International Civil Aviation Organization

Twenty Eighth Meeting of the Communications/ Navigation and Surveillance Sub-group (CNS SG/28) of APANPIRG

Bangkok, Thailand, 01-05 July 2024

Agenda Item 6: Navigation
6.4 Other navigation related matters

NAVIGATION AND SURVEILLANCE GROUND INSPECTION AND PLANS DRONE INSPECTION IN INDONESIA

(Presented by Indonesia)

SUMMARY

This paper provides information about navigation and surveillance ground inspection and plans drone inspection in Indonesia according for maintain operational performance in accordance with established operational standards and requirements

1. INTRODUCTION

1.1 Navigation and surveillance equipment used for air traffic services must maintain operational performance in accordance with established operational standards and requirements. This has been regulated in the provisions of the Director General of Civil Aviation Regulation Number: SKEP/83/VI/2005: Ground Inspection Procedure for Electronic and Electric Facilities for Aviation which refers to Annex 10 Volume I and DOC. ICAO 8071 Volume 1: Manual on Testing of Radio Navigation AIDS.

1.2 Ground inspection is performed by:

a. Periodic test consists of parameter measurements and output measurements with the provisions:

1. For VOR, ILS (Localizer, Glide Path, Middle Marker, Outer Marker) carried out 1 x 2 weeks;
2. For Non-Directional Beacon, visual AIDS (PAPI), Distance Measuring Equipment, carried out 1 x 4 weeks;
3. For Primary Surveillance Radar (PSR), Secondary Surveillance Radar (SSR), Monopulse Secondary Surveillance Radar (MSSR) is done 1 x 8 weeks.

Periodic test results must be reported periodically to the Directorate General.

b. Special test, is carried out when it occurs:

1. replacement of spare parts, relocation, reconditions that can affect the performance of equipment;
2. accident at the airport;
3. natural disasters; etc.

1.3 The provisions of navigation and surveillance ground inspection periodic test as follows:

Equipment	Number of Equipment	Ground Inspection frequency	Test Equipment
NDB	32	1 per 4 weeks	Frequency meter, RF thermocouple ammeter, wave analyser, modulation meter or oscilloscope, field intensity meter
VOR	70	1 per 2 weeks	Oscilloscope, VOR test generator, frequency counter, modulation analyser, wattmeter, VSWR indicator, spectrum analyser, built-in VOR test equipment;
DME	70	1 per 4 weeks	Oscilloscope, power meter, frequency counter, coupler and attenuator, spectrum analyser, built-in DME test equipment;
ILS	44	1 per 2 weeks	frequency meter, oscilloscope, spectrum analyser, RF power output meter, built-in ILS test equipment, portable ILS receiver.
Radar	27	1 per 8 weeks	oscilloscope (wide band), spectrum analyser, power meter, waveguide coupler and attenuator, wave meter; test signal generator (swept), RASS (Radar Analysis Support Systems) tools.

Table 1. Navigation and surveillance ground inspection periodic test

1.4 VOR test results

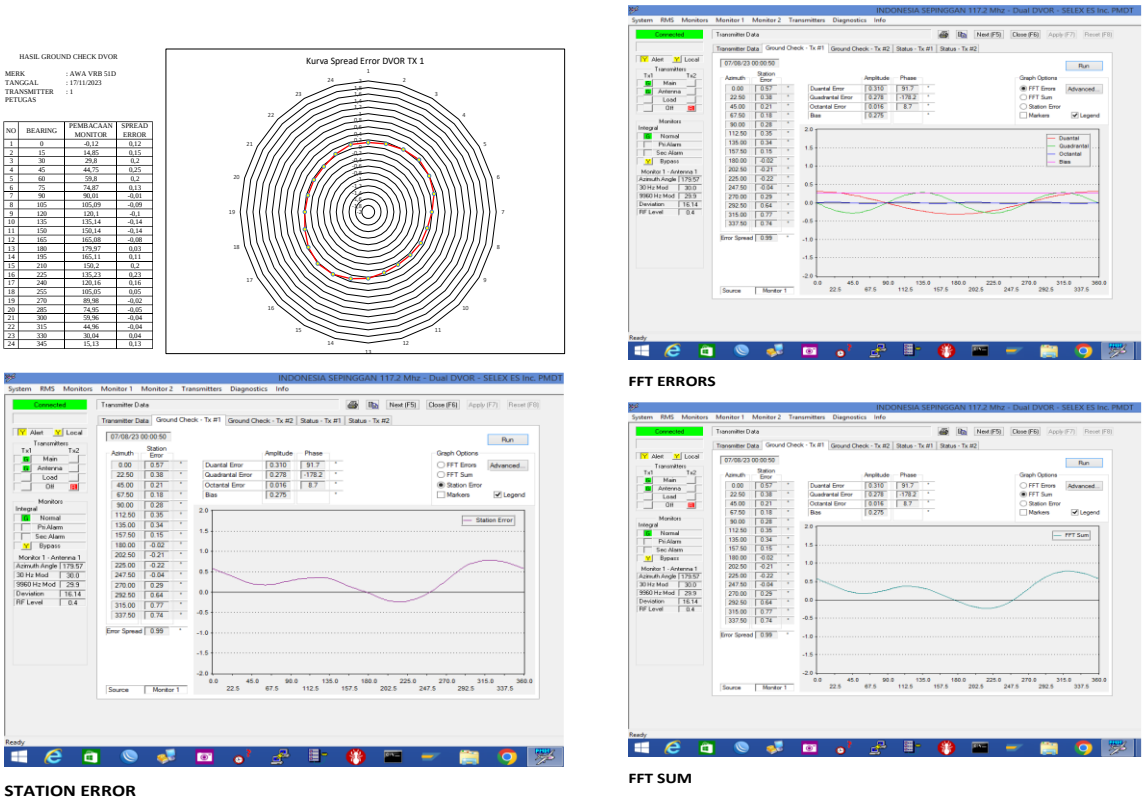
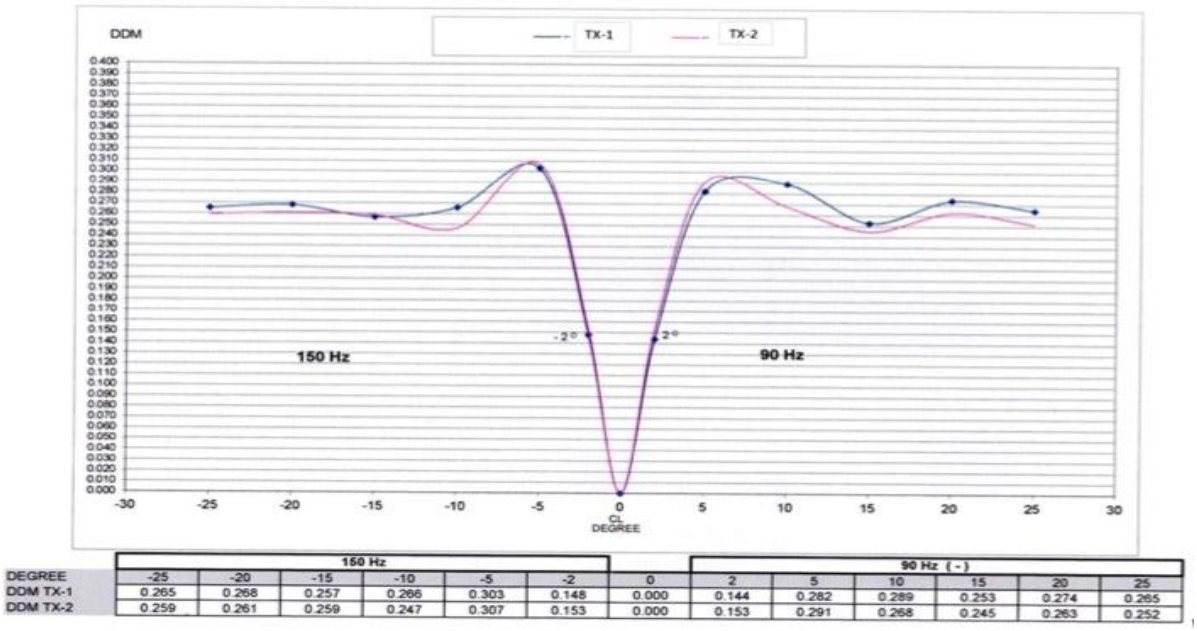


Figure 1. VOR field test & PMDT test result

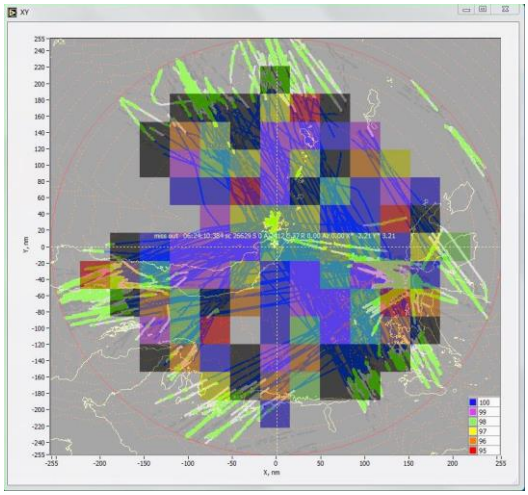
1.5 ILS test results



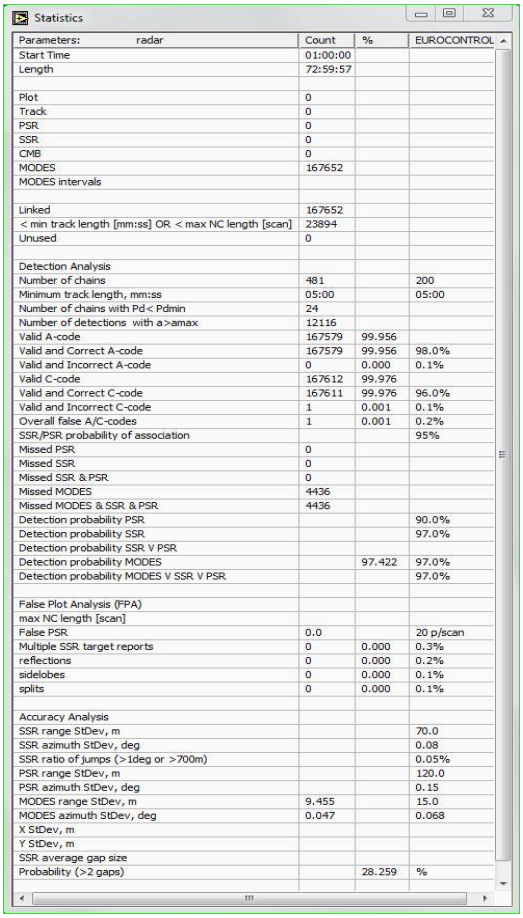
	150 Hz							90 Hz (-)					
DEGREE	-25	-20	-15	-10	-5	-2	0	2	5	10	15	20	25
DDM TX-1	0.265	0.268	0.257	0.266	0.303	0.148	0.000	0.144	0.282	0.289	0.253	0.274	0.265
DDM TX-2	0.259	0.261	0.259	0.247	0.307	0.153	0.000	0.153	0.291	0.268	0.245	0.263	0.252

Figure 2. ILS field test using Portable ILS Receiver

1.6 Radar test results

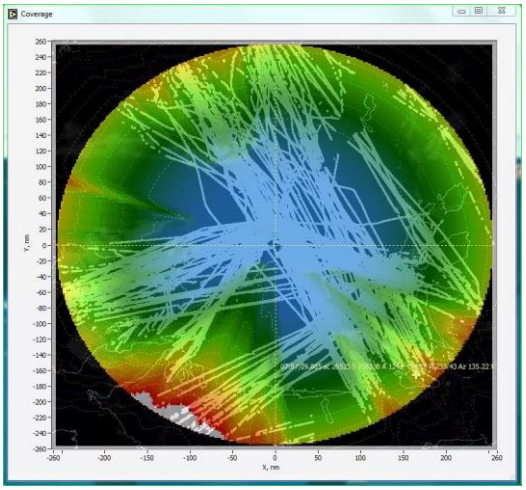


Probability of Detection (PD)

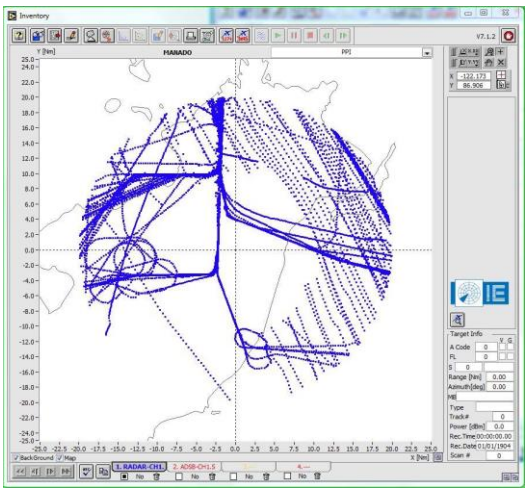


Statistics			
Parameters: radar	Count	%	EUROCONTROL
Start Time	01:00:00		
Length	72:59:57		
Plot	0		
Track	0		
PSR	0		
SSR	0		
CMB	0		
MODES	167652		
MODES intervals			
Linked	167652		
< min track length [mm:ss] OR < max NC length [scan]	23894		
Unused	0		
Detection Analysis			
Number of chains	481		200
Minimum track length, mm:ss	05:00		05:00
Number of chains with Pd< Pdmin	24		
Number of detections with a>amax	12116		
Valid A-code	167579	99.956	
Valid and Correct A-code	167579	99.956	98.0%
Valid and Incorrect A-code	0	0.000	0.1%
Valid C-code	167612	99.976	
Valid and Correct C-code	167611	99.976	96.0%
Valid and Incorrect C-code	1	0.001	0.1%
Overall false A/C-codes	1	0.001	0.2%
SSR/PSR probability of association			95%
Missed PSR	0		
Missed SSR	0		
Missed SSR & PSR	0		
Missed MODES	4436		
Missed MODES & SSR & PSR	4436		
Detection probability PSR			90.0%
Detection probability SSR			97.0%
Detection probability SSR V PSR			
Detection probability MODES		97.422	97.0%
Detection probability MODES V SSR V PSR			97.0%
False Plot Analysis (FPA)			
max NC length [scan]			
False PSR	0.0		20 p/scan
Multiple SSR target reports	0	0.000	0.3%
reflections	0	0.000	0.2%
sidelobes	0	0.000	0.1%
splits	0	0.000	0.1%
Accuracy Analysis			
SSR range StDev, m			70.0
SSR azimuth StDev, deg			0.08
SSR ratio of jumps (>1deg or >700m)			0.05%
PSR range StDev, m			120.0
PSR azimuth StDev, deg			0.15
MODES range StDev, m	9.455		15.0
MODES azimuth StDev, deg	0.047		0.068
X StDev, m			
Y StDev, m			
SSR average gap size			
Probability (>2 gaps)		28.259	%

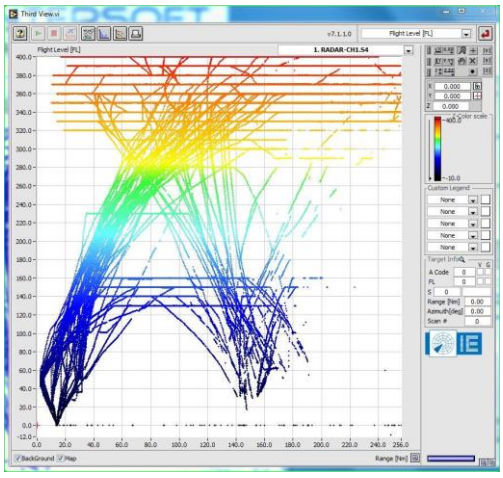
Statistics Analysis



Data coverage analysis



Horizontal coverage track trajectories



Vertical coverage track trajectories

Figure 3. Radar test results using RASS Tools

2. DISCUSSION

2.1 The method of check on the ground has limitations because it cannot check air signals. The best way to check the air signal from the ground is to use an antenna mast or check the signal on the nearest building roof or on the mountain. However, besides the problem of difficulties on access to check points, such checks cannot measure radio signals of the aircraft approach route and cannot check the entire range of the radio signal service provided by navaids.

2.2 Meanwhile, the purpose of ground inspections is also carried out as preparation before periodic flight inspections so that high-cost flight inspections can be carried out with shorter flight hours so that costs are more efficient.

2.3 To overcome the limitations of ground inspections on the ground, it can utilize the Unmanned Aircraft System (UAS) or drone technology. Due to the ability to measure the entire range of the radio signals so the inspection results could be more accurate and could be a consideration to extend the flight inspection time period.

2.4 Trial on the use of drone in ground inspection of ILS and VOR have been carried out at Yogyakarta International Airport with good results and more real in measuring the entire range of radio signal service provided by navaids.

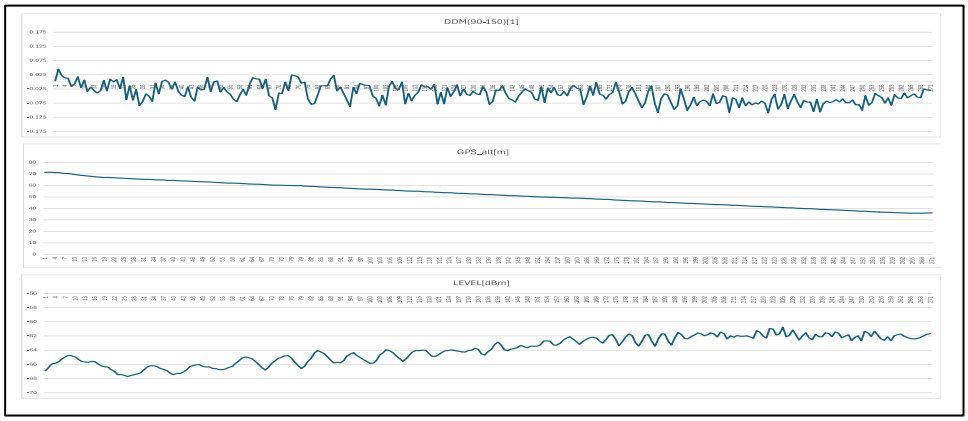


Figure 4. ILS drone inspection trial test results

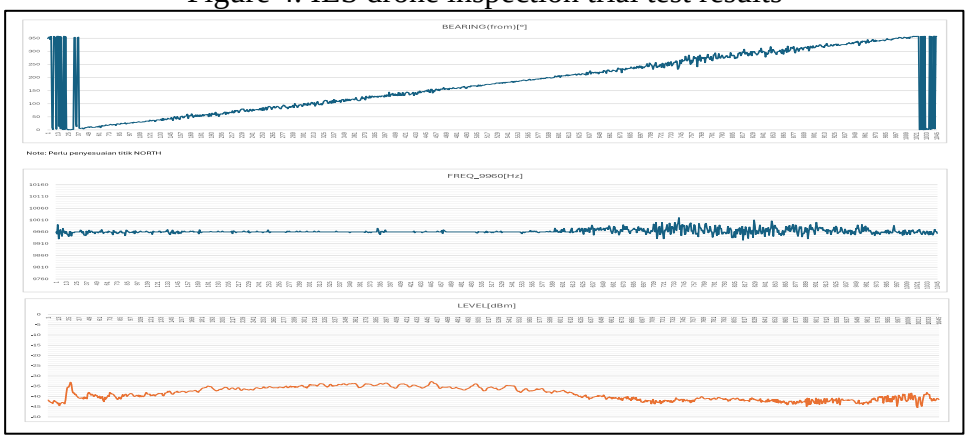


Figure 5. VOR drone inspection trial test results

Figure 6. Trial of drone inspection at YIA

2.5 Ministry of Transportation Indonesia has established regulation of UAS Operations in Indonesia Airspace, with decree number PM 37 year 2020, which contain about the UAS category - based max. Take Off Weight (<55lbs and > 55 lbs), *Registration sUAS & Remote Pilot Certificate* (RPC) through the Sidopi Go Online System (Remote Pilot Registration, Operation Authorization), Remote Pilot Standardization of Skill and Competency via Training Provider, Visual Line of Sight (VLOS) and/or Beyond VLOS rule, Limitation of drones operations, Airspace Limitation, Safety Assessment, Oversight, Communication and Coordination Procedure between ATC and Remote Pilot. There is no regulation on Ground Inspection of Navigational Aids using drones.

Conclusion

2.6 Directorate General of Civil Aviation to prepare the amendment regulation of Navigation Aids ground inspection using drones which refer to Ministry of Transportation Regulation, decree number PM 37 year 2020 about UAS Operations and also considering of Manual and autonomous drone operation, Weather information, drone battery condition.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper, and
b) discuss any relevant matter as appropriate
