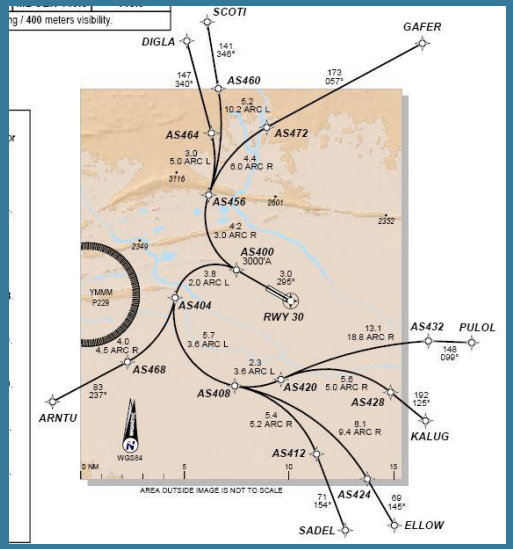
GPS & Australian Aviation

airside | AIRSERVICES AUSTRALIA

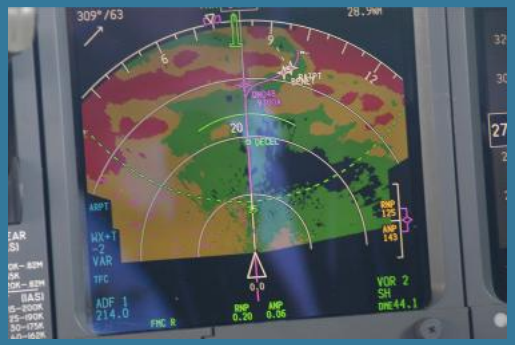


CGSIC

International Information Session

Nashville, Tennessee

17 November 2012



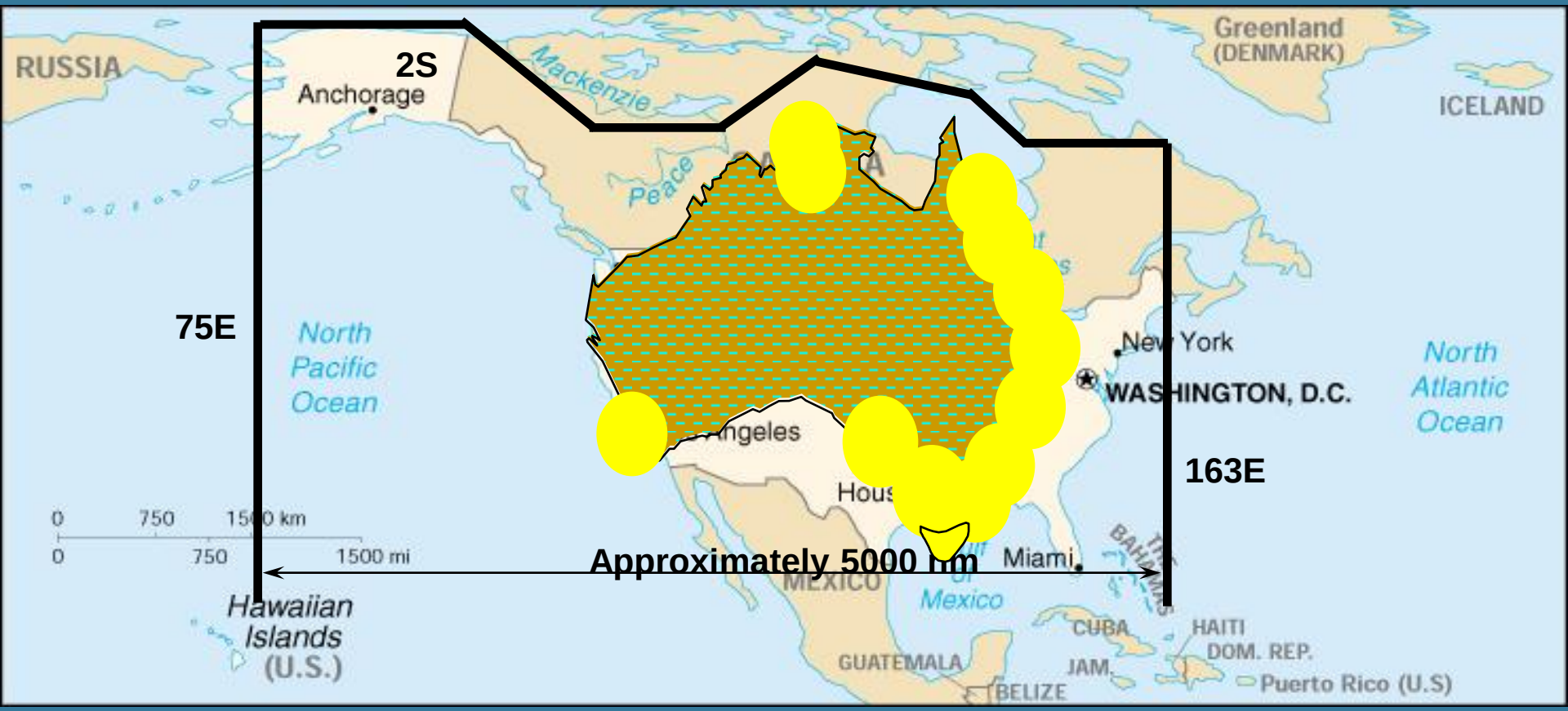
Ed Williams
Navigation Planning
Airservices Australia

Contents

- Australian Aviation Context
- GPS and Aircraft Navigation
- GPS and Aircraft Surveillance
- Thanks and Thoughts

Australia's ATC Environment

AIRSERVICES AUSTRALIA



Radar Separation

Procedural Separation

Aviation Growth

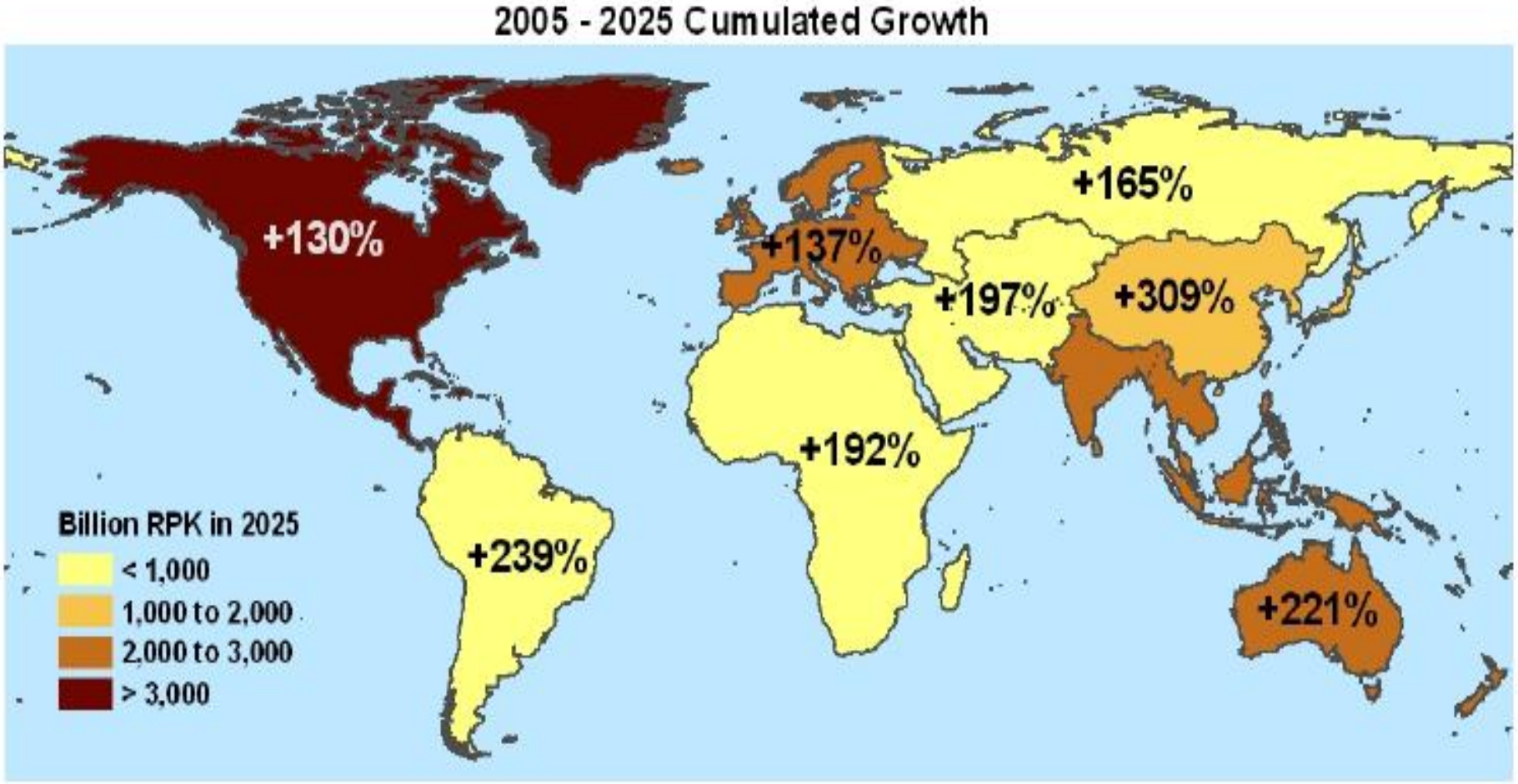
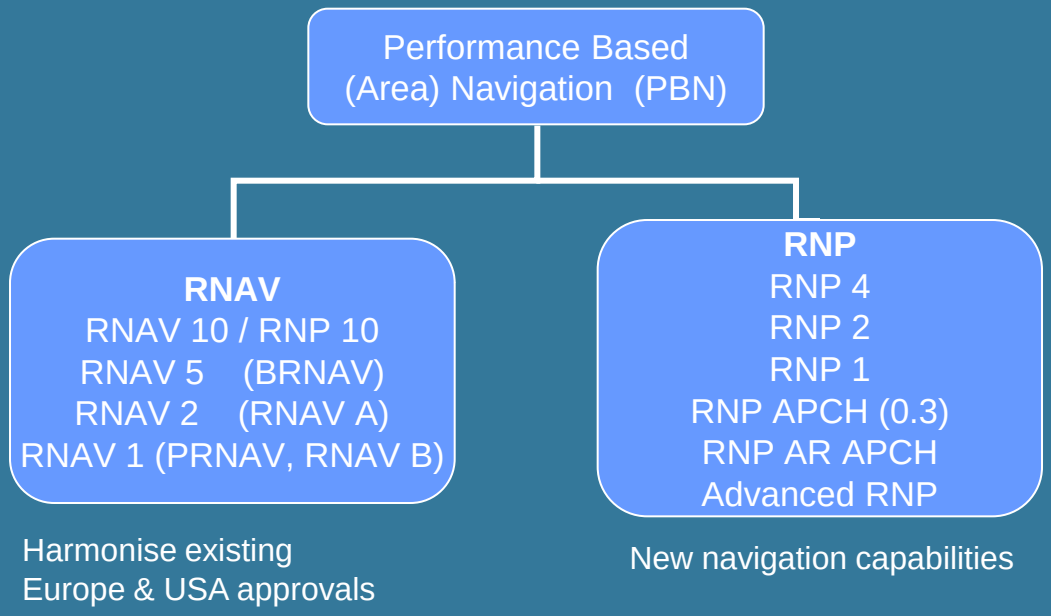


Fig.2-5 : Long-term Forecasts in Worldwide Traffic Growth

Contents

- Australian Aviation Context
- GPS and Aircraft Navigation
  - Optimised long haul Oceanic
  - Optimised Arrival & Approach
- GPS and Aircraft Surveillance
- Thanks and Thoughts

Performance Based Navigation (PBN)



Oceanic: RNP-4 RNAV-10 protracted transition

En Route: RNP-2 RNAV-5 transition within radar

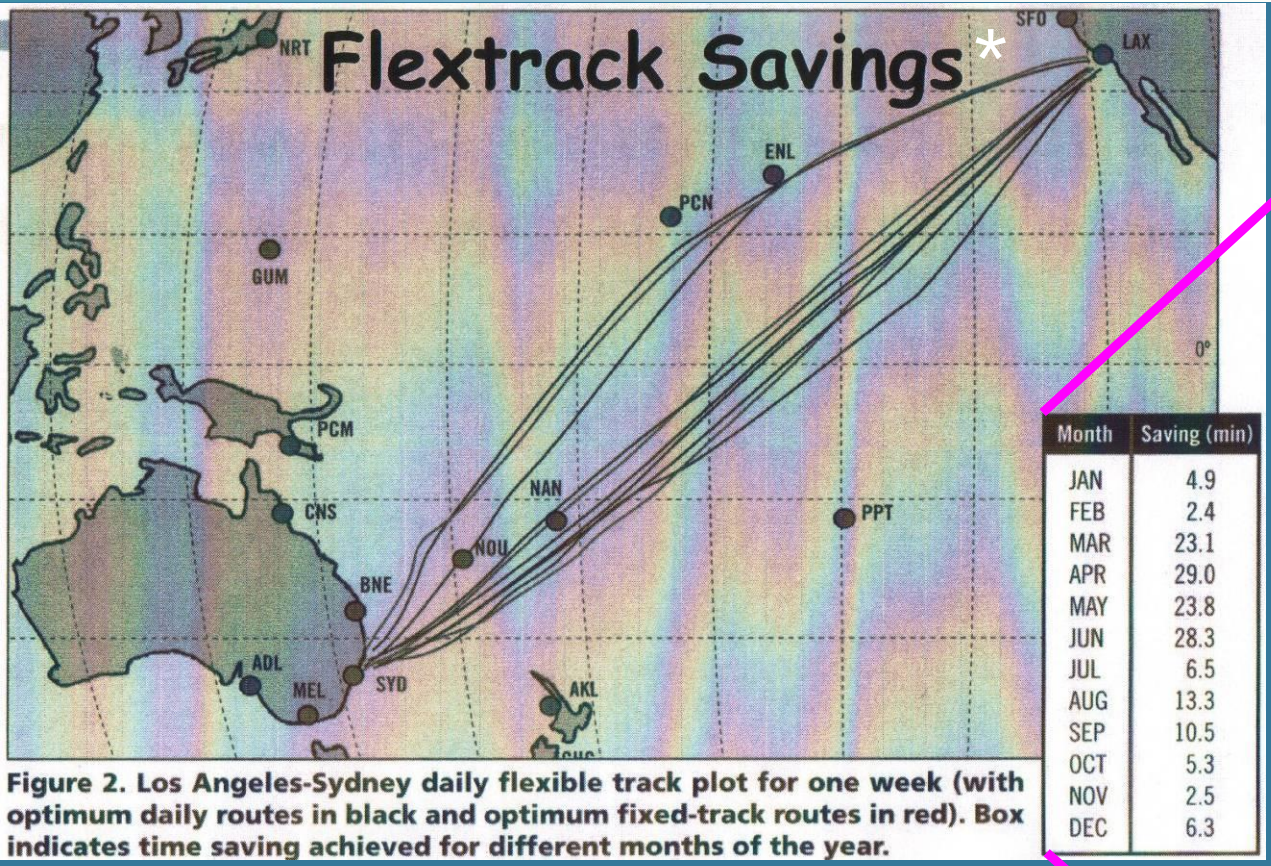
Arrival: RNP-1 RNAV-1 for short transition

NPA: RNP-APCH / RNAV(GNSS)

Specialised: RNP Special at Operator Request

GPS is a powerful enabling technology

User Preferred Route



Month	Saving (min)
JAN	4.9
FEB	2.4
MAR	23.1
APR	29.0
MAY	23.8
JUN	28.3
JUL	6.5
AUG	13.3
SEP	10.5
OCT	5.3
NOV	2.5
DEC	6.3

Figure 2. Los Angeles-Sydney daily flexible track plot for one week (with optimum daily routes in black and optimum fixed-track routes in red). Box indicates time saving achieved for different months of the year.

Month	Saving (min)
JAN	4.9
FEB	2.4
MAR	23.1
APR	29.0
MAY	23.8
JUN	28.3
JUL	6.5
AUG	13.3
SEP	10.5
OCT	5.3
NOV	2.5
DEC	6.3

2.4 < 29 mins * 8 flights = 0.3 < 3.8 flt hours/day

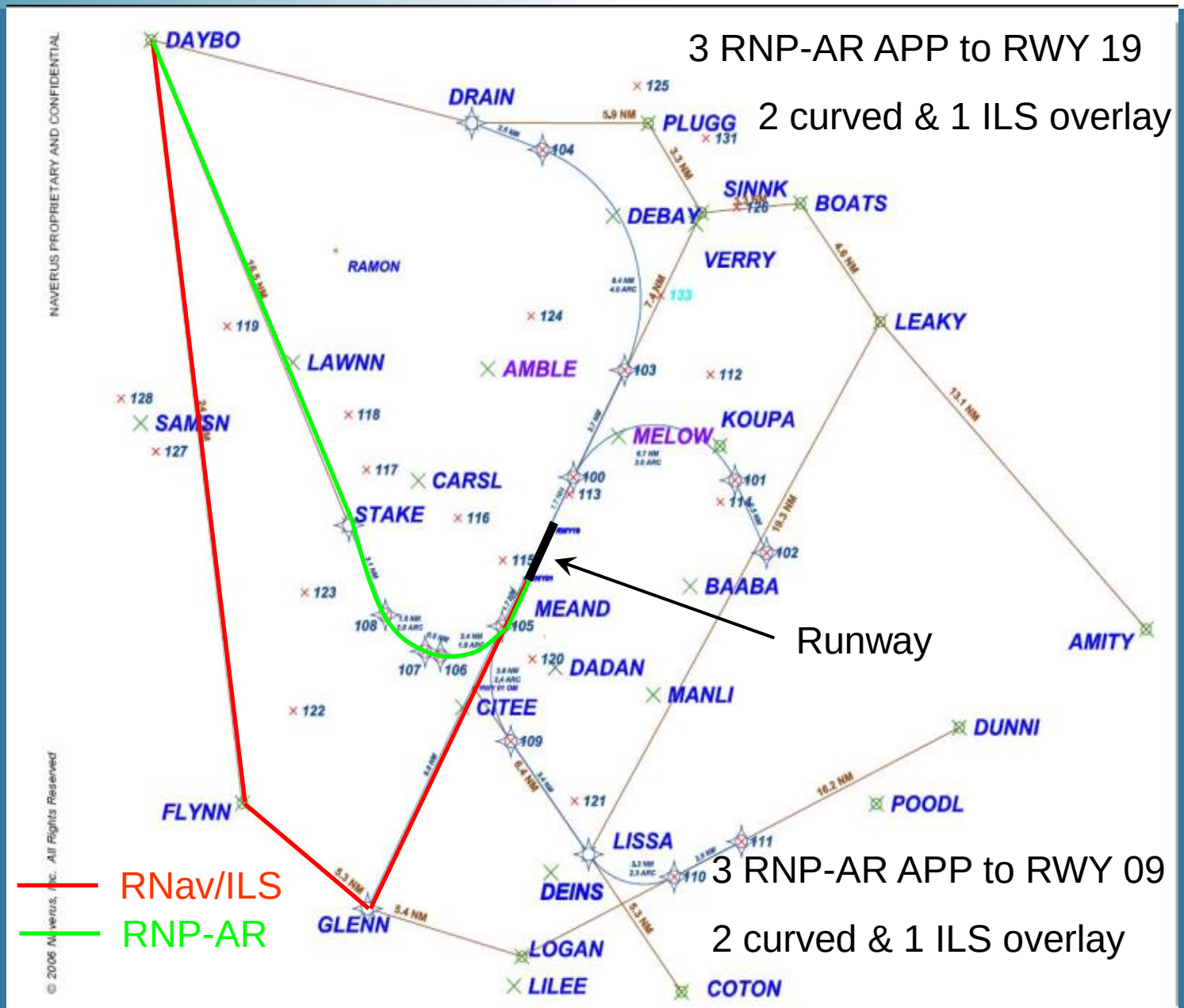
0.3 < 3.8 hr @ 11 tonne/hr = 3.3 < 41.8 tonne/day

3.3 < 41.8t * 10.8 * 59 * 1.48 = $ 3,112 < 39,420 AUD

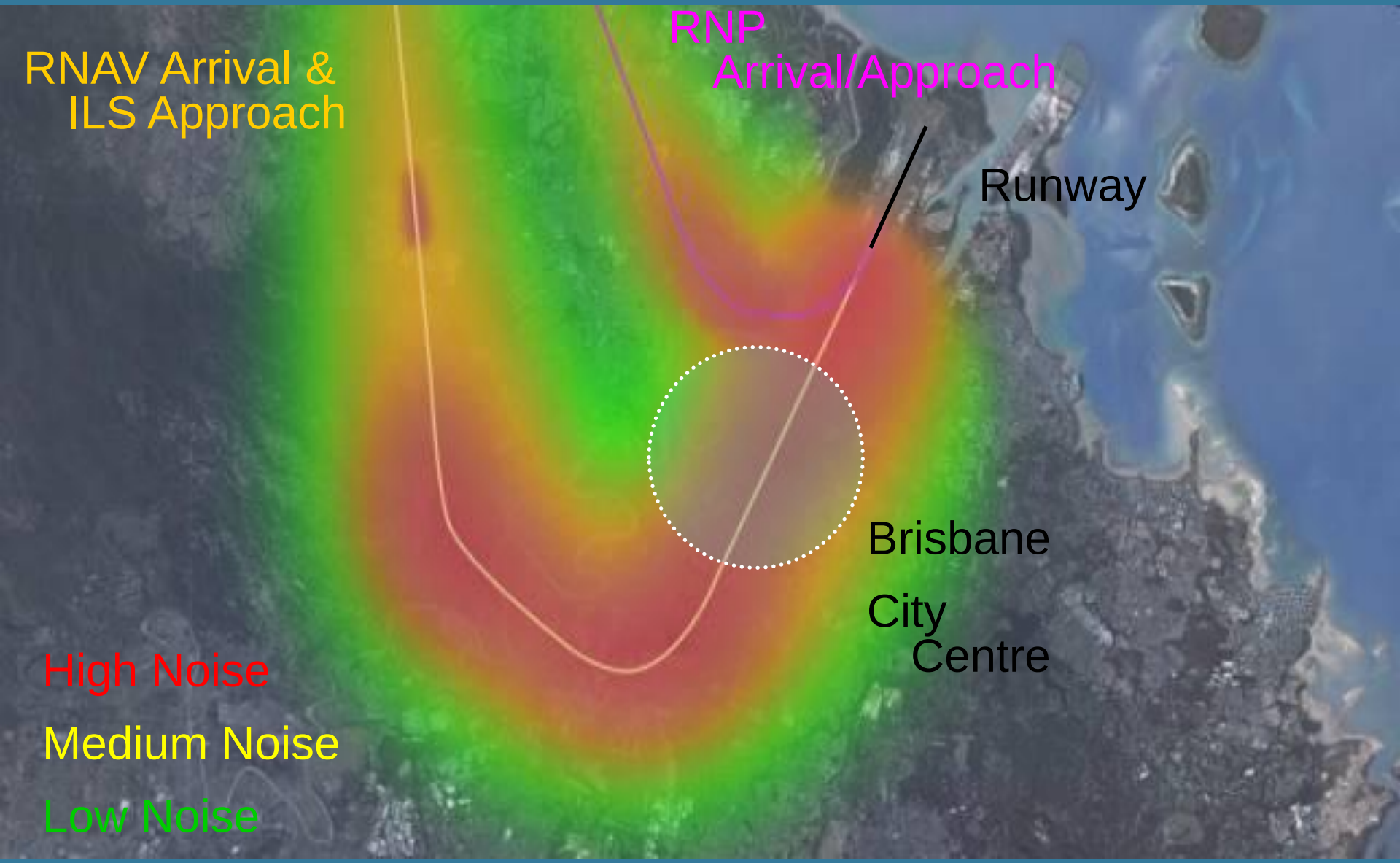
3.3 < 41.8t * 3.3 = 10.9 < 138 tonne CO_2

*Courtesy of QANTAS

Brisbane – RNP Concept

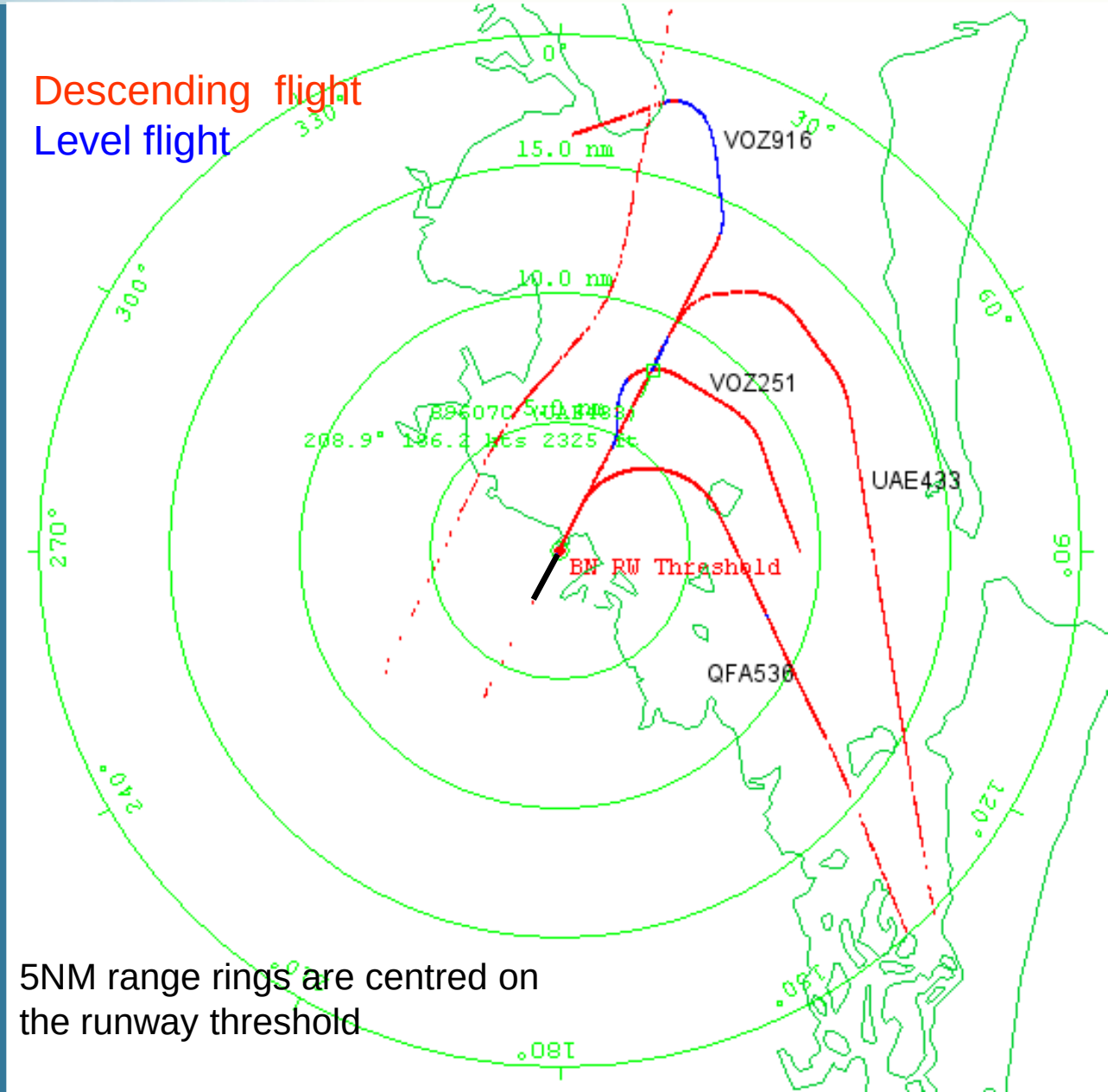


PBN at Work

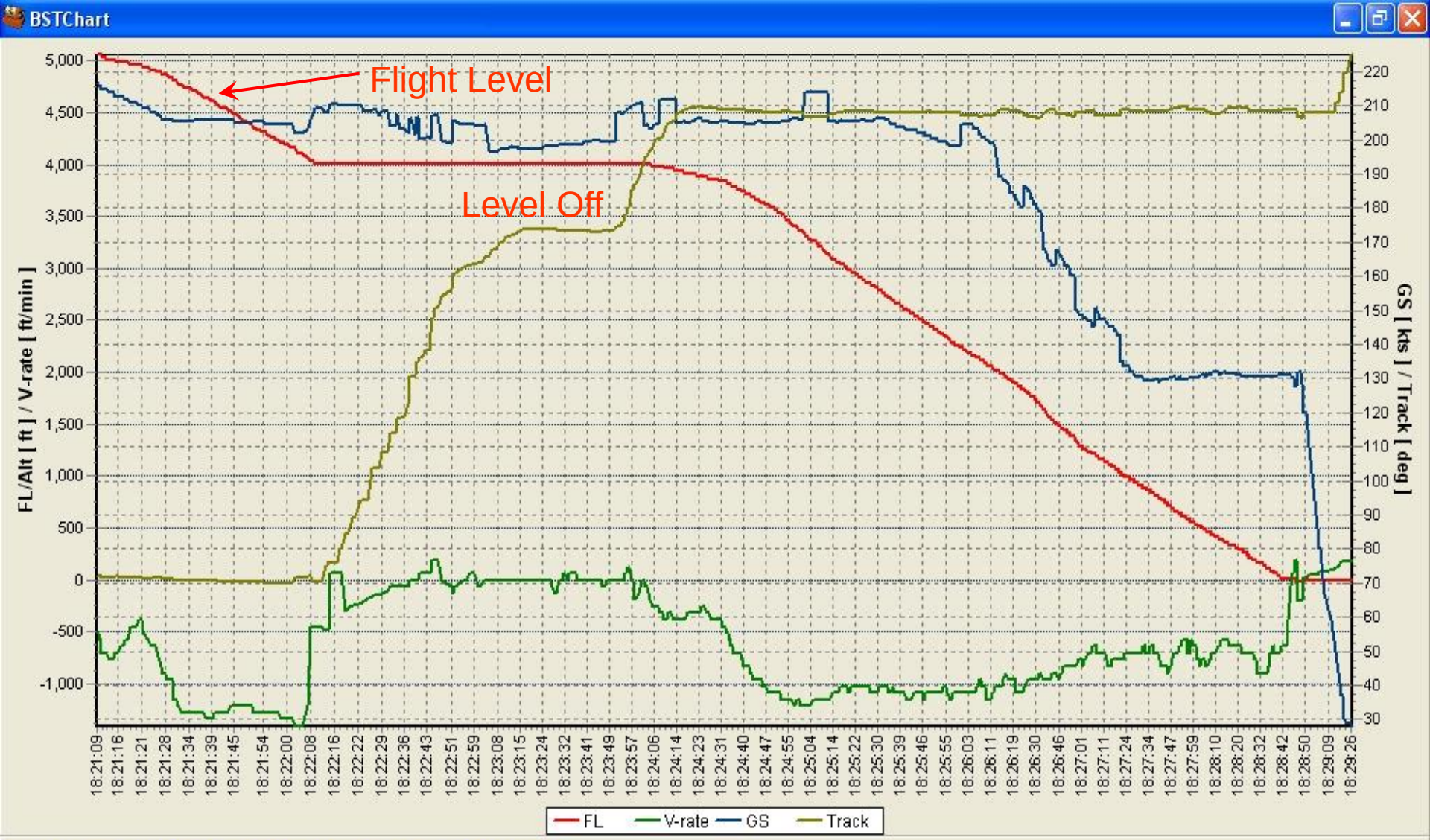


Four Consecutive Arrivals

- Instrument weather conditions (IMC)
- VOZ & UAE flights RNav onto the ILS
- QFA536, a B737-800, conducted an RNP-AR approach



5NM range rings are centred on the runway threshold



C:\A GENERAL STORE\RNP\BN RNP TRIAL\BN RNP-AR 20070614-182105.bst

Load bst

Settings

Select callsign or hex

Callsign VOZ916 Chart

Hex

Recording times

Start time 2007/06/14 18:21:09

End time 2007/06/14 18:44:26

GE kml

GE kml

Flat

Msg count 3974

QNH

QNH adjustment

QNH 1020 hPa

TA 10500 ft

QNH = 1020 185 ft

TA = 10500 ft

Plotted flight

Callsign	VOZ916
Hex	7C6D25
Date	2007/06/14
Start time	21:09 PM
End time	:29:27 PM
Track dist.	488.7
Msg count	752

Flight extremes

FL/Alt	-15	5,060
GS	28.0	216.6
V-rate	-1,408	192
Dist.	8,232.7	8,564.5

Chart control

FL GS

V-rate Track

X-labels

Top

Bottom

GIF

Save

Trk2

Route

Aircraft data

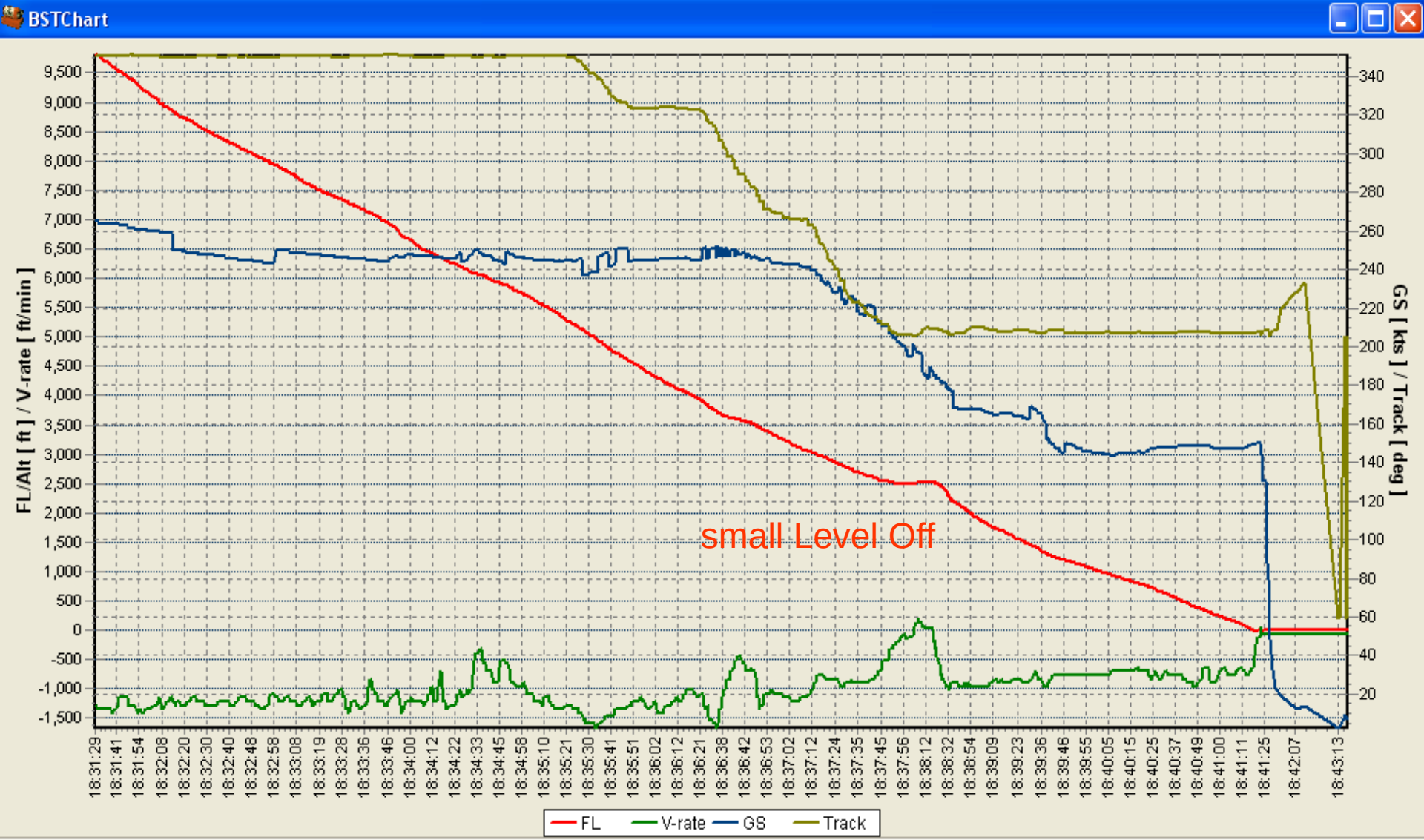
Reg

ICAO

Type

Owner

Country



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Load bst

Settings

Select callsign or hex

Callsign UAE433 Chart

Hex

GE kml

GE kml

Flat

Recording times

Start time	2007/06/14	18:21:09
End time	2007/06/14	18:44:26

Msg count 3974

QNH

QNH adjustment

QNH 1020 hPa

TA 10500 ft

QNH = 1020 185 ft

TA = 10500 ft

Plotted flight

Callsign	UAE433
Hex	89607C
Date	2007/06/14
Start time	31:29 PM
End time	:44:09 PM
Track dist.	507.0
Msg count	918

Flight extremes

FL/Alt	-15	9,810
GS	2.5	264.7
V-rate	-1,664	192
Dist.	8,232.5	8,561.9

Chart control

FL GS

V-rate Track

X-labels

Top

Bottom

GIF

Save

Trk2

Route

Aircraft data

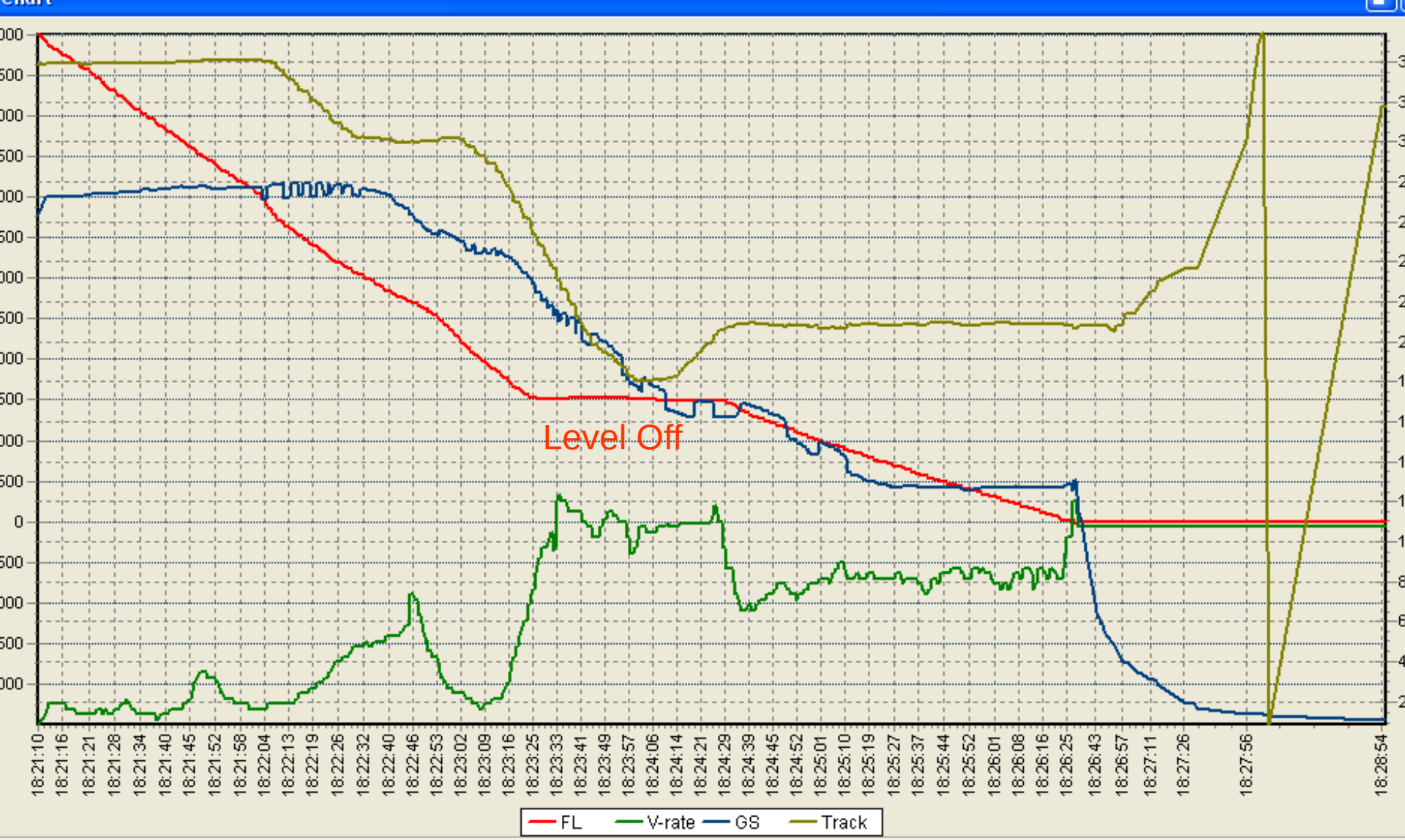
Reg

ICAO

Type

Owner

Country



ENERAL STORE\RNP\BN RNP TRIAL\BN RNP-AR 20070614-182105.bst

Select callsign or hex

Callsign VOZ251 Chart

Hex

GE kml

GE kml

Flat

QNH

QNH adjustment

QNH 1020 hPa

TA 10500 ft

QNH = 1020 185 ft

TA = 10500 ft

Plotted flight

Callsign	VOZ251
Hex	7C6D28
Date	2007/06/14
Start time	21:10 PM
End time	:28:57 PM
Track dist.	508.6
Msg count	599

Flight extremes

FL/Alt	-15	6,010
GS	11.0	279.7
V-rate	-2,496	320
Dist.	8,232.5	8,557.8

GIF

Save

Trk2

Chart control

FL GS

V-rate Track

X-labels

Top

Bottom

Route

Aircraft data

Reg

ICAO

Type

Owner

Country

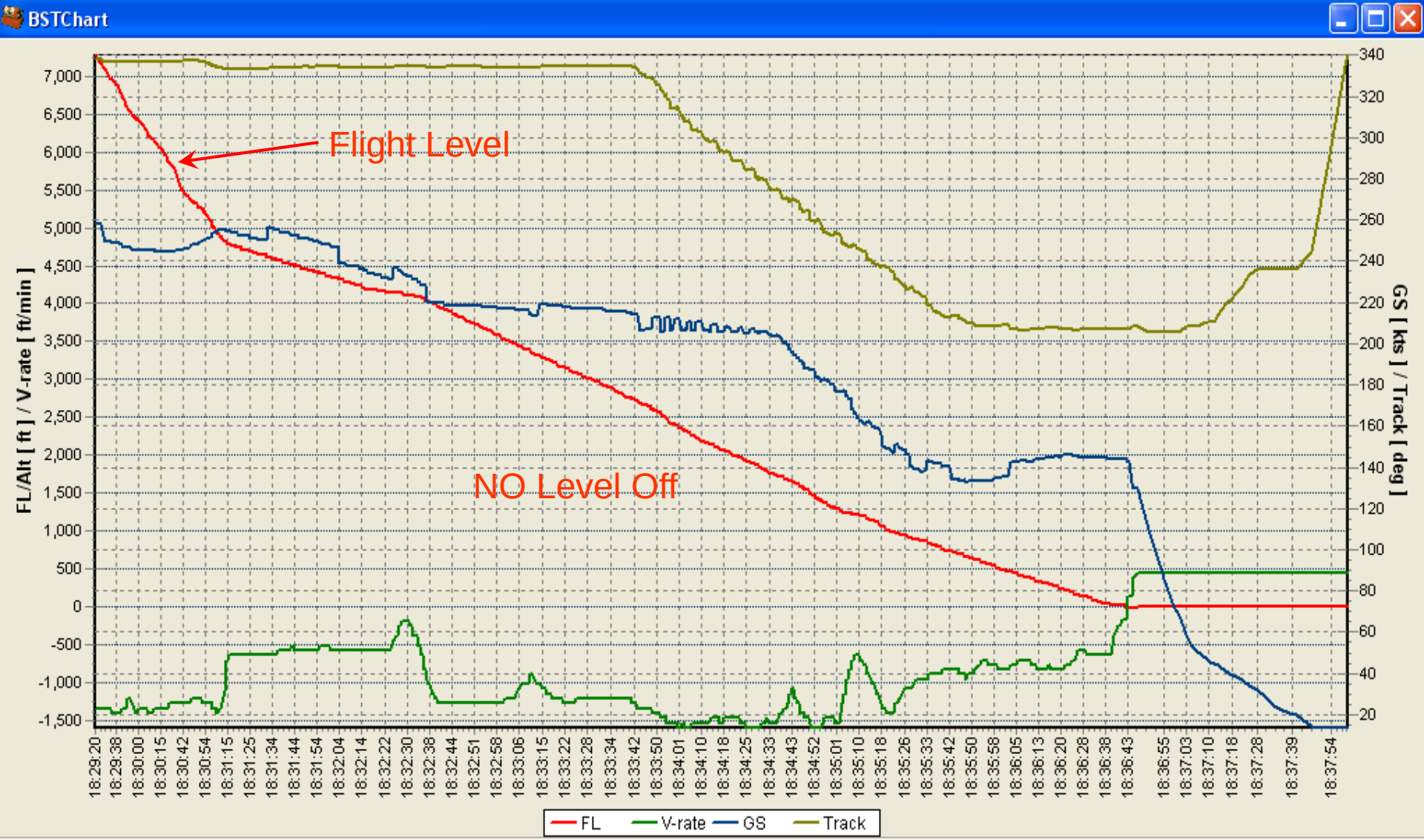
Recording times

Start time 2007/06/14 18:21:09

End time 2007/06/14 18:44:26

Msg count

3974



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Load bst

Settings

Select callsign or hex

Callsign QFA536 Chart

Hex

Recording times

Start time 2007/06/14 18:21:09

End time 2007/06/14 18:44:26

Msg count 3974

GE kml

GE kml

Flat

QNH

QNH adjustment

QNH 1020 hPa

TA 10500 ft

QNH = 1020 185 ft

TA = 10500 ft

Plotted flight

Callsign	QFA536
Hex	7C6DB8
Date	2007/06/14
Start time	29:20 PM
End time	:38:01 PM
Track dist.	485.4
Msg count	692

Flight extremes

FL/Alt	-15	7,285
GS	13.5	258.9
V-rate	-1,600	448
Dist.	8,232.5	8,554.7

Chart control

FL GS

V-rate Track

X-labels

Top

Bottom

GIF

Save

Trk2

Route

Aircraft data

Reg

ICAO

Type

Owner

Country

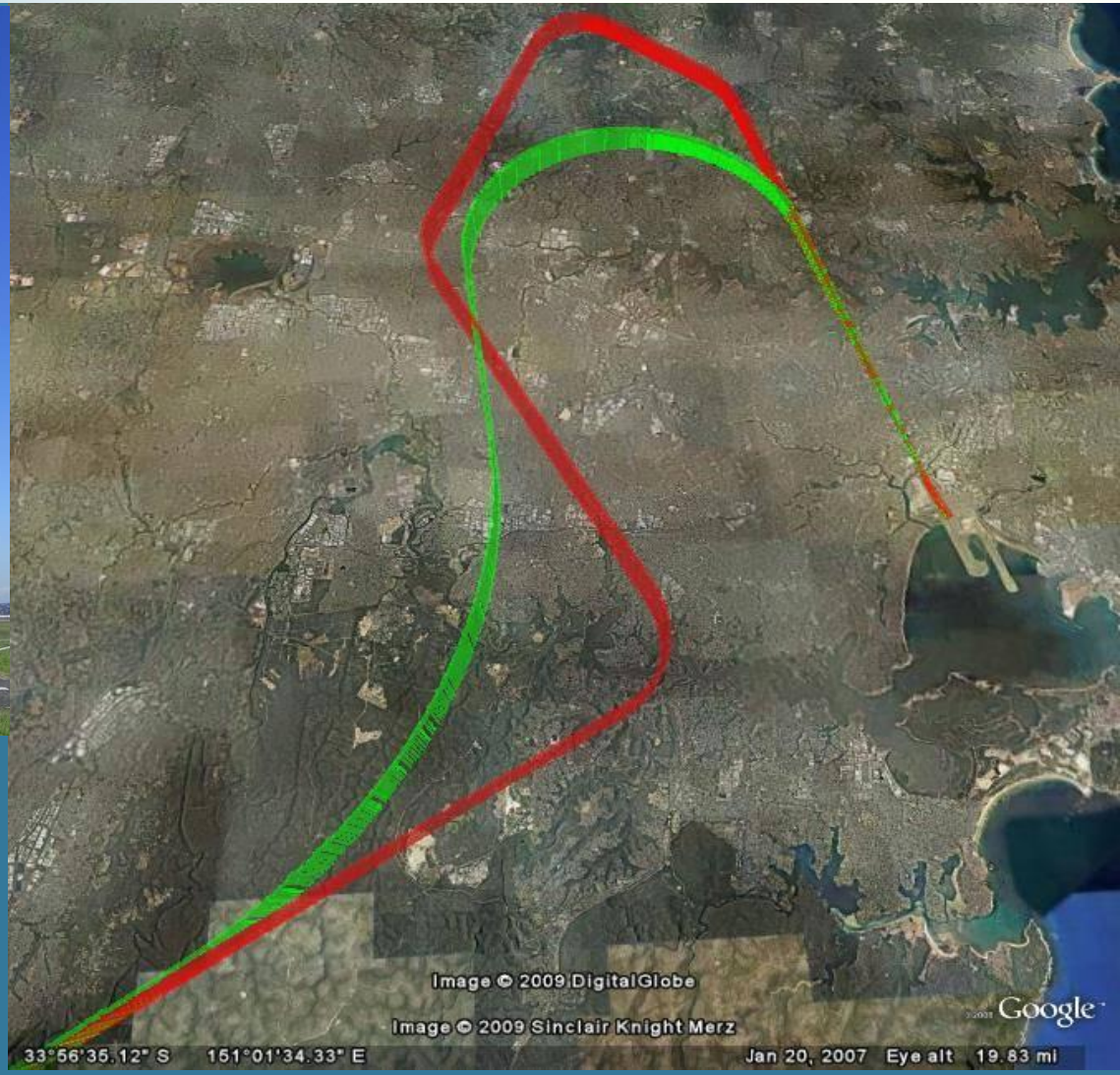
Brisbane TMA RNP-AR Ops

24 Months of Operations

- ✈ Two aircraft types (B738 & A320)
- ✈ Track Keeping:
  - 7,532 flights (2,404,276 data points) analysed
  - Straight flight – 20m (1 std dev)
  - Manoeuvring – 42m (1 std dev)
  - B737NG wingspan 36m
  - Greatest deviation 469 m

- ✈ Economic Savings
  - 3,200 RNP Arrival/Approach otherwise ILS (due weather)
  - 55,946 track miles avoided; 699,325 kg fuel saved
  - 2,237,840 kg CO2 not emitted
  - PLUS efficiency of Continuous Descent Arrival/Approach

RNP / APV Arrival – GLS Approach



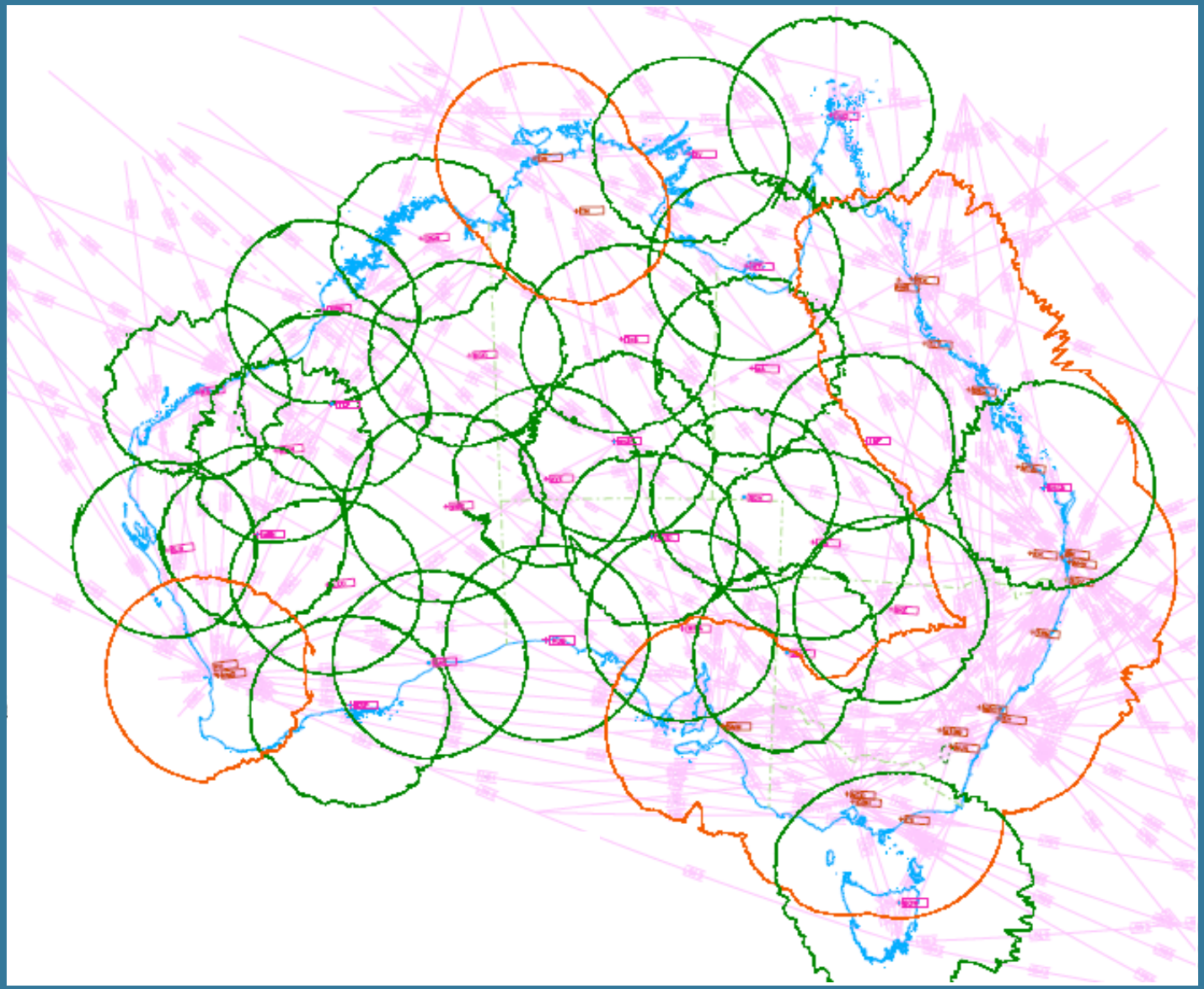
SLS-4000 GBAS

The more efficient green RNP/APV - GLS guided procedure compared to typical vectored red track currently used at Sydney.

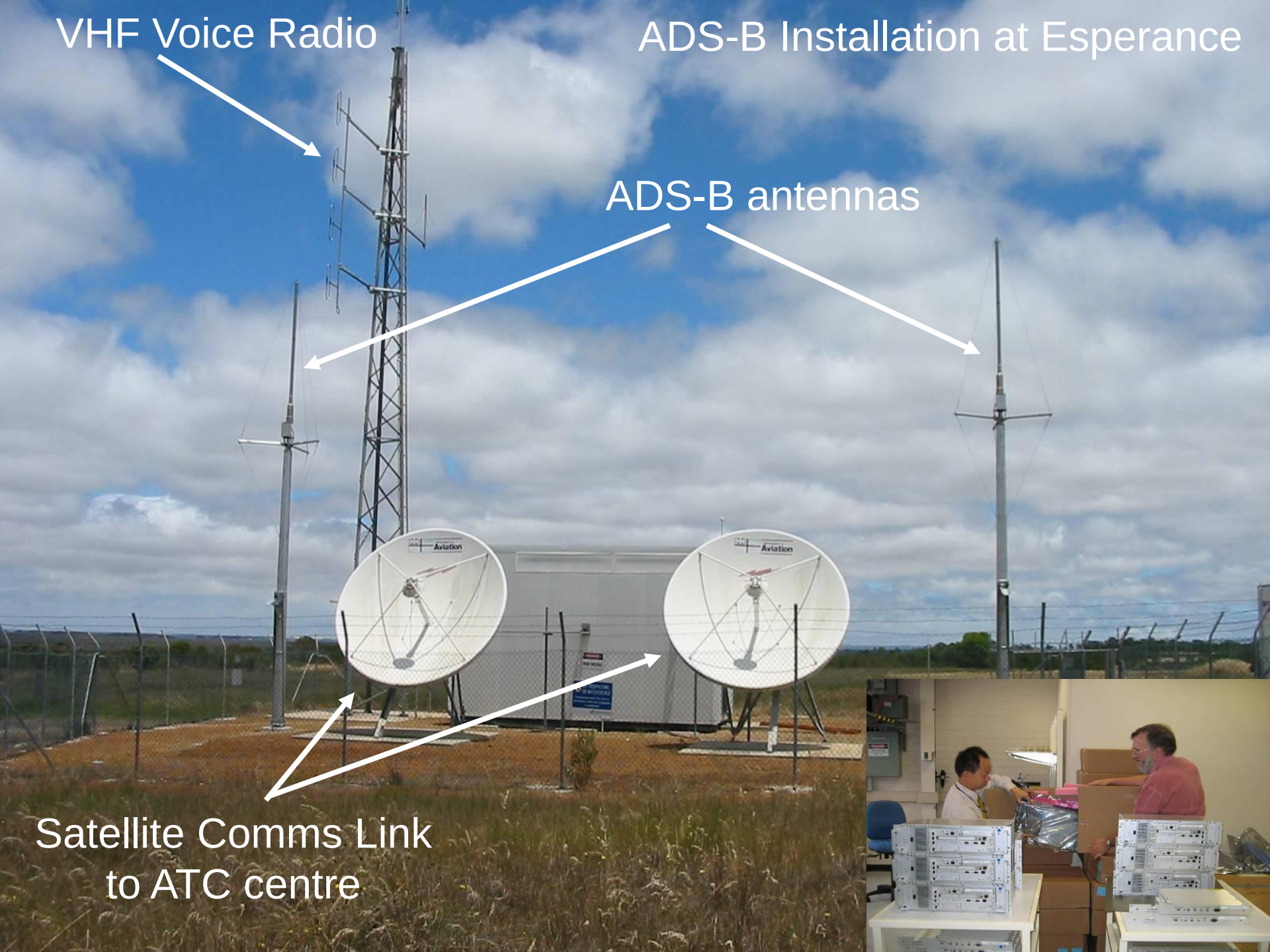
Contents

- Context
- Performance Based Navigation (PBN)
  - Navigation Specifications
  - Beneficial Application of RNP
  - Choice of Navigation Specifications
  - Approach with Vertical Guidance (APV)
  - GPS Landing System
- ADS-B
  - Applications and Technology
  - Beneficial Application
- Mandates

ADS-B above FL 290



ADS-B Installation at Esperance



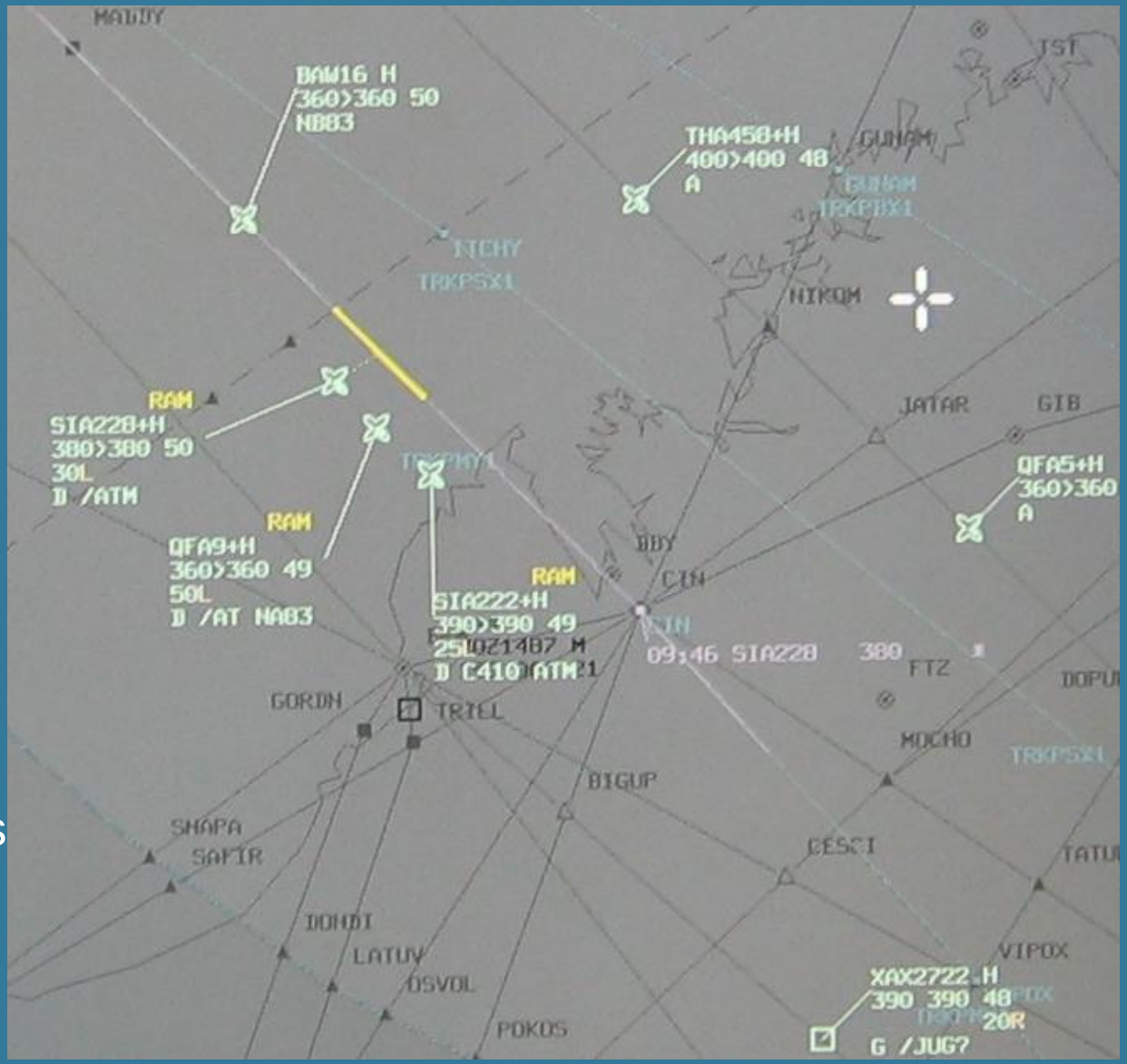
ADS-B Installation at Longreach


Some ADS-B installations are in remote areas

ADS-B cohabitates with other services

ATC Feedback

- Greater probability of optimum altitude
- Flexibility to accommodate weather
- Less ATC intervention
- Greater visibility increases Safety
- 55% of Domestic Flights
- 73% of International Flights

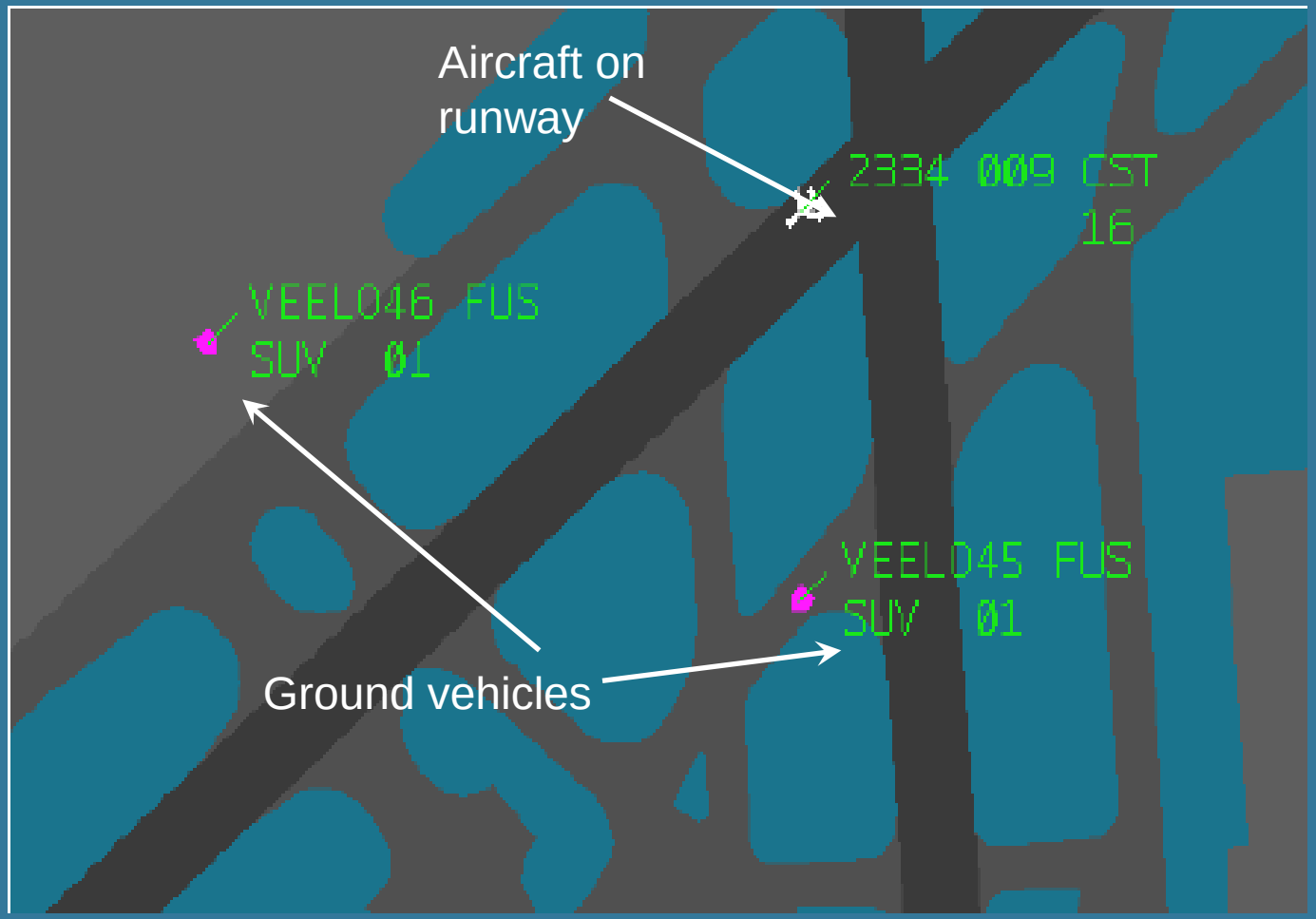


Oceanic Route Crossings

Broome

Broome

Surface Movement ADS-B



Installation Issue?

Contents

- Context
- Performance Based Navigation (PBN)
  - Navigation Specifications
  - Beneficial Application of RNP
  - GPS Landing System
- ADS-B
  - Applications and Technology
  - Beneficial Application
- Mandates

Mandates

- PBN IFR Navigation:
  - Using GPS as enabling technology
  - Forward fit: 6 Feb 2014; Retrofit: 4 Feb 2016
- ADS-B Out
  - Aust aircraft operating at/above FL290: 12 Dec 2013
  - IFR Aircraft registered on/after 6 Feb 2014
  - IFR Aircraft registered before 6 Feb 2014 retrofit 2 Feb 2017
- Navigation & ADS-B Carriage Requirements:
  - http://www.comlaw.gov.au/Details/F2012L01739/Download
- PBN Approval Requirements:
  - http://www.comlaw.gov.au/Details/F2012L01570/Download

Thanks

- GPS improved with time:
  - Robustness - 27 Satellite geometry
  - Accuracy - Equivalent User Range error decreased
  - Availability – Practical Purposes 100%
- Women and Men who pioneered / operate GPS:
  - You have our Sincere thanks for the truly exceptional Service
- Politicians & Administrators:
  - GPS gives immense Safety, Environment and Economic benefit
  - Ubiquitous in all aspects of life
  - Easy to take for granted
  - GPS needs to be protected, fostered, replenished, grown

Questions

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