International Civil Aviation Organization

Twenty Ninth Meeting of the Communications/ Navigation and Surveillance Sub-group (CNS SG/29) of APANPIRG

Bangkok, Thailand, 16-20 June 2025

Agenda Item 8: Surveillance

8.2 Other Surveillance-related Matters

ADS-B QUALITY PERFORMANCE MONITORING

(Presented by JAPAN)

SUMMARY

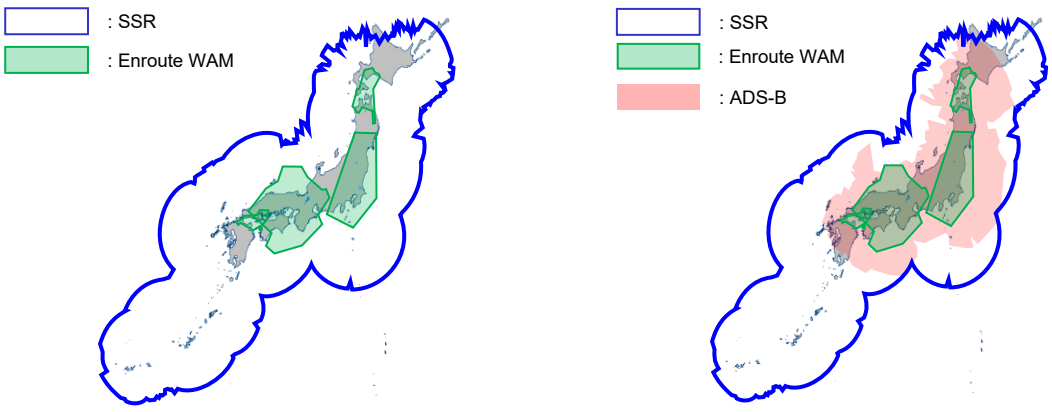
This paper introduces the recent development of ADS-B quality performance monitoring tool in Japan and propose collaborations among APAC States for improving ADS-B quality performance of aircraft.

1. INTRODUCTION

1.1 To cope with the increasing traffic and enhance the resilience of surveillance system, JCAB has developed and implemented a multi-sensor system consists of several surveillance sensors such as SSR, WAM and ADS-B, and HARP (Hybrid Air-Route surveillance sensor Processing equipment), which provides higher update rate and higher position accuracy. With a plan to integrate ADS-B data to expand the area of higher accuracy and higher update rate, Japan has also developed ADS-B quality performance monitoring tool.

2. DISCUSSION

2.1 In Japan, there are 21 en-route radars, 4 en-route WAM areas and ADS-B receivers installed at each WAM ground station. Surveillance service coverage in Japan is depicted in Figure 1.



Previous surveillance coverage Current surveillance coverage

Fig. 1 : Surveillance service coverage in Japan

2.2 HARP collects target data from en-route SSRs and WAMs, and uses sensor fusion to calculate the position of aircraft. Currently, HARP is being updated to incorporate ADS-B data into its fusion data. These multi-sensor target data are displayed on the ATC display every 2 seconds. HARP multi-sensor system overview is depicted in Figure 2.

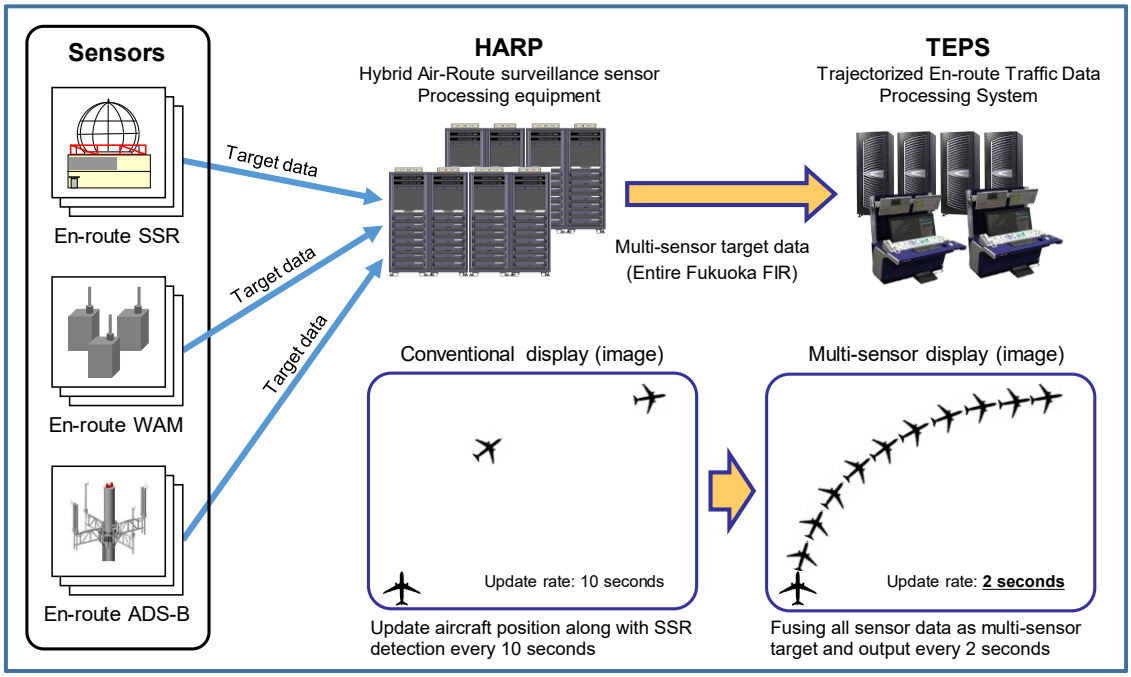


Fig. 2：HARP multi-sensor system overview

2.3 Along with the multi-sensor implementation, JCAB will use DAPs information with a goal of monitoring for conformance of selected altitudes and reducing the number of communications by airborne information (e.g. MACH number) as operational support for air traffic controllers. Currently, JCAB is in the process of updating SSRs with additional DAPs

2.4 With a plan to expand the area of ADS-B, Japan has also developed an ADS-B quality performance monitoring tool. This tool monitors NIC/NACp values of each aircraft in each en-route WAM area. An example of NIC/NACp value of ADS-B in each WAM area is shown in table 1 and table 2 respectively. Currently, over 95% of aircraft have NIC values of above 8 and over 95% of aircraft have NACp values of above 9 in all area, however, it is necessary to make an effort to reduce the number of aircraft which does not have NIC values above 8 nor NACp value above 8 in cooperation with other States, especially for foreign registered aircraft.

Table 1. NIC value of ADS-B in each WAM area

		関東WAM	北海道WAM	近畿WAM	周防灘WAM	関東WAM	北海道WAM	近畿WAM	周防灘WAM	関東WAM
NIC	Ver.2(all)	2025/4/10	2025/4/10	2025/4/10	2025/4/10	2025/4/21	2025/4/21	2025/4/30	2025/4/21	2025/4/30
	#Aircraft	984	115	1029	583	1159	87	1070	571	1037
	#Data	5426906	415477	4034875	1063856	5203389	361076	3874642	1008434	5138255
Radius of containment(Rc)	NIC									
Rc unknown	0	0.5287%	0.4116%	0.6542%	0.7042%	0.2480%	0.3897%	0.2545%	0.3053%	0.1520%
Rc < 20NM(37.04km)	1	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
Rc < 8NM(14.816km)	2	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%
Rc < 4NM(7.408km)	3	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%
Rc < 2NM(3.704km)	4	0.0040%	0.0000%	0.0008%	0.0000%	0.0051%	0.0000%	0.0000%	0.0000%	0.0058%
Rc < 1NM(1852m)	5	0.1182%	0.0014%	0.0640%	0.0000%	0.1544%	0.0000%	0.0532%	0.0000%	0.1442%
Rc < 0.6NM(1111.2m) Rc < 0.5NM(926m) Rc < 0.3NM(555.6m)	6	0.3968%	0.1290%	0.1976%	0.0020%	0.4010%	0.0000%	0.1877%	0.0002%	0.2708%
Rc < 0.2NM(370.4m)	7	0.2397%	0.6296%	0.7303%	0.8695%	0.1932%	0.0000%	0.6172%	0.5032%	0.5201%
Rc < 0.1NM(185.2m)	8	97.4787%	96.1724%	97.7030%	97.5834%	98.4359%	99.2785%	98.4664%	98.1883%	98.4406%
Rc < 75m	9	1.0602%	2.0998%	0.4542%	0.5795%	0.5111%	0.3318%	0.3382%	0.3015%	0.4665%
Rc < 25m	10	0.1737%	0.5562%	0.1958%	0.2614%	0.0512%	0.0000%	0.0829%	0.7016%	0.0000%
Rc < 7.5m	11	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%

Table 2. NACp value of ADS-B in each WAM area

		関東WAM	北海道WAM	近畿WAM	沖防瀬WAM	関東WAM	北海道WAM	近畿WAM	沖防瀬WAM	関東WAM
NACp	Ver.0	2025/4/10	2025/4/10	2025/4/10	2025/4/10	2025/4/21	2025/4/21	2025/4/30	2025/4/21	2025/4/30
	#Aircraft	984	115	1029	583	1159	87	1070	571	1037
	#Data	5426900	415475	4034875	1063856	5203386	361074	3874636	1008434	5138252
Est Position Uncertainty	NIC									
EPU>=10nm	0	0.4242%	0.4125%	0.5536%	0.6949%	0.2527%	0.3894%	0.2606%	0.3146%	0.1440%
EPU<10nm	1	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
EPU<4nm	2	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
EPU<2nm	3	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
EPU<1nm	4	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
EPU<0.5nm	5	0.0000%	0.0000%	0.0000%	0.0000%	0.0002%	0.0000%	0.0000%	0.0000%	0.0000%
EPU<0.3nm	6	0.2008%	0.0014%	0.0944%	0.0000%	0.2769%	0.0000%	0.1567%	0.0000%	0.2806%
EPU<0.1nm	7	0.2191%	0.1290%	0.0576%	0.0000%	0.2092%	0.0000%	0.0450%	0.0000%	0.1105%
EPU<0.05nm	8	1.6252%	0.9019%	2.4821%	2.9954%	0.4691%	0.0008%	1.9678%	3.0857%	1.0718%
EPU<30m	9	74.1620%	62.5686%	78.0741%	78.6135%	74.6404%	64.8518%	74.3475%	73.8585%	79.2818%
EPU<10m	10	22.8914%	35.7432%	18.5550%	17.4001%	24.0502%	34.7580%	23.1946%	22.6631%	18.9320%
EPU<3m	11	0.4773%	0.2433%	0.1831%	0.2961%	0.1011%	0.0000%	0.0276%	0.0781%	0.1793%

2.5 With an increasing demand to cope with GNSS RFI jamming and spoofing, Japan also has developed GNSS RFI monitoring tool. The functional diagrams of GNSS RFI monitoring tool are shown in Figure 3. The tool on the left, for detecting GNSS jamming, acquires C/N0 data for each GPS satellite from the 80 GPS-based Control Station nearest to each airport, switching between them at regular intervals. If the C/N0 value falls below a set value, the tool will alert you to the possibility of GNSS jamming. The tool on the right, for detecting GNSS spoofing, compares ADS-B track data, which is dependent on GPS, with multi-sensor track data, which is not dependent on GPS, and if a clear deviation is found, it determines that GNSS spoofing is likely to be occurring. Currently, these tools have been evaluated for official operation.

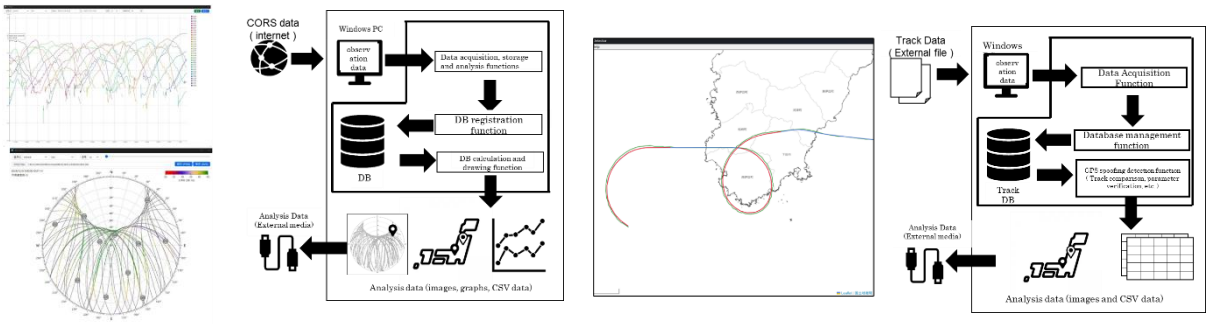


Figure 3. Functional Diagrams of GNSS RFI Monitoring Tool

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;
b) call for collaborations among APAC States for improving ADS-B quality performance of aircraft; and
c) promote collaborations among APAC States for information sharing of methodologies for GNSS RFI monitoring.

– – – – – – – – – – – – –