

Accuracy and Effectiveness of CTO in Traffic Flow Control

1. Overview

In NARAHG, we try to realize international ATFM by specifying CTO at FIR boundary. Actually, based on the CTO designated from the downstream ATFMU (or ATSU) before taking off, EDCT/CTOT of the target flight is calculated on the upstream ATFMU, and the CTO is achieved by taking off at EDCT/CTOT.

Although it is not easy to achieve a specified CTO, we provide data on the effectiveness of international ATFM by CTO from our experience in Japan.

2. Current international ATFM in Japan

In Japan, ATMC has concluded the LOA with several adjacent FIR now, and has operated international ATFM.

The MINIT is used as the main method, and the coordination is requested from the downstream ATFMU.

In the case of Japan, the ATFM system is operated for a long time, and when the MINIT is requested from adjacent ATFMU, ATMC often decides to convert required time separation at FIR boundary to EDCT/CTOT of the target flight at departure airport by the ATFM system.

(As you know, the operation of EDCT/CTOT for congestion in each area in Japan has been activated as one of the targets, including FIR gates).

3. Future international ATFM in NARAHG

In NARAHG, in addition to MINIT, we also consider how to directly specify CTO for each target flight as an alternative method of international ATFM.

It is not currently activated, EDCT/CTOT will be calculated based on assigned CTO from adjacent ATFMU instead of calculated by the own ATFM system, and it will be possible to deal with the future procedure without much difference from current procedure.

4. Actual data analysis

The current ATFM system calculates CTO related to MINIT for keeping time separation, but system does not inform the operator for CTO.

ATFM system informs the operator for only EDCT/CTOT calculated by system based on CTO.

The relationship between CTO and EDCT/CTOT and actual ATD/ATOT and ATO recorded in the system was analyzed.

In this paper, we analyze the 3 FIR boundary gates, ONIKU(boundary for Shanghai FIR via A593/BULAN(boundary for Taipei FIR via A1/SAPRA(boundary for Incheon FIR via G585), using the data of 1 days with flow control, respectively.

1) A593@ONIKU bound for ZSPD

There were 30 flight via ONIKU.

If the compliance window for taking off is assumed to be - 5 minutes to + 10 minutes for the difference between EDCT/CTOT and ATD/ATOT, then the rate of achievement is about 83% (figure 1-1). The actual Japan Compliance Window is basically - 1 minutes to + 10 minutes. There are some differences depending on the airport.

After taking off, the influence of control orders is affected, but when the difference between CTO at the time of calculation of EDCT/CTOT and ATO is assumed to be the same compliance window, the rate of achievement is about 68% (figure 1-2).

The CTO has not communicated to the operator, but has shown that it is an ATO close to the CTO at the time of calculation.

Figure 1-3 is shown different minutes “between ATD – EDCT at each departure airport” vs “between ATO – CTO at ONIKU as FIR boundary”.

EDCT/CTOT Compliance

CTO Compliance

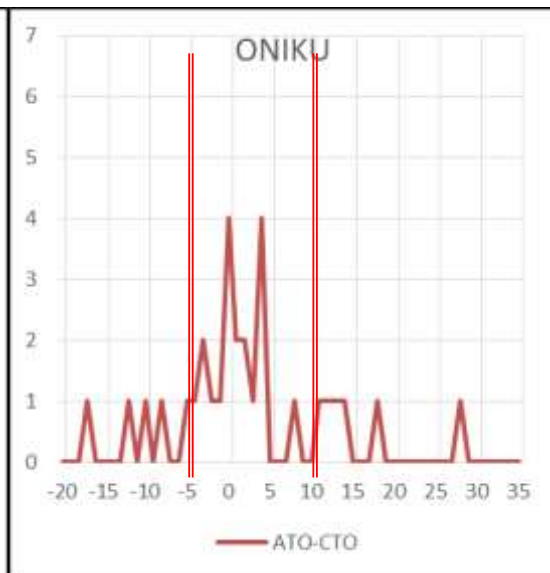
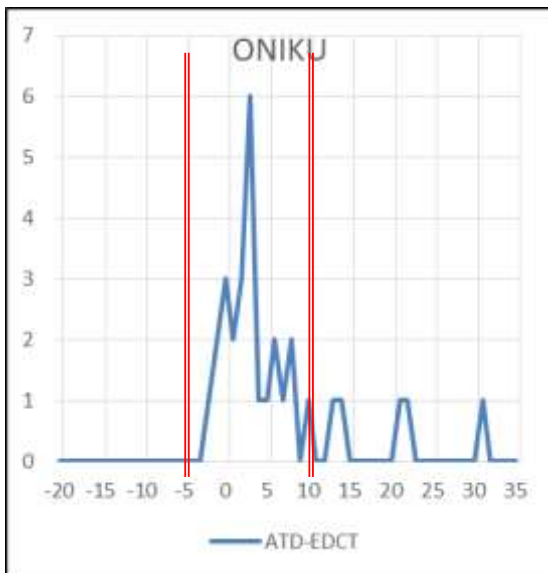


figure 1-1

figure 1-2

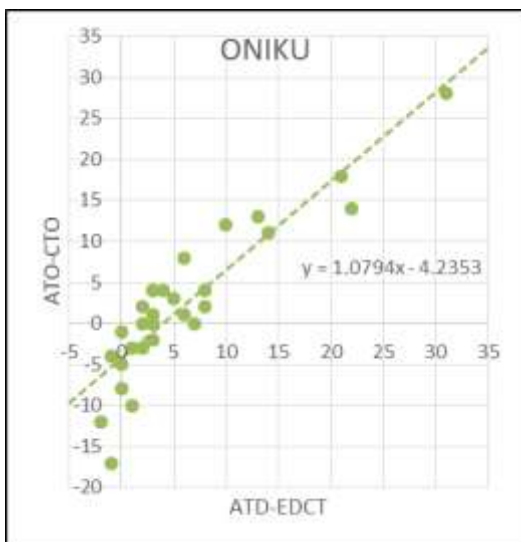


figure 1-3

2) A1@BULAN bound for VHHH

There were 19 flight via BULAN.

If the compliance window for taking off is assumed to be - 5 minutes to + 10 minutes for the difference between EDCT/CTOT and ATD/ATOT, then the rate of achievement is about 95% (figure 2-1).

After taking off, when the difference between CTO at the time of calculation of EDCT/CTOT and ATO is assumed to be the same compliance window, the rate of achievement is about 79% (figure 2-2).

The CTO has not communicated to the operator, but has shown that it is an ATO close to the CTO at the time of calculation.

Figure 2-3 is shown different minutes “between ATD – EDCT at each departure airport” vs “between ATO – CTO at BULAN as FIR boundary”.

EDCT/CTOT Compliance

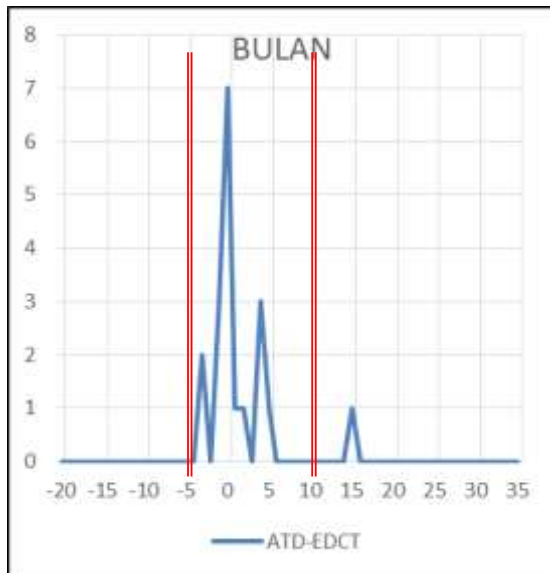


figure 2-1

CTO Compliance

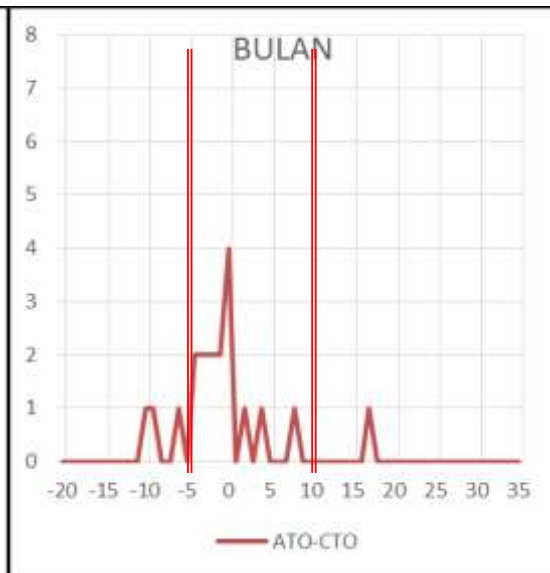


figure 2-2

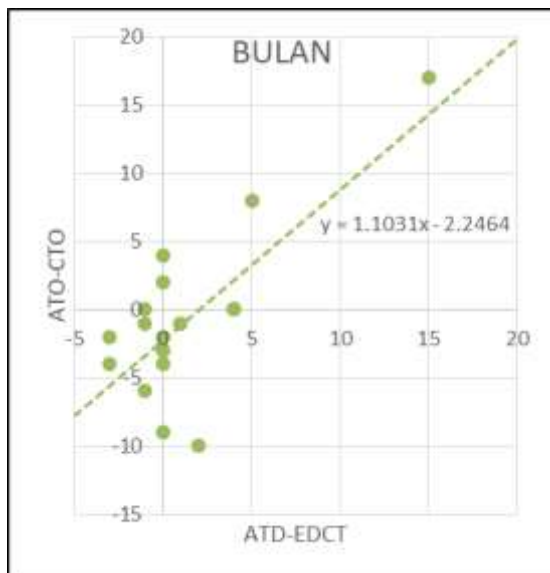


figure 2-3

3) G585@SAPRA bound for ZBAA

There were 12 flight via SAPRA.

If the compliance window for taking off is assumed to be - 5 minutes to + 10 minutes for the difference between EDCT/CTOT and ATD/ATOT, then the rate of achievement is about 83% (figure 3-1).

After taking off, when the difference between CTO at the time of calculation of EDCT/CTOT and ATO is assumed to be the same compliance window, the rate of achievement is about 83% (figure 3-2).

The CTO has not communicated to the operator, but has shown that it is an ATO close to the CTO at the time of calculation.

Figure 3-3 is shown different minutes “between ATD – EDCT at each departure airport” vs “between ATO – CTO at SAPRA as FIR boundary”.

EDCT/CTOT Compliance

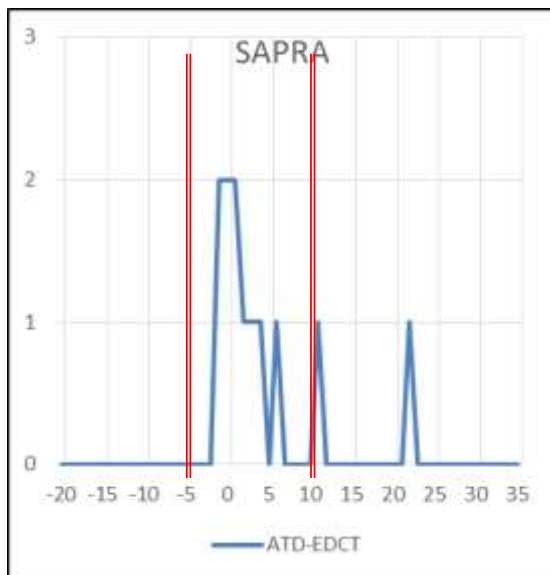


figure 3-1

CTO Compliance

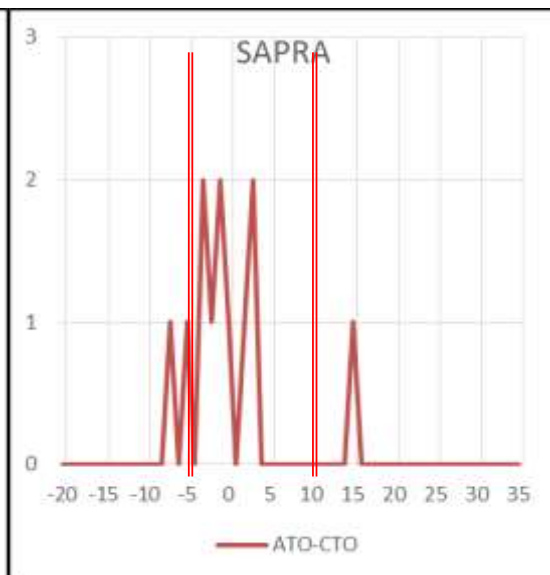


figure 3-2

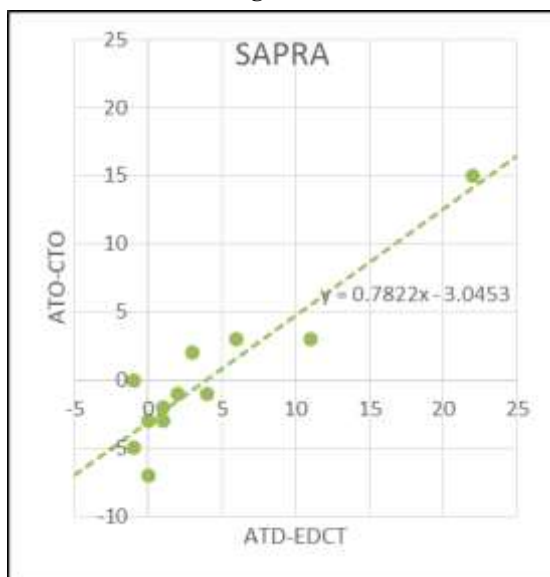


figure 3-3

5. Conclusion

As analyzed by data, it is possible to cross at FIR boundary closer to the CTO by taking off at EDCT/CTOT based on CTO as much as possible.

In Japan, traffic flow control by EDCT/CTOT has been activated for many years, so not only controllers, but also pilots are collaborative as well as pilots have been able to perform cooperative operation such as request clearance when the EDCT is taken into consideration. High rate has been achieved.

As a future challenge, it would be possible to make ATO more closer to CTO by establishing a way to recover the extra time that occurred when taking off or in-flight.

In the case the flight departed as EDCT/CTOT, the ATO has possibly earlier in some cases. There seems to be some reason for it

We believe that it is necessary to advance the analysis and to increase the accuracy of CT