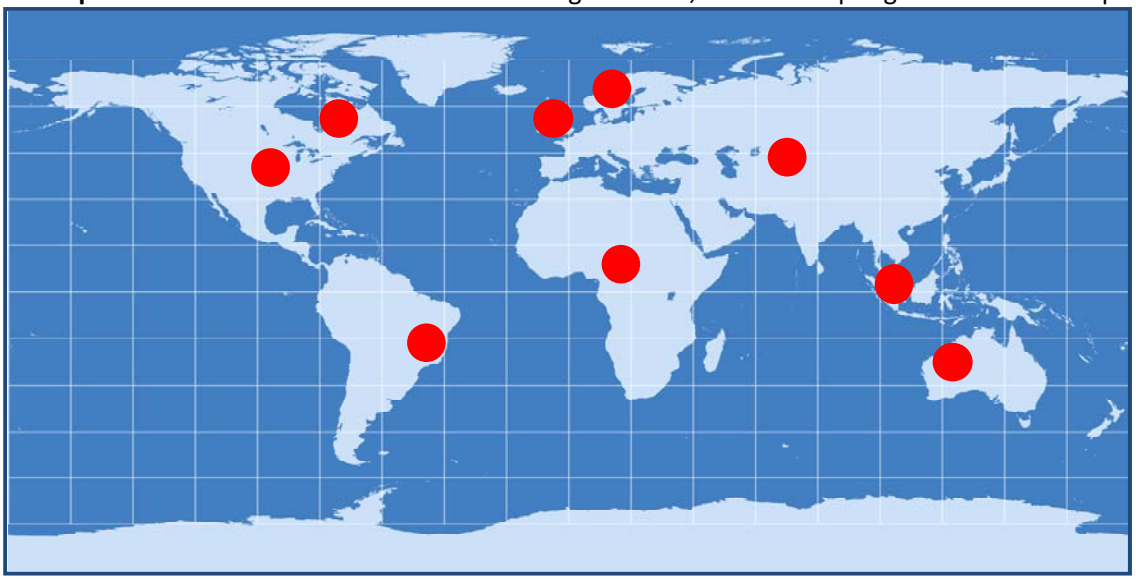
Introduction

The Global RFID Committee for Oil & Gas hosted a workshop with contractors and technology providers on Thursday 14 August 2014 in the Perth Convention & Exhibition Centre, directly after the inaugural RFID for Energy, Mining & Construction Conference and Exhibition in Perth, Western Australia. Technology exchange is already taking place between global operators including Woodside, Petrobras, Total, BP and Shell, whilst others are encouraged to participate.

The members of the committee believe that RFID technology has the potential to deliver significant benefits, and are collaborating toward global standardization. The committee also hopes to jointly encourage the development of technologies that meet the specific needs of the oil and gas industry's business and technical requirements, including the creation of RFID equipment certified as intrinsically safe. The purpose of this workshop was to establish oil & gas use cases and a framework for achieving technology standardization for this industry.

Facilitators: Alastair McArthur, RAMP RFID; Mark Roberti, RFID Journal; Diana Hage and Stephen Schwartz, RFID Global.
Sponsor: Martijn Truijens, Woodside Energy Ltd.
Participants: There were near 300 conference registrations, 58 workshop registrations: see map



Methodology:

The audience was randomly split into 6 working groups, each of them reporting back on two (2) exercises, as follows:

- Exercise #1: Brainstorm Use Cases for RFID technology in the Oil & Gas industry. Select Top 3 Use Cases with High Impact if Standards are adopted.
- Exercise #2: For Top Use Cases selected in Exercise 1, identify standards in place today; missing standards; limitations or features needed; and constraints / barriers.

Exercise #1: Brainstorm Use Cases for RFID technology in the Oil & Gas industry. Select Top 3 Use Cases with High Impact if Standards are adopted.

Photos – 1st. RFID for Energy, Mining & Construction Conference, Perth, Western Australia

Working Group 1: **Top 3 Use Cases for RFID in the Oil & Gas Industry**	
Use Case 1	Material Tracking (& Trace)
Use Case 2	People Tracking
Use Case 3	Performance Improvement (You Can't Improve What You Don't Measure)

Working Group 1 Notes on Oil & Gas applications for RFID technology:

Explore → Appraise
1. Productivity / Performance Measurement
2. Automation

Develop → Produce → Abandon
1. Material Tracking
   - Visibility through Supply Lifecycle
   - Authenticity
   - Certification
2. Reducing Paperwork / Efficiency
3. Data Linking
4. Actionable decision-making at point of read
5. People Tracking
   - Supervision
   - TPSL
   - Access / Security
   - Man Down
   - Mustering Speed
   - Speed
   - Integration
   - '1' TAL
6. Construction
7. Commission
8. Cross-Industry Compatibility
   - Marine
   - Oil & Gas
   - Resources

Other Comments written on handout:

- Info. Asset to Electronic Timestamp, Alarm
- Local Asset – Sync to – Engineering Database
- Change Management
- Data Integrity
- CCU Small ←> CCU Large → GPS → Sat Comm
- EPC – Low Cost / High Volume

Working Group 2: **Top 3 Use Cases for RFID in the Oil & Gas Industry**	
Use Case 1 and 2	Material Tracking (& Trace) Features: • Security • e-pedigree / anti-counterfeiting • Visibility Stakeholders: • Manual / shippers • Logistics companies • End Users Trace application: • Recall to reduce risk • Component maintenance Benefits: • Inventory Management • Component management • Liability reduction • Productivity increase • Cost decrease
Use Case 3	<u>Complete Lifecycle MRO</u> Stakeholders: • End Users • Service Providers Benefits: • Visibility • Compliance • Traceability • Liability reduction • Risk Management • Safety

Working Group 2 Notes on Oil & Gas applications for RFID technology:

1. Supply Chain
2. Track and Trace
    - Security
    - e-Pedigree
    - Anti-Counterfeit
3. Inventory Management
4. Complete Lifecycle MRO
    - Component Management
    - Ship Loose Components
        - Anti-Counterfeiting

    * Manufacturer's Packing to supplier
        - Uniformity
        - Interoperability

4. Risk Exposure -> RFID solution to reduce liability
5. Manage by analytics / RFID
    * Hesitancy to share information

Synergies / Benefits of RFID for entire supply chain:

- RFID to decrease fragmentation in the industry
    * Same part is managed differently, depending on which customer has it
    Game Changer

Working Group 3: **Top 3 Use Cases for RFID in the Oil & Gas Industry**		
Use Case 1	<u>Material Assets</u> Problems to Solve: • Supply Chain • Maintenance / Inspections • Traceability / Risk Mitigation	Who Cares: • Manufacturers • Transport / Logistics • Constructor • Operator
Use Case 2	<u>People</u> Problems to Solve: • Access Control • Mustering • Evacuation • Qualification / Competencies	Who Cares: • Contractors • Operators
Use Case 3	<u>Automation</u> Problems to Solve: • Vehicles • Inventory • Processes	Who Cares: • Manufacturers • Contractors • Operators

<u>Working Group 3 Notes on Oil & Gas applications for RFID technology:</u>

1. Safety Isolations
2. Maintenance / Inspections (Tools / Assets)
3. Traceability
4. Risk Mitigation (this is a benefit)
5. Asset History (part of asset tracking)
6. Anti-Counterfeiting (part of traceability)
7. People Tracking
   - Location Control
   - RTLS (Man-Down)
   - Access Management
   - Competencies
8. Condition Monitoring
9. Supply Chain *
10. Warehouse Operations
11. Tool Tracking
12. Kan Ban – Replenishment (part of asset mgmt.)
13. Vehicle Control
    - Speed
    - Location (Coordinates)

Working Group 4: **Top 3 Use Cases for RFID in the Oil & Gas Industry**		
Use Case 1	<u>Materials Tracking - all phases for full supply chain</u> Problems to be solved: • Right Place / Right Time • Correct Item • Predictability • Transparency Benefits: • Less Material Losses • More Tool Time • Reduced Schedule • Reduced Inventory	Who Cares: • Schedulers • Expeditors • EPL Companies • Logistics Operators • Operational Staff (End Users)
Use Case 2	<u>Equipment Identification for Maintenance / Shutdowns</u> Problems to be solved: • Adherence to Plan / Scheduling • Visibility / Accountability (similar to Tools case) Benefits: • Increased Utilization • Reduced Inventory • Reduced Maintenance Costs • Reduced TCO – Total Cost of Ownership • Improved Safety	Who Cares: • Shutdown Planners • Quality • Finance • Safety • Process • Operators
Use Case 3	<u>Smart Tags (Condition Monitoring)</u> Problems to be solved: • Condition Visibility Benefits: • Extending Equipment Life • Improved Safety • Financial	Who Cares: • End Users • Maintenance Group (Condition Monitoring) • Process Engineers • Community / Safety • Transport Companies

Working Group 4 Notes on Oil & Gas applications for RFID technology:

1. Tool Tracking through all phases (particularly Exploration)
    - Logistics
    - Anti-Theft
    - Calibration
    - Maintenance
    - Cost Control
    - Fit for Purpose
2. Materials tracking for full supply chain through all phases
3. Logistics – Efficient, real-time location
    - Staging
    - BOM Confirmation
    - Manifest Confirmation
    - Scheduling
    - Dangerous Goods – Visibility, Compatibility
    - Stock Control
    - Forecasting
4. Personnel Tracking
    - Safety
    - Progress Monitoring
    - Compliance
    - Asset Assignment
    - Access Control
    - Training & VOC's
5. Equipment Identification
    - Maintenance/Shutdowns
    - During Transport Logistics
    - Isolation Identification
    - Spares
    - Obsolescence
    - Availability
6. Vehicles
    - Parent/Child Relationships
7. Smart Tags
    - Instrument Connections
    - Preservation
8. Fabrication
    - WIP Tracking versus Plan (Intra-Contractor Granularity) & Exception Visibility

Working Group 5: **Top 3 Use Cases for RFID in the Oil & Gas Industry**		
Use Case 1	<u>Construction Management</u> Challenges: • WIP Progress versus Plan • Exception Visibility Benefits: •	Stakeholders: • Contractors • Client • Government Bodies
Use Case 2	<u>Logistics Optimisation</u> Challenges: • Right Item / Place / Time (JIT) Benefits: • Work Efficiency • Productivity	Stakeholders: • Contractors • Client
Use Case 3	<u>Shutdown Management</u> Challenges: • Sequencing / Coordination • People Tracking Benefits: • Shutdown Time • Safety	Stakeholders: • Client (Operator) • Customer
Use Case 4	<u>Reduce Operational Costs (This is a benefit associated with many use cases)</u> Challenges: ? Benefits: ?	Stakeholders: • Operator

<u>Working Group 5 Notes on Oil & Gas applications for RFID technology:</u>

1. Develop Phase
   - New Projects
   - Procurement (Long Lead Items)
   - Fabrication
   - Transportation

- Storage
- Assembly
- Installation
- Commissioning
- Handover

2. Drilling Phase
3. Existing Asset Modifications / Tie-Ins / Add-Ons
4. Production
   - Onshore Facilities
   - Offshore Facilities (Fixed / Float)
   - Subsea
5. Shutdowns / Turnarounds
6. Operations
7. Maintenance
8. Personnel
   - Access
   - Safety
   - Productivity
   - Competency
   - Ownership
   - Security
   - Authorisation
9. % Measurement
10. Visualisation
11. QA inspection / compliance (regulatory)
12. Validate / verify
13. Preservation
14. Location Management (part of Asset Tracking)
15. Workflow Optimisation
16. Logistics
    - Offshore
    - Inventory Management
17. Transportation
18. Audits
19. Identification
20. Supervision
21. Emergency management
22. Defect management
23. Permit & isolations
24. Condition monitoring
25. Security 26. Transactions / re-order 27. Safety (Food)

Working Group 6: **Top 3 Use Cases for RFID in the Oil & Gas Industry**		
Use Case 1	<u>Asset Tracking</u> o Supply Chain o Inventory Replenishment o Supplier -> EPC -> Owner/Operator o Compliance Benefit: Improve Productivity	
Use Case 2	<u>Personnel Location / Tracking</u> Benefit: Safety	
Use Case 3	<u>Real-Time Condition Monitoring</u> • Monitor Broad Base • Process Automation • Benefit: Improve Reliability	
Use Case 4	<u>Maintenance / Inspections</u> • Vehicle Control & Automation • Valve Isolations • Guided Path / Map	

<u>Working Group 6 Notes on Oil & Gas applications for RFID technology:</u>

- Explore < 1%
- Appraise < 3%
- Develop (Drilling, Construction)
- Production & OSM
- Abandon – learn from Development and Production experiences

Notes captured by the facilitators during Exercise 1:

Consolidated list of Top Use Cases (a tally of top use cases from all participants is provided at the end of this notes summary):

1. Materials / Asset Tracking
    - Transparency
    - Predictability
    - Supply Chain
    - Inspections
2. Condition Monitoring
    - Sensor Tags
        - Temperature
        - Vibration
    - Condition Visibility
    - Extend Life of Equipment
3. Personnel Tracking
    - Access Control
    - Mustering, Evacuation
    - Qualification of Competency
    - Community
    - Safety
4. Maintenance & Shutdowns
5. Construction Management
6. Logistics
7. Transportation
8. Audits
9. Optimization
10. Performance Management
    - Focus: High Cost Items, Cost of Downtime
11. Data Management
12. Tie Marine to Oil & Gas / Marine Logistics
    - From Build -> Install -> Operate
13. Track & Trace
    - Authenticate Assets
    - Trace – Component Maintenance
14. Complete MRO Lifecycle
    - Visibility
    - Compliance
    - Safety
15. Automation - “Roomba” for Mining

Exercise #2: For Top Use Case selected in Exercise 1, identify standards in place today; missing standards; limitations or features needed; and constraints / barriers.

Top Application Areas:

1. Material Asset Tracking
2. Real-time Condition Monitoring
3. Personnel Tracking
4. MRO Lifecycle

Working Group 1 Topic: MRO Lifecycle

Standards in place today:

1. Refer to presentations

Maintenance Standards Missing / Gaps:

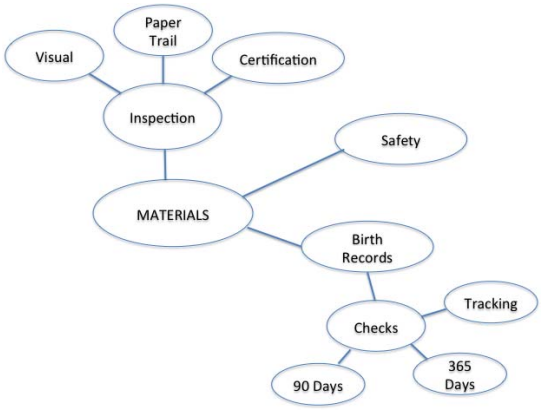
1. Birth Record (1 KB info)

- Materials
- DOB
- Manufacturer
- Parts & Components
- Paperwork

Limitations / Features needed:

1. Conditional

2. Non-Conditional



Constraints / Barriers:

Actions:

1. Develop & accept industry standard(s)
2. Global study on frequencies (Oil/Gas)
3. Alignment of Oil/Gas operators and trials (Transparency)

Working Group 2 Topic: Asset Tag Standards

Standards Missing / Gaps:

Need to Set Tag Standards:

1. Cross-Industry Compatibility
   - Marine
   - Oil & Gas
   - Resources
   - Freight Movement
     - Need tag communication Protocol
2. Data Integration
   - Local Asset to System database
   - Change Management
   - Build -> Install -> Commission -> Operate -> Decommission
   - Access to Data
   - Automation of Data
3. Internal Data Standards (Internal to Tag)

Limitations / Features needed:

Current Standards around –

- Low Cost / High Volume
- High Cost (Capital -> Downtime) / Lower Volume

Assets

Current Standards

- Serial #
- Multiple Data Bases
- Gap - Possible multiple RFID Tag #'s. TID = Tag ID #
- Limitation - Education
- Securing tags to prevent unauthorized removal

Required for Standards:

- Standard to generate unique #
- Central Data Point
- Adherence to manufacturing standards
- Unique ID number
  - Through technology to require a unique # to ensure same tag / asset being tracked
- Authenticity / Validation
- Agreed Educational documents / tools on RFID use

Working Group 3 Topic: Real Time Condition Monitoring

Standards in place today:

1. Refer to presentations

Standards Missing / Gaps:

1. Global Standard missing, including frequency
2. Pressure / Temperature, Oil/Gas
3. IECEX certification requirements
4. Inside battery limit conditions
5. Colour of tag
6. Active: Battery temperature allowance
7. Near Plant Delivery Risk
8. Offshore Container certification
9. Container content writing to single tag
10. Recycle / Reuse

Limitations / Features needed:

1. Food transport (temperature)
2. Riser loads (pressure)
3. IECEX Infrastructure
4. IECEX Solar Power standards
5. Preservation standards
6. Smart tags – USB port
7. #1 Frequency standards, including 'reserved for use' as government controls spectrum
8. Frequency security
9. Separation distances (other) radio eq.

Constraints / Barriers:

Actions:

1. Develop & accept industry standard(s)
2. Global study on frequencies (Oil/Gas)
3. Alignment of Oil/Gas operators and trials (Transparency)

Working Group 4 Topic: Material Asset Tracking

Standards in place today:

1. GS1
2. Shipping Industry Containers
3. Inspection Code
4. Bill of Lading
5. LC's
6. In house standards

Standards Missing / Gaps:

1. Enforcements
2. Positioning of ID's
3. Additional relevant data tags (certificates)
4. Update method
5. Security / encryption
6. Integrity / Quality
7. Inter-operability / Data Sharing / technology
8. Process standards
9. Volumetric size / weight

Limitations / Features needed:

3. Specification details
4. Government standards
5. Cross industry standards
6. Supplier capability
7. Uniqueness of components

Constraints / Barriers:

1. R.O.I.
2. Short term vs. long term view
3. Willingness / enforcements from suppliers
4. ERP capability
5. IP protection
6. IT – Windows vs. Android

Top Use Cases for RFID in the Oil & Gas industry (prioritized by vote frequency):

1. Materials Asset Tracking
2. Personnel Tracking
3. Maintenance and Shutdown Management
4. Real-Time Condition Monitoring
5. Logistics Management

Top Suggested Use Cases	# of Votes from Top 3	Additional inputs	Total
Materials / Asset Tracking	4	1	5
People / Personnel Tracking	3	1	4
Performance Improvement	1		1
Traceability / Anti-counterfeiting	1		1
Complete Lifecycle MRO	1		1
Automation	1		1
Maintenance / Shutdown Mgmt.	3	1	4
Condition Monitoring / Smart Tags	2	2	4
Construction Management	1		1
Logistics Management	1	2	3
Other use cases suggested:			
Maintenance / Inspections / QA		2	2
Safety, Permits & Isolations, Food safety		3	3
Supply Chain		1	1
Warehouse Operations		1	1
Tools tracking		2	2
Vehicles / Vehicle control		2	2
Fabrication / WIP tracking		1	1
Workflow Optimisation		1	1
Transportation		1	1
Audits		1	1
Emergency Management		1	1
Defect management		1	1
Security		1	1