

Exploring Novel ATM&CNS Technologies for Future Air Traffic System

Project Leader

HARADA, Akinori, Dr. Eng.

Assistant Professor, Intelligent Mechanical Systems Engineering

1. Objective

The continuous increase in the volume of world air traffic causes environmental concerns, flight safety deterioration and capacity reduction. This project is aimed at exploring novel ATM (Air Traffic Management) & CNS (Communication, Navigation and Surveillance) technologies which address such issues. Currently, one promising research theme is the development of a trajectory calculation tool which is capable of precisely reproducing the FMS (Flight Management System) commands on the ground side. Such trajectory prediction technology is of great importance for establishing a trajectory management system based on TBO (Trajectory Based Operation) concepts. The usability of the proposed tool will be investigated by large-scale flight analyses using actual flight data.

2. Project Outline

The requirements of this precise trajectory prediction tool include processing of flight data, validation of the accuracy of both meteorological data and aircraft performance model, and the development of a trajectory calculation logic which closely mimics the one used in the FMS. Prediction accuracy of the waypoint passing time or arrival time is investigated by a number of flight analyses with actual flight data such as radar tracks and ADS-B (Automatic Dependent Surveillance Broadcast) data. Within the scope of project title, other research themes can also be proposed. For example, two current candidate proposals are the development of a 4-dimensional flight trajectory optimization method with the fixed terminal time, and the realization of a continuous decent approach in a congested airport.

3. Expected Performance

- (a) Develop a precise trajectory prediction tool used in the trajectory management system
- (b) Reveal the potential benefits of TBO
- (c) Propose a novel idea to break through technical difficulties in ATM research

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

- (a) Fundamental knowledge of Flight Dynamics, Guidance and Control, and Nonlinear Optimization
- (b) Practical knowledge of aircraft flight operation and ATC (Air Traffic Control)
- (c) General knowledge of FMS and AP (Auto Pilot)

References

- (1) A. Harada, "Numerical Investigation on Flight Trajectory Optimization Methods", Air Traffic Management and Systems II, Springer Japan, Vol.420, pp. 89-112, 2015.
- (2) A. Harada, "Air Traffic Efficiency Evaluation by Trajectory Optimization and ADS-B Data", 30th Congress of the International Council of the Aeronautical Sciences (ICAS2016), Daejeon, Korea, 2016.
- (3) A. Harada, H. Matsuda, Y. Miyazawa, "Dynamic Programming Trajectory Optimization by Piecewise

Linear Approximation”, AIAA Scitech2015, AIAA 2015-1075, Florida, USA, 2015.

- (4) A. Harada, T. Kozuka, Y. Miyazawa, N. K. Wickramasinghe, M. Brown, Y. Fukuda, “Analysis of Air Traffic Efficiency using Dynamic Programming Trajectory Optimization”, 29th Congress of the International Council of the Aeronautical Sciences (ICAS2014), Paper No. 2014-0743, St. Petersburg, Russia, 2014.

See my webpage:

<https://www.kochi-tech.ac.jp/profile/en/harada-akinori.html>

See our admission guidelines:

https://www.kochi-tech.ac.jp/english/admission/ssp_aft19oct/ssp_application_guideline.html

Contact

E-mail: harada.akinori@kochi-tech.ac.jp