

**SURVEILLANCE AND CONFLICT RESOLUTION SYSTEMS PANEL (SCRSP)**

**SURVEILLANCE SYSTEMS**

**WORKING GROUP-B**

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Agenda Item 5.5 : Implementation monitoring

Analytical Results of Unauthorized Aircraft Address  
Measured by Aircraft Address Monitoring System

INFORMATION PAPER

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**SUMMARY**

This paper presents the analytical results to detect the unauthorized aircraft address by Aircraft Address Monitoring System installed at the New Tokyo and Kansai international airports.

## 1. Introduction

The Aircraft Address Monitoring System (AAMS), which is the detection system for unauthorized aircraft addresses, began to operate from July 17th in 1996 at New Tokyo International Airport and from June 1st in 1997 at Kansai International Airport. It was already introduced by several WPs at WG-1 (SICASP), WG-B (SCRSP), and SICASP-7, and the latest WP was WP/B/4-25-I at Frankfurt in October 2003.

This paper updates the list of the unauthorized address aircraft, considering the recent analytical results.

## 2. Analytical Results and Conclusion

The analytical results measured by the AAMS are listed in Table-1 and transition of numbers of detected unauthorized address aircraft is shown in Fig-1. Most of unauthorized address aircraft are estimated by the differences between the nationality of their registration numbers and the nationality of their aircraft addresses. Some unauthorized address aircraft are estimated by their aircraft addresses having only their nationality codes. The number of detected unauthorized address aircraft has been decreasing since AAMS started to operate in the second half of 1997, but as the result of this analysis, we can see the tendency to increase the number of unauthorized address aircrafts from a few countries again. Some detected unauthorized aircraft were operated by private owners or companies in late a few a half-year. For a while, what we need to do in such a situation is to keep watch to the change in the detected number of unauthorized aircraft and analyze it to determine whether the above-mentioned tendency represents only a transient phenomenon or a newly appeared steady state.

This activity will be continued until implementation of SSR mode-S sensors in Japan or vanishing all unauthorized address aircraft.

(Note)

We found several errors in table-1 of WP/B/4-25-I, all of which are attributable to human errors in performing the analysis routine. The method used in the routine is described below.

<Analysis method>

### 1. Used data

- (1) Plotting data (Mode-A/C and Mode-S replies) and unauthorized address track lists from AAMS
- (2) Flight plan data from FDP

### 2. Analysis procedure

- (1) Plotting data associated with the unauthorized address track lists were searched for using the analysis tool of AAMS and were plotted out.
- (2) For each tracks, flight plan data were retrieved using Mode-A code as a key to find the registration number.
- (3) Only tracks that have correlation with Mode-A and Mode-S plotting data were selected as

eligible for above procedure. Each track selected for the analysis was checked against the Mode-S address assignment country and aircraft registration country. If they did not agree with, the aircraft was determined to be an unauthorized address aircraft.

- (4) As a rule, a track that appeared only once in the analysis period was not regarded as an authorized address aircraft. However, any aircraft that had been identified as an unauthorized address aircraft even once in the past is regarded as an unauthorized address aircraft.
- (5) The data of the above analysis were confirmed by persons in charge and presented in a tabular form.

The data contained in the WP presented to you included the errors that resulted from such mistakes as wrong counts, judgments based on wrong reasons, and double counting in step (5) above. Please accept our apologies for the inconvenience you suffered due to these mistakes.

Table 2 shows the data in Table-1 of WP/B/4-25-I that have been corrected based on a careful reanalysis.

In addition, from the WP of this time onward, the form of table will be changed as follows:

So far, the table contents were classified according to the registration country, Mode S address, and registration number. From now on, they are classified according to the operation airline country, Mode-S address assignment country, and its code, in addition to the above items in order that the reader will be able to identify the reasons for which an aircraft was determined to be an unauthorized address aircraft.

## **Reference**

[1] Naoki Fujii, "Aircraft Positioning System Using Tri-lateration Method", Proceedings of the International Conference on Electromagnetics in Advanced Applications (ICEAA 97), Sep., 1997, Torino, Italy, pp.483-486

[2] Naoki Fujii, "Detection Rate with SSR Mode-S Squitter Measured by New Aircraft Surveillance System Adopting Tri-Lateration Method" Proceedings of the ION National Technical Meeting, Jan., 1998, Long Beach, USA, pp.263-270

Table-1 List of Detected Unauthorized Mode S Aircraft

Registration Country	Registration Number	Operation Airline	Operation Airline Country	Mode-S Address	Mode-S Address assignment country	Code* 2000 1st half	2000 2nd half	2001 1st half	2001 2nd half	2002 1st half	2002 2nd half	Total	Remarks	
Aruba?	P4GJC	OPR/PV	-	48412E	Netherlands	1				2	2	4		
Australia	VNA764	Vietnam Airlines	Vietnam	000000	No assignment	3		12				12		
No assignment	70400	OPR/DOD	-	AE010D	U. S. A	1					2	2	U. S. governmental?	
Germany	DABVT	Deutsche Lufthansa, A.G.	Germany	BC4AD4	No assignment	1		6	5		6	17	3C4AD4? bit 1 error	
Italy	IDEIC	Alitalia-Linee Aeree Italiane, S.P.A.	Italy	340089	Spain	1			2			2	300089?	
Japan	JA8498	Japan Air System CO. LTD.	Japan	02DDCA	Tunisia	1				2		2	86DDCA, upper 6 bits error	
Japan	JA8930	Japan Transocean Air	Japan	3C618D	Germany	1	25					26		
Korea	HL7465	Korean Air Lines CO. LTD.	Korea	38DC65	France	1				4	14	18	71B8CA?, 1 bit shift	
Korea	HL7281	Korean Air Lines CO. LTD.	Korea	713A81	Saudi Arabia	1	1					1		
Malaysia	9MMHL	Malaysian Airlines System	Malaysia	750000	Malaysia	2	10	2	7			25		
Malaysia	9MMPJ	Malaysian Airlines System	Malaysia	7D0034	Australia	1			4	2	1	7	750034? , bit 5 error	
Malaysia	9MMPM	Malaysian Airlines System	Malaysia	F7007A	No assignment	1	5	6	1			21		
Russian Federation	RPC3223	Philippine Air Lines Inc.(PAL)	Philippine	77801D	Syria	1					5	5		
U. K. ?	MM62173	Private?	-	33FFF8	Italy	1					2	2		
China	BHXA	Cathay Pacific Airways LTD.	China	70015B	Afghanistan	1	3					3		
China	B16103	EVA Airlines Corporation	China	81908B	India	1		1				1		
U. S. A	N201YT	Private?	-	E1A484	Argentina	1			2			2		
U. S. A	N527MC	China Airlines	Taiwan	000005	No assignment	1	4					5		
U. S. A	N213MT	Private?	-	E19242	Argentina	1			2			2		
U. S. A	N307FV	Private?	-	000000	No assignment	3			2			2		
U. S. A	N496AN	Private?	-	04C034	Kenya	1					2	2		
U. S. A	N526MD	World Airlines	U. S. A	44B24D	Belgium	1					4	4		
U. S. A	N666US	Northwest Orient Airlines INC.	U. S. A	88CC56	Japan	1	16					37		
U. S. A	N142SW	Northwest Orient Airlines INC.	U. S. A	780009	China	1	2					2		
U. S. A	N881Q	Private?	-	C7DC05	No assignment	1				2		2		
*code 1 : The nationality of the registration number differs from that of Mode-S address.						Total Number		39	65	27	25	14	36	206
*code 2 : The bits for individual assignments are all zeroes.						No. of Unauthorized aircraft		7	6	5	8	6	8	40
*code 3 : All bits are zeroes.														

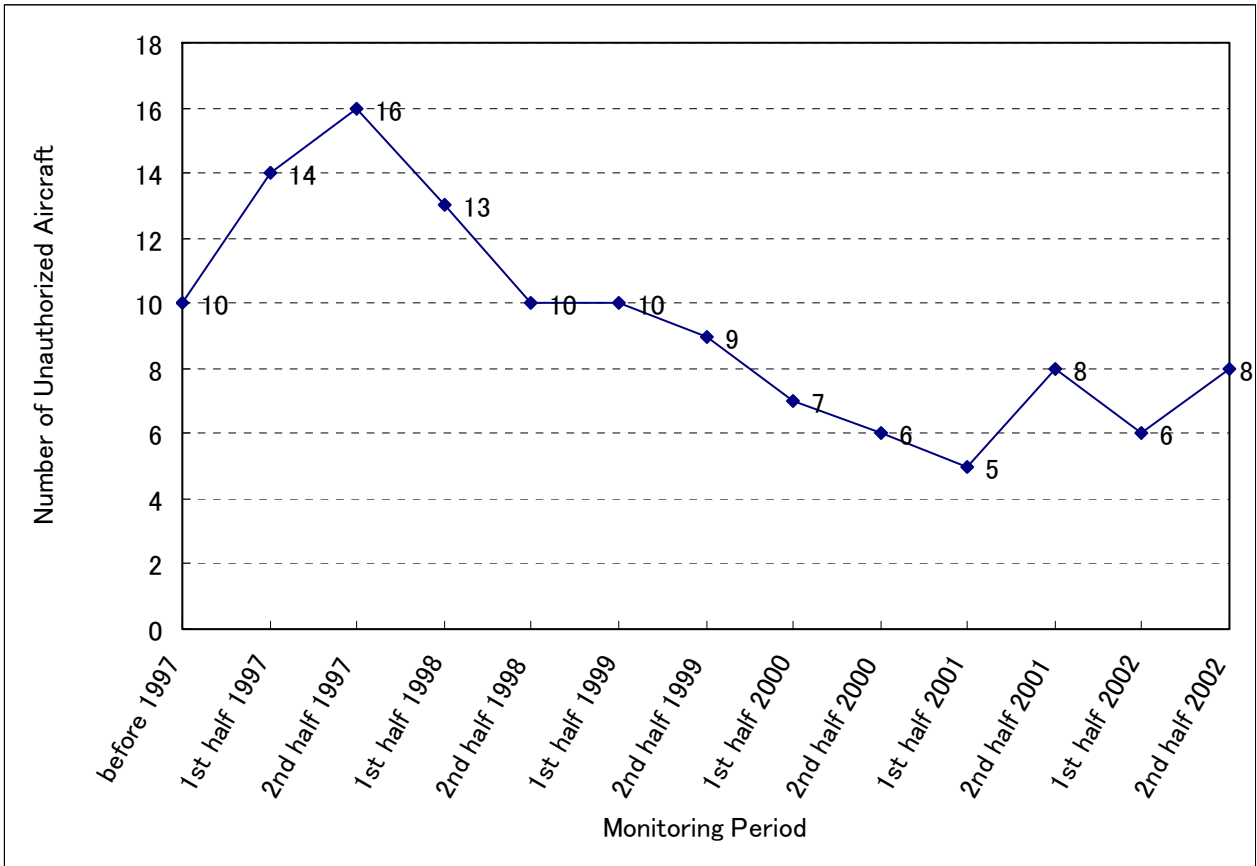


Figure-1: Transition of Number of Detected Unauthorized Address Aircraft

Table-2 List of Unauthorized Mode-S Aircraft (WP/B/4-25-1 table-1 Rev.2)

No.	Country	Aircraft Address	Registration Number	before 1997	1st half of 1997	2nd half of 1997	1st half of 1998	2nd half of 1998	1st half of 1999	2nd half of 1999	1st half of 2000	2nd half of 2000	1st half of 2001	2nd half of 2001	1st half of 2002	Total	
1	Taiwan	300033	N517MC		19	1	15*	13	3							51	
2		300035	N518MC		12	1	17	13	1							44	
3		3C4B2A	N512MC					7*								7	
4		44CD82	N10MB	21	18	4	20	12	3							78	
5		E47D32	N606GC			8										8	
6		3C4B2B	N509MC					1	1							2	
7		30002B	N516MC						2							2	
8	20196D	N105Y							2						2		
9	U. S. A	88CC56	N666US						23	21	16					60	
10		780009	N142SW							2						2	
11		000000	N307FV											0***	2	2	
12		E19242	N213MT											0***	2	2	
13		E1A484	N201YT											0***	2	2	
14		C7DC05	N881Q												2	2	
15		8DD49A	N990WC					1	1							2	
16		750000	9MMHL	6	20		3	5*	6	10	6	10	2	7**		75	
17		F7007A	9MMPM						1	3*	5	9	6	1		25	
18		7D0034	9MMPI											4	2	6	
19		Pakistan	APBDZ	18	17												35
20			APBEB	9	17	1											27
21			APBEC	5	16												21
22			APBEG	6	15												21
23			B2320		6	11	18*										35
24	B2321			8	9	9										26	
25	B2322			14	31	33*										78	
26	B2174			2											2		
27	B2319				2										2		
28	B2309					1	1								2		
29	B2172			2											2		
30	70015B	BHXA				3	2	3	14	3					25		
31	81908B	B16103							2				1*		3		
32	000005	N527MC								1	4*				5		
33	A7DCEF	V8RBG		2	7	1									10		
34	060010	V8RBN			2	1									3		
35	AC7651	OHLGC		17	22	37									76		
36	4A0032	PKGII				7									7		
37	A7E13C	HL7496	12												12		
38	38DC65	HL7465												4	4		
39	713A81	HL7281			1*							1*			2		
40	E50813	ZKSUI				1*	1*	1	1						4		
41	70C016	4RADD						10							10		

Table-2 List of Unauthorized Mode-S Aircraft (WP/B/4-25-1 table-1 Rev.2)

No.	Country	Aircraft Address	Registration Number	before 1997	1st half of 1997	2nd half of 1997	1st half of 1998	2nd half of 1998	1st half of 1999	2nd half of 1999	1st half of 2000	2nd half of 2000	1st half of 2001	2nd half of 2001	1st half of 2002	Total
42	Japan	3C618D	JA8930								1	25*				26
43		02DDCA	JA8498												2	2
44		000001	JA3981			22**	17**									39
45		06EF40	JA8960			4**										4
46	Viet Nam	000000	VNA764										12			12
47	Italy	340089	IDEIC										0***	2		2
48		33FFF8	MM62173													2
49	Germany	BC4AD4	DABVT											5		11
50	Switzerland	FFBFFF	SWR16			1				1						2
51	Unknown	48412E	P4GJC													2
	TOTAL NUMBER			105	206	137	124	56	22	66	39	65	27	25	14	886
	Number of Unauthorized Aircraft			10	14	16	13	10	10	9	7	6	5	8	6	114

\* miscount : Error in counting (making wrong count).

\*\* misjudgement : The track list for statistic processing includes the "reason code" as one of its items. The code is used for authorized/unauthorized judgment. Misjudgement refers to an entry of wrong code for the item.

\*\*\* duplicate count : A counted target has been counted in another period.

The following aircrafts are deleted, cause of only one time detection.

Country	Aircraft Address	Registration Number
Taiwan	300033	Unknown
	3C4B2A	Unknown
United States	3C4B2A	N509MC
	86DD86	N669US
	A85D47	N638US
Malaysia	798007	N617US
	750000	9MMPE 9MMHM
China	7C0000	B2332
	780000	B3996
	A017BF	N105EV
Japan	A12615	JA8562
	000000	JA8098