

GLS Operational Experience



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IGBWG Melbourne May 2026

Agenda

- History
- Fleet Status
- Benefits
- In-Service Issues
- Next Steps



Standing on the Shoulders of Others

**GLOBAL NAVIGATION SATELLITE SYSTEM
LANDING SYSTEM**

TECHNOLOGY/PRODUCT DEVELOPMENT

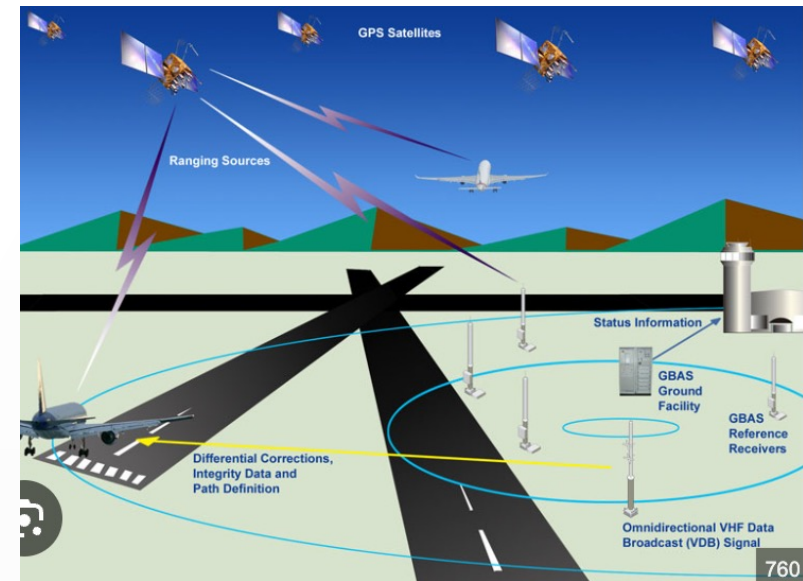
The aviation industry is developing a new positioning and landing system based on the Global Navigation Satellite System (GNSS). The GNSS landing system (GLS) integrates satellite and ground-based navigation information to provide the position information required for approach and landing guidance. Potential benefits of the GLS include significantly improved takeoff and landing capability at airports worldwide and at reduced cost, improved instrument approach service at additional airports and runways, and the eventual replacement of the Instrument Landing System. Boeing plans to certify the airborne aspects of GLS on the 737, to support Category I operations, by the end of 2003.

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AERO 3



History

2005 - Boeing GLS launch customer -
737NG

2007 - GBAS Beta-Trial Sydney Kingsford-
Smith SLS-3000+ – YSSY – including
Autoland

2008 - Airbus GLS launch customer – A380

2008 -Portable GBAS trials –
Boeing/Honeywell/Alaska Airlines/Qantas
Juneau Alaska

GBAS SLS-4000 Sydney (YSSY)

GBAS SLS-4000 Melbourne (YMML)

GLS Displaced Threshold Operations

Trial RNP-AR to GLS



Qantas Group Fleet Status

Qantas Mainline

79 737NGs

10 A380s

14+12 787-9/10

5 + 43 A321XLR

24 A350-1000

Jetstar

11 787-8

30+ A320

A220 – not offered in production!



Qantas Group GLS Experience

- 100s of thousands of approaches conducted since 2005
 - Manually flown and Autoland
 - 6+ GBAS locations
 - Thousands of pilots
 - 4+ aircraft types
 - All weather conditions
 - Year round over 20 years (some breaks due SLS-3000+ to 4000 transition and the odd lightning strike!)



Realised Benefits

Amazingly smooth, stable lateral and vertical approach paths in all directions

Consistent pilot interface, minimal differences

Precision approach capability where none existed – YMML 09 & 34

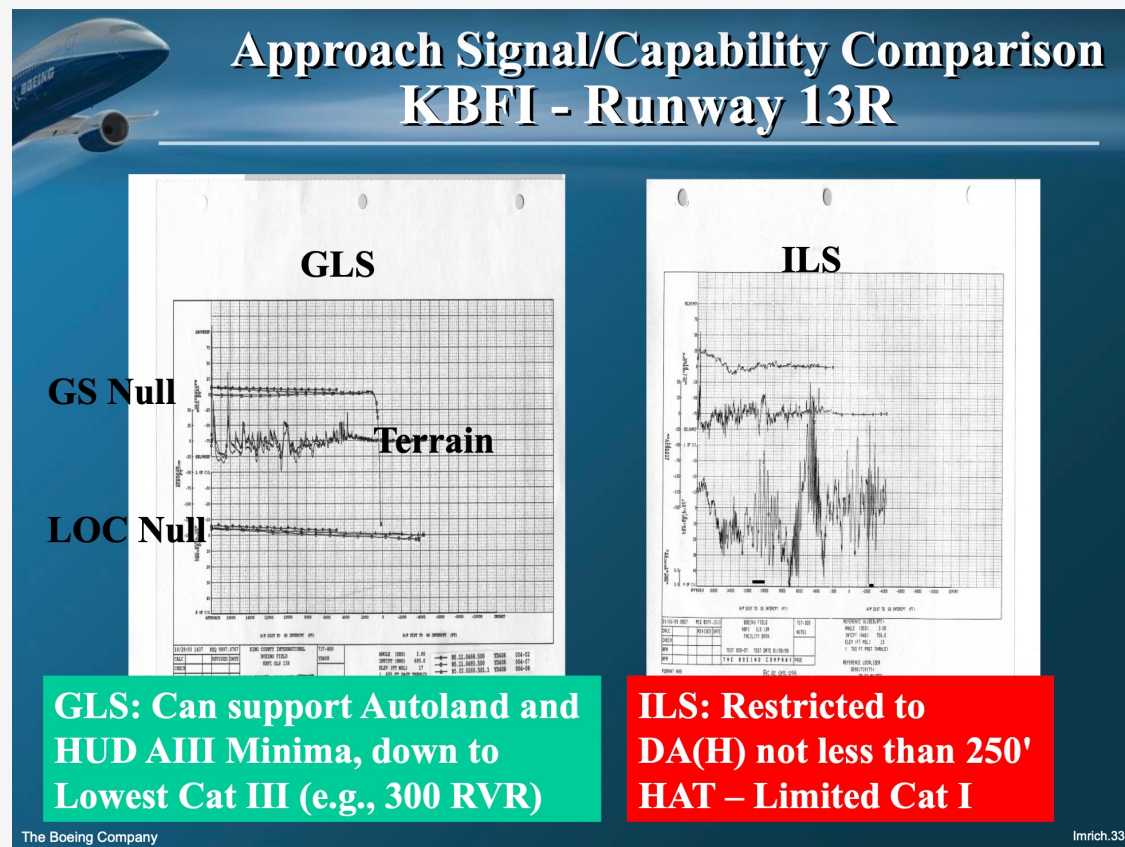
Not affected by ILS limitations

Alternate minima planning benefits, redundancy

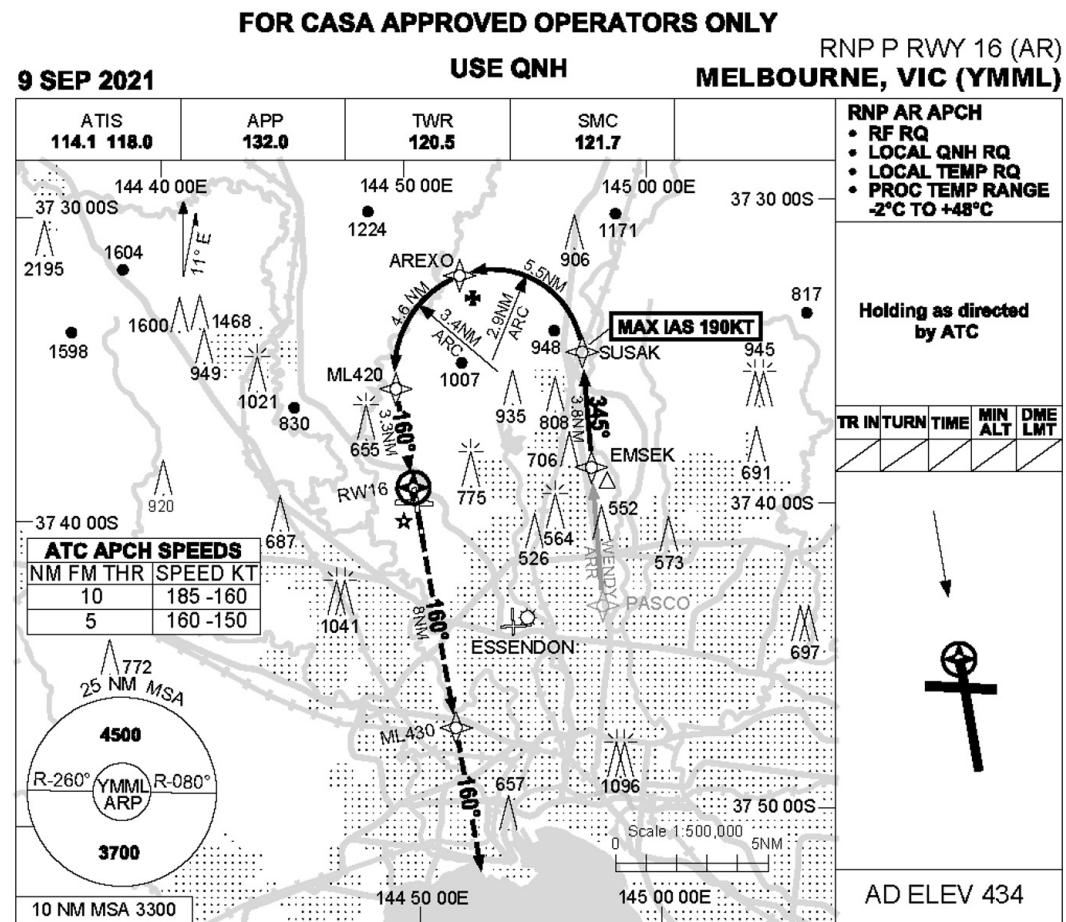
Complimentary interoperability with RNP-AR

- both can combine to provide smooth, stable, predictable, environmentally and community friendly approach paths

Tighter touchdown footprints with Autoland/HUD



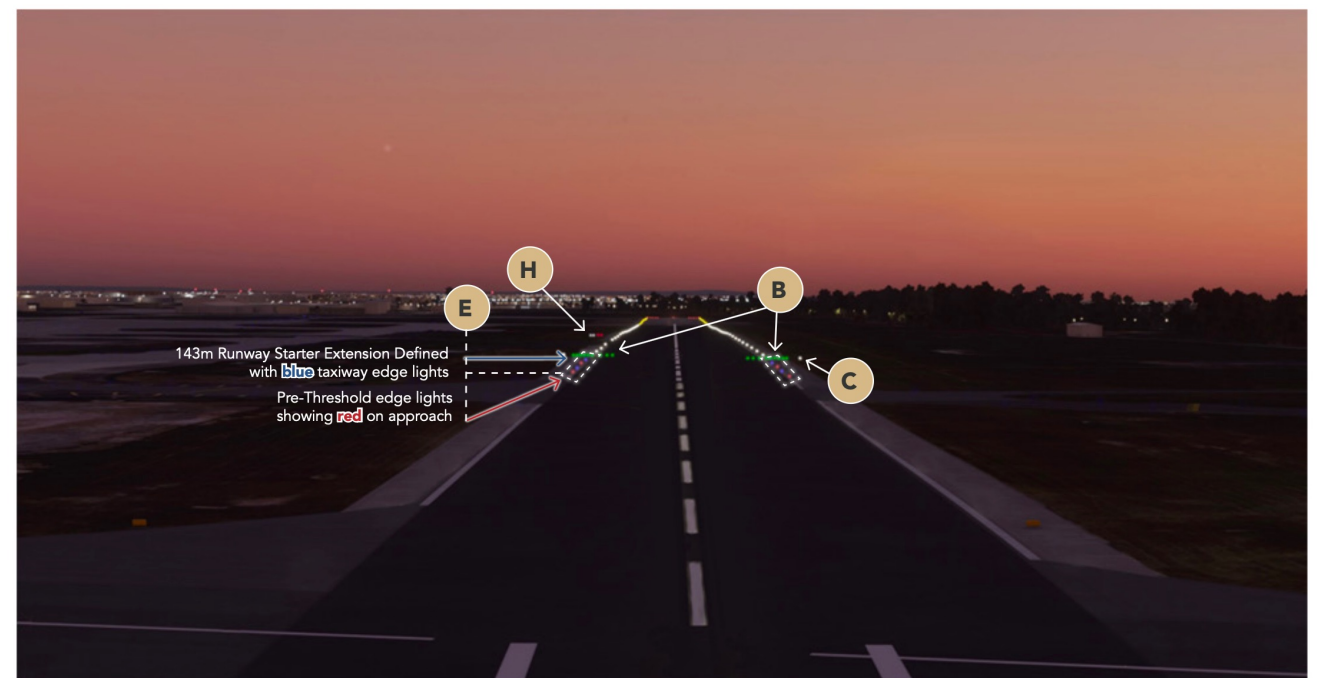
Realised Benefits – Displaced Threshold YMML 16



MELBOURNE AIRPORT

Airline Operator Information Brief

Runway 16 Approach on night (Runway 16 displaced threshold) - Visual Impression



Alternate Planning Minima

09:43 Wed 13 May

QFA 21 ZNB EDTO 12 May TSAT 03.35z TOBT 03.35z TTOT 03.47z

Plan Messages 101 Fuel 1 Load 3 Nav Log Links

YMML
MELBOURNE INTL
TAFOR

ETD: 03.35Z DPD: 07.49z
DP1: 07.47z

DETERMINING ALTN MINIMA - FOR DESTINATION AND DPA PLANNING

RWY 16: 800 - 2800 M (ILS AND GLS)* NA A330
900 - 3200 M (ILS OR GLS AND RNP LNAV/VNAV)*
1000 - 3700 M (RNP LNAV AND LNAV/VNAV)*

DURING RWY

RWY 27: 4000 M (GLS AND RNP LNAV/VNAV) NA A330
4500 M (RNP LNAV AND LNAV/VNAV)

900 - 4000 M (GLS AND RNP LNAV/VNAV)*
1000 - 4500 M (RNP LNAV AND LNAV/VNAV)* A330
1100 - 5200 M (RNP LNAV AND VOR DME) 330

ALTN MINIMA - WHEN USED AS AN ALTERNATE

0 - R550/V800 M (CAT II + 2ND SUITABLE RWY)
700 - 2300 M (ILS AND GLS)*
800 - 2700 M (ILS AND RNP LNAV/VNAV)
900 - 3200 M (RNP LNAV AND LNAV/VNAV)*

RWY 27 HIALS U/S

RWY 27: 500 - 2300 M (BOTH RWYS SUITABLE WITH ILS OR GLS)*
600 - 3000 M (ILS AND GLS)*
900 - 4300 M (ILS AND RNP LNAV/VNAV)*
1000 - 4700 M (RNP LNAV AND LNAV/VNAV)*

RWY 09: 2800 M (BOTH RWYS SUITABLE, 27) NA A330
1000

EDTO ALTN PLANNING MINIMA

RWY 34: 300 - 2300 M (GLS)*
500 - 2800 M (RNP LNAV/VNAV)*
RWY 16: 500 - 1600 M (ILS/GLS)*
600 - 2000 M (RNP LNAV/VNAV)*
RWY 09: 400 - 2300 M (GLS)*
600 - 2800 M (RNP LNAV/VNAV)*

09:47 Wed 13 May

QFA 21 ZNB EDTO 12 May TSAT 03.35z TOBT 03.35z TTOT 03.47z

Plan Messages 101 Fuel 1 Load 3 Nav Log Links

YSSY
KINGSFORD SMITH
TAFOR

EDTO: 06.15z-08.37z

1. A380 RWY 16L/34R AVBL FOR ALTN MINIMA CALCULATIONS.
2. GLS NOT AUTH FOR A330 AND EXPRESS FREIGHT.
3. MORE MINIMA/RWY OPTIONS (INCL 07/25) AVBL DOCUNET (EFA COMPLY 365)
REFER: DOCUNET >> FLIGHT PLANNING AND MINIMA >> DETERM,QUAL AND EDTO PLANNING MINIMA.

DETERMINING ALTN MINIMA - FOR DESTINATION AND DPA PLANNING

RWY 16LR: 500 - 1800 M (BOTH RWYS WITH ILS SA CAT II)
600 - 2000 M (BOTH RWYS WITH ILS OR GLS) *
800 - 2800 M (BOTH RWYS WITH RNP LNAV/VNAV) *

RWY 16R: 700 - 2600 M (ILS AND GLS) NA A330
800 - 3200 M (ILS OR GLS AND RNP LNAV/VNAV)
1000 - 4100 M (RNP LNAV AND LNAV/VNAV)

RWY 34LR: 500 - 2000 M (BOTH RWYS WITH ILS SA CAT II) *
600 - 2100 M (ILS AND GLS) *
900 - 3600 M (RNP LNAV AND LNAV/VNAV) *

ALTN MINIMA - WHEN USED AS AN ALTERNATE

RWY 34LR: 0 - R550/V800 M (SA CAT II + 2ND SUITABLE RWY) NA A330
700 - 1400 M (BOTH RWYS WITH ILS OR GLS)
800 - 2000 M (BOTH RWYS WITH RNP LNAV/VNAV/APCH)*
900 - 3600 M (RNP LNAV AND LNAV/VNAV) NA A330

RWY 09: 0 - R550/V800 M (SA CAT II + 2ND SUITABLE RWY/APCH)*
400 - 1800 M (BOTH RWYS WITH ILS OR GLS)
700 - 3200 M (BOTH RWYS WITH RNP LNAV/VNAV) NA A330

RWY 09: 600 - 2300 M (ILS AND GLS)
700 - 3100 M (ILS OR GLS AND RNP LNAV/VNAV)
RWY 16: 800 - 3500 M (RNP LNAV AND LNAV/VNAV)

RWY 07: 600 - 2300 M (ILS AND GLS)
RWY 25: 600 - 3100 M (ILS OR GLS AND RNP LNAV/VNAV)

EDTO ALTN PLANNING MINIMA

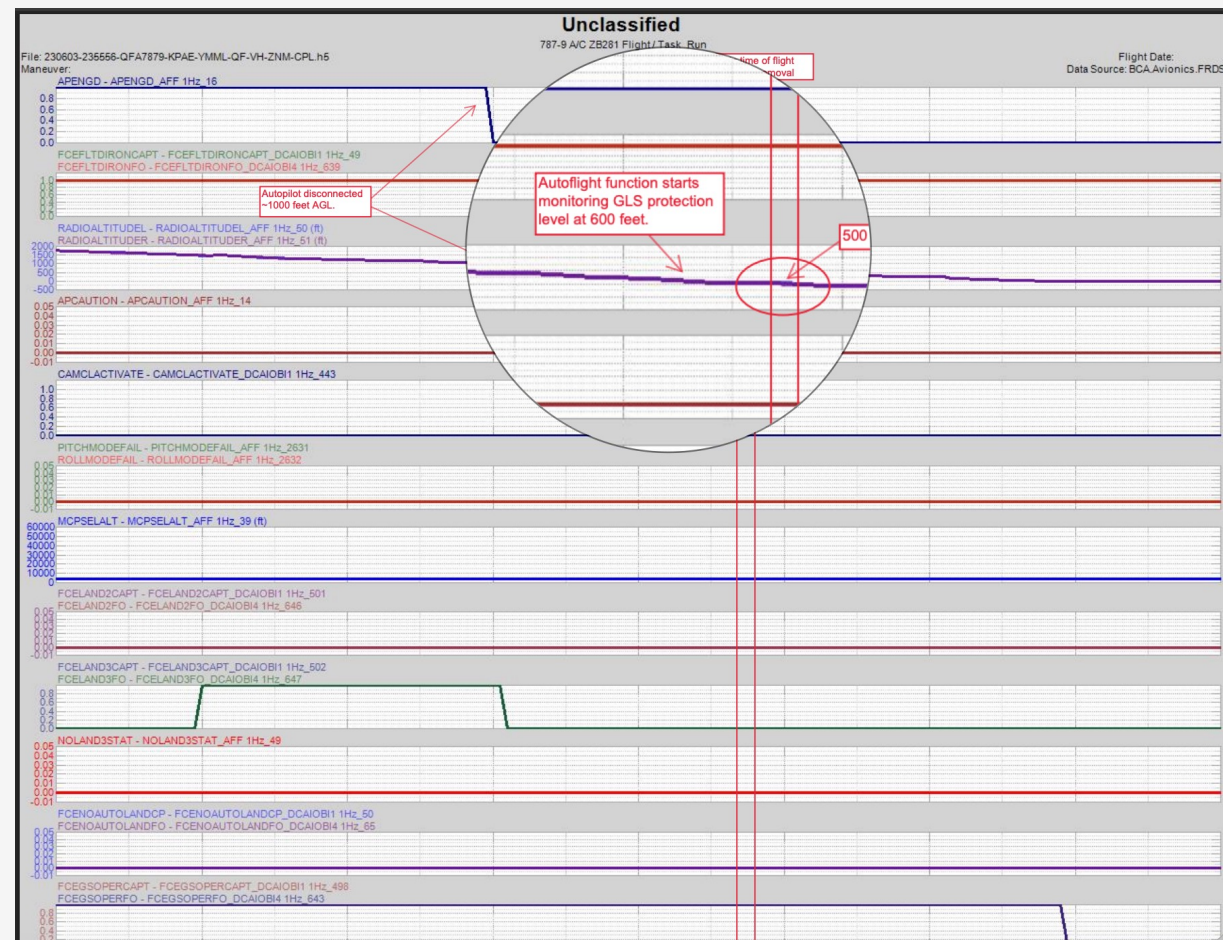
RWY 34: 300 - 2300 M (GLS)*
500 - 2800 M (RNP LNAV/VNAV)*
RWY 16: 500 - 1600 M (ILS/GLS)*
600 - 2000 M (RNP LNAV/VNAV)*
RWY 09: 400 - 2300 M (GLS)*
600 - 2800 M (RNP LNAV/VNAV)*

TAF YSSY 102322Z MAY 20 (ILS OR GLS) 02025
FM111700 32008KT 9999 NSW SCT025
FM120000 15012KT 9999 NSW SCT025
INTER 1100/1105 5000 SHRA BKN014
INTER 1113/1200 5000 SHRA BKN014
RMK T 20 22 20 19 Q 1033 1032 1032 1033

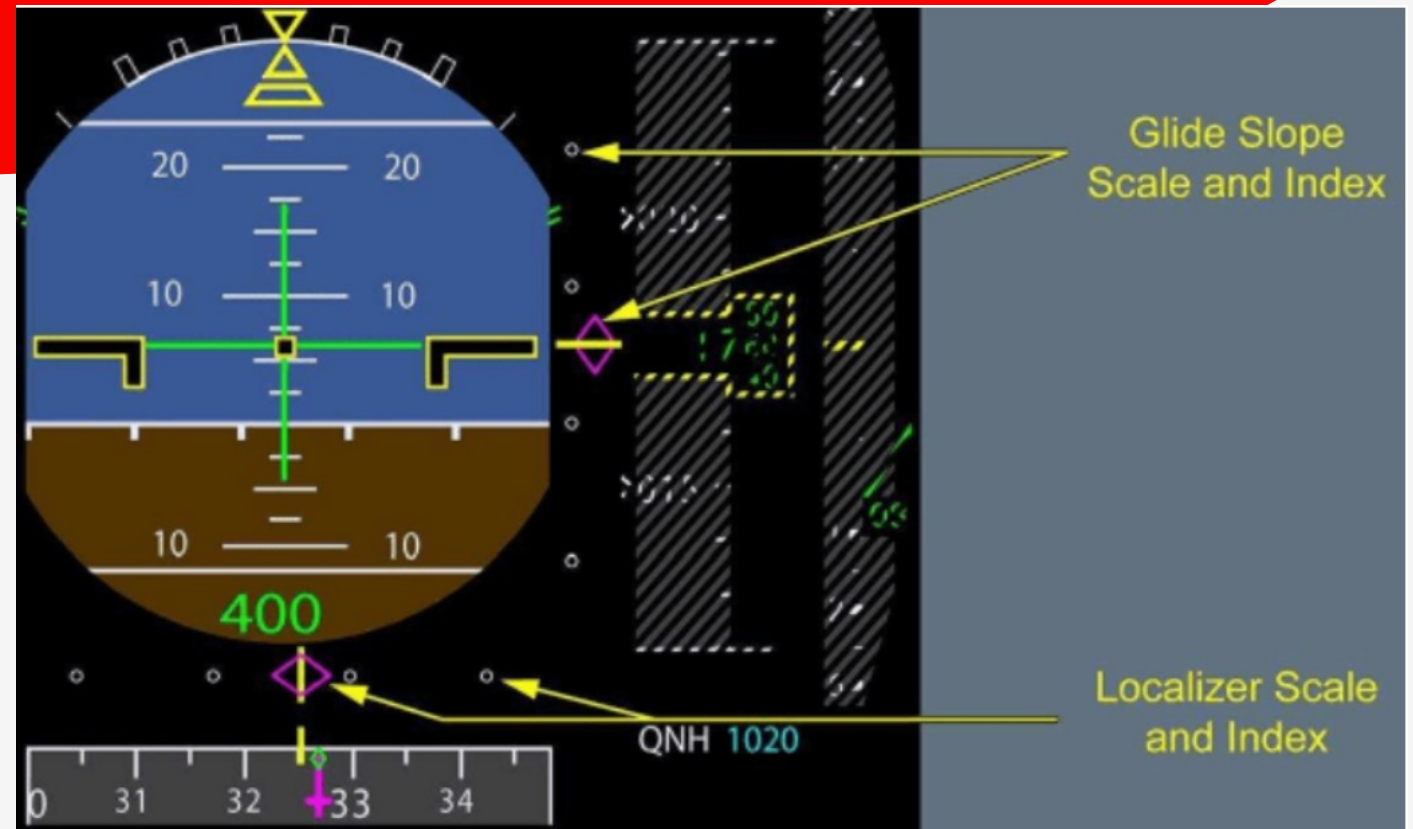
In-Service Issues

737 (GLU-925) & 787 (Honeywell INR)

- Single side course deviation data removed from view, impacts Autoland
- *The difference in left and right GLS vertical deviation can indicate that one of the INRs excluded more satellites that the other for use in its GLS deviation calculations*



In-Service Issues



A321XLR (GLU-2100) “Drop-Out”

Passing approximately 1,000ft on approach to RW34 YMML whilst utilising the GLS for the conduct of an approach in day VMC conditions (CAVOK), with trainee Captain as PF, both autopilots engaged in approach mode, a brief (approximately 5 second transient failure of the GLS (glideslope only) indication occurred on the Captain side. Normal indications remained on the F/O side. When normal glideslope indications returned on the Captain side the F/O side glideslope indication instantaneously failed for a similar time period of 5 seconds before returning to normal indications. No further issues occurred during the remainder of the approach to landing. ATC contacted on arrival who confirmed no apparent issues with the GLS installation known during this time period.

In-Service Issues

Dual GPS Failure

Caused by latched fault incurred while experiencing RFI through the Middle East. INR reset task introduced for all transits either side of known GPS-RFI affected areas.



Next Steps - 737 and 787 Cat II – Flight Director and Autoland



787 Airplane Flight Manual

Operational Data

Section Autopilot Flight Director System, continued from previous page

A201431

- Primary Flight Controls in Normal mode
- LAND 3 annunciated
- Autoland status annunciation displayed for each pilot
- Independent ILS displayed for each pilot:
 - SGL SOURCE APPROACH alerting message not displayed
- Independent radio altitude sources displayed for each pilot:
 - SGL SOURCE RAD ALT alerting message not displayed

This AFM provision does not constitute operational approval or credit for Category III use of the system.

Low Weather Minima - ILS Automatic Landing - Fail-Passive

The autopilot system has been shown to meet the airworthiness, performance and integrity criteria applicable to Category III as specified in FAA Advisory Circular 120-28D Appendix 3 for a fail-passive automatic landing system, when coupled to an ILS beam using U.S. Type III ILS facilities and the following criteria satisfied:

- Primary Flight Controls in Normal mode
- LAND 2 annunciated
- Autoland status annunciation displayed for each pilot
- Independent ILS sources displayed for each pilot:
 - SGL SOURCE APPROACH alerting message not displayed
- Independent radio altitude sources displayed for each pilot:
 - SGL SOURCE RAD ALT alerting message not displayed

This AFM provision does not constitute operational approval or credit for Category III use of the system.

Low Weather Minima - Autopilot ILS Approach

The autopilot system has been shown to meet the airworthiness, performance and integrity criteria applicable to Category II as specified in FAA Advisory Circular 120-29A, Appendix 3 for automatic approach when coupled to an ILS beam using U.S. Type II or III ILS facilities with the following criteria satisfied:

- Primary Flight Controls in Normal mode
- LAND 3 or LAND 2 annunciated
- Independent ILS sources displayed for each pilot:
 - SGL SOURCE APPROACH alerting message not displayed
- Independent radio altitude sources displayed for each pilot:
 - SGL SOURCE RAD ALT alerting message not displayed

This AFM provision does not constitute operational approval or credit for Category II use of the system.

Low Weather Minima - Autopilot GLS Approach

The autopilot system has been shown to meet the airworthiness, performance and integrity criteria applicable to Category II as specified in FAA Advisory Circular 120-29A, Appendix 3 for automatic approach and the airworthiness and performance criteria as specified in FAA Advisory Circular 120-28D Appendix 3 for automatic landing when coupled to GLS guidance provided by a ground facility that meets the requirements for CAT I GBAS as defined in ICAO Annex 10 amendment 85 with the following criteria satisfied:

Continued on next page

D631Z003.938

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787 Airplane Flight Manual

Operational Data

Section Autopilot Flight Director System, continued from previous page

A201431

- Primary Flight Controls in Normal mode
- LAND 3 or LAND 2 annunciated
- Independent GLS sources displayed for each pilot:
 - SGL SOURCE APPROACH alerting message not displayed
- Independent radio altitude sources displayed for each pilot:
 - SGL SOURCE RAD ALT alerting message not displayed

During anomalous ionospheric conditions, some GBAS systems may exhibit undetected vertical errors exceeding 32.8 feet (10 meters) and lateral errors exceeding 55.8 feet (17 meters). Such errors could prevent satisfactory autoland performance and therefore operational mitigations may be required to ensure vertical and horizontal errors do not exceed these levels during CAT II operations.

This AFM provision does not constitute operational approval or credit for Category II use of the system.

Low Weather Minima - Flight Director ILS Approach

The flight director system has been shown to meet the airworthiness, performance and integrity criteria applicable to Category II as specified in FAA Advisory Circular 120-29A, Appendix 3 for manual approach using flight director guidance on the Head Down Display (HDD) or Head Up Display (HUD) using U.S. Type II or III ILS facilities with the following criteria satisfied:

- Primary Flight Controls in Normal mode
- Independent ILS sources displayed for each pilot:
 - SGL SOURCE APPROACH alerting message not displayed
- Independent radio altitude sources displayed for each pilot:
 - SGL SOURCE RAD ALT alerting message not displayed
- Independent Flight Director guidance sources displayed for each pilot:
 - SINGLE SOURCE F/D alerting message not displayed

This AFM provision does not constitute operational approval or credit for Category II use of the system.

Low Weather Minima - Flight Director GLS Approach

The flight director system has been shown to meet the airworthiness, performance, and integrity criteria applicable to Category II as specified in FAA Advisory Circular 120-29A, Appendix 3 for manual approach using flight director guidance on the Head Down Display (HDD) or Head Up Display (HUD) using GLS guidance provided by a ground facility that meets the requirements for CAT I GBAS as defined in ICAO Annex 10 amendment 85 with the following criteria satisfied:

- Primary Flight Controls in Normal mode
- Independent GLS sources displayed for each pilot:
 - SGL SOURCE APPROACH alerting message not displayed
- Independent radio altitude sources displayed for each pilot:
 - SGL SOURCE RAD ALT alerting message not displayed
- Independent Flight Director guidance sources displayed for each pilot:
 - SINGLE SOURCE F/D alerting message not displayed

This AFM provision does not constitute operational approval or credit for Category II use of the system.

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Thank you