



Potential Passive Wireless Sensor Tag Applications

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CTO Mission



Main sources of innovation come from *outside* the energy industry

Technology start-ups and mainstream technology firms



Military



Consumer markets



IT&S
information technology and services

Mission:
Solve business problems that defy traditional IT solutions through adoption of external technology innovation

Rapid awareness and adoption within BP



Business problems that may have a technical solution



CTO Mission:

Solving business problems that do not lend themselves to traditional IT solutions through creative application of digital technology

What it is

- Applying new **or** existing digital technology in novel ways to create business value
- Combining digital technologies in new ways to create better solutions
- Displaying the commitment and entrepreneurship required to gain adoption at scale

What it *isn't*

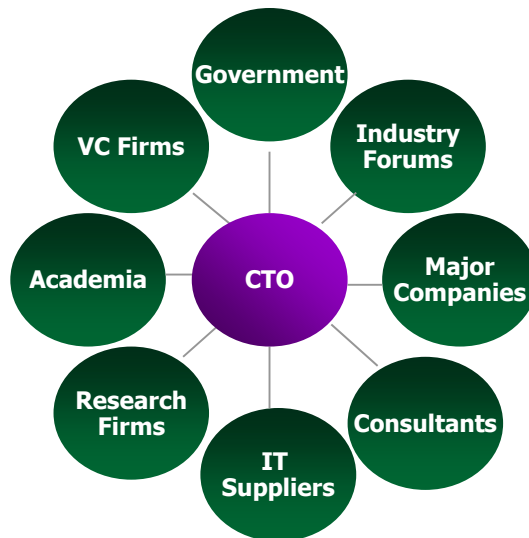
- Research and development
- New product invention
- Implementing a standard transaction system
- Routine IT service delivery

CTO Operating Model



- Small CTO team links into **vast ecosystem of external knowledge sources**.
- The CTO team acts as a catalyst and assistant – BU's and local teams retain ownership and control

Tapping into CTO's ecosystem



Tapping into the world's ecosystem



- **"Seeker" Network**
- **NineSigma**

CTO is a pragmatic problem solver, not an R&D group

CTO-Led Breakthrough Solutions



Vehicle and Equipment Tracking

A GPS and satellite/cellular tracking system integrated into existing fleet software eliminates unproductive and hazardous driving in search of equipment that can't be readily located



LPG Tank Monitoring

Unique satellite system monitors customers' LPG tanks, enabling automatic scheduling of tank refills & logistics; 34% improvement in delivery efficiency and 74% reduction in customer complaints



Equipment Health Monitoring

Equipment health breakthrough using an innovative technology that predicts problems in time to fix them before trouble occurs. Refining projects savings of \$100m annually



LPG Bottle Supply Chain Automation

First integration of RFID chips into product construction, enabling process changes that reduce labour costs and increase safety



Industrial Wireless Measurement

Groundbreaking wireless system cuts the cost of collecting sensor data by 90%, enabling increased instrumentation to improve refinery availability and safety



Pipeline Aircraft Tracking

New Guardian technology enables more frequent and effective tracking of surveillance aircraft, aiding operations and safety

CTO-Led Breakthrough Solutions



Employee and Visitor Safety

New RFID-based system provides alerts if people enter restricted zones or visitors stray too far; offers flexibility in creating safety zones



Pipeline Location

Using RFID balls to provide more accurate information about pipeline location at the surface as well as information about physical depth of the pipeline



Turnaround Task Tracker

Scalable system to provide automatic near real-time tracking of the thousands of inter-related tasks of a turnaround, reducing turnaround time by 5-15%



Alaska Compliance Access Portal

Used “mashup” technology to allow BP and regulators to review compliance information by showing the pipeline’s “pedigree” in a Google Earth-like interface



Integrated Mobile Applications

First integrated mobile applications suite for plant isolation point tracking linked to CoW. Common platform supports Rounds, Warehouse, Mobile Maintenance and more for E&P and Refining



BGAN Backup in Baku

Broadband Global Area Network satellite service providing reliable and cost effective communications backup

CTO Processes and Program



Gain business adoption of an emerging digital technology having business impact of \$50 million or more

Scan the marketplace and BP business direction to match business need to emerging technologies



Address business pull for new technology solutions to their high priority problems by leveraging the CTO ecosystem

Educate executive management and the business on emerging technologies to add fresh thinking and stimulate action

Game Changers

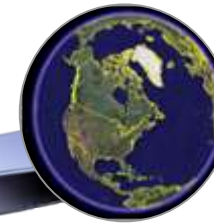


**Track
and
Trace**



**3D Virtual
Environments**

**Location
Intelligence**



**Predictive
Analytics**



**"Clipboard to
Computer"
*Field Force
Automation***

**Sensory
Networks**



**Commodity
Platforms**



**Global Sourcing /
India**



2002 2003 2004 2005 2006 2007-08 2009-10 2010-11

Why Passive Wireless Sensors Tags May Be The Next Game Changer



- Cost - No battery and no radio costs
- Manufacture In Quantity – Like RFID tags
- Life time power – no battery replacement
- Safety – little or no stored power

Generation 1	Generation 2	Generation 3	Generation 4
Wired	Motes	Active Sensor Tags	PWST?
~\$10,000 per point	~\$1,000 per point	~\$100	~\$10

True “Lick and Stick” Sensors

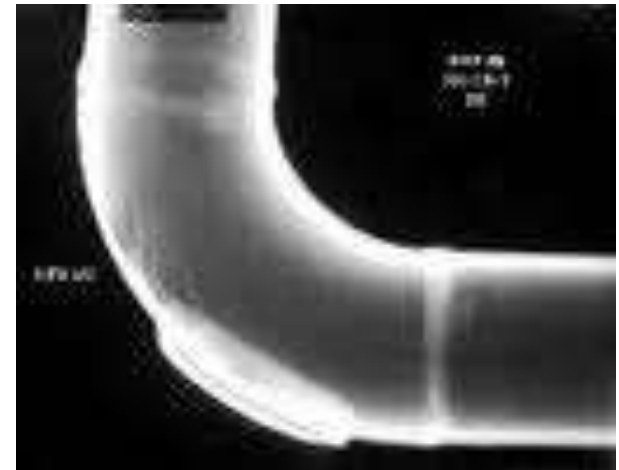


Potential Applications

CUI



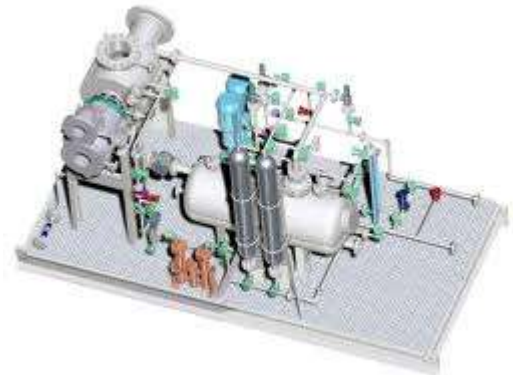
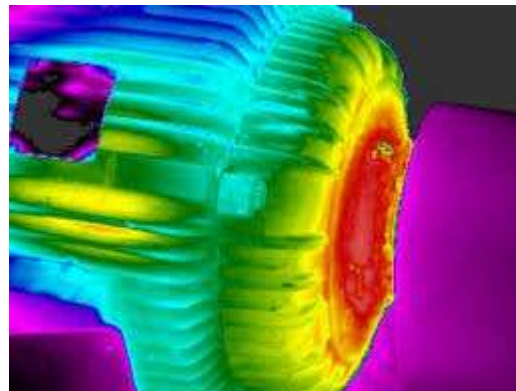
- Monitor corrosion under insulation
- Millions of locations in our plants/infrastructure
- Measure moisture, pH, Oxygen, actual corrosion



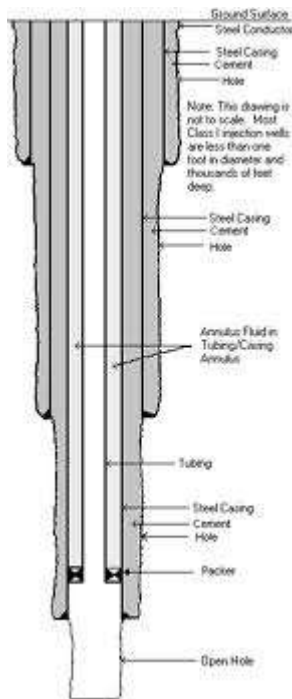
Rotating Equipment



- Low cost tags to monitor our rotating equipment
- Temperature, pressure, vibration, power consumption
- Must need to operate in hazardous (Intrinsic safe) location



Abandoned Well Monitoring



- Need to monitor plug and abandoned wells for environmental integrity issues
- Carbon capture business needs to ensure well integrity carbon capture
- Long term monitor for up to 50 years
- Limited access to the wells

People Location



- Know the location of our workers in “heavy metal” canyon of steel environments
- Understand their condition – I am “OK”, just been exposed to gas, etc.



Flame Monitoring



Refining uses large amounts energy (flames) to produce product. Better understanding the health of those flames can increase yields and decrease costs.

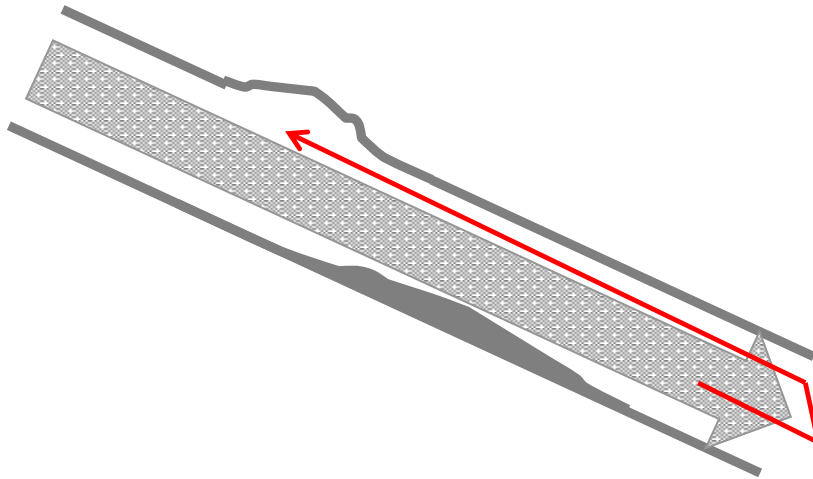
Refining uses flares to remove waste product under “upset” conditions. Better monitoring of those flares can improve safety during those conditions.

Downhole Monitoring



Hole Quality Challenge

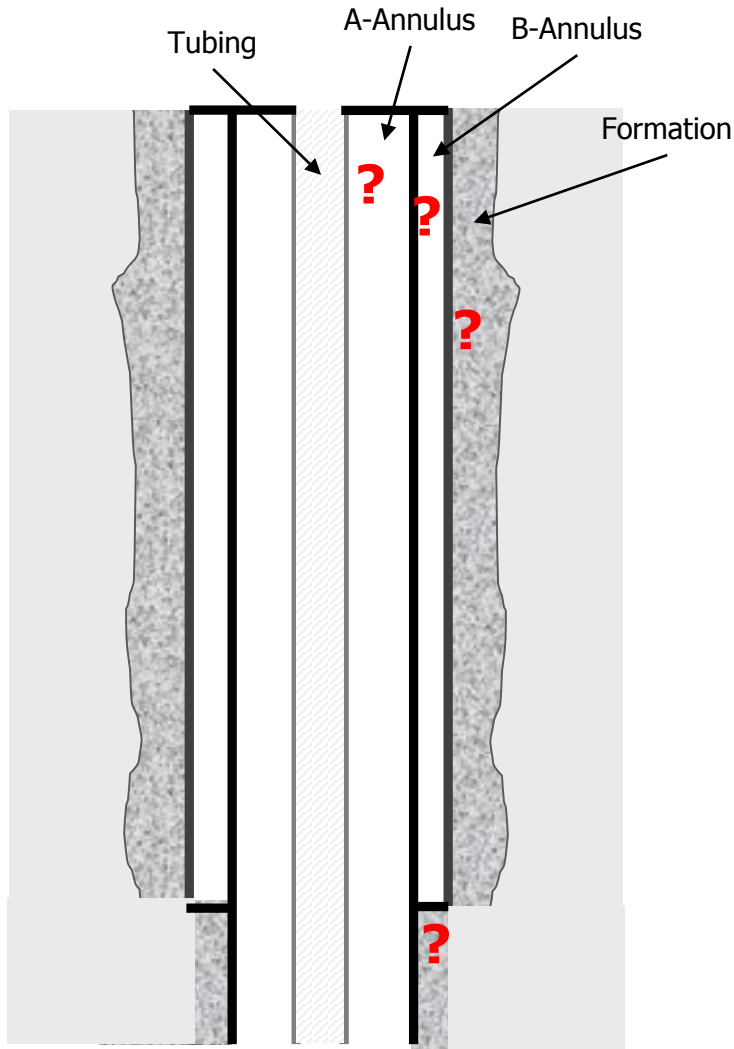
How can we measure the hole quality along the length of uncased hole while drilling (without intelipipe)?



Cement Challenge

Not only must we be able to measure this through casing – we will have to do this potentially through more than one layer and/or production tubing (and wells are not always symmetrical as shown here). We also need an oriented, 360 degree scan – and not a 2d cross section as shown here.

Behind Casing and Annulus Pressure Measurement



A build up of pressure in an annulus or behind casing (where not expected) is a sign of integrity issues and can lead to collapse and loss of well – and also be an early sign of larger issues

Challenge

For subsea wells we have no access to the annulus.

Key Challenges



- Standards
 - Image having a different reader for each tag type
- Read Range
 - Drive by readings
 - Minimize infrastructure in hazardous locations
- Security
 - Image traders reading stock levels
- Access to difficult to measure locations
 - Downhole, hot locations, under insulation
- Sensor type - Measure the right things
- Price – compete with active and semi-active tags

Thank you

