Agenda

01 Corporate Overview

02 Aviation Domain Reference

03 Aviation Domain for overseas market
01 Corporate Overview
Corporate Overview - Basic Data

- Headquarters: Tokyo, Japan

- Turnover: JPY 1,425 billion. (USD 13.3 billion, EUR 10.4 billion)

- Employees: 11,000 [Non-Consolidated]
  75,000 [Consolidated]

- Business Areas:
  Broad range of IT services including consulting, system integration and IT outsource.
  Ex: Card and payment services,
  Service platform for mobile phone (Development into LTE from 3G),
  Big data analysis including social media.

- History:
  1967 - Started as a division in NTT Nippon Telegraph and Telephone Corporation
  1988 - Separated from NTT (May 23, 1988)
  1995 - Listed in Tokyo Stock Exchange (Code 9613)

* The above figures are as of the end of Fiscal Year 2014.
• Planning management strategies for the NTT Group; Encouraging fundamental R&D efforts

**NIPPON TELEGRAPH AND TELEPHONE CORPORATION** (Holding Company)

**NTT Group**
- Turnover: JPY10,700.7 billion
- Operating Income: JPY1,202.0 billion
- Subsidiaries: 946
- Number of Employees: 239,750
- Number of Consolidated Subsidiaries: 946

**Regional Communications Business**
- NIPPON TELEGRAPH AND TELEPHONE EAST CORPORATION
  - NTT's Voting Rights Ratio: 100%

**Long-Distance and International Communications Business**
- NTT Communications Corporation
  - NTT's Voting Rights Ratio: 100%

**Mobile Communications Business**
- NTT DOCOMO, INC.
  - NTT's Voting Rights Ratio: 66.7%

**Data Communications Business**
- NTT DATA CORPORATION
  - NTT's Voting Rights Ratio: 54.2%

- Dimension Data Holdings plc
  - NTT's Voting Rights Ratio: 100%

*The above figures are as of the end of FY2014.*
58,000 employees in 41 countries

- Over 26,000 employees are working in overseas countries.
- Select suitable resources from all over the world.
02 Aviation Domain Reference
We have been developing and providing Air Traffic Control, Air Traffic Management and Air Space Management for JCAB (Japan Civil Aviation Bureau). NTT Data also recently started sales and marketing to global market.

40 years of experience in the Aviation Domain.
ATM, RDP, ADS and many other systems were provided to JCAB.

We had unix-based Flight Procedure Design system for more than 10 years. With the professional expertise, PANADES was developed in 2009 as package product and has globally been sold since 2010.

We have ICAO IFPP (Instrumental Flight Procedure Panel) advisor and ATM RPP (Air Traffic Management Requirements and Performance Panel) advisor in NTT DATA Group.

NTT DATA is a member of CANSO (Civil Air Navigation Service Organization) since 2011.
Based on the experience in Japan, NTT DATA aviation domain expand its products to overseas market

1. Electric Terrain & Obstacle Data (eTOD)
DigitalGlobe, a leading provider of high-resolution earth imagery products, announced to develop a new eTOD solution jointly with the NTT DATA’s s 3D mapping technology.

2. Tower simulator
NTT DATA and technobrain will provide 3D simulator for tower control. There will be some more products to be released in near future.
This is the end of presentation of NTT DATA’s company introduction.

Ms. Yamashiro will explain what NTT DATA do for Air Traffic Flow Management.
Introduction of NTT DATA’s ATFM solution
We, NTT DATA Corporation, have been providing ATC, ATFM/CDM and ASM system to JCAB (Japan Civil Aviation Bureau) for more than 40 years.

1. NTT DATA’s approach to ATFM

2. New Concept for the ATFM System

3. Future works
1. NTT DATA’s approach to ATFM
1. NTT DATA’s approach to ATFM

- NTT DATA is the leading company of ATM system in Japan.

  - Support JCAB since introduction of ATFM system.
  - Provide ATFM system.
  - Provide any other ATFM relative systems as follows.
    - Fast-Time simulator
    - Dynamic Airspace Validation system
    - Spot-information Management and Planning system
    - RVSM safety validation system
1. NTT DATA’s approach to ATFM - Functions of ATFM

Flow control Function

- Target area: sector, airport, air way
- Target flight: domestic flight, Inbound traffic with neighboring coordination
- Method:
  - ground delay
  - assigning the control time of arrival at specific waypoints
  - sequencing at specific airways
  - departure interval

Flow control actual performance ※record from 2013 April to 2014 March

- Flow control executions: about 2,500 times/year
- Flights assigned to departure delay: about 25,000 flights/year
  (1.65% of total flight)
- Average delay time: about 8.66 min/flow controlled aircraft
1. NTT DATA’s approach to ATFM - Capacity of the airport

**Capacity**

- Capacity of the airport is measured by “Spacing Time”.
- Spacing time is the extent of the time that air traffic controller must delay the time of arrival at runway in the air so that all aircraft can land sequentially with keeping proper separation. (ex. Runway usage time)
- When Maximum Spacing time exceed Maximum Allowable Spacing time, the situation is overcapacity

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① Maximum Spacing time
② Maximum Allowable Spacing time (10min in this case)

Overcapacity
Capacity

- Capacity of the Sector is measured by “workload”
- Workload is the time that air traffic controller have to control aircrafts in every 30 minutes. (instruction, ATC system operation and time of judgment)
- Different value of workload factor is set to each type of flight. (Regional, Passing, Arrival, Departure)
- Workload factor is defined by the result of the simulation based on the operational data, and pre-set to the ATFM system.

Maximum Capacity
1800[sec]

- Regional flights
- Passing flights
- Arrival flights
- Departure flights
2. New Concept for the ATFM System
2. New Concept for the ATFM System

Our new concept is “Collaborative Planning and Optimization”. Under this concept, NTT DATA offers solutions for the congestion caused by the rapid air traffic growth, and it enables maximum use of the airspace.
Our ATFM system can solve several kinds of air traffic flow congestion in the followings.

【Domestic Air Traffic Flow】
Ex. : Indonesia
Feature: Congestion by excessive domestic air traffic flow in several area

【Particular Airport】
Ex. : Singapore
Feature: Congestion by excessive air traffic flow around particular large airport

【International Air Traffic Flow】
Ex. : Mekong Region
Feature: Congestion by excessive air traffic flow among several countries

【System Needs】
Overall optimization of whole domestic air traffic flow

【System Needs】
Individual optimization around particular large airport

【System Needs】
Sharing air traffic flow among several countries and solve their congestion
2. New Concept for the ATFM System - Enhanced engine for air traffic flow calculation

① To generate trajectory from OAG data
When flight plan is not presented by airline or air traffic flow is verified before flight plan is presented, NTT DATA’s ATFM system can show Estimated Departure/Arrival Time, Flight Time and generate trajectory from OAG data internationally available.

② To predict accurate traffic volume from high-precision trajectory
NTT DATA’s ATFM system can calculate Estimated Passing Time at trajectory fix and Estimated Arrival Time with weather conditions and aircraft performance. The ATFM system can improve their accuracy with recalculation whenever flight plan and weather condition are updated.
2. New Concept for the ATFM System
- Enhanced engine for a large volume of air traffic flow

① Selectable Coordination by Aircraft
- Only aircrafts from domestic airports
- Only aircrafts from overseas airports
- Exception special flight like VIP, etc.

② Various Coordination Methods
a) Trajectory Coordination: To avoid congested area by rerouting
b) Time Coordination:

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<tr>
<th>Coordination Methods</th>
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<th>FCFS (First Come First Served) &lt;Scheduled Departure Order&gt;</th>
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<td>FCFS (First Come First Served)&lt;Scheduled Arrival Order&gt;</td>
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<td>FCFS (First Come First Served) &lt;Scheduled In-Bounding Order to Control Area&gt;</td>
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<td>OTFS (On Time First Served)</td>
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Before Flow Control
6 aircraft throughput / 50 minutes

After Flow Control
First Come First Served

- To keep moderate spacing time among aircrafts
- To reduce traffic volume unit time

Control Area
1 Runway
2 Airport
3 Fix
4 Sector
5 FIR Boundary

Control Methods
1 Ground Delay Program(GDP)
2 Ground Stop(GS)
3 Minimum Departure Intervals(MDIs)
4 Minutes-in-trail(MINIT)

Delay Allocation Methods
1 Equal delay to all aircrafts ➔ Focus on average delay time
2 Delay in specific aircrafts ➔ Focus on on-time performance
This function handles Sub-Regional ATFM concept with CDM. This method can reduce the workload of 2 countries’ ATFM and achieve efficient flights for both of the countries. Neighbor countries need same ATFM system. Main server coordinates harmonized air traffic flow between two countries. Both countries input restrictions for flow control before the calculation. (ex. flight interval to their FIRs)

**New Concept for the ATFM System**

Country A

Country B

FIR

ATFM system simulates traffic flow considering the request and both countries’ traffic volume.

Request:
Extend flight interval from 5 minutes to 30 minutes for FIR B

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RWY 14R/32L in airport B is non-useable due to an accident. Need to control with only one runway.
2. New Concept for the ATFM System - flexible Optimization

Our system can meet various kinds of requirements for air traffic flow management from individual optimization to overall one. (Optimization for an airport and domestic FIR, International coordination with neighbor FIR)
Our ATFM system enables end user to make system integration and support CDM
3. Future works
NTT DATA will contribute to ASBU implementation supporting application for ATC/ATM

CNS technology
- ATS Interfacility Data Communications
- Surveillance Data Fusion
- Data exchange model standardization - AIXM/FIXM, SWIM

Apply to ATC/ATM
- Trajectory based operation
- Optimum capacity
- Total optimization of air traffic flow
- Airport CDM

3. Future works

Performance Improvement Areas

- Airport Operations
  - Optimization of approach procedures
  - Increased runway throughput through WT separation
  - Improve traffic flow through runway sequencing
  - Safety and efficiency of surface operations
  - Improved airport operations through airport-CDM

- Globally Interoperable Systems and Data
  - Digital aeronautical information management
  - Increased interoperability, efficiency and capacity
  - MET information supporting enhanced operation

- Optimum Capacity and Flexible Flights
  - Improved flow performance through network planning
  - Improved ops. through enhanced en-route trajectories
  - Initial capability for ground surveillance
  - Air traffic situational awareness (ATSA)
  - Improved access to optimum flight levels
  - ACAS improvements
  - Increased effectiveness of ground based safety nets

- Efficient Flight Path
  - Initial application of data link en-route
  - Improved flexibility and efficiency in descent profiles
  - Improved flexibility and efficiency in departure profiles

Block 0 (2013)
- Optimized airport accessibility
- Increased throughput through dynamic WT separation
- Departure, surface and arrival management
- Enhanced safety and efficiency of surface ops., and EVS
- A-CDM Total Airport Management
- Remotely operated aerodrome control management
- Integration of all digital ATM information
- FF-ICE/L application before departure
- Application of system-wide information management
- Integrated meteorological information

Block 1 (2018)
- Network operation planning
- Improved operations through free routing
- Increased ops. and efficiency through interval management
- Ground based safety nets on approach
- Improved traffic synchronization and initial trajectory based operation
- Improved flexibility and efficiency in descent profile
- Improved flexibility and efficiency in descent profile
- Integration of RPA systems into non-segregated airspace

http://www.icao.int/Meetings/anconf12/Pages/ASBU-Briefings.aspx