

# HAWAIIAN AIRLINES



- 767 Aircraft and A320neo
- Cobham Aviator 300D
- Satvoice
- Aircraft Tracking
- FANS over SBB



# SHENZHEN AIRLINES



- A320 aircraft
- Cobham Aviator 300D
- Satvoice
- Aircraft Tracking
- FANS over SBB



# UNITED AIRLINES

**inmarsat**  
aviation



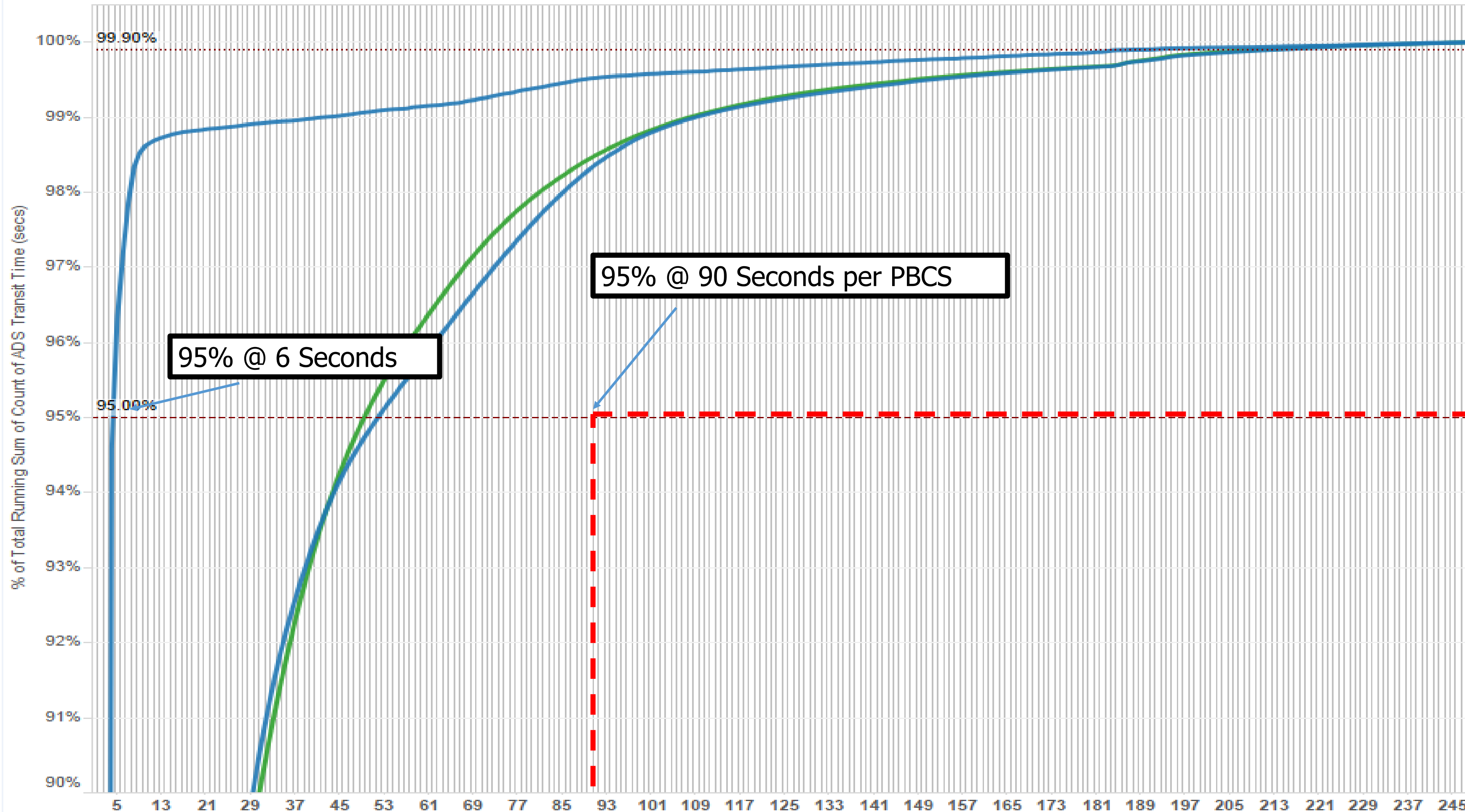
- 767 Aircraft
- North Atlantic
- Cobham Aviation 300D
- FANS over SBB
- Flight Tracking
- Black Box in the Cloud
- EFB Applications

# SB-S LATENCY ADS-C PERFORMANCE COMPARED TO CLASSIC AERO MAY '16 TO JULY '17



## All ADS-C Downlink Latency

ADS-C Downlink Latency in Seconds [Transit Time (bin)]



Choose Breakdown  
DP Owner

All

### No. of measurements

Ocean Region	
AMER	3,999,655
AORE	5,714,913
AORW	5,892,317
APAC	7,530,998
EMEA	5,128,741
IOR	4,437,068
POR	5,678,776
<b>Grand Total</b>	<b>38,382,468</b>

Aircraft Type  
All

ATSP  
Multiple values

Operator  
All

DP Owner  
Multiple values

ADS-C Latency bin size  
1

- Ocean Region
- AMER
  - AORE
  - AORW
  - APAC
  - EMEA
  - IOR
  - POR

Month  
Multiple values

ADS Contract  
All

AES Id.  
All

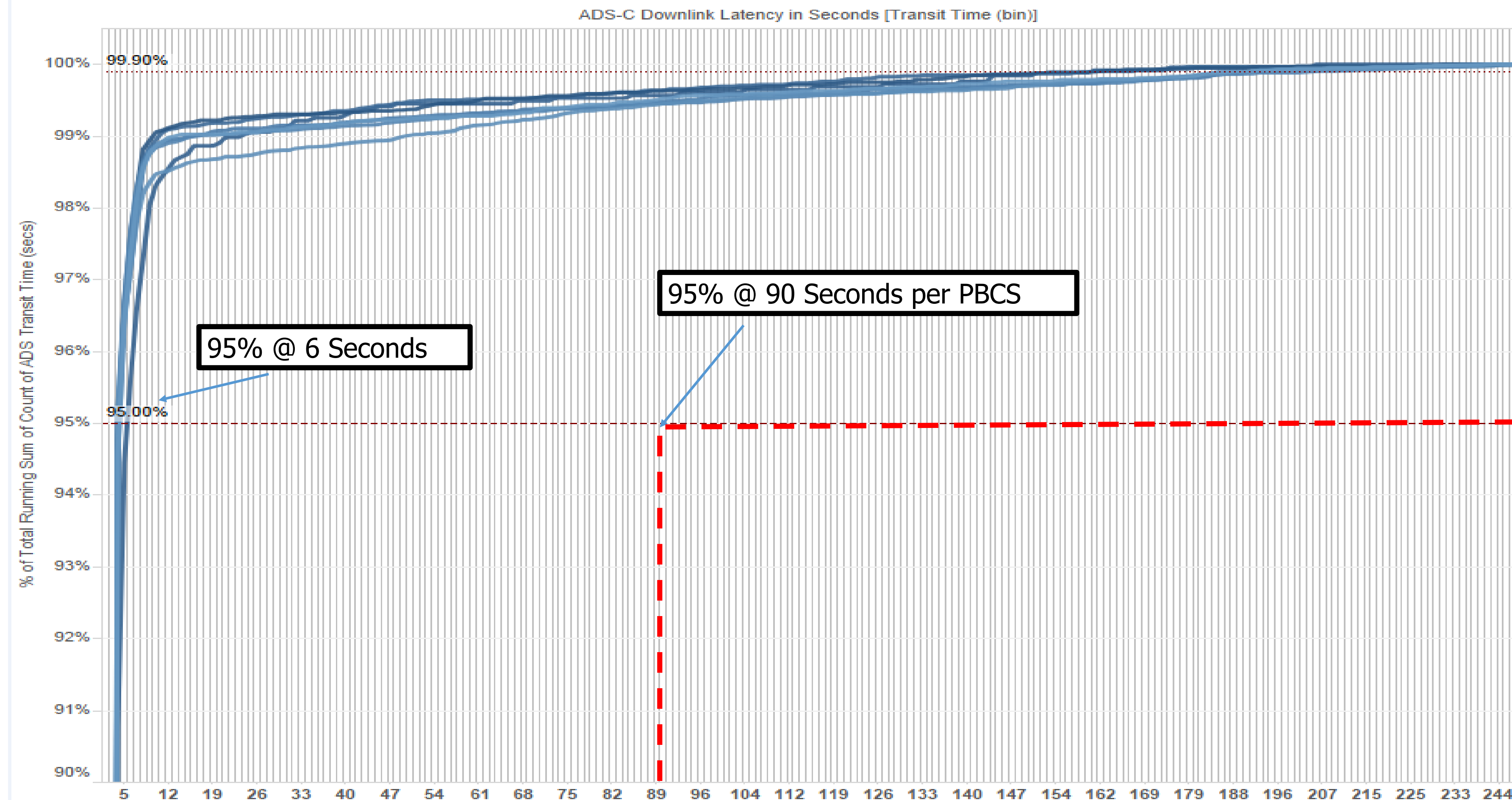


# OVERALL SWIFTBROADBAND PERFORMANCE

## ADS-C SEPT '16 TO JULY '17



### SB-Safety ADS-C Downlink Latency



Choose Breakdown  
Year-Month

- Classic Aero
- SB-Safety

#### No. of measurements

Ocean Region	
AMER	57,531
APAC	20,470
<b>Grand Total</b>	<b>78,001</b>

Aircraft Type  
All

ATSP  
Multiple values

ADS-C Latency bin size  
1

Operator  
All

DP Owner  
Multiple values

- Ocean Region
- AMER
  - AORE
  - AORW
  - APAC
  - EMEA
  - IOR
  - POR

Month  
Multiple values

ADS Contract  
All

AES Id.  
All

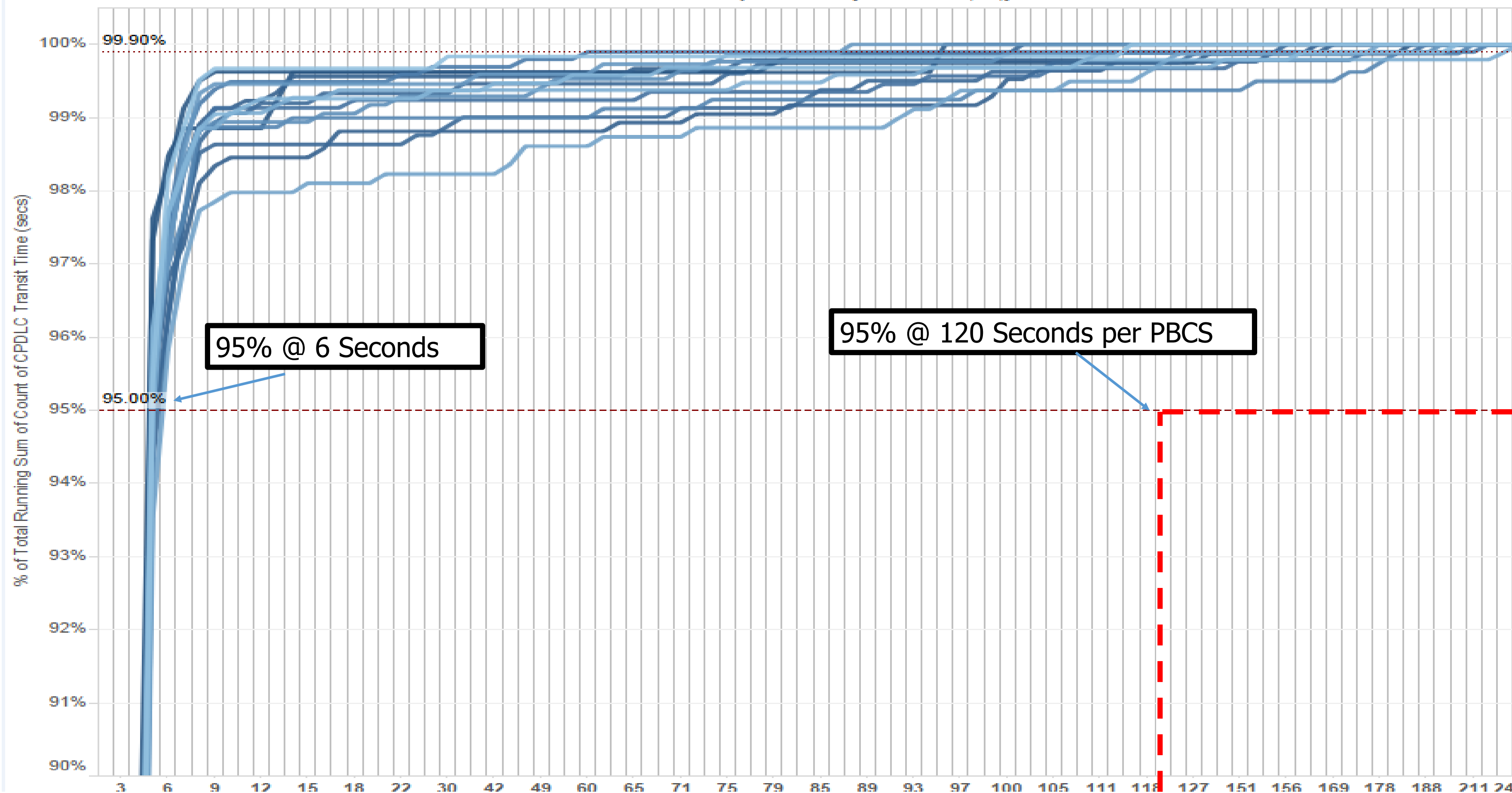
# OVERALL SWIFTBROADBAND PERFORMANCE

## CPDLC MAY '16 TO JULY '17



### SB-Safety CPDLC Actual Communication Technical Performance (ACTP)

CPDLC Latency in Seconds [Transit Time (bin)]



Choose Breakdown  
Year-Month

- Classic Aero
- SB-Safety

#### No. of Measurements

Ocean Region	
AMER	9,705
APAC	2,268
<b>Grand Total</b>	<b>11,973</b>

Aircraft Type  
All

ATSP  
All

CPDLC Latency bin size  
1

Operator  
All

DP Owner  
All

- Ocean Region
- AMER
  - AORE
  - AORW
  - APAC
  - EMEA
  - IOR
  - POR

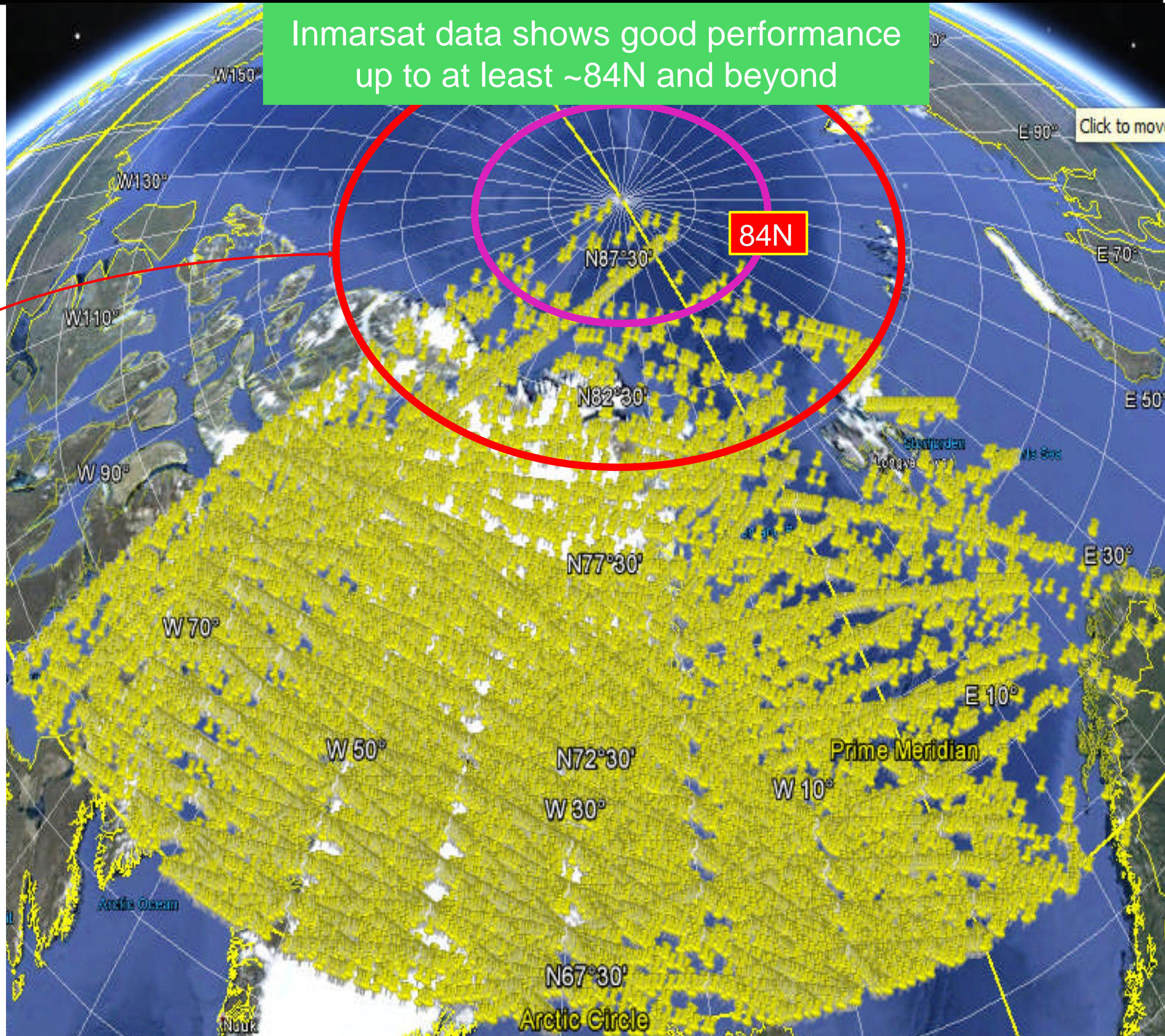
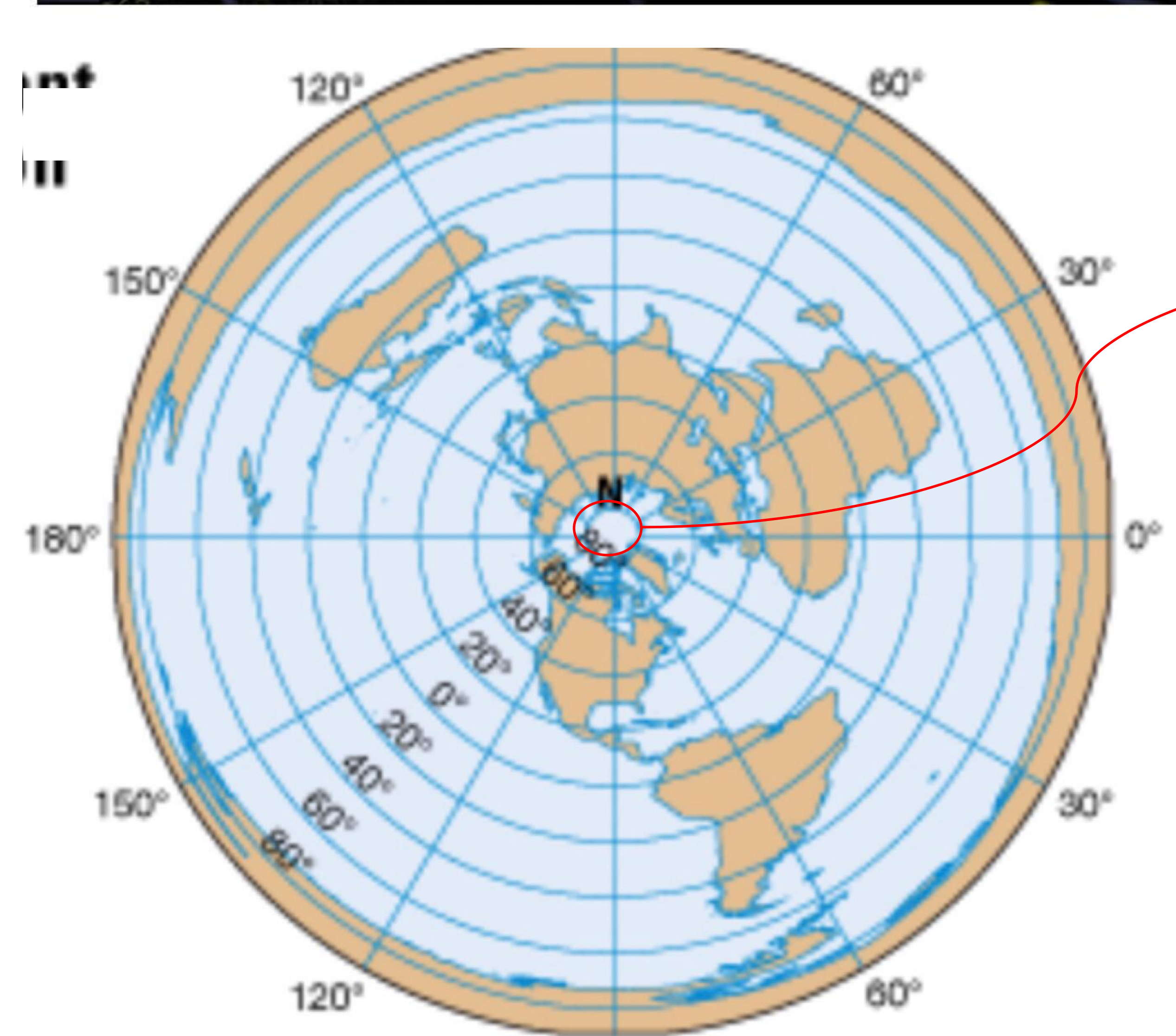
Month  
All

AES Id.  
All



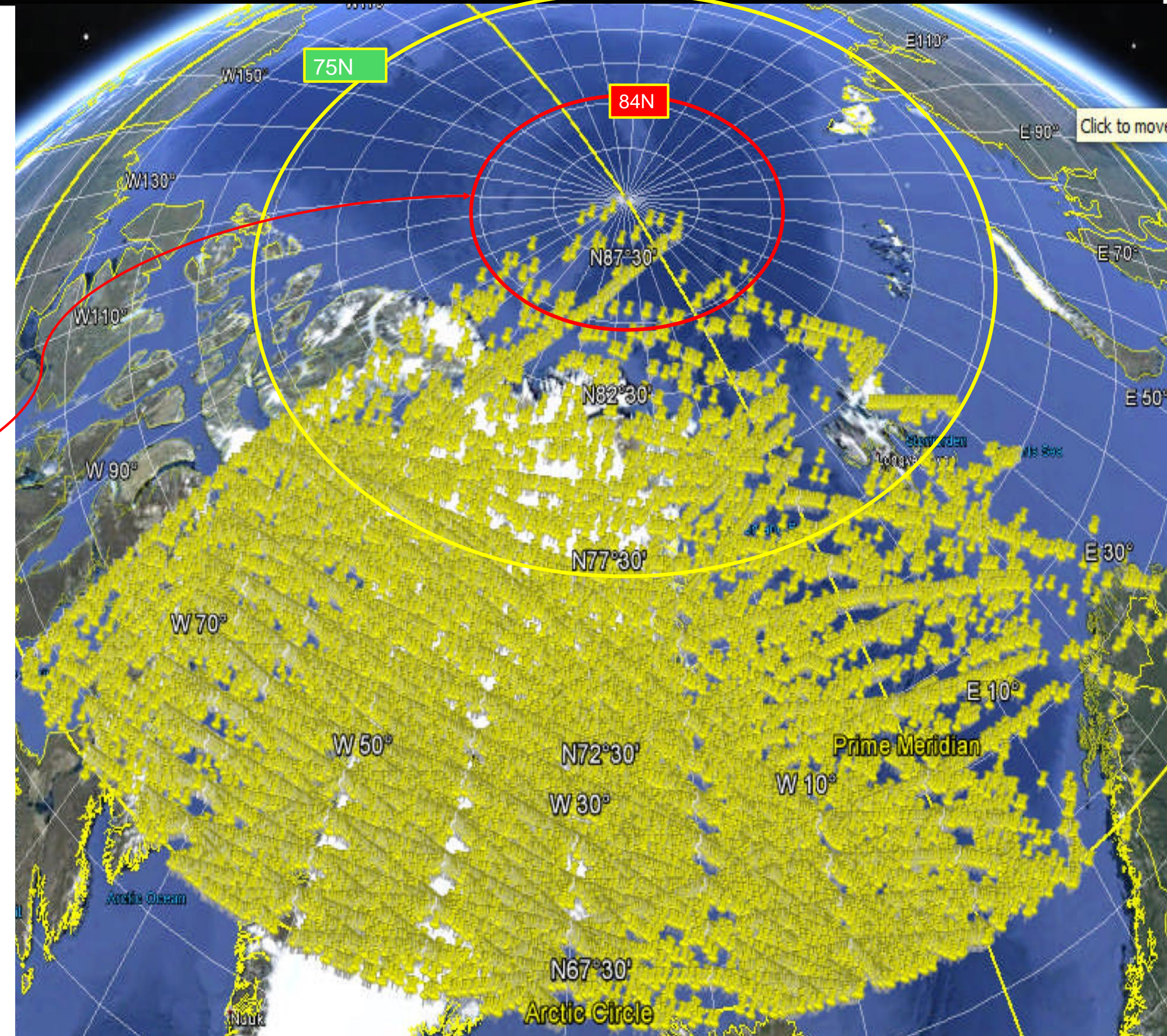
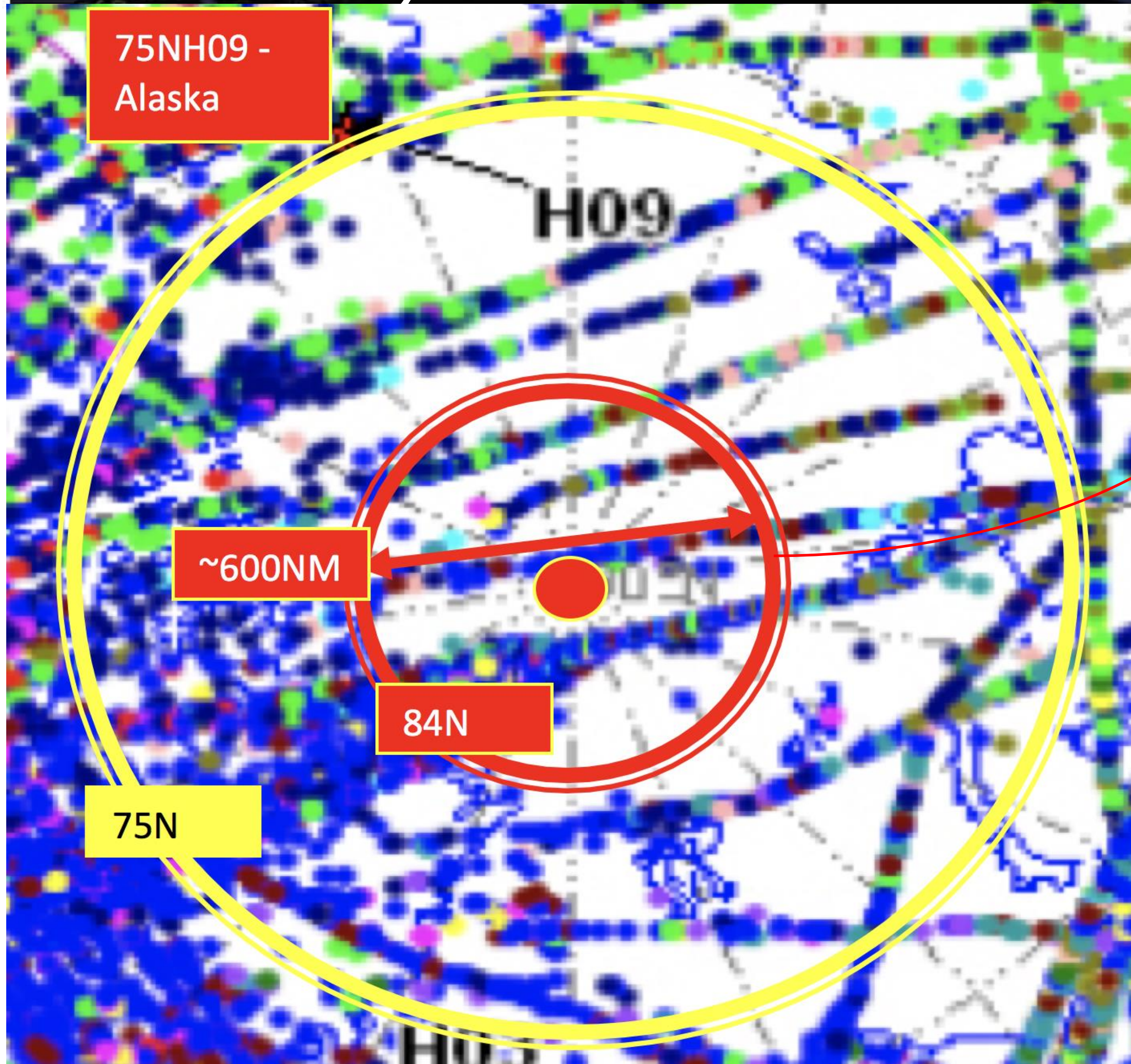
# INMARSAT POLAR COVERAGE PERFORMANCE

(DATA PRESENTED TO THE CROSS POLAR WORKING GROUP)



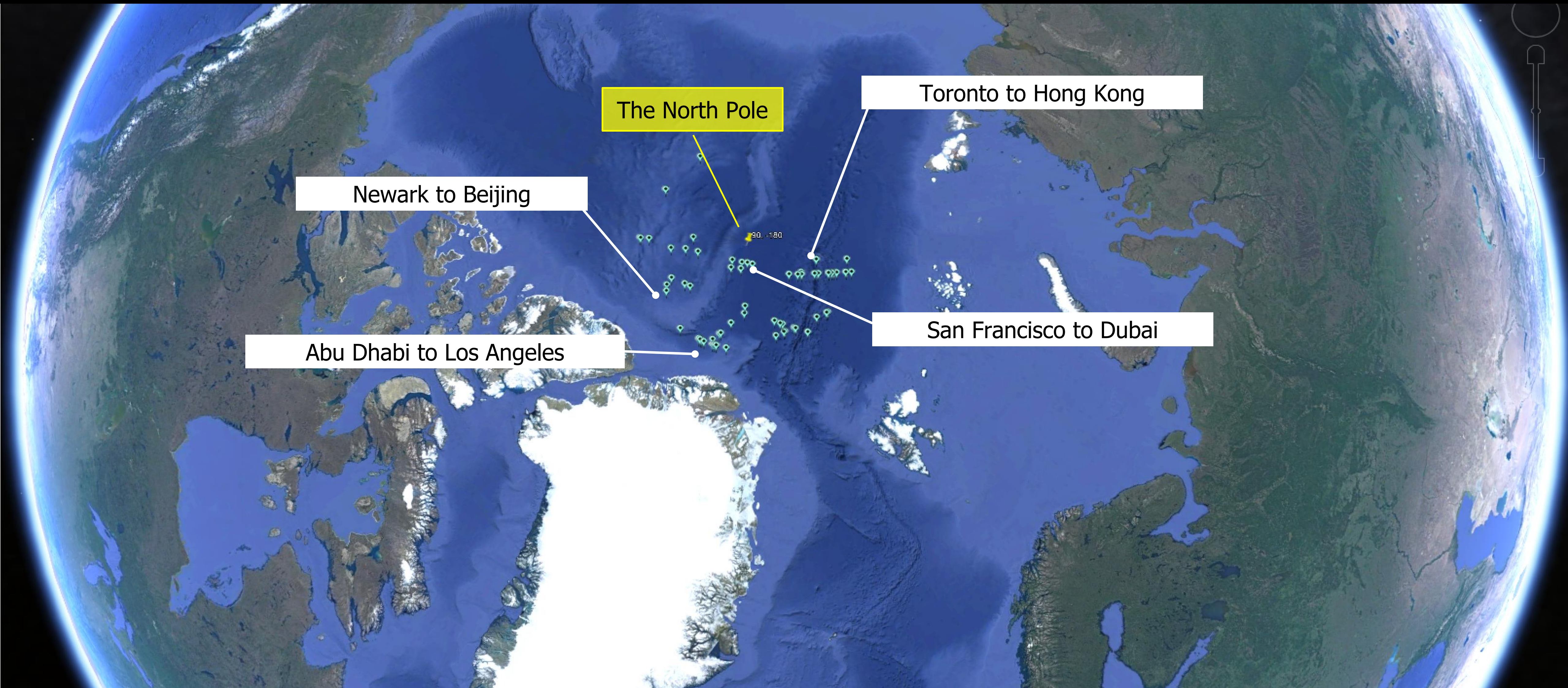


# HFDL DATA (LEFT) SHOWS LESS THAN 10 FLIGHTS ON AVERAGE ACTUALLY CROSS THE POLE (NORTH OF ~85N)





# Inmarsat Polar Position Reports



4 Northernmost Position Reports June-August 2017 (87-88 N)



# INMASRAT POLAR REGION PERFORMANCE

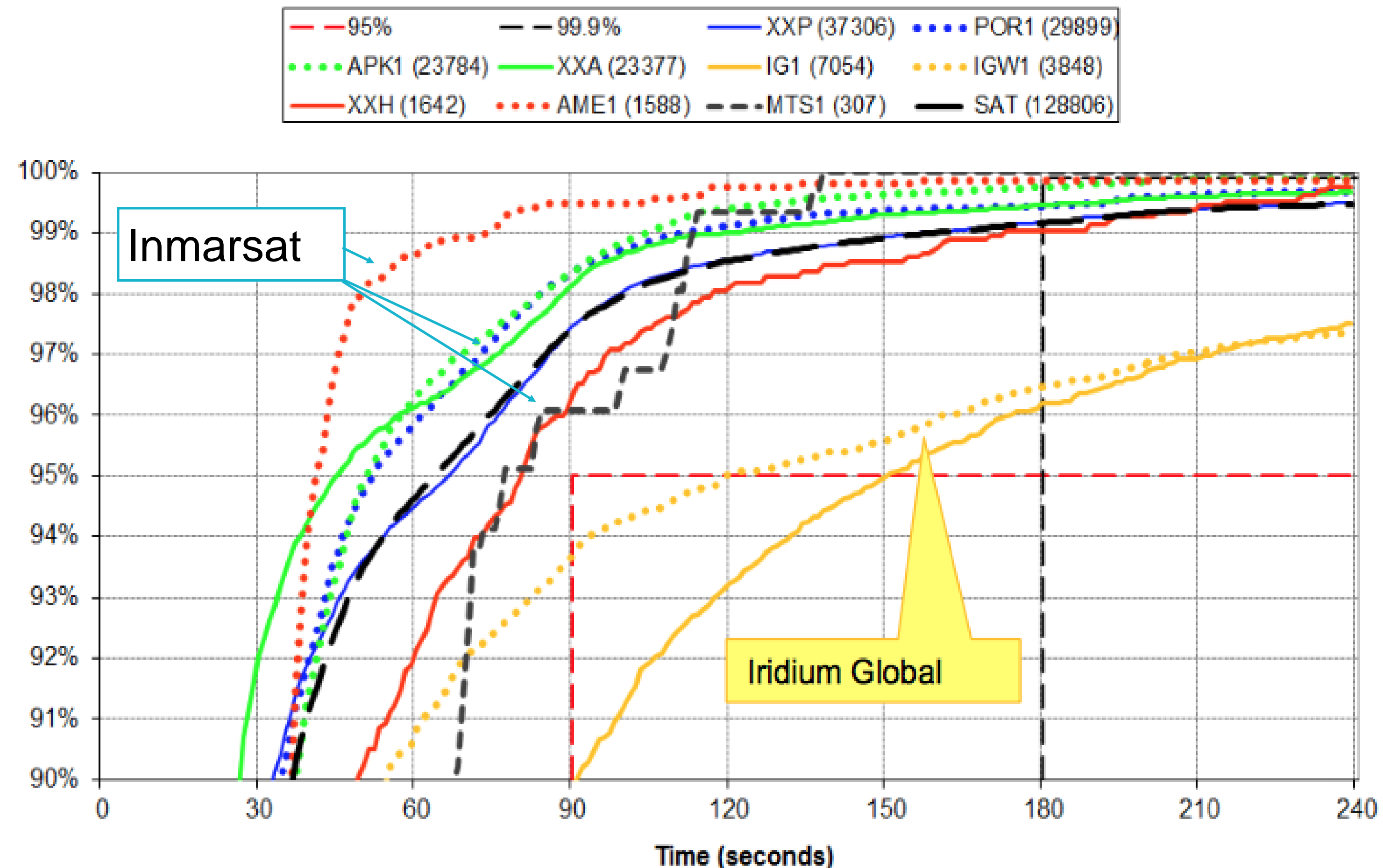
(AS DETERMINED BY THE FAA)



- The Anchorage FIR includes a section which extends to the North Pole.
- In this region, Inmarsat performance still exceeds mandatory minimum performance for procedural separation, albeit with somewhat lower margin.\*
- However, demonstrated actual global performance is more important for any safety system than a single area.

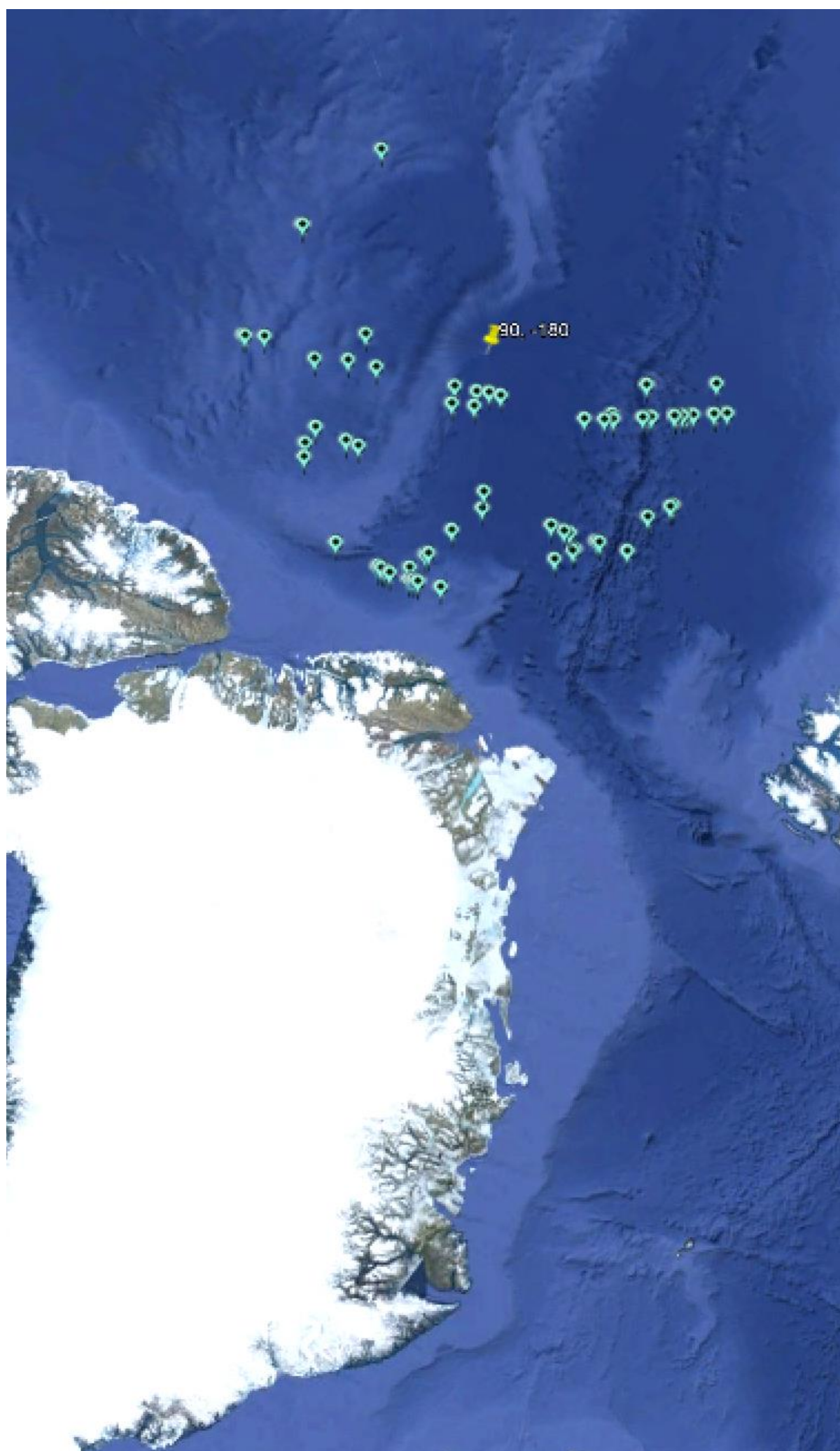
\*source & chart: FAA

Anchorage FIR - June 2016  
Actual Surveillance Performance (ASP)





# CONSIDERATIONS REGARDING GLOBAL COVERAGE AND AVAILABILITY SPECIFICATIONS



## Inmarsat does have global availability, including the poles!

- We regularly see traffic up to 90N, but we cannot guarantee the 99.9% network availability we normally guarantee.
- However, some ANSPs cancel reporting contracts North of 80N. Therefore, actual polar performance cannot easily be determined.
- Typical day (July 28 2017): 4 westbound flights and 5 eastbound flights passed through a waypoint substantially north of 84-85N. Most polar' traffic traverses in the 75-85N region.

## Present day Inmarsat global coverage performance: >99.99% of global flight hours at 99.9% network availability

- Based on approx. 60,000,000 flight hours this year\*.
- **For GADSS: To how many 9ers do we need to be "global"?**
- **There is no 100%, so the spec needs to define a risk/probability**

\*The Boeing Company. Statistical Summary of Commercial Jet Airplane Accidents Worldwide Operations | 1959–2015



# TOWARDS A RISK-BASED APPROACH TO PERFORMANCE REQUIREMENTS



- According to FAA, Inmarsat already meets or exceeds global safety and reliability criteria.\*
- For any safety related aerospace system, overall availability (or risk of failure) is determined by
  - the overall system performance and
  - system design.
- Risk of failure needs to consider all factors (including planes). For example: Additional requirements for polar flights (FAA AC120-428, north of 78N and south of 60S):
  - In addition to ETOPS: comply with part 121, appendix P, section III
  - Location less of an issue than recovery!
- How safety is handled in surveillance:
  - Defined "Acceptable risk of collision."
- **For GADSS:**
  - **Proposal to define globally an "Acceptable risk of an incident occurring outside of GADSS service availability"**

## Measured Availability Using Reported Outages from Jul 2015 to Jun 2016

Satellite	Region	DSP	Path ID	# unplanned outages affecting path > 10 min	Sum of unplanned outages affecting path > 10 min (min)	Estimated availability for path
Inmarsat I-3	AOR-E	SITA	AOE2	2	92	99.98%
		ARINC	XXN	0	-	100.00%
	AOR-W	SITA	AOW2	2	92	99.98%
		ARINC	XXW	0	-	100.00%
	IOR	SITA	IOR2	3	112	99.98%
		ARINC	XXI	3	278	99.95%
	POR	SITA	POR1	4	400	99.92%
		ARINC	XXP	2	372	99.93%
Inmarsat I-4	EMEA	SITA	EUA1	7	427	99.92%
		ARINC	XXF	7	403	99.92%
	Americas	SITA	AME1	2	92	99.98%
		ARINC	XXH	0	-	100.00%
	Asia-Pac	SITA	APK1	2	92	99.98%
		ARINC	XXA	1	24	100.00%
Iridium	Global	SITA	IGW1	6	714	99.86%
		ARINC	IG1	3	539	99.90%
<b>PBCS criteria - max values</b>						
Safety - 99.9%				48	520	99.90%
Reliability - 99.99%				4	52	99.99%

	Meets safety and reliability criteria
	Meets safety criteria only
	Does not meet safety or reliability criteria



\*FAA, 2016



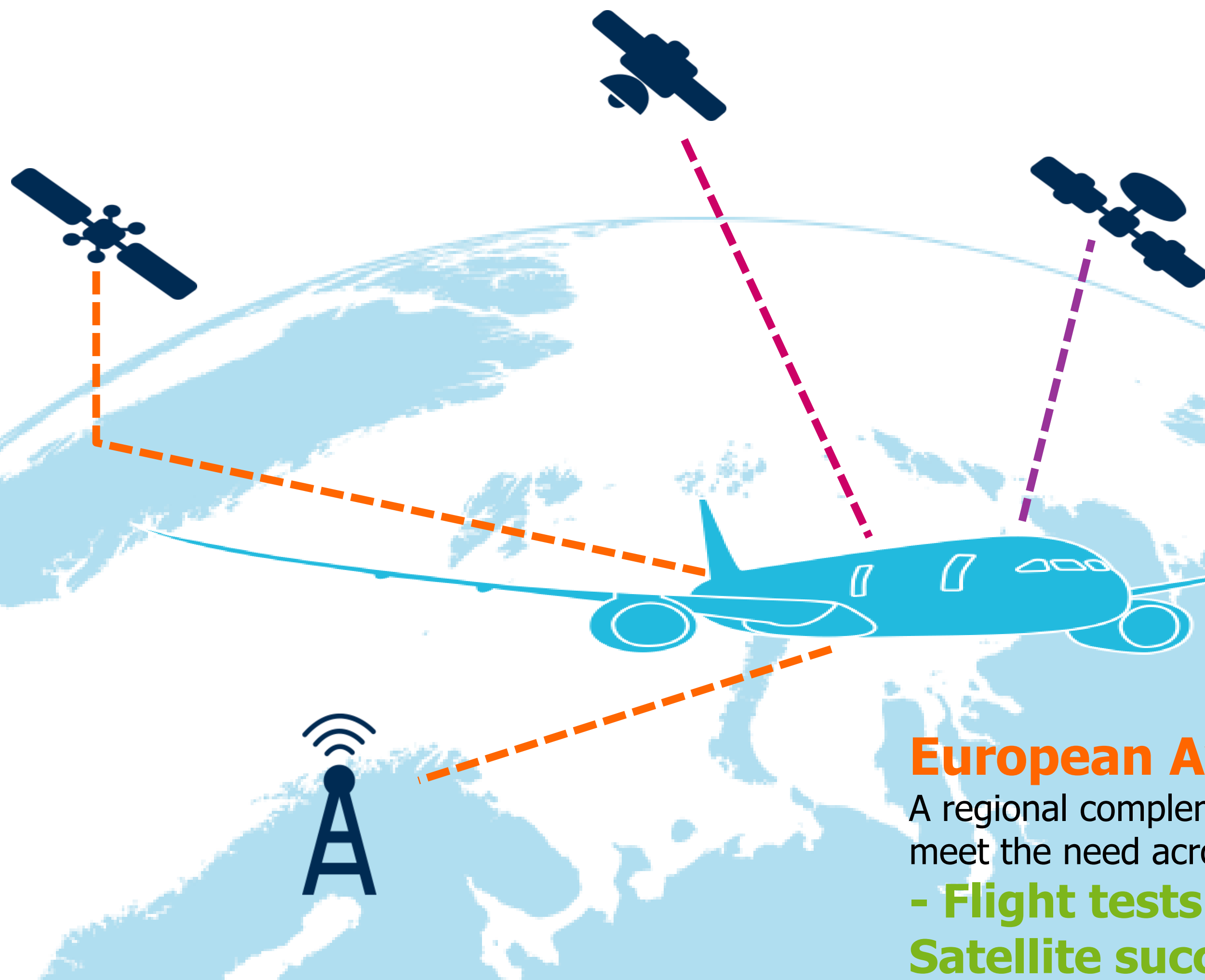
# THANK YOU



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# Inmarsat Aviation Updates for 2016/17



## SOS: Classic Aero & SB-Safety

Worldwide safety and operations to the cockpit using the L-band with premium reliability of 99.9%

- **Airbus LCS announcement**
- **Progress toward SwiftBroadband – Safety PARC recommendation & global CSI**

## Global Xpress

Seamless, highspeed broadband available globally. Unconstrained Ka-band ideally suited to larger, **long haul** aircraft with global cabin connectivity requirements

- **'Bring it on!' official launch at APEX 2016, LH launch customer. Successful launch of constellation.**

## European Aviation Network

A regional complement to GX. S-band satellite and complementary ground network over EU to meet the need across high traffic areas and airport hubs for **short/medium haul** aircraft

- **Flight tests / SAS tests complete. IAG launch customer. Satellite successfully launched**



# STANDARDS

## Completed standards (RTCA and ICAO Technical Manual Amendment)

- MASPS DO-343 published
- MOPS DO-262B published, FAA Technical Standard Order (TSO)-C159b refers
- ICAO Technical Manual (TM) amendment published 6<sup>th</sup> February as:
  - 2016-03902/02 - ANB-DOC 9925 with title [Amendment No.1 - Manual for Aeronautical Mobile Satellite (Route) Service]