



*International Civil Aviation Organization*

**NINETEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION  
AND SURVEILLANCE SUB-GROUP (CNS SG/19) OF APANPIRG**

Bangkok, Thailand, 20 – 24 July 2015

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**Agenda Item 6.3: Discuss other surveillance related matters.**

**INTERIM GLOBAL TRACKING IN AUSTRALIA**

(Presented by Australia)

**SUMMARY**

This paper presents a summary of the Interim Global Tracking Initiative implemented by Australia,

**1. INTRODUCTION**

1.1 The loss of Air France Flight 447 in 2009 and Malaysia Airlines Flight 370 in 2014 highlighted the need for continuous tracking of aircraft.

1.2 ICAO responded by holding the Global Tracking Conference in May 2014 and the High Level Safety Conference in February 2015, proposing the following performance requirements:

- One aircraft position report every 15 minutes during normal operations
- The ability to identify non-normal operations
- In case of an incident, know the aircraft position to within 6NM

1.3 The recommended approach was to take advantage of existing surveillance systems in the short-term. In the medium-term, ICAO is developing formal Performance Standards for Global Tracking.

**2. DISCUSSION**

2.1 High-level airspace over continental Australia is surveilled using radar and ADS-B with VHF and HF communications, which already provides the necessary capability for Global Tracking. ADS-C was chosen as the solution for oceanic airspace within Australian FIRs. Advantages of ADS-C include:

- ADS-C has been in use in Australia for 20 years
- Airservices automation system (Eurocat) support ADS-C
- Over 90% of wide-body aircraft are equipped with ADS-C (FANS-1/A)
- ADS-C has the capability to identify non-normal operations
- Any increased costs of supporting ADS-C are offset by reduced separation

2.2 The initiative was implemented in three phases:

- Phase 1 – 30/01/15: In partnership with QANTAS, Virgin Australia, Inmarsat, SITA, and ARINC, reporting rates were increased by manual ATC input to 10 minutes for QANTAS A380/A330/B744 and Virgin A330/B777 in oceanic airspace east of the continent.
- Phase 2 – 30/04/2015: The service was extended to all oceanic airspace in the Brisbane FIR, plus Honiara and Nauru FIRs (under contract with Airservices); this included all airspace users with an ADS-C capability. Following the second ICAO conference, the reporting rate was reduced to 14 minutes (to support the 30/30 separation standard) and implemented in the automation system instead of relying on manual input.
- Phase 3 – 28/05/2015: The service was extended to all oceanic airspace in Melbourne FIR.

2.3 The phased implementation provided the opportunity to monitor technical parameters – such as the level of data traffic handled by Communications Service Providers and the Airservices automation system – and to receive feedback from airlines, particularly on the cost of communications. Results indicated a negligible increase in message count, no change in message latency, and positive feedback from all partners.

2.4 New Zealand commenced similar operations on the 28<sup>th</sup> of May, 2015, and the USA followed on the 25<sup>th</sup> of June with Anchorage and Oakland oceanic control centres. Dialogue with Malaysia, Indonesia, South Africa, and Fiji has been initiated and Australia can provide support.

2.5 In summary, the Global Tracking Initiative implemented in Australia:

- incorporates the key recommendations from ICAO
- uses existing technology (no cost for those with FANS-1/A) with a modest increase in messaging costs, but can be offset through reduced separation standards leading to a greater probability of receiving optimum route and flight level clearances
- is in operation today in all Australian-controlled oceanic airspace
- benefits 65% of aircraft, 80% of passengers, or 92% of passenger-hours flown (risk exposure)

2.6 Next steps include:

- Exploring solutions for non-ADS-C capable aircraft
- Exploring display solutions for airlines
- Providing support for other interested States in the APAC region

### **3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matters as appropriate.

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# Interim Global Tracking

Australia

**CNS SG/19**  
20<sup>th</sup>-24<sup>th</sup> of July, 2015

**Simon Reynolds**  
Engineer

- Rationale
- Operational Context (Australia)
- FANS-1/A ADS-C
- Concept
- Phase 1
- Next Steps
- Benefit Achieved
- Summary

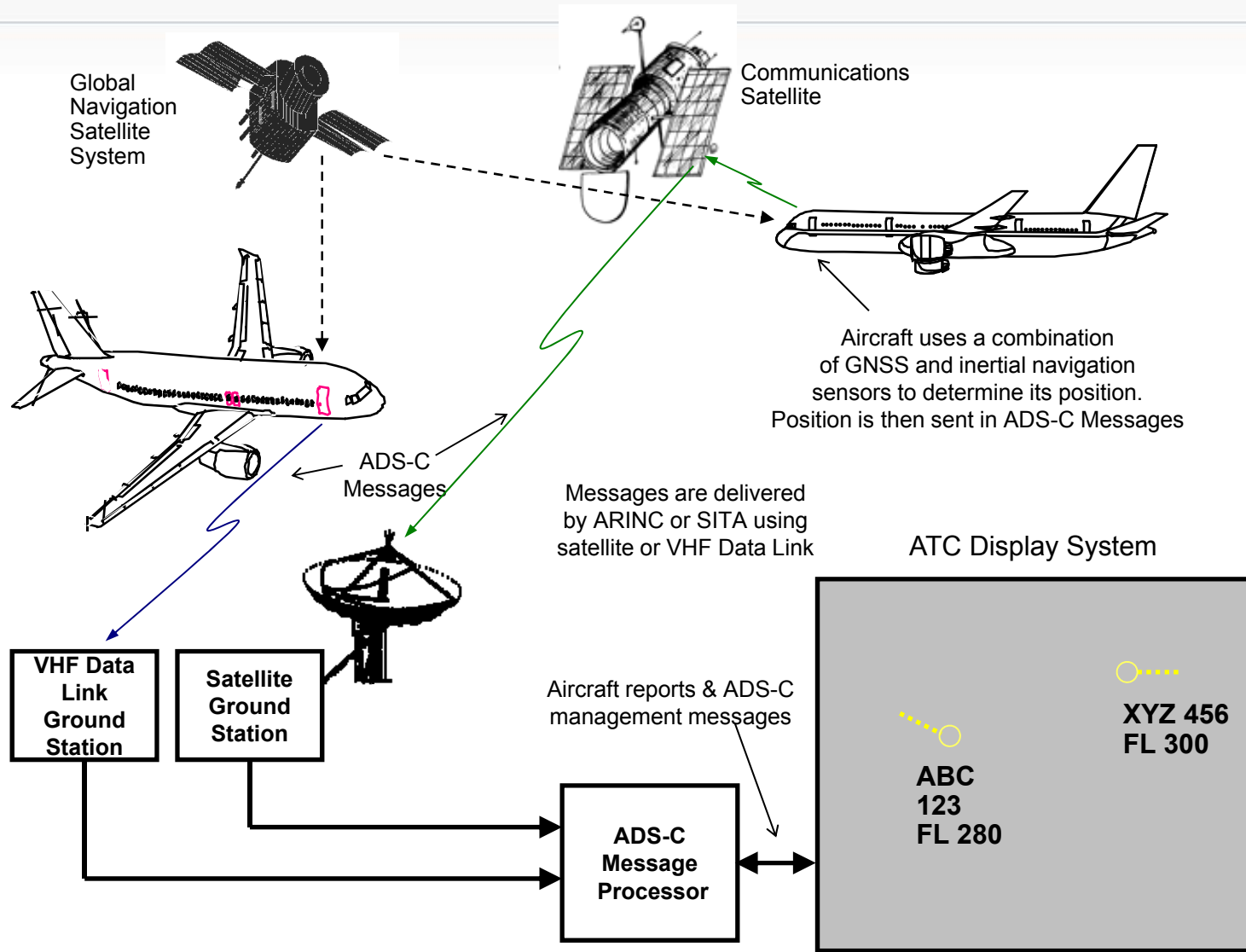
- Loss of AF447 and MH370 highlighted need for tracking of aircraft
- Socially not acceptable to not know aircraft location at all times
- ICAO Global Tracking Conference (May, 2014):
  - Position report every 10 minutes (normal operations)
  - Position report every 1 minute (non-normal operations)
- ICAO High Level Safety Conference (Feb, 2015) refined to:
  - Position report every 15 minutes (ops normal)
  - In case of incident, know A/C position to within 6 NM
  - Take advantage of existing surveillance systems
- ICAO Performance Standard for Global Tracking being developed

# Operational Context (Australia)



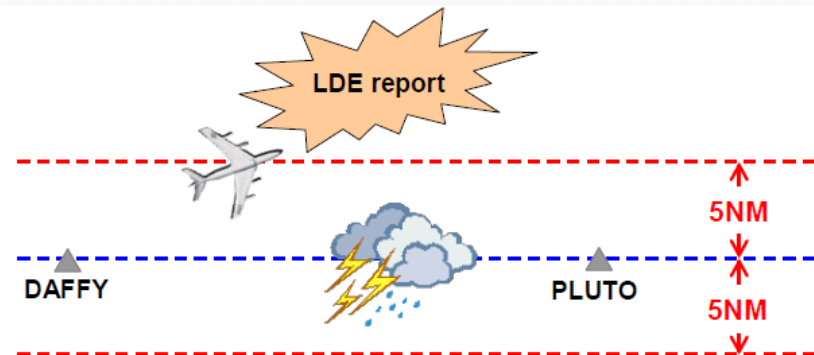
- Controlled Airspace - ATC Services
  - Continental airspace
    - Surveillance (tracking) by radar/ADS-B
  - Oceanic airspace
    - implies Automatic Position Reporting, messages by SATCOM
- Over 90% of wide-body aircraft equipped with FANS-1/A ADS-C
- Airservices' ATC Automation System supports FANS-1/A ADS-C
- ADS-C has been in routine service in Australian FIRs for 20 years
- Non-normal operations can be detected by monitoring conformance to lateral & vertical ATC clearances
  - Clearance is known to ATC & pilot but not to the airline ops
- Use of one system to provide surveillance and aircraft Global Tracking allows cost to be offset by improved ATC service (smaller separation standard increases probability of optimum route & altitude)

# FANS-1/A ADS-C Architecture



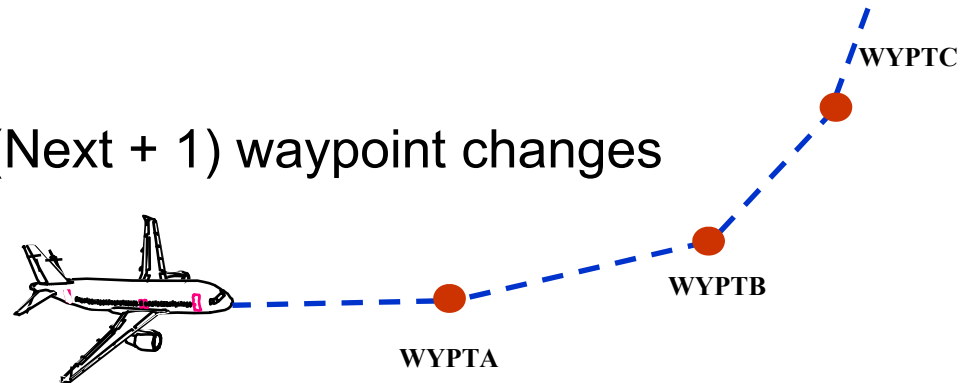
# ADS-C Contracts

- Periodic
  - Report Position
- Event
  - Altitude Range Change Event
    - used for level conformance
  - Lateral Deviation Event (LDE)
    - used for route conformance
  - Waypoint Change Event
    - Occurs when Next or (Next + 1) waypoint changes



ADS-C lateral deviation event report – (Ref: ICAO GOLD)

- Demand
  - also known as 'one shot'
  - can be initiated by controller at any time





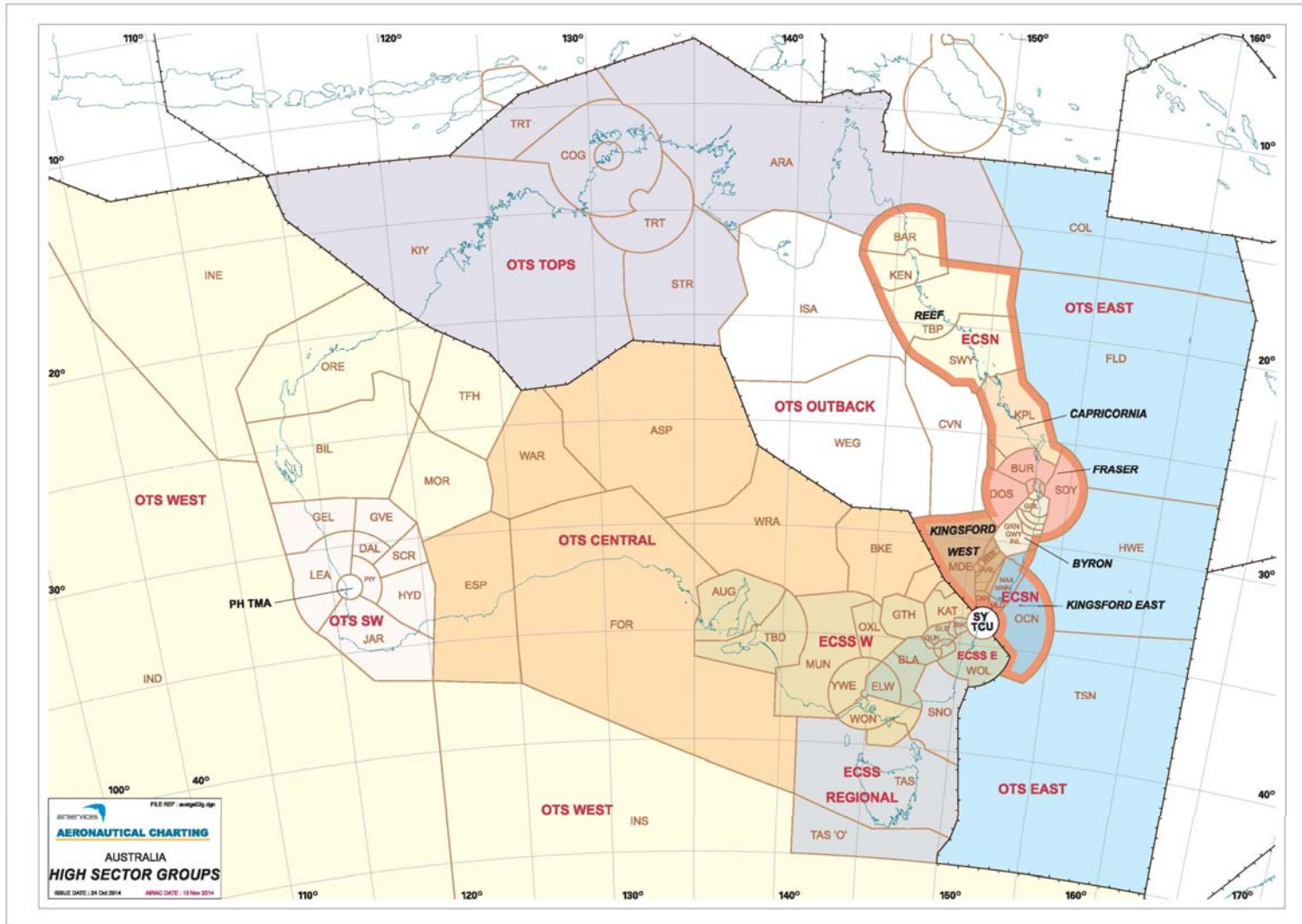
- Concept
  - Use existing FANS-1/A ADS-C surveillance
    - Less than perfect solution but available today
  - Reporting rate (aircraft operations normal) = 1 per 14 min
  - Automatically detect non normal operations
    - ADS-C Route Conformance Warning (ARCW)
    - Route Adherence Monitoring (RAM)
    - Cleared Level Adherence Monitor (CLAM)
  - Set reporting rate ops non-normal 1 per 5 min
    - Non-normal – ARCW, RAM , CLAM or Pilot ADS-C Emergency
  - Controller can set higher reporting rate as required
  - Missed Report Alert to Controller
    - Lost Comms Procedure → SAR Procedure

# Phase 1 (1 of 3)



- Partners
  - Airlines
    - Virgin Australia: B777 x 5 and A330 x 5
    - Qantas: A388 x 12, B744 x 12, and A330 x 26
  - ANSP/ATSP
    - Airservices
  - Communication Service Providers
    - Inmarsat
    - SITA
    - ARINC
  
- Oceanic east of Australia (OTS East)
- 10 min reporting rate for participating airlines
- Operations commenced on 30 Jan 2015

# Phase 1 (2 of 3)



- SatComm considerations
  - Increase in message rate = increase in data transmission
  - Care to avoid overload of:
    - SatComm network (Inmarsat)
    - Data comms networks (SITA & ARINC)
    - ATC Automation System FANS-1/A processing
  - Message count, latency, etc. recorded and analysed:
    - Negligible increase in total message count
      - Increase in periodic message count
      - Decrease in rate change message count
    - No measured change in message latency
    - No signs of overload in SatComm, data comms, or processing

# Phase 2



- Reporting rate decreased to 14 min to satisfy:
  - ICAO 15 min requirement (HLSC Feb '15) AND
  - Comm/Sur requirements to support 30/30 separation standard
  
- Extend service to all ADS-C equipped aircraft operating in:
  - Brisbane FIR
  - Honiara FIR & Nauru FIR (upper airspace services provided by Airservices under contracts)
  
- Dialogue with Airlines, particularly on comms cost
  
- Went into service 30 April 2015 (AIRAC cycle)

# Phase 3 and Next Steps

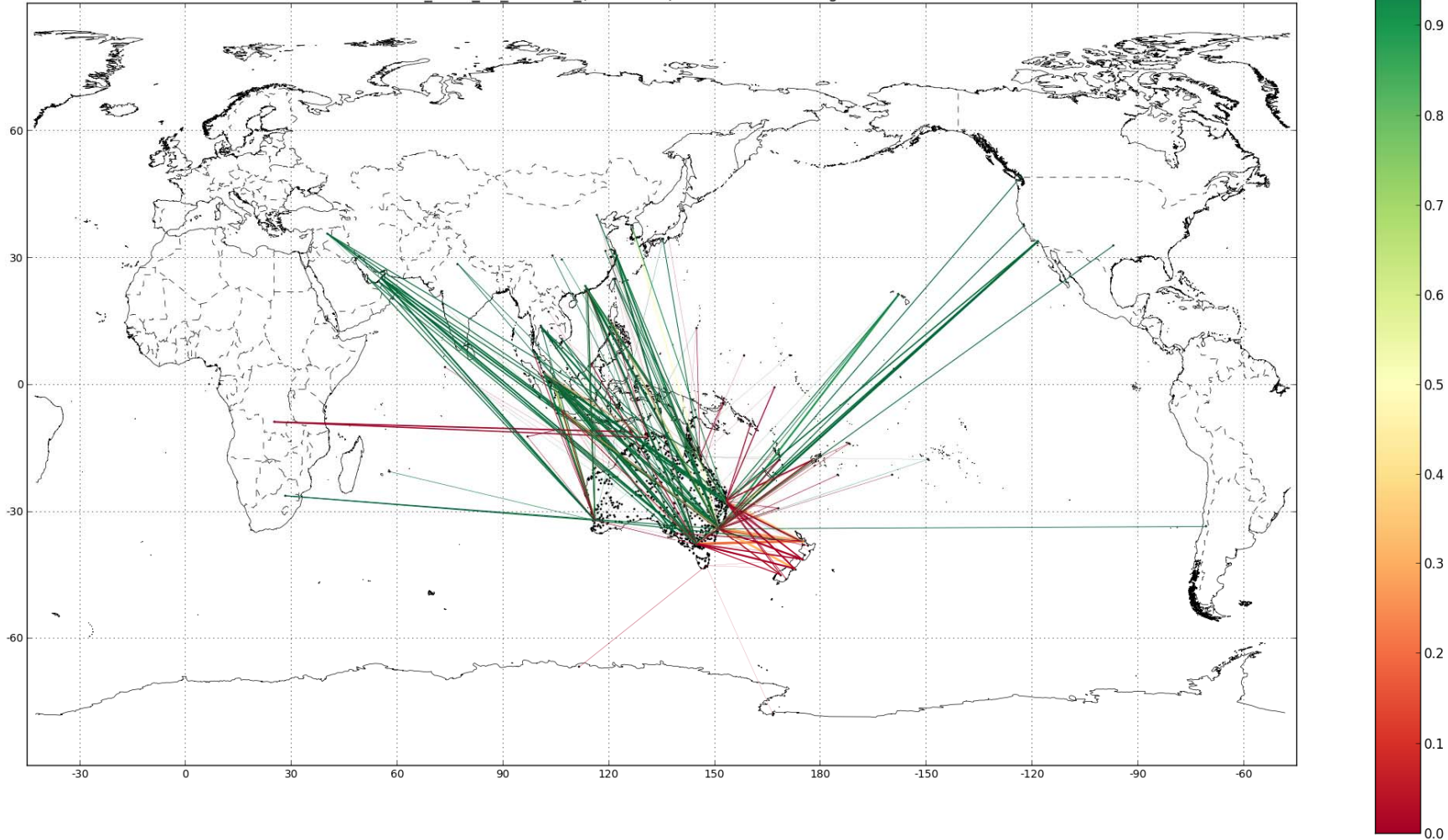


- Extended service to all ADS-C aircraft in Melbourne FIR oceanic on 28 May 2015
  
- NZ – commenced on 28 May 2015
- USA – commenced 25 June 2015 (ZAN & ZOA)
  
- Next Steps:
  - Explore display solutions for airline operations centres
  - Explore data feed from Airservices
  - Explore with other countries their similar use of ADS-C for GT
  - Malaysia, Indonesia, South Africa, Fiji – in discussion
  - Explore solutions for non-ADS-C equipped aircraft
    - Significant numbers of A320/B738 flights in oceanic airspace to/from Australian with no ADS-C capability

# Benefit Achieved



CPDLC FANS 1A SATCOM (INMARSAT) for International Flights in 02-2015



connecting australian aviation



# Operation by City Pair and A/C Type



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	
			A319	A320	A332	A333	A343	A346	A388	B738	B742	B744	B748	B752	B763	B772	B773	B77L	B77W	B788	B789	C550	CL60	F100	F900	GLEX	GLF6	H25B	MD11	(blank)	Grand Total	
4	ADEP-2	ADES-2																														
5	CYVR	YSSY																58														58
6	FAOR	YPPH				44	13																									57
7		YSSY										58																				58
8	KLAX	YBBN										58										33										91
9		YMML							55													25										80
10		YSSY							65			54			57		58	58														292
11	KSFO	YSSY													57																	57
12	NZAA	YBBN		43		24			59	224					14	7			54													425
13		YBCG		102						59																						161
14		YBCS		40											4																	44
15		YBSU		19																												19
16		YMML		155					58	229		19							58													519
17		YPAD		44																												44
18		YPPH														21							36									57
19		YSSY		154		30	51		58	336		17		43	117	37			8		25								4		880	
20	NZCH	YBBN		58						60																						118
21		YBCG		50																												50
22		YMEN																						2								2
23		YMML		107						30																						137
24		YSSY		126						85					22				58													291
25	NZQN	YBBN		29						52																						81
26		YMEN																									2					2
27		YMML		33																												33
28		YSSY		64						38																						102
29	NZWN	YBBN								156																						156
30		YMML		81						59																						140
31		YSSY		95						116																						211
32	OMAA	YMML																	58													58
33		YPPH			58																											58
34		YSSY						33											84													117
35	OMDB	YBBN								29																						29
36		YMML								148																						148
37		YPAD																				57										57
38		YPPH															11	162														173
39		YSSY								174																						174
40	PHNL	YBBN													34																	34
41		YBCS																								2						2
42		YMEN																								2						2
43		YMML			30																											30
44		YSSY			111	18						12			10											2	7		54		214	
45	RJAA	YBCG																				24									24	
46		YBCS																				75										75
47		YMML				32																										32
48		YSSY										63			20	58																141
49	SCEL	YSSY										25																				25
50	VHHH	YBBN				115																										115
51		YBCS					32																									38

One month of oceanic operations

connecting australian aviation



# Global Tracking Benefit Achieved

- Risk exposure can be measured in passenger-hours flown:
  - Wide Bodies (A330, A340, A388, B744, B777, B787):
    - 7,370 operations = 65%
    - Passengers carried: 300 to 550 – use 400 (average)
    - Flight duration: 11 hours
    - 91.9% of passenger-hours flown
  - Narrow Body (A320, B737):
    - 3,990 operations = 35%
    - Passengers carried: 180 passengers
    - Flight duration: 4 hours
    - 8.1% of passenger-hours flown
- Benefit achieved for around 91.9% of passenger-hours flown

- ADS-C meets the intent of HLSC recommendation Global Tracking
- ADS-C fitted to most wide body aircraft operating oceanic
- ADS-C Global Tracking benefit to 92% of passengers flying oceanic
- Display to ATC and /or Airline
- Cost is a modest increase in ADS-C messaging
- Cost can be offset by more efficient aircraft operations
  - use 50/50 or 30/30 separation
  - greater probability of optimum route and altitude

# Any Thoughts

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