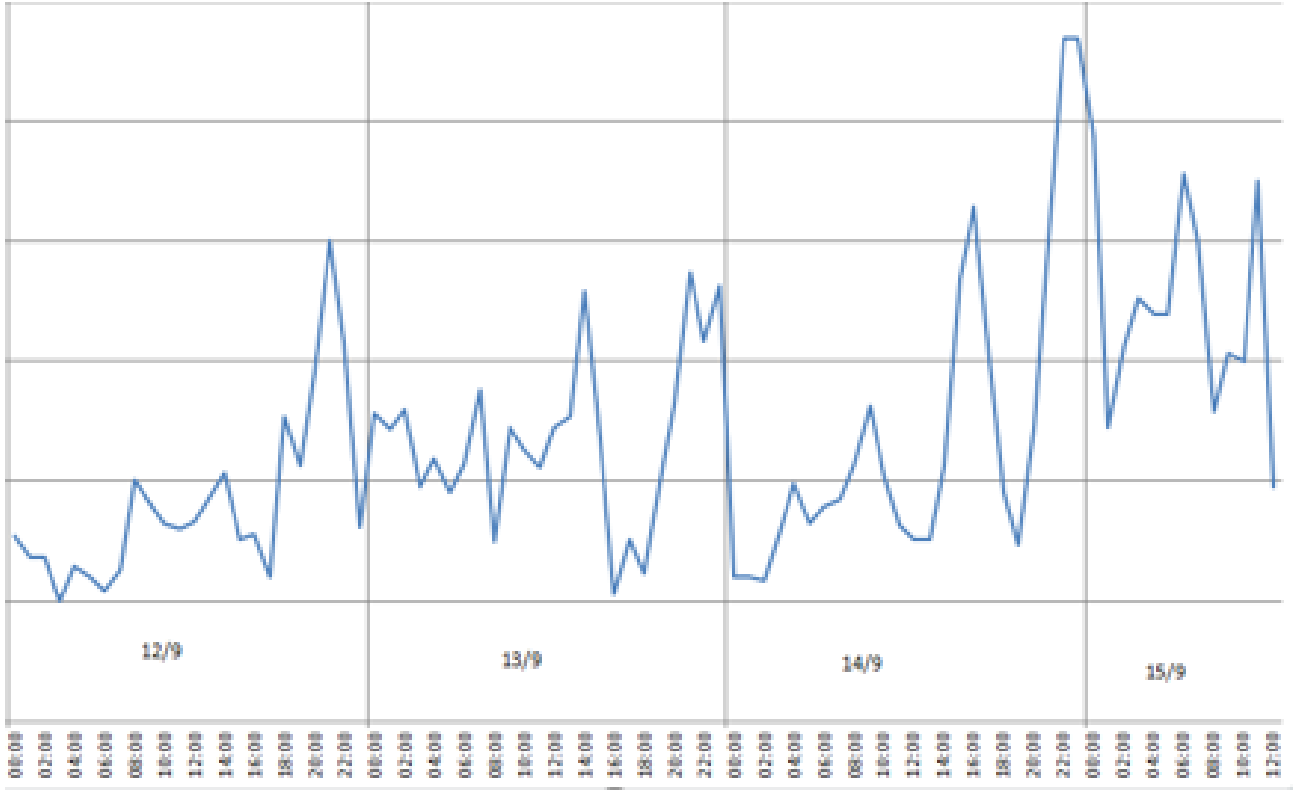
In addition to COTS wireless ISA100 Wireless instruments available, Alcoa is working with ISA100 Wireless instrument vendor to develop:

- Lower cost light weight wireless pressure transmitter that can be used as wireless pressure gauge ✓
- Wireless safety shower panic button ✓
- Wireless push button that can be used in multiple of installations and applications including pulsed version for operator rounds timestamping ✓
- ISA100 Wireless serial interface that can be used on speciality analysers developed in house based on a small PLC ✓

- Actively seeking to find a ISA100 Wireless power transducer to retro fit onto older Motor Control Cubicle
- Seeking light weight, low cost ISA100 Wireless temperature probe that can be used to quickly assist in fault finding and monitor process upset with minimal installation overhead
- Seeking ISA100 Wireless signal strength dongle to connect via Bluetooth for wireless field survey

Rapid deployment of wireless transmitter for fault-finding (~2 hour implementation time)

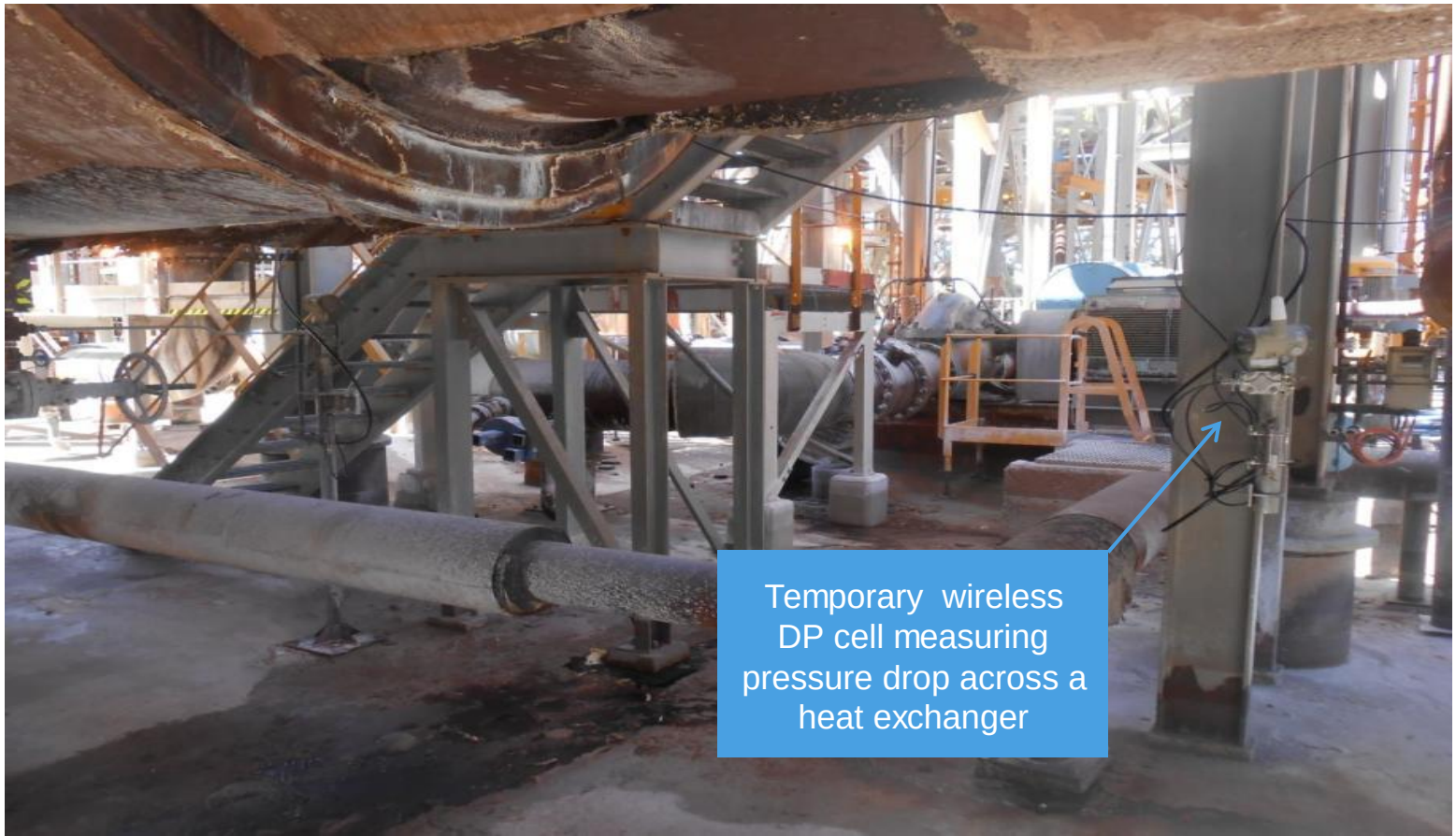
Line pressure measurement in a un monitored line



Using wireless instrument provides more options to solve problems

- Using a standard wireless Differential Pressure transmitter to measure rotating rake height.
  - OEM solution required slip rings and hardwired solution

Rapid deployment of wireless instrument to monitor process conditions



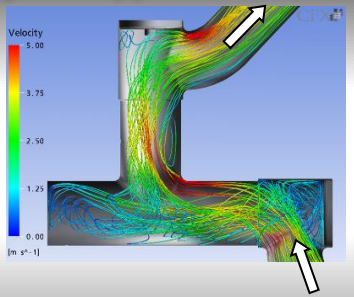
Process Automation

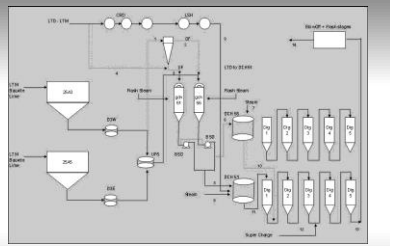
We are continuously defining opportunities for improvement

Alcoa

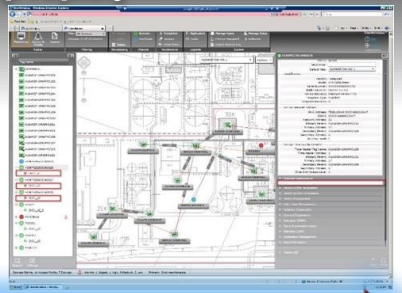
Plant-wide process models, rich data, advanced analytics and agility = continuous improvement

Innovation cycle: use plant data, identify new opportunities, test ideas and implement





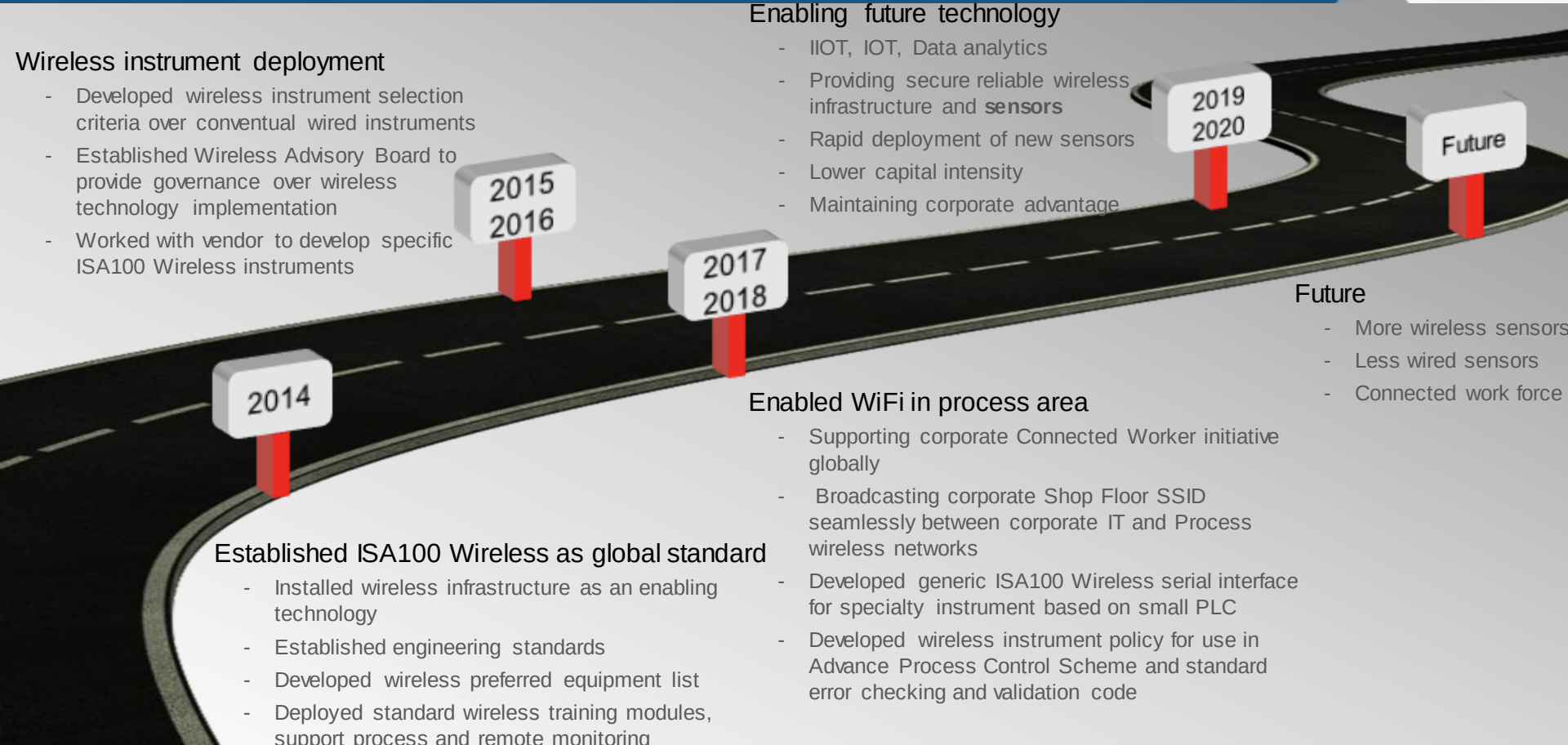
We use our wireless infrastructure to fill data gap rapidly



Plantwide wireless mesh

From installing wireless device on process to having process data : duration one day

Alcoa wireless journey



Wireless instrument deployment

- Developed wireless instrument selection criteria over conventual wired instruments
- Established Wireless Advisory Board to provide governance over wireless technology implementation
- Worked with vendor to develop specific ISA100 Wireless instruments

Established ISA100 Wireless as global standard

- Installed wireless infrastructure as an enabling technology
- Established engineering standards
- Developed wireless preferred equipment list
- Deployed standard wireless training modules, support process and remote monitoring

Enabled WiFi in process area

- Supporting corporate Connected Worker initiative globally
- Broadcasting corporate Shop Floor SSID seamlessly between corporate IT and Process wireless networks
- Developed generic ISA100 Wireless serial interface for specialty instrument based on small PLC
- Developed wireless instrument policy for use in Advance Process Control Scheme and standard error checking and validation code

Enabling future technology

- IIOT, IOT, Data analytics
- Providing secure reliable wireless infrastructure and **sensors**
- Rapid deployment of new sensors
- Lower capital intensity
- Maintaining corporate advantage

Future

- More wireless sensors
- Less wired sensors
- Connected work force

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