



ICAO

International Civil Aviation Organization

**Twenty Fourth Meeting of the Communications/
Navigation and Surveillance Sub-group (CNS SG/24) of
APANPIRG**

Web-conference, 30 November – 4 December 2020

Agenda Item 5: Navigation

5.5 Other navigation related issues

GBAS VDB FREQUENCY COMPATIBILITY FOR TOKYO HANEDA

(Presented by Japan)

SUMMARY

This information paper provides the information on GBAS VDB frequency compatibility analysis for Tokyo Haneda which is now in operational trial. Following the latest standards, the VDB frequency at Tokyo Haneda has been confirmed to be compatible with existing VOR stations.

1. INTRODUCTION

- 1.1 Category-I GBAS has been implemented in the world, and there are several projects to implement GBAS in the APAC region.
- 1.2 Japan Civil Aviation Bureau (JCAB) has installed a GBAS at Tokyo Haneda intended for operation from the end of March 2020.
- 1.3 The ICAO standards on the frequency compatibility between VHF radio navigation aids have been defined, which would help finding an appropriate frequency to implement a GBAS.
- 1.4 This information paper shares the experience in frequency compatibility consideration for GBAS VDB at Tokyo Haneda based on the latest standards.

2. DISCUSSION

- 2.1 In this paper, the VDB frequency compatibility with other VHF radio navigation aids near Tokyo Haneda is examined, which is called “airport-to-airport compatibility”, based on the latest VHF frequency coordination criteria defined in the ICAO Annex 10. Compatibility with other systems in the same airport should be examined in the other context considering the geometry of the VHF facilities and runways, which is called “same-airport compatibility”.

2.2 The details of the frequency compatibility analysis procedures are not described in this paper. Instead, high level summary of the steps are described below:
VHF radio navigation aids near the declared operational coverage (DOC) are listed up. For equivalent isotropic radiation power (EIRP) of 50 W, the declared operational coverage (DOC) is 23 NM from the VDB up to the altitude of 10,000 ft, as per ICAO Annex 10 Volume I.

1. Required desired-to-undesired (D/U) ratio is determined depending on the frequency separation between the desired GBAS VDB and other systems.
2. Required separation to satisfy the D/U ratio requirement at the edge of the DOC is determined by using the ITU-R propagation curve (ITU-R Recommendation P.528-4). Here, the minimum power level (102 dBW) of the VDB is assumed. (It should be noted that the original ITU-R Recommendation P.528-4 does not support the VHF aeronautical radio navigation frequency band, and a work to lower the frequency limit is ongoing at ITU-R.)
3. The required separation is compared with the geographic separation between the desired GBAS VDB and other systems. If the geographic separation is longer than the required separation, the GBAS VDB frequency is compatible with existing systems.

2.3 Figure 1 shows the locations of the GBAS VDB at Tokyo Haneda and VOR stations near the DOC. The frequency assigned for GBAS VDB at Tokyo Haneda is 114.300 MHz.

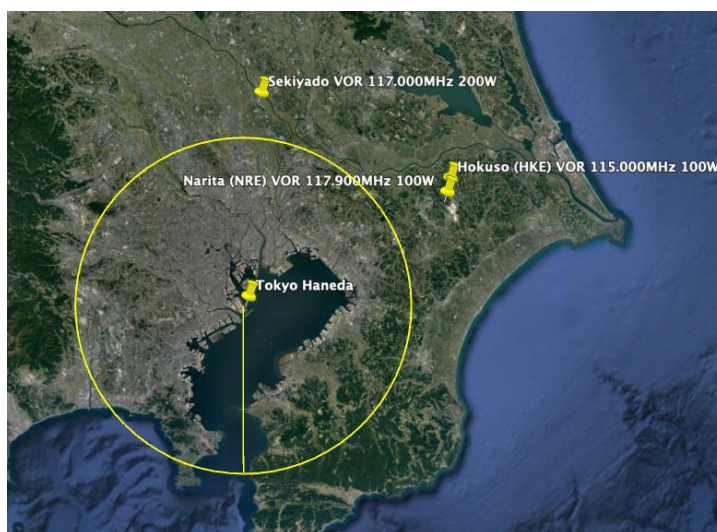


Figure 1. The DOC (23NM radius) of GBAS at Tokyo Haneda and nearby VOR stations.

2.4 Table 1 shows the summary of compatibility of the GBAS VDB at Tokyo Haneda with the three VOR stations shown in Figure 1. According to the analysis, the frequency of the GBAS VDB at Tokyo Haneda are confirmed to be compatible with the three VOR stations. Even for the HKE VOR at Tokyo Narita which has frequency of 115.000 MHz which is 700 kHz away from the frequency of GBAS VDB at Tokyo Haneda, the

geographic separation is longer than the required separation. In reality, the situation would be even better because of conservative assumptions made in the compatibility analysis. For example, the desired signal level is assumed to be the minimum required level. In real case, the signal level may not always be the minimum level, because an operational margin is considered in determining the minimum signal level. In addition, it may be operationally accepted if the area where the analysis shows incompatibility is not in the GBAS VDB service volume.

2.5 During the compatibility analysis, it was found that the ICAO Frequency Finder for the APAC region could not find an appropriate frequency for Tokyo Haneda (WP43, ICAO NSP Joint GSWG/SWG/VWG Meeting, Virtual, April 2020). It turned out to be because the frequency database included several VOR stations which have already been decommissioned. One of the lessons learned is that it is important to keep the regional frequency database consistently up to date.

Table 1. Compatibility of GBAS VDB at Tokyo Haneda

VOR	Frequency (MHz)	Power (W)	Separation (NM) from VDB at Tokyo Haneda	Required separation (NM)	Overall compatibility
Narita (NRE) (Tokyo Narita)	117.900	100	32	23+δ*	Compatible
Hokuso (HKE) (Tokyo Narita)	115.000	100	33	33	Compatible
Sekiyado (En-route)	117.000	200	28	23+δ*	Compatible

*"δ" means a negligibly small value.

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 matters as appropriate.
