



# IoT - Where Do You Start?

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International Airport



# About SeaTac Airport

**First Runways Built in 1944**

**51.8 Million Passengers in 2019**

- 4% Increase over 2018
- #8 in US, #31 in World
- 80 Gates and 16 Hardstand Positions

**438,391 Takeoffs and Landings in 2018**

**Top Carriers, By Passengers:**

- Alaska: 50%
- Delta: 23.3%
- Southwest 6% United 6% American 5% Other 10%



# Agenda

- What is IoT?
- Why IoT at SeaTac?
- Proof of Concept Approach
- Selecting the Right Use Case
- Current Status of Project
- Example To-Be Process
- Overview of Technical Design
- Next Steps
- Examples from Current Project Throughout

# What is IoT?

## What:

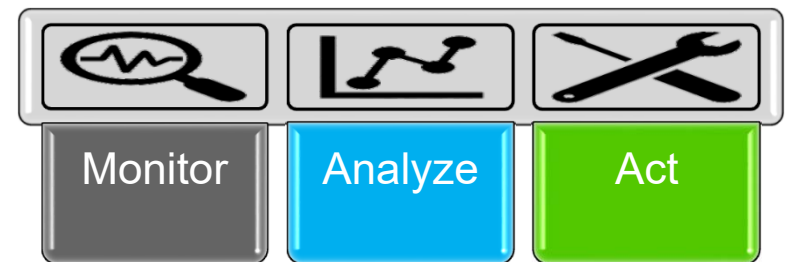
- Internet of Things
- Connecting assets (things) to a network

## Why:

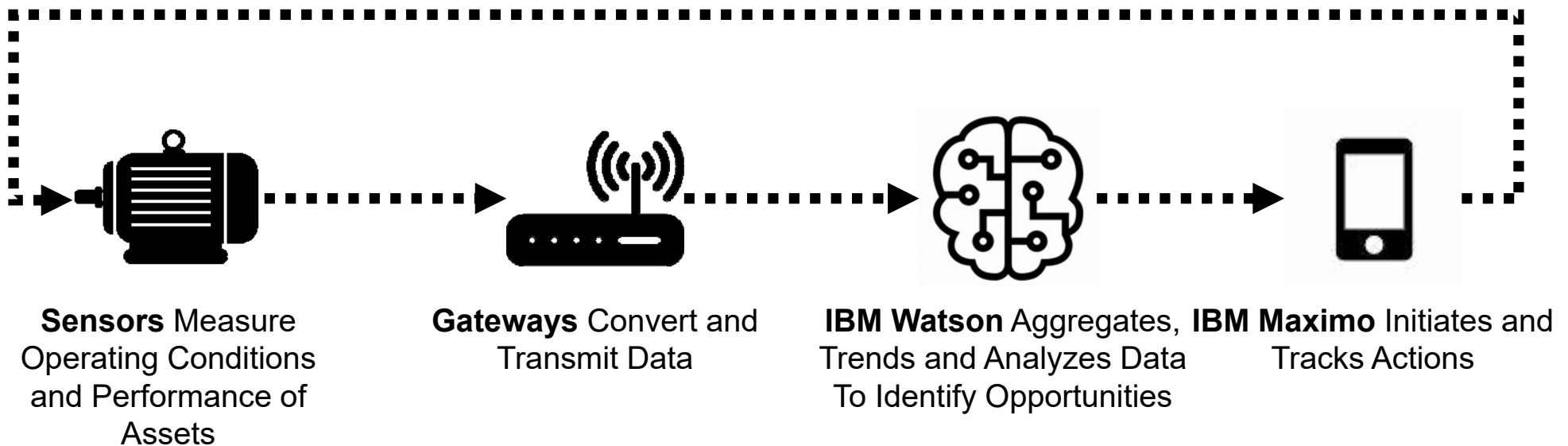
- Communicate information they've collected or receive information and act on it
- Interject Data Analytics, Artificial Intelligence, and Machine Learning to improve response to asset conditions

## For Maintenance:

- Assets are sensed to monitor and report their condition
- Software can analyze the condition data and develop responses
- Response can be enacted in the form of a notification, recommendation, or Work Order



# IoT for Asset Management



# How do you improve customer experience amid tremendous growth ?

## The Challenge:

- Positive Customer Experience Directly Tied to Facilities Operation
- Continuous Growth in Customer Traffic
- Aging Facilities and Systems
- 24/7/365 Operations
- Huge Capital Program – “Building while Operating”

## The Impact:

- Increased Reactive Incidents
- Limited Opportunities for Proactive Maintenance
- More Complex Prioritization Decisions



# Building the Business Case for a Proof of Concept

- IoT Promises an Ability to Proactively Notify You of Problems Prior to a Failure
- But, IoT are Seemingly “Point-Solutions” – Technology Solutions that Solve Specific One-Off Problems
- So, How Do You Embark on Building an IoT Program That Will Make a Difference?

# Building the Business Case for a Proof of Concept

## Start Small, But With a Future State in Mind

Do a Proof of Concept With Deliverables Beyond just the Technology Solution

- Early Win That Builds Momentum
- Document the Project Methodology so the Success is Repeatable
- Test the IT Infrastructure so the Success is Scalable

## Benefits of This Approach:

- Smaller Initial Investment with Direct ROI
- Smaller Barrier to Entry on Next Project
- Increased Momentum Towards Next Project





# Selecting the Use Case



# ID Airport Challenges

## Who:

- Executive Sponsors
- Project Team
- Cross-Functional Representatives

## What:

- Brainstorm Any and All Challenges Facing Airport:
- Customer Experience
- Tenant Experience
- Operations
- Facilities Management
- Financial

## How:

- Whiteboard Session
- Organize Issues into Categories



### System Failures/Breakdowns

- HVAC and Supporting Systems – includes inability to properly cool or heat area as well as leaks/floods
- Related to Restrooms - including plugged toilets, flooding, ventilation (rarely), and water temperature
- Elevators
- Biffy Dumps / Lift Stations – typically loss of vacuum in the system
- Baggage Handling System - both mechanical and bag hygiene
- Drainage / Sewer Lines – including clogs and corrosion
- Motors on Various Systems
- Loading Bridges / Gate Amenities - including 400 hz system, PC Air, Potable Water
- Electrical Rooms – in particular high temperature alarms
- "Waterfront" (off-site) Boilers
- UPS Systems



### Keeping Up With Proactive Maintenance Programs

- Filter Replacements
- Airfield Lights Inspections and Cleaning
- Backflow Preventers Testing



### Customer Experience and Safety

- Lighting Levels – bulb replacements
- Automatic Doors – alignment and failures
- Fire Pump starts - overabundance of water into system and leaks and flooding
- Hot/Cold Calls
- Odor Complaints
- Restroom Cleanliness
- Trash
- Escalator/People Movers "Transported Falls"
- Wait Times at TSA
- Wayfinding Through Airport
- Comfort at the Gates – includes lighting, chairs, electrical



### Asset Tracking (losing stuff):

- PC Air Units
- EGSE's
- Scissor Lifts

# Prioritize

## Who:

- Executive Sponsors
- Project Team
- Cross-Functional Representatives

## What:

- Establish Initial Objective Prioritization of Issues

## How:

- Score Each for Severity
- Score Each for Frequency
- Score Each for Detectability
- Compile Scores and Rank

The top two tiers of the stack-ranked results of the discussion are provided below:

Issue/Opportunity	Severity	Frequency	Detectability	Combined
Baggage - Bag Hygiene Failures	3	3	3	9
Gate Amenities - Potable Water Issues	3	3	3	9
HVAC - Air Handlers - Condensate Flooding/Leaks	3	3	3	9
HVAC - Filter Change Out Process Optimization	3	3	3	9
Mechanical - Conveyor Rotary Motors - Failures / Power Draw Detection	3	3	3	9
Other - Comfort At Gates - power at powered seats	3	3	3	9
Other - Trash Compactors	3	3	3	9
Restrooms - Cleanliness	3	3	3	9
Restrooms - Equipment Issues/Leaks/Floods	3	3	3	9
Baggage - Mechanical Failures	3	2	3	8
Chilled Water - Distribution Issues	3	2	3	8
Electrical - Lighting Level Issues In Specific Areas Related to Safety)	3	2	3	8
Gate Amenities - 400 hz system - Cable Issues	3	3	2	8
Gate Amenities - HVAC - PC Air Issues	3	2	3	8
HVAC - Comm Rooms - High Temp Alarms	3	2	3	8
HVAC - VFD Condition	3	2	3	8
Other - "Waterfront" Boiler Alarms	3	2	3	8
Other - Various Manual Alarms (i.e. Lift Stations)	2	3	3	8
Wastewater - Biffy Dumps / Lift Stations - Failure	3	2	3	8
Water - Chlorine Level Monitoring	3	3	2	8

# Vote and Discuss

## Who:

- Executive Sponsors
- Project Team
- Cross-Functional Representatives

## What:

- Add Subjective Judgement to The Prioritization and Try to Build Consensus

## How:

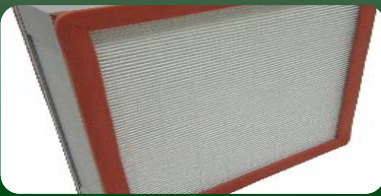
- Individuals Vote for Their Top Three
- Individuals Verbalize Justification for Their Vote
- Group Discusses Vote Results and Justifications

	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6	Participant 7	Participant 8	TOTAL
<b>Critical Asset Monitoring IoT - Opportunities</b>									
HVAC - Filter Change Out Process Optimization		1	3	3	2	3	3	3	18
HVAC - VFD Condition / Vibration Analysis	2		1	2	3	2		2	12
Mechanical - Conveyor Rotary Motors - Failures / Power Draw Detection			2		1		2	1	6
Baggage - Bag Hygiene Failures	3						1		4
Restrooms - Cleanliness		3							3
HVAC - Air Handlers - Condensate Flooding/Leaks	1			1					2
Restrooms - Equipment Issues/Leaks/Floods		2							2
Water - Chlorine Level Monitoring						1			1

# Selection of Use Case

- **The Vote & Discuss Exercise Resulted in Consensus on the Type of Asset to Target.**
  - Both the Prioritization Scoring and Subjective Factors Introduced in the Discussion is What Drove the Consensus
  - Additional Discussion Identified Opportunity to Actually Target 3 Different Use Cases on the Identified Asset Type
  - Took a time-out and engaged other facility SMEs in the discussion to validate Use Cases
- If It Doesn't Happen This Way for You, an Additional "Final" Vote Could be Utilized

# SeaTac's Initial Use Cases



## Optimize Filter Inspection and Replacement

- **How:** Monitoring Differential Pressure Automatically (vs. Manually)
- **Why:** To Automatically Detect and Prioritize When Filters Should be Changed
- **Results:** Fewer Unnecessary Replacement, Fewer Overdue Replacements, Improved Efficiencies in Process



## Monitor Fan Motor Conditions

- **How:** Monitoring Temp, Vibration and Current Related to Motors
- **Why:** To Automatically Detect Motor Health and Predict Motor Failure to Drive Maintenance Response
- **Results:** Fewer Equipment Failures, Fewer Unnecessary Maintenance Activities, Prescriptive Maintenance Recommendations



## Monitor Condensate Levels in Drainage Pans

- **How:** Monitor for Fluid Level in Drainage Pan
- **Why:** To Automatically Detect Blockage Condition and Respond Prior to Leakage or Flooding
- **Results:** Fewer Leaks or Flood Events

# Define Success Criteria

## Who:

- Executive Sponsors
- Project Team
- SME's for Selected Use Cases

## What:

- Define Specific Criteria for Success of Proof of Concept

## How:

- ID Key Deliverables of POC
- Write the Story of the Future State
- ID KPI's/Metrics That Should Improve With To-Be State



Cost Avoidance of Manual Inspections



Fewer PM Cycles



Fewer Failures



Establishment of Scalable Processes and Infrastructure

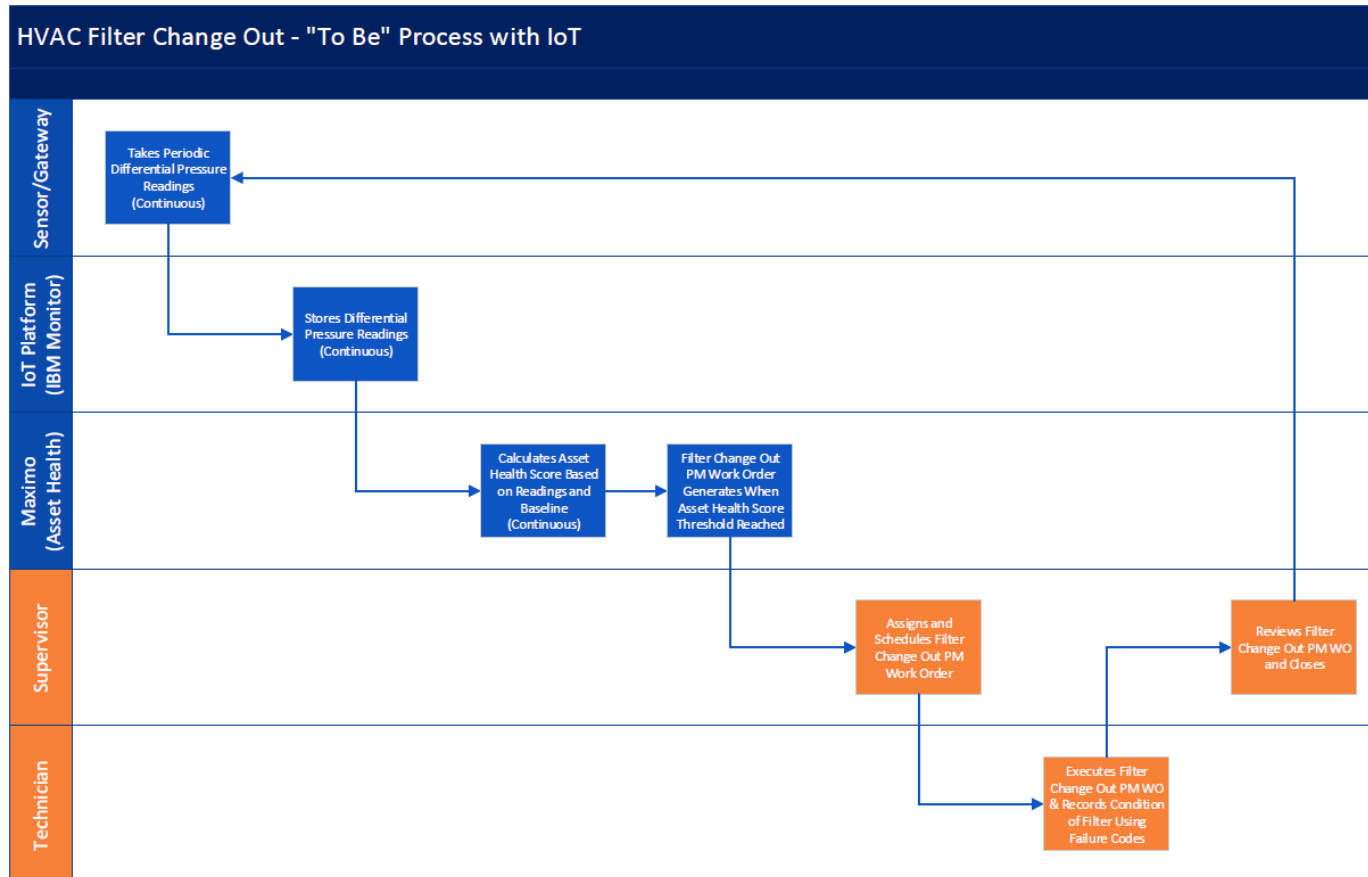
# Planning the Proof of Concept

We're  
Here!





# Example To-Be Process



## Edge Sensors

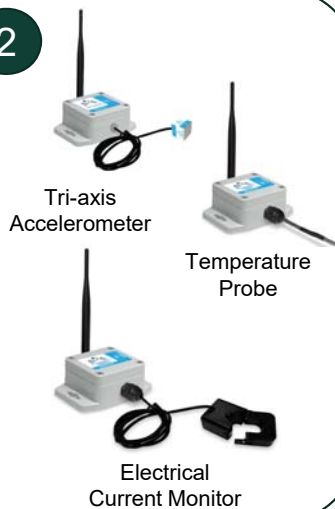


1



Differential Pressure

2



Tri-axis Accelerometer

Temperature Probe

Electrical Current Monitor

3



Water Detection

## Gateway(s)

Gateways convert the encrypted 900MHz sensor data to cellular for transmission to IBM/Maximo



## Cellular Network



## IBM Monitor (Watson IoT Platform)



Monitor

Cloudant

## SeaTac Maximo Environment

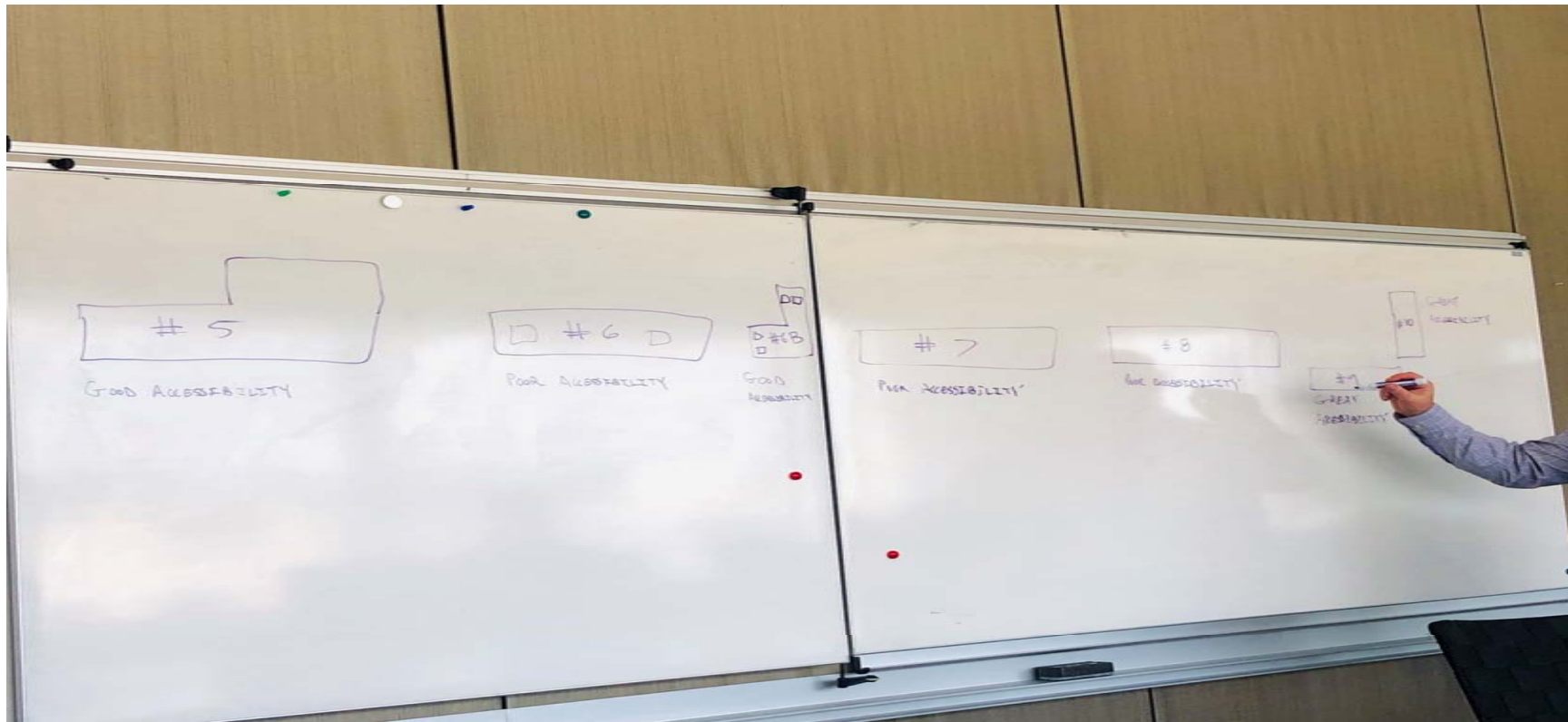
AHI User Interface



# Overview of Technical Design

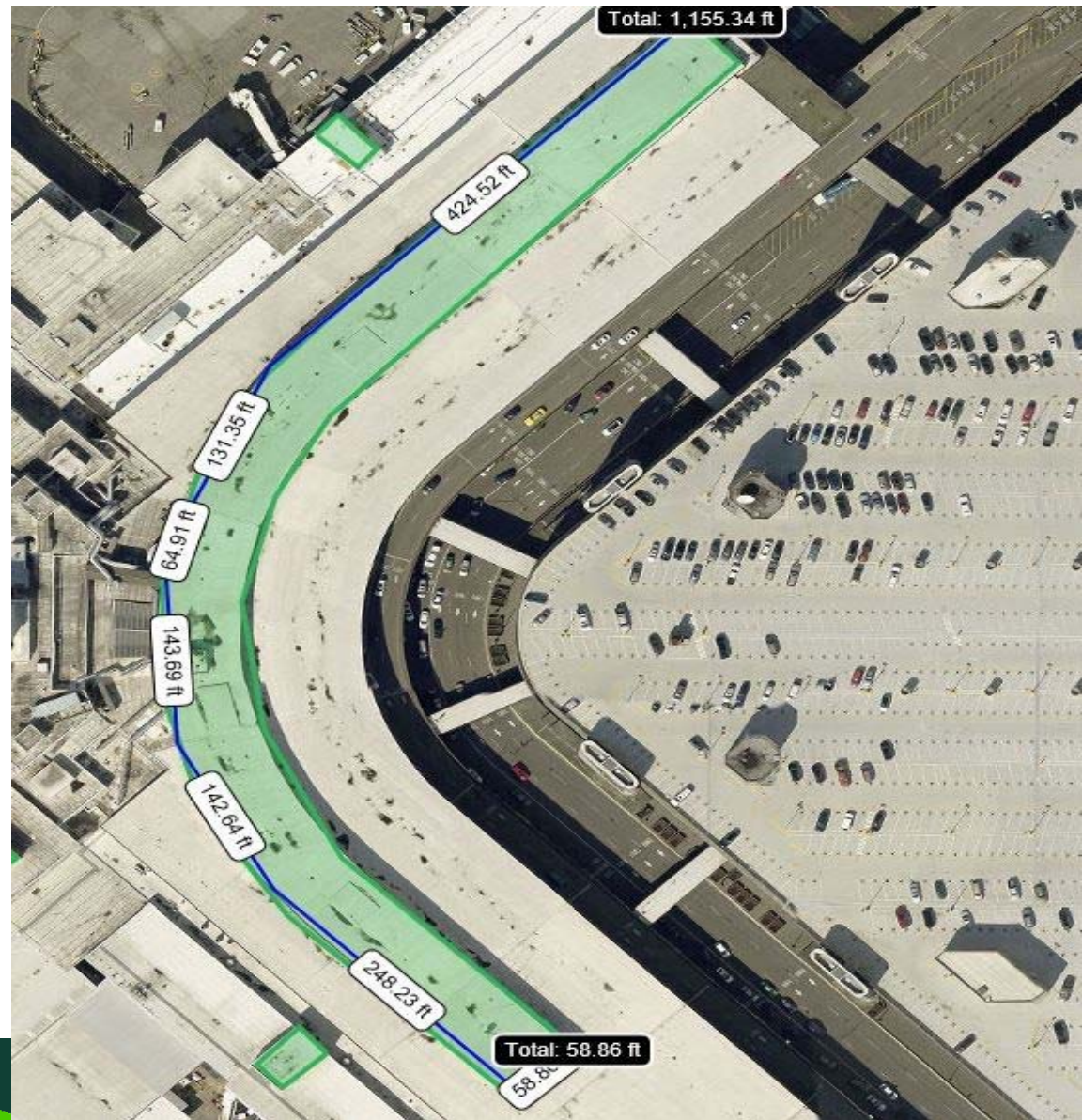


# Assets to target for IoT pilot??



# Air Handling Units (AHU) selected for IoT Pilot

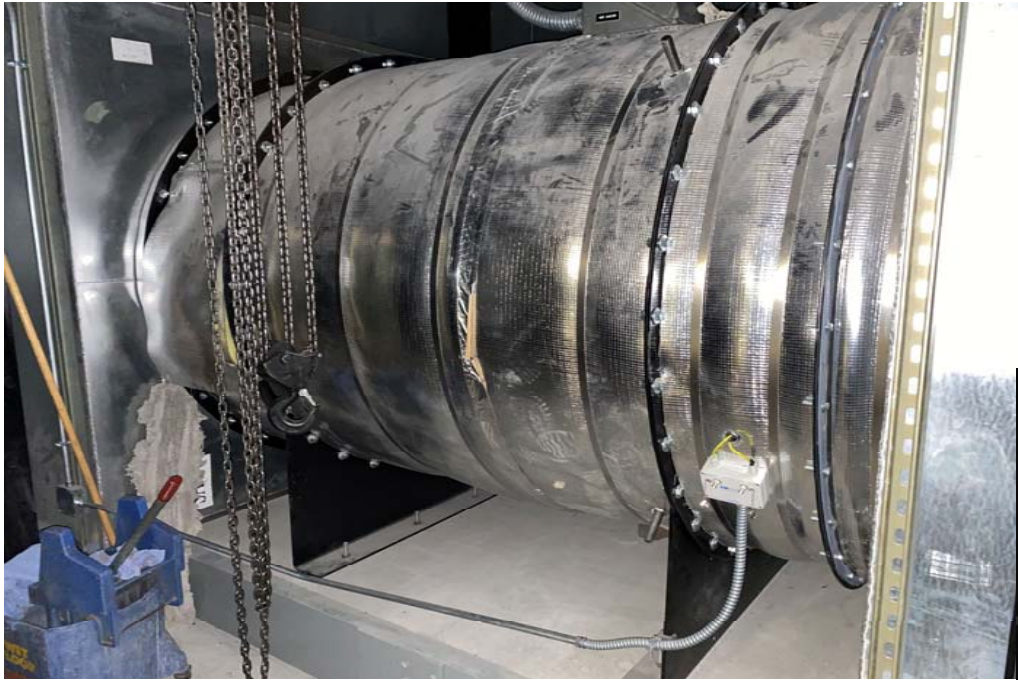
**Location:  
Main Terminal**





# AHU Motor Casing

## Filter bank



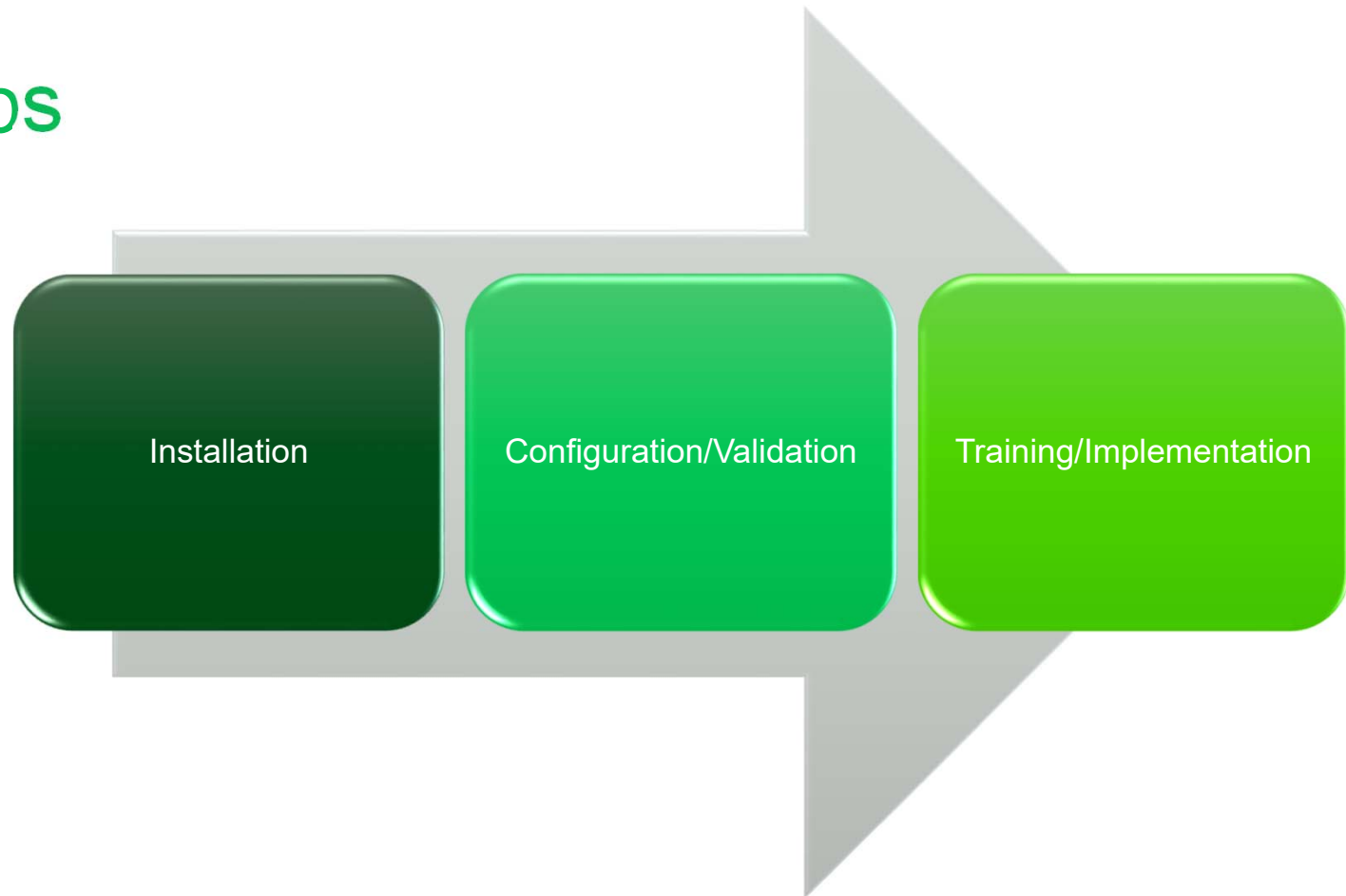
## Example: Condensate Drain



## Existing Diff Pressure Probe



# Next Steps



# Key Takeaways

- Understand the problem you are trying to solve
- Do your research on IoT! Understand it is not just technology!
- Get executive support and support from various stakeholders
- Develop business case, secure funding for project
- Start small (proof of concept), show success, and expand to scale
- **Engage, Engage, Engage!!**
  - **The right people need to be at the table** – Key decision makers/sponsors, industry experts (IoT), facility maintenance subject matter experts, IT infrastructure & security, and asset management.





# SEA

Seattle-Tacoma  
International  
Airport

Operated by the  
Port of Seattle

[FlySEA.org](https://flysea.org)

