GLU-2100 OVERVIEW

COMMITTED TO ADVANCED GNSS TECHNOLOGY

ABOUT COLLINS AEROSPACE

Collins Aerospace is a leader in technologically advanced, intelligent solutions that help redefine the aerospace and defense industry.

We dedicate our capabilities, comprehensive portfolio and expertise to solving customers' toughest challenges and meeting the demands of the global market.

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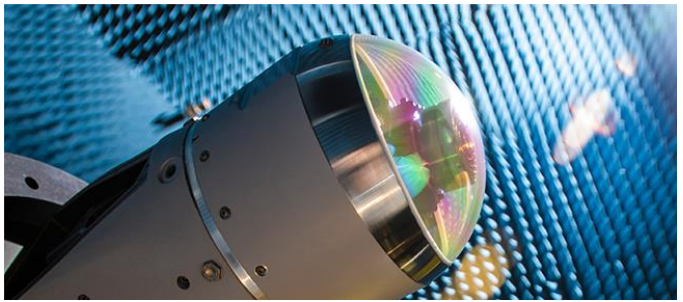
Pratt & Whitney

Raytheon Intelligence & Space

Raytheon Missiles & Defense



ABOUT COLLINS AEROSPACE

FORMED TO MEET CUSTOMER NEEDS AND REPRESENT THE BEST IN INNOVATION, TECHNOLOGY AND EXPERTISE.

Advanced Structures

Avionics

Connected Aviation Solutions

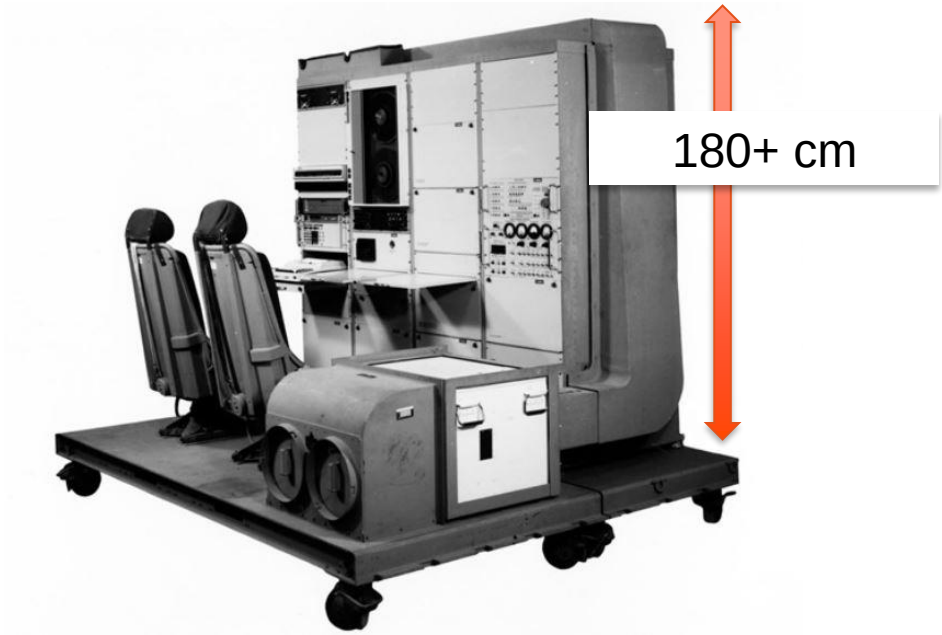
Interiors

Mission Systems

Power & Controls

AT THE START OF GNSS

- July 19th, 1977 – First GPS signal from first Global Positioning System (GPS) satellite known as NTS-2 decoded at the heritage Rockwell Collins facility in Cedar Rapids



Rockwell Collins engineer named David Van Dusseldorp sat on the rooftop of a company building in Cedar Rapids, Iowa: He said "the future of GPS was uncertain at the time, but I really felt like we had just accomplished something important".

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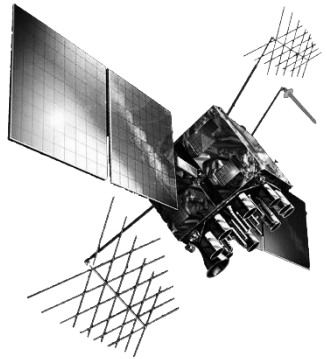
COLLINS HISTORY IN GNSS

SBAS ADOPTION IN AVIATION IN AFRICA

- May 25, 1983 – First GPS guided transatlantic flight
- 1995 – First TSO for a Multi Mode Receiver
- 2006 – First SBAS – GPS-4000S
  - Participation in GIANT to deploy PBN LPV operations in Europe
- 2018 – business jet aircraft and new generation aircraft such as A220 and A350XWB use LPV for approaches using Collins SBAS

EVOLUTION OF GNSS NAVIGATION

ENHANCED NAVIGATION PERFORMANCE



1998
- GPS approved for sole means of navigation

2000
- Selective availability turned off

2003
- First SBAS LPV approach

2005
- GBAS Cat I implemented

2015
- Implementation of RNP/RNAV in global aerospace

2021
- US ADS-B GNSS req.
- GLS Cat II/III emerging

2023
- RF Robustness
- Multi-frequency/ Multi-constellation

2025
- Geo-political mandates
- LPV everywhere

MORE EFFICIENT AIRSPACE

MANDATED GNSS PERFORMANCE

IMPROVED GLOBAL CAPABILITIES

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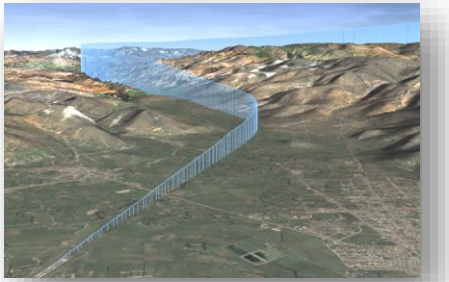
SBAS AIRSPACE BENEFITS

SBAS ADOPTION IN AVIATION IN AFRICA

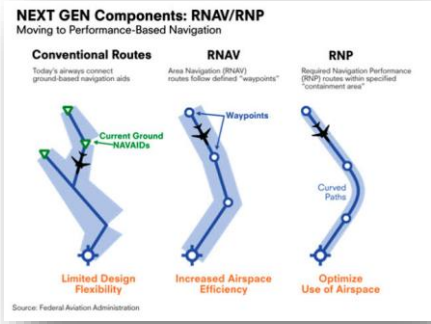
INCREASED ACCURACY AND INTEGRITY

- SBAS helps eliminate ionospheric error in GNSS solution
- Better availability of RNAV/RNP procedures
- Improved accuracy ADS-B Out position reports



COVERAGE OVER LARGE AREA

- Especially Areas typically under-served with ground based Nav-Aids



KEY ENABLER FOR LPV

- ILS - like display in the cockpit with Decision Altitude/Decision Height
- SBAS can serve ALL IFR Runways ends for the whole continent
- Improves fuel efficiency through better diversion and alternate airport options

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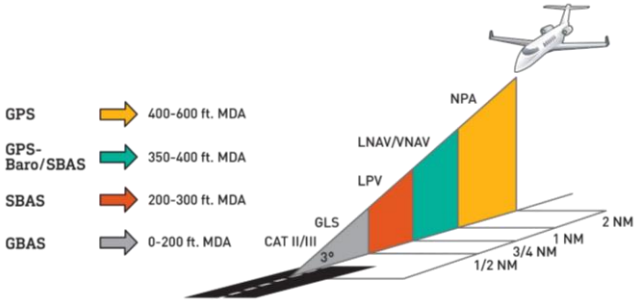
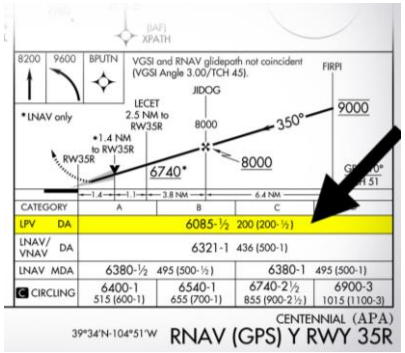
LPV BENEFITS

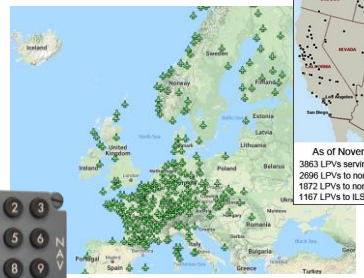
LOCALIZER PERFORMANCE WITH VERTICAL GUIDANCE

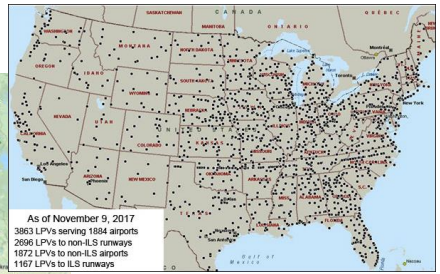
- CAT I Landing Performance
  - No Ground Infrastructure
  - Not as Limited by Terrain
  - No temperature limitations





- Airborne LPV Implementation
  - SBAS GNSS Receiver – e.g. GLU-2100
  - LPV Database
    - Can be Hosted in MMR or FMS
  - Display Annunciations
  - SBAS Tuning





CONTINUOUS DEVELOPMENT

COLLINS LEADERSHIP AND COMMITMENT TO EVOLUTION

1995
- OEMs required GPS and increased integration
- GLU-920 GPS-4000

2000
- Selective availability turned off
- GLU-920

2005
- GPS landing system emerges
- GLU-925

2010
- SBAS benefits begin to surface
- GPS-4000S GLU-925S

2018
- Increased integration and SBAS for ADS-B
- **GLU-2100**

2021+
- MF/MC GLS Cat II/III LPV
- RF Detection and Mitigation

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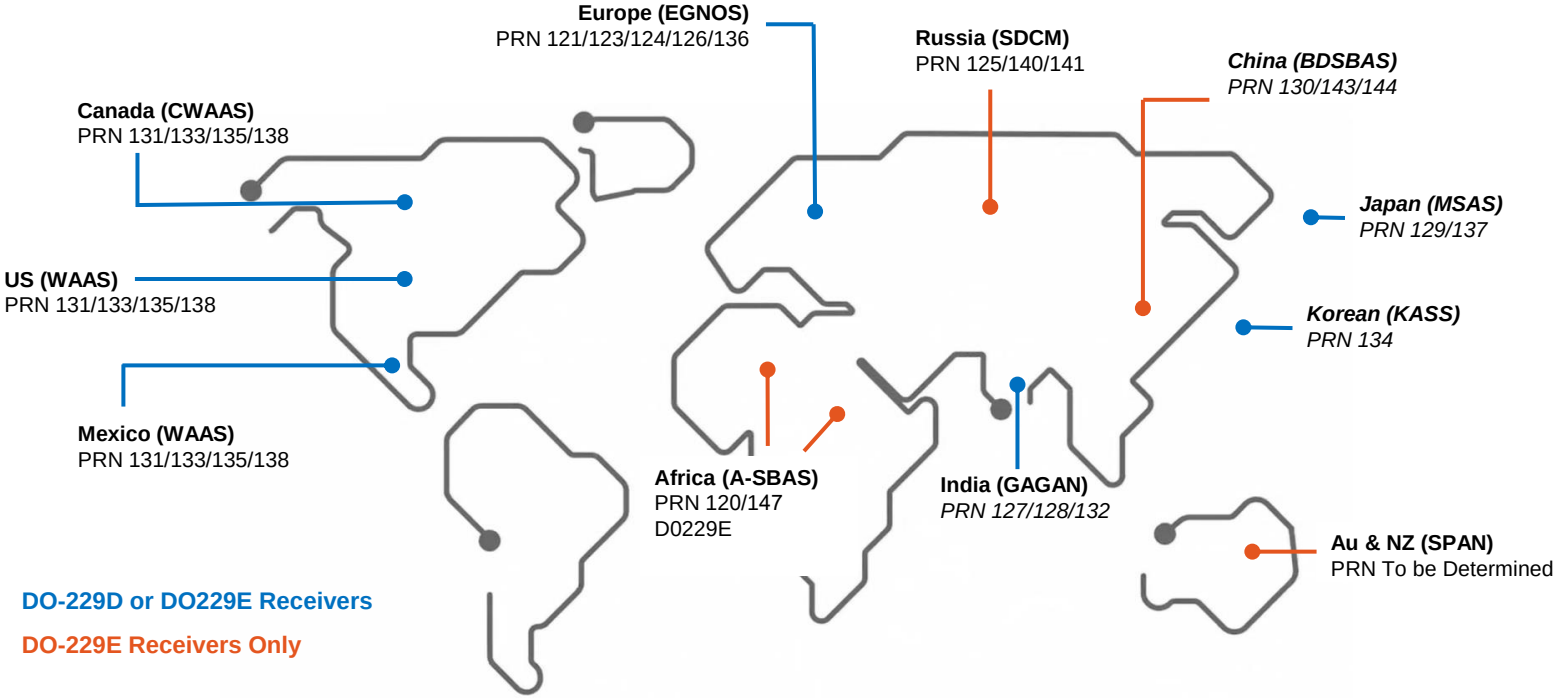
SBAS PRN ASSIGNMENTS



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GLU-2100 DETAILS

INTEGRATION OF NAVIGATION AND LANDING FUNCTIONS

- ROBUST HW BASELINE FOR FUTURE GROWTH
- SW DEFINED RADIOS FOR FLEXIBILITY
- INTEGRATED VOR

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GLU-2100: HARDWARE BASELINE

POWERFUL, MULTI-FUNCTIONAL AND EASILY UPGRADABLE

- **Drop-in replacement to existing MMRs**
- Completely new GNSS engine
  - SBAS Capable for multiple regions – DO-229**E** ready
  - Dual thread, DAL A HW and SW to support GLS II/III
  - RF front end capable of supporting DFMC (up to 100 channels)
- Used for Multiple DF/MC research and development projects (see links for more information)
  - Flew on B777 Eco Demonstrator
  - GLAD Global ARAIM for Dual Constellation
  - MUGG Multi-Mode GPS and Galileo Project

GLU-2100

INTEGRATION OF VOR

VOR-900 + GLU-925

GLU-2100 with Integrated VOR

Specification	GLU-925 & VOR-900	GLU-2100	Reduction
Hardware/PN Count	4 units	2 units	50%
Size	12 MCU	6 MCU	50%
Unit Weight (target)	18.9lbs/8.57kg	9.9lbs/4.5kg	48%
Power	68W	40W	41%

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CAPABILITIES OF OUR NEXT GEN MMR

THE NEXT STEPS FOR ADVANCING GNSS TECHNOLOGY

ADDED FUNCTIONALITY
- SBAS to satisfy ADS-B out mandate requirements
- SBAS for LPV enablement

MAINTAIN EXISTING PROVEN CAPABILITIES
- SA Aware, FLS, RNP-AR, ILS Cat III and GLS Cat I

SIZE, WEIGHT AND POWER IMPROVEMENTS
- Integration of VOR/MB functionality

PATENTED TECHNOLOGY TO ENHANCE PERFORMANCE
- Multi-Constellation dynamic tracking
- Robust interference improvements
- Policy database for regional GNSS adaptation

FUTURE FUNCTIONALITY
- GLS Cat II/III
- MF/MC

CURRENT FUNCTIONALITY
Form fit function replacement for GLU-925, + SBAS NAV and LPV
Specific SBAS Capable Antennas, Integrated VOR

FUTURE FUNCTIONALITY:
DF/MC, GLS Cat II/III

Adaptive HW baseline to support growth.
Design assurance Level A. **DO-229E**
Flexible RF front end.

FUTURE CAPABILITIES

SOFTWARE ONLY UPDATES

ROBUST HARDWARE BASELINE

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COLLINS AEROSPACE GLU-2100

COMMITTED TO THE ADVANCEMENT OF GNSS TECHNOLOGY

MOST MODERN HW AND SW DESIGN

GNSS LEADERSHIP AND DEVELOPMENT

COLLINS LEGACY OF MMR INNOVATION

READY FOR FUTURE CAPABILITIES NOW

24/7/365 WORLD CLASS SUPPORT

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THANK YOU

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