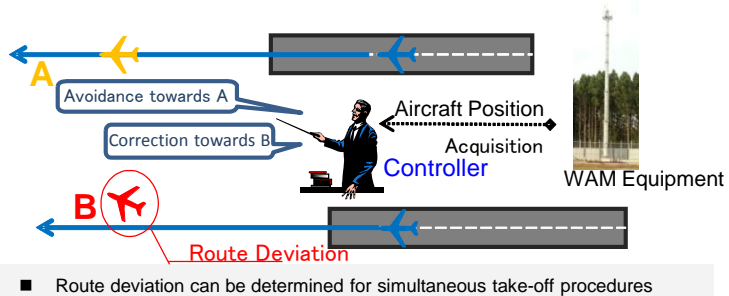


Contribution: Narita Airport capacity increased from 64 to 68 per hour (since March, 2014)

Research Institute: ENRI (Electronic Navigation Research Institute)

<Policy Overview>

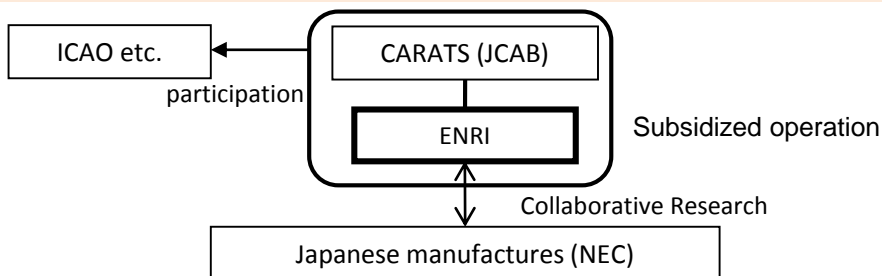
- With the use of WAM, positions of aircraft flying in the vicinity of the airport can be provided to air traffic controllers with high accuracy and frequency



WAM: Wide Area Multi-Lateration

<Research Overview> 2009-2012

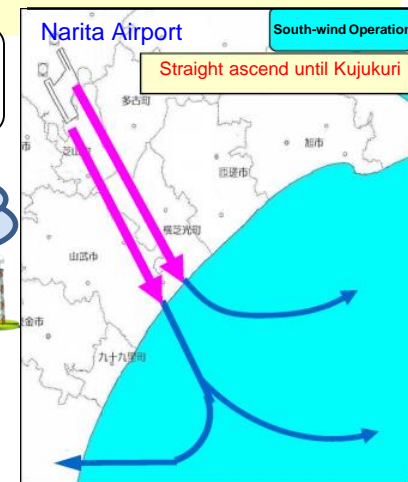
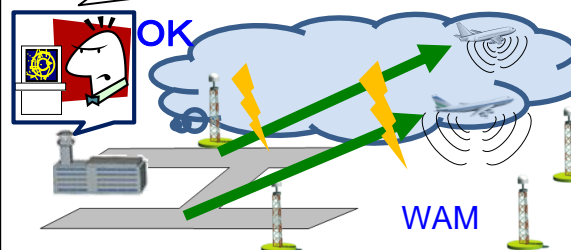
- Objective: Development of high-capacity WAM and performance study in real-life environment
- Theme: Study for Enhanced Airport Surface Monitoring
- Structure: See below



<Output Overview>

- Experimental WAM system was developed to test in real-life environment the provision of aircraft positions with high accuracy and frequency assuming simultaneous parallel runway operations
- With the implementation of WAM, achieved simultaneous parallel runway operations at Narita Airport, contributing to increase in airport capacity [began operation since March, 2014]

Aircraft monitoring can be achieved for right after taking off under low-visibility conditions



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- Provided decision making material for WAM-enabled simultaneous parallel runway operations as well as incorporating the experiment results into the capacity specifications-

<Website Link> ENRI Annual Report

https://www.enri.go.jp/info/nenpou/nenpou_index.htm

<Contact>

(Contact for Policy) CARATS Office

MLIT JCAB Air Navigation Services Dep. Air Navigation Services Planning Dep. 03-5253-8111(ex. 51104/51106)

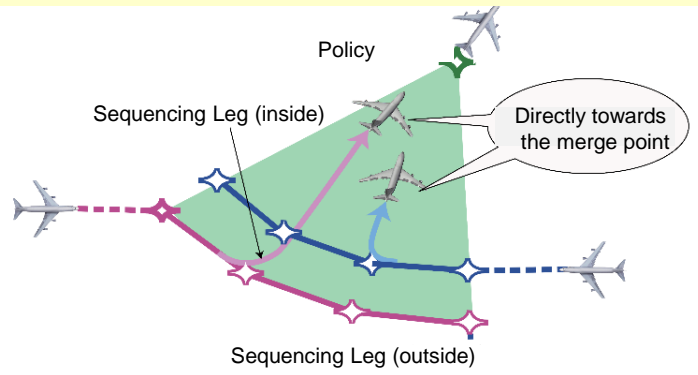
(Contact for Research) National Institute of Maritime, Port and Aviation Technology Electronic Navigation Research Institute, Independent Administrative Institution, Managing Director for Research Affairs, 0422-41-3432

Contribution: Benefit estimation and operation concepts in videos were achieved (from 2020)

Research Institute: ENRI (Electronic Navigation Research Institute)

<Policy Overview>

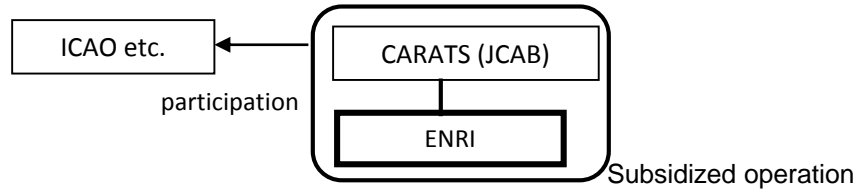
- PMS (Point Merge System) will be implemented at Haneda Airport to replace radar vectoring as a procedure to handle arrival flights [to be implemented at JCAB from 2020 onward]



■ Example of PMS approach procedure

<Research Overview> 2011-2014

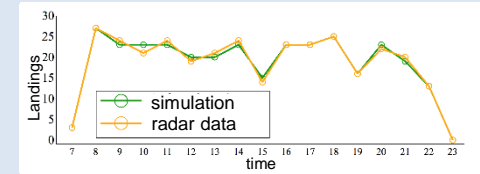
- Objective: Development of PMS simulation model
- Theme: Study for ATM Performance Assessment
- Structure: See below



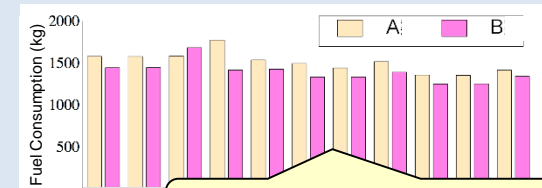
<Output Overview>

Prediction by Simulation

- ◆ Simulation model will be developed and evaluated for consistency with real conditions
- ◆ Evaluated model will be used to estimate fuel consumption and arrival
- ◆ Video will be developed to get an idea of traffic flows



Example of evaluation



Estimation of fuel consumption (comparison with an alternative plan)

Contributed to Decision Making for Implementation

(Operational Benefits)

Reduction in fuel consumption by repetitive descent toward the merge point etc.

<Website Link> ENRI Annual Report
https://www.enri.go.jp/info/nenpou/nenpou_index.htm

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(Contact for Policy) CARATS Office
 MLIT JCAB Air Navigation Services Dep. Air Navigation Services Planning Dep. 03-5253-8111(ex. 51104/51106)
 (Contact for Research) National Institute of Maritime, Port and Aviation Technology Electronic Navigation Research Institute, Independent Administrative Institution, Managing Director for Research Affairs, 0422-41-3432

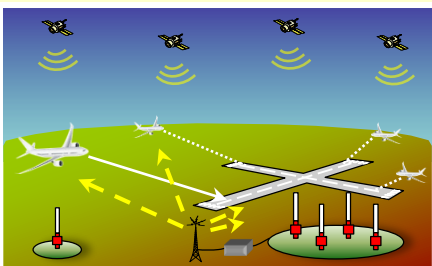
Contribution: Implementation of GBAS (CAT I) at Haneda Airport (since Sep. 2016)

Research Institute: ENRI (Electronic Navigation Research Institute)

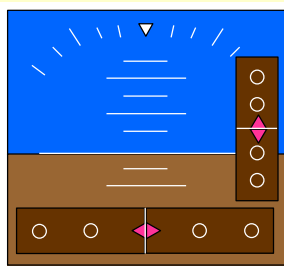
<Policy Overview>

GBAS: Ground-Based Augmentation System

- Introduction of Precision Approach service (CAT I) by implementing ICAO-standard GBAS [trial operation to begin from FY2019 at Haneda Airport]



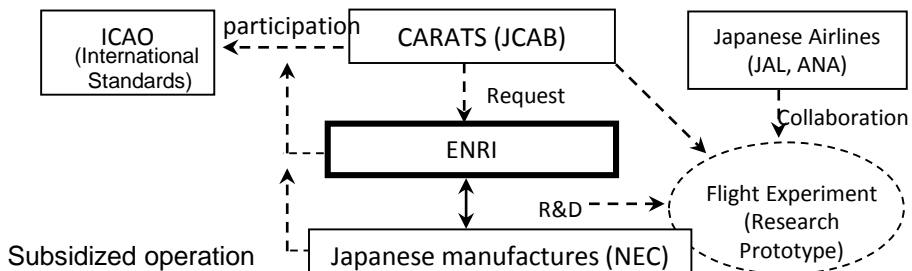
[GBAS System Positioning]



[Onboard Display]

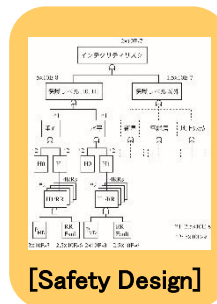
<Research Overview> 2008-2011

- Objective: Development and evaluation of technology for GBAS (CAT I) safety design
- Theme: Development of Safety Analysis and Risk Management Technology for GNSS Precision Approach
- Structure: See below

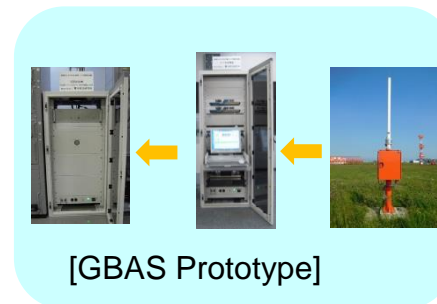


<Output Overview>

- Implementation of GBAS (CAT I) at Haneda Airport was enabled by incorporating technology that ensures safe approach and landing (adjusting to disturbance caused under Japan's ionosphere conditions, which differ from western countries)



[Safety Design]



[GBAS Prototype]



[B787 Experiment]

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1. New development of safety design technology for precision approach that meets ICAO international standards through design and manufacturing of experimental prototype (experimented in airport environment and on airline aircraft)
2. New monitor procedure adjusting to disturbance caused under ionosphere conditions in areas with a low magnitude latitude such as Japan

<Website Link> ENRI Annual Report
https://www.enri.go.jp/info/nenpou/nenpou_index.htm

<Contact>

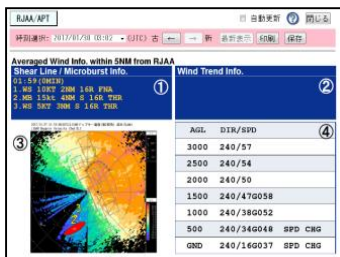
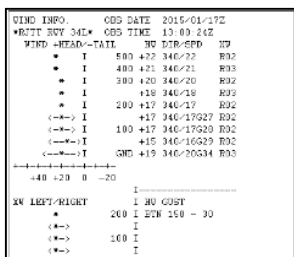
(Contact for Policy) CARATS Office
 MLIT JCAB Air Navigation Services Dep. Air Navigation Services Planning Dep. 03-5253-8111(ex. 51104/51106)
 (Contact for Research) National Institute of Maritime, Port and Aviation Technology Electronic Navigation Research Institute, Independent Administrative Institution, Managing Director for Research Affairs, 0422-41-3432

Contribution: Low-altitude observation information provided for Haneda/Narita airports (from April, 2017)

Research Institute: JAXA (Aerospace Exploration Agency)

<Policy Overview>

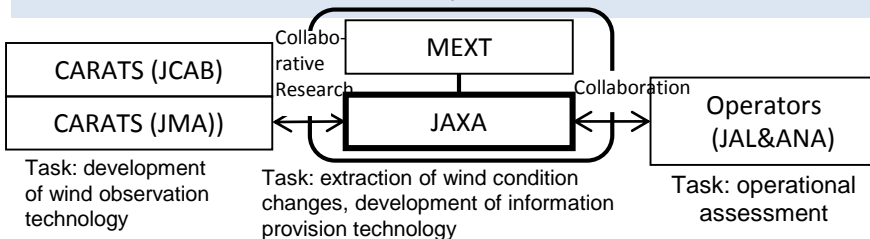
- Information provision for operators on Airport Low-level Wind Information including wind shear along approach procedures [implemented at JMA since April 2017 for Haneda/Narita airports]



■ Cockpit (text format) ■ Operator-oriented (web display)

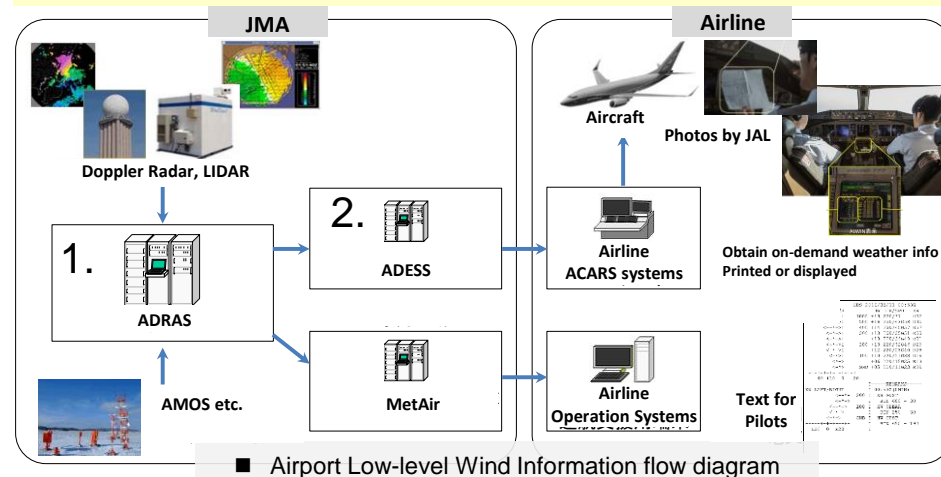
<Research Overview> 2011-2015

- Objective: Observation, information provision and operational assessment for low-level wind conditions
- Theme: Research and Development for Information Contributing to Safe Aircraft Operations based on Low-level Wind Shear Observation Information (collaborative research with JMA and JAXA)
- Structure: See below. Subsidized operation for JAXA



<Output Overview>

- Observation, processing and information provision for Airport Low-level Wind Information achieved through collaborative research with JMA and JAXA in collaboration with operators.



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1. Technology for automated extraction of wind condition changes affecting take-off and landing based on analysis of flight data from airlines, incorporated into JMA systems processing
2. Format for wind conditions provision readily interpretable to pilots reflecting operational assessment by operators, incorporated into text format

<Website Link> <http://www.aero.jaxa.jp/research/star/dreams/weatherinfo/>

<Contact>

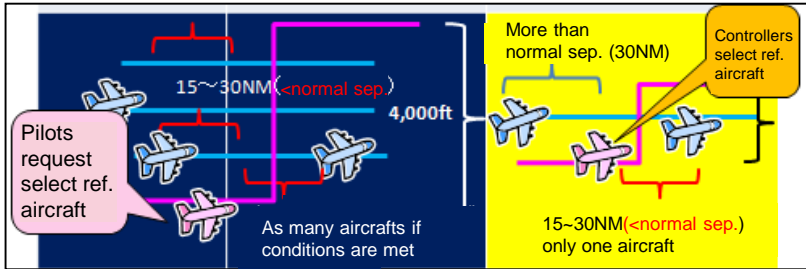
(Contact for Policy) CARATS Office
MLIT JCAB Air Navigation Services Dep. Air Navigation Services Planning Dep. 03-5253-8111(ex. 51104/51106)
(Contact for Research) Japan Aerospace Exploration Agency, Independent Administrative Institution, Aeronautical Technology Directorate, PR 050-3362-8036

Contribution: Decision-making upon benefit estimation for CDP&ITP implementation (2014)

Research Institute: ENRI (Electronic Navigation Research Institute)

<Policy Overview>

- Shortened separation for oceanic routes can be applied for when ascending/descending

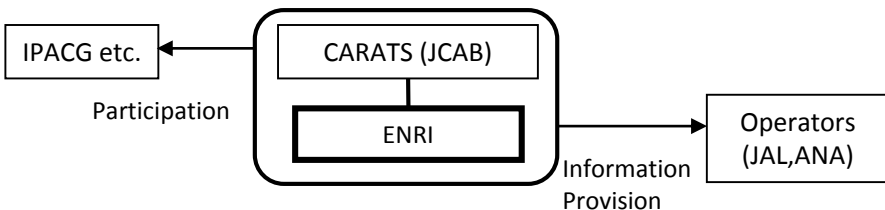


■ Conditions for ITP ■ Conditions for CDP

ITP: In-Trail Procedure (requires ASAS installation)
CDP: Climb Descent Procedure (requires RNP4)

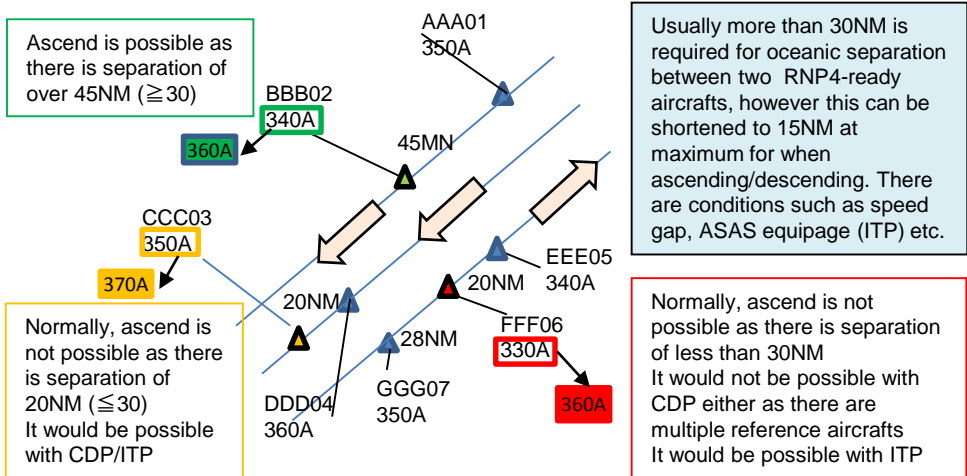
<Research Overview> 2012-2015

- Objective: Proposal of conditions on optimized route generation for PACOTS (Pacific Organized Track System)
- Theme: Study for optimization of oceanic routes including arriving routes
- Structure: See below: subsidized operations



<Output Overview>

- Oceanic ATC simulation conducted to test implementation benefits of CDP/ITP, confirming reduction tendencies in fuel consumption and flight time
- CDP/ITP will be implemented in Fukuoka FIR [from FY 2019]



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- Contributed to decision making by providing airlines with simulation results

<Website Link> ENRI Annual Report
https://www.enri.go.jp/info/nenpou/nenpou_index.htm

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Contribution: GNSS surveillance realized (from 2020)

Research Institute: ENRI (Electronic Navigation Research Institute)

<Policy Overview> GNSS: Global Navigation Satellite System

- Safe PBN (Performance-Based Navigation) operations can be achieved by introducing ICAO standard GNSS (Global Satellite Navigation System) equipment

Collection of GNSS transmission Collection of airport RF conditions Realtime information

■ Concept of GNSS surveillance

<Research Overview> 2016-2017

- Objective: Proposal of concept for GNSS surveillance
- Theme: Study on GNSS surveillance
- Structure: See below. Subsidized operation

<Output Overview>

- Implementation of GNSS surveillance equipment in Fukuoka FIR incorporating ground-based GNSS performance monitoring technology into the equipment [2017: JCAB contracts for equipment. 2018: manufacturing of equipment, 2020: scheduled for operation]

Performance requirements for GNSS surveillance equipment

New procedure for GNSS outage detection

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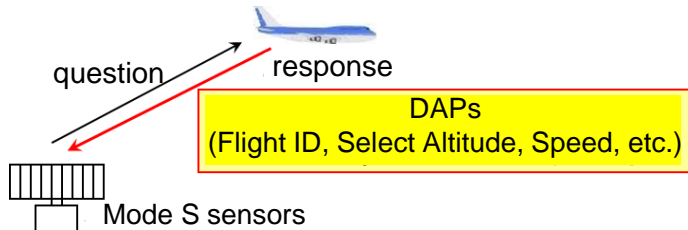
- Performance requirements for GNSS surveillance were proposed and incorporated to meet ICAO international standards through experimental systems
- New procedure was proposed and incorporated for instant detection of GNSS outage by monitoring onboard navigation performance information

<Website Link> ENRI Annual Report
https://www.enri.go.jp/info/nenpou/nenpou_index.htm

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<Policy Overview>

- Reliability assessment and information downlink for use in ATC systems can be achieved by introducing SSR Mode S sensors with DAPs capability

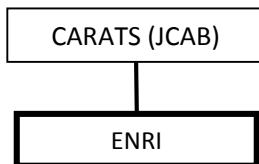


■ DAPs Outline

DAPs: Downlink Aircraft Parameters

<Research Overview> 2011-2015

- Objective: Improvement on reliability of ATC system
- Theme: Study for Hybrid Surveillance System
- Structure: See below. Subsidized operation

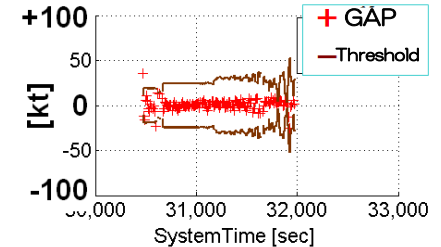
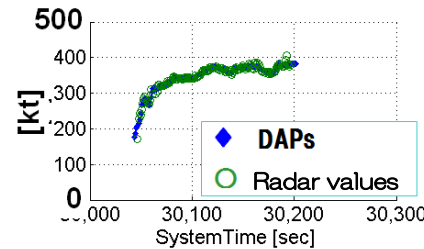


<Output Overview>

- Development of a monitoring system for detecting abnormal values and evaluating matches with set-up information and DAPs information
- Assessment towards enhanced reliability for DAPs after implementation [Assessment to begin after 2015]

Assessment example of GS (Ground Speed)

DAPs and radar-derived values are compared and the gap is determined as abnormal values when exceeding the threshold



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- Contributed as reference material for reliability assessment methodology while developing DAPs-ready SSR systems.

<Website Link> ENRI Annual Report
https://www.enri.go.jp/info/nenpou/nenpou_index.htm

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