Contributing to Efficient Air Traffic Operations

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1. ICAO (CAEP) activities for ENVIRONMENT

2. JCAB’s challenge for Efficient Air Traffic Operations
   - **DARP** (Dynamic Airborne Reroute Procedure)
   - **UPR** (Users Preferred Route)
   - **RNP-AR** (Required Navigation. Performance –Authorization Required)
   - **CDA** (Continuous Decent Arrival)
   - **FUA** (Flexible Use of Airspace)
   - **ATFM** (Air Traffic Flow Management)

3. GBAS (Ground Based Augmentation System) Implementation plan
The 39th session of ICAO Assembly reached a historic ENV agreement.

- The basket of measures (i.e. aircraft, technology and standards, operational improvement, sustainable alternative fuel, and GMBM.

- CORSIA: Carbon Offsetting and Reduction Scheme for International Aviation

The Assembly Resolution adopted on ENV.

Resolution A39 1-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection

- General provisions, noise and local air quality.
- Climate change.
- Global Market Based Measure scheme.
### DARP-1

#### HNL ⇒ HND/NRT

- **TTL**: 219,300lbs/16:10 Savings
- 251 DARP / 4348 Flights (5.8%)
- (2012.10.1-2017.8.31)

#### HND/NRT ⇒ HNL

- **TTL**: 27,800lbs/2:41 Savings
- 47 DARP / 3589 Flights (1.3%)
- (2012.10.1-2017.8.31)

#### HND/NRT ⇒ LAX

- **TTL**: 63,900lbs/3:27 Savings
- 49 DARP / 2559 Flights (1.9%)
- (2014.3.1-2017.8.31)

#### NRT ⇒ SJC

- **TTL**: 5,800lbs/0:33 Savings
- 11 DARP / 797 Flights (1.4%)
- (2015.6.25-2017.8.31)

#### NRT ⇒ SFO

- **TTL**: 58,900lbs/3:52 Savings
- 24 DARP / 1058 Flights (2.3%)
- (2014.11.1-2017.8.31)

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<table>
<thead>
<tr>
<th>Departure Airport</th>
<th>Arrival Airport</th>
<th>Target FLT</th>
<th>Applied DARP FLT</th>
<th>Executing Rate (%)</th>
<th>TTL Fuel Saving (LBS)</th>
<th>TTL Time Saving</th>
<th>Fuel Saving per flight (LBS)</th>
<th>Time Saving per flight</th>
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</thead>
<tbody>
<tr>
<td>HNL</td>
<td>HND/NRT</td>
<td>4348</td>
<td>251</td>
<td>5.8%</td>
<td>219,300</td>
<td>16:10</td>
<td>874</td>
<td>0.03</td>
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<tr>
<td>HND/NRT</td>
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<td>47</td>
<td>1.3%</td>
<td>27,800</td>
<td>2:41</td>
<td>591</td>
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<tr>
<td>HND/NRT</td>
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<td>2559</td>
<td>49</td>
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<td>63,900</td>
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<td>1,304</td>
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<tr>
<td>NRT</td>
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<td>1058</td>
<td>24</td>
<td>2.3%</td>
<td>58,900</td>
<td>3:52</td>
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<tr>
<td>NRT</td>
<td>SJC</td>
<td>797</td>
<td>11</td>
<td>1.4%</td>
<td>5,800</td>
<td>0:33</td>
<td>527</td>
<td>0.03</td>
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</tbody>
</table>

(Data: A total of 12,351 flight between 2012.10.1 and 2017.8.31)
The flight route was TRACK 2 which was made by avoiding the volcanic ash of SHEVELUCH volcano. After that, the diffusion prediction map was updated and the diffusion area was reduced, so we operated Re-Route by DARP. For the benefits of DARP, Fuel Saving was 5300 LBS and Time Saving was 18 minutes. Even if it is difficult to predict the change like this time, it is considered that the latest data can be applied as appropriate and DARP can be used to minimize the influence on flight.
UPR User Preferred Route

- PACOTS (Fixed)
- UPR

EAST-BOUND ➔
WEST-BOUND ←
Flying a pre-defined P-RNAV Standard Arrival Route (STAR) to ILS Intercept Point minimizing emissions and noise.

CDA at Kansai International Airport

Traditional Approach

Level off segment forcing the aircraft to use engines, flaps, slats etc. that creates more emissions and noise.

CDA is implemented at
- Kansai Airport
- Naha Airport
- Kagoshima Airport

Green Approach

Actual flight path at KIX

ENV Benefit of CDA
- Noise reduced by up to 5 dB
- Fuel savings – 50-150 kg per flight
- CO2 by over 300 kg per flight
- NOx also reduced
RNAV / RNP Approach in JANS

As of Aug. 17, 2017
【RNAV / RNP Approach 67 airports】

- Breakdown of RNAV/RNP Approach -

- RNAV Approach serving 19 airports
- RNP AR Approach serving 26 airports
- RNP Approach serving 22 airports
- Basic RNP 1 serving 34 airports
- RNAV1 serving 37 airports
RNP-AR example-1

Solution for WX challenged airport

RNP AR Approach

Conventional route <VOR & ILS>

Strong WEST wind

Odate-Noshiro Airport

mountainous area
RNP-AR example-2

Solution for Closely located Airport

OZUKI Aerodrome (Navy training)  
HOFU Aerodrome (Air force training)

Kitakyushu Airport

TSUIKI Airbase

Yamaguchi-UBE Airport
Civil and Military Working together toward FUA

FUA: Flexible Use of Airspace

Military Training Areas in Japan

Air Traffic Management Center

Ministry of Land, Infrastructure, Transport and Tourism
Benefits of ATFM

The ATMC provides Routing management, Approval for flight plans and Flow control as ATFM functions.

- Routing management:
  Managing route-network to form efficient and orderly traffic flow and rerouting to avoid congested airspace or severe weather area.

- Approval for IFR flight plans:
  The flight plans are given by ATMC with necessary instructions in accordance with overall traffic flow management.

- Flow control:
  To ensure appropriate and maximum traffic flow by instructing minimum restrictions when traffic demand exceeds airspace capacity.
  - Assignment of Expected Departure Clearance Time/EDCT.
  - Assignment of restrictions on ATC procedures to ATC facilities.

Japan’s Experience and Benefit

- Total Delay Time: 120,000 minutes.
- Economic Effect: 32,000 kiloliters fuel reduction (cost cut: 24,400,000$)
- Eco Friendly: 6,000 tons of CO2 emission reduction.
**GBAS Implementation Plan**

- JCAB is now installing Japan’s 1\textsuperscript{st} GBAS, manufactured by NEC at Tokyo International airport scheduled to be in operation in 2022 after test and evaluation periods of 2 years.

- GBAS consists of
  - **4 Reference Receivers** for collecting navigation data from GPS
  - **Processor** for generating GBAS signal
  - **VHF Data Broadcast unit** for transmitting digital data to aircraft
  - **Ionosphere Field Monitor (IFM)** for mitigating severe ionosphere effect at low geo-magnetic location in Japan

- GBAS corrects GPS errors and provides vertical and horizontal guidance to suitably equipped aircraft for precision approach and landings, initially CAT-I and eventually to CAT-III standards.
Advantages for GBAS

GBAS provides new operational concept and solution.

One system covers Multi-R/W
- Precision approach procedures for multiple runway are provided by one system.
- CAT-I GBAS standard had incorporated in ICAO ANNEX-10 and the multiple runway service also already operated in several countries.

No Critical/Sensitive area
- The aircraft landing timing by GBAS does not require CSA, which is required by ILS technical operation, consequently enables to set holding line close to runway.

Flexible precision approach
- In the combination of RNAV/RNP procedure, it enables to introduce CDA to R/W-end. This advantage would be expected to improve fuel consumption, noise abatement and CO2 emission.

Offset landing point
- Technically GBAS has possibility to set several landing point on the runway and it is expected to reduce noise pollution and separation minima by wake turbulence.
Thank you for your attention!