

**58th CONFERENCE OF
DIRECTORS GENERAL OF CIVIL AVIATION
ASIA AND PACIFIC REGIONS**

*Dhaka, Bangladesh
15 to 19 October 2023*

AGENDA ITEM 4: AIR NAVIGATION

**DEVELOPMENT OF SATELLITE-BASED AUGMENTATION
SYSTEM (SBAS)**

(Presented by Pakistan)

INFORMATION PAPER

SUMMARY

This Paper presents the development status of Pakistan Space-Based Augmentation System (Pak-SBAS) program, which is being undertaken by Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) in cooperation/coordination with Pakistan Civil Aviation Authority (PCAA).

DEVELOPMENT OF SATELLITE-BASED AUGMENTATION SYSTEM (SBAS)

1. INTRODUCTION

1.1 Pakistan CAA recognizing the importance of Performance Based Navigation (PBN), have developed PBN implementation Plan (PLN-003-OPAT 2020-2024), and by adopting phased approach, the PBN Approach Procedures, Standard Departures / Arrivals (SIDs /STARs) for all airports have been designed and successfully implemented. Although all PBN Approach Procedures are based on the GNSS, but in the absence of Augmentation System such as Satellite Based Augmentation System (SBAS), these PBN procedures are categorized as Non-Precision Approach Procedures.

1.2 SBAS technology provides the opportunity to cover very large areas of airspace and areas formerly under-served by navigation aids. It also adds increased capability, flexibility, and, in many cases, more cost-effective navigation options than legacy ground-based navigation aids. SBAS is a key enabler of Performance Based Navigation (PBN).

1.3 Approach Capability SBAS enables Localizer Performance with Vertical guidance (LPV) approaches. LPVs are operationally equivalent to a Category I Instrument Landing System (ILS) but are more economical. LPVs do not require the installation or maintenance of navigation aids at the airport since the navigation service is provided to the aircraft entirely by satellites.

1.4 Keeping in view of the importance, the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) (the National Space Agency of Pakistan), in coordination with Pakistan CAA, has initiated the program for the development of PAK-SBAS to upgrade aircraft operations utilizing the Performance Based Navigation (PBN) in Pakistan.

2. DISCUSSION

Overview

2.1 The Pak-SBAS will provide both Public and Authorized services to users in the aviation, transportation, surveying & mapping, precision agriculture, urban planning & infrastructure development, disaster management and other sectors.

2.2 The Pak-SBAS will comply with the SBAS requirements of International Civil Aviation Organization (ICAO) published in Annex 10 - Aeronautical Communications, Volume I, Radio Navigation Aids. The Pak-SBAS L1 Signal-in-Space will comply with the corresponding requirements in the SBAS Minimum Operational Performance Standards (MOPS) (DO-229E) published by RTCA (Radio Technical Commission for Aeronautics).

2.3 The Pak-SBAS L5 Signal-in Space will comply with the SBAS L5 DFMC Interface Control Document (version 1.3) developed by the SBAS Interoperability Working Group (IWG).

2.4 The Pak-SBAS B2b Signal-in-Space will comply with corresponding requirements in the BeiDou Navigation Satellite System, the China Satellite Navigation Office (CSNO).

2.5 The Pak SBAS will be certified by PCAA with support from certification experts.

Configuration

2.6 The current configuration of Pak-SBAS comprises Paksat-MM1 satellite at 38.2°E (GEO 1) in the Space Segment and twelve Range and Integrity Monitoring stations (RIMS), one Data Processing Centre (DPC), one Ground Uplink Station (GULS) in the Ground Segment. The Ground Segment utilizes both terrestrial and satellite communication links for interconnectivity.

2.7 The Pak-SBAS RIMS receive data from GPS & BDS satellites and transmit it to DPC.

The DPC will also be linked to an International GNSS Service (IGS) Data Center (DC) to receive data online. The DPC generates Pak SBAS correction messages and transmit the same to GULS. The GULS transmits the Pak-SBAS correction messages to the Paksat-MM1 satellite, which broadcasts L1/ L5/ B2b signals. The broadcast signals are received by compatible ground terminals.

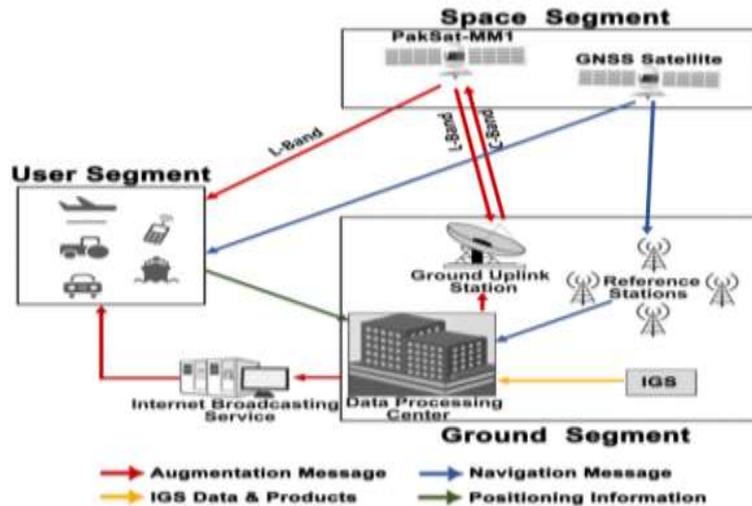


Figure 1: Pak-SBAS System Architecture

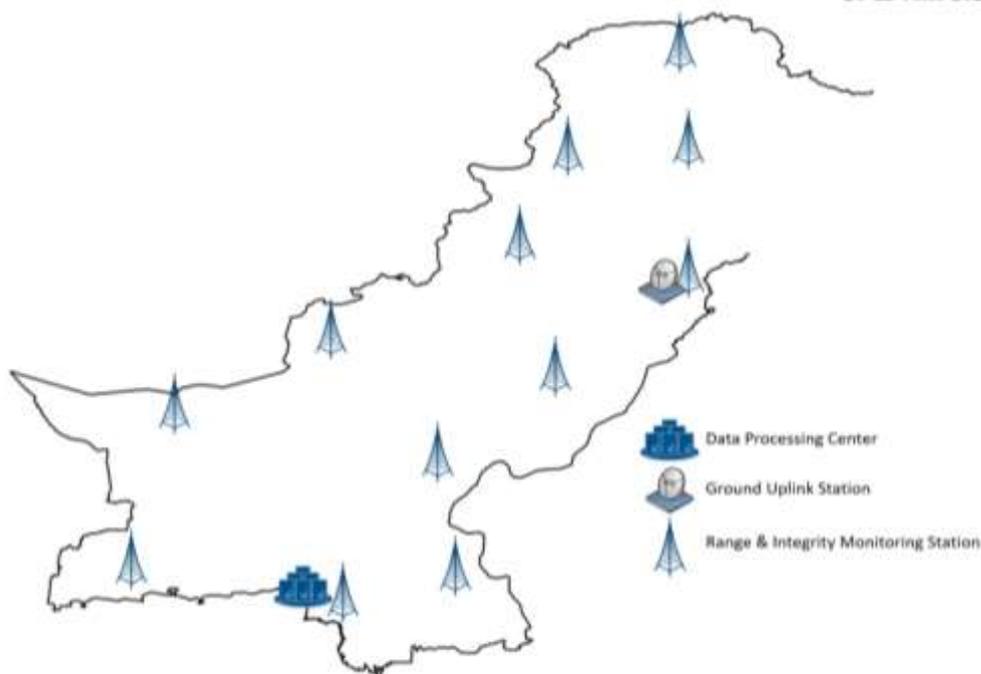


Figure 2: Pak-SBAS Infrastructure

Implementation Status

2.8 The Pak-SBAS development contract was awarded in Nov 2020, the kick-off meeting was held in Aug 2021, and Preliminary Design Review (PDR) was completed in Dec 2021

2.9 The Pak-SBAS Critical Design Review (CDR) was completed in Aug 2022, and system development is currently under process.

2.10 Pakistan CAA fully support SUPARCO in the process of application of GPS and BDS PRN codes for Pak-SBAS, and its service is planned to be tested and commissioned by end-year 2024.

2.11 The launch of the second satellite (GEO-2) in the Pak-SBAS Space Segment and augmentation of the Ground Segment is being considered in the year 2026.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to note the information contained in this Paper.

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