



AGENCE SPATIALE ALGERIENNE



EVALUATION OF THE ALGERIAN SATELLITE BASED AUGMENTATION SYSTEM

From 2021 to 2023



**Seventeenth Meeting of the International Committee on Global Navigation Satellite
Systems Madrid, Spain 15 – 20 October 2023**



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- ❑ Overview of Alcomsat-1 satellite
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The first Algerian communication satellite: Alcomsat-1

- ❑ Alcomsat-1 project is part of the Algerian national space program.
- ❑ Alcomsat-1 satellite is operated by the Algerian Space Agency (ASAL) which was launched in December 2017.
- ❑ The satellite is managed by two control and operation centers in Algeria



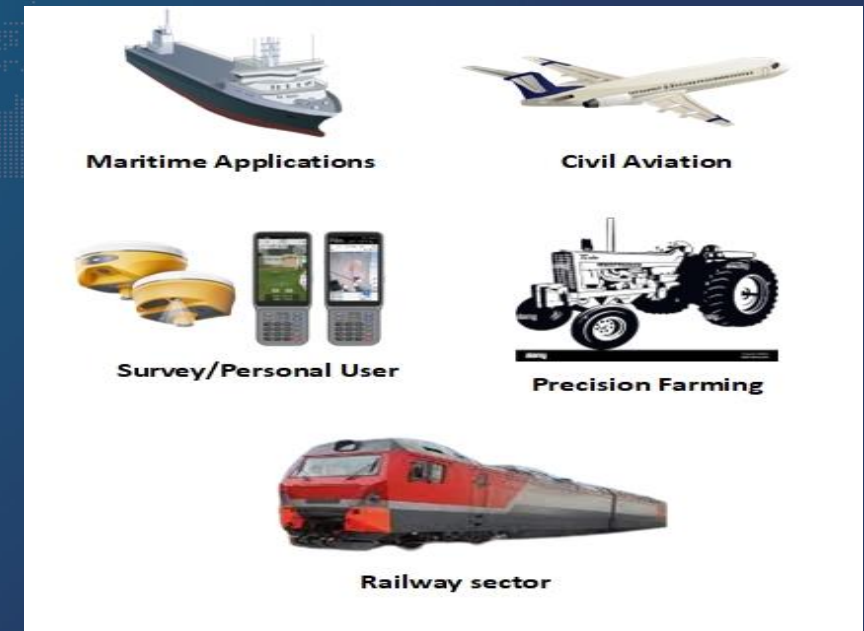
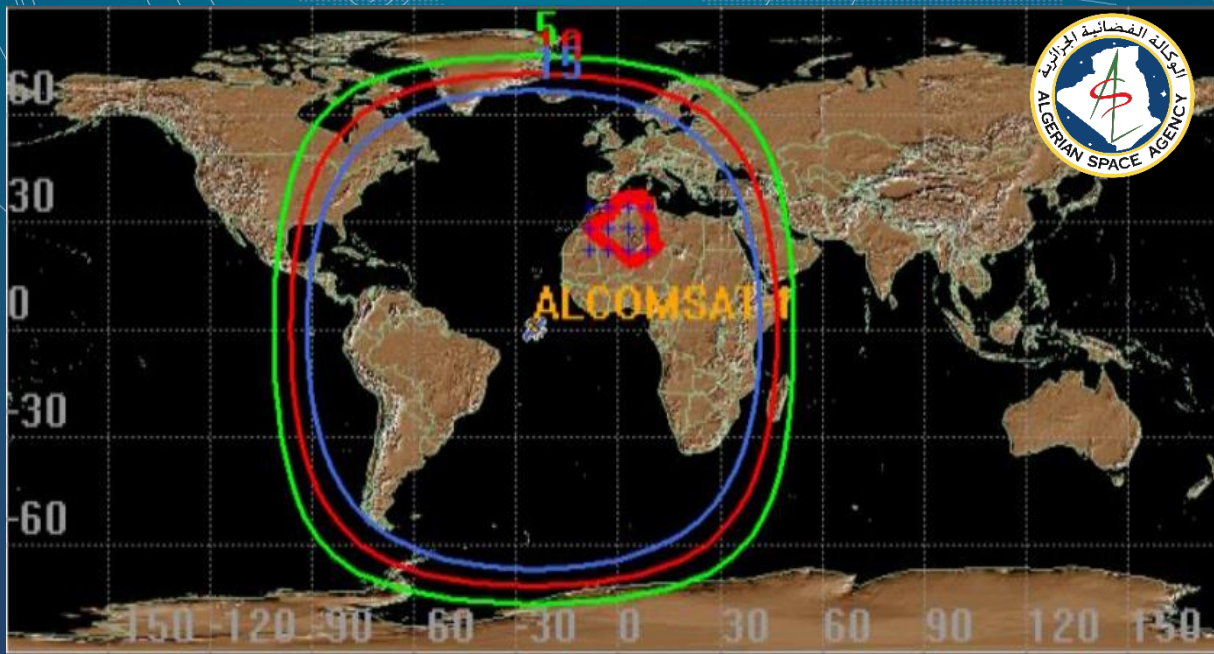
Service life: 15 years



- ❑ Alcomsat-1 is located at 24.8° W in geostationary orbit.
- ❑ Alcomsat-1 contains 33 transponders → two in L band dedicated for AL-SBAS.

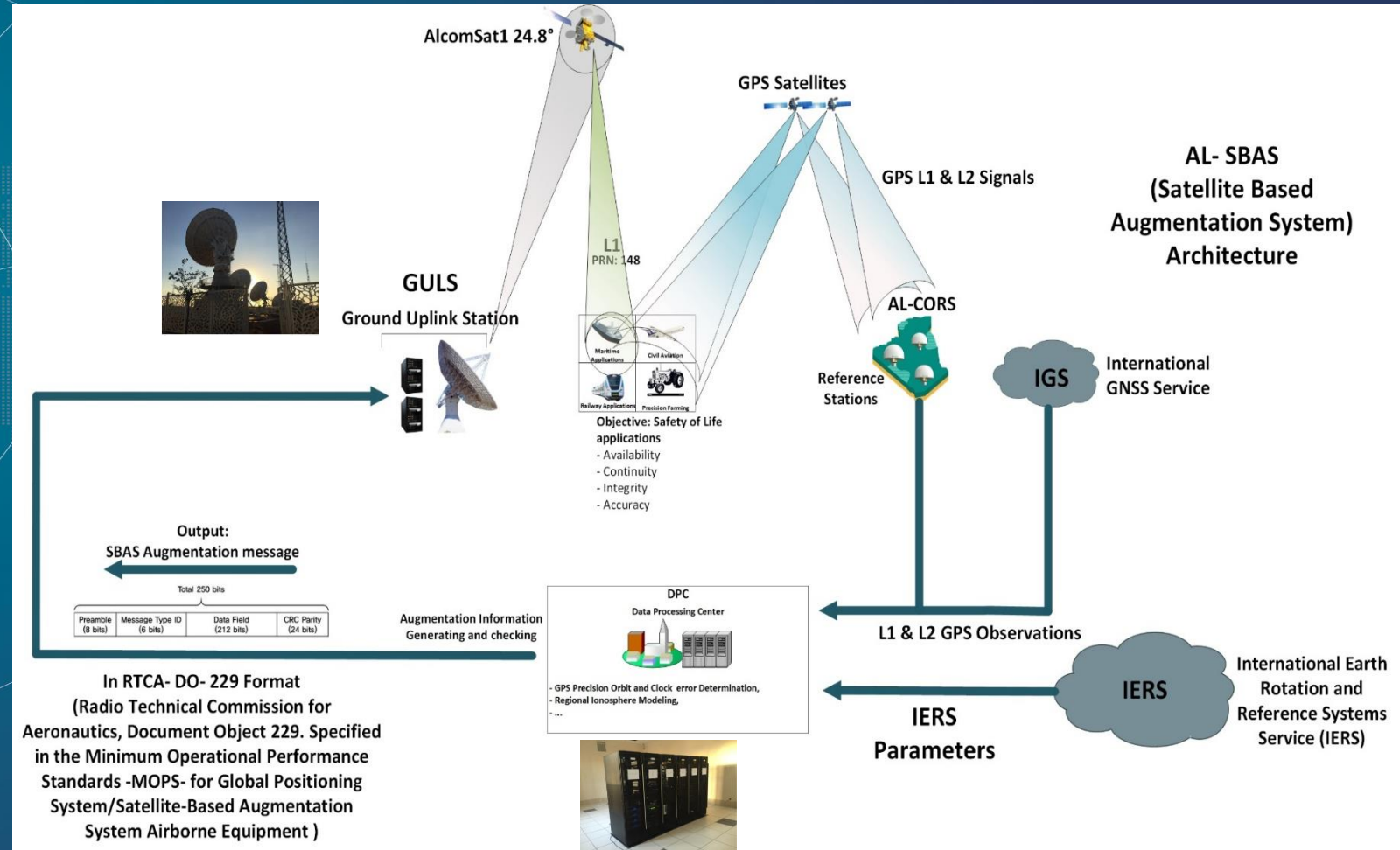
- The Algerian Space Agency successfully deployed an SBAS payload equipped with L1 and L5 transponders channels on board of Alcomsat-1.

- The primary objective of the AL-SBAS system is to provide SBAS services not only to aviation users but also to various other sectors such as maritime navigation, surveying, transportation, and railways.



AL-SBAS

- Reference Stations (AL-CORS) are deployed and strategically dispersed across Algeria Country,
- 01 Data Processing Centre (DPC), for orbit and clock error determination, regional ionosphere modelling ...etc
- 01 Ground UpLink Station (GULS),
- Alcomsat-1 navigation transponders L1/L5,
- User terminals.





AL-SBAS Messages

AL-SBAS transmit a navigation message containing 250 bits of information  MOPS

Type	Contents
0	Don't use for safety applications
1	PRN mask assignments, set up to 51 of 210 possible
2-5	Fast corrections
6	Integrity information
7	Degradation Parameters
9	Geo Navigation message (X,Y,Z, time, etc.)
10	Degradation parameters
12	SBAS Network time / UTC offset parameters
17	Geo satellite almanacs
18	Ionospheric grid points masks
24	Mixed fast corrections/long term satellite error corrections
25	Long term satellite error corrections
26	Ionospheric delay corrections
27	SBAS Service message
28	Clock Ephemeris Covariance Matrix message
62	Internal test message
63	Null message



AL-SBAS Code PRN

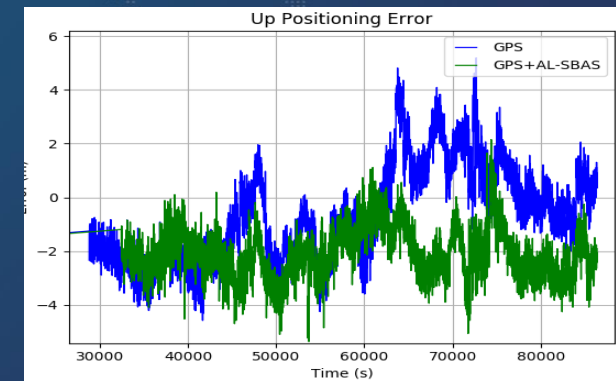
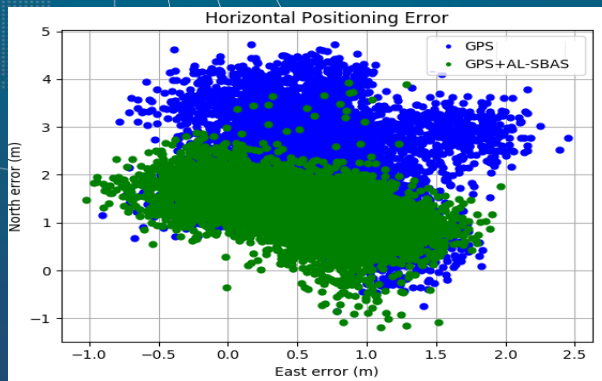
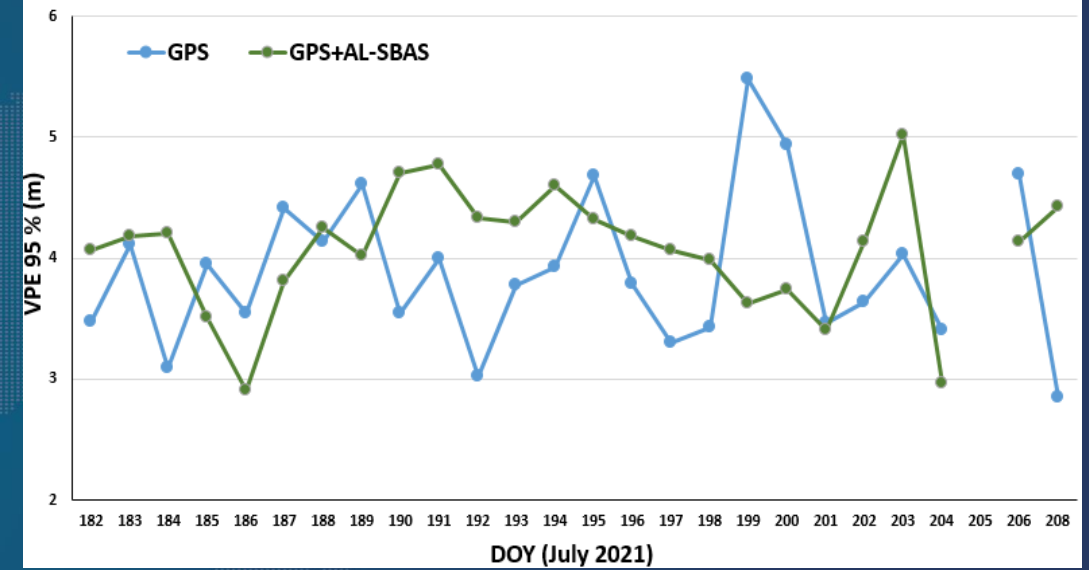
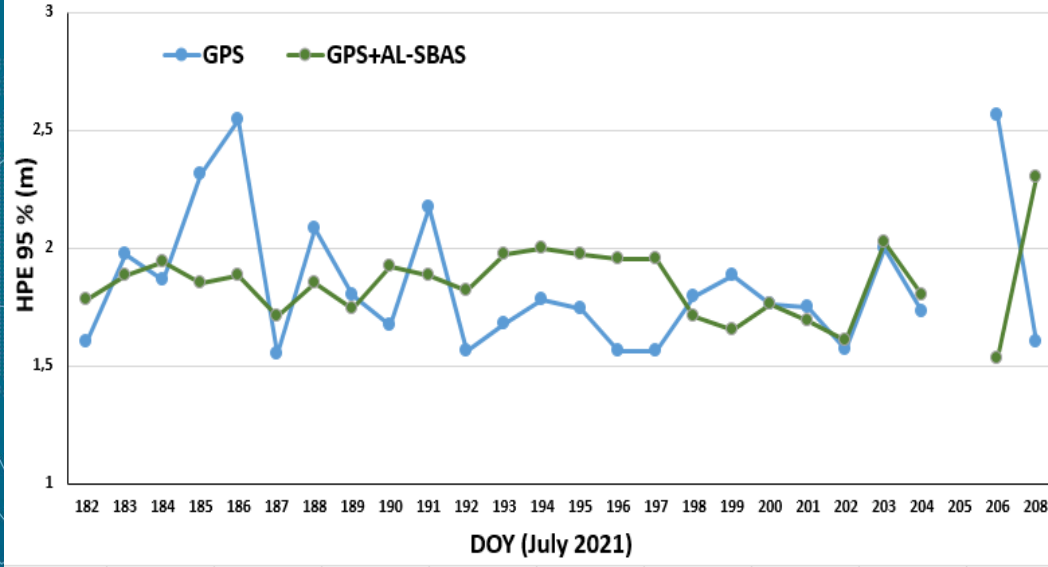
The U.S. Space Force assigned the code PRN 148 for AL-SBAS: this code is used to broadcast the AL-SBAS signal in space (SIS).

PRN code (SBAS Range)	Effective date	Expiry date	Motive	Type of assignment
148	Jan 4, 2018	Jan 4 , 2019	Test and Validation	Temporary assignment
148	Jan, 2019	Jan, 2020	Test and Validation	Temporary assignment
148 (Nov. 2020)	Jan, 2020	Jan, 2021	Test and Validation	Temporary assignment
148	Jan, 2021	Jan, 2022	Test and Validation	Temporary assignment
148	Jan, 2022	Dec 31, 2023	Test and Validation	Temporary assignment



AL-SBAS Performance tests : July 2021

95 percentile position errors for Oran site in north Algeria

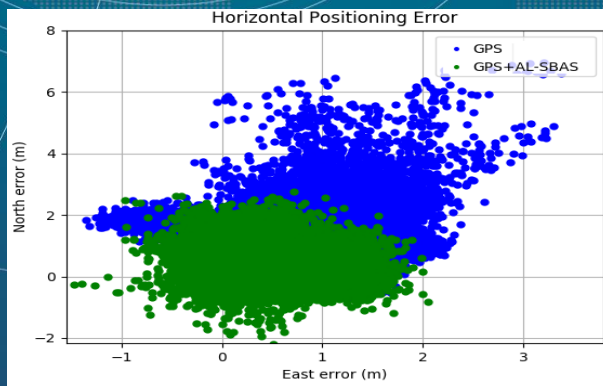
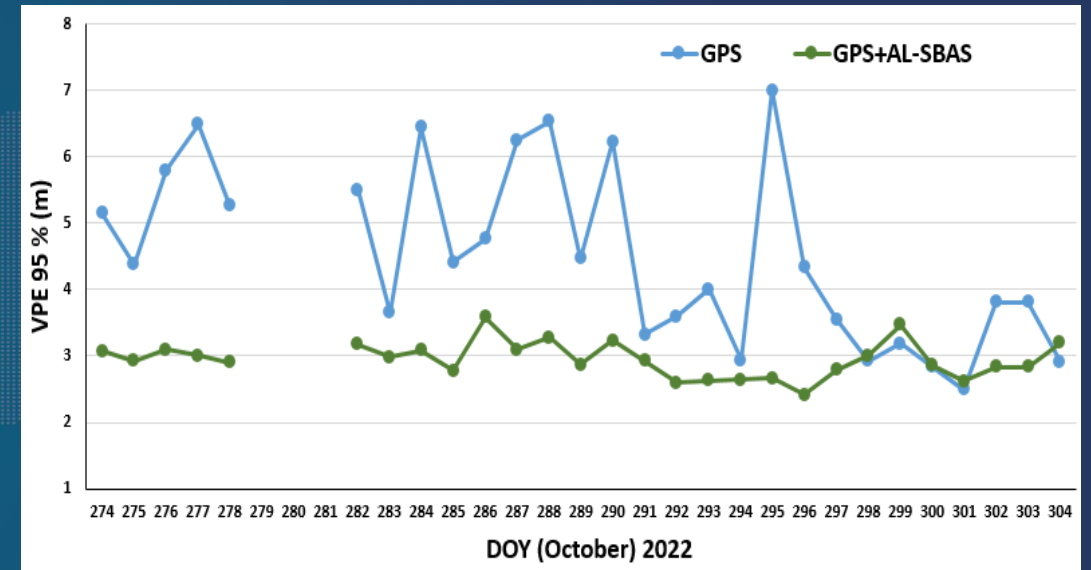
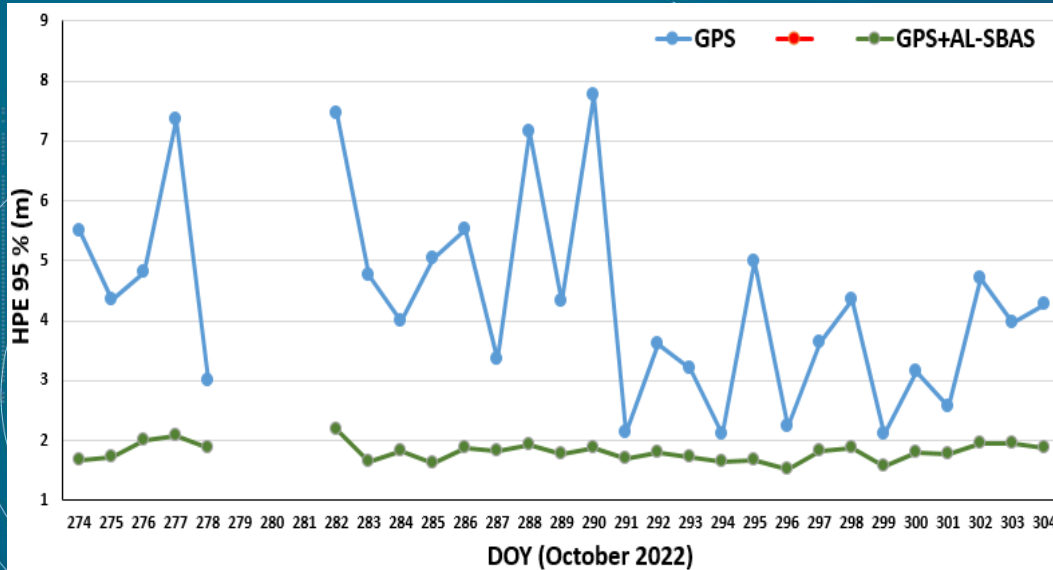


5 July (DOY 186)

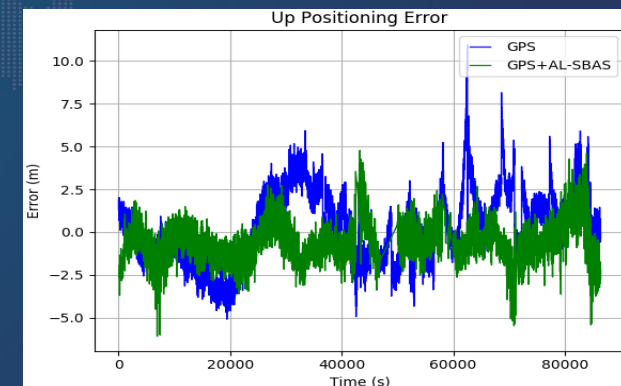


AL-SBAS Performance tests : October 2022

95 percentile position errors for Oran site in north Alegria



23 october (296)



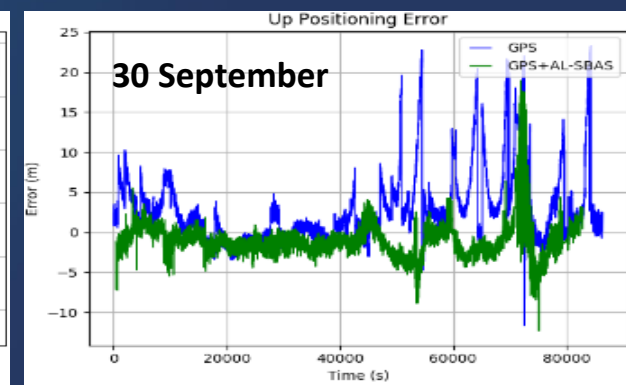
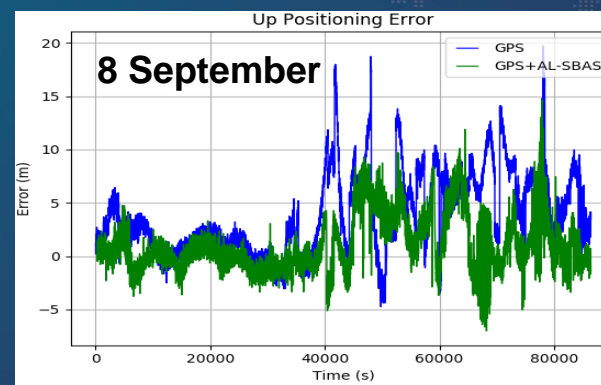
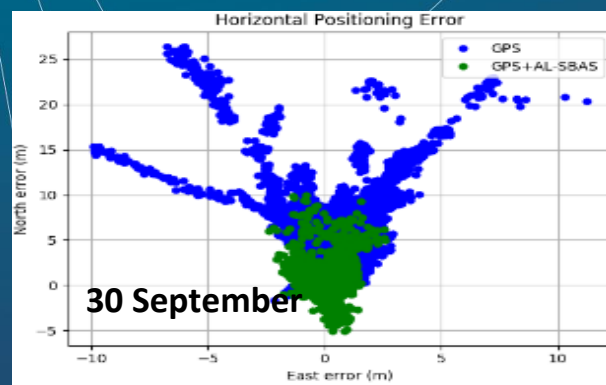
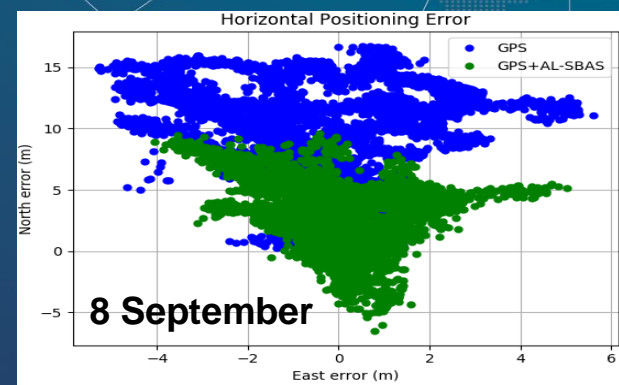
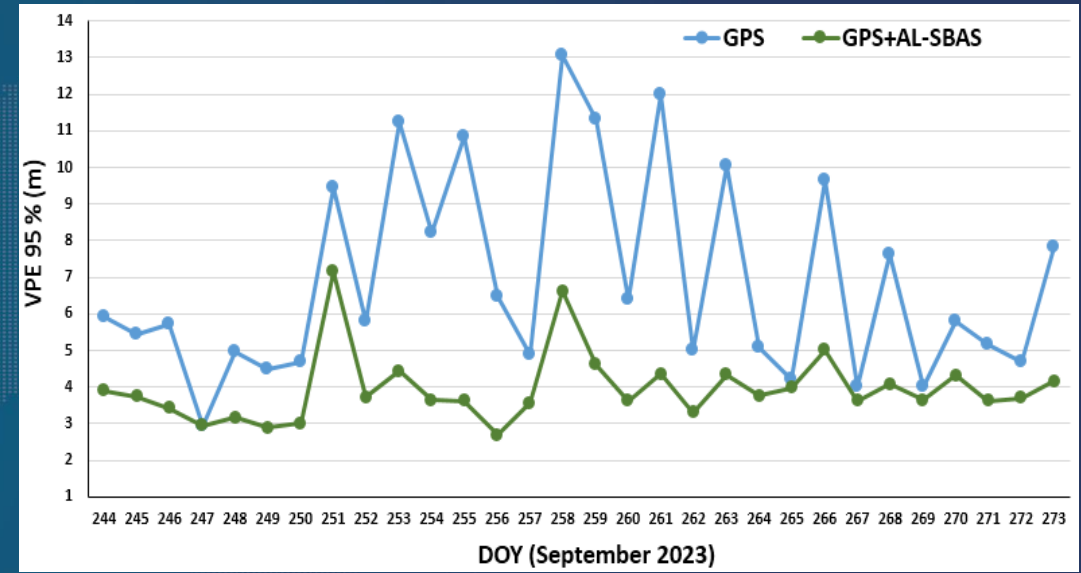
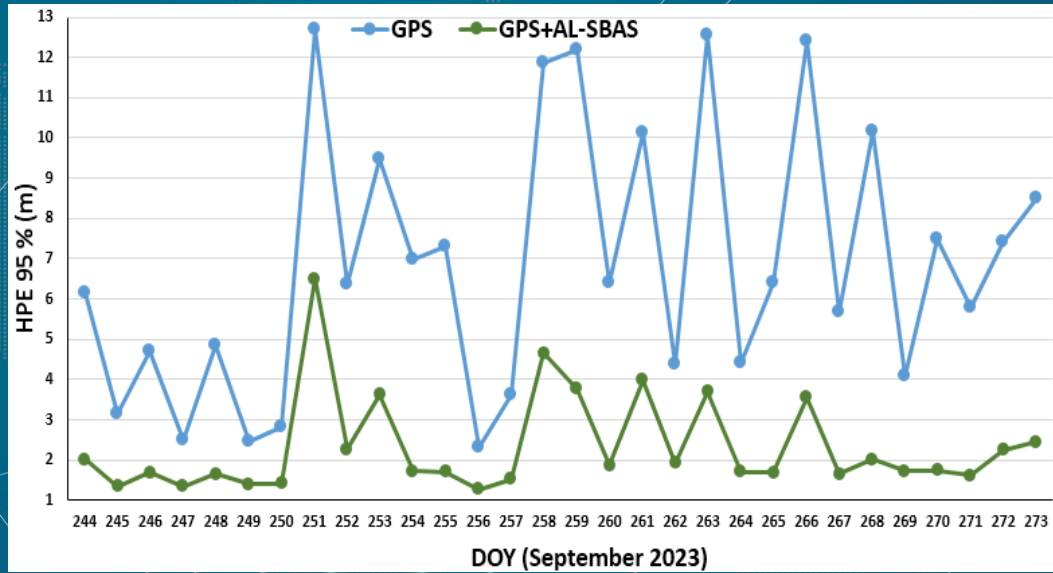
- S. Kahlouche, L. Tabti, A.B. Benbouzid, F. Outamazirt: Algerian satellite based augmentation system based on ALCOMSAT-1 : characteristics and preliminary performance tests. *International Meeting on the Applications of Global Navigation Satellite Systems*, 5 - 9 December 2022, Vienna, Austria.

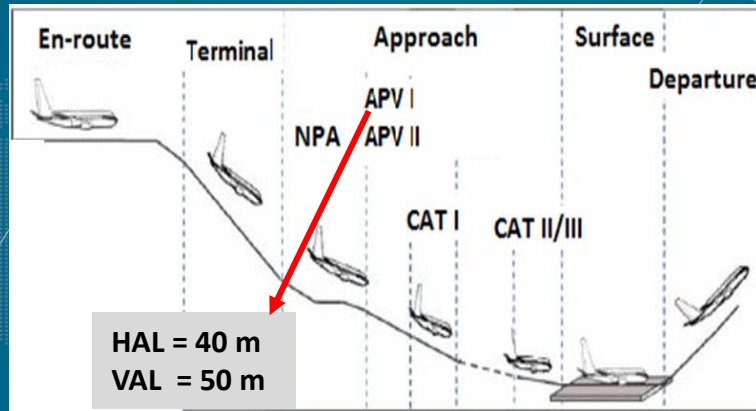
- L. Tabti, A.B. Benbouzid⁽²⁾, F. Outamazirt, Y.A Betchim, Y. Bouhafs, *Current status and Assessment performance of Algerian Augmentation System AL-SBAS based on Alcomsat-1*, ICG WG B: Enhancement of GNSS Performance, New Services and Capabilities, July 19 th, 2023,



AL-SBAS Performance tests : September 2023

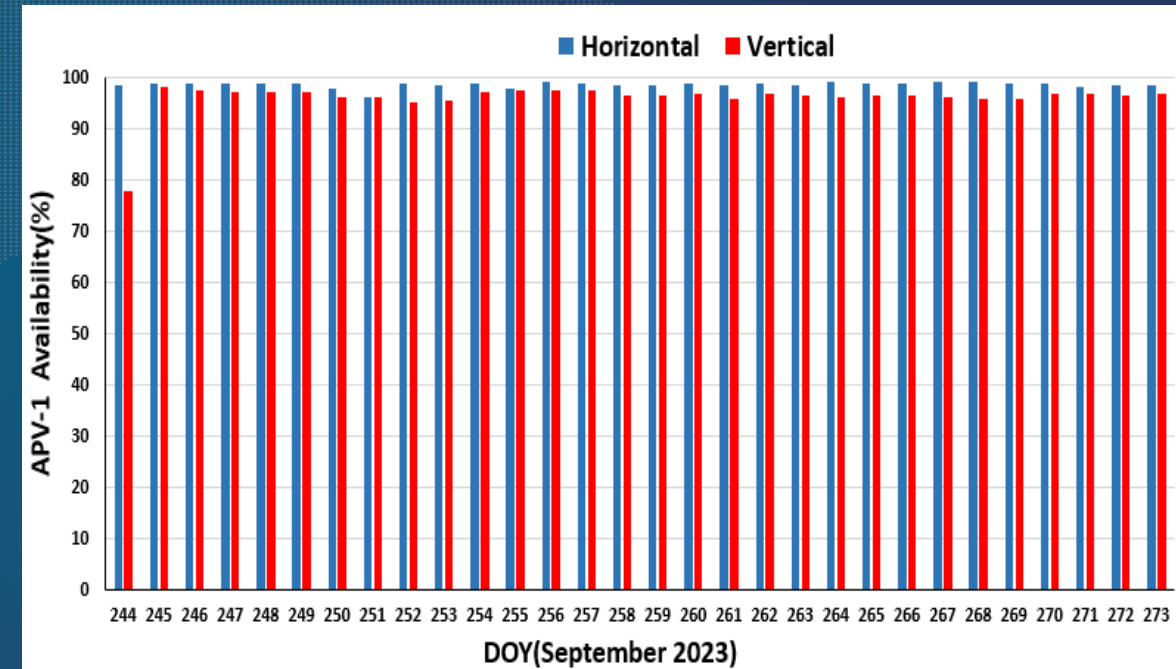
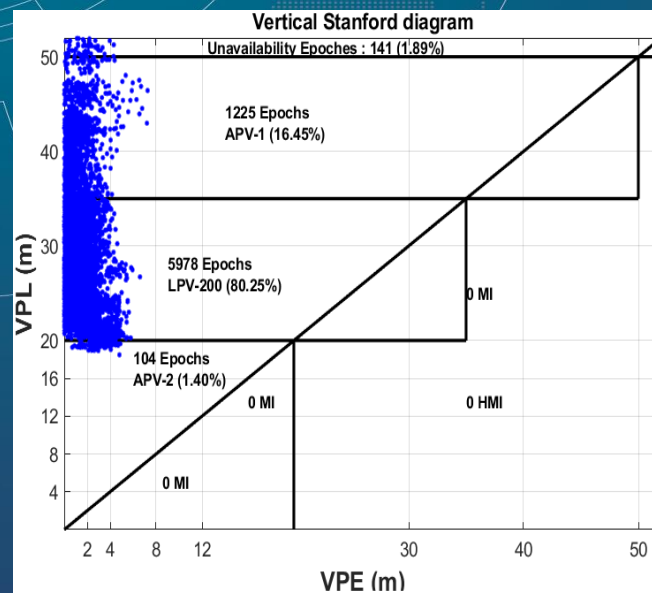
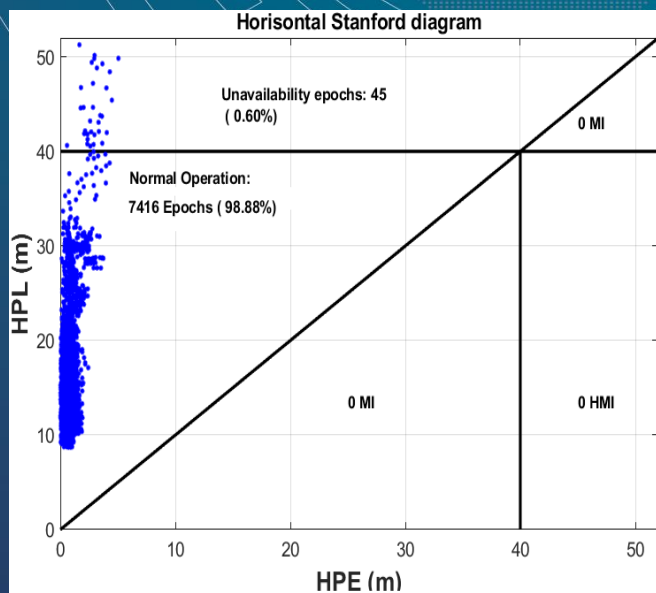
95 percentile position errors for Oran site in north Algeria





Availability : Protection level (PL) / Alarm limit (AL)

Integrity (2 September 2023: Stanford diagram)





Conclusion

- ❑ Algeria sets up the Algerian Satellite Based Augmentation System (AL-SBAS) shows so far good performance.
- ❑ The initial Single Frequency (SF) services of AL-SBAS with PRN 148 was started in July 20, 2020, the system operates permanently since this date.
- ❑ The initial tests have yielded very interesting results in term of precision (July 2021, October 2022 and September 2023),
- ❑ Algeria is taking short, medium and long-term actions to ensure that the AL-SBAS complies with the ICAO Standards and Recommended Practices. **Algeria intends that this step of action will be supported by the ICG.**
- ❑ To ensure system redundancy, Algeria encourages the cooperation with EGNOS and ANGA to significantly conduct the SBAS services deployment and provision to meet requirements of the aviation and extend the coverage of the AL-SBAS system and then ensures an uncut in the African areas.



AL-SBAS Perspective

- The Algerian space agency attaches great interest, through its 2020-2040 national space program, in order to ensure the continuity and sustainability of the AL-SBAS system and its effective implementation through the realization of the second Alcomsat-2 satellite and its related installations.
- Additionally, under this national space program, ASAL aims to strengthen its capacity building in the field of space technologies, especially highly qualified human resources in the field of GNSS and added value services.



ICG Membership benefits

- Algeria firmly believe that our participation in the ICG will enable our country to contribute to the ICG's mission and vision, while gaining valuable insights and collaborating with other GNSS providers, users, and related organizations.
- As a candidate member of the ICG, we look forward to actively participating in its initiatives, workshops, and working groups, and contributing to the ongoing dialogue and exchange of information among member states. We believe that our commitment will foster mutual learning and cooperation, supporting sustainable development, and benefiting both Algeria and the global community.
- In line with the ICG's mission statement, we share the ICG's vision of facilitating compatibility, interoperability, and transparency among all satellite navigation systems, promoting the use of their open service applications, and **ensuring the best satellite-based positioning, navigation, and timing for peaceful uses worldwide.**



ICG Membership benefits

- Contribute to technical interoperability to ensure seamless transitions between SBAS service areas.
 - Promote SBAS services and their widespread adoption.
 - Collaborate on research and development in technological areas within this field.
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- The benefits of this membership will allow Algeria to monitor and deal with current and future technological and operational aspects related to the development of the Algerian SBAS. This will ensure the continuity and availability of its services beyond the limits of Algerian airspace.



Thank You

