HKIE Technical Seminar

Introduction to Airport System Design and Technology

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Agenda

• Aviation Standards & Practices
• Check-in Services
• Security Screening Technologies
• Challenges in Airport Design
• New Airport Technologies
• Conclusion
Aviation Standards and Practices
Aviation Standards and Practices

- **International Air Transport Association (IATA)**
  - IATA Common Use Recommended Practice (RP) 1797
  - IATA Airport Handling Manual – 922 Basic requirements for passenger loading bridge aircraft interface (IATA AHM922)

- **International Civil Aviation Organization (ICAO)**
  - ICAO Annex 14
  - ICAO Annex 17

- European Space Agency ESA Aircraft ground support equipment – Specific requirements – Part 4: Passenger boarding bridges (EN12312-4:2003)

- ANSI/EIA/TIA standards

- IEEE standards
IATA ADRM

Airport Development Reference Manual

- Provide guidance on designing airport facilities
- Take user needs in mind

9th Edition (current edition)

- Guidance aligned with current requirements of ICAO and IATA members
- Entire section dedicated to Enhanced Level of Service standards for airport capacity
- Baggage handling systems
ICAO Annex 14

• Fundamental rules and requirements for Airport Design and Operations
• Standards and Recommended Practices that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome
• Sets forth the minimum aerodrome specifications for aircraft which have the characteristics of those which are currently operating or for similar aircraft that are planned for introduction
ICAO Annex 17

• Provides the standard procedures and guidance on how to **safeguard the industry against acts of unlawful interference**

• Assists each contracting state in the implementation of their own national Civil Aviation Security Programme in accordance with ICAO
ICAO Security Manual

- Assist Contracting States in implementing Annex 17 to the Chicago Convention by providing guidance on how to apply its Standards and Recommended Practices (SARPs)

- Volume I — National Organization and Administration
- Volume II — Recruitment, Selection and Training
- Volume III — Airport Security, Organization, Programme and Design Requirements
- Volume IV — Preventive Security Measures
- Volume V — Crisis Management and Response to Acts of Unlawful Interference
IATA Airport Handling Manual

Provide specifications and guidelines on:

• Passenger Handling, Baggage Handling, Cargo and Mail Handling
• Aircraft Handling and Loading, Load Control
• Airside Management and Safety, Aircraft Movement Control
• Ground Handling Agreements
• Airport Handling Ground Support Equipment Specifications, Environmental Specifications for Ground Handling Operations
Check-in Services
• Established in 1929, major provider of transport communications and systems engineering solutions for eight industries: *aviation, airports*, defense, government, healthcare, networks, security, and transportation.

• Headquartered in Annapolis, Maryland; Two regional headquarters in London, established in 1999 to serve the Europe, Middle East, and Africa region, and Singapore; Established in 2003 for the Asia Pacific region

• ARINC has more than 3,200 employees at over 120 locations worldwide.

• A multinational information technology company specializing in providing IT and telecommunication services to the *air transport industry*.

• The company provides its services to around 450 members and 2,800 customers worldwide — this amounts to *over 90% of the world's airline business*. 
Security Screening Technologies
Security Screening Technology

**Traditional: X-ray Machine**

- Check carry-on items
- Items are typically colored on the display monitor to represent one of three main categories: organic (**orange**), inorganic (**green**), metallic (**purple**)
- Machine operators are trained to look for suspicious items

*AN X-RAY OF A BAG. NOTICE THAT ALL ORGANIC ITEMS ARE A SHADE OF ORANGE.*
Security Screening Technology

**Traditional:** Metal Detector

- Handheld or Walkthrough
- Find metal inclusions hidden within objects
- Based on pulse induction (PI)
Security Screening Technology

Backscatter X-rays

- Produce a high resolution 2D image
- A technology released in Israel in early 2008 allows full body scan of passengers **without** taking off their shoes
- Scan in under 1.2 seconds for objects as small as a razor blade
- Controversial (Privacy issue)
Security Screening Technology

The FAST Project

• **Future Attribute Screening Technology**
• Screens passengers *based on natural behavioral signals* like pulse rate, breathing patterns, momentary facial expressions, and fidgeting
• The FAST system uses a range of sensors, from simple cameras to a souped-up Nintendo Wii balance board, to collect data to help screeners determine whether or not a person may indicate hostile intent
Security Screening Technology

“Checkpoint of the future”

- Passengers are guided into one of three corridors upon presenting their passports: blue for frequent travelers, purple for normal passengers and orange for those deemed to require enhanced vetting.
- People do not have to empty their pockets, remove any of their clothing or subject.
Challenges in Airport Design
Drivers for change

Global IT Development
(Server, Switch, Storage, Virtualization, Cloud)

Airport – Mixed use development (non-aeronautical revenue generation)

Service Availability Anywhere, Anytime, Any Device

“Zero” Service Downtime (little maintenance window)
Challenges in Airport System Design

• Legacy systems – limited technology options
• Technology upgrade plan / migration
• Technology risks and obsolescence
• System capacity, redundancy, diversity, etc.
• Cabling distance limitation – 90m rule a challenge
• Space limitation (pits and ducts, containment, etc.)
• Airport expansion plans in phases
• Multi-terminal / Multiple carrier operations
Design considerations

• 24 x 7 as a minimum (small maintenance window)

• Multi-party / stakeholders
  
  Client, CIQ&P, DoH, HKO, FSD, CAD, architects, airport planner, traffic consultant, signage, MEP engineers, fixed / mobile operators

• System Interfacing among Different Systems – complexity vs. cost

• Shared Infrastructure vs. Standalone
  
  ⇒ Ownership
  
  ⇒ Operational Efficiency
  
  ⇒ Maintenance Responsibility
Real Examples
New Technologies
Flight Information Display System

I expect a smooth journey from home to departure gate

We expect FIDS to be easily available at any time

- FIDS is becoming increasingly complex in response to user demand
- Selective Information to be displayed in multi-terminal configuration
- Research and development is key - can be lengthy and costly

In the PAST, simply listed the flight

NOW expected to list all the airline codeshares, display video advertising and destination weather reports.

★★★★★★★★
“A leading supplier is not just a retailer, but also a partner who helps us to find the best display solutions for our display systems.”
★★★★★★★★

Main criteria of most airport representatives:
The ability to be adapted to their current systems
Readability
Functionality
Longevity
Maintenance
Appearance
Flight Information Display System (cont.)

Conventional Design

FUKUOKA AIRPORT

NINOY AQUINO INTERNATIONAL AIRPORT T1
Flight Information Display System (cont.)

Integrate with interior design, simple and slim
Flight Information Display System (cont.)

Interactive display with 3D options

- Holographic presentation
- Interactive display – more personalized information
- More useful to passenger

Challenges

- Require new holographic projector and interactive display
- Require upgrade or new version of information display server
- Higher cost
- Yet to be proven 100% effective

Walking time to gate, London Heathrow International Airport

Air Ticket with QR code, Wing's Airline

American Airlines

Look Beyond the Screen
Experience more with EON Holographic 1, an interactive, 360° experience.
Flight Information Display System (cont.)

Personalized Flight Information on Smart Phone

- Passenger account based personalized information
- Real-time flight and commercial information
- Highly interactive with passengers

- Can be integrated with mobile boarding pass, Location Based Service and indoor way-finding
- Can be integrated into existing airport Apps
- Interface with FIDS network is required
Self Check-in and Bag Drop

Common User Terminal Equipment

- Common check-in equipment throughout the airport
- Airlines and handling agents can access their own applications from workstations
- Service providers such as SITA / ARINC
Self Check-in and Bag Drop (cont.)

Common User Terminal Equipment

Automated Boarding Gate, E-Gate

- Validate boarding pass (paper or electronic)
- Validate passenger access to airport Lounge
- Ensure that they are dealing with ‘confirmed’ passengers

Benefits
- Minimize security risks
- Reduce waiting time and costs
- Save space
- Increase customer satisfaction
- Increase security capacity
- Key benefiting factor for airlines traveling to destination countries that require Advanced Passenger Information (API) on all inbound passengers
Self Check-in and Bag Drop (cont.)

Common-Use Self Service (CUSS) Kiosk – Check-in

- Reduce labor cost of ground staff
- Reduce check-in time and eliminate queuing
- Maximize passenger handling throughput
- Reduce space and time
  ⇒ Enable more retail outlets or entertainment facilities

Wireless CUSS kiosks at Trudeau airport
Self Check-in and Bag Drop (cont.)

Common-Use Self Service (CUSS) – Bag Drop

SYDNEY AIRPORT

AMSTERDAM AIRPORT SCHIPHOL

PARIS-ORLY AIRPORT

GATWICK AIRPORT
IP CCTV Surveillance

- Turn images and audio into data
- Transmit this data over a data network
- Image accessible anywhere with network connection

**Analog System**

**IP System**
**IP CCTV Surveillance (cont.)**

**BENEFITS**

- Do not require local recording – Greater flexibility
- No theoretical limit to resolution – Better performance
- Run over existing IP networks – Easier installation
- Integrate and co-exist on the same network/cabling as other IP based systems – Better System Integration

Integration also means that an IP camera will be able to transmit images to an IP Video Phone automatically
Passenger Flow Monitoring and Management System

- Multiple Technology Possible – Bluetooth, WiFi, CCTV camera
- New system capable of detecting / counting the number of passengers passing through selected check points and passenger tracking
- Performance Pledge Measurement

Crowd Alert Enabled by Video Analytics

MULTI-SITE DASHBOARDS
Passenger Flow Monitoring and Management System (cont.)

Video Analytics using CCTV

Higher Reliability
✓ People counting and congesting monitoring
✓ Facial recognition
✓ Motion and Non-motion detection
✓ Perimeter Intrusion Detection
✓ Timely event handling with automated event reporting
✓ Crowd detection
✓ Unattended Objects

Integrated with CCTV system cameras
• Cost saving
• Camera location and resolution to be reviewed / planned

Separate CCTV system cameras
• Dedicated function but with higher cost
• More flexible in camera choice, location and installation method
Mobile Device as a Sensor

- Promote interactivity between airport and passengers
- Analyze and drive business strategies with acquired data
- Enable location-based services (e.g. navigation and tracking)

Tobii Glasses, Airports of the Future research project
Connectivity between Terminals and Buildings

- Extension of the same airport infrastructure in multiple terminals and buildings
- Achieve the same system compatibility and operational consistency

Challenges
- Pits and ducts space and capacity
- Lack of terminal planning on ultimate capacity
- Ad-hoc cabling service required
MPLS-VPN vs. DWDM

MPLS-VPN

- **MPLS**: MultiProtocol Label Switching
- Speed up the delivery of network packets over multiple protocols
- **MPLS-VPN**: VPN is built on top of an MPLS network
- Form logically separated networks on a common physical infrastructure
- Flexible network addressing (separate VRF tables for different VPNs)
MPLS-VPN vs. DWDM (cont.)

DWDM
- **Dense Wavelength Division Multiplexing**
- Puts data from different sources together on an optical fiber
- Each signal carried at the same time on its own separate light wavelength
- Different data formats at different data rates can be transmitted together
Network Topology and Resilience
Control Room Technology

**DESIGN CRITERIA**

- Multiple Systems operating on common workstations
- Each workstation able to log into several systems
- Critical systems with dedicated workstation i.e. AGL, ACS
- 1 - 2 workstations for each operator, with multiple screens
- Each system to be web browser enabled
- Withstand possible hazardous events
- Effective and ergonomic design
Centralized Video Wall

- A full view of all handling tasks and handling-related events
- Multiple Displays
- Centralizes all monitoring
- Maximizes effectiveness in providing a Centralized Command and Control

ZEEBRUGGE CONTROL CENTER HAVE BEEN MONITORING THE GAS TRANSPORT TO BELGIUM AND FRANCE

DISPLAY CRITICAL DATA SOURCES FROM MULTIPLE SYSTEMS, TENNESSEE AIR NATIONAL GUARD

HUB CONTROL CENTRE (HCC) AT MADRID-BARAJAS AIRPORT
Web Based Browser Thin Client

- Virtual desktop based on virtualization technology
- Secured access and authentication
- Fast log-in and log-out
- Works like an “Android” machine

LET SERVERS DO THE WORK!
A THIN CLIENT CAN CONSIST OF AS LITTLE AS A MONITOR, KEYBOARD, AND MOUSE.
Airport Apps

- Terminal maps
- Airport news
- Check-in details
- Flight updates
- Flight progress tracking
- Scheduled flight timetables of up to 6 months
- Weather forecasts for different locations around the world
- Information for shopping, dining and services

**Push Notification Feature:**
Notify passengers who request information about changes to flight details
Wi-Fi Location Services

- Airport-Free Wi-Fi – mandatory
- Detect and track Wi-Fi signals from devices
- 802.11n (minimum) and 802.11ac – more antennae and power
- Capture, aggregate and analyze customer movements and behavior
Wi-Fi Location Services (cont.)

Case Study: Copenhagen Airport

**CHALLENGE**
- Further improve efficiency
- Enhance passenger experience

**SOLUTION**
- Cisco Mobility Services Engine wireless platform
- SITA Passenger@Airport for Augmented Reality and Passenger Flow
Wi-Fi Location Services (cont.)

Case Study: Copenhagen Airport

**LOCATION ANALYTICS**

- More than 20 million travelers visiting per year
- Cisco Connected Mobile Experiences since 2010
- Identify boarding passengers and track their routes through the terminals
- Identify trends, improve capacity management

Tracing historical data to understand passengers’ patterns

Tracking routes in a 3D map

Identify trends from peak to low travel seasons
Wi-Fi Location Services (cont.)

Case Study: Copenhagen Airport

Improve capacity management by adjusting layouts, changing stores and security staffing, and mitigating bottlenecks

- Passengers can navigate around more efficiently
- Potential bottlenecks can be identified quickly and removed before passengers are affected
- More cost effective
- Increase passenger satisfaction and throughput to 30 million a year
Conclusion
Key Messages

• Technology changes fast
• Airport more than a transport hub – customer centric premise
• Observe to international standards and practices
• System availability – 99.995%
• Balance between cost and technology deployment
• Passenger-oriented personalized services
Thank you