

sure

crossTM
wireless network

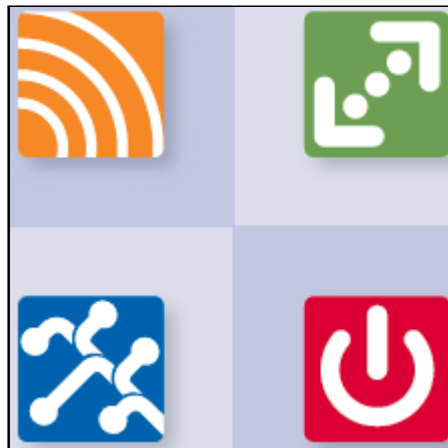
sensing unplugged.

BANNER[®]

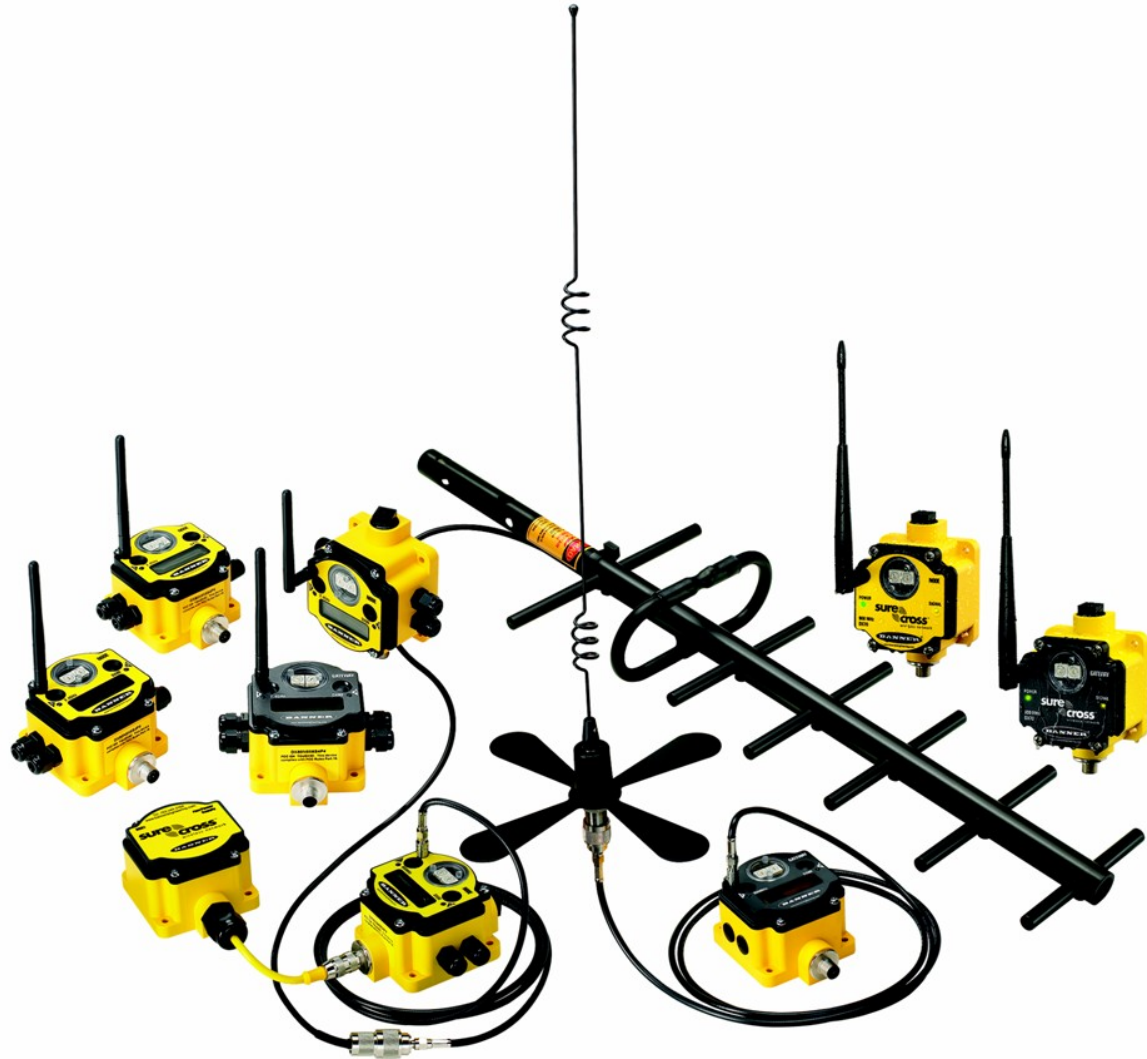
more sensors, more solutions

www.bannerengineering.com/wireless

On-Facility Wireless Control and Monitoring



Wireless: Simple and Reliable Solutions



What is Required in the Municipal Environment?



- Integrate with Existing Equipment
- Scalable Across Large Facilities
- Resistant to Interference and Harsh Environments
- Power Efficient for Remote Deployment





Current Wireless Options



DIN Rail Versions



Start with a radio
having little or no
I/O



Panel Mount Versions



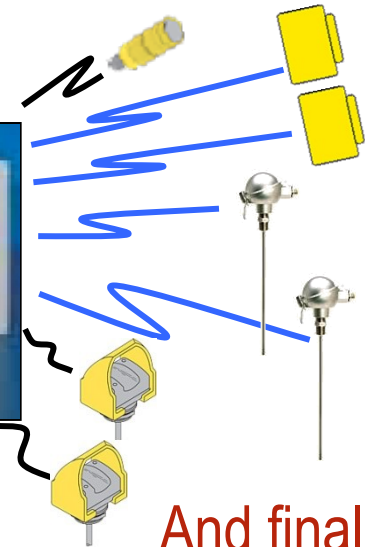
Add: DIN Rail
Some I/O
Terminal strips



Mount all
your stuff

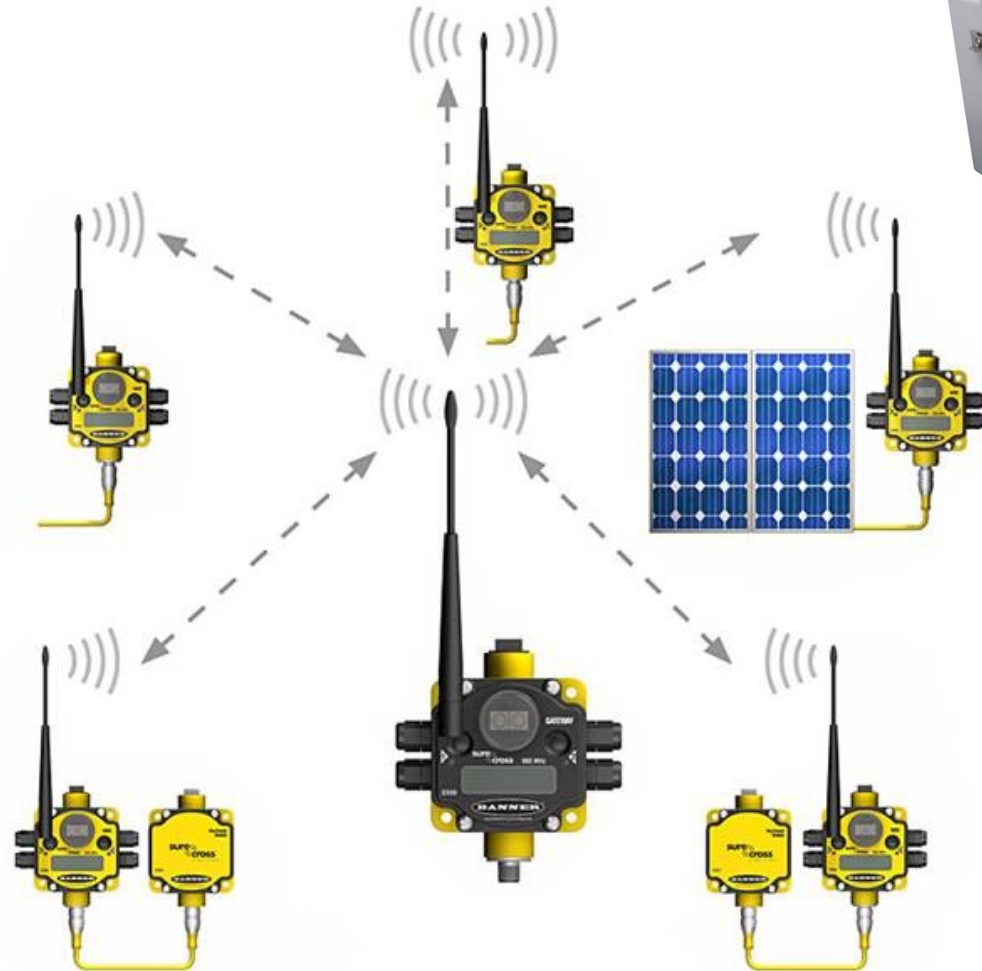


Stick it in a box and
then install the box



And finally...
Wire your I/O

Wireless: Radio, Battery and I/O In One Package





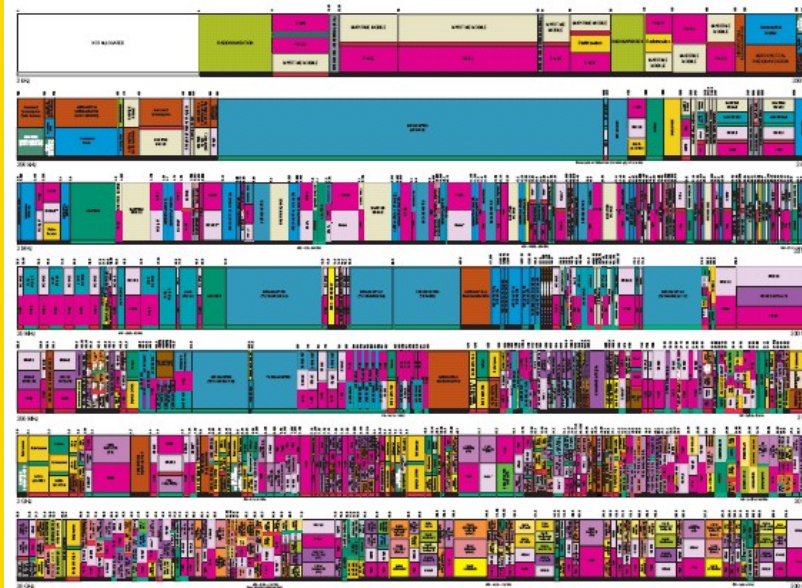
Radio Design



Radio Design: Frequency



- Bidirectional Transceiver Broadcasting in Industrial, Scientific, Medical (ISM) Band:
 - 902-928 MHz ISM Band
 - 2.4 GHz ISM Band
 - No license required (but, it is certified by the FCC)



Mega-Hertz = 1×10^6 cycles/sec.

Giga-Hertz = 1×10^9 cycles/sec.

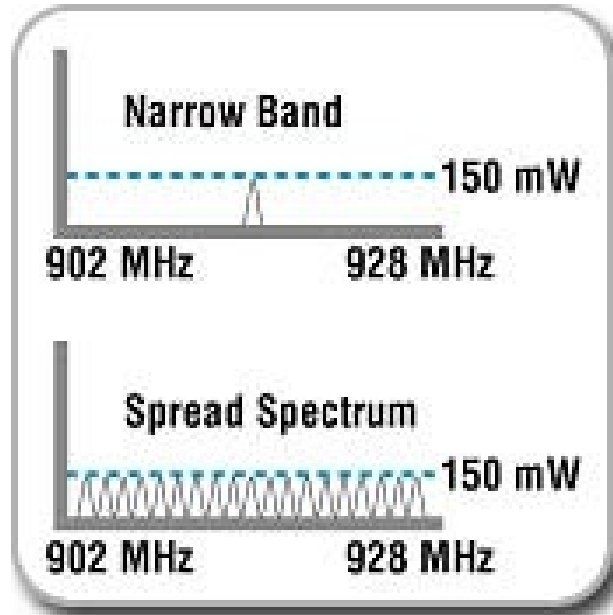
US Department of Commerce
Radio Frequency Allocation Chart



Radio Design: Architecture



Frequency Hopping Spread Spectrum (FHSS)



HOP TABLE

1	2,4,6,8,10....
2	1,3,5,7,9
3	
4	
5	

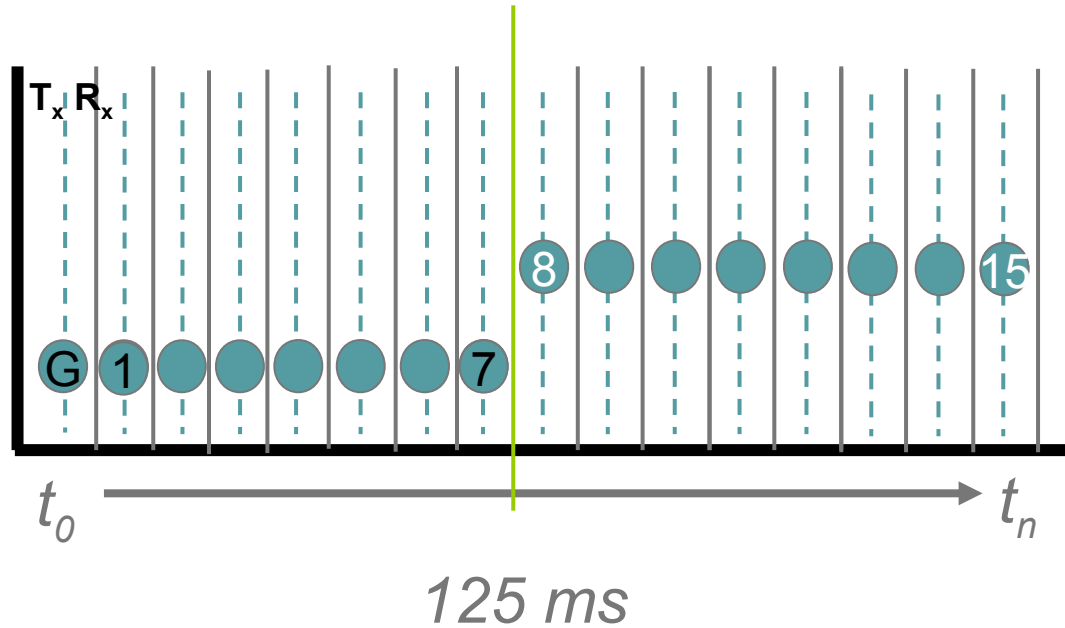
- Allows for many radios to operate in confined spaces



Radio Design: Architecture



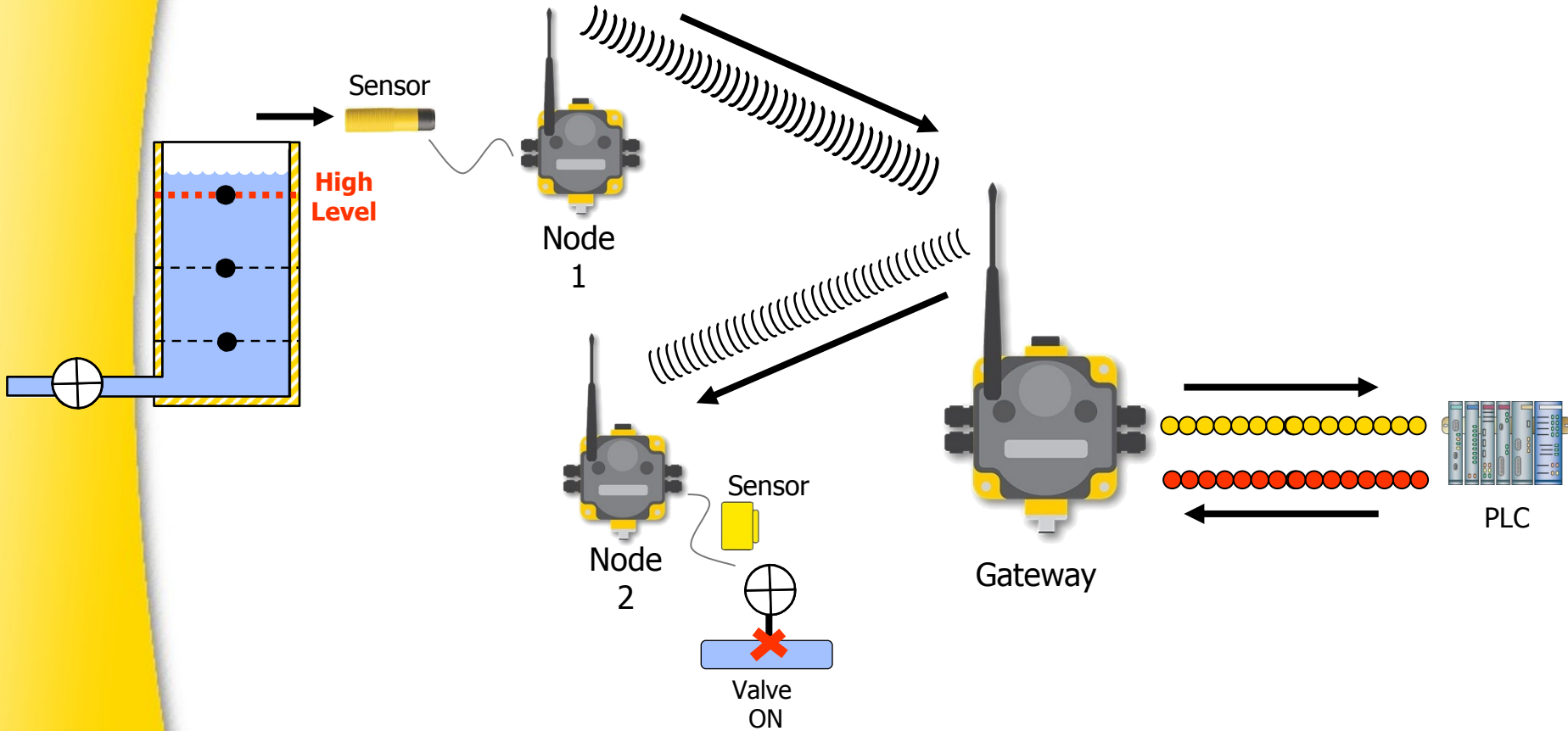
Time Division Multiple Access (TDMA)



- Every Transmitter & Receiver is Guaranteed a time slot
- Minimizes possibility of packet collisions
- Contention Approach – Different? Better?



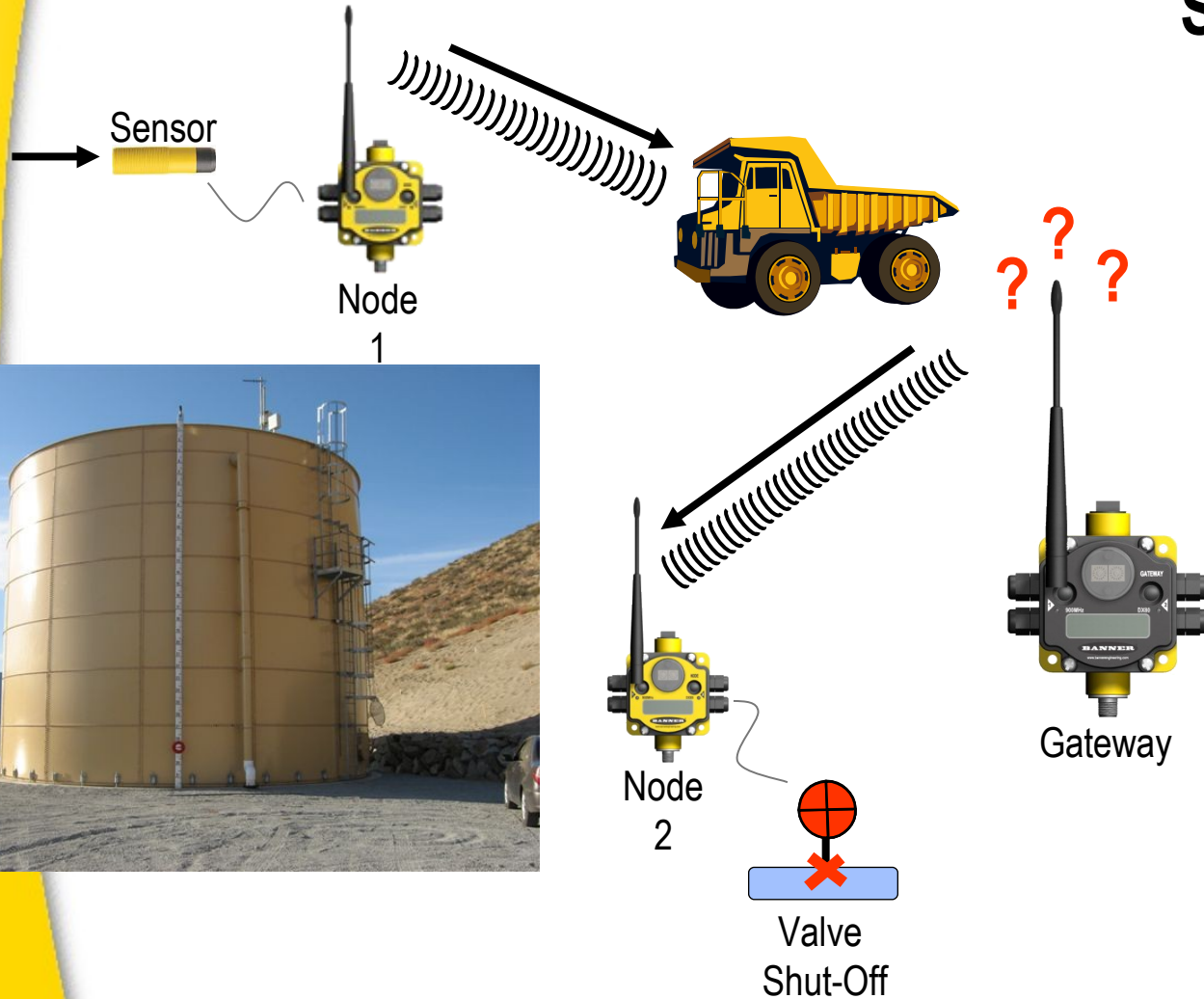
Radio Design: Wireless Control



Radio Design: Deterministic Control



Safe Harbor Scenario








Radio Design: Site Survey



For Example...the SureCross method



= # of packets

1GXX		> -90 dBm
1YXX		
1RXX		< -100 dBm
<hr/>		
1MXX		« -108 dBm
Total = 100		 RF signal strength

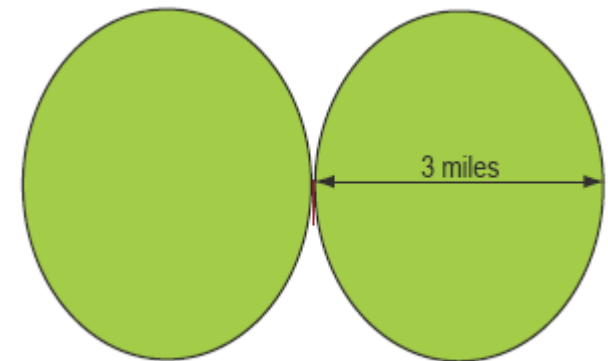
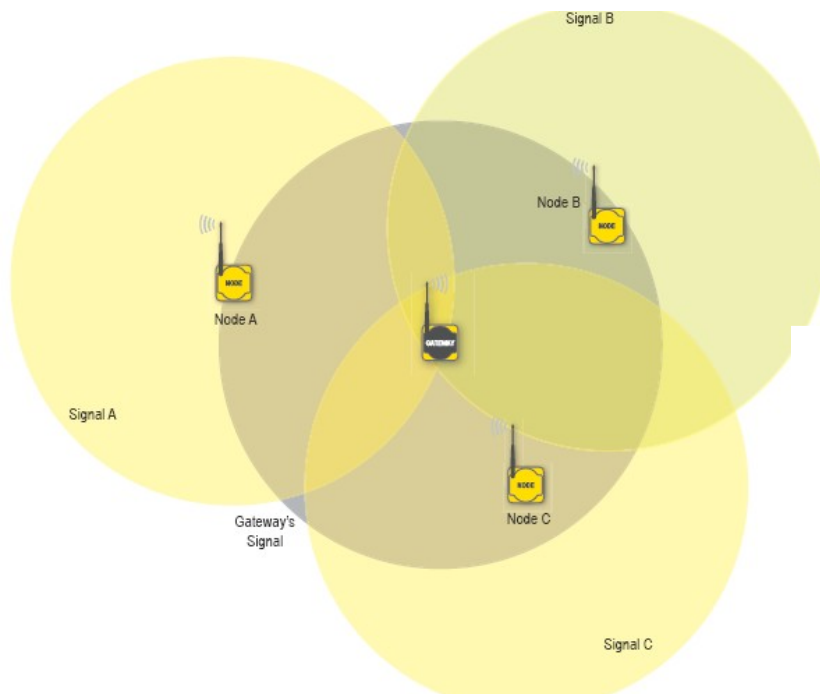
Sum of **Green, Yellow, Red & Missed** packets will be "100"



Radio Design: Antennas



- Multi-directional
 - Omni or Omni-directional
 - Signal radiates in all directions (low gain)
 - Internal Antenna Option



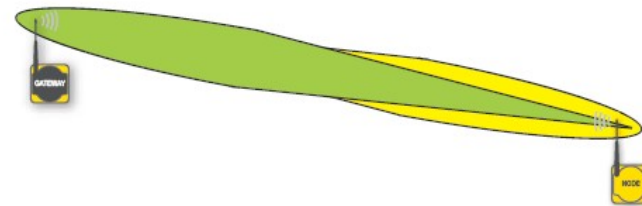
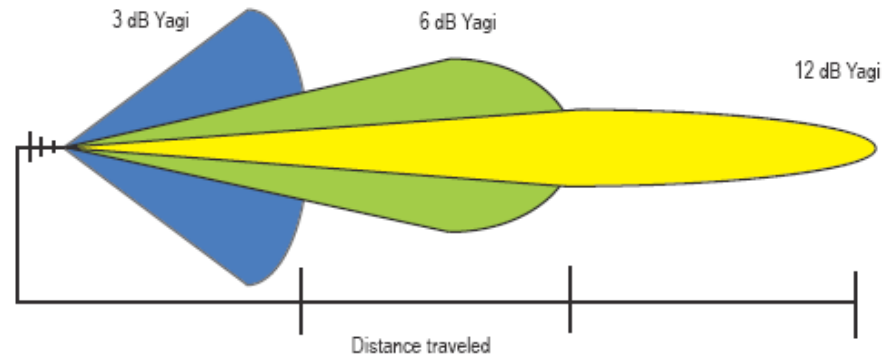
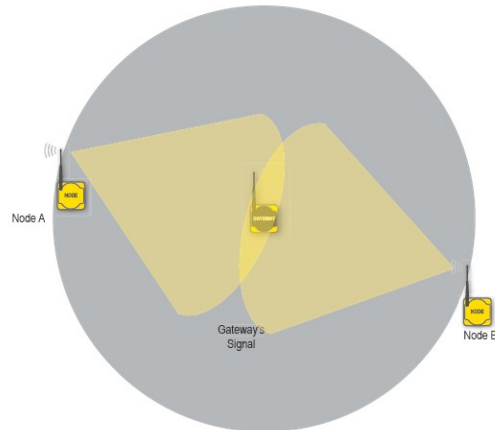
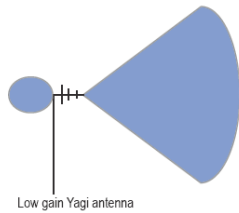
Side View - Zero Gain Dipole Omni





Radio Design: Antennas

- Directional
 - Yagi
 - Focuses the energy in one specific direction (higher the gain, the more focused)



Power Design

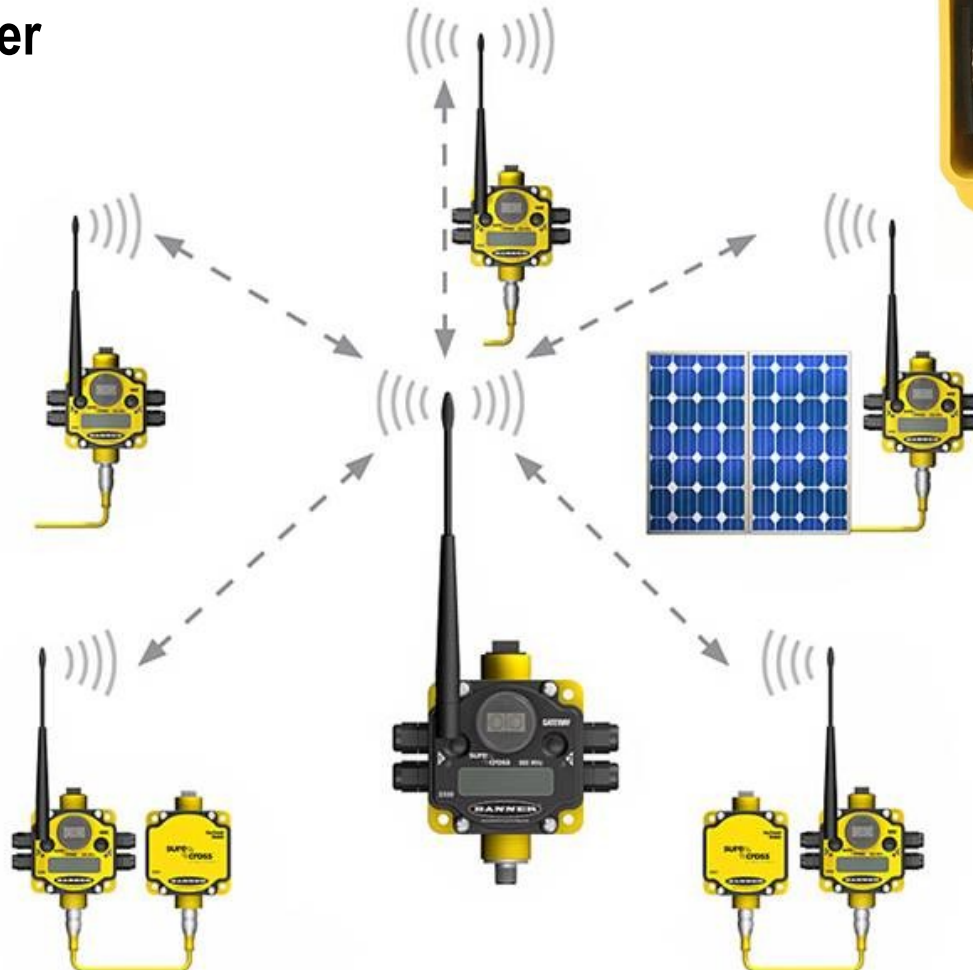


Power Design: *FLEX*Power™



Flexible Power Options

- Line Power
- Battery
- Solar

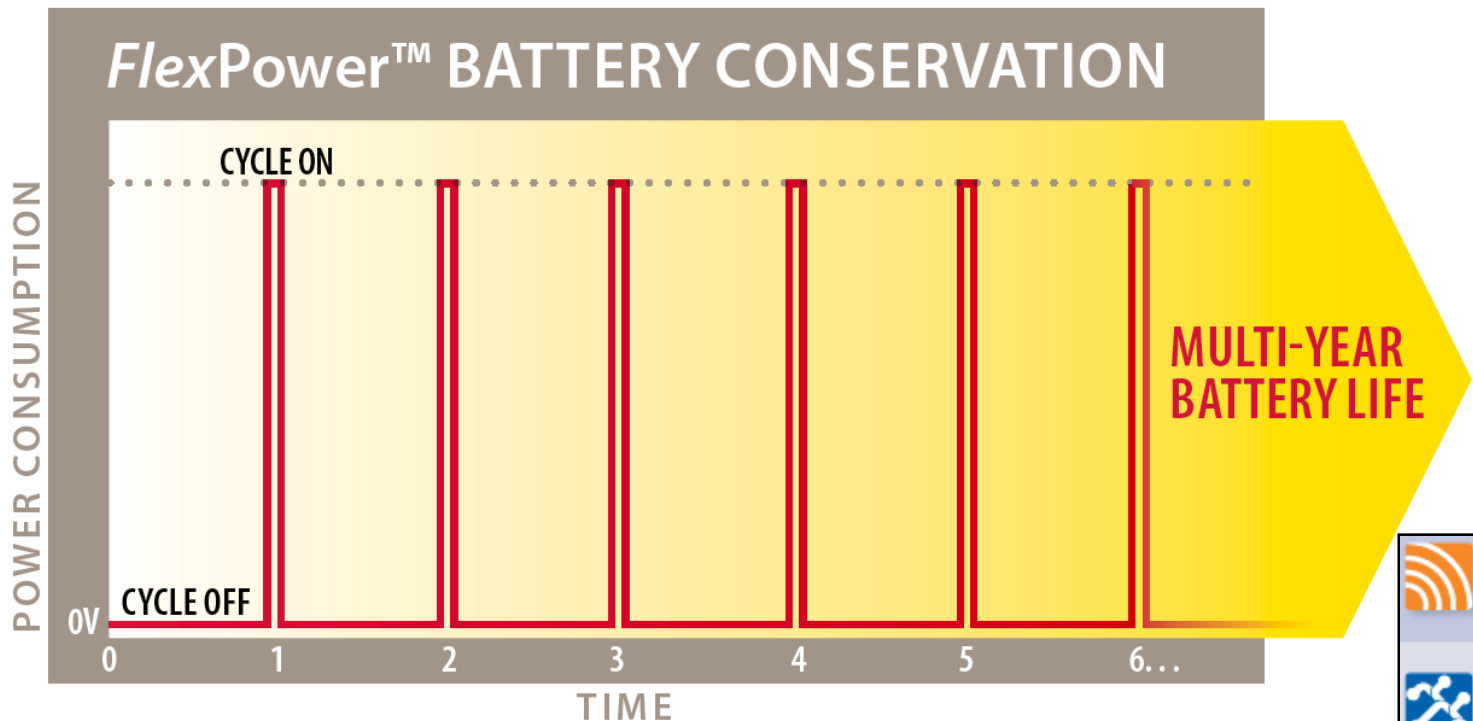




Banner's Solution

- Small Battery 3.6V
- Big Punch
- Lots of Endurance
- External Battery Box

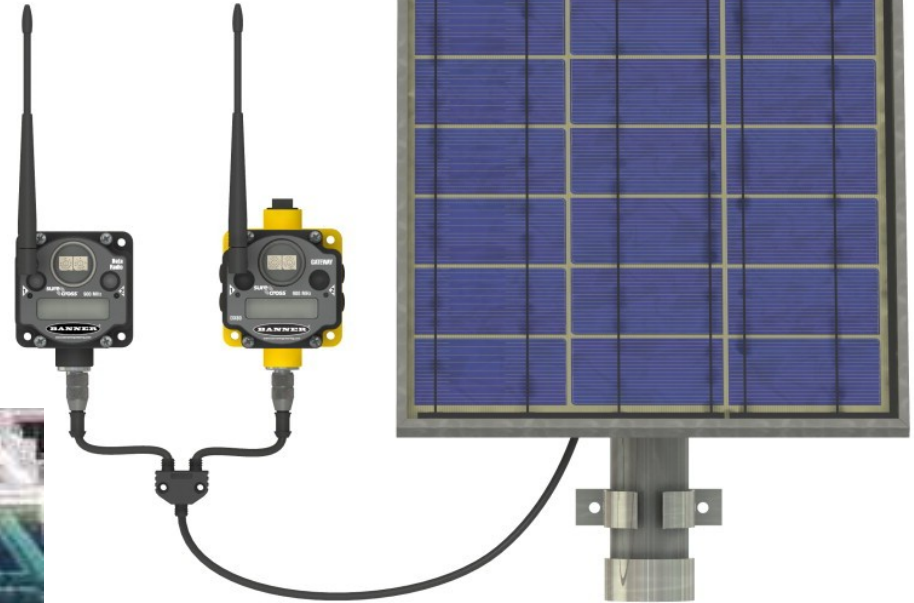
Gives Us the Peel-n-Stick Solution



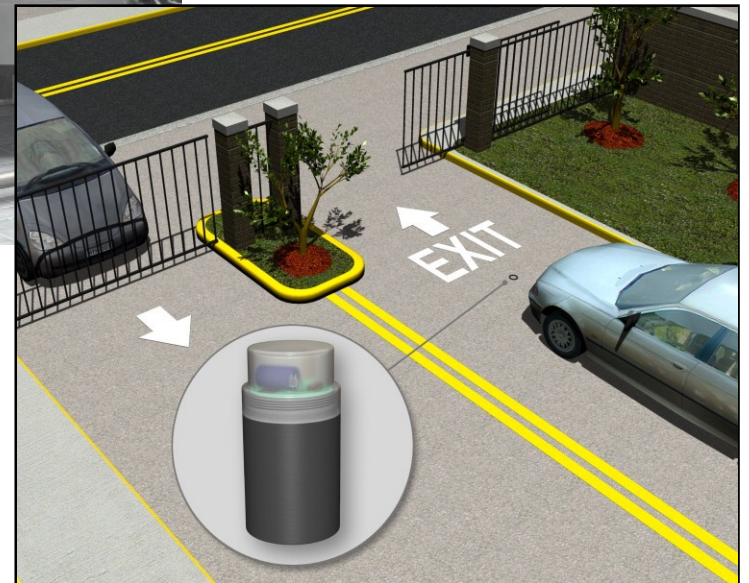
Power Design: “Peel-n-Stick”



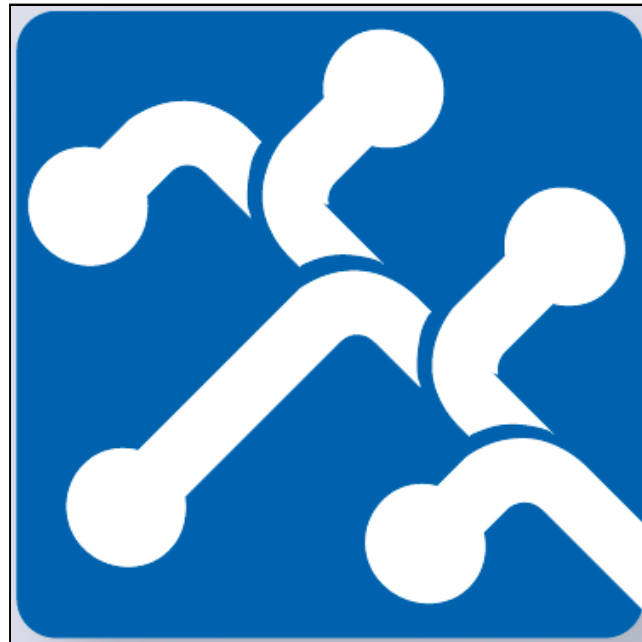
- Flexible and Mobile
- No Hassle Installation
- Unlimited Expandability
- No Software Required
- Access Remote Locations



Wireless Solutions: Various Battery Approaches



I/O Design





I/O Design: Flexible I/O

Multiple Types of I/O

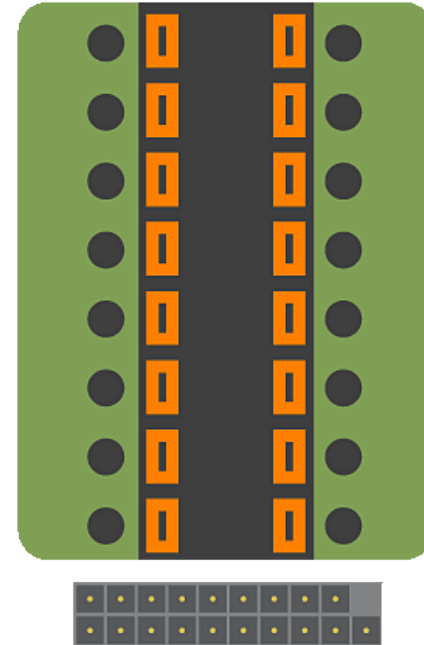
- Digital
- Analog
- Thermal
- Communication
- Transparent Serial



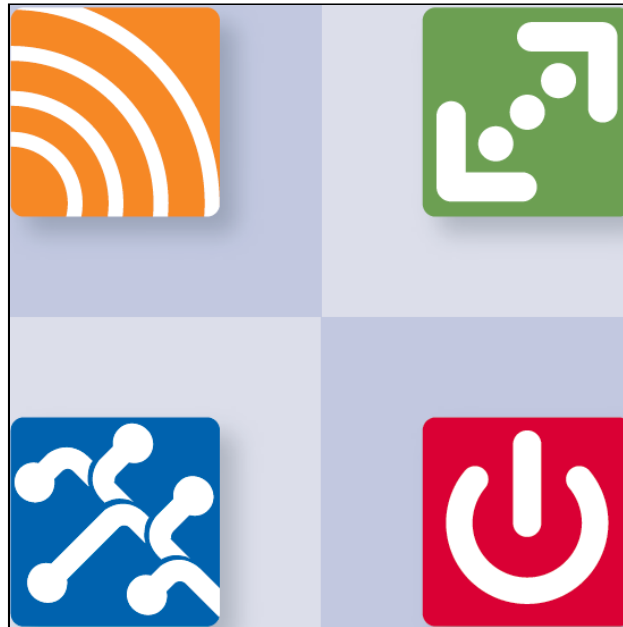
I/O Design: DX80 Off-the-Shelf Options



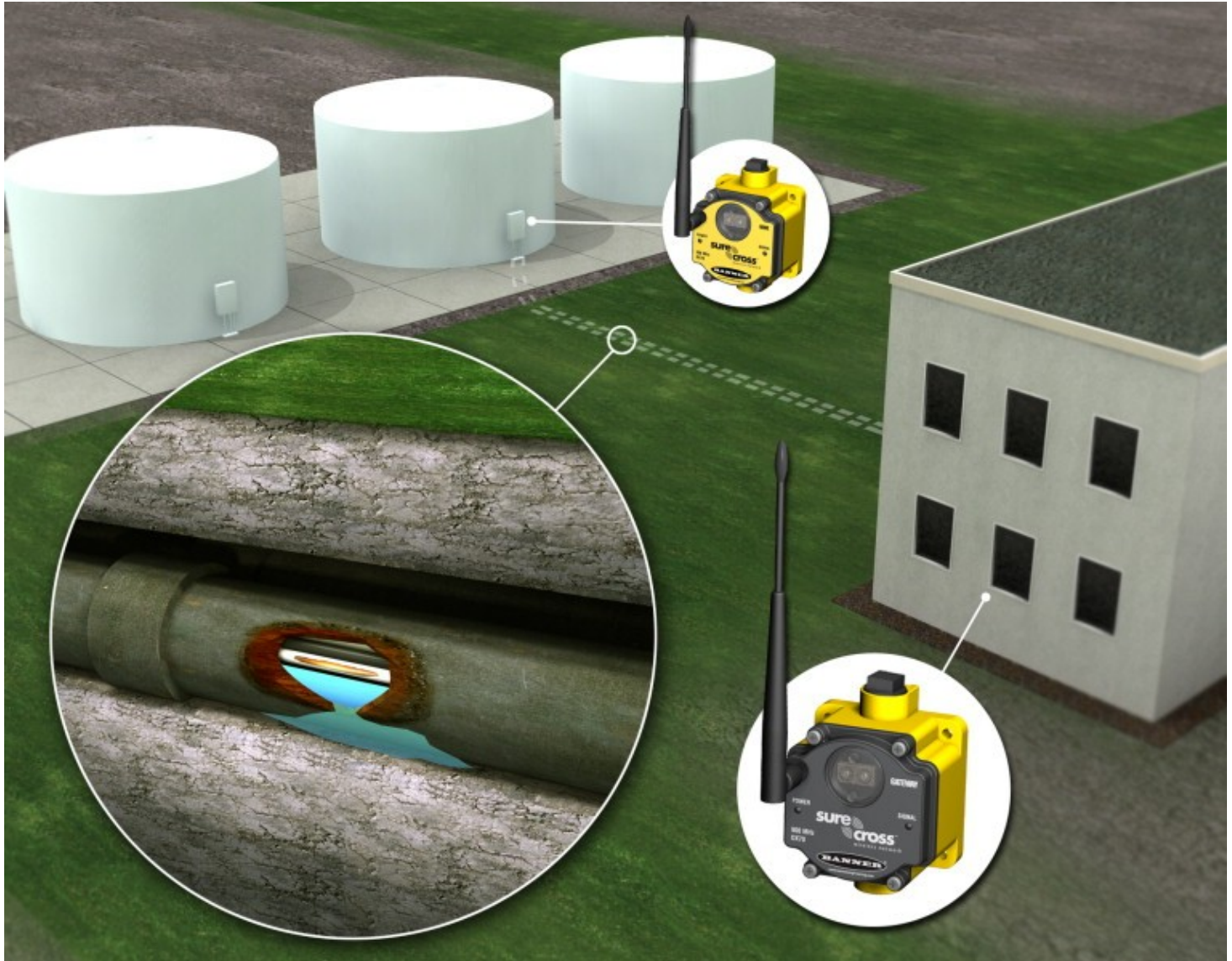
- **Inputs (example)**
 - 2, 4, 6, or 8 digital
 - 2 or 4 digital, 2 or 4 analog
- **Outputs (example)**
 - 2, 4, 6, or 8 digital
 - 2 or 4 digital, 2 or 4 analog
- **Gateway communication**
 - Serial RS-485 modbus RTU
 - GatewayPro ~ TCP/IP
 - GatewayPro ~ Ethernet IP



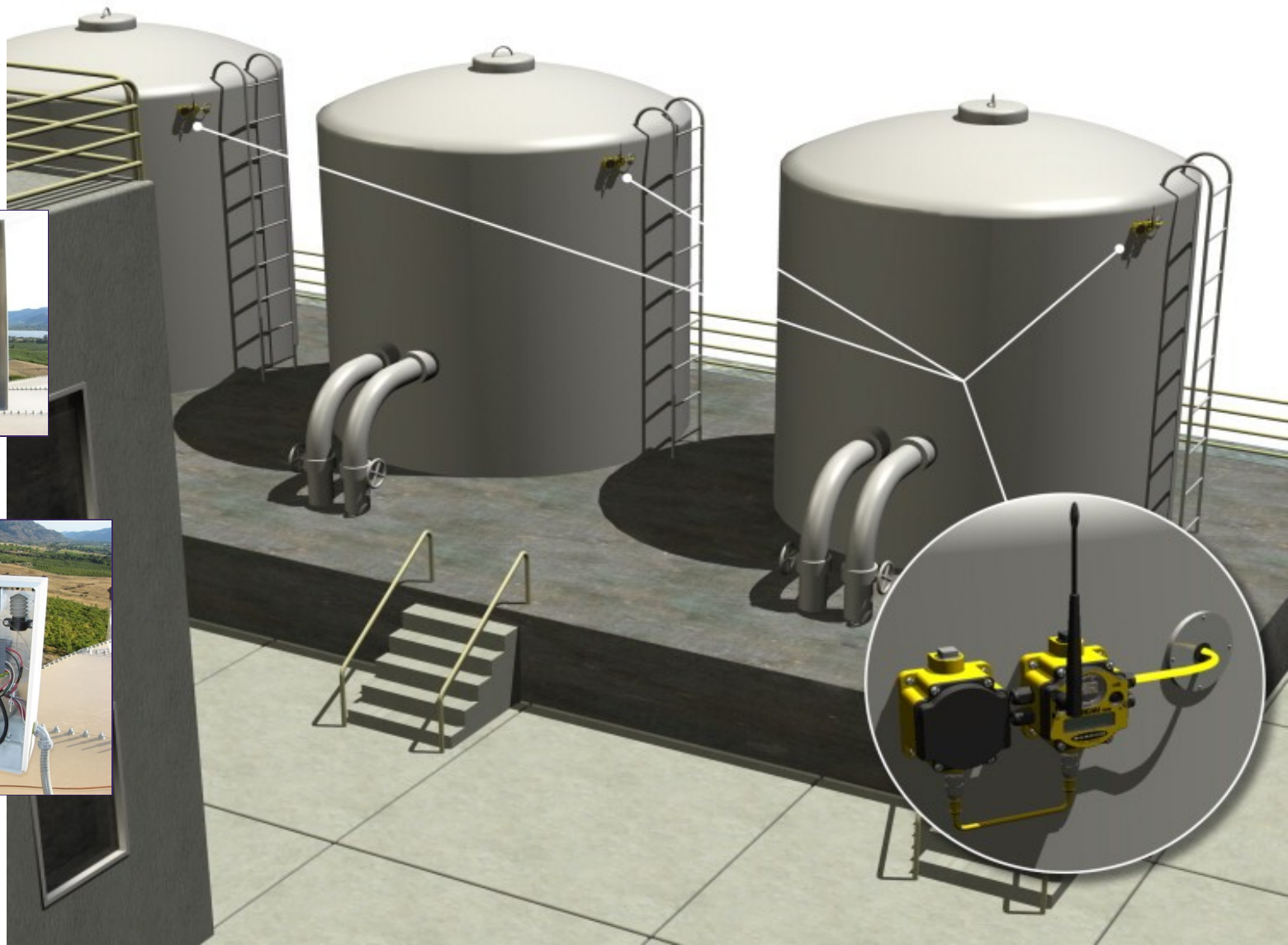
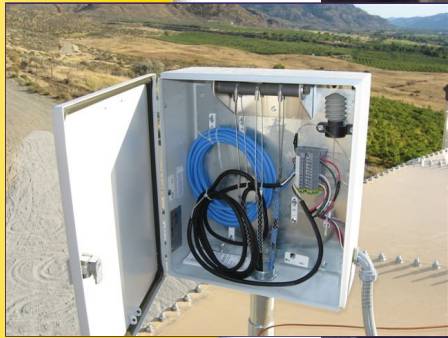
Winning With Wireless



Wireless Solutions: Failed Conduit



Wireless Solutions: External/Remote Tank Monitoring



Wireless Solutions: Preventative Maintenance



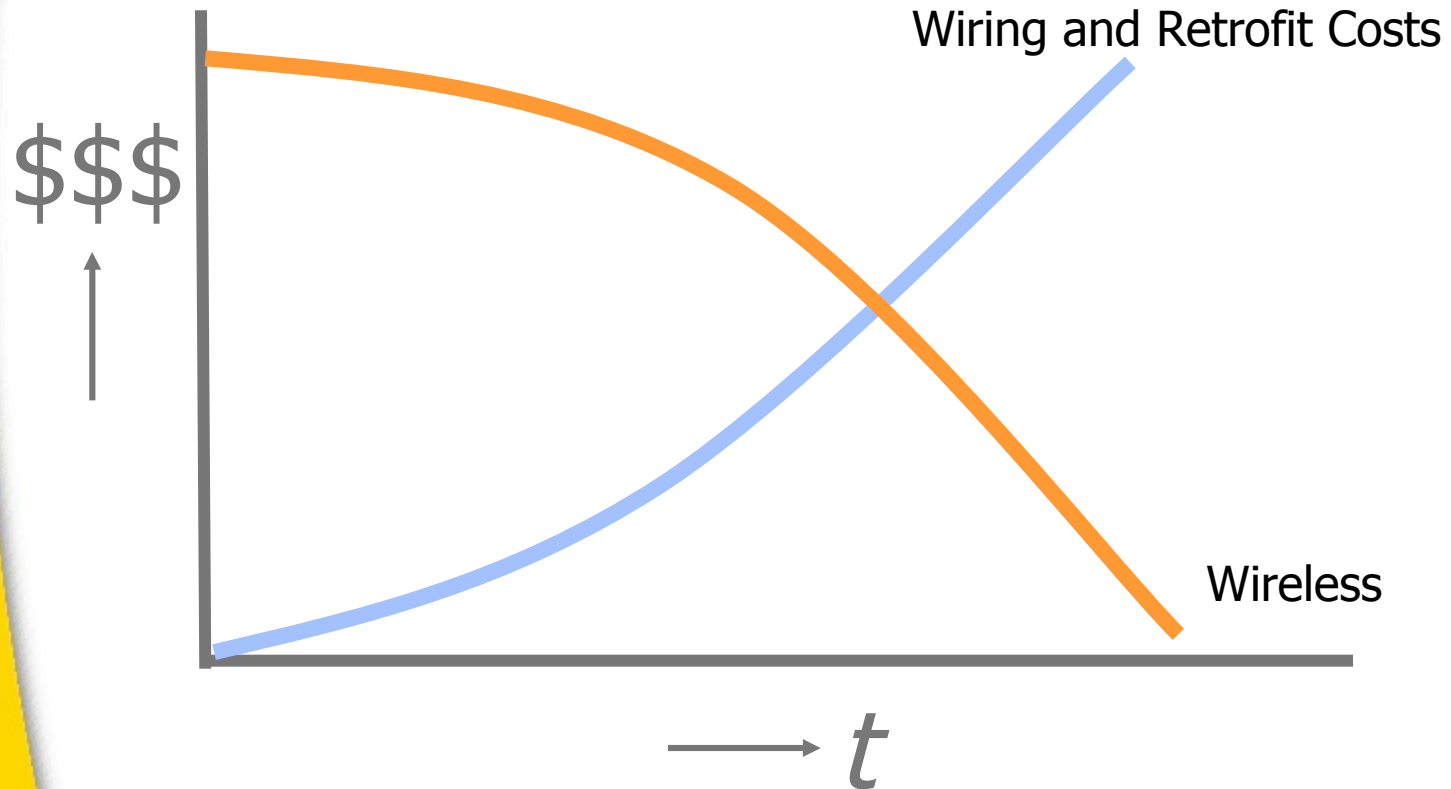
Wireless Solutions: Video Monitoring (Revenue)



SureCross Solutions: Cost of Wireless



Cost of Implementation



sure

crossTM
wireless network

sensing unplugged.

BANNER[®]

more sensors, more solutions

www.bannerengineering.com/wireless