# ISA100 Wireless Training: Galveston, Texas

ISA100 Wireless Application and Use Cases
Oil Field Real-time Monitoring
**Sessions 3 and 4**

Background

- Oil field is comprised of 9 operational oil wells ("production cells")
- The production cells are outfitted with pumpjacks ("nodding donkeys")
- The oil field was not covered by a dedicated, local wireless infrastructure the data was being extracted initially using cellular connectivity
- Each production cell has its own local PLC that is engaged in supervisory control (ISA95 – Level 1)
- The extraction points are spread over an area of 1.5 x 1.0 kilometers
- Terrain is rather plain with small hills and some wooded areas
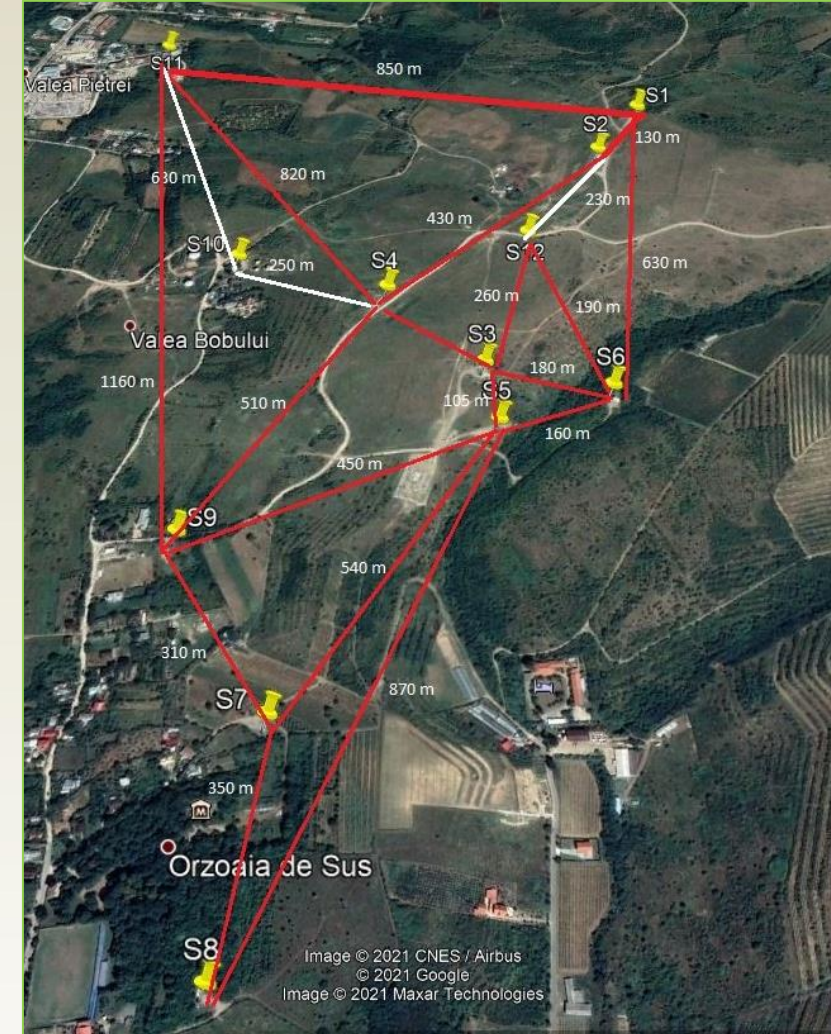
The Challenge

- Real-time operational monitoring of the production cells with minimal capital expenditure
- Monitoring and surveillance of the pumpjack to:
  - Ensure that the extraction process is in good health
  - Pro-actively detect potential issues – oil well full or partial collapse
  - Determine efficiency of the extraction process
- Monitor additional parameters in the production cell
  - Temperature and pressure monitoring
- Monitor existing PLCs engaged in supervisory control
- Reduce capital expenditure incurred by having to install hardwired field instruments and monitoring equipment spread over an area of 1.5 x 1.0 kilometers
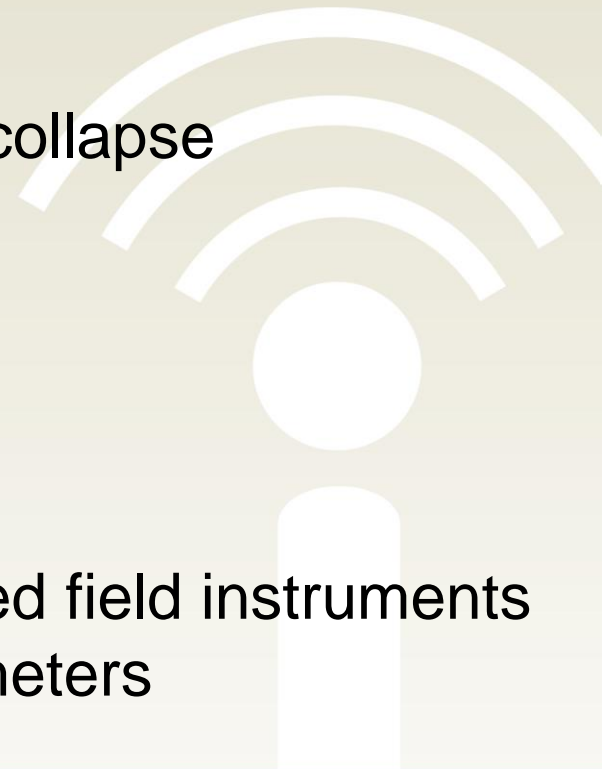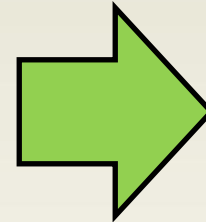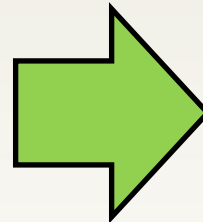
Requirements
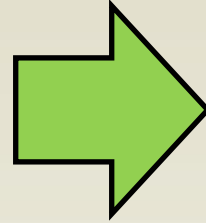
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Reduce CAPEX	Eliminate costly cabling needed using wireless connectivity for both the backbone infrastructure and field equipment
Real-time monitoring covering the entire oil field	Use wireless connectivity for both: Field Ares Network: instruments, PLCs, RTUs WAN: backbone infrastructure
High data reliability and latency guarantees	Mesh wireless technology such as ISA100 Wireless architected specifically for wireless process automation (monitoring and control)

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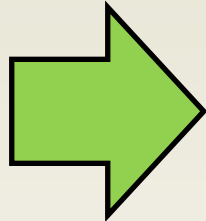
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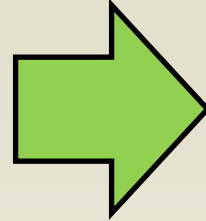
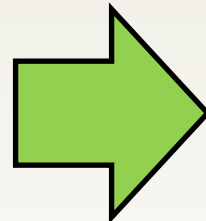|	
Interoperability	Use standards-based technologies such as ISA100 Wireless and WiFi supported by many vendors
Backend Connectivity	Report data to software entities: Level 3: Honeywell Experion Level 4: Historian - OSI Soft PI
Security	Use secure, field-proven standards-based wireless technologies like ISA100 Wireless and WiFi

Requirements (contd)

- The field instruments installed at the 8 production cells together with the wireless backbone infrastructure will form the plant-wide wireless network
- Parameters of interest will be available in real-time throughout the plant-wide network
  - ISA100 Wireless field instruments
  - PLCs
  - RTUs
- Field instruments installed will be engaged in monitoring and will also report data locally to PLCs for supervisory control through wired actuators
- Field instruments will monitor and control various parameters such as pressure and temperature
  - Typical data reporting rates range from 1 – 30 seconds (data burst/publish rate)
- Field instruments will be installed in HAZLOC areas

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The Solution

- Connect ISA100 Wireless compliant field instruments
- Deploy highly reliable plant wide Wi-Fi Mesh wireless backbone canopy
- Connect MODBUS RTU/TCP and Ethernet/serial field instruments using WiFi adapters
- Extract process data via MODBUS and OPC UA
- Products suitable for deployment in hazardous and non-hazardous areas
- Support for high-throughput, low-latency communications and mobility for simultaneous field data, audio and video surveillance transmission
- Connect IP cameras and handheld maintenance tools
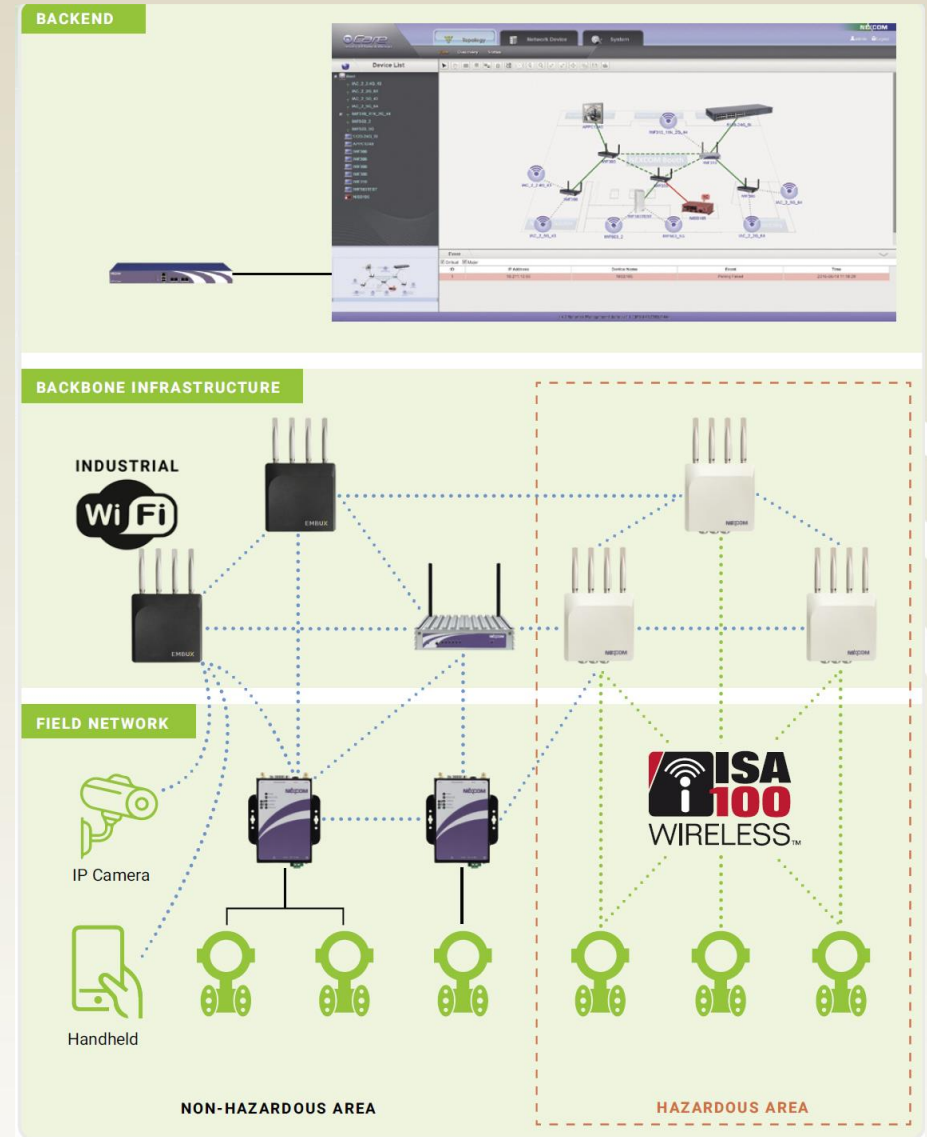
The Solution - The Backbone Infrastructure (WAN)

The wireless backbone infrastructure allows bridging of the OT/IT domains for a comprehensive digital transformation
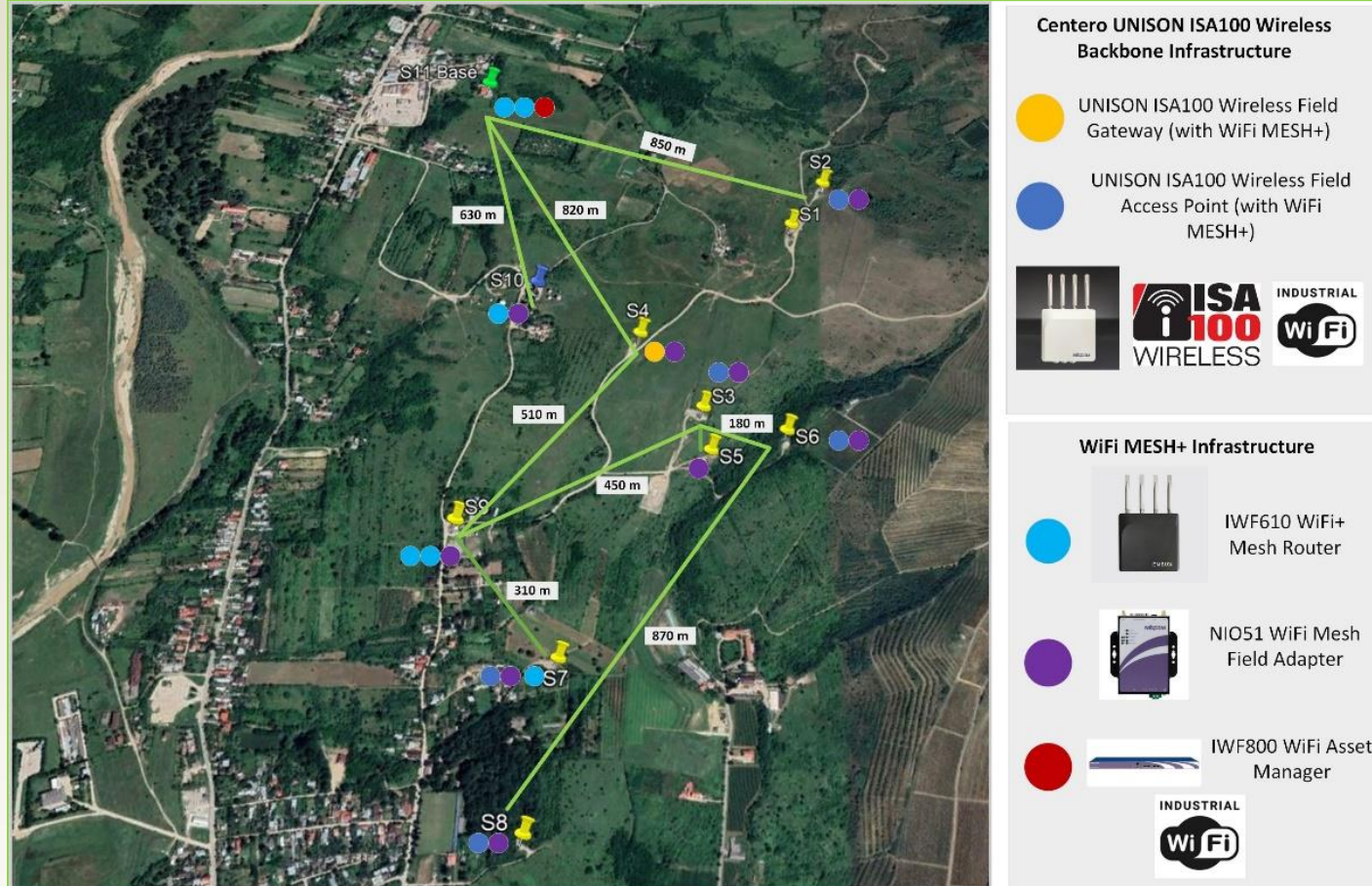
Benefits of ISA100 Wireless

Cost Savings	- Up to 90% of installed cost of conventional measurement technology can be for cable conduit and related construction - Typically: 1/2 the costs, 1/5 of the time - New and scaled applications are now economically feasible
Improved Reliability	- Wired sensors may be prone to failure in difficult environment - Wireless can add redundancy to a wired solution
Improved Visibility	- Condition monitoring of secondary and remote equipment - Process monitoring, fast additional data for trouble shooting
Improved Control	Add wireless to existing processes for more optimal control
Improved Safety	Safety related alarms - end to end SIL2 certifiable

The Solution - The Field Area Network (FAN)

Pumpjack Monitoring and Surveillance

- Data is being transmitted over the WiFi Mesh backbone infrastructure
- Pumpjack donkey arm is monitored by using a
  - Bright WLP Wireless Load accelerometer
  - WellLynx RTU
- WellLynx RTU
  - Suitable for deployments in hazardous locations - CLASS 1 DIV 2 certified
  - Plant network interfaces: RS485, Ethernet (RJ45), WiFi, Modbus RTU, Modbus TCP, DNP3, OPC-UA, MQTT
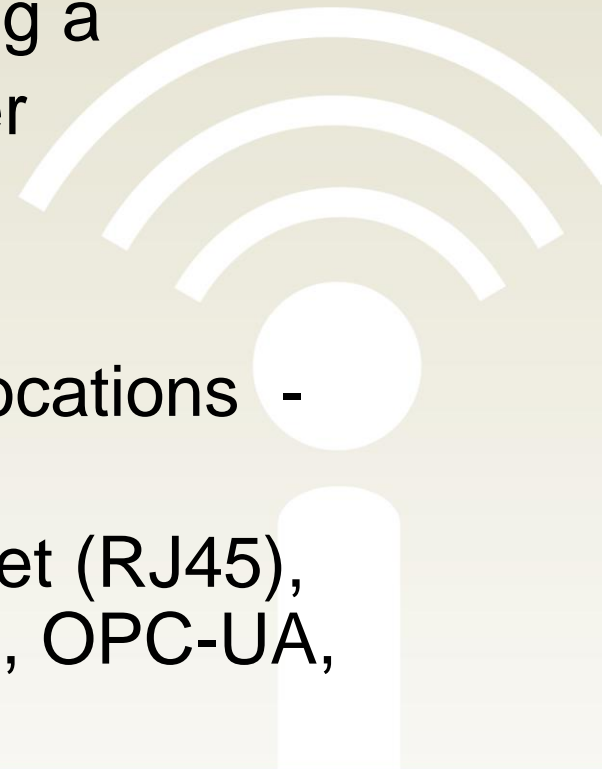
The Solution - The Field Area Network (FAN)

Oil Well Production Cell Monitoring

- ISA100 Wireless certified instruments communicate with the ISA100 Wireless Field Gateway and Field Access Point
- Data is being transmitted over the WiFi Mesh backbone infrastructure
- Field instruments will monitor and control various parameters such as pressure and temperature
  - Typical data reporting rates range from 1 – 30 seconds (data burst/publish rate)
- Field instruments are installed in HAZLOC areas
  - Honeywell Temperature Transmitter STIW400
  - Honeywell Pressure Transmitter STGW74L

The Solution - The Field Area Network (FAN)

Oil Well Production Cell Monitoring

- Local PLCs connected to NIO51 WiFi Mesh+ field adapter
- NIO51 WiFi Mesh+ field adapter communicates with IWF610 WiFi Mesh+ routers
- Data is being transmitted over the WiFi Mesh+ backbone infrastructure

ISA100 + WiFi Mesh+ Wireless Infrastructure

CONNECT

- ISA100 Wireless and WiFI Mesh+ high throughput backbone connectivity
- Supports highly scalable deployments in multiple topologies
- Monitoring and advanced control features
- Over-the-air provisioning with advanced security features
- Advanced diagnostics – NAMUR, wireless health and battery life
- Native support for DD/CF files
- Long-range ISA100 Wireless connectivity - 1.2 miles (2 km) LoS
- Multiple models for deployments in hazardous as well as non-hazardous areas

ISA100 + WiFi Mesh+ Wireless Infrastructure

CONNECT

- ISA100 Wireless compliant System/Security Manager, Gateway and Backbone Router
- Scalability: **200** ISA100 Wireless field instruments in up to **20** wireless mesh subnets
- Publication data reporting rates: 0.5, 1, 2, 5, 10, 30 seconds, 1, 5, 15, 30 and 60 minutes
- Over-the-Air provisioning with enhanced security mechanisms
- DD/CF file parsing including all ISA100 Wireless native objects and WCI extensions
- Suitable for deployments in hazardous locations - C1D2 or ATEX
  - UL: Class I, Division 2, Groups A, B, C, D and T4
  - ATEX: Class I, Zone 2; EX nA II, T2
- Plant network interfaces: MODBUS, GCCI, OPC UA (ISA100 Data Model)
- All software and firmware is remotely upgradable via secure AES-256 encrypted and authenticated process
- Power redundancy (DC and PoE)

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ISA100 WIRELESS

INDUSTRIAL Wi Fi

Industrial WiFi Mesh+ Infrastructure

CONNECT

- Deploy and manage Industrial WiFi Mesh Infrastructure
- Explosion proof Wi-Fi 802.11 a/n mesh router for hazardous locations (HazLoc)
- Multiple operation modes Mesh/AP/Client meets various deployment models
- Class I, Div2 and ATEX certified for oil and gas refineries, petrochemical plants, paper/pulp mills and mining pits
  - UL: Class I, Division 2, Groups A,B,C and D
  - ATEX: Class I, Zone 2; EX nA II T5
- High throughput and mobility for simultaneous data, audio and video surveillance transmission
- Path-redundant, adaptive and self-healing Mesh network functionality
- State of the art security and versatile security management options
- Extended range (2XMIMO 2X2) without reliability and latency trade-offs
- Extended -40 to +75 °C operation temperature range
- Heavy industrial grade with Level-4 EMC immunity to Surge, ESD/EFT
- Hosts intuitive web-based configuration and management interface
- Easy web-based configuration and security management through nCare
- Power redundancy (DC and PoE)

INDUSTRIAL
Wi Fi

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Industrial WiFi MESH+ Field Adapter

MONITOR and CONTROL

- Deploy and manage industrial WiFI Mesh connected field instruments and infrastructure
- Cost-effective industrial WiFI/Mesh connectivity for Modbus RTU/TCP and serial/Ethernet devices
- Multiple WiFI operation Mesh/Router/Client modes meet various deployment models
- Path-redundant, adaptive and self-healing WiFi Mesh network connectivity
- MODBUS RTU/TCP to WiFi adapter
- Supports serial RS232/422/485/Ethernet to WiFi and Ethernet bridging
- WiFI Mesh/802.11 a/b/g/n and 2.4/5 GHz selectable with 2x2 MIMO
- Extended -40 to +70 °C operating temperature range
- Easy web-based configuration and security management through nCare

Challenges Encountered

- Oil field real-time monitoring is a novel use case
- Large distances between the oil wells (production cells) required installation of directional antennas
- Antennas had to be installed via extension cables on top of electric poles at various heights
- Terrain and vegetation also presented a challenge for some of the wireless links
- Directional WiFi antennas needed to be aligned and fine tuned for optimal wireless performance for the long wireless range connectivity

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Acceptance Test Results

- Real-time monitoring of oil well efficiency
- Data provided allow for early, pro-active alerting of oil well collapse
- ISA100 Wireless communication reliability > 99.9%
- WiFi Mesh+ wireless backbone infrastructure communication reliability > 99.7%
- ISA100 Wireless process values are extracted through
  - MODBUS -> reported to Honeywell Experion
  - OPC UA ISA100 Wireless data model -> reported to historian
- Process values collected from field RTUs over WiFi -> reported to DCS and historian