The Making of a Smart Airport: Preparing for the Internet of Things

Wednesday, May 22, 2019 2:00-3:30 PM ET
Purpose

Discuss research from the Airport Cooperative Research Program (ACRP) Research Report 191: A Primer to Prepare for the Connected Airport and the Internet of Things.

Learning Objectives

At the end of this webinar, you will be able to:

• Describe what the IoT is and how it relates to airport operations
• Identify practices for IoT application at airports
• Discuss real-life use cases of IoT
ACRP Webinar
The Making of a Smart Airport — Preparing for the Internet of Things
May 22, 2019
Global Lead, Digital Transformation

Directed AECOM’s Aviation Technology Practice

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2. Volunteer for a project panel
3. Prepare a research proposal
4. Answer an ACRP survey
5. Apply the research results

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Today’s Speakers

Johanna Zmud, Texas A&M University

Joe Mariani, Deloitte

and

Humphrey Loe, San Francisco International Airport

Presenting ACRP Report 191

A Primer to Prepare for the Connected Airport and the Internet of Things
A Primer to Prepare for the Connected Airport and the Internet of Things
Johanna Zmud, Ph.D.
Principal Investigator

- Senior Research Scientist, Texas A&M Transportation Institute
- Division Head, Multimodal Planning and Forecasting
- Former manager, Transportation, Space, Technology Program, RAND Corporation
- Doctorate in sociology of technology, University of Southern California
ACRP Report 191 Oversight Panel

Kevin Carlson, AECOM, Panel Chairman
Kiel Barnekov, Orlando International Airport, Orlando, FL
Grant Gray, Faith Group, LLC, Kingwood, TX
Shannetta Griffin, Columbus Regional Airport, Columbus, OH
David A. Kipp, Burns Engineering, Chesterfield, MO
Steve Liang, University of Calgary, Calgary AB
Xiaogong Lee, FAA Liaison
Aneil Patel, Airports Council International– North America Liaison
Christine Gerencher, TRB Liaison
Marci Greenberger, ACRP Acting Manager
Describes Internet of Things (IoT) concepts and underlying technologies

Examines how IoT creates value in an airport environment

Identifies how other industries have implemented IoT

Identifies opportunities for IoT in an airport environment

Presents current use cases and factors influencing IoT adoptions, including enablers and barriers

Discusses future IoT activities

Published 2018
While in early stages of application, IoT is becoming increasingly important for airports.

Airport operators and their stakeholders need basic information in order to:

- Understand IoT
- Discover its impacts
- Know how to use IoT
- Be ready for what’s next?
Approach to Addressing the Problem

Data Collection for the Primer

- Literature review
- Stakeholder interviews
- Fall 2016 online survey
- Case studies
  - 8 in airport environment
  - 3 in other industries
Understand IOT

Discover its Impacts

MCO App Screen
Joseph Mariani
Deloitte IoT Research Lead

- Research Manager, Deloitte’s Center for Government Insights
- Led Deloitte’s global research into how IoT creates value and its impact on various industries
- Previous experience as a consultant, high school science teacher, and Marine Corps intelligence officer
What Is IoT? How Does It Create Value?

The information value loop describes the architecture of the Internet of Things:

- **Value drivers**
- **Stages**
- **Technologies**

**MAGNITUDE**
Scope | Scale | Frequency

**RISK**
Security | Reliability | Accuracy

**TIME**
Latency | Timeliness

**ACT**
- Augmented behavior
- Sensors

**CREATE**
- Augmented intelligence
- Network

**COMMUNICATE**
- Standards

**AGGREGATE**

**ANALYZE**

ACRP (Airport Cooperative Research Program)
Greater Value, Greater Challenges

Revenue Focused

- Airlines:
  - Baggage handling
  - Passenger operations
  - Flight operations
- Aircraft Maintenance
- Fuel, catering, and other services
- OEMs & Manufacturers

Mission Focused

- TSA Security Screening
- Police & Medical Services
- Airport Ground Staff:
  - Operations
  - Customer Service
  - Communications
  - IT & Contracting
- FAA & ATC

Non-Airport Specific

- Retail & Entertainment Tenants
- Commercial Tenants (cargo, office space, hotels)
- Off-Airport Transportation
  - Taxis
  - Public Transit
  - TNCs and Commercial Shuttles/Buses
  - 3rd Party Travel Information
- Vendors to Airport
  - HVAC & Environment
  - Facilities Management
  - Parking, etc…

Airport Specific

- Municipalities
- Regional Economic Development Groups and Chambers of Commerce

Passengers & Customers
Technological and Organizational Changes
What Can IoT Do?

- Internal Operations
- End-to-End
- Ecosystem-Wide

- Efficiency
- Differentiation
- New Revenue
Theory Guides Implementation

**Efficiency**
- Short-Term ROI Needed
  - Use Operational Expenditures
  - Draw from single account where efficiency gains are expected

**Differentiation**
- Mid-Term ROI Needed
  - Use Operational Expenditures
  - Draw from many accounts
  - Consider cost-sharing with vendors or alternate payment models (pay for use, pay as you grow, etc.)

**New Revenue**
- Long-Term ROI Acceptable
  - Use Capital Expenditures
  - Consider:
    1. Own Financing (savings, working capital funds)
    2. Other’s Financing (banks, bonds, pooled capital markets)
    3. Shared Ownership Arrangements (PPPs, etc.)
Know How to Use IoT

Be Ready for What’s Next

Biometric Control System at Bag Drop
**IoT Planning Process**

**Top-Down Approach**
- Consider IoT capabilities that help achieve **strategic objectives**
- Develop IoT capability model that describes **IoT maturity**
  - Complexity of IoT data vs. capabilities to house and analyze
  - Communications/infrastructure requirements vs. what exists
  - Cost vs. available funds
  - Stakeholders that benefit vs. security/privacy procedures to secure their cooperation

**Bottom-Up Approach**
- Consider **spectrum of IoT applications**
- Determine where various stakeholders currently deploy IoT solutions
- Determine gaps that IoT could fill
- Evaluate suitability of IoT solution
  - Cost of device
  - Complexity and robustness of data
  - Accuracy, reliability, and timeliness of required data
  - Network bandwidth/connectivity requirements
  - Primary motivator

**Additional Benefit:** Identify stakeholders with needed capabilities
Implementing IoT in the Passenger Experience

Passenger Journey Map
As they journey through an airport, a passenger interacts with technology systems spread across various stakeholders. Each system influences the safety, ease, and overall experience of a customer during their travel. While different airports vary in operating models, this map represents the kind of experience a passenger would have at an airport.
## Passenger Journey: IoT Solutions and Stakeholders

### Steps of Passenger Journey

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Arrival/Parking</th>
<th>Check-In</th>
<th>Check Bag</th>
<th>Security</th>
<th>Airport Activities</th>
<th>Board Aircraft</th>
<th>Departure</th>
<th>Arrival</th>
<th>Customs</th>
<th>Baggage Claim</th>
<th>Departure/Parking</th>
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*Image credits: [TRB](https://www.trb.org), [ACRP](https://www.airportresearch.org)*
Implementing IoT in Airport Operations

Airport Ops Journey Map

Airport Technology Stakeholder Key:
- Airline
- Airport Operations
- Service Providers
- TSA/CBP/FAA
## Operations Journey: IoT Solutions and Stakeholders

### Steps of Aviation Operations Journey

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Land</th>
<th>Arrive at Gate</th>
<th>Ramping Service</th>
<th>Board Crew &amp; Pre-flight</th>
<th>Security Screening</th>
<th>Load PAX and Cargo</th>
<th>Flight Plan &amp; Taxi</th>
<th>Departure</th>
<th>ATC Control In-Flight</th>
<th>Maintenance</th>
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**ACDM** = airport collaborative decision-making
## Capability Gap Assessment

### Steps of Aviation Operations Journey

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<th>Stakeholders</th>
<th>Arrive at Gate</th>
<th>Ramping Service</th>
<th>Board Crew and Pre-flight</th>
<th>Load PAX and Cargo</th>
<th>Etc.</th>
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<tr>
<td><strong>Airport Operator</strong></td>
<td><strong>Existing Solution:</strong> Automatic runway warning lights</td>
<td><strong>Objective Achieved:</strong> Safety/security</td>
<td><strong>Possible Solution:</strong> Biometric security access for crew</td>
<td><strong>Infrastructure Maturity:</strong> High</td>
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<tr>
<td><strong>Airline</strong></td>
<td><strong>Existing Solution:</strong> Sensorized wheelchairs to meet aircraft at gate</td>
<td><strong>Objective Achieved:</strong> Efficiency</td>
<td><strong>Existing Solution:</strong> Sensor to determine food or beverage levels on plane</td>
<td><strong>Objective Achieved:</strong> Efficiency</td>
<td><strong>Infrastructure Maturity:</strong> Low</td>
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<td><strong>Etc.</strong></td>
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### Infrastructure Maturity Required
- **Low**
- **Moderate**
- **High**
Barriers and Challenges to IoT Implementation

Technical and Organizational Challenges

- Technology and infrastructure
- Safety, security, privacy
- Talent
- Business Case
- Financing

SFO supports a data science intern program, in association with the City of San Francisco’s intern program, that engages with undergraduate and graduate programs from colleges and universities in the region. Skill sets include data science, software development, and business analysis. When interns come to the SFO IT department, they work on developing real solutions that are applied in the field.
SFO Case Study

San Francisco International Airport (SFO)
Member, Airport Council International (ACI)

Member, ACI Airport Community Recommended Information Services (ACRIS) Working Group

Member, Association of American Airport Executives (AAAE) Innovation Forum
In 2015, SFO developed a web service, the TNC API, to enable real-time data exchange between TNCs and the Airport’s ground transportation and finance departments.

- TNCs provide data to a digital platform managed by AAAE for 27 subscribing airports.
- Types of data: Vehicle ID, TNC ID, event type, time, latitude, longitude, plate number, ride count
- The data are used by airports to reconcile self-reported invoices and to enforce curbside compliance.
- TNCs as a percentage of ground transportation at SFO: 2015 30%; 2018 80%
- TNC Annual Trip Growth at SFO: 2015 3.3M; 2018: 10M
SFO Case Study: TAXIQ App (Short Trip)

In 2016, SFO developed TaxiQ Dispatcher Web application to validate “short” privileges for taxi drivers who remain within a geo-fence surrounding the airport and return within two hours.
SFO Case Study: TAXIQ App (Long Trip)
FOR ADDITIONAL INFORMATION

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• Joe Mariani, Deloitte, jmariani@DELOITTE.com

• Humphrey Loe, San Francisco International Airport, Humphrey.Loe@flysfo.com
Panelists Presentations


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- Conducts research to find solutions.
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Report 13: Integrating Airport Information Systems

Report 70: Guidebook for Implementing Intelligent Transportation Systems Elements to Improve Airport Traveler Access Information

Report 177: Enhancing Airport Wayfinding for Aging Travelers and Persons with Disabilities

Report 182: Guidance for Planning, Design, and Operations of Airport Communications Centers

Synthesis 62: Cell Phone Lots at Airport

Synthesis 65: Practices to Develop Effective Stakeholder Relationships at Smaller Airports

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