

Provision of “CARATS Open Data”

*Air Navigation Services Department
Civil Aviation Bureau
Ministry of Land, Infrastructure, Transport and Tourism*

1. Purpose

The Ministry of Land, Infrastructure Transport and Tourism (MLIT) considers it necessary to promote research and development, to grow the nation’s air transportation system, to substantively expand aviation services and to continuously improve service quality. In particular, it believes it necessary to accelerate research in aviation fields carried out by universities and research institutes. The Committee for Promoting Renovation of Air Traffic Systems has therefore decided to widen the external release of data held by air traffic control centers for use as research material.

“CARATS Open Data” is made available as part of this effort. It has been processed to remove the need for confidentiality and is intended for general release.

Users of “CARATS Open Data” should appropriately handle the data understanding this objective and the following notes on its use. It is hoped that “CARATS Open Data” will be used for activities that will contribute to the development of air transportation.

2. Overview of Data and Specifications

The data set of “CARATS Open Data” includes flight track information (time, position and altitude of each flight at regular intervals) taken from certain time periods in Japanese Fiscal Years (JFY) 2013 – 2016 (1 April 2013 – 31 March 2017). The data set is based on data obtained from en-route radars operated by the MLIT’s Civil Aviation Bureau and has been processed and smoothed.

- (1) The data set is named “CARATS Open Data”.
- (2) The data set is provided as Comma Separated Value (CSV)-format electronic files formatted as shown in the example below. Please note the following;
 - Times are Japan Standard Time (JST).
 - The actual “callsigns” of each flight have been replaced with virtual Flight Identifiers (Flight ID) such that each flight has a unique Flight ID within a single day and that a flight that spans two days has the same Flight ID on each day.
 - Aircraft type codes are the abbreviations contained in ICAO (International Civil Aviation Organization) Document 8643 “Aircraft Type Designators”.

Columns:	Time	Flight ID	Latitude (deg)	Longitude (deg)	Altitude (ft)	Type
	08:00:00.1	FLT0300	42.413533	141.681313	6247	B763
	08:00:00.1	FLT0320	33.877210	131.116394	11800	DH8D
	08:00:00.2	FLT0422	42.275752	141.749411	20266	B773
	08:00:00.3	FLT0311	35.508394	133.801179	7979	B738

- (3) Data are taken from the following one-week periods (from Monday to the following Sunday) every other month in JFY2013 and 2014 (6 weeks data from each year, a total of 12 week’s data).

- **JFY 2013:**
 - 2013 06 – 12 May
 - 08 – 14 July
 - 02 – 08 September
 - 04 – 10 November

- 2014 06 – 12 January
03 – 09 March
- **JFY 2014:**
 - 2014 12 – 18 May
14 – 20 July
15 – 21 September
10 – 16 November
 - 2015 12 – 18 January
09 – 15 March
- **JFY 2015:**
 - 2015 11 – 17 May
13 – 19 July
14 – 20 September
09 – 15 November
 - 2016 11 – 17 January
07 – 13 March
- **JFY 2016:**
 - 2016 09 – 15 May
11 – 17 July
12 – 18 September
14 – 20 November
 - 2017 09 – 15 January
06 – 12 March

However, radar data are not available for several Area Control Centers (ACC) and time periods. Data from other ACCs were used during these periods to fill coverage gaps.

(4) File names

Data for each day (24 hours) are contained in three files covering the time periods 00:00 – 12:00, 12:00 – 18:00 and 18:00 – 24:00. File names are of the format YYMMDD_h1_h2 where YYYY is the year, MM is the month (01-12), DD is the day (01-31), h1 is the start hour (00, 12 or 18) and h2 is the end hour (12, 18 or 24). For example:

The file named	20120507_00_12.csv	contains data for 2012/05/07 00:00 – 12:00
The file named	20120507_12_18.csv	contains data for 2012/05/07 12:00 – 18:00
The file named	20120507_18_24.csv	contains data for 2012/05/07 18:00 – 24:00

Data for surface operations (only at Tokyo Int'l Airport) are provided in a separate set of data files. Data for each day (24 hours) are contained in a single file. File names are of the format of `trk_surface_YYMMDD`. For example:

The file named `trk_surface_20120507.csv` contains data for 2012/05/07 00:00 – 24:00

(5) Data characteristics

(a) Data are for scheduled flights operating under Instrument Flight Rules (IFR). Flight operating under Visual Flight Rules (VFR), flights that do not enter en-route controlled airspace, military/defense forces and private flights etc. are not included in the data set.

(b) Time and position data (latitude, longitude and altitude) contain errors and no guarantee is made of their accuracy. In particular, errors may be especially large at low altitudes.

(c) The following erroneous data may be included:

(i) Position data largely removed from a flight's track.

(ii) Altitude values which are zero or negative.

(iii) A few tens of seconds of "false" track data may appear at before the start or after the end of the flight, which appear to show the aircraft in flight.

(d) The different radar coordinate system used by each ACC have been transformed into a single coordinate system. However, discontinuities in flight tracks may occur when the source of ACC

- of the radar data changes.
- (e) Flight track data are normally recorded at 10-second intervals corresponding to the scan time of en-route radar antennas. However, the interval between successive track records may not be precisely 10 seconds for the following reasons:
 - (i) The relationship between the direction of flight and the radar's axis of rotation.
 - (ii) The resolution of the recorded time stamp (1ms).
 - (iii) Loss of data.
 - (f) Time intervals of en-route radar data and terminal radar data are different.
 - en-route radar data: 10 seconds
 - terminal radar data: 4 seconds

3. Steps for Data Acquisition

(1) Please apply for data acquisition by sending e-mail to the contact address shown below with your "name, address, affiliation, desired year of data, purpose of use"

- When using the data with multiple number of people, such as research and development teams, list all the individual's name on the application.
- please be as specific as possible when writing the purpose of use of the data, examples as follows,

(Example 1) To carry out research and development of simulation of ●●

(Example 2) In order to use as a teaching material at the △△ class of ×× university

- If there is any changes to the information on the application such as addition or change of team members, applicant affiliation, please contact the email address provided.

【mail】 hqt-carats@mlit.go.jp

(2) CARATS office will then examine the provided information and will decide whether to provide data or not. In this process we might contact to the individual applicants to clarify necessary information.

(3) Once you receive a reply from CARATS office, confirming your request granted, please send following items by mail to the CARATS office.

- The required number of DVD-R / RW (The number of media per person is limited to 1 per desired year.)
- Protective material such as air cap bag for protecting DVD-R / RW
- A reply envelope large enough to contain above items with necessary amount of stamps being posted (return address also filled in).

[Mail address] 2-1-3 Kasumigaseki, Chiyodaku, Tokyo, 100-8918 Japan

[The mailing address] destination Ministry of Land, Infrastructure, Transport and Tourism
Aviation Bureau traffic control department traffic control Planning Division CARATS
Secretariat

(4) Once the packages been received by CARATS office, we will copy the desired data to the DVD-R/RW and send you back by the reply envelope you've inserted.

4. Conditions of Use

- (1) Use of redistribution of CARATS Open Data for purposes other than research and development, education or academic research (e.g. commercial use) is prohibited.
- (2) CARATS Open Data are provided without warranty. MLIT accepts no liability for claims arising from the use of CARATS Open Data or results based on CARATS Open Data.
- (3) MLIT cannot respond to questions regarding the content of the data, flight operations, air traffic control procedures or other such matters. Please also refrain from contacting aircraft operators, air traffic control centers etc.
- (4) When publishing or otherwise making available research papers, articles or other materials that contain results based on the use of CARATS Open Data. Please include a note acknowledging the use of “CARATS Open Data provided by MLIT, Japan”.

If you do not agree to the above conditions, please discontinue use of the data and destroy the data.

5. Other Conditions

- (1) The contents of the “CARATS Open Data” data set may be changed without prior notice. Also, the release of CARATS Open Data may discontinue.
- (2) The MLIT is considering expanding the time periods by the CARATS Open Data and increasing the types of data made available. However, it will not respond to individual requests.
- (3) Requestor’s personal information will be used for analyses, including validity checking of data disclosure and measures for the development of air traffic systems.
- (4) To help improve the usability of CARATS Open Data, the “PlotTrack” data visualization tool (Japanese version only) developed by the Electronic Navigation Research Institute (ENRI) is also provided. The PlotTrack software is copyrighted by ENRI. Please refer to the “PlotTrack User Manual” (Japanese version only) for details of its use.

Contact Details for Feedback etc.

Secretariat of the Committee for Promoting Renovation of the Air Traffic System
Air Navigation Services Planning Division,
Air Navigation Services Department, Civil Aviation Bureau,
Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

Email: hqt-carats@mlit.go.jp