



*GNSS Flight Inspection and  
Flight Procedure Validation*

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*GNSS Flight Inspection overview*

*GNSS Procedures*  
*Flight Inspection Requirements*  
*Sensors*  
*Flight Inspection Results*  
*Summary*

# *GNSS Procedures*

## *GNSS System*

*ABAS*

*SBAS*

*GBAS*

## *Procedures*

*LNAV / npGPS*

*LNAV / Baro VNAV*

*LNAV / VNAV*

*LPV / LP*

*GBAS*

# *SBAS systems*

## *US: WAAS*

*Wide Area Augmentation System*

## *Europe: EGNOS*

*European Geostationary Navigation Overlay Service*

## *Japan: MSAS*

*Multi-functional Satellite Augmentation System*

## *India: GAGAN*

*GPS Aided Geo Augmented Navigation*

## *SBAS systems*

*Space Based Augmentation System.*

*Basic principle:*

*GPS parameters measured by ground reference stations and relayed to SBAS receivers through dedicated satellites.*

*Goal:*

*Improve GPS accuracy, integrity and safety.*

## *SBAS systems*

*Typical errors that are corrected:*

*Ionospheric conditions*

*Satellite ephemeris*

*Satellite clock*

*→ Normal accuracy: 1-2m*

## *SBAS procedures*

*SBAS can be used for all GNSS procedures except GBAS.*

*LPV procedures are the highest precision GNSS procedures to be flown by SBAS at present without special approval (RNP 0.15 AR – (Authorization required))*

*LPV*

*Localizer Performance with Vertical guidance.  
Gives guidance similar to ILS.*

*Correction data via SBAS  
FAS Data block – part of navigation database  
in Aircraft FMS / GNSS receiver.*

## *FAS Data*

*Final Approach Segment Data-block used for LPV and GBAS procedures.*

*Defines the approach vector to the runway.*

*Includes position of approaching threshold and far end of runway, GP angle and course width++*

# FAS Data

| Field                              | SBAS/GBAS | Range/Format/Resolution   |
|------------------------------------|-----------|---|
| Block Type                         | SBAS/GBAS |   |
| Operation Type                     | SBAS/GBAS | SBAS {[0]Straight In, [1-15]Reserved},<br>GBAS {[0]Straight In, [1]Terminal Area<br>Path, [2]Missed Approach, [3-<br>15]Spare}  |
| SBAS Provider                      | SBAS/GBAS | SBAS {[0]WAAS, [1]EGNOS, [2]MSAS,<br>[3-13]Spare, [14]GBAS Only, [15]Any<br>SBAS Provider}, GBAS {[14]GBAS Only}  |
| Airport Identifier                 | SBAS/GBAS | [A-Z\\d]{0..4}  |
| Runway                             | SBAS/GBAS | {[0] None, [1] R, [2] L, [3] C}   |
| Approach Performance<br>Designator | SBAS/GBAS | SBAS {[0]LPV, [1]Category I,<br>[2]Reserved for Category II,<br>[3]Reserved for Category III, [4-<br>7]Spare}, GBAS {[0]GSL A OR GSL B,<br>[1]GSL C, [2]GSL D, [3]GSL E, [4]GSL F,<br>[5-7]Spare} |

# FAS Data

| Field                               | SBAS/GBAS | Range/Format/Resolution |
|-------------------------------------|-----------|-------------------------|
| Route Indicator                     | SBAS/GBAS | [A-HJ-NP-Z]{0,1}        |
| Reference Path Data Selector        | SBAS/GBAS | 0 - 48                  |
| Reference Path Identifier           | SBAS/GBAS | [A-Z\d]{0,4}            |
| LTP/FTP Latitude                    | SBAS/GBAS | DDMMSS.ssss[N S]        |
| LTP/FTP Longitude                   | SBAS/GBAS | DDDMMSS.ssss[W E]       |
| LTP/FTP Ellipsoidal Height (metres) | SBAS/GBAS | -512.0 - 6041.5, 0.1    |
| FPAP Latitude                       | SBAS/GBAS | DDMMSS.ssss[N S]        |
| FPAP Longitude                      | SBAS/GBAS | DDDMMSS.ssss[W E]       |
| Threshold Crossing Height           | SBAS/GBAS | {[0]ft, [1]m}           |
| Glidepath Angle (degrees)           | SBAS/GBAS | 0.0 - 90.0, 0.01        |
| Course Width (metres)               | SBAS/GBAS | 80 - 143.75, 0.25       |
| Length Offset (metres)              | SBAS/GBAS | 0 - 2032, 8             |
| HAL                                 | SBAS Only | 0.0 - 50.8, 0.2         |
| VAL                                 | SBAS Only | 0.0 - 50.8, 0.2         |
| CRC Value                           | SBAS/GBAS | HEX                     |

## *FAS Data*

*Verification of correct data and CRC is important.*

*FAS data obtained from procedure designers can be loaded into flight inspection systems via removable media for verification of correct CRC and correctness of facility data.*

# GBAS

*Ground Based Augmentation System  
Dedicated GLS stations on airport.*

## US: LAAS

*Local Area Augmentation System*

*Correction data and FAS data transmitted from  
GLS on VHF Data Broadcast to aircraft.*

# GBAS

*Aircraft GBAS receiver is connected to NAV antenna and GPS antenna.*

*The GBAS receiver is tuned to the airport VDB station and the appropriate procedure is selected through the Reference Path Data Selector (RPDS).*

*GBAS receiver use the received FAS data and correction data to calculate a ILS look alike guidance signal.*

# Requirements

*ICAO Doc 8071 Vol II defines the requirements for flight inspection of GNSS procedures and validation of the instrument flight procedures.*

*Requirements*  
*ABAS: LNAV / npGPS*  
*(Chapter 2, ICAO Doc 8071 Vol-II):*

*Validation of Procedure design according to chapter 5  
instrument flight procedure validation;*

*Fly the full procedure from initial approach to missed approach.*

*Visual verification of Missed Approach Point (MAPt)*

*Check flyability of procedure and obstacle clearance.*

*Check for Interferences. Look for Receiver Autonomous  
Integrity Monitoring (RAIM) alerts.*

*Check GNSS signal quality.*

# Requirements

## SBAS

*(Chapter 3, ICAO Doc 8071 Vol-II):*

*Validation of Procedure design according to chapter 5  
instrument flight procedure validation.*

*Fly the full procedure from initial approach to missed approach.*

*Visual verification of Missed Approach Point (MAPt)*

*Check flyability of procedure and obstacle clearance.*

*Check for Interferences.*

*Check GNSS signal quality.*

*Verify FAS data and CRC for LPV procedures.*

# Requirements

## GBAS

*(Chapter 4, ICAO Doc 8071 Vol-II):*

*Validation of Procedure design according to chapter 5  
instrument flight procedure validation.*

*Check flyability of procedure and obstacle clearance.*

*Check for Interferences.*

*Measure VDB Coverage.*

*Check GNSS signal quality.*

*Compare accuracy with FI position reference system (E.g. RTK)*

*Verify FAS data and CRC.*

# Requirements

## GBAS

*(Chapter 4, ICAO Doc 8071 Vol-II):*

*Flight Inspection procedures for GBAS:*

*VDB coverage arc +/- 10 deg @ 20NM.*

*VDB coverage arc +/- 35 deg @ 15NM.*

*VDB coverage Level runs from 21NM @ 10000ft.*

*VDB coverage Level runs from 21NM @ 2000ft*

*Final Approach path.*

*Logging of VDB signal strength and GNSS signal quality.*

## *Why Flight Inspection of GNSS?*

*GNSS signal itself can not be calibrated, but the following data must be verified / measured:*

- *Verification that all procedure data are correct*
- *Flyability*
- *Terrain / Obstacle clearance check – when flying Baro-VNAV; be aware of obstacle clearances in temperatures lower than standard since aircraft is below indicated altitude.*
- *RF Interference check*

# *Why Flight Inspection of GNSS?*

*Continental Drift / Earthquakes can invalidate previous checked FAS data.*

*New Obstacles can be a safety issue.*

## *Sensors*

*Main philosophy:*

*Aircraft should be equipped to fly procedure.*

*SBAS capable cockpit equipment.*

*(For GBAS - guidance is normally provided to cockpit from FIS installed GBAS receiver)*

*The Flight Inspection System (FIS) must be equipped to analyze received signals.*

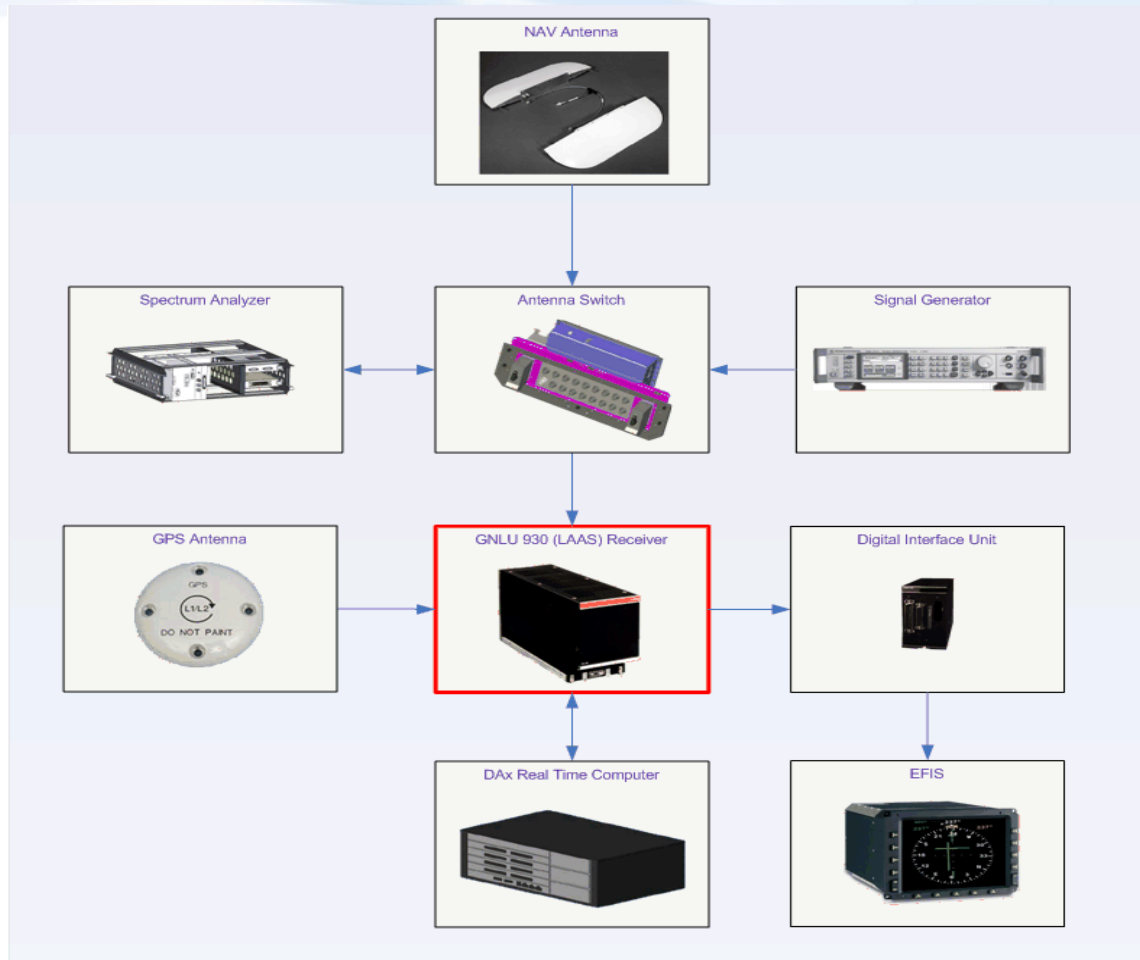
# GMLU 930

*Collins GMLU-930 Multi Mode Receiver  
often used for GBAS and SBAS flight  
inspection.*

*The unit operates with dedicated flight  
inspection firmware to support the  
output of extensive data related to flight  
inspection of GPS, SBAS and GBAS  
procedures.*



# GNLU 930 Connections:



# GNLU 930

## Example of available data:

Calculations and Algorithms Control System [RC.4.2.4.3 - May 26 2011]

Console ID: [ ] Client connection: [DAX] [FOX] [RPX] [Six] [OBx] [UCx] [ADx] [CVx] System: Heart beat: 53393 Tolerance: MANINV Run Local FOX: Start FOX

DADC2 IRU1 IRU2 IRU3 VHF1 UHF1 CMU1 OSS EMM1 EMM2 EMM3 SG1 SG2 1020Hz  
 Server Analyzer Test Event ALT1 HYPOx GPS1 GPS2 GNLU1 THEO1 NAV1 NAV2 DME1 DME2 XPDR1 MKR1 MKR2 FMS1 FMS2 DADC1

**DataRX** | MLS | MLS Data Words | GLS | GLS RS-422 | GLS Status | GNLU Status | SBAS

**Collins\_GNLU955**  
 Delay 0  
 Serial -  
 SDI 0  
 Src\_id 10087

**Dup [46182]**  
 No payload 0  
 is NULL 0

**Arinc 429 Dup [40650]**  
 Arinc 429 40650  
 Parity Failure 0  
 Unknown label 13176  
 Last unknown [ILS] o254

**Serial**  
 RS422 5532

**Landing Mode**  
**[4] GLS Mode**  
 NAV: GBAS Mode

Msg 102: Visible Satellite Information  
 Reference Station ID SBGL Station Latitude [°] -22,8004  
 Operating Receivers 4 Station Longitude [°] -43,2495  
 Accuracy Designator 2 Station Height [m] 7,74

Msg 103: Position, Velocity, Time Solution

Msg 106: Differential GPS Status

Msg 107: RAIM Data  
 Local MagVar [°] -21

Msg 115: Ground Station Information  
 Validity 1 [Valid]  
 RSDS 0

Msg 140: TAP Data Status  
 Dmax [m] 42000

**GNLU Tuning**

Freq/Ch and Mode [o33] Landing Mode: [GLS] MLS Channel [o36] Runway Heading [o17] Az Angle [o153] GP Angle [o155] Back Az [o175]  
 Landing Mode: [GLS] MLS Ch.: [600] Rwy hdg: [0] Az Angle [0] GP Angle [3.0] Back Az [0]  
 Freq: [108.7] RPDS: [029]  AutoSelect  
       
 SSM: [0] Tuning word send to DAX: 0x00000000 00000000 00000000 00000000

DAX Sync: utcNONE | System State: ssIDLE

# GNLU 930

## Example of available data:

Calculations and Algorithms Control System [RC.4.2.4.3 - May 26 2011]

Console ID: [ ] Client connection: [DAX] [FOX] [RFX] [Six] [OBx] [UCx] [ADx] [CVx] System: Heart beat: 53393 Tolerance: MANINV Run Local FOX: Start FOX

DADC2 IRU1 IRU2 IRU3 VHF1 UHF1 CMU1 OSS EMM1 EMM2 EMM3 SG1 SG2 1020Hz  
 Server Analyzer Test Event ALT1 HYPOx GPS1 GPS2 GNLU1 THEO1 NAV1 NAV2 DME1 DME2 XPDR1 MKR1 MKR2 FMS1 FMS2 DADC1

**DataRX** | MLS | MLS Data Words | GLS | GLS RS-422 | GLS Status | GNLU Status | SBAS

**Collins\_GNLU955**  
 Delay 0  
 Serial -  
 SDI 0  
 Src\_id 10087

**Dup [46182]**  
 No payload 0  
 is NULL 0

**Arinc 429 Dup [40650]**  
 Arinc 429 40650  
 Parity Failure 0  
 Unknown label 13176  
 Last unknown [ILS] o254

**Serial**  
 RS422 5532

**Landing Mode**  
**[4] GLS Mode**  
 NAV: GBAS Mode

Msg 102: Visible Satellite Information Receiver mode is: NAV: GBAS Mode HDOP 0,89 Horiz.Error [m] 0  
 Msg 103: Position, Velocity, Time Solution VDOP 1,34 Vert.Error [m] 1  
 Msg 106: Differential GPS Status GPS Time 399882,01 UTC Time 54267,01 PDOOP 1,6 Time Error [m] 0  
 GPS Week 616 UTC Date 1991/10/31 TDOP 0,81 Vel.Error [m/s] 0  
 Set Time 268545 Sat.Used 9 GDOP 1,78  
 Msg 107: RAIM Data  
 Msg 115: Ground Station Information  
 Msg 140: TAP Data Status  
 Latitude [°] -22,8468 ECEF X 4273042,75 Vel. East [m/s] -75,06  
 Longitude [°] -43,4022 ECEF Y -4041131,48 Vel. North [m/s] -77,29  
 Altitude [m] 628,6 ECEF Z -2461338,46 Vel. Up [m/s] -0,16

| ID | PRN | Used in pos  | Ch. activity      | State           | C/N [dBHz] |
|----|-----|--------------|-------------------|-----------------|------------|
| 0  | 25  | [3] Used     | [5] Code tracking | [3] Tracking OK | 47         |
| 1  | 29  | [3] Used     | [5] Code tracking | [3] Tracking OK | 50         |
| 2  | 21  | [3] Used     | [5] Code tracking | [3] Tracking OK | 48         |
| 3  | 6   | [3] Used     | [5] Code tracking | [3] Tracking OK | 41         |
| 4  | 18  | [3] Used     | [5] Code tracking | [3] Tracking OK | 47         |
| 5  | 16  | [3] Used     | [5] Code tracking | [3] Tracking OK | 45         |
| 6  | 31  | [0] Not used | [5] Code tracking | [3] Tracking OK | 41         |
| 7  | 15  | [3] Used     | [5] Code tracking | [3] Tracking OK | 48         |
| 8  | 22  | [3] Used     | [5] Code tracking | [3] Tracking OK | 48         |
| 9  | 26  | [3] Used     | [5] Code tracking | [3] Tracking OK | 43         |
| 10 | 120 | [0] Not used | [5] Code tracking | [3] Tracking OK | 43         |
| 11 | 133 | [0] Not used | [5] Code tracking | [3] Tracking OK | 43         |

**GNLU Tuning**

Freq/Ch and Mode [o33] MLS Channel [o36] Runway Heading [o17] Az Angle [o153] GP Angle [o155] Back Az [o175]  
 Landing Mode: [GLS] MLS Ch.: [600] Rwy hdg: [0] Az Angle [0] GP Angle [3.0] Back Az [0]  
 Freq: [108.7] RPDS: [029]       
 SSM: [0] Tuning word send to DAX: 0x00000000  
 00000000 00000000 00000000 00000000

DAX Sync: utcNONE | System State: ssIDLE

# GNLU 930

## Example of available data:

Calculations and Algorithms Control System [RC.4.2.4.3 - May 26 2011]

**Console ID**

**Client connection**

DAx
  FOx
  RPx
  Sbx
  OBx
  UCx
  ADx
  CVx

**System**

Heart beat: 53393  
Tolerance: MANINV

**Run Local FOX**

Start FOX

---

DADC2 | IRU1 | IRU2 | IRU3 | VHF1 | UHF1 | CMU1 | OSS | EMM1 | EMM2 | EMM3 | SG1 | SG2 | 1020Hz

Server | Analyzer | Test | Event | ALT1 | HYPOx | GPS1 | GPS2 | GNLU1 | THEO1 | NAV1 | NAV2 | DME1 | DME2 | XPDR1 | MKR1 | MKR2 | FMS1 | FMS2 | DADC1

**DataRX**

MLS | MLS Data Words | GLS | GLS RS-422 | GLS Status | GNLU Status | SBAS

**Collins\_GNLU955**

Delay 0  
Serial -  
SDI 0  
Src\_id 10087

**Dup [46182]**

No payload 0  
is NULL 0

**Arinc 429 Dup [40650]**

Arinc 429 40650  
Parity Failure 0  
Unknown label 13176  
Last unknown [ILS] o254

**Serial**

RS422 5532

**Landing Mode**

**[4] GLS Mode**  
NAV: GBAS Mode

Msg 102: Visible Satellite Information

Msg 103: Position, Velocity, Time Solution

Msg 106: Differential GPS Status

Msg 107: RAIM Data

Msg 115: Ground Station Information

Msg 140: TAP Data Status

|            |           |          |     |
|------------|-----------|----------|-----|
| GPS Time   | 399882,01 |          |     |
| GPS HIL    | 3,3       | LAAS HPL | 3,3 |
| GPS VIL    | 5,7       | LAAS VPL | 5,7 |
| PRR Vector |           |          |     |
|            | 1         | 0        |     |
|            | 2         | 0        |     |
|            | 3         | 0        |     |
|            | 4         | 0        |     |
|            | 5         | 0        |     |
|            | 6         | 0        |     |
|            | 7         | 0        |     |
|            | 8         | 0        |     |
|            | 9         | 0        |     |
|            | 10        | 0        |     |
|            | 11        | 0        |     |
|            | 12        | 0        |     |
|            | 13        | 0        |     |

|                |         |              |      |
|----------------|---------|--------------|------|
| Fault detected | 0 [No]  | Alt valid    | 0    |
| Fault count    | 0       | Alt type     | 2    |
| Isolated fault | 0       | Alt residual | 0    |
| RAIM avail     | 1 [Yes] | Alt in pvt   | 0    |
| Horz int thr   | 555,6   | Sigma baro   | 1017 |
| Parity vec mag | 0,1     | K Baro B     | 0    |
| Num of meas    | 9       | Timetag      | 0    |
| VDOP Alt       | 12,8    | Sigma VC     | 1017 |
| Alt cal thr    | 3,3     |              |      |
| Fault det thr  | 6,2     |              |      |
| HUL            | 3,3     |              |      |

**GNLU Tuning**

|   |   |  |  |  |  |
|---|---|--|--|--|--|
| Freq/Ch and Mode [o33]<br>Landing Mode: <input type="text" value="GLS"/><br>Freq: <input type="text" value="108.7"/><br>RPDS: <input type="text" value="029"/><br><input type="button" value="Tune o33"/> | MLS Channel [o36]<br>MLS Ch.: <input type="text" value="600"/><br><input type="button" value="Tune o36"/> | Runway Heading [o17]<br>Rwy hgd: <input type="text" value="0"/><br><input type="button" value="Tune o17"/> | Az Angle [o153]<br>Az Angle <input type="text" value="0"/><br><input checked="" type="checkbox"/> AutoSelect<br><input type="button" value="Tune o153"/> | GP Angle [o155]<br>GP Angle <input type="text" value="3.0"/><br><input type="button" value="Tune o155"/> | Back Az [o175]<br>Back Az <input type="text" value="0"/><br><input type="button" value="Tune o175"/> |
|---|---|--|--|--|--|

Tuning word send to DAx: 0x00000000  
00000000 00000000 00000000 00000000

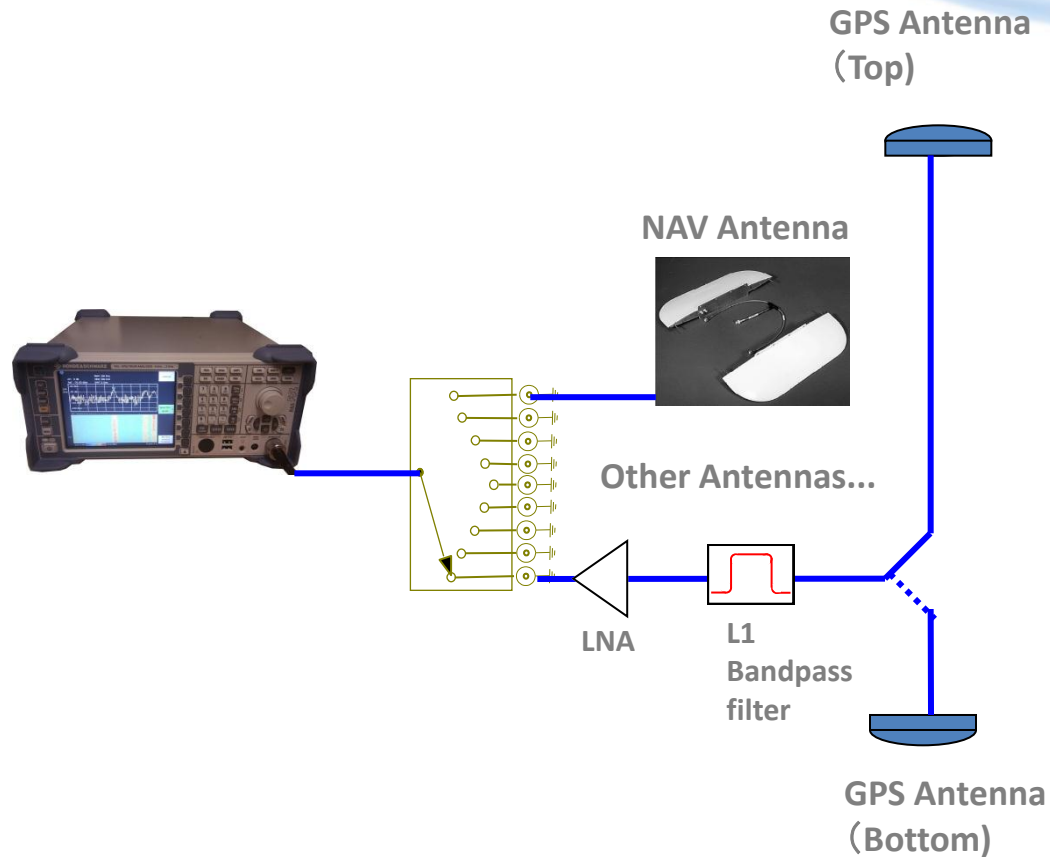
DAx Sync: utcNONE | System State: ssIDLE

# Spectrum Analysis



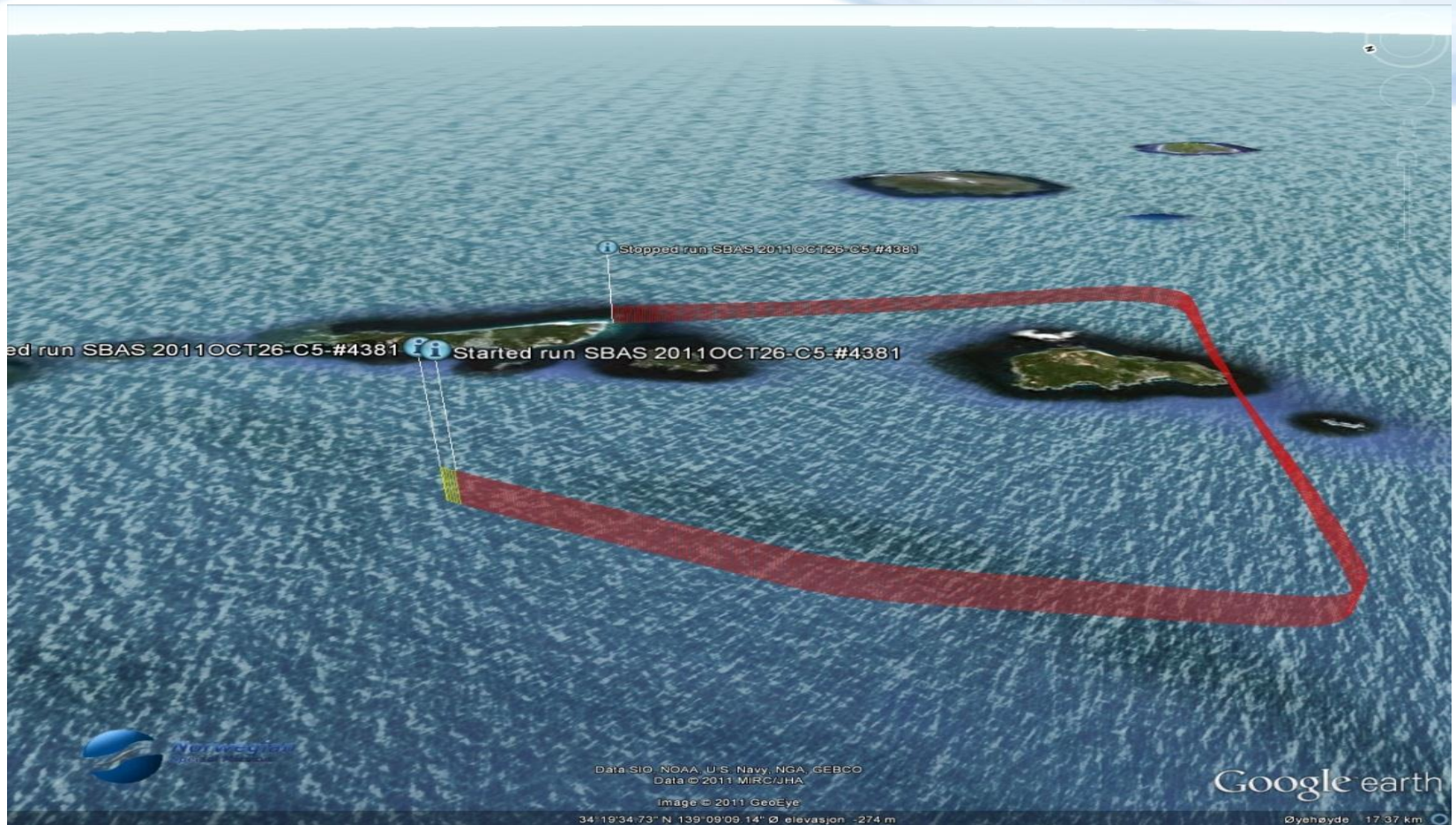
*Spectrum Analyser is used for detection of interference in GPS band and VDB band (GBAS)*

# Spectrum Analysis Connections:



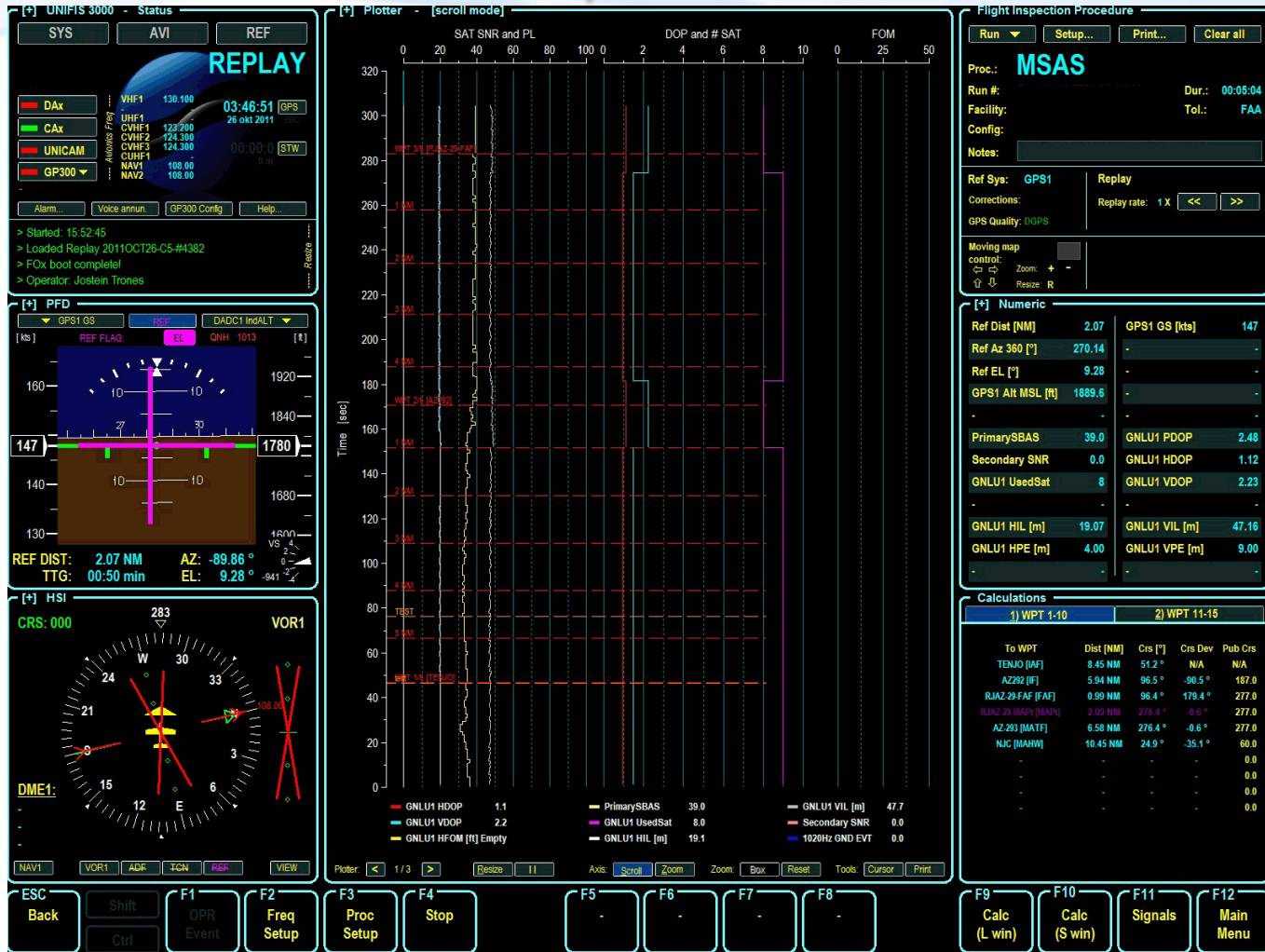
# Flight Test Results

## Example SBAS:



# Flight Test Results

## Example SBAS:



# Flight Test Results

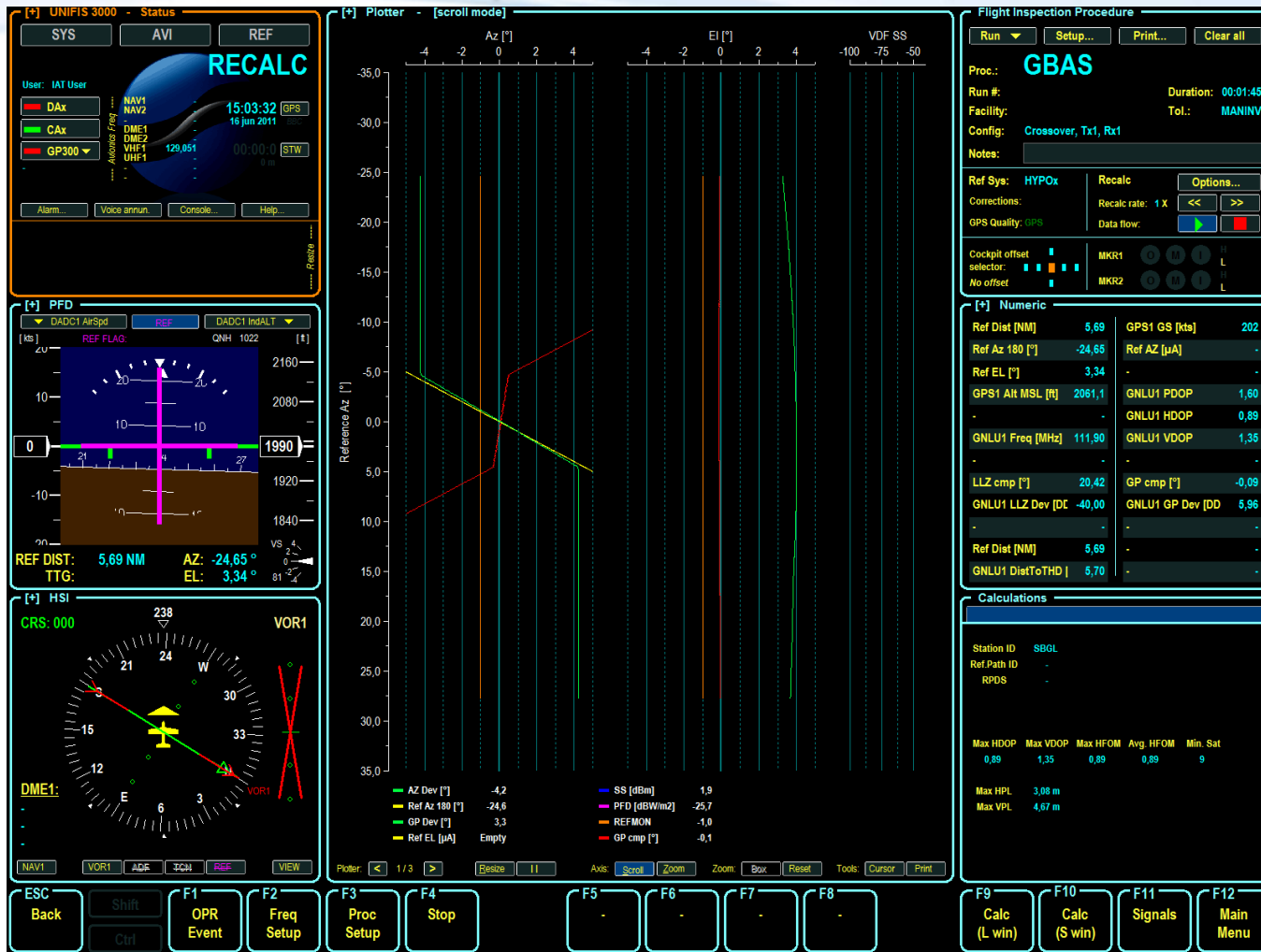
## Example SBAS:

[+] Calculations (large)

|              | 1) SBAS   |           |           |           |           | 2) WPT Overview |           |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------------|-----------|
|              | Segment 1 | Segment 2 | Segment 3 | Segment 4 | Segment 5 | Segment 6       | Segment 7 |
| Max HDOP     | 1.1       | 1.1       | 1.1       | 1.1       | 1.3       | -               | -         |
| Avg HDOP     | 1.0       | 1.0       | 1.1       | 1.1       | 1.2       | -               | -         |
| Min HDOP     | 0.9       | 0.9       | 1.1       | 1.1       | 1.1       | -               | -         |
| Max VDOP     | 2.3       | 2.2       | 2.2       | 2.2       | 2.7       | -               | -         |
| Avg VDOP     | 1.6       | 1.6       | 2.2       | 2.2       | 2.4       | -               | -         |
| Min VDOP     | 1.5       | 1.5       | 2.2       | 2.2       | 2.2       | -               | -         |
| Max PDOP     | 2.5       | 2.5       | 2.5       | 2.5       | 3.0       | -               | -         |
| Avg PDOP     | 1.9       | 1.9       | 2.5       | 2.5       | 2.6       | -               | -         |
| Min PDOP     | 1.7       | 1.7       | 2.5       | 2.5       | 2.5       | -               | -         |
| Max HPL      | 20.3 m    | 19.5 m    | 19.5 m    | 20.1 m    | 20.6 m    | -               | -         |
| Avg HPL      | 19.8 m    | 19.2 m    | 19.2 m    | 19.2 m    | 20.0 m    | -               | -         |
| Min HPL      | 19.2 m    | 19.0 m    | 19.0 m    | 19.0 m    | 19.7 m    | -               | -         |
| Max HPE      | 4.0 m     | 4.0 m     | 4.0 m     | 4.0 m     | 4.0 m     | -               | -         |
| Max VPL      | 49.2 m    | 48.8 m    | 48.8 m    | 49.2 m    | 54.6 m    | -               | -         |
| Avg VPL      | 47.5 m    | 47.5 m    | 47.7 m    | 47.5 m    | 50.4 m    | -               | -         |
| Min VPL      | 46.6 m    | 46.9 m    | 47.1 m    | 46.9 m    | 48.6 m    | -               | -         |
| Max VPE      | 9.0 m     | 9.0 m     | 9.0 m     | 9.0 m     | 10.0 m    | -               | -         |
| Max SBAS SNR | 39@129    | 40@129    | 39@129    | 41@129    | 39@129    | -               | -         |
| Avg SBAS SNR | 34.1      | 38.7      | 38.6      | 38.4      | 36.1      | -               | -         |
| Min SBAS SNR | 32@129    | 38@129    | 38@129    | 34@129    | 32@129    | -               | -         |
| Min SV SNR   | 29@3      | 30@3      | 35@17     | 35@17     | 28@17     | -               | -         |
| Min SV Used  | 8         | 8         | 8         | 8         | 7         | -               | -         |

# Flight Test Results

## Example GBAS Xover:



# Flight Test Results

## Example GBAS Xover:

[+] Calculations (large)

| GBAS Crossover          |               |           |            |             |               |                  |
|-------------------------|---------------|-----------|------------|-------------|---------------|------------------|
| --- Ground Station ---  |               |           |            |             |               |                  |
| Station ID              | SBGL          | MagVar    | -21,00 °   | Ref.Path ID | -             |                  |
| Operating Receivers     | 4             | Dmax      | 42000,00 m | RPDS        | -             |                  |
| Ground Accuracy (GAD)   | C             |           |            | RSDS        | 0             |                  |
| Ground Integrity (GCID) | 1             |           |            |             |               |                  |
|                         | Min           |           |            | Max         | Avg           |                  |
|                         | Field Str     | Integrity | LLZ Flag   | GP Flag     | Dist Error    | Bearing Error    |
| Total:                  | -25,70 dBW/m2 | Valid     | Valid      | Invalid     | -0,01 NM      | -0,69 °          |
| [-35°, -10°>            | -             | Valid     | Valid      | Valid       | -             | -                |
| [-10°, 0°>              | -             | Valid     | Valid      | Valid       | -             | -                |
| [0°, 10°>               | -             | Valid     | Valid      | Valid       | -             | -                |
| [10°, 35°]              | -25,70 dBW/m2 | Valid     | Valid      | Valid       | -0,01 NM      | -0,69 °          |
| Max HPL                 | 3,33 m        |           |            |             |               |                  |
| Max VPL                 | 5,70 m        |           |            |             |               |                  |
| --- GPS Parameters ---  |               |           |            |             |               |                  |
|                         | Max HDOP      | Max VDOP  | Max HFOM   | Avg. HFOM   | Min. Sat used | Min. Sat SNR     |
|                         | 0,89          | 1,35      | 0,89       | 0,89        | 9             | SNR@PRN<br>49@25 |

## Summary

- *The aircraft should be equipped to fly the SBAS procedure – Upgrade cockpit?*
- *The FIS system should be connected to the aircraft SBAS system for logging of data.*
- *The FIS system should be capable of interference detection – a FIS with a Spectrum Analyzer connected to relevant antennas and should be capable of logging frequency spectrum data.*

## Summary

- *For GBAS; use a GBAS receiver (eg. GNLU-930) in the FIS, and give flight guidance to the cockpit.*
- *Fly the GNSS procedures frequently to check for obstructions and interference – new obstacles can be a critical safety issue*
- *Continental Drift / Earthquakes may invalidate previous checked FAS data.*