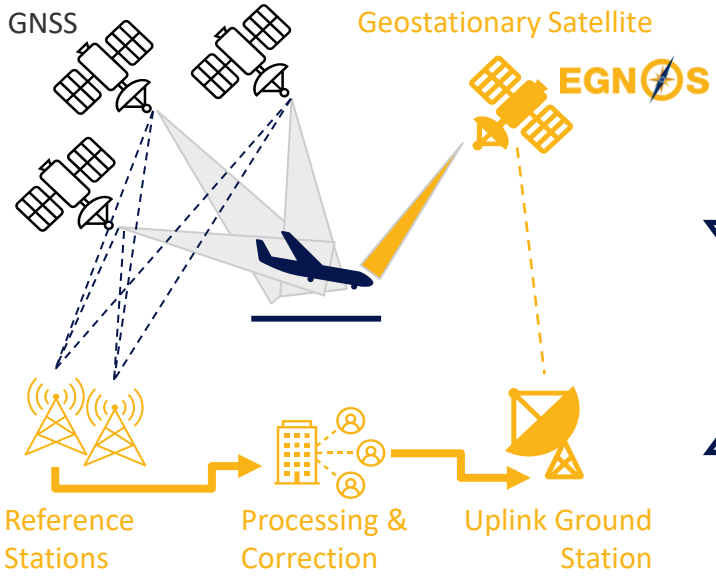
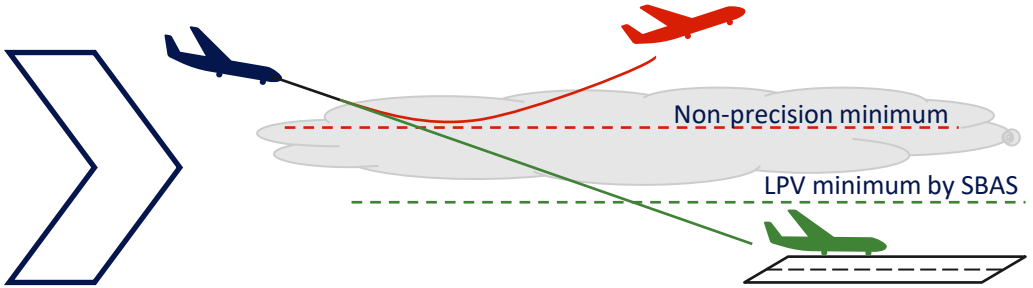
Implementation of LPV Operation – an Airline Perspective

EGNOS Workshop, 1.- 2. October 2025
Lufthansa Group

Internal

Satellite Based Augmentation System - How it works for aviation



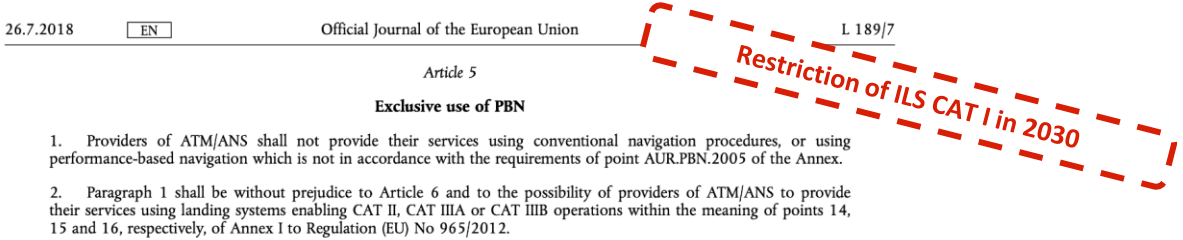


- Satellite based Approach Technology that augments the Global Navigation Satellite System (GNSS) using **geostationary satellites** which **broadcast the augmentation information to the Aircraft**.
- **Accuracy**, **integrity** and **availability** is **improved**.

- Lower **Localiser Performance with Vertical Guidance** (**LPV**) Minimum makes lower approaches to the runway in bad weather situations possible
  - **Less Delay, Disruption and Cancellation**
  - **Less Fuel Consumption and less CO2 Emission**

LUFTHANSA GROUP

SBAS/LPV - Why might we need SBAS and LPV in the future?



26.7.2018 EN Official Journal of the European Union L 189/7

Article 5

Exclusive use of PBN

1. Providers of ATM/ANS shall not provide their services using conventional navigation procedures, or using performance-based navigation which is not in accordance with the requirements of point AUR.PBN.2005 of the Annex.

2. Paragraph 1 shall be without prejudice to Article 6 and to the possibility of providers of ATM/ANS to provide their services using landing systems enabling CAT II, CAT IIIA or CAT IIIB operations within the meaning of points 14, 15 and 16, respectively, of Annex I to Regulation (EU) No 965/2012.

What will be the consequences of the Decommission of ILS CAT I ?

- Higher Minima at Airports without ILS CAT II & III
  - **Higher likelihood of Diversions** due to low cloud ceiling at Destination
  - **Higher alternate fuel** required due to low cloud ceiling at nearest Destination Alternate
- Number of Non-Precision Approach with Barometric Vertical Guidance would rise significantly
  - Higher likelihood of **false QNH Setting**

Localiser Performance with Vertical Guidance (LPV) Approaches with 200ft Minimum (Airbus: SLS)

- Same Minima as ILS CAT I
  - **Type B Approach** for Alternate Planning
  - Lower Decision Altitude
- SLS Approach with **Geometric Vertical Guidance**
  - Vertical Guidance not based on QNH
  - No Temperature Correction
  - Available at every Airport in SBAS areas

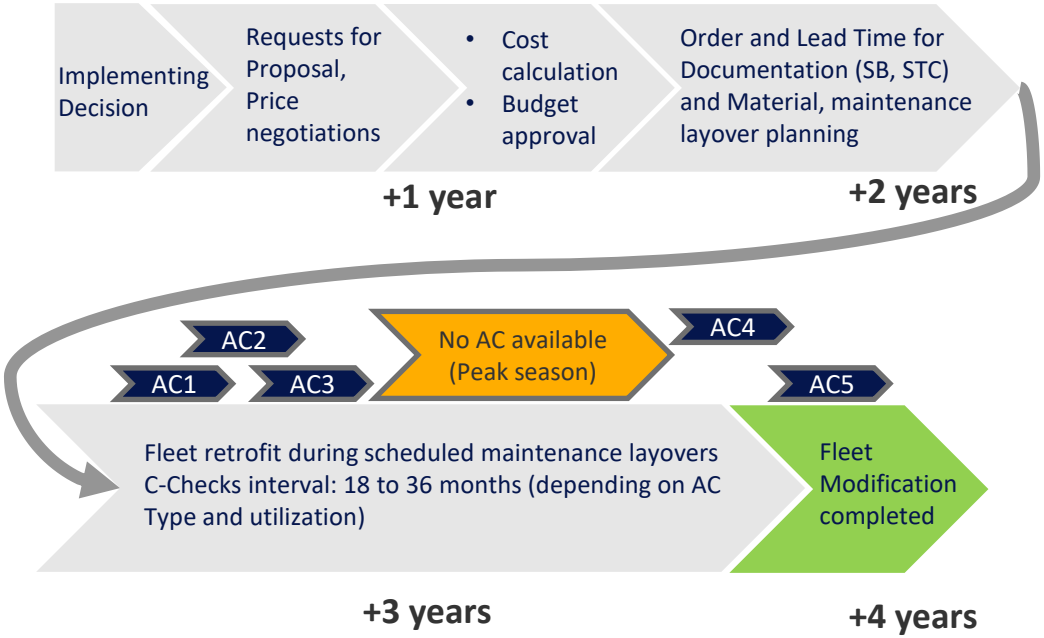
Risks:

- **Jamming and Spoofing** can lead to loss of SBAS/SLS Capability in RFI areas
- New **Multi Mode Receiver** needed -> **expensive and time-consuming upgrade** for older aircraft
- Possibility of “light Restriction of ILS CAT I” with **small effects on LHG Destinations without SLS Capability**

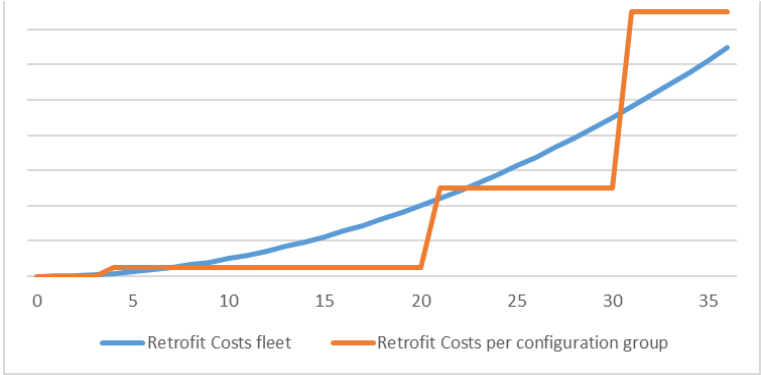
LUFTHANSA GROUP

SBAS/LPV - Challenges for retrofitting aircraft with LPV capability

Long Implementation Timeline for Retrofits



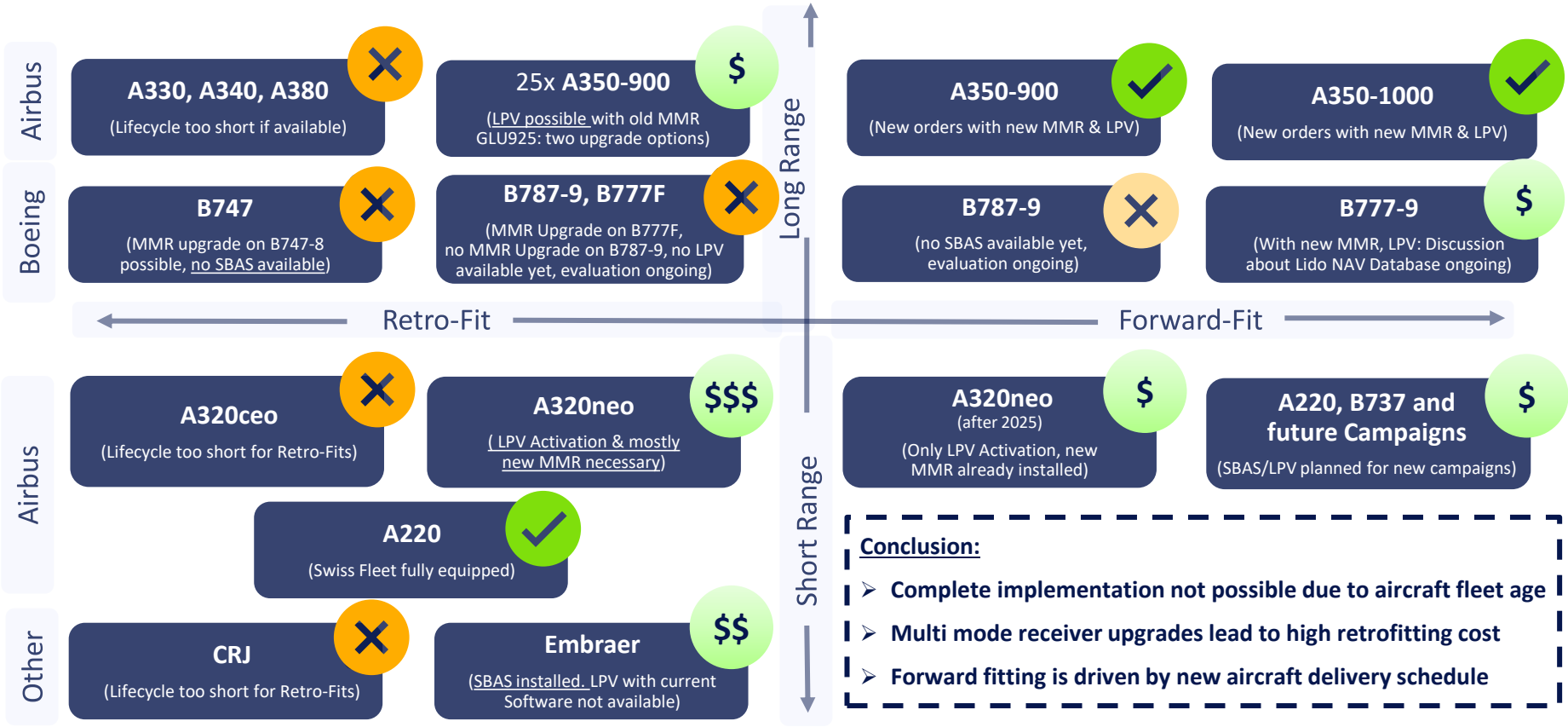
Retrofit cost over aircraft age in years



- Sub fleets per age have different preconditions even if same AC Type (e.g., A320ceo vs. A320neo)
- Old aircraft more expensive to retrofit
  Drivers:
  - Multi Mode Receiver Generation
  - Lacking GNSS integration or installation
  - Design/certification costs for small sub fleets

LUFTHANSA GROUP

SBAS/LPV - Lufthansa Group Aircraft fleet overview



Conclusion:

- **Complete implementation not possible due to aircraft fleet age**
- **Multi mode receiver upgrades lead to high retrofitting cost**
- **Forward fitting is driven by new aircraft delivery schedule**

LUFTHANSA GROUP


Thank you
for your attention

New Multi Mode Receiver and LPV Capability - Technology, Advantages and Risks

Multi Mode Receiver GLU2100 by Collins

Avionic Platform for future **Jamming and Spoofing Robustness** and enabling **Landing Capabilities LPV, GLS and RNP-AR**

Technology

SBAS and Localiser Performance with Vertical Guidance (LPV)

Satellite based Navigation Technology that augments Global Navigation Satellite Systems (GNSS) using geostationary satellites. **Accuracy, Integrity and Availability** of GNSS is improved.

GNSS Jamming and Spoofing

- Faulty or Corrupted Satellite Signal

Locked-up GPS after Radio Frequency Interference (RFI) till Landing

- No EGPWS available, no ADS-B Out available

Demand

ILS CAT I Decommissioning in Europe in 2030 (PBN-IR)

- Higher Minima at Airports without ILS CAT II & III
  - Higher likelihood of **diversions** and **higher alternate fuel**
- More RNP Approaches: Higher likelihood of **false QNH Setting**

Robust Avionics: Modern Multi Mode Receiver – GLU2100

- Solution for the Lock-up Problem acc. Airbus
- Software updates for increased RFI robustness from 2026 on
- Update for **Multi-Frequency** and **Multi Constellation** from 2030 onward

Advantages

LPV Approach with Geometric Vertical Guidance

- Vertical Guidance **not affected by false QNH** and **temperature**
- Available at every Airport in SBAS areas
- Lower Alternate Planning Minima due to **Type B Approach**

- **No immediate protection** against RFI & future adaptation by spoofer
- Updates may **not be free of charge** by manufacturers

Risks

- Jamming and Spoofing can still lead to **loss of SBAS/SLS Capability**
- Planning & Network: Will EU **stick to the Mandate for ILS Decommissioning?**

New MMR GLU2100 - Enables SLS and increases RFI Robustness

Über dem Irak

Passagierflugzeuge werden durch gefälschte GPS-Signale in die Irre geleitet

Manipulierte GPS-Signale machten verschiedene Crews in den letzten Tagen navigationsunfähig. Der Standort der Zwischenfälle ist besonders besorgniserregend.

Quelle: aerotelegraph.com

GPS Spoofing in the Middle East Is Now Capturing Avionics

Quelle: Forbes

Electronic Warfare Confounds Civilian Pilots, Far From Any Battlefield

Planes were built to trust GPS signals. Jamming and spoofing in the Middle East and Ukraine have diverted flights and caused inaccurate onboard alerts. Quelle: The New York Times

- **But will there be commercial air traffic without GNSS Navigation in the future?**

GNSS Jamming and Spoofing

- **Faulty or Corrupted Satellite Signal**
  - In the Middle East Regions observed
  - Risk of Navigation Failure (CF Info 07/2023 – "GPS Spoofing Irak")
- **Old Multi Mode Receiver Locked-up GPS after Radio Frequency Interference (RFI) till Landing (e.g. TFU 34.36.00.030 for all Airbus Aircraft)**
  - No EGPWS available
  - No SLS available
  - No ADS-B Out available

Click here

Robust Avionics: Modern Multi Mode Receiver (MMR) – GLU2100

- Solution for the Lock-up Problem acc. Airbus
- Update for **Multi-Frequency** (Communication with GNSS on multiple frequencies) and **Multi Constellation** (Connectivity to different GNSS, e.g. GPS + Galileo) from 2030 onward
- Phase updates for increased RFI robustness from 2026 on
- **OS-NMA Authentication mechanism of Galileo signals**

New MMR necessary to use SLS/SBAS on existing A320

- New Aircraft already equipped with latest MMR Gen

Risks:

- No immediate protection against RFI and adaptation by spoofer in the future
- Updates may not be free of charge by manufacturers

LUFTHANSA GROUP