ATM Modernization

Digitalization or Digital Transformation?

Presented to: ATIEC 2019
By: David J. Almeida
    Director, ATM Enterprise Integration
    LS Technologies, LLC
Date: September 24, 2019
Tech is Transforming the World?

Patients dying while waiting for an organ donor could soon be a thing of the past. By 2030, organs will be biologically 3D-printed on demand. (Source: World Economic Forum, Healthcare in 2030: goodbye hospital, hello home-spital)

In initial tests, a machine-learning algorithm created at Carnegie Mellon was able to predict heart attacks four hours in advance, with 80% accuracy. (Source: The Economist, Of prediction and policy)

Usage-based auto insurance enabled by the Internet of Things will grow nearly 1,200% by 2023. This insurance uses real-time information about a driver’s actual driving to assess actuarial risk. (Source: IHS Markit, Usage-Based Insurance Expected to Grow to 142 Million Subscribers Globally by 2023, IHS Says)

After watching 5,000 hours of TV, Google’s DeepMind AI was able to lip-read 34% more accurately than a professional lip-reader. (Source: New Scientist, Google’s DeepMind AI can lip-read TV shows better than a professional)

In 2016, 80% of companies purchased a stand-alone cyber security insurance policy, up from 51% in 2015. (Source: RIMS, the risk management society, 2016 RIMS Cyber Survey)

What Does That Mean to Aviation?
Headwinds in Aviation Sector

1 - https://www.bbc.com/news/uk-england-london-49636149#
2 - International Air Transport Association Development Outlook

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique city pairs</td>
<td>20032</td>
<td>21332</td>
<td>22376</td>
</tr>
<tr>
<td>Compared to 1998</td>
<td>95%</td>
<td>108%</td>
<td>119%</td>
</tr>
<tr>
<td>Transport cost, US$/RTK (2018)</td>
<td>79.3</td>
<td>77.8</td>
<td>77.5</td>
</tr>
<tr>
<td>Compared to 1998</td>
<td>-53%</td>
<td>-54%</td>
<td>-54%</td>
</tr>
</tbody>
</table>

Source: IATA Economics, Economic Performance of the Airline Industry, Mid-year 2019
ATM Modernization

**Digitalization or Digital Transformation?**

**Going digital, or Digitalization¹**

- The process of converting something to digital form

**Digital Transformation²:**

- The reworking of the products, processes and strategies within an organization by leveraging current technologies.
Reworking Business-as-Usual

More data is better

It will not get us there!

ICAO Global Air Navigation Plan (GANP) Document 9720
Rethinking ATM

• From voice driven instructions to automation augmented air traffic decision-making
• From where aircraft is to where it will be

Assessing Where We Are

• Where we started:
  – CDM working with Industry
  – More Tools, More Data

1 - https://www.fly.faa.gov/Products/Information/ETMS/etms.html
2 - https://www.fly.faa.gov/ois/
3 - https://www.aviationweather.gov
Standards Drive Interoperability

**Interoperability:** Ability of different IT systems & software applications to communicate, exchange data, and use the exchanged information.

### Interface Standards & Options

- **Service:** WFS, WMS, WCS, Custom
- **Message API:** JMS, SOAP, REST, WSDL, WADL, .NET
- **Data Format:** WXXM, FIXM, AIXM, IWXXM, FIXS, AIXS, WXXS
- **Message Format:** XML, JSON, SOAP, JMS, MQTT, DDS, GML
- **Messaging Wire Protocol:** AMQP, HTTP, MQTT, DDS
- **Network Infrastructure:** TCP/IP, DNS, NTP
Reworking Business Processes

• Business Strategy
• Business Processes/Metrics
• Technical Requirements

Founded on Security Principles
Information Flows for Decisions

- **ATC is a human-centered business**
  - Greater collaboration between stakeholders
- **Data assimilated into decision-making**
- **Secure Exchange**
  - Criticality: Safety ?
- **Ground integration:**
  - ATC: ANSP to ANSP
  - AOC: Dispatch to FDP
- **Air-ground based:**
  - ATC: clearances
  - AOC: EFB, etc.
The Goals and Challenges Ahead

**Goals & Needs:**
- More capacity
- More automation
- More integration
- Resiliency
- Federated IAM
- “Negotiation Net”

**Disruptions:**
- Aerodata, Saber
- United, Delta

**New Tech:**
- Airport Beacon and NOTAMS
- A/C Maintenance blockchain by Aeron

**Key Network Features:**
- Access Control, Authenticate
- Availability
- Credentials, Certificates

**Trust Framework:**
- Define Cybersecurity Global Governance
- Harmonize Specifications Development
- Establish global federated hub

**Best Practices:**
- Robustness and scalable for growth
- Built on open standards: interoperable
- Independently assessed, audited & enforced
- Cost effective: open to market forces

**New Capabilities:**
- Greater Capacity
- Connected Aircraft
- New entrants

**Disruptions:**
- DHS 757 Comms
- Gatwick 50M£
- Abu Dhabi $3M/30 mins

**New Tech & Ops:**
- Aircraft breaking (IoT)
- Faster routing to gate
- Machine Learning

**Key Data Features:**
- Data Integrity
- Authorization
- Transport Security
Rethinking Solutions

- Versus -
Layered Security Approach

Use Case Development

Operational Scenario Analysis

Threat Matrix

ICAO Artifacts

PANS & SARPS

Requirements Analysis

DIWG

GRAIN WG

Input to WGs

Application/Systems

Identity

SWIM

Network
Good: Better Situational Awareness

- Integrates other applications
- Offers decision-makers insights
- Provides current operational picture
- Easy to monitor traffic situation

“Europe’s Current Air Traffic Situation”, Eurocontrol: https://www.eurocontrol.int
Better: Integrated Dashboards

- Browser-based dashboard
- Integrates tools, single application
- Ingests multiple data sources
- Leverages SWIM metering service (TBFM), others…

"Taxi Out, Return to Gate". Bill Tuck, Delta Airlines, SWIFT #3, May 8, 2018
https://www.faa.gov/air_traffic/technology/swift/media/SWIFT%20Meeting%20Presentation%20Slides%202010%20May%202018%20(TM%20final).pdf
“Art of the Possible”

- New Approach
  - New Sources, New Tools

https://www.faa.gov/air_traffic/technology/swim/swift/media/SWIFT%20Meeting%20Presentation%20Slides%202010%20May%202018%20(TM%20final).pdf
Conclusions

• ATM making great strides in digitalization
  – SWIM deployments and information services
  – Service oriented architecture (SOA)…a start!

• Change “analog” workflows to digital that representing change in business-as-usual
  – Legacy users continue pursue efficiencies…re-invent!
  – New entrants never had “analog” workflows

• Invest and research in “trust” technologies

• Result: fundamental transformation required to achieve ATM Modernization