

**INTERNATIONAL CIVIL AVIATION ORGANIZATION****TWENTY FIFTH MEETING OF THE  
ASIA/PACIFIC AIR NAVIGATION PLANNING AND  
IMPLEMENTATION REGIONAL GROUP (APANPIRG/25)***Kuala Lumpur, Malaysia, 8 – 11 September 2014***Agenda Item 3: Performance Framework for Regional Air Navigation Planning and Implementation****3.4: CNS****IMPLEMENTATION OF STEEP GLIDE SLOPE ILS AT  
TRIBHUVAN INTERNATIONAL AIRPORT***(Presented by Nepal)***SUMMARY**

This paper presents the proposed planning and implementation of steep glide slope Instrument Landing System (ILS) system in the topographically constrained the Tribhuvan International Airport (TIA), Nepal

**1 INTRODUCTION**

1.1 The Republic of Nepal presently has only one international airport the Tribhuvan International Airport (TIA) that serves as the main gateway to the country.

Aircraft operations at TIA is very challenging because it is surrounded by rugged mountains, and is not equipped with Instrument Landing System (ILS) that is common feature for international airports.

At present, TIA operation is mainly based on VOR/DME non-precision approach. However, since 2012 RNP AR approach has been implemented which is currently being used by a limited number of international airlines only.

1.2 A recent study for the implementation of ILS at TIA has provided the following three alternatives to improve the current operational environment while meeting ICAO – PANS OPS criteria.

- a. On-set ILS with a non- standard steep glide path angle approach
- b. Off-set ILS with a non-standard steep glide path angle approach (Off-set: 5 degree)
- c. Localizer only approach with a standard minimum glide path angle (Off-set: 14 degree)

## 2. DISCUSSION

2.1 Recently a study has been carried out under JICA assistance to assess the possibility of implementing ILS and other Precision Approach and guidance system at TIA.

### Main features of alternatives:

The table below summarizes the main features of the existing two straight-in approach procedures i.e., VOR/DME and RNP-AR, and the three proposed alternatives, i.e. On-set ILS, Off-set ILS and LOC only.

**Main Features of Approach Procedures**

	<b>Alignment</b>	<b>Decent Gradient (GP)</b>	<b>DH/MDH (CAT-C)</b>	<b>Visibility (ALS)</b>
VOR/DME	0°	(3.0°:D3-THR) (5.3°:D9-D3)	632ft	2800m
RNP AR	0°	2.8°	340ft	900m
<b>On-set ILS</b>	<b>0°</b>	<b>4.3°</b>	<b>318ft</b>	<b>700m</b>
Off-set ILS	5° at 763m	4.2°	386ft	1100m
LOC only	15° at 1,868m	3.5°	472ft	1500m

Source: JICA Survey Team

As seen from the above table, the On-set ILS approach procedure will achieve the lowest DH/MDH (for CAT-C aircraft) among the alternatives studied.

### 2.2 Consultation with Airlines:

On consultation with various airline pilots to discuss the best options for the improvement of instrument approach procedures at TIA, airlines opted for On-set ILS approach among the three alternatives for the following reasons.

#### 2.2.1 Aircraft Operational Aspects

- a. ILS will significantly improve runway usability of TIA during poor weather conditions.
- b. Exact straight-in approach gives greater advantage to the pilots.
- c. Steep GP angle is not a problem for the pilots operating at TIA. As compared with the existing VOR approach, in which initial descent angle is 5.3°, GP angle of 4.3° with On-set ILS approach option is an improvement.
- d. 15° turn approximately 1NM before the threshold is very difficult as the Off-set angle is very large, requiring 17-18° bank at low altitude.
- e. Sharp turn should be avoided as weather change very fast.

2.2.2 **Advantage of On-set ILS options**

- a. Almost all airline fleet are equipped with ILS.
- b. Usability is high.
  - All flights can use the localizer as it will provide more precise azimuth guidance than the VOR, which has scalloping signals in 6-9 NM section.
  - All domestic flights (involving turbo-prop aircraft) can use the ILS with 4.3° GP angle.
  - International flights (Jet aircraft) with lower approach speed would be able to select ILS with 4.3° GP angle.
- c. From the ATC view point, controllers will have less complication in providing separation if all aircraft use straight-in approach.
- d. Having dual system, ILS and VOR/DME, for the straight in approach path provides increased reliability and back-up to each other.
- e. For bigger aircraft (CAT D and E) even if 4.3 degree glide slope is difficult to use, will have better accuracy by the localizer than the VOR.

2.3 **Further consideration to be made**

As stated above the On-set ILS approach procedure involves a “non- standard” steep glide path.

Although 4.3° is less steep than 5.3° (9.3%) in the existing VOR/DME approach Runway 02 from D9 to D3, appropriate safety margin shall be applied.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited to note the information provided in this paper:

3.2 Member states are invited to share their experience regarding the usage and acceptability of steep glide path angle ILS and provide comments and suggestions regarding the regulatory aspects including operation approval of airlines.

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