Aircraft SBAS equipage to gain LPV capability

The experiences made by Ljungbyhed Aero Club

Ljungbyheds Flygklubb

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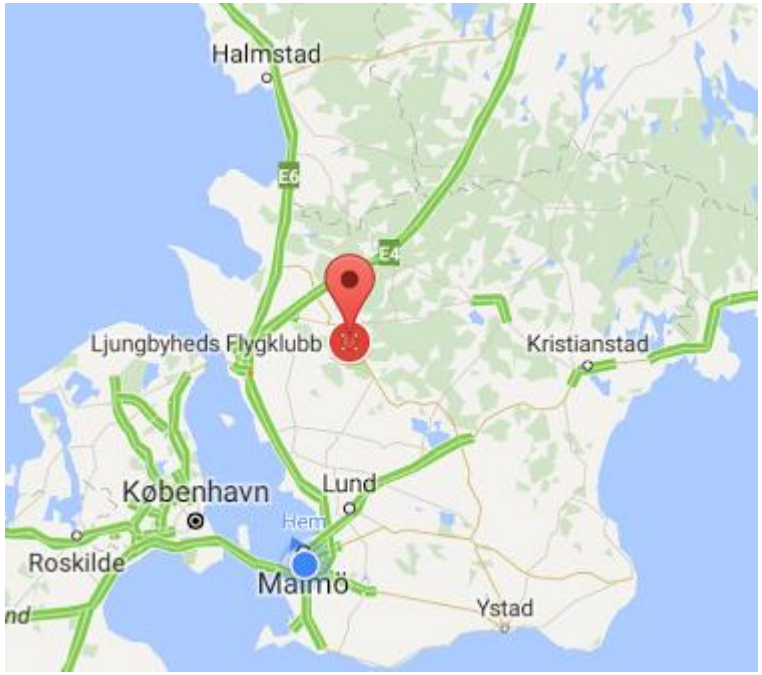
Background and scope of work

- Ljungbyheds Flygklubb (Ljungbyhed Aero Club) was awarded financial support from GSA within the scope of the EGUS SC2 Implementation Project with the purpose of
- **Upgrading one aircraft to get SBAS capability**
  - **Covering all steps in the process in order to get the certification and operational approval**

About Ljungbyhed Aero Club

- Ljungbyheds Aero Club is located in southern Sweden at Ljungbyhed airport, ESTL
  - The airport itself is also included in the project
  - Financial support for developing LPV approaches
- Club fleet of gliders and motor aircraft
  - Piper PA28, Piper PA32R, Diamond Star DA40-180 and Robin DR400/180R
- Flight school, RF, providing Private Pilot License training



Which aircraft to upgrade?

The Piper aircraft

- Have Garmin GNS430 NAV/COM/GPS
- Approved for non-precision RNP APCH (LNAV minima)
- GNS430 have 8.33kHz COM channel spacing – a requirement for IFR flight in many countries

Robin DR400/180R

- Mainly used as glider tug.
- No GPS installed

Diamond DA40-180

- KLN94 GPS - Approved for non-precision RNP APCH (LNAV minima)
- KX155A NAV/COM - Only 25kHz VHF COM channel spacing

Upgrade this aircraft

By upgrading the Diamond Star DA40-180

- We gain APV SBAS capability
- AND
- Maintain the IFR flight capability by adding 8.33kHz VHF COM channel spacing

Which SBAS receiver to install?

Garmin GNS530W & GNS430W – Discontinued

- Do not come with AML STCs → risk of high fees and tedious paper work
- Might require EASA Major Modification to get both LPV and P-RNAV approval

Avidyne IFD540 – Not yet EASA approved

Garmin GTN750 – Too large to fit in aircraft panel

Garmin GTN650 – Selected GPS

- AML STCs exist for Garmin GTN series → lower fees and easier paper work

SBAS Equipment Installation Experience

- Garmin GTN 650 SBAS receiver is installed in the aircraft
  - About 1 weeks work at the avionics shop

- Even though the GTN 650 comes with an AML STC for some unknown reason each installation still requires an individual EASA Minor Modification Approval
  - **It took EASA several months to issue the Minor Modification**

The long road towards EASA Minor Modification Approval 1/2

- Request for Minor Modification Approval submitted to EASA February 2015
- EASA delegated the work to the Dutch CAA
- The Dutch CAA requests post installation test flight data in order to issue the minor modification approval!?
  - In other GTN 650 installations by the avionics shop test flight data was not requested
  - What could possibly warrant test flight data for a simple GTN 650 installation?
- Flight test results were submitted April 2015

The long road towards EASA Minor Modification Approval 2/2

- Dutch CAA refused to issue Minor Modification Approval due to that the aircraft has only one 8.33kHz VHF COM radio
  - There exist **no aircraft rules** requiring dual 8.33kHz VHF COM radios
  - There might exist **airspace rules** requiring dual 8.33kHz VHF COM radios
  - The GTN650 AML STC does not require dual 8.33 VHF COM radios
- Avionics shop finally manages to convince the Dutch CAA to drop the requirement for dual 8.33 VHF COM radios
- Minor Modification Approval is stalled because the Dutch CAA forgot to correctly sign all necessary documents
- EASA Minor Modification Approval is issued in July 2015
  - It took **6 months to get the Minor Modification Approval!**

EASA Minor Modification Approval - Conclusion

- EASA is non-deterministic and makes it hard to schedule SBAS APV work
- Why does some Minor Modifications need flight test data and some not?
  - NO flight test data should be needed for any APV SBAS installation in small aircraft
- Do not mix up aircraft regulations and airspace regulations
- Why does the Dutch CAA quote national rules when acting on behalf of EASA?
- There seem to exist confusion among national CAAs when it comes to 8.33kHz VHF COM rules
- Stop requiring a Minor Modification Approval for SBAS installations when an AML STC exists

Pilot Qualifications – Is Operational Approval Needed?

- Operational Approval – YES or NO?
  - Swedish CAA were initially of the opinion that CAA approved RNP pilot training is needed for APV operations
  - Swedish AIC 01-14 **IMPLEMENTATION OF APPROACH PROCEDURES WITH VERTICAL GUIDANCE (APV) IN SWEDISH AIRSPACE**

    Airworthiness and operational requirements
    The operator must have an approval for APV SBAS issued by its Civil Aviation Authority (with reference to EASA AMC 20-28 or equivalent).
  - When specifically requesting legal references supporting the view that operational approval is needed, I received written clarification from the Swedish CAA confirming that there currently are no rules requiring operational approval
  - **→ NO operational approval is needed!**
  - It is unfortunate that incorrect information is published in the Swedish IAIP
    - The Swedish ANSP LFV that publishes the IAIP has been notified

LPV Wish List

- IFR is safer that VFR
- Approaches with vertical guidance are safer than approaches without vertical guidance

- Make it easy to install APV SBAS receivers
  - Stop requiring Minor Modification Approval when AML STC exists
- Make it easy for pilots to fly APV SBAS procedures
  - Please do not start requiring extensive and expensive RNP Approach training
- Instrument approaches are safer than VFR landings in marginal visibility
  - Allow APV SBAS approaches at aerodromes without ATC or AFIS

APV Baro-VNAV (LNAV/VNAV) approaches and aircraft with APV SBAS

- Some airports only have RNP approaches with APV Baro-VNAV LNAV/VNAV minima. No APV SBAS LPV minima.
- Unclear if APV Baro-VNAV procedures are checked and coded as being obstacle safe for angular deviation to allow APV SBAS receivers to provide a glideslope
- It is not easy (possible) for pilots to know if they will get a glideslope when flying approaches with LNAV/VNAV minima
- It is not easy for pilots to know if they may legally fly approaches to LNAV/VNAV minima based on SBAS
- Germany allows SBAS aircraft to fly LNAV/VNAV approaches
  - See next slide

Germany on APV Baro-VNAV (LNAV/VNAV) approaches and aircraft with APV SBAS

USE OF EGNOS ON RNAV (GPS) OR RNP APPROACH PROCEDURES WITH VERTICAL GUIDANCE

The use of the European Satellite Augmentation System (SBAS) “EGNOS” has been approved for operations on the RNAV(GPS)/RNP approach procedures published for APV procedures (APV baro-VNAV up to the published "LNAV/VNAV" minimum, APV-SBAS up to the published “LPV” minimum).

Class 2, 3 or 4 approved SBAS aircraft avionics are a requirement for the use of vertical guidance with “EGNOS” on APV baro-VNAV procedures (LNAV/VNAV minimum).

Information on the system availability of “EGNOS” will be published by NOTAM in the case of negative availability. Otherwise, it may be assumed that the “EGNOS” system is ready for operation.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