AUSTRALIAN CNS UPDATE

Australian Government
Civil Aviation Safety Authority
www.casa.gov.au

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safe skies for all


Australia
2000 NM
Mahogany Plantation is up here
Potential Coffee La
Mountain T
is in the
AUSTRALIA
EDITION 1
Simple Conic Projection
0 200 400 kilometres
HYPSOMETRIC TINTS
BATHYMETRIC TINTS
2000 1500 1000 500 200 0 200
Heights and depths are shown in metres
Populated places
Greater than 1 000 000
100 001 - 1 000 000
20 000 - 100 000
Less than 20 000
Road, principal
Selected railways
Spot elevation
State boundary
River, perennial
River, non-perennial
Lake, perennial
Lake, non-perennial
Reef
Population figures based on
wealth of Australia
) 1996
NORTHERN TERRITORY
WESTERN AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
ACT
GREAT SANDY DESERT
GIBSON DESERT
GREAT VICTORIA DESERT
TANAMI DESERT
NULLARBOR PLAIN
PILBARA
KIMBERLEY
GREAT AUSTRALIAN BIGHT
TIMOR SEA
TASMAN SEA
PAPUA NEW GUINEA
PERTH
ADELAIDE
DARWIN
ALICE SPRINGS
BRISBANE
GOLD COAST
SYDNEY
NEWCASTLE
CENTRAL COAST
WOLLONGONG
CANBERRA
MELBOURNE
GEELONG
HOBART
KALGOORLIE-BOULDER
ESPERANCE
ALBANY
BUNBURY
GERALDTON
KARRATHA
PORT HEDLAND
NEWMAN
MEEKATHARRA
LAUNCESTON
DEVONPORT
BURNIE

CIVIL AVIATION SAFETY AUTHORITY

1928 – NDB
1948 – VOR
1956 - ILS
1953 - VAR
1960 – Omega
1960s - INS
1995 – GPS
2011+ - ?????

FIRST IFR GPS RECEIVER

TSO C145/6 RECEIVERS

- **Approved for primary means IFR**

No ADF/DME – GPS may be only aid

GNSS APPROVALS

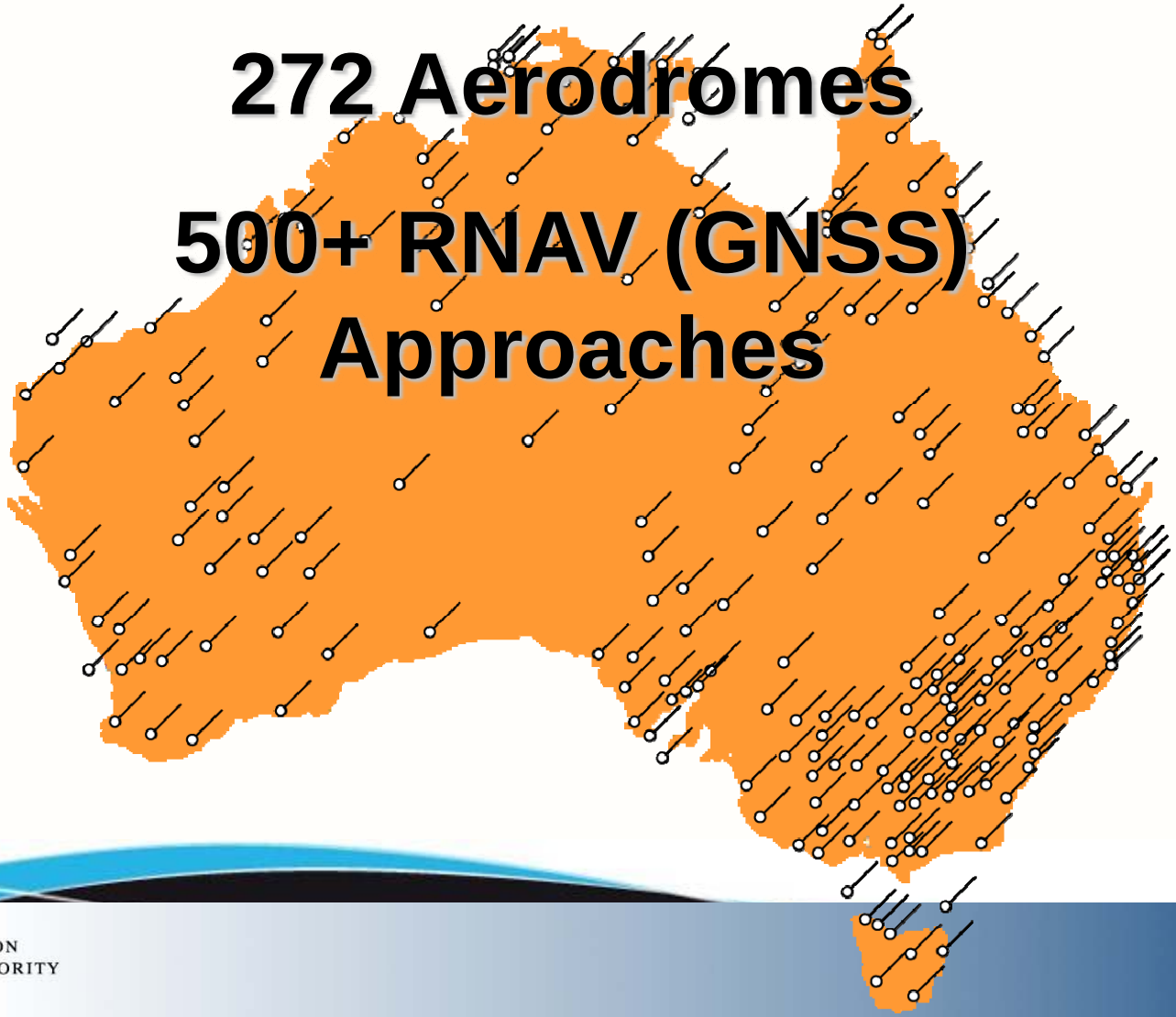
- 1995 Primary means enroute
  - 15 NM separation standard
- 1998 GPS non precision approaches 500+
- 2004 RNP 10 /RNP 4
- 2006 RNP-AR approaches
- **2006 Primary means GNSS**
- 2007 GLS Sydney
- 2011 Baro-VNAV approaches


australia
photo: michalturski.com

Aerodromes RNAV APPROACH

272 Aerodromes

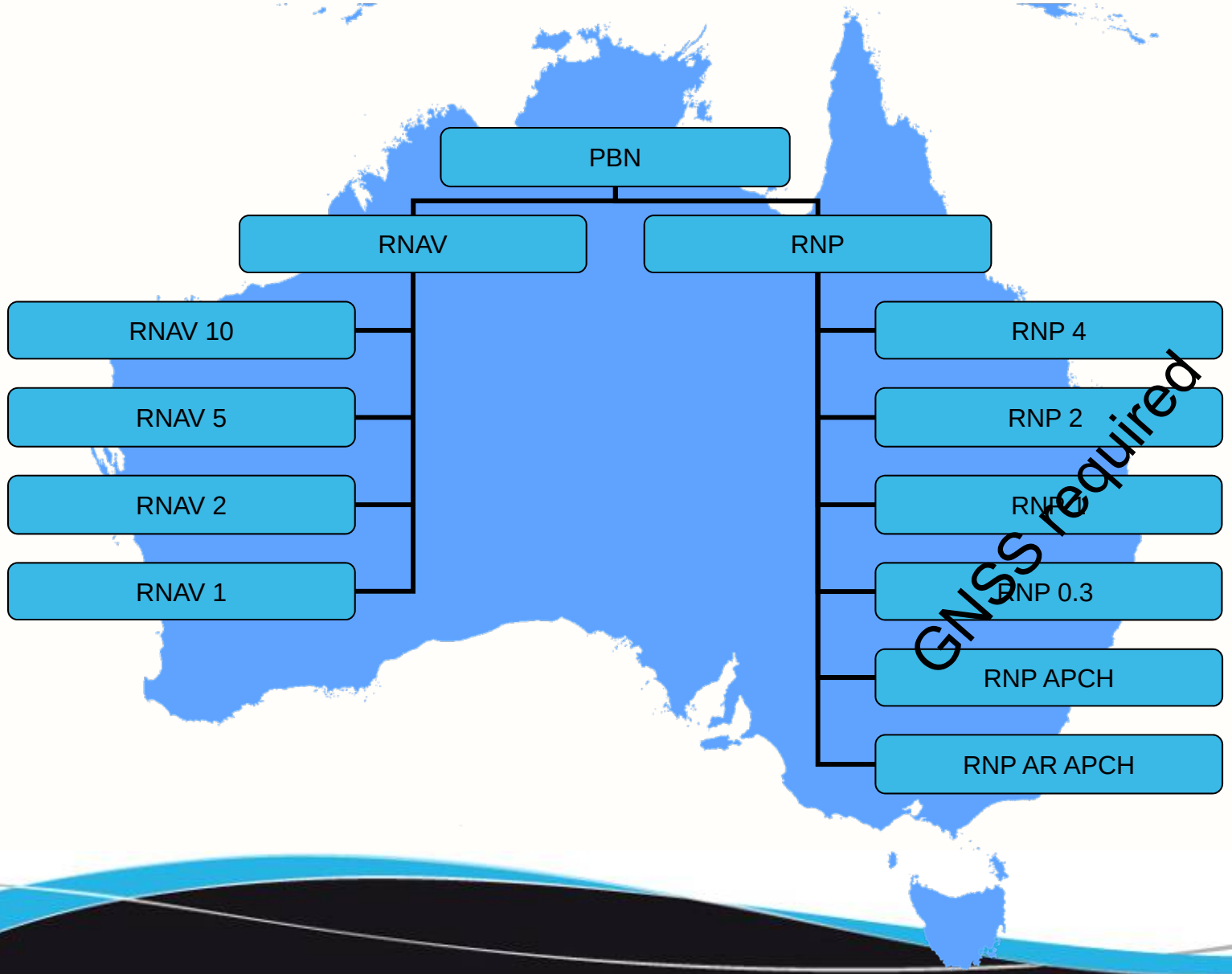
500+ RNAV (GNSS) Approaches



SYDNEY GLS – SLS 4000

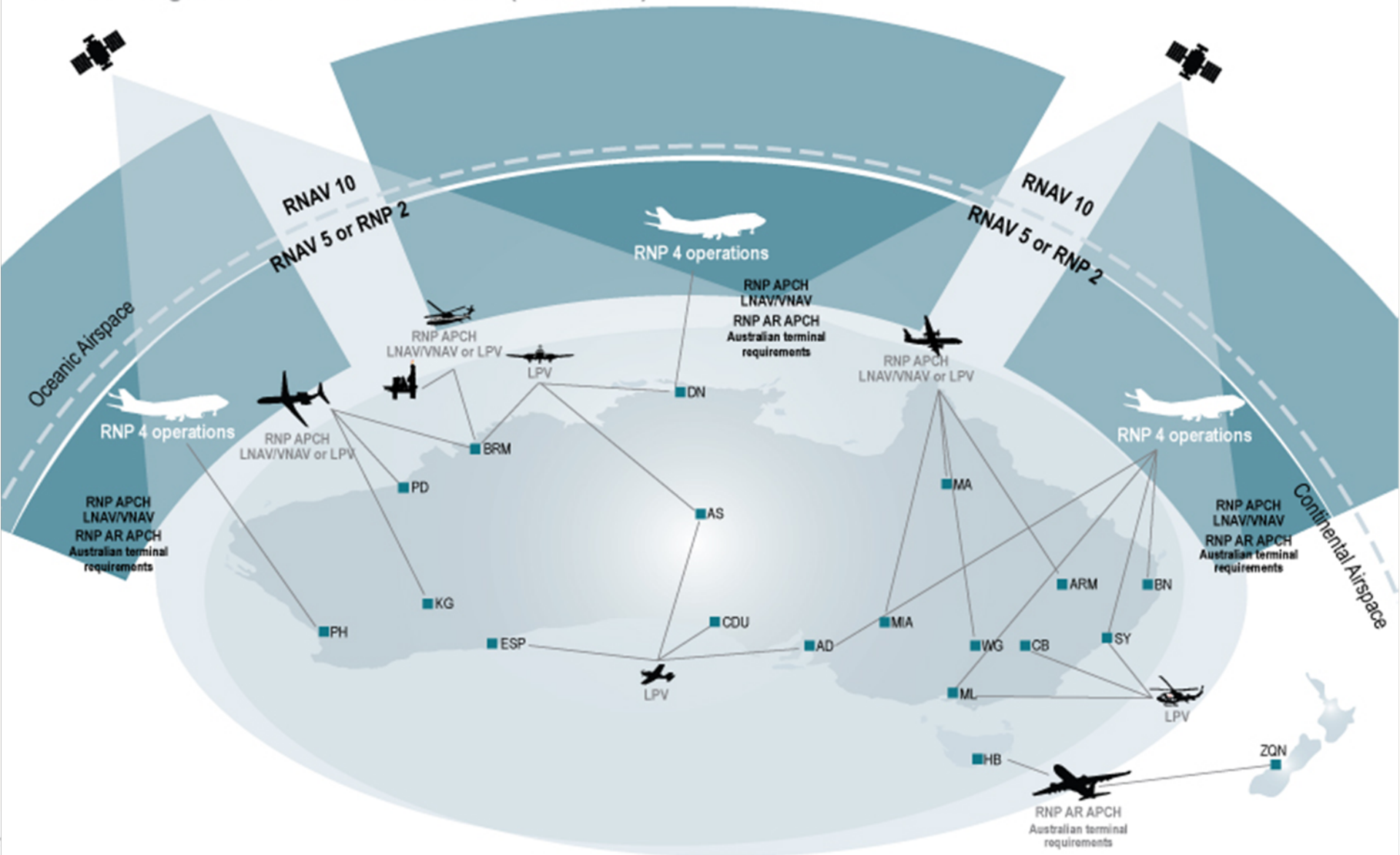
Performance Based Navigation (PBN) and Approach with Vertical Guidance (APV)

Australia's approach to PBN implementation



PBN IMPLEMENTATION PLAN—AUSTRALIA

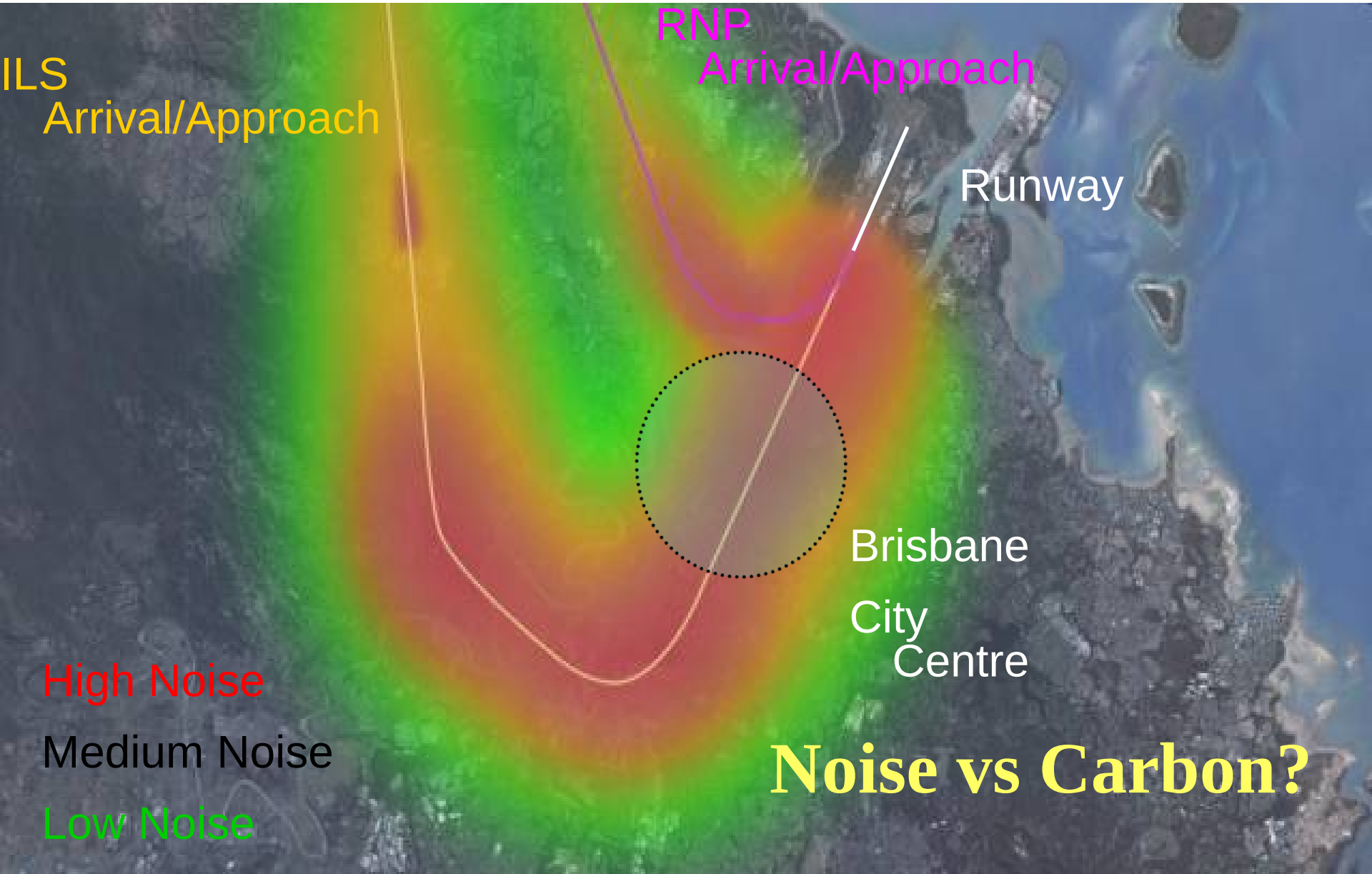
Future navigation construct—2013-2017 (with SBAS)



Airservices RNP AR Operations National Network

- Nationally linked RNP network by 2012
- 28 major and regional aerodromes
- RNP AR APCH, DEP and EOSID
- ICAO and Proprietary procedures
- Australian unique RNP AR op approval for proprietary procedures

PBN at Work

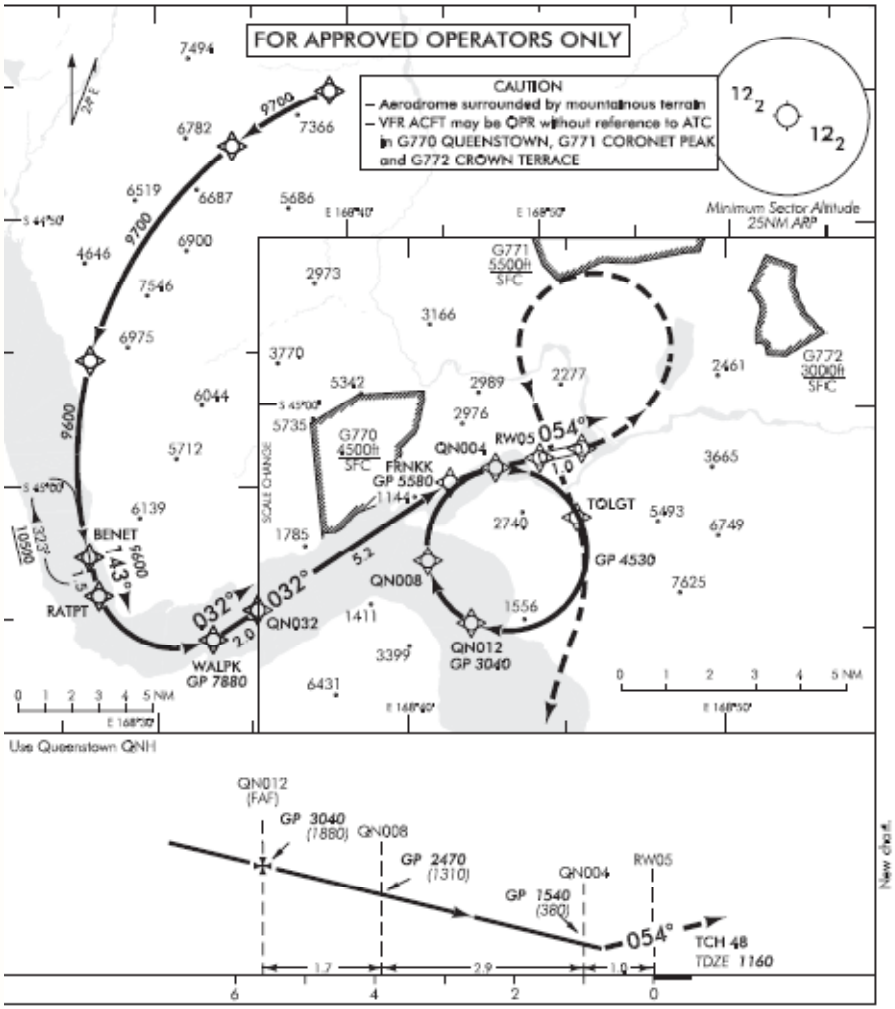

RNP
Arrival/Approach
ILS
Arrival/Approach
Runway
Brisbane
City
Centre
High Noise
Medium Noise
Low Noise
Noise vs Carbon?

NG TECHNOLOGIES

ELEV 1171 CAT C,D

QUEENSTOWN
RNAV (RNP) RWY 05

TOWER: 118.1 128.0 UNATTENDED: 118.1 ATIS: 126.4



MISSED APCH: Climb to 9800 via the RNP RNAV missed approach track

Category	A	B	C	D
RNP0.10	NA		1434(274) – 2000	
RNP0.15			1488(328) – 2000	
RNP0.18			1501(341) – 2000	
RNP0.30			2361(1201) – 5	


MAN
AUTO
HUD BRT
FUEL PUMPS
OFF
L
R
ON
CTR
AFT
FWD
FWD
AFT
FUEL PUMPS
L WIPER
PARK
INT
LOW
RUNWAY TURNOFF
TAXI
STANDBY COMPASS
RADIO RECEIVERS ON
COURSE
234
A/T
ARM
IAS/MACH
V NAV
HEADING
234
L NAV
ALTITUDE
10500
SPEED
HDG SEL
ALT HLD
YAW DAMPER
MAIN PANEL DU
LOWER DU
LIGHTS
AUTO BRAKE
FUEL FLOW

8 Years of RNP-AR Operation

RNP APPROACH BENEFITS

- Safety
  - Runway aligned DA – almost anywhere
  - Lateral & vertical guided approaches
  - CFIT risks reduced
  - Use of automatics
  - Engine INOP solutions
- Operations
  - Departure uplift
  - Low minima
  - Cost benefit

High reliance on self-contained area navigation systems

- TSO 129 stand alone navigators
- TSO 146 stand alone navigators
  - Mode S ES transponder to enable ADS-B

- IRS/GNSS/Multi sensor FMS
  - TSO 129 FMS
  - SA aware
  - FDE
  - Mode S ES transponder to enable ADS-C

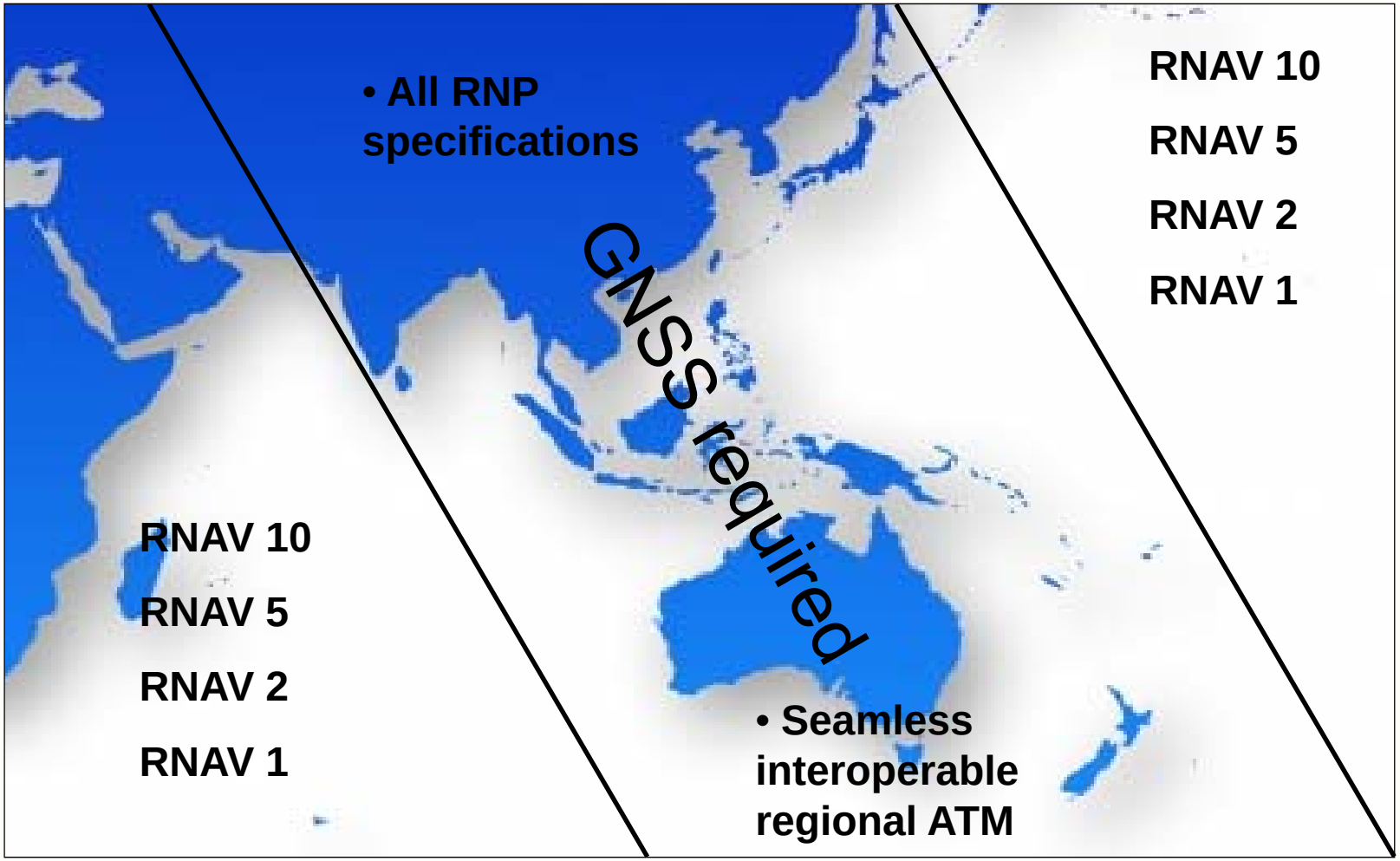
AUSTRALIAN PBN EXPERIENCE

- Basic RNP/GNSS Navigation Regulations in place
- Very high level of industry acceptance
- Significant safety and financial benefits
- Transition to GNSS expected by industry
- Technology before the Regulations!
  - eg B737 – 800 RNP
- Next Generation?
  - Systems
  - Rules

NAVIGATION INFRASTRUCTURE

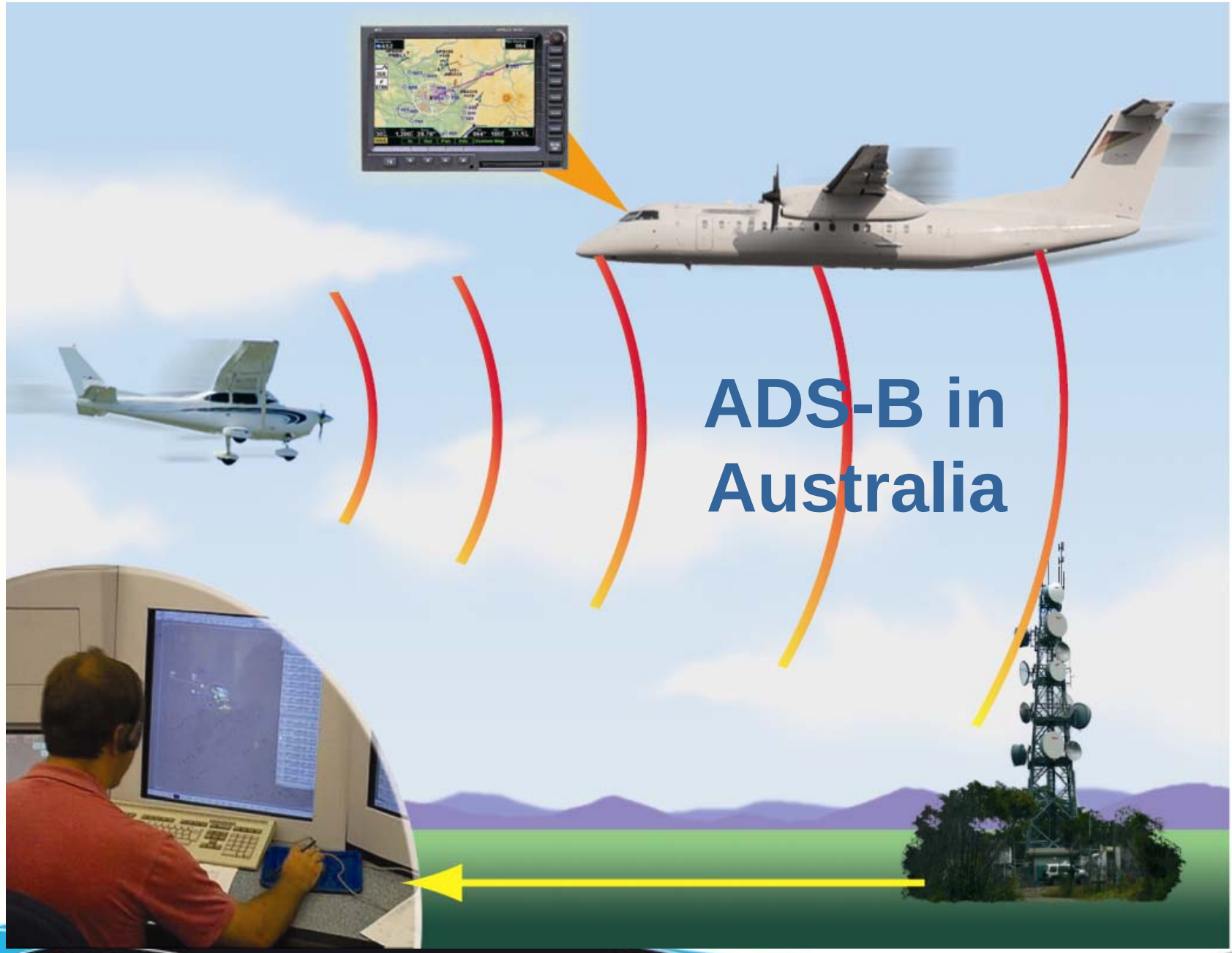
- GNSS – Primary Means
  - TSO C129 is OK provided ground aid alternate is available
- Reduction in ground based aids
  - Especially ADF
- “Back up” ground aids
  - Decided by Industry and Airservices

APANPIRG –recommended GNSS enabled RNP navigation specifications for APAC

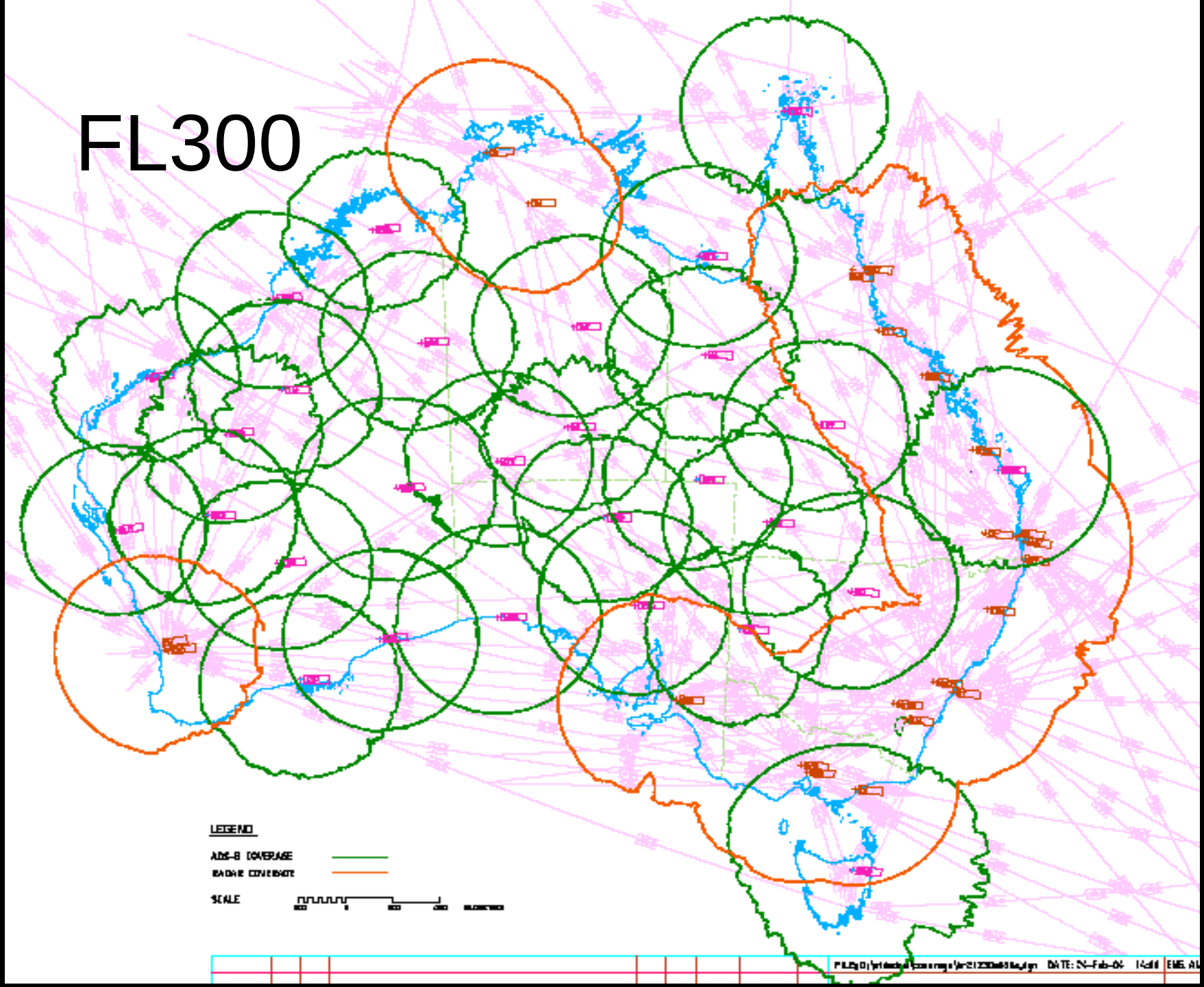


Benefits of PBN revolve around safety, efficiency and environmental impact

- Safety
  - Approaches with Vertical Guidance (APV)
    - APV is CFIT mitigator (eg: Lockhart River, Kokoda)
    - Only 10 % of Australian aerodromes have APV
- Efficiency
  - Reduced regulatory overheads (fewer specifications)
  - International interoperability (no duplication)
  - Fewer track miles flown (less time in air/fuel burn) per flight
- Environmental
  - Reduced track miles and lower power settings = reduced fuel burn = CO2 emissions
  - Reduced noise footprint, particularly on approach (late configuration, thrust at idle) and departure (reduced takeoff thrust)


ADS-B in
Australia

FL300



SAT COM VOICE

- ICAO decision not to use in 1990s
- Europe now allow as a substitute for
  - One HF
  - “Third party” coms
    - No suitable for RNP 4 separation and below
- SAT Com Voice Task Force
  - To set rules for global use
    - As a substitute for one HF
    - Possible LRCS in long term
  - Airservices advice – ATS not set up to use SCV
    - Need new consoles etc

AUSTRALIAN CNS MANDATES

- ADS- B 2013+
- GNSS 2014 -16
- TCAS 2014+

- See Discussion Paper and NPRMs


B747
A380

ISSUES

- **New GNSS Systems**
  - **Avionics?**
  - **Augmentation – needed?**
- **Interference**
  - Jammers
  - **Frequency protection**
  - Solar High in 2013
- **Policy on PNT**
  - APNT
    - US Policy “Need Backup” – FAA has yet to decide
    - Australian/Regional/ICAO position???

PLANNED GNSS

- •**Global Constellations**
- –**GPS (30+)**
- –**GLONASS** (30)
- –Galileo (27+3)
- –**Compass** (27+3 IGSO + 5 GEO)
- •Regional Constellations
- –**QZSS** (3)
- –IRNSS (7)

- **Satellite-Based Augmentations**
- –**WAAS (3)**
- –**MSAS (2)**
- –**EGNOS** (3)
- –**GAGAN** (2)
- –SDCM (2)

GNSS IN 2020?

- 50+ satellites in view
- Great car navigation - for urban canyons
- Receiver design
  - Aviation
    - Boeing Study – 441 possible combinations!!!
- Able to do APV without augmentation?
- Still need a back up?
- Australian Navigation Policy??

BACKUP???

- NDBs
  - Use against ICAO APV Resolution
  - Not fitted to new aircraft
    - A330 to new GA
    - Being phased out in USA and UK
- DME
  - Too expensive / technically ‘impossible’
- Any other choice???
- Multiple constellation GNSS?

Locata®

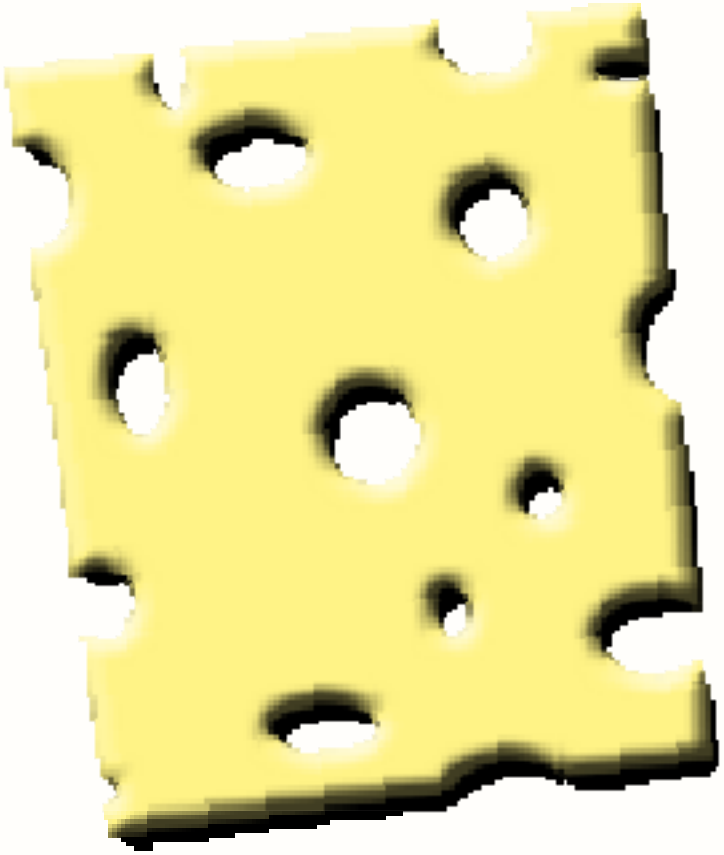
Locata 101

Locata Technology Overview 12.15 Wednesday

The technology, the development and the business…

Nunzio Gambale – Locata Corp

Reality...



“GPS is like Swiss cheese...

...it’s full of holes”

Customer Quote - a GPS fleet boss, trying to meet spec for bus location at LAX

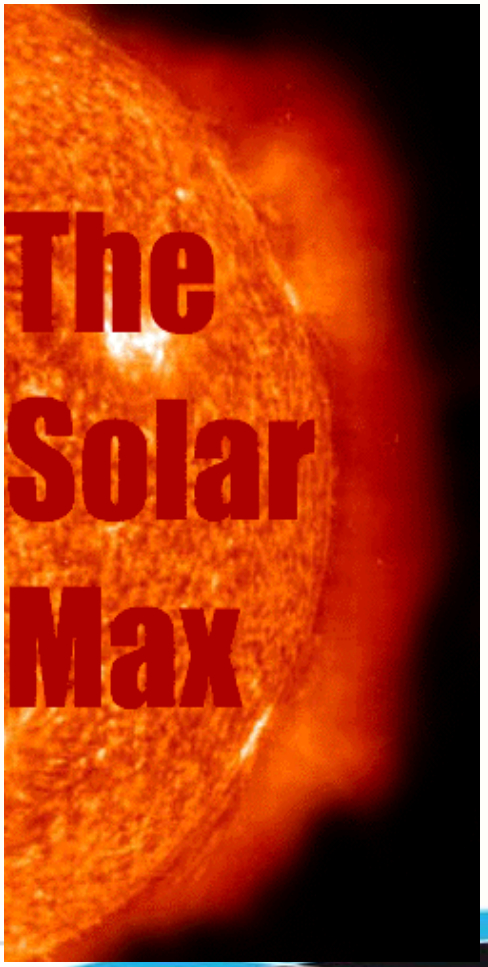
A REGIONAL SBAS?

- APAC cannot meet ICAO APV resolution
  - Limited number of Baro-VNAV aircraft
  - Need 100% LPV = Need SBAS
    - (or wait for enhanced constellations/equipment)
- How to progress a Regional SBAS
  - PBN Task Force
  - APEC GNSS Implementation Team (GIT)
    - Successful SBAS trial

JAMMING AND INTERFERENCE

- **GPS jammers**
  - Illegal in Australia
  - Available on the Net - $40
  - “Personal Privacy Devices
  - Car/Truck monitoring
- **Stuff up GLS systems**
  - Memphis
- TSO GPS – stop working (maybe)
- **Report any GPS interference**

SOLAR MAX



Solar Max in 2012+
(along with end of world!)

No GPS issues with last one

Worst storm in Solar Low!

DECISIONS NEEDED

- ICAO
  - Is a back up required for GNSS?
  - Global Air Navigation Industry Symposium
    - GANIS
  - ASBUs!!!! – pick yours!!
- Industry
  - What is the next generation aviation receiver design

The joys of new technology??!!

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QUESTIONS
DISCUSSION


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