Digitizing LNG Production Operations

Actionable Insights from the Cameron LNG Digital Journey

Franz Field
Cameron LNG
IT/Digital Manager
1. Introduction: Cameron LNG
2. Business Context: Cameron LNG
3. Digital Value Drivers
4. Digital Value Case 1: Digitizing Field Activities
   - AVEVA™ Mobile Operator
5. Digital Value Case 2: Wireless Field Sensors / PI Analytics
   - AVEVA™ PI System™, PI Asset Framework, PI Vision, PI Connectors
6. Summary & Challenges
7. Questions
Local Roots with a Global Reach

- 1 x World Scale LNG Export Facility COMPANY
- 3 Trains x 4.5 MTPA = 13.5 MTPA nominal capacity
  Authorized export capacity of 14.95 MTPA (1.7 bcfd)
- Air Products APCI propane mixed refrigerant C3-MR
- GE/Baker Hughes Frame 7EA gas turbines
- Power supply = Entergy Louisiana Utility grid
- Tolling Agreement; no Upstream, No Trading, No Shipping

2014 AUG  Final Investment Decision
2019 MAY  Train 1 Commissioning
2020 AUG  Full Commercial Operations
2022 DEC  500th Cargo
Cameron LNG – Digital / Business Context & Drivers

OPEX Business Model: POWER + PEOPLE + PRODUCTION

- Modern LNG Facility – instrumented for control
- Plant Fiber communications infrastructure; fiber connection to internet
- Pipeline gas supply – options and interconnectivity
- Reliable GRID Power
- Focused Business Model – Molecules from pipeline fence to loading arms. Controllable OPEX.

- Skilled / Small workforce
- Built by senior leaders with international LNG Project and Operations Experience
- Resilient / Open / Friendly Culture

- Single Tennant / Cloud-first Business & Production IT Systems Infrastructure
- Right-sized proven LNG/Oil & Gas core systems
  - SAP, Energy Components, UniSim, **PI System, Mobile Operator** (Intelatrac)
- 2D & 3D CAD Models for new facilities - SmartPlant Instrumentation, P&ID, PDS 3D
# Strategic Digital Drivers

<table>
<thead>
<tr>
<th></th>
<th>Prove Small, Plan for Scale</th>
<th>Execute affordable/achievable/scalable digital pilots to demonstrate technology capabilities, HSSE compliance, benefits, organizational impact, related opportunities, and supply chain readiness</th>
</tr>
</thead>
</table>
| 1 | Early results – weeks not months  
Demonstrate viable path forward                                                                 |                                                                                                                                                                                                 |
| 2 | Material Upside, Low Regret  
- One implementation unlocks multiple business case opportunities  
- Proving efficiency gains in one use case unlocks similar opportunities                                                                 | Digital solutions and pilots where one implementation unlocks multiple improvement opportunities.  
Solutions with efficiency gains in one use case unlock insights to further efficiencies |
| 3 | Build durable Digital Delivery Partnerships  
- Technology Suppliers  
- Post Pilot Digital Delivery partners                                                                 | Identify Digital technology vendors and service providers who wish to partner with Cameron LNG.  
Build digital delivery capability to scale digital transformation at Cameron LNG through pragmatic and strategic partnerships. |
| 4 | Build Credibility Demonstrate Efficacy  
- Data speed / coverage / plot plan  
- Consumer grade devices / Field use  
- Form factor x data entry                                                                 | Through scaled implementation model, demonstrate digital technologies and services are fit for purpose for Cameron LNG business size, scale, and existing technologies already implemented. |
Digitizing Field Activities

Field Wireless Data / Connected Worker
CONNECT the Connected Worker

Field Wireless Data

• Bring Data to the Field – access data systems in the Field. Reduce round trips to offices to access information.

• Bring Field Data to the Office – data entry from the Field, sensor data. Reduce manual entry and data errors
Challenge: Digital Technologies x Electrical Safety / Hazardous Locations

Digital Devices must be rated for use in Hazardous Zone – Class 1 Div 2 LNG Liquefaction Area

• LNG Equipment Areas – Primarily Class 1 DIV 2 – Electrical Safety
• Division 2 = Locations where ignitable concentrations of flammable gases, vapours or liquids are not likely to exist under normal operating conditions.

• Risk / Considerations
  • Sealed battery – waterproof, dust-proof
  • Time-based risk factors – how long is the device or equipment present in the hazardous location?
  • Device power
AVEVA™ Mobile Operator at Cameron LNG

Operator Rounds Management

• Shift Operator Rounds – 3 shifts / day x 365 days
• Structured procedures to make Observations, Collect non-networked instrument data
• Write equipment maintenance requests if/when needed and sync directly to Maintenance System SAP
• Interfaces to SAP Preventative Maintenance, PI Historian, Shift Logbook, Lab Information System

• Intelatrac in use for many years at Cameron LNG
  2022: Added Field Wireless Data / CBRS network to Site
  2023: Mobile Operator 2020 R2 on Ecom Ex-Cover 6 Pro D2
  2024: Moving from shared / shift device to dedicated mobile handheld for each Operator
Field Wireless High-Speed Data

Private 4G LTE Band 48 (CBRS) Installation

• Cost-effective addition of high speed wireless data to Field Operations

• Support business processes in the Field
  o Not for process control
  o Not connected to control systems network

• High Security – SIM card required for access

• Not dependent on Public Carrier Network

• 1-2 LTE Cellular Radios cover 1 mile x 3 mile site

• CBRS / LTE Band 48 ease of use, no spectrum licensing

• LTE Band 48 Support in most all modern mobile devices – Apple & Android
Mobile Devices for Field Use

- Electrical Safety: Class 1 DIV 2
  - Apple iOS - Industrial cases; UL-certified
  - Android – Pepperl+Fuchs eCOM

- 4G LTE Band 48 (CBRS) for High-Speed data in the field
Digital Field Operations

Major Turnaround Maintenance Planning

Mobile Access to SAP Maintenance System Records
Wireless Field Sensors / PI Analytics

Electrically Safe : Class 1 DIV 2
Low Cost
AVEVA™ PI System™ at Cameron LNG

Democratize plant data across the Enterprise

- All/Majority of all Control System / DCS data is available in PI System : ~70,000 PI tags
- PI Vision to democratize DCS graphics and frequently used graphics to understand current plant conditions
- PI Asset Framework (AF) for calculated values, e.g. environmental reporting : ~5000 AF assets
- PI data feeds Commercial, Operations Shift Logbook and generates LNG Cargo Certificate of Quality
- Critical systems for Analysis, Production Planning and Optimization

2023: Seeq rollout – *Engineering Data Workbench*

2024: Wireless Field Sensors – additional data sources to PI using PI Connectors
Production Operations Dashboard with PI Vision
Challenge: Hot Air Recirculation (HAR) effect on ACHE
Hot Air Recirculation (HAR) to Air-Cooled Heat Exchangers
LNG Industry Challenge: HAR impacts LNG Production

Understand / Correlate temperature profile across banks Air-Cooled Heat Exchangers

Understand / Correlate ambient temperature across site under different weather and wind conditions to Heat Exchanger Performance and resulting Production

Figure 4. Plant Slowdown Due To HAR for MLNG Tiga
Wireless LoRaWAN Ambient Temperature Sensors to PI System
Wireless Weather Stations – Ambient Temperature to PI System
Wireless Sensor Pilot - LoRaWAN / PI Architecture

Long Range + Low Power + Class 1 DIV 2 Wireless Sensors

- LoRaWAN Sensors
- LoRaWAN RF 902-928 MHz Antenna
- LoRaWAN Gateway, Network Server & Join Server
- MultiTech Conduit 300 Gateway

Antenna Tower Field Systems Rack

MQTT Distributor

Ignition IIOT Industrial Automation / Data Services

MQTT Transmission

PI System

AVEVA

MQTT Broker Sparkplug B Server/Broker
Ignition with Site Sync Module Functioning as LoRaWAN Enablement
MQTT Transmission Sparkplug B Publisher
MQTT Broker Sparkplug B Server/Broker

MQTT Client

PI MQTT Sparkplug B Connector

MQTT Subscriber of Decoded LoRaWAN data. PI Tag Creation

Publish Decoded LoRaWAN Data Tags to the MQTT Distributor

Publishers Deposit Data and Subscribers Consume Data
Decode LoRaWAN Payload. Build Sensor Data Tag structure. Configure Connection LoRaWan Network Server

SiteSync Module

MQTT Distributor

LoRaWAN RF 902-928 MHz Antenna

Receive LoRaWAN Sensor Data via LoRa RF
Send LoRaWAN Sensor Data via LoRa RF
Demodulate LoRa RF LoRaWAN Sensor Payloads and Publish MQTT over IP

Cirrus Link Site Sync LoRaWAN Module

MQTT Transmission

PI Tags / AF Structure

2023_10
ACHE Wireless Temperature Sensor Trial – Rain/Storm Event

Rain Event ~ 1.5 in/hr
Digital Solutions Summary

**Business Opportunity**

- Digitize LNG Operations business processes
  - Reduce manual effort in data entry
  - Gain access and insight to data ‘trapped’ on paper
- Digital technologies enable field access to Operations systems and data in usable formats to maximize ‘wrench time’ and minimize office data entry/data visualization

- Add additional data monitoring instrumentation capabilities for different parts of LNG Production

**Digital Solutions**

Consumer-grade Mobile Tablets and Smartphones rated for use in Hydrocarbon hazardous areas with high-speed wireless data network

Private 4G LTE/CBRS: Wide-area high speed data with high security. Cost-effective to implement and support

Mobile Digital Applications for Industrial Business – Aveva Mobile Operator, Shift Logbook, SAP PM, Electronic Work Permits, 3D Review Model

Low Cost Wireless Sensors – Temperature, Vibration, Position

LoRaWAN wireless data infrastructure to PI System
Challenges

• Technology Industry has been slow to deliver cost-effective, modern digital devices for safe use in Hydrocarbon Operations environment

• Historical lag to bring latest consumer technologies to industrial environment at affordable price point is getting better but still lacking

• Ex/Electrically Safe solutions needed for:
  o Handheld computers
  o Wireless Sensors
  o Wireless Communications

• Energy Industry needs to collaborate effectively with Technology Industry to accelerate solutions and time to value
Franz Field

IT/Digital Manager

Cameron LNG

https://www.linkedin.com/in/franz-field/

US Gulf Coast Digital LNG

https://www.linkedin.com/groups/14312452/
Questions?
Please wait for the microphone.
State your name and company.

Please remember to...
Navigate to this session in the mobile app to complete the survey.

Thank you!
Thank you!