



GUIDING DEPLOYMENT OF WIRELESS INSTRUMENT NETWORKS EMBRACING THE TECHNOLOGY

February 8, 2017

PHILLIPS 66 REFINING OVERVIEW



Our Refining segment processes crude oil and other feedstocks into petroleum products such as gasoline, diesel and aviation fuel. Phillips 66 has 13 refineries and a net crude oil processing capacity of 2.2 million barrels per day (MMBD).

Built in 1927 - The Borger Refinery is located in Texas, about 50 miles northeast of Amarillo. It's owned by WRB Refining LP, a 50/50 partnership between Phillips 66 and Cenovus Energy, and operated by Phillips 66. The refinery processes primarily medium sour crude oil and NGL delivered through pipelines from West Texas, the Texas Panhandle and Canada. Borger has a gross NGL fractionation capacity of 22,500 BPD.

Borger has two fluid catalytic cracking units, alkylation, delayed coking, hydrodesulfurization and naphtha reforming. This enables it to produce a high percentage of transportation fuels such as gasoline, diesel and aviation fuels, as well as petroleum coke, NGL and solvents. Pipelines move refined products to West Texas, New Mexico, Colorado and the Midcontinent region

U.S. REFINING as of March 31, 2016



EUROPE REFINING As of March 31, 2016



PROBLEM – RELIABILITY AND EOL SUPPORT ISSUES

TANK GAUGE EQUIPMENT AND ICS SYSTEMS OBSOLESCENCE



- (147) Tank Gauge Instruments Throughout (9) Tank Farms
 - Tank Farms Spread over 7 Mile Area not counting production areas
 - L&J Shand & Jurs Tank Gauges Beyond End of Life
- (18) Customized RTU Locations Beyond End of Life
 - Custom L&J code to Bristol PLC Integration to Control System
 - Slow link 900Mhz serial radio based systems
 - Challenges – Size of areas being covered, Locations and terrain
 - Prerequisite – Must be completed before Blending ICS upgrade can begin
- Blending Instrumented Control System (ICS)
 - Honeywell OM&S System Support Beyond End of Support
 - Challenge – Migrate to new system under 48 hour cutover

SOLUTION REQUIREMENTS

PROPOSED SOLUTIONS MUST BE PART OF LONG RANGE PLAN



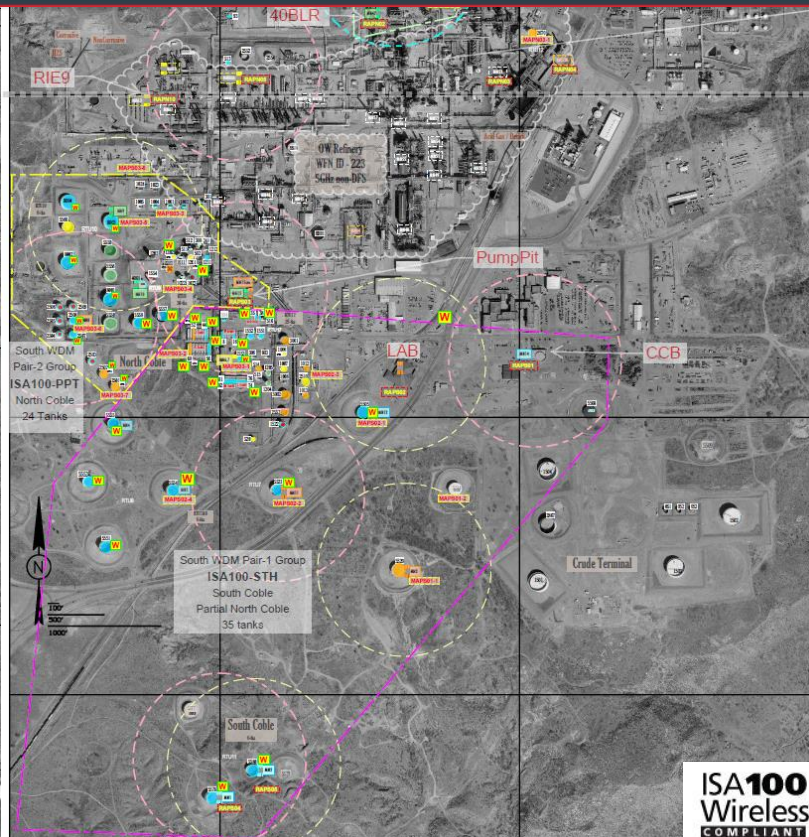
- Total installed cost estimates are presented as part of Long Range Capital budget cycles (5 and 10yr plans)
- Solutions must be supported for minimum of 15 years
- Interim phased solutions must be compatible with later phases
- Solutions must be implemented without disruption to existing ICS Blending Operations

SOLUTIONS EVALUATED

A MULTI-PHASE PROJECT WAS CHOSEN FITTING LRP REQUIREMENTS

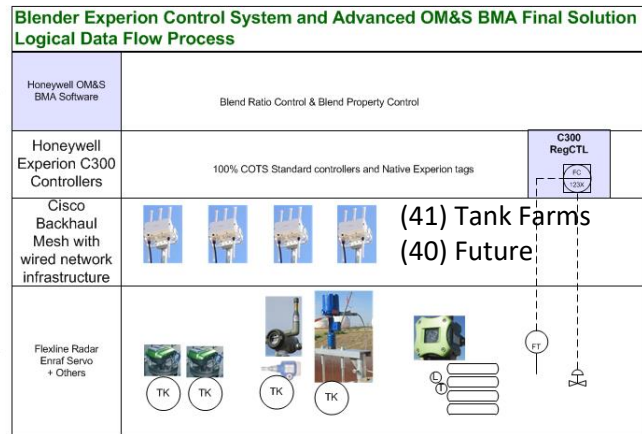
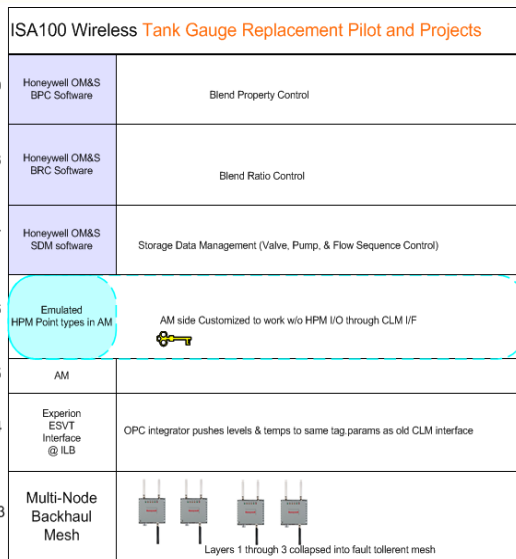
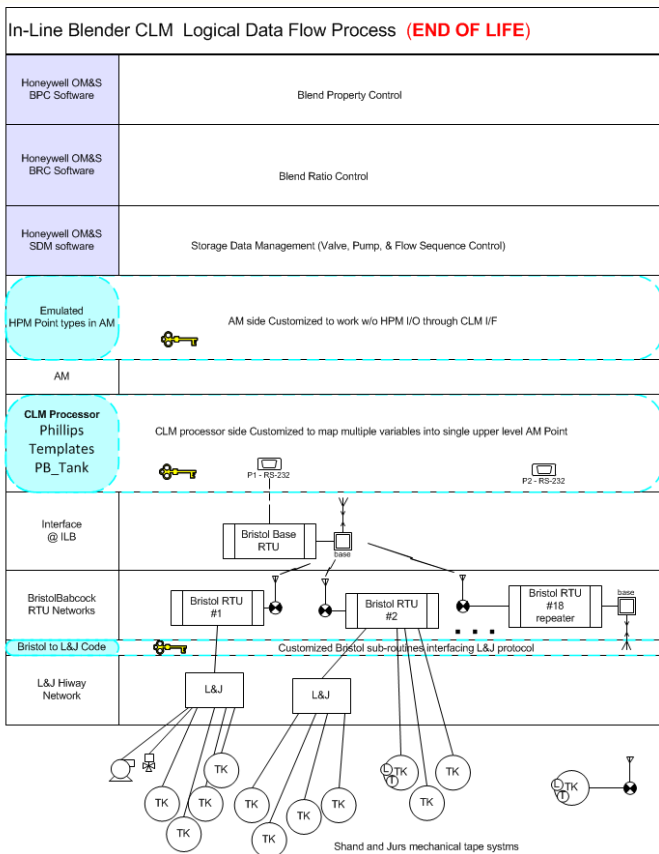


- Replace Tank Gauge Instruments (2 ½ year Pilot and Phased projects)
 - Hardwired and wireless solutions were evaluated
 - Wireless technologies chosen as the most cost effective method
 - ★ ISA100 Honeywell OneWireless selected
 - + Scalable to thousands
 - + Maintenance Friendly - OTA Provisioning, OTA Sensor & Radio Upgrade
 - + Greater Security - encryption at more protocol layers
 - + QoS end to end latency timing guaranteed – S84* (every packet timestamp inspected)
 - + Interoperability is Better – Additional Functionality Feature Sets (tunneling)
 - + Device Meshing repeater configurable as needed (increased battery life)
 - + Higher Reliability in communication – Adaptive Hopping Schemes with multiple offsets in each
 - Pilot case study 10, 20 tanks to prove technology
 - Expanded to include all tanks



ISA100 HONEYWELL ONE-WIRELESS FIT

COMPLEX CUSTOMIZED INTEGRATION REPLACED WITH COTS BEST PRACTICES



(147) Tank Gauge Instruments (Radar & Servo)

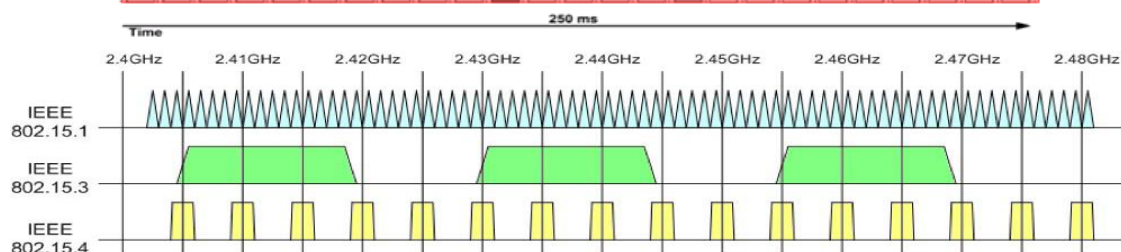
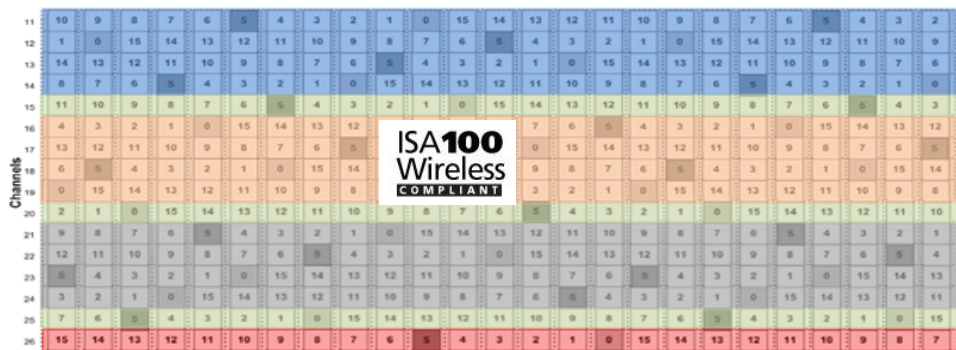
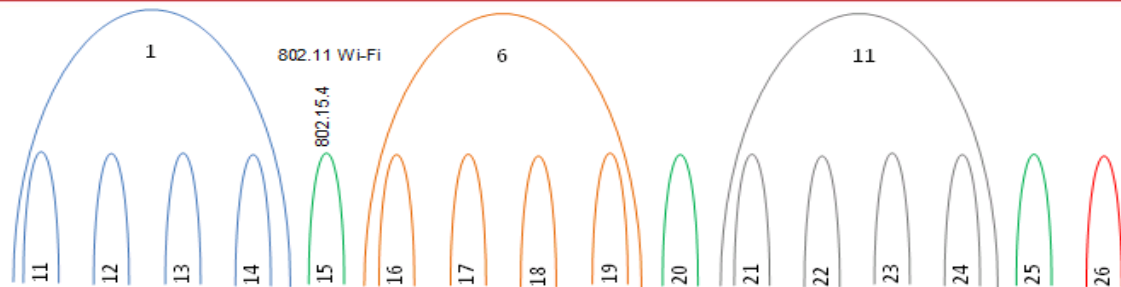
(137) Added XYR 6000 multi-channel xmtrs (power alarm and High Level)

(60) Floating roof IHLL (Tuning Fork & Float Switch)

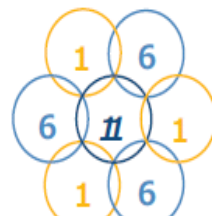
ISA100
Wireless
COMPLIANT

WIRELESS DESIGN & MANAGEMENT PLANNING

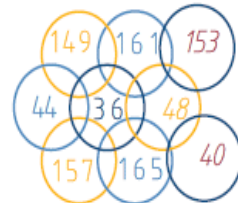
THE WIRELESS PIPE SIZES ARE LIMITED, PLAN USAGE WISELY



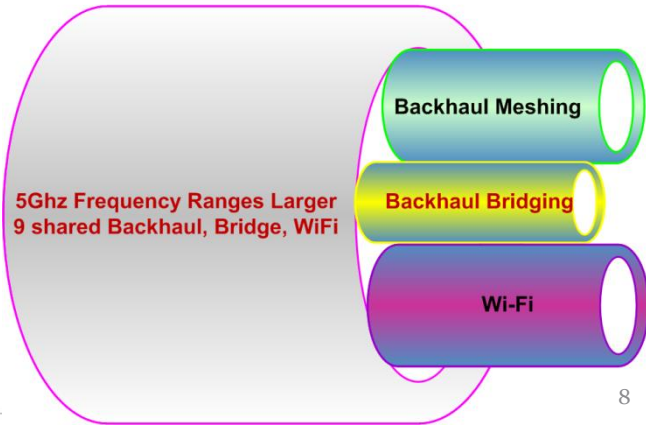
Typical 20 Mhz Channel Selections
802.11b/g/n - 2.4 GHz
(minimize cell overlap)



Non-DFS 20 Mhz Channel Selections 802.11a/n - 5 GHz



2.4Ghz Frequency is Shared Space
3-Wifi, 15 Instrument, 80 Bluetooth
ISA100 60%



CONSTRUCTION EXECUTION

A MULTI-PHASE PROJECT WAS CHOSEN FITTING LRP REQUIREMENTS



- **Pilot Wireless Tank Gauge Project**
 - Honeywell completed wireless surveys and system design
 - P66 managed 3rd Party contractor for construction installation
 - Honeywell completed configuration commissioning
- **Plant Wide Tank Gauge and Blender Upgrade Projects**
 - Honeywell re-verified wireless surveys
 - Honeywell completed Network designs
 - Honeywell managed 3rd Party contractor for construction installation
 - Honeywell completed configuration commissioning

BENEFITS

PERFORMANCE IMPROVEMENTS



- OneWireless Devices are Experion ICS Native
- Simplified Integration Complexity (Easier to Support)
- Scalable (Easier to add new Devices)

\$ Increased Reliability

\$ Increased Speed of Data to the operator - minutes to seconds

\$ Blending Performance increased 18% (# of Blends per week)

- Prepared Foundation to deploy Mobile Operator Applications (2017 rollout)

- **Design and Size Wireless upfront including future wireless vision**
 - Allocate channel management and expected throughputs per application
 - Eliminates costly re-design and replacement when deploying new applications
 - Eliminates reliability issues caused by coexistence interference (There will be interference, manage what you can)
 - Wireless instrument networks were new to P66 and the lessons learned on the Borger project along with piloting wireless projects across our company quickly lead to the development of companywide wireless guidelines and standards
 - Wireless awareness
 - Development and deployment of wireless instrument networks and Wi-Fi mobile operator applications
 - Requires evaluation of new applications prior to purchase to ensure conformity, compatibility and avoid system interference
 - Determine power needs/options (Solar may not always be an option as our Pilot testing revealed)
- **Partnership with Honeywell**
 - Pilot testing the wireless infrastructure resulted in vendor redesign and helped influence enhancement plans to incorporate capabilities of IEEE's and ISA100's most current instrument network standards.
 - maximum density of instruments,
 - increased security,
 - reliability
 - improved user maintenance.