

Qatar GBAS Project

Doha, Qatar

12-13 December 2023

NAV-AIDS Unit, Electronics Engineering Section

Air Navigation Department, QCAA



Scope of the Presentation

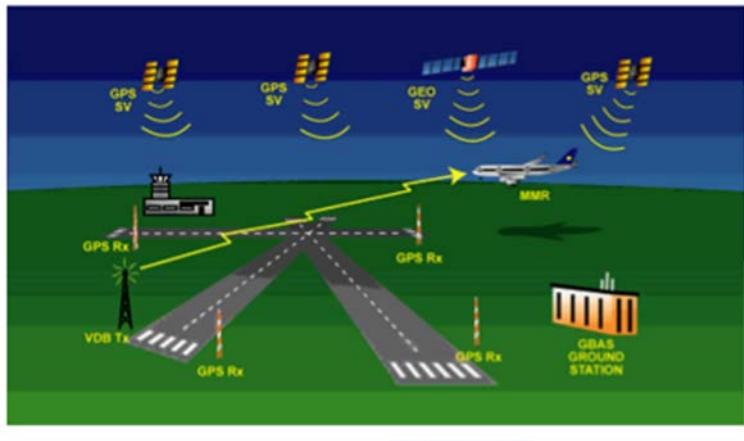
- A glimpse of GNSS and GBAS
- Working Principle of GBAS and its function
- Advantages of GBAS
- Qatar's endeavour towards GBAS Implementation
- The road map ahead

A glimpse of GNSS and GBAS



- GBAS uses monitoring stations at airports to process signals from core constellations and **broadcast corrections and approach path data** to support **precision approach operations**.
- As of 2017, approximately 140 GBAS stations were certified and transmitting SARPs-compliant signals, about half of which have published procedures for CAT I operations;
- a number of prototype stations provide signals for test and evaluation, several of which are used for validation of GBAS approach service types to support Category II/III operations;
- over 100 airlines have GBAS equipage, totalling over 2 000 aircraft. GBAS is used in daily revenue service in several States.

A glimpse of GNSS and GBAS



- GBAS (**Ground Based Augmentation System**) is a satellite-based **precision approach aid** for aircraft landings.
- GBAS works with the **satellite-based GPS navigation system**.
- According to ICAO/Eurocontrol planning, GBAS will in the long term replace the current ILS (Instrument Landing System), due to increased accuracy and lower operational costs.

A glimpse of GNSS and GBAS

CAT-I GBAS in Operation		
Table1. CAT-I GBAS Status		
Airport	State	Operation start
Bremen airport	Germany	Feb.2012
Houston Airport	USA	Apr.2012
Newark Airport	USA	Sep2012
Málaga airport	Spain	May2014
Sydney Airport	Australia	May2014
Frankfurt Airport	Germany	Sep2014
Zurich Airport	Switzerland	Oct2014
Moscow airport+100	Russia	2016~
Melbourne Airport	Australia	May2019
CAT-I GBAS installed (in Preparation for Operation)		
Kimpo Airport	Korea	Evaluating
Shanghai Airport (Pudong)	China	Evaluating
Chennai airport	India	Evaluating
Rio de Janeiro Airport	Brazil	Evaluating
St. Helena Airport	UK	Evaluating
GBAS planned (including under installing)		
Perth / Brisbane Airport	Australia	Under Planning
Kuala Lumpur Airport	Malaysia	Under Planning
Dubai Airport	UAE	Under Planning
Dakar Airport	Senegal	Under Planning
John F. Kennedy Airport	USA	Under Planning
La Guardian Airport	USA	Under Planning
Seattle Airport	USA	Under Planning
San Francisco airport	USA	Under Planning
Balice Airport	Poland	Under Planning
Haneda Airport	Japan	Under Planning



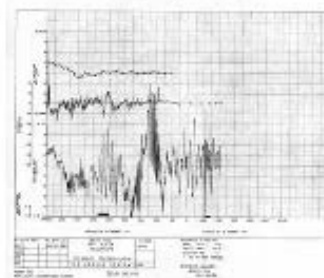
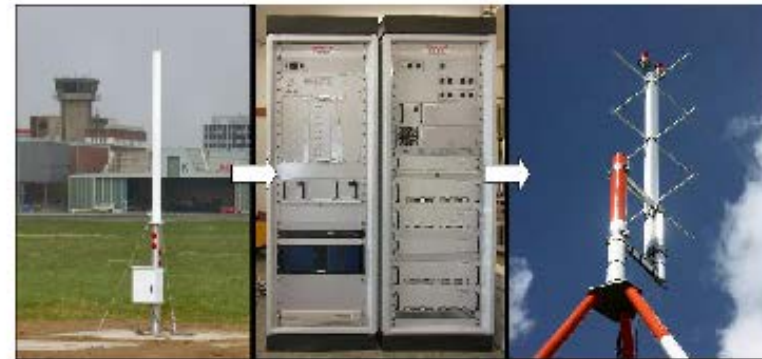
A glimpse of GNSS and GBAS

ILS

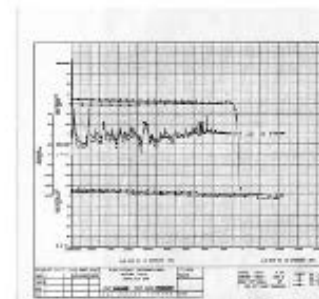


Instrument Landing System
glideslope and localizer

GBAS



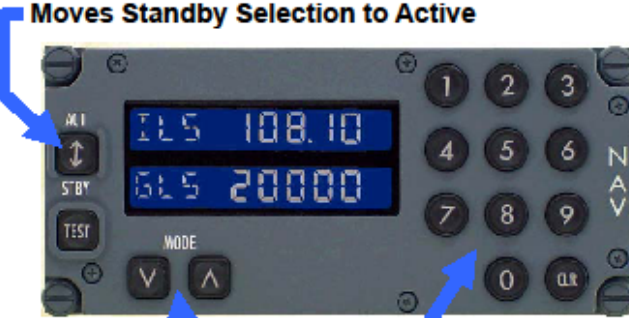
**Glide slope
Radar Alt
Localizer**



A glimpse of GNSS and GBAS

Boeing GLS:737NG Crew Interface

Navigation Control Panel



Moves Standby Selection to Active

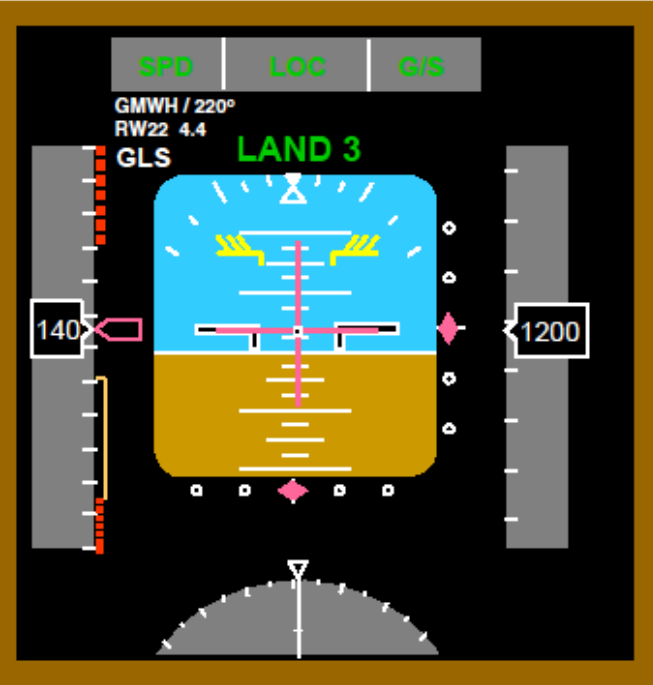
Cycles through Modes: ILS, VOR, GLS

Keypad data entry

- Common Flight Mode Annunciator and auto-flight annunciations
- Data block indicates approach data and type
- Common deviation display "ILS - like"
- Common crew procedure

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Primary Flight Display



SPD | LOC | G/S

GMWH / 220°
RW22 4.4
GLS

LAND 3

140 | 1200

Filename.ppt | 8



Working Principle of GBAS and its function

How Does GBAS Work? – Functions of the GBAS Ground Station

- **GBAS Function: Ground-based correction of the GPS data** sent from the satellite.

The inaccuracy, which we know from car navigation systems, needs to be corrected.

The GPS satellites send positioning data to the GBAS Ground Station, where the signals are corrected and sent to the aircraft.

→ This is why GBAS works more precisely than the GPS in cars.

- **GBAS Function: Transmission of approach path data**

The details of the approach path are sent to the aircraft on final approach.

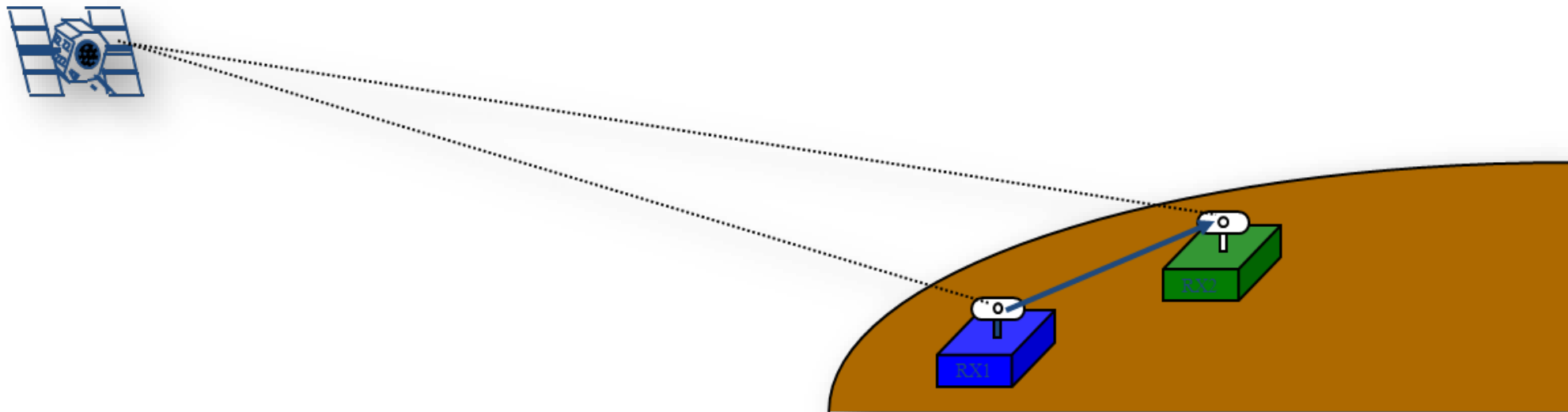


Working Principle of GBAS and its function

LOCAL AREA DIFFERENTIAL PRINCIPLE

I - Basic Principle

- Measurements made by two receivers are affected by the same errors as long as these two receivers are not too far from each other.



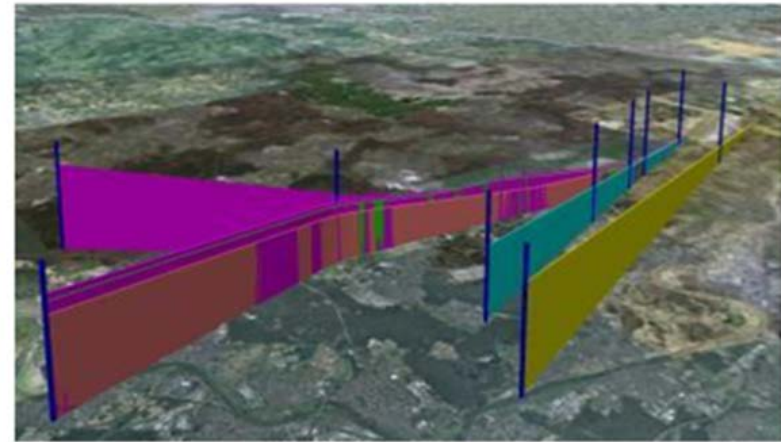
Working Principle of GBAS and its function

The GBAS Ground Station Consists of Four GPS-Receivers (RSMU), One Transmitter (VDB) and a Shelter



Advantages of GBAS

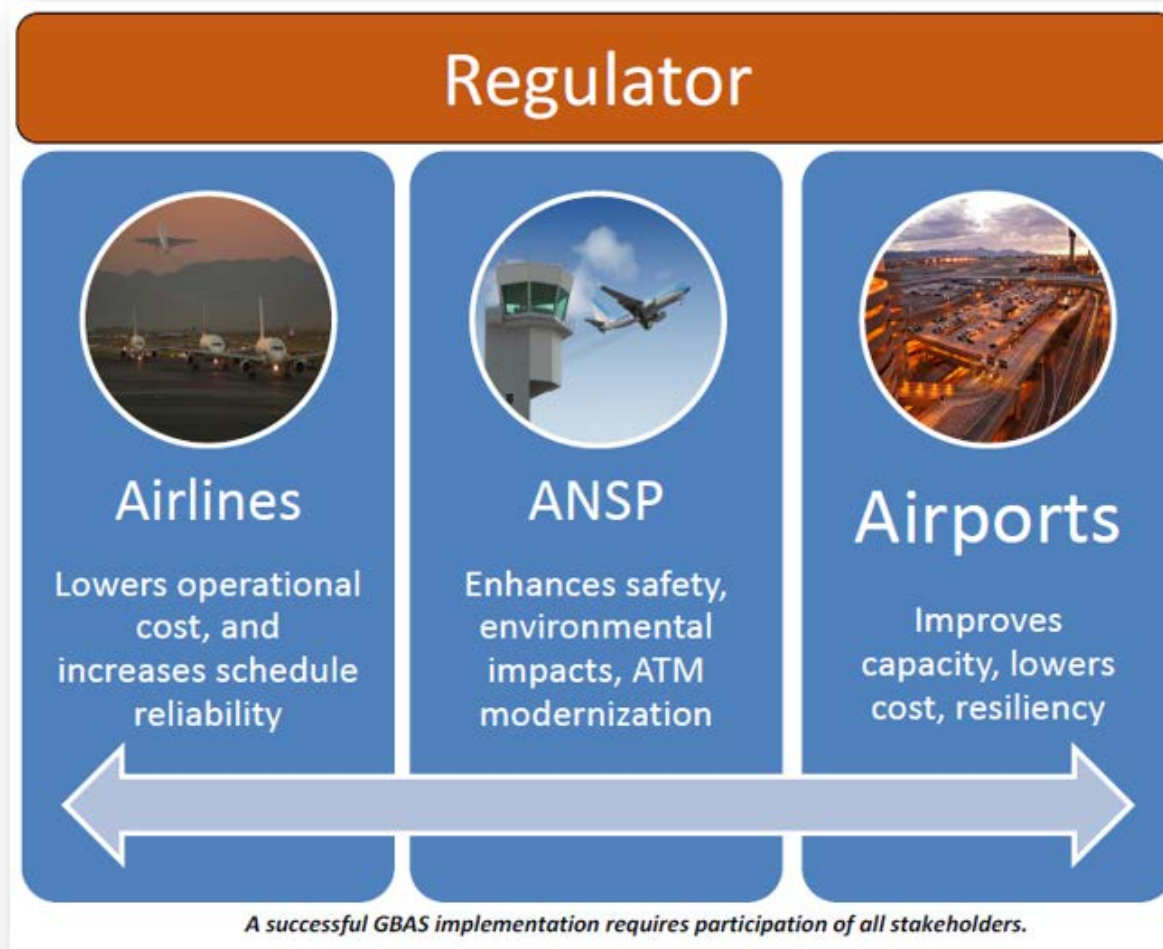
- **One GBAS Ground Station** is sufficient for all of the airport's runways. Up to 49 approach procedures can be transmitted from one GBAS Ground Station.
- Due to a more flexible approach path adaptation (of the glide slope and path) **noise-reduced approaches** are possible by avoiding flying over densely populated areas.



Animation/Foto: Honeywell



Advantages of GBAS



Qatar's Endeavour towards GBAS implementation

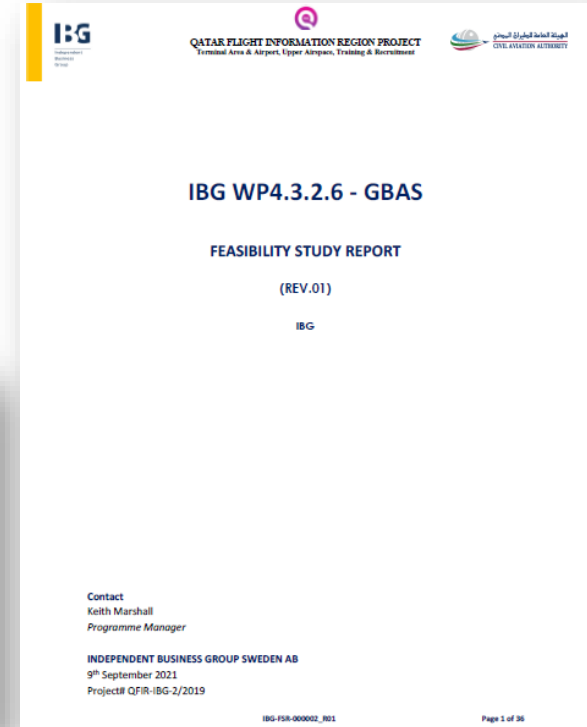
- In 2019, feasibility study was carried out for the Ionospheric effect on Navigational Satellite's signals over Qatar.
- In 2022, the infrastructure was established to support the collection of iono data and its effect on GPS signals are being analysed and recorded.

Qatar's Endeavour towards GBAS implementation



Qatar's Endeavour towards GBAS implementation

- The ionospheric study was planned for one complete year commencing Oct 2022.
- Ionospheric analysis reports were provided on a quarterly basis.
 - ❑ Candidate days for **1st Quarter**
 - October 23, 2022; December 13, 2022
 - ❑ Candidate days for **2nd Quarter**
 - March 24, 2023; April 15, 2023; April 23, 2023
 - ❑ Candidate days for **3rd Quarter**
 - June 27, 2023; July 31, 2023
 - ❑ Candidate days for **4th Quarter**
 - September 18, 2023; September 24, 2023



Ionospheric Study over Qatar's Hamad and Doha International Airport

Ionospheric Analysis First Quarter report, 16th Feb 2023

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 Ref. No : HTS-GBAS-0116-LTR-006
 Pages : 1 + attachments
 Date : 16 February 2023

Project: Ionospheric Analysis Study & Survey Assessment for Ground Based Augmentation System (GBAS)
 Subject: **Ionospheric Analysis First Quarter report**

Dear Sir,
 Please find the attached **first quarter** report for the ionospheric analysis.
 Should you require more information, please contact the undersigned

Yours faithfully,

 Oguzhan Torunlar
 Project Manager
 Honeywell Building Solutions
 Enclosures as above

Ionospheric Analysis Second Quarter report, 05th June 2023

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 Ref. No : HTS-GBAS-0116-LTR-008
 Pages : 1 + attachments
 Date : 05 June 2023

Project: Ionospheric Analysis Study & Survey Assessment for Ground Based Augmentation System (GBAS)
 Subject: **Ionospheric Analysis Second Quarter report**

Dear Sir,
 Please find the attached Second quarter report for the ionospheric analysis.
 Should you require more information, please contact the undersigned.

Yours faithfully,

 Oguzhan Torunlar
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Ionospheric Analysis Third Quarter report, 23rd November 2023

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 Pages : 1 + attachments
 Date : 23 November 2023

Project: Ionospheric Analysis Study & Survey Assessment for Ground Based Augmentation System (GBAS)
 Subject: **Ionospheric Analysis Third Quarter report**

Dear Sir,
 Please find the attached Third quarter report for the ionospheric analysis.
 Should you require more information, please contact the undersigned.

Yours faithfully,

 Oguzhan Torunlar
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Ionospheric Analysis Fourth Quarter report, 27th November 2023

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 Pages : 1 + attachments
 Date : 27 November 2023

Project: Ionospheric Analysis Study & Survey Assessment for Ground Based Augmentation System (GBAS)
 Subject: **Ionospheric Analysis Fourth Quarter report**

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 Please find the attached Fourth quarter report for the ionospheric analysis.
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Yours faithfully,

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The roadmap ahead

Roadmap Ahead

- As per Honeywell, the final report of one year study will be submitted by 15th of December 2023.
- It will consider the analysis of 10 candidate days, but those days will be different from the days already covered in quarterly report
- We are keeping our fingers crossed as Qatar's Latitudes are just above 23.5 Degree parallel (Tropic of Cancer).

Optimistic Approach

- **ICAO's Doc 9849** GNSS Manual also talks about the long run benefits of having GBAS and Qatar always endeavour to remains on the forefront of cutting-edge technology.



Country	Qatar
Latitude	25.286106
Longitude	51.534817
DMS Lat	25° 17' 9.9816" N
DMS Long	51° 32' 5.3412" E



SINCERE THANKS TO ALL OF YOU

