



ICAO

*International Civil Aviation Organization*Asia/Pacific GBAS/SBAS Implementation Task Force  
(APAC GBAS/SBAS ITF/1)

24 – 26 June 2020, Tokyo Japan

国土交通省  
Ministry of Land, Infrastructure, Transport and Tourism

**Agenda Item 2:** Review of the Terms of Reference and the election of the APAC GBAS/SBAS ITF Chairpersons

## CONCEPT AND BENEFITS OF GBAS SBAS

(Presented by the Secretariat)

### SUMMARY

This paper provides a summary of concept and benefits of GBAS and SBAS systems. This was first presented at the GBAS/SBAS Implementation Workshop held in Seoul, Republic of Korea on 3-5 June 2019.

## 1. INTRODUCTION

1.1 Among all the augmentation systems to the core satellite constellation, the Airborne Based Augmentation System (ABAS) is the most commonly used by the aircraft. This augmentation mainly improves the integrity of GNSS and can be used for all phases of flight. In combination with inertial systems, it brings further improvement during the outages of GNSS.

1.2 Nevertheless, ABAS alone is not sufficient to use a Decision Altitude/Height for landing. For this purpose, it is possible to use the APV Baro VNAV, based on the baro altimeter and which provides a vertical barometric path, and it is also recommended to rely on two other augmentation systems, Ground Based Augmentation System (GBAS) or Satellite Based Augmentation System (SBAS), to get a vertical geometric guidance on the final approach.

## 2. DISCUSSION

2.1 The **Attachment A** shows the presentation about the Concept and Benefits of GBAS and SBAS.

## 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.

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UNITING AVIATION

NO COUNTRY LEFT BEHIND



# Concept and benefits of GBAS - SBAS



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Regional Sub-Office  
24-26 June-2020



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## GBAS & SBAS

Concept 

Benefits 

Implementation challenges 



## Satellite constellations



GPS

Glonass

Galileo

Beidou



Several types of errors :

- Satellite clock & ephemerid
- Ionosphere
- Troposphere

And lack of integrity

**Need to elaborate corrections**



# Global Navigation Satellite System (GNSS)



GPS

Three types of augmentations

Glonass

Galileo

Beidou



ABAS



Aircraft Based Augmentation System

GBAS



Ground Based Augmentation System

SBAS

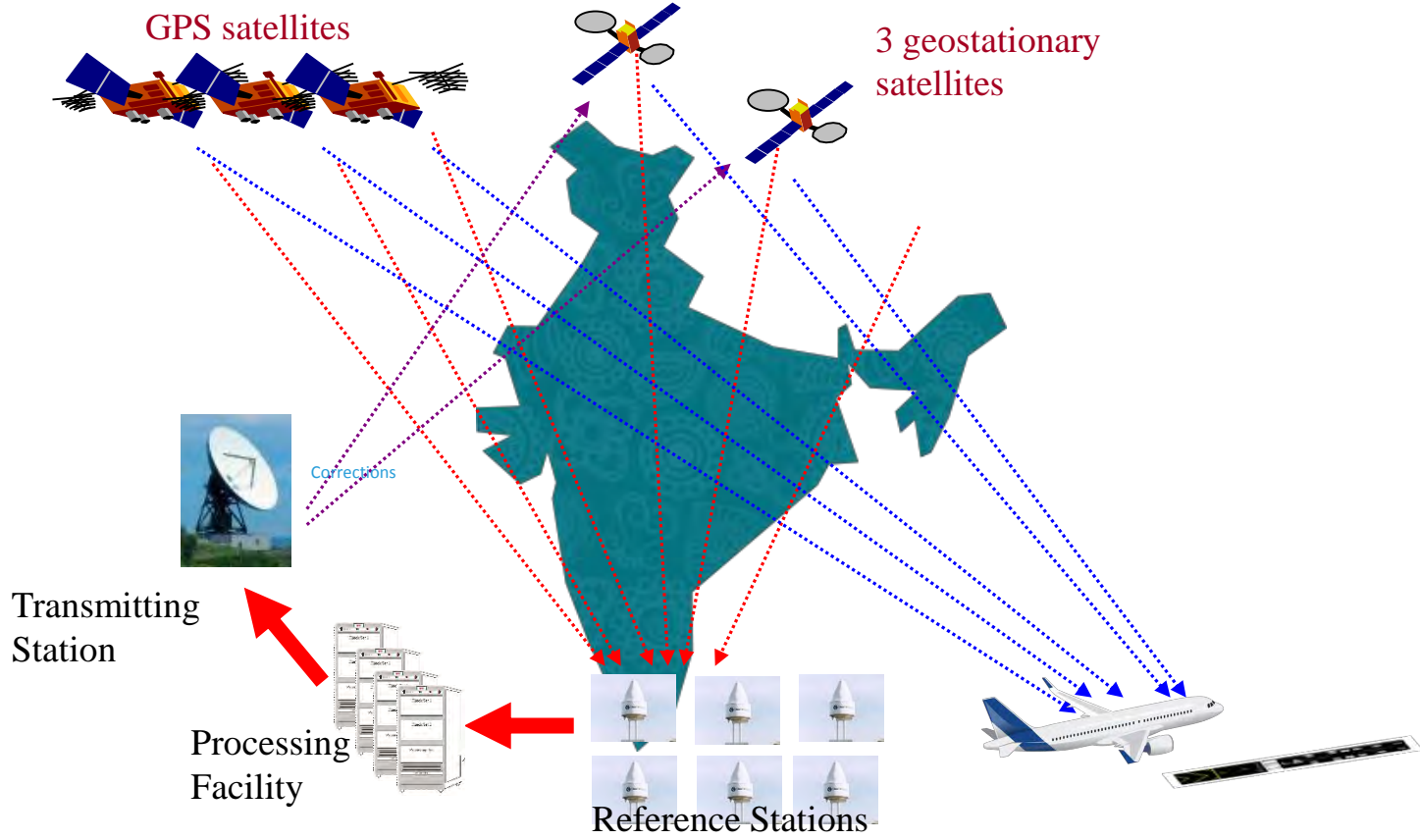


Satellite Based Augmentation System

**Future** : Development of dual frequency multi constellation receiver. Great improvement of PBN coverage all over the globe, especially for the vertical.

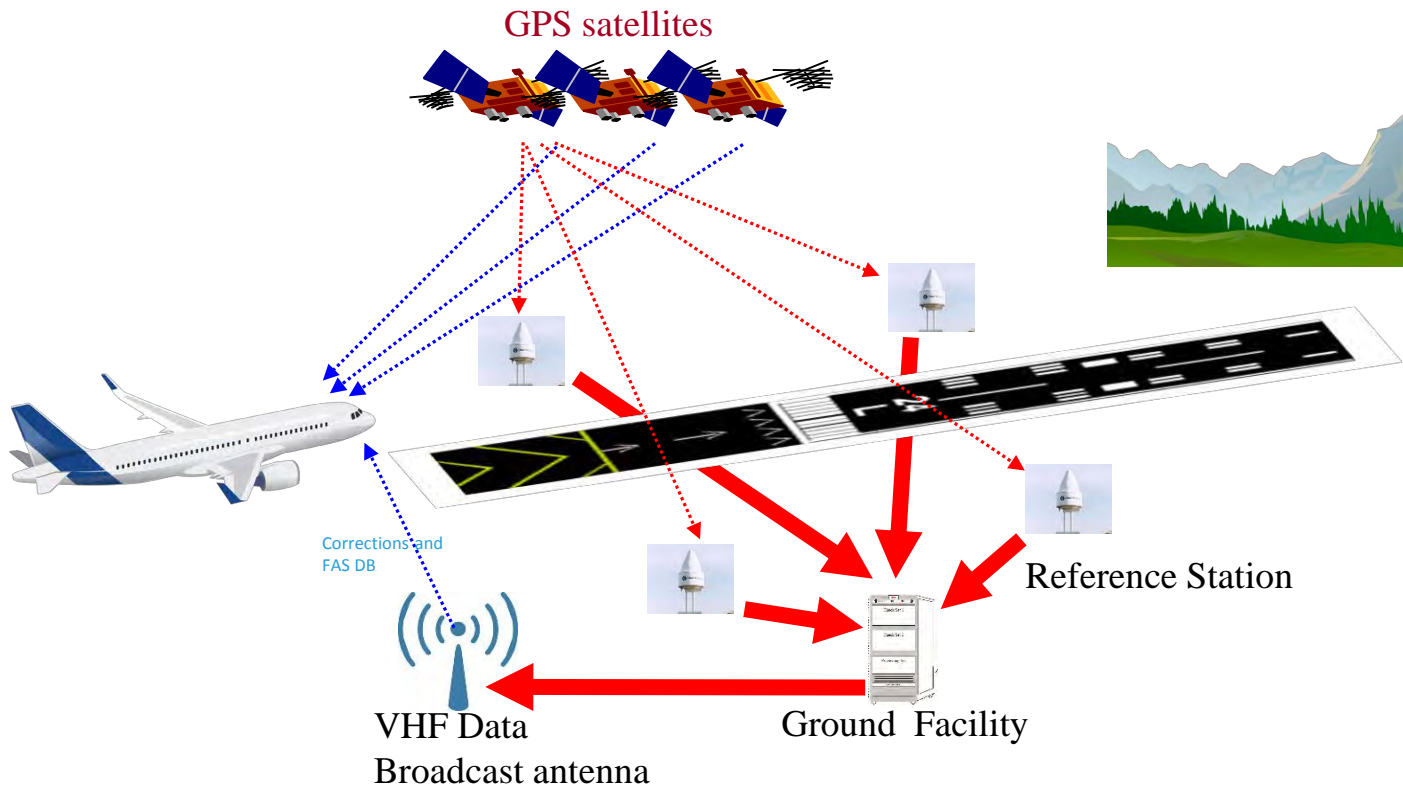


# SBAS architecture



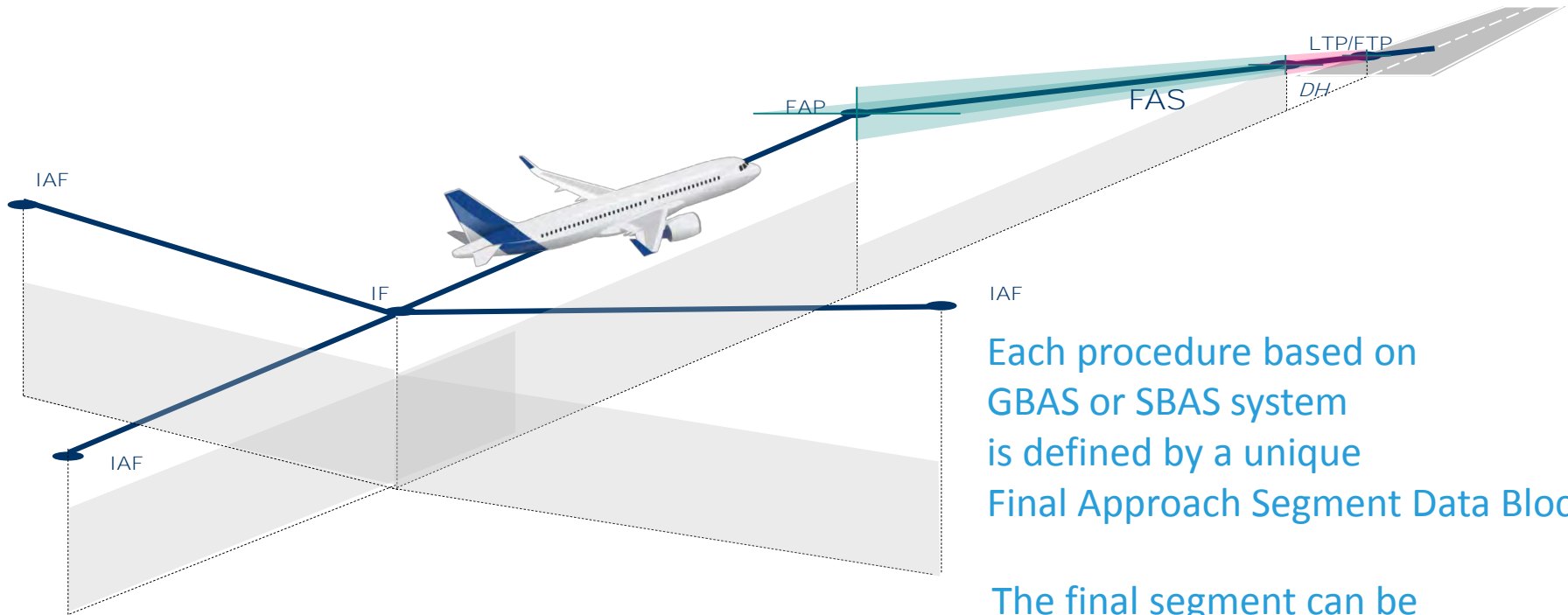


# GBAS architecture





# Final Approach Segment Data Block

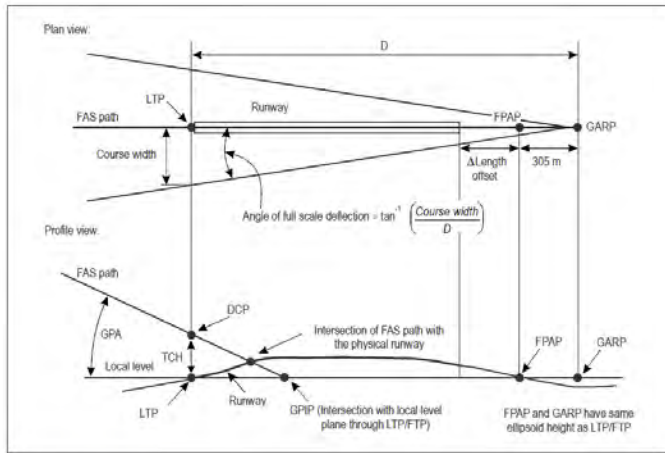


Each procedure based on GBAS or SBAS system is defined by a unique Final Approach Segment Data Block

The final segment can be intercepted before the FAP



# Final Approach Segment Data Block



- DCP — datum crossing point
- FAS — final approach segment
- FPAP — flight path alignment point
- FTP — fictitious threshold point (see Figure D-7)
- GARP — GNSS azimuth reference point
- GPA — glide path angle
- GPIP — glide path intersection point
- LTP — landing threshold point
- TCH — threshold crossing height

Figure D-15. FAS path definition

Table B-66. Final approach segment (FAS) data block

| Data content                    | Bits used | Range of values                       | Resolution          |
|---------------------------------|-----------|---------------------------------------|---------------------|
| Operation type                  | 4         | 0 to 15                               | 1                   |
| SBAS provider ID                | 4         | 0 to 15                               | 1                   |
| Airport ID                      | 32        | —                                     | —                   |
| Runway number                   | 6         | 1 to 36                               | 1                   |
| Runway letter                   | 2         | —                                     | —                   |
| Approach performance designator | 3         | 0 to 7                                | 1                   |
| Route indicator                 | 5         | —                                     | —                   |
| Reference path data selector    | 8         | 0 to 48                               | 1                   |
| Reference path identifier       | 32        | —                                     | —                   |
| LTP/FTP latitude                | 32        | ±90.0°                                | 0.0005 arcsec       |
| LTP/FTP longitude               | 32        | ±180.0°                               | 0.0005 arcsec       |
| LTP/FTP height                  | 16        | -512.0 to 6 041.5 m                   | 0.1 m               |
| ΔFPAP latitude                  | 24        | ±1.0°                                 | 0.0005 arcsec       |
| ΔFPAP longitude                 | 24        | ±1.0°                                 | 0.0005 arcsec       |
| Approach TCH (Note)             | 15        | 0 to 1 638.35 m or<br>0 to 5 276.7 ft | 0.05 m or<br>0.1 ft |
| Approach TCH units selector     | 1         | —                                     | —                   |
| GPA                             | 16        | 0 to 90.0°                            | 0.01°               |
| Course width                    | 8         | 80 to 143.75 m                        | 0.25 m              |
| Δlength offset                  | 8         | 0 to 2 032 m                          | 8 m                 |
| Final approach segment CRC      | 32        | —                                     | —                   |

Note.— Information can be provided in either feet or metres as indicated by the approach TCH unit selector.



## GBAS & SBAS

Concept

Benefits



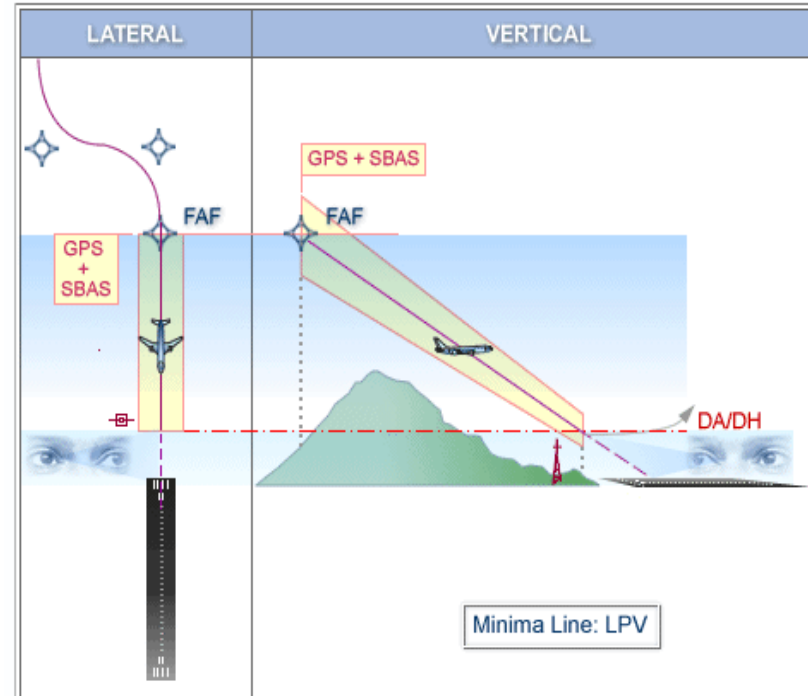
Implementation challenges





## GBAS SBAS expected benefits

- Main benefit on the final segment
  - Horizontal and Vertical geometric guidance
  - ILS like display in the cockpit
  - with a Decision Altitude / Height
  - Independent of QNH setting and of temperature





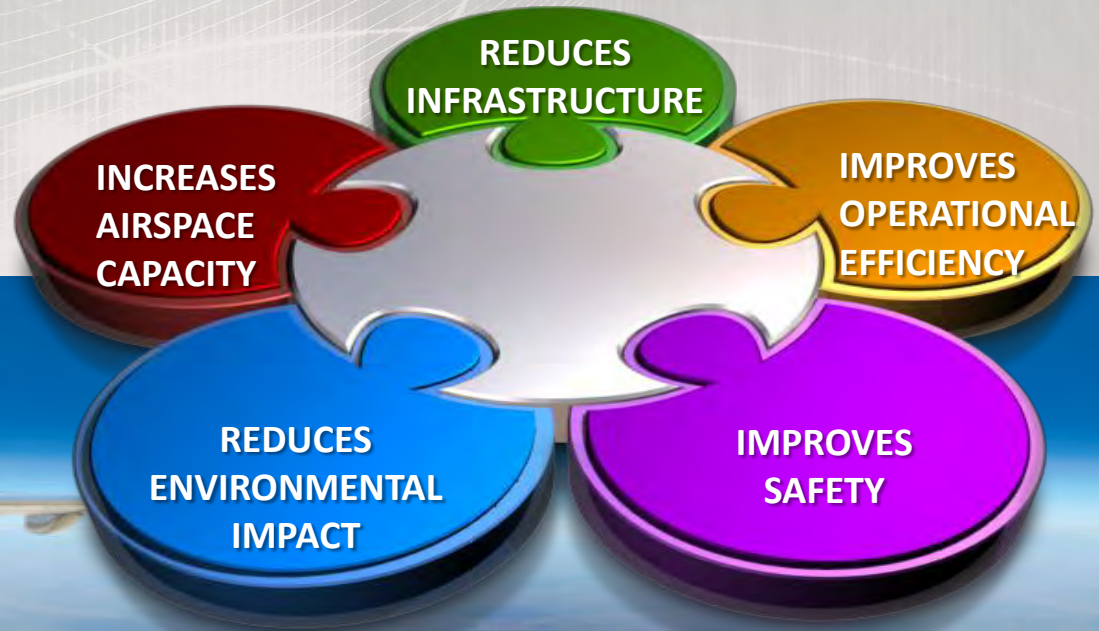
## GBAS SBAS expected benefits

- Can bring operations
  - SBAS : down to **CAT I** ( APV 250 ft and SBAS CAT I 200 ft )
  - GBAS : **CAT I** to **CAT III** ( special study for Ionosphere)
- Can serve
  - SBAS : All IFR runway ends **on a whole continent**
  - GBAS : All IFR runway ends **at the same airport**





## GBAS SBAS expected benefits





## GBAS & SBAS

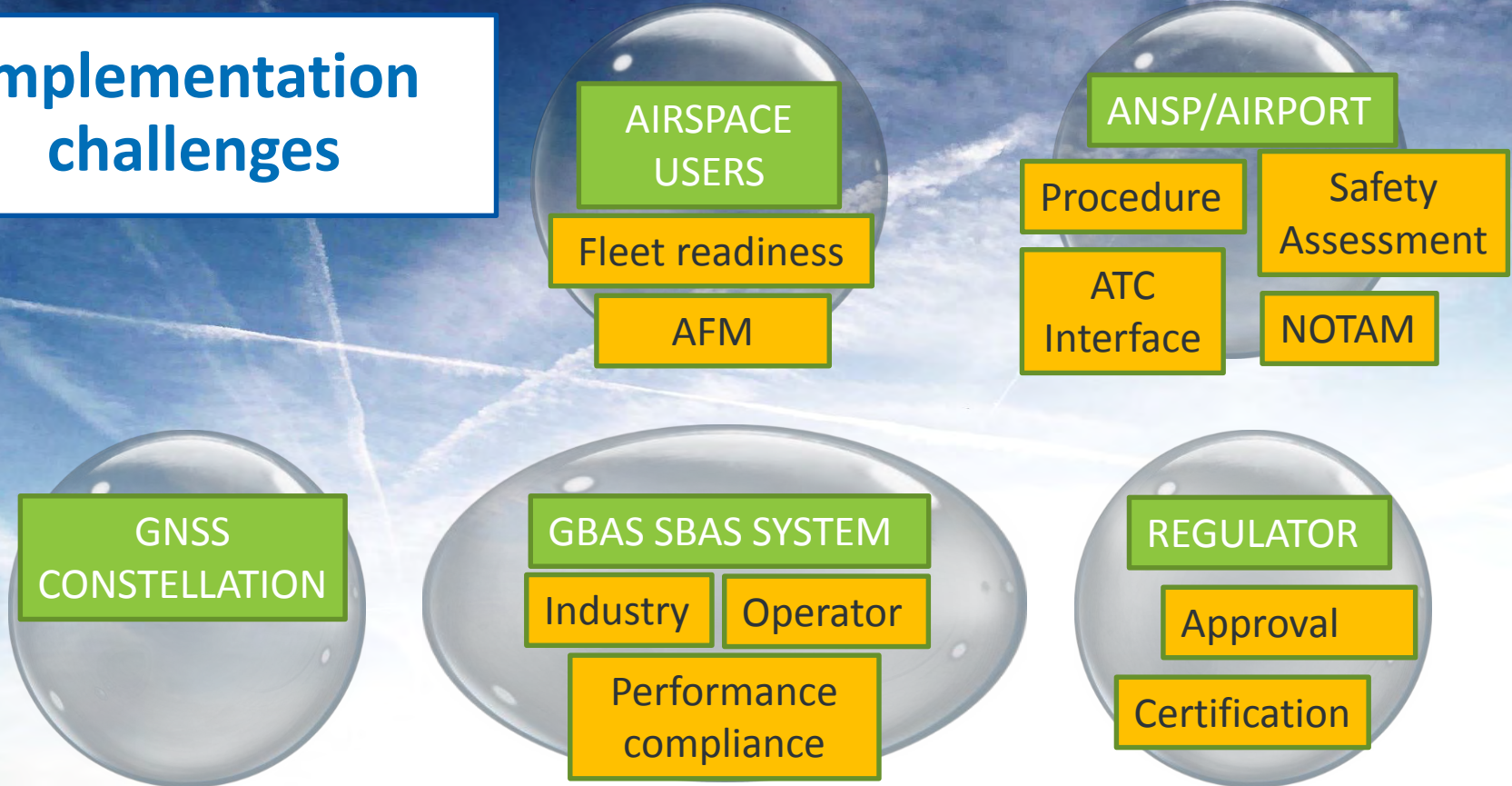
**Concept**

**Benefits**

**Implementation challenges** 



# Implementation challenges





# Implementation challenges





## Implementation challenges



Need to involve all your stakeholders



THANK YOU!