ASP
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AERONAUTICAL SURVEILLANCE PANEL (ASP)

Evaluation Results of Multilateration at Tokyo international Airport

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SUMMARY

Electronic Navigation Research Institute (ENRI) has conducted evaluation tests of Multilateration at Tokyo international airport. This working paper describes first results of the Multilateration evaluation tests.

1. Introduction

Tokyo international airport will be expanded by adding the new fourth runway, and thereby a traffic capacity is estimated to become 407,000 times per year. JCAB (Japan Civil Aviation Bureau) has investigated ATC support systems to provide safety and smooth operation in the estimated high traffic situation.

For airport surface surveillance, JCAB has planed to introduce Multilateration system. The purposes of introducing Multilateration are target ID display, surveillance to ASDE (SMR) blind area, improvement of reliability, and so on. JCAB commissioned ENRI to verify Multilateration for introducing it to Tokyo international airport. As the result, ENRI has conducted evaluation tests of Multilateration by using an evaluation system at Tokyo international airport.

2. Configuration of the evaluation system

Evaluation areas were selected, since a number of Remote Unit (RU) of the evaluation system is not sufficient to evaluate whole airport area. A configuration of the evaluation system was decided by taking into account of the airport layout and simulation results. Figure 1 represents the evaluation areas and the system configuration. The evaluation system consists of 9 RUs. The installation of the evaluation system was completed in December 2005.

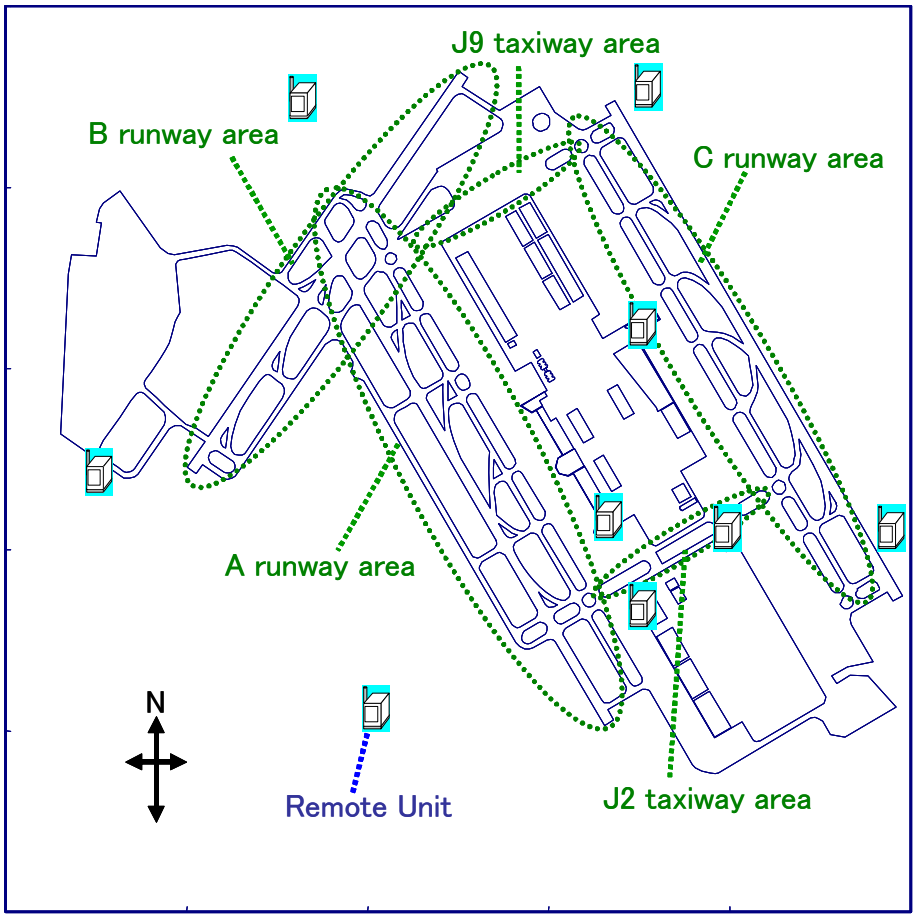


Figure 1 Evaluation area and system configuration

3. Evaluation results

The evaluation tests had been conducted from January to March 2006 by using an experimental vehicle, a flight inspection aircraft, and airline's aircraft. Figure 2 represents one of tracking outputs on the flight inspection aircraft tests. Also table 1 shows detection probabilities and position errors of this tracking output in each area. For detection probability, test results in each area do not satisfy the EUROCAE MOPS. Position errors in this table are calculated by cross track error based on GPS position. For this reason, actual position errors become greater values than this table values. For position error, it is considered that test results in each area do not also satisfy the EUROCAE MOPS.

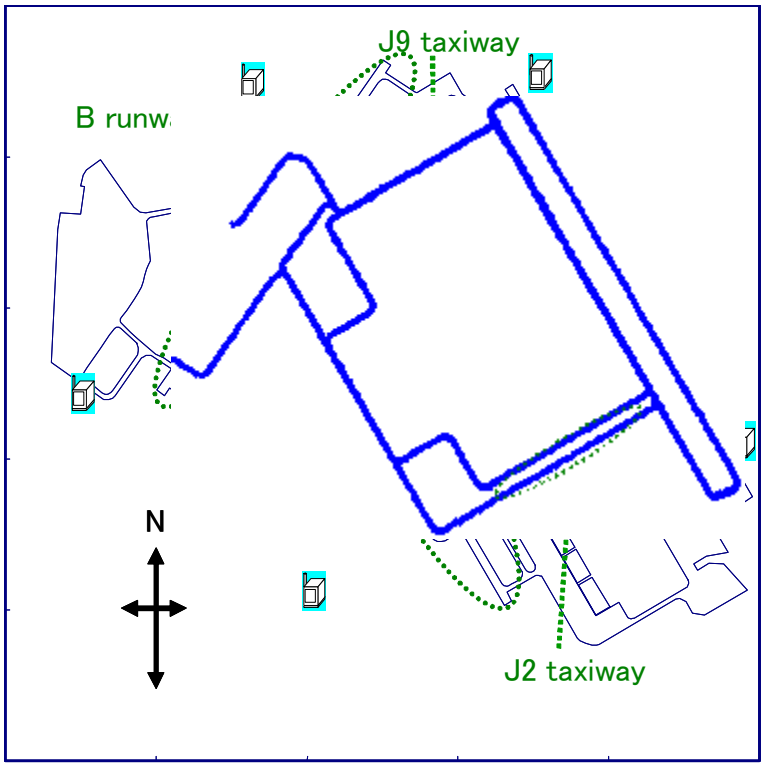
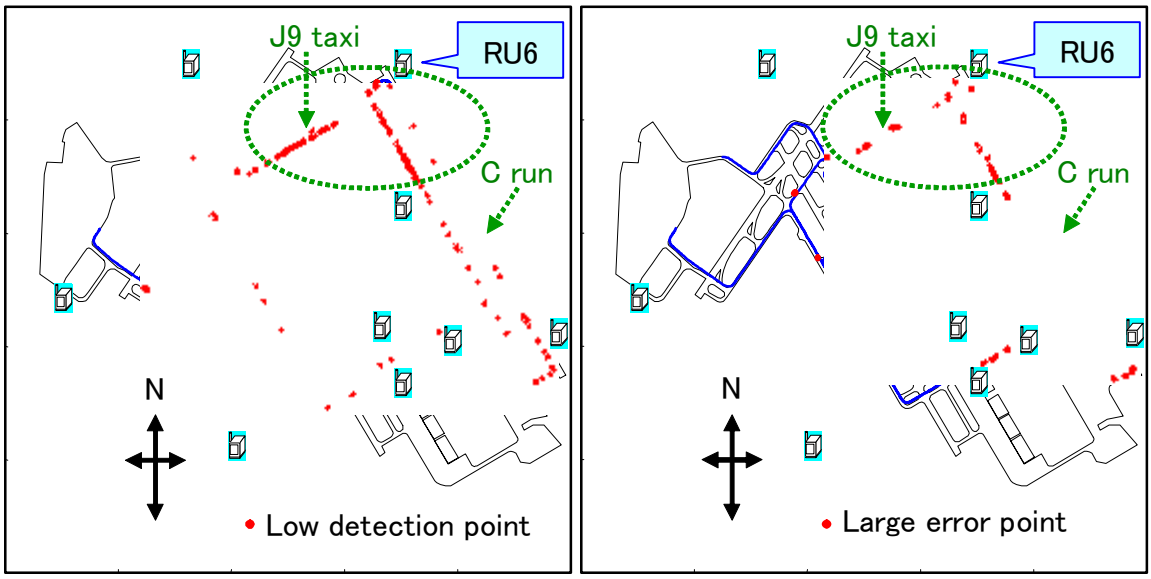


Figure 2 Tacking output by flight inspection aircraft

Table 1 Detection probability and Position error in each area

	Detection Probability (Within any 2sec period)	Position Error (With a confidence level of 95%)
A runway	99.8%	6.3m
B runway	99.2%	4.9m
C runway	99.2%	7.3m
J2 taxiway	99.7%	6.9m
J9 taxiway	97.4%	6.8m
MOPS	Better than 99.9%	Within 7.5m

Figure 3 represents performance degraded points in the tracking output. These points tend to concentrate on J9 taxiway and C runway area, especially north side. It is considered that one of the reasons is insufficient a number of RUs in these areas compared with other areas. In addition, antenna height on RU6 is restricted by regulation of approach surface. Figure 4 represents antenna situation on RU6. It is difficult to install the RU6 antenna in appropriate location, because the C runway faces toward the gulf of Tokyo. Figure 5 represents a traffic situation near the RU6 in the flight inspection tests. The low antenna height of RU6 has a negative impact to the performance, especially due to shielding and reflection generated by aircraft waiting departure.



(a) Low detection point (b) Large error point

Figure 3 Performance degraded points

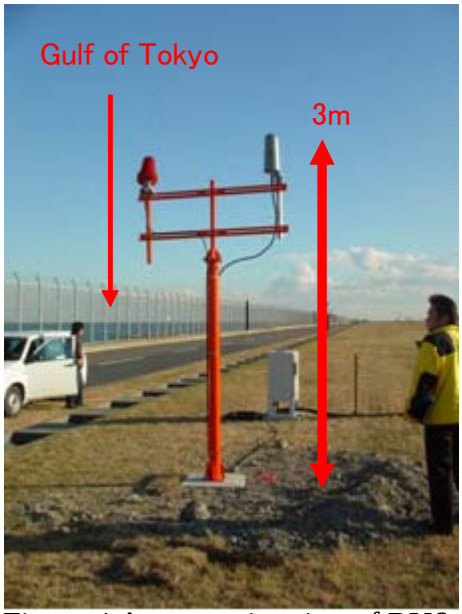


Figure 4 Antenna situation of RU6

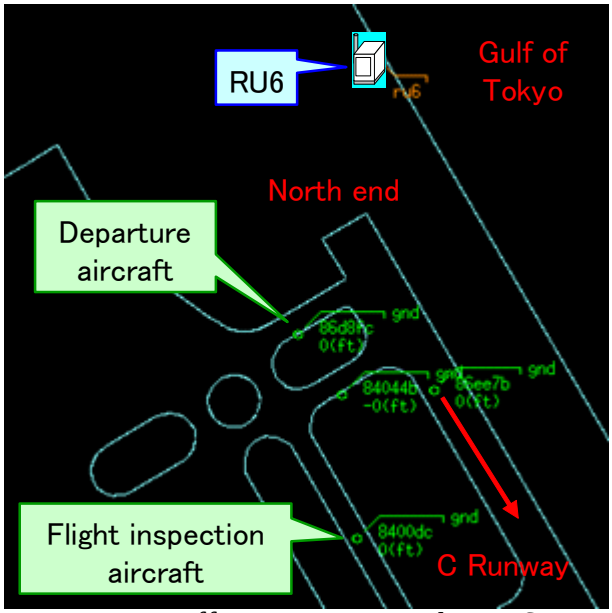


Figure 5 traffic situation near the RU6

4. Consideration

We consider that good results were taken as a first step. However, system performance has not yet satisfied the EUROCAE MOPS in this time. On the other hand, problems to be solved such as insufficient a number of RUs and antenna height restriction by airport regulation could be confirmed in this evaluation. We are now investigating solutions for above problems to achieve better performance in the next evaluation. The next evaluation will be started from October 2006.

5. Conclusion

The TSG meeting is invited to note the above information.