Presentation On:

ADS-B Implementation Workshop

A case study in Nepal

PSR/SSR

In Nepal, PSR/SSR, collocated, system at Tribhuvan International Airport (VNKT) was first introduced in 1998 A.D. to provide radar based approach (APP) control services in Kathmandu FIR.

Make: Toshiba-NEC,

Under Japanese Grant Assistance

PSR Coverage limited to 50 NM

SSR coverage standard 250 NM but limited due terrain shadowing

MSSR

T-MSSR, in addition to SSR, installed at Tribhuvan International Airport (VNKT) terminal for approach (APP) control.

E-MSSR installed at Mt. Bhattendanda, at 7000 ft high mountain top south of TIA for area (ACC) control services in Kathmandu FIR.

However major air routes L626 (KTM- DEL) lacks coverage beyond 250 NM.

Make: NEC ,

Under Japanese Grant Assistance

Operated since 2017 A.D.

En- route coverage up to: 250 NM, above 15000 ft altitude

ADS-B Ground Stations;

In order to address, the lack of radar coverage along L626, Four (4) **ADS-B ground stations** have been installed, in 2020 A.D at

Dhangadhi (VNDH),

Nepalgunj (VNNG),

Gautam Buddha International Airport, GBIA (VNBW) and

Mt. Phulchowki, Kathamndu

intended not only to supplement the MSSR based surveillance but also to acquire surveillance capabilities especially for NRA

Make: ERA, Czech republic

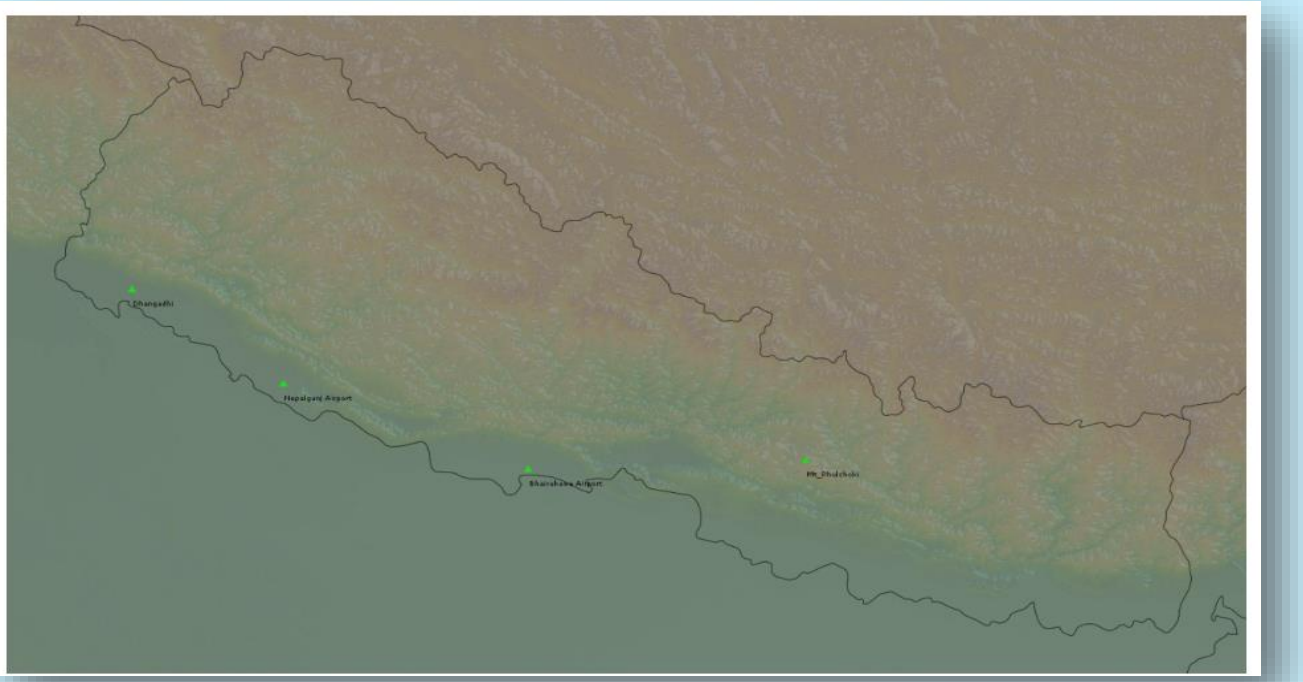
RTCA: D0260 B Compliant (Version. 2.0)

Message Format: Asterix 21, Version 2.1

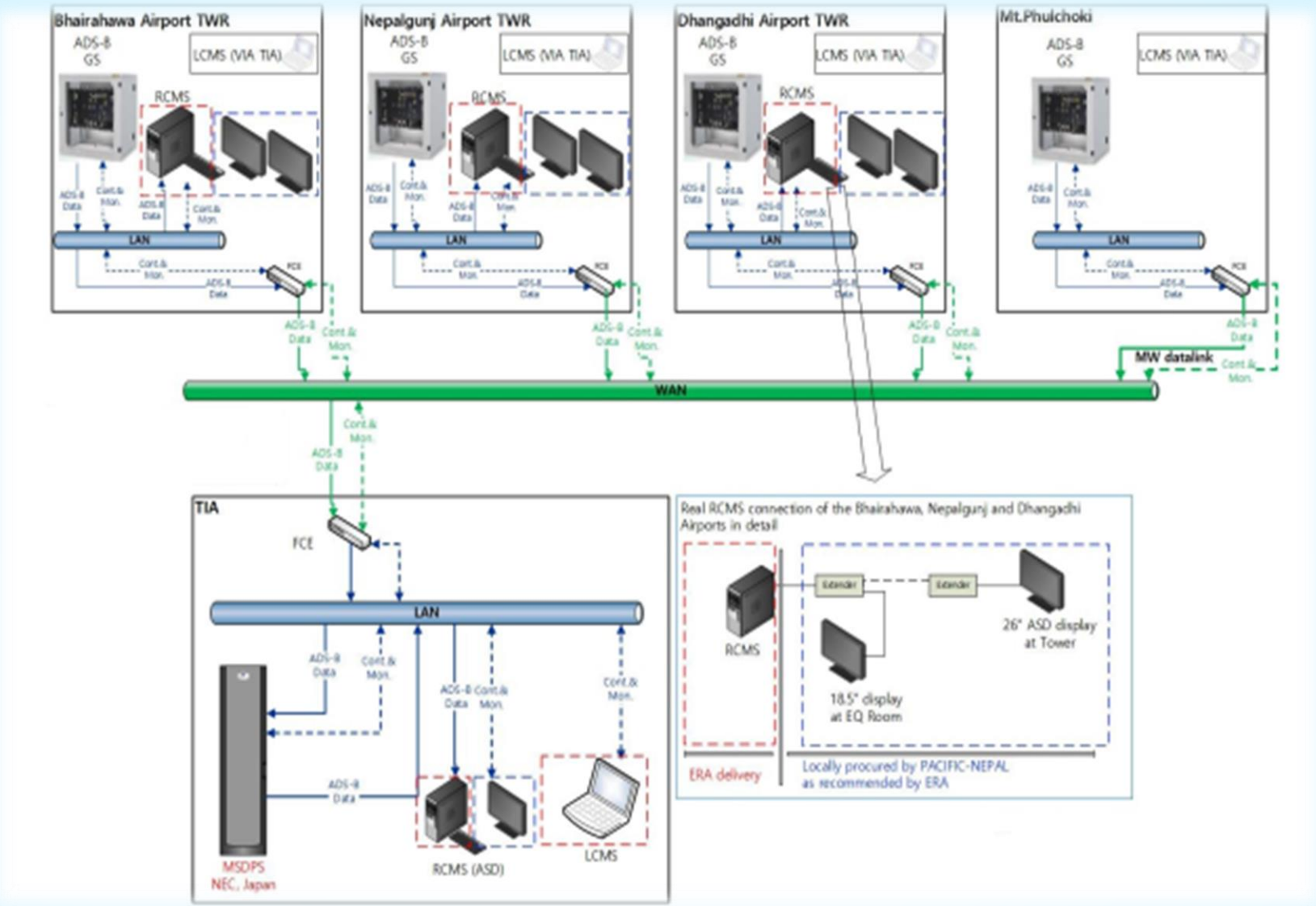
Operation in test mode since 2021 A.D

Configuration: Category Tier 2 (AIGD Edition 15.0)

In the process of AIC and AIP publications


Dhangadhi
Nepalgunj Airport
Bhairahawa Airport
PR_Dhulikhel

ADS-B System Architecture and its Connectivity Diagram



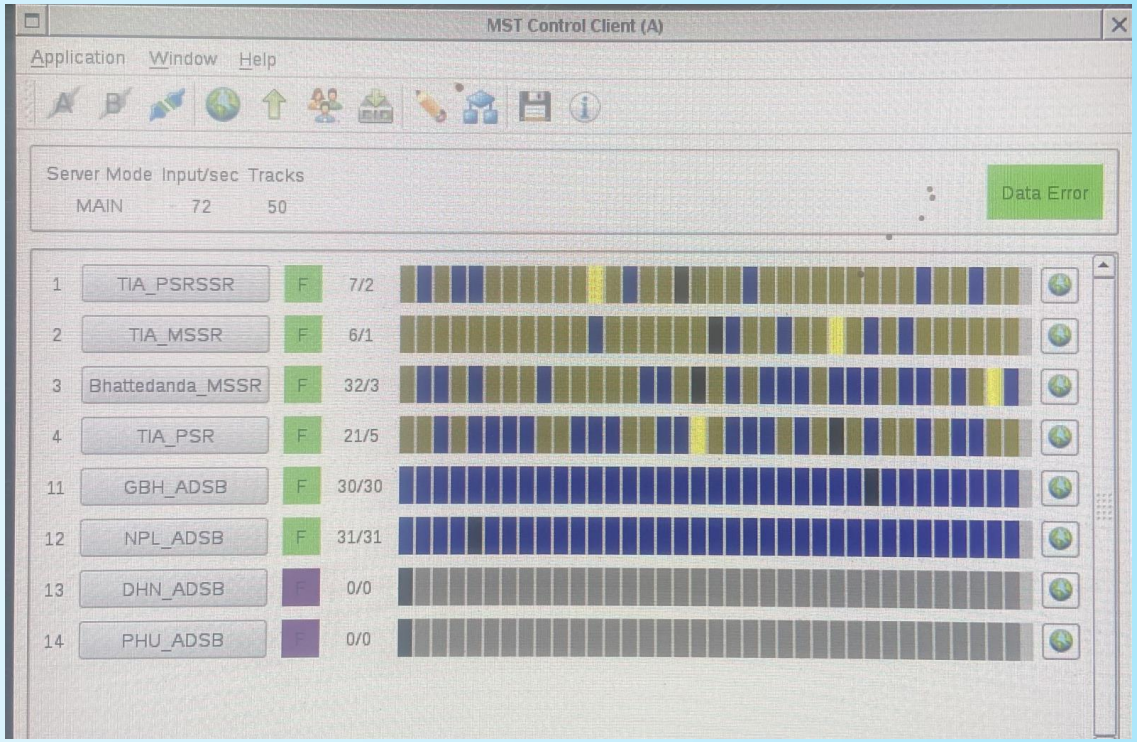
MSDPS

MSDPS , Make: NEC Japan, has been used to process the surveillance data in order to display the air traffic information on the Air situation display (ASD) serving APP and ACC positions.

NEC documentation states that it has the capability to integrate with 64 surveillance data sensors . However, we have to seek their services to enable the sensor ports.

At present, it has been integrated with following sensors;

- TIA_PSR,
- TIA_SSR,
- TIA_MSSR,
- Bhattedanda_MSSR,
- Dhangadhi_ADS-B,
- Nepalgunj_ADS-B,
- GBIA_ADS-B and
- Mt. Phulchowki_ADS-B.



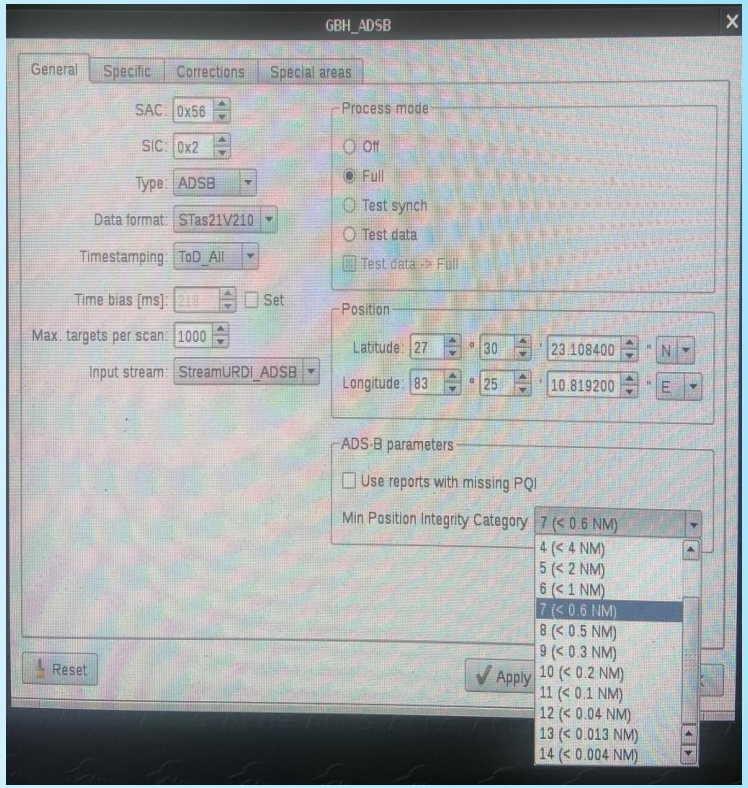
ADS-B performance requirement /Quality control parameters;

Taking references from Cir 326, Appendix c, Table C -1 SASP comparative assessment,
The key minimum performance for ADS-B system to enable the use of a 3 NM or 5 NM separation minimum in the provision of air traffic control, has been identified as follows;

Table C-1: SASP comparative assessment

	Characteristic	Minimum Requirement 3 NM	Minimum Requirement 5 NM
1.	Position: Accuracy	A 95 percentile accuracy of 0.3 NM This can be represented by either: a) navigation accuracy category (position) = 6 or better; or b) navigation uncertainty category = 5 (for GNSS derived positional data only)	A 95 percentile accuracy of 0.5 NM This can be represented by either: a) navigation accuracy category (position) = 5 or better; or b) navigation uncertainty category = 4 (for GNSS derived positional data only)
2.	Position: Integrity	A containment radius of <1 NM and the likelihood of the position error exceeding containment radius of 1e - 5 This can be represented by either: a) navigation uncertainty category = 4 or better; or b) navigation integrity category = 5 (or better) and surveillance integrity limit = 2 (or better)	A containment radius of <2 NM and the likelihood of the position error exceeding containment radius of 1e - 5 This can be represented by either: a) navigation uncertainty category = 3 or better; or b) navigation integrity category = 4 (or better) and surveillance integrity limit = 2 (or better)
3.	Position: Latency	4 seconds	4 seconds
4.	Position: Update Rate	5 seconds	12 seconds

In our case, MSDPS (Make: NEC), it has been configured the performance requirement, Min. Position Integrity Category (PIC) : 7 (< 0.6 NM) as Quality control indicator/criteria for displaying ADS-B data in ASD, which differs from those parameter in CIR 326 Appx. C.



If we compare the PIC value : 7 (< 0.6 NM) with NUCp and NIC, in PIC conversation table, we find it is close to NUCp: 4 and NIC: 6 values.

However, the parameter PIC is slightly differ from those parameters defined in Cir 326, Appx. C

ICAO Annex 10 and 11 as well as Doc. 4444 are silent on these parameters which is causing us lack of confidence in proceeding with using the system for ADS-B based ATS services

Unfortunately, the OEM's documentation provided to us is also silent about these issues.

For the value of "PIC", the following conversion table shall be used:

PIC	Integrity Containment Bound	NUCp ED102/DO260	NIC (+ suppl.) DO260A	NIC (+ suppl.'s) ED102A/DO260B
15	not defined			
14	< 0.004 NM	9	11	11
13	< 0.013 NM	8	10	10
12	< 0.04 NM		9	9
11	< 0.1 NM	7	8	8
10	< 0.2 NM	6	7	7
9	< 0.3 NM	-	-	6 (+ 0/1)
8	< 0.5 NM	5	6 (+ 0)	6 (+ 0/0)
7	< 0.6 NM	-	6 (+ 1)	6 (+ 1/1)
6	< 1.0 NM	4	5	5
5	< 2.0 NM	3	4	4
4	< 4.0 NM	-	3	3
3	< 8.0 NM	-	2	2
2	< 10.0 NM	2	-	-
1	< 20.0 NM	1	1	1
0	No integrity (or > 20.0 NM)	0	0	0

Source: Eurocontrol Standard Document for Surveillance Data Exchange, Part 12: Category 021, Ed. 2.1

Facing difficulties in demonstrating objectives conformance with the following PANS-ATM (Doc. 4444) requirements -

8.1.10 ADS-B shall only be used for the provision of air traffic control service provided the quality of the information contained in the ADS-B message exceeds the values specified by the appropriate ATS authority.

8.6.1.1 The controller shall adjust the situation display(s) and carry out adequate checks on the accuracy thereof, in accordance with the technical instructions prescribed by the appropriate authority for the equipment concerned

8.6.1.2 The controller shall be satisfied that the available functional capabilities of the ATS surveillance system as well as the information presented on the situation display(s) is adequate for the functions to be performed.

Lack of common guidance on the following matters;

what standard documentation is required to accompany an ATM system installation, so as to address the following Doc. 4444 requirements (Chapter: 2)

Ensuring that the surveillance system -

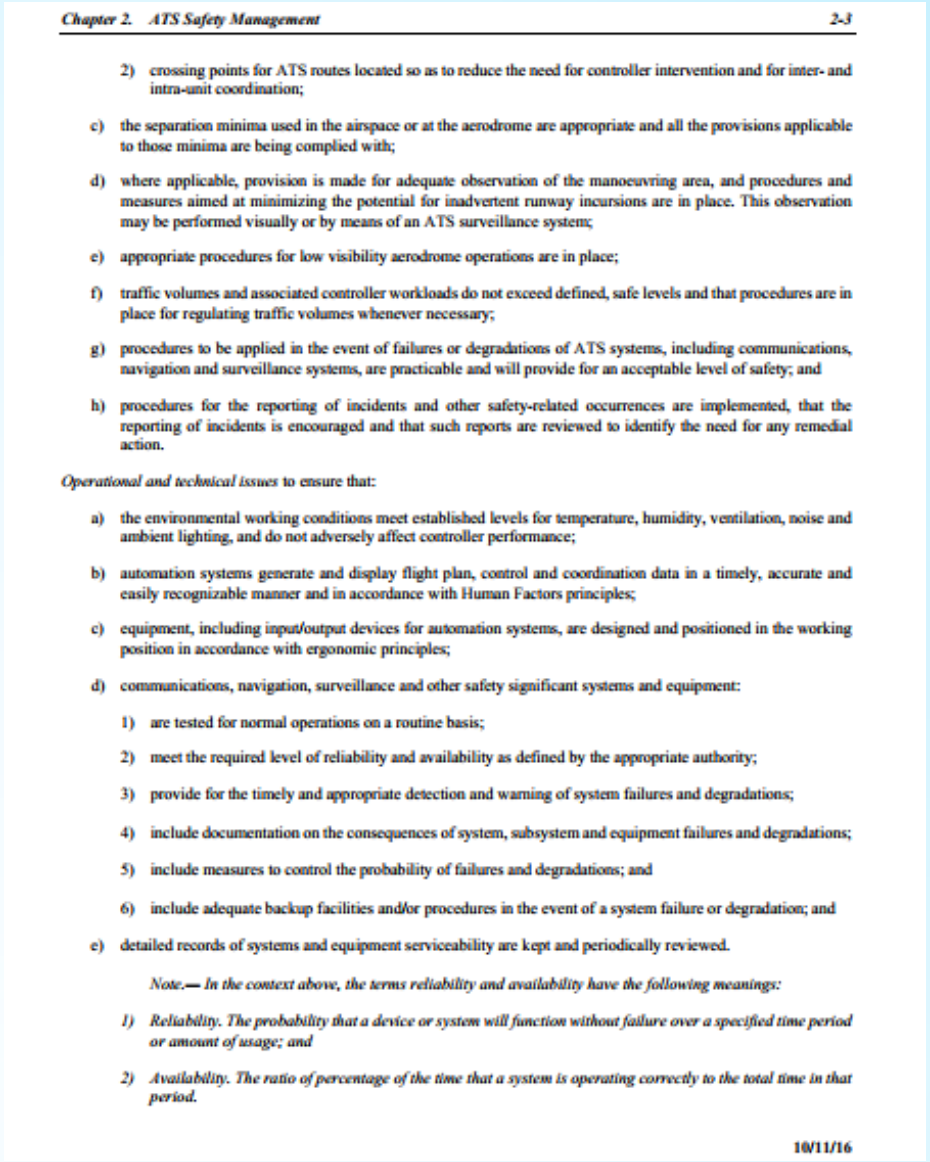
2) meet the required level of reliability and availability as defined by the appropriate authority;

3) provide for the timely and appropriate detection and warning of system failures and degradations;

4) include documentation on the consequences of system, subsystem and equipment failures and degradations;

5) include measures to control the probability of failures and degradations; and

6) include adequate backup facilities and/or procedures in the event of a system failure or degradation;



Chapter 2. ATS Safety Management 2-3

2) crossing points for ATS routes located so as to reduce the need for controller intervention and for inter- and intra-unit coordination;

c) the separation minima used in the airspace or at the aerodrome are appropriate and all the provisions applicable to those minima are being complied with;

d) where applicable, provision is made for adequate observation of the manoeuvring area, and procedures and measures aimed at minimizing the potential for inadvertent runway incursions are in place. This observation may be performed visually or by means of an ATS surveillance system;

e) appropriate procedures for low visibility aerodrome operations are in place;

f) traffic volumes and associated controller workloads do not exceed defined, safe levels and that procedures are in place for regulating traffic volumes whenever necessary;

g) procedures to be applied in the event of failures or degradations of ATS systems, including communications, navigation and surveillance systems, are practicable and will provide for an acceptable level of safety; and

h) procedures for the reporting of incidents and other safety-related occurrences are implemented, that the reporting of incidents is encouraged and that such reports are reviewed to identify the need for any remedial action.

Operational and technical issues to ensure that:

a) the environmental working conditions meet established levels for temperature, humidity, ventilation, noise and ambient lighting, and do not adversely affect controller performance;

b) automation systems generate and display flight plan, control and coordination data in a timely, accurate and easily recognizable manner and in accordance with Human Factors principles;

c) equipment, including input/output devices for automation systems, are designed and positioned in the working position in accordance with ergonomic principles;

d) communications, navigation, surveillance and other safety significant systems and equipment:

1) are tested for normal operations on a routine basis;

2) meet the required level of reliability and availability as defined by the appropriate authority;

3) provide for the timely and appropriate detection and warning of system failures and degradations;

4) include documentation on the consequences of system, subsystem and equipment failures and degradations;

5) include measures to control the probability of failures and degradations; and

6) include adequate backup facilities and/or procedures in the event of a system failure or degradation; and

e) detailed records of systems and equipment serviceability are kept and periodically reviewed.

Note.— In the context above, the terms reliability and availability have the following meanings:

1) Reliability. The probability that a device or system will function without failure over a specified time period or amount of usage; and

2) Availability. The ratio of percentage of the time that a system is operating correctly to the total time in that period.

10/11/16

Nepal is always willing to learn from the experience of other member states

&

Thank you all for sharing your knowledge and experience about

ADS-B based surveillance system

and

its implementation

Have a Good Day!