

SBAS

“IS” the only effective solution for safe approaches at every airport in Australia and New Zealand

NZ Airports Assn 10th Sept 2015

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What is SBAS ?

• **Satellite Based Augmentation System**

- the same as **WAAS** in the USA
- the same as **EGNOS** in Europe
- the same as **MSAS** in Japan
- the same as **GAGAN** in India
- Plus soon to be **SDCM** in Russia, **SNAS** in China,
- Also being investigated in **South America, Africa, Korea**

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Augmentation is the correction of the GNSS signal for

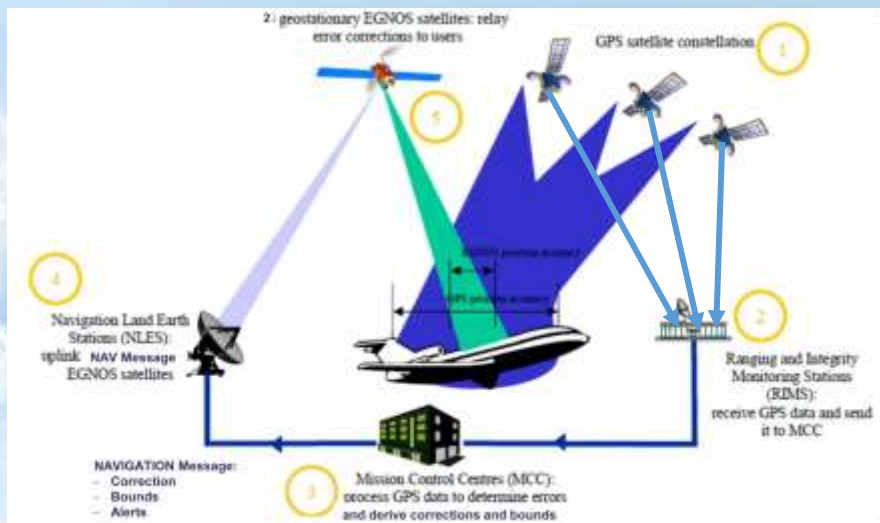
- Satellite clock errors
 - Satellite orbit variations
 - Ionosphere interference
- SBAS provides Accuracy, Integrity, Availability & Continuity
- The four pillars of ICAO navigation requirements

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How does SBAS work



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Current SBAS areas in the world



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AUNZ-SBAS - The deployed System

AUNZ-SBAS



46 Reference Stations Sites

2 Mission Control Centre (Nominal & Backup)

4 Interfacing units with uplink stations (Nominal & Backup)

4 GEO Up-link stations (Nominal & Backup)

2 GEO satellite Xpr (1 sat as a starter)

A telecom Network

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How does SBAS affect Airports

- Reduces ground based Infrastructure which saves \$\$\$\$
- Enables any airport to comply with ICAO resolution 37-11
- Allows accurate positioning of any ground vehicles on the apron. A cheaper solution than Multilateration?
- Reduces the likelihood of CFIT accidents in the approach phase

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ICAO resolution 37-11

- Requires Implementation of approach procedures with Vertical Guidance for all instrument runway ends either as the primary approach or as a backup for precision approaches by 2016.
- There are 3 ways to achieve a GNSS approach with vertical guidance (APV)

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BaroVnav

- BaroVnav requires a certified weather station at each airport to broadcast the accurate QNH. (ground Infrastructure)
- The pilots on board set the QNH and the FMS or GNSS receiver calculates a glide path for the aircraft to follow.
- Enter a wrong QNH and you get a wrong starting altitude
- Two pilot crews cross check. Single pilot has no cross check
- BaroVnav is not available to the vast majority of GA aircraft.
- BaroVnav is **not** a cat1 approach

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SBAS LPV

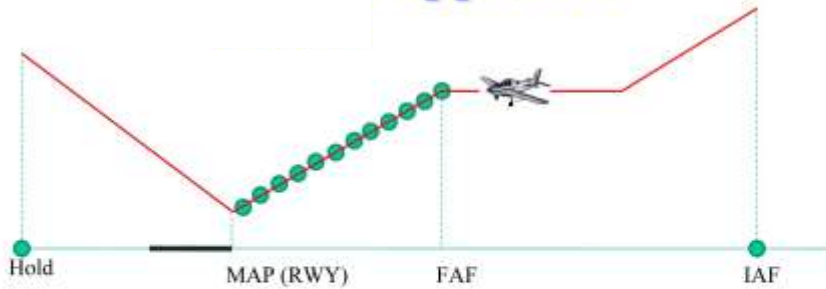
- Localiser Performance with Vertical guidance
- In the USA there are 3,556 SBAS LPV approach procedures serving 1733 airports.
- This is more than the number of published Cat I ILS procedures
- LPV is the only alternative to a Cat 1 ILS available to all aircraft types.
- FAA mandate that any new cat 1 approach must be LPV
- LPV approaches can only be achieved with augmentation
- SBAS is the only ICAO accepted wide area augmentation system available to all aircraft from A380 down to a Cessna 150.

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SBAS LPV Approach



An LPV approach contains a nearly continuous sequence of lat/lon/alt points for the final approach segment.

- Precise altimeter setting not required – relaxed alternate requirement
- No temperature corrections required

11/44 3/22/2009 Andrew Strangin

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All you need in a GA aircraft to fly an SBAS LPV Approach



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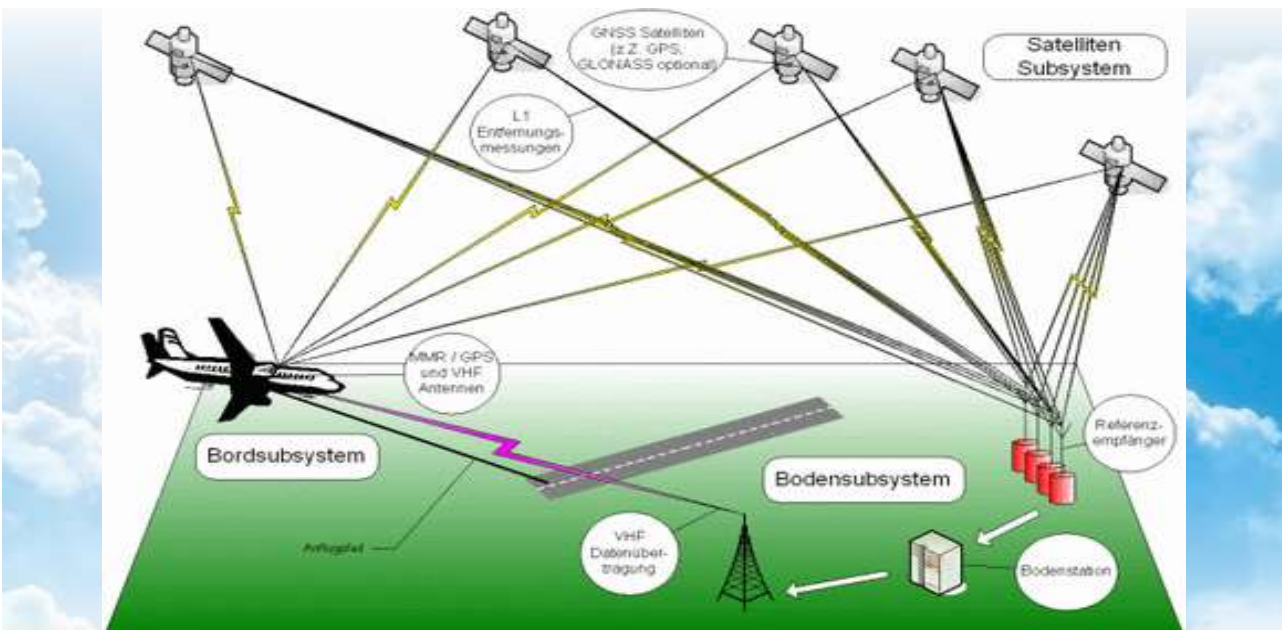
Garmin 430W

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- **Ground Based Augmentation system or LAAS Local Area Augmentation System with Max 20nm radius**
- **The only GNSS landing system that can give Cat 1 to Cat 3 approaches**
- **Requires Ground infrastructure at the airport**
- **Serves all runway ends at the airport**
- **Requires VHF signal to aircraft. The vast majority of GA aircraft cannot be equipped for GBAS**



ADSB and PBN

- The New Southern Sky implementation will likely mandate every IFR GA and commercial aircraft (and the majority of VFR) to be fitted with an SBAS capable receiver for ADSB by 2021.
- Unless we get an SBAS system, operators will not get the full benefit from their investment in the technology.

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Controlled flight into terrain “CFIT”

- is an accident in which an airworthy aircraft, under pilot control, is
- **unintentionally**
- flown into the ground, a mountain, a body of water or an obstacle.

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San Francisco 777 hits sea wall on a clear day when ILS out for service

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Birmingham Alabama UPS flight Main runway closed, cross runway used with no ILS

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**Birmingham Alabama
A300 UPS freight
No vertical Guidance**

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**Air Canada at Halifax.
No ILS but there was a WAAS approach available**

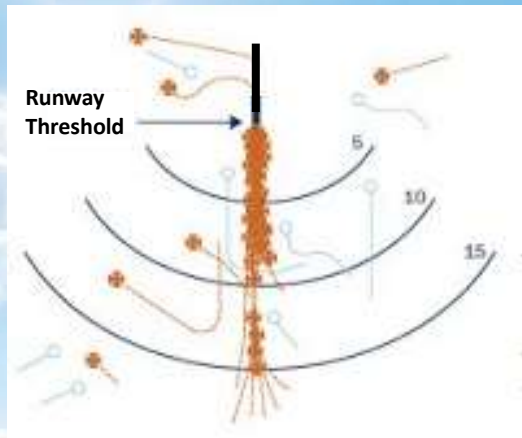


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Lateral tracking is not the problem



- **> 60% of CFIT accidents are within 8 nm of Rwy Threshold**
- **Lateral tracking is not the issue**

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Australian Experience – Warning Signs / free lessons

- **1993: 7 deaths – Navajo, Young**
- **2004: 6 deaths - Chieftan, Mt Hotham**
- **2005: 15 deaths – Metroliner, Lockhart River**
- **2003: Near Miss – RFDS King Air, Ripped off main gear on Wall**
- **Jet transport have deviated well below altitude steps with lack of vertical guidance a significant factor.**
- **2010: A330 OOL**
- **2011: E190 MEL**
- **2011: B777 MEL**
- **2012: B737 CBR**
- **2012: B744 MEL**

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What is the cost and who will pay ?

- SBAS is free to air and available to anyone with smartphone or late model GNSS receiver
- Road, Rail, Marine and Agriculture will all benefit.
- Repeatability is paramount. Where you are today is where you will be in a week or a month. This is vital for spraying fertilising or irrigating.
- In all other countries SBAS is treated as National Infrastructure

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Why is Aviation driving this.

- We need **Integrity, Accuracy, Reliability, Continuity**
- Other ground based augmentation services may provide greater precision but not with the integrity and Reliability of SBAS
- **SBAS is the only wide area augmentation approved by ICAO**
- It is not new technology it has been in service for 11 years
- Aviation does not have another option for all phases of flight

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The future for New Zealand

- Mt Cook will have 25 SBAS LPV capable ATR's by 2020
- Air Nelson has a fleet of 23 Q300 that are SBAS capable now with the addition of a loss of signal light, which is a minor modification.
- Other commercial aircraft are being upgraded at a fast rate with Sounds Air using PC12's, Origin Jetstream's, Jetstar Q300's, Life flight Jetstream's
- All Rescue helicopters will have SBAS capability for LPV approaches to any helipad.
- All will or can be capable of LPV SBAS approaches
- The expectations of our travelling public will be such that if we don't have the best safety solutions our international reputation could be severely damaged.

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What now ?

- We need you to understand the system and promote SBAS at the highest level of Government
- We need to work together to drive this through Government to a point where we have a system operating by 2020. Less than 5 years away.
- Government departments will just pass this around without anyone actively driving it.

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AIRBUS SLS Briefing April 2014

SLS / LPV – a pilot's wish list

EGNOS and WAAS already enhance flight operations, by making precise and safe instrument approaches possible at many runways in Europe and North America

There could be larger benefits to the air transport community with some involvement from the stakeholders

This is what I'd like to see as an operational pilot:

- LPV approaches at all runways within adequate SBAS coverage
- Additional SBAS constellations / regions
- LPV200 capability and "real" Cat1 minima
- LPV solution on more A/C types

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must be treated as A National Infrastructure priority

Thank You

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