ASIA PACIFIC REGIONAL ATM AUTOMATION SYSTEM SYMPOSIUM

22 – 23 NOVEMBER, NANJING, CHINA

SP 303

Enhancing Air Navigation Safety and Efficiency in Hong Kong FIR Through Implementation of ADS-B

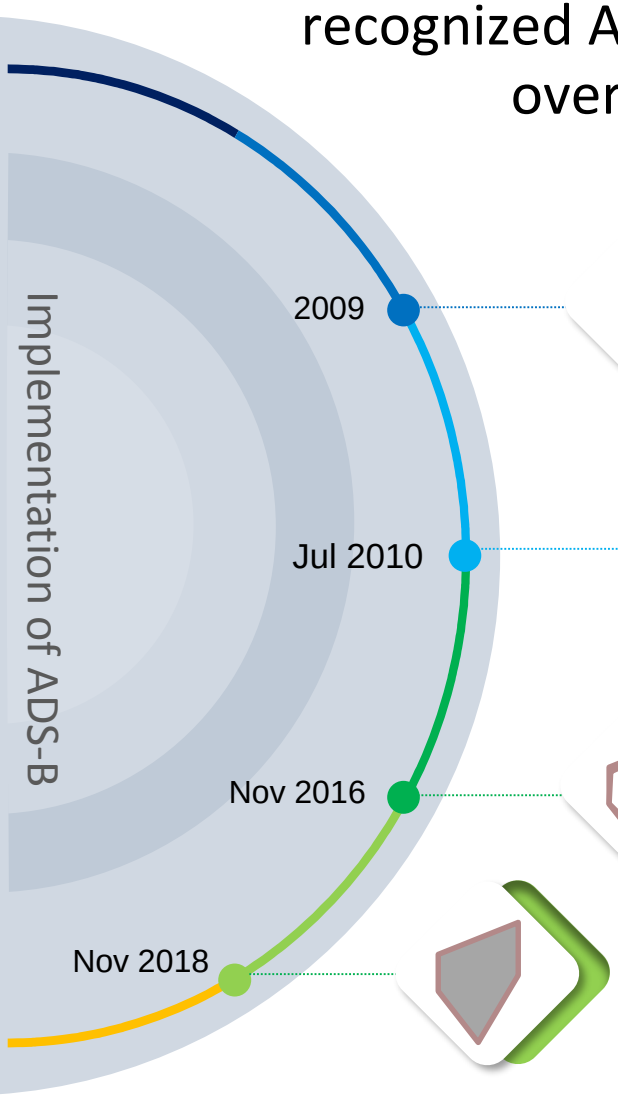
Presented by Hong Kong, China

Enhancing Aviation Safety through the Use of ADS-B

- Well-known limitations in mode A/C radar technology
  - Radar signals susceptible to Terrain blockage, Signal garbling / reflection, Transponder busy in replying to interrogations etc.
- Causing known aircraft display issues on radar screens
  - false targets, aircraft positions temporarily not displayed, and split targets
  - irrespective of brands of Air Traffic Management System (ATMS) being used
- ADS-B recognized as a cost-effective means in overcoming such limitations
  - Enhancing the tracker performance
  - Enhancing the reliability of detection
  - Minimizing the frequency of garbling or corruption
- To adopt a phased approach for gradual implementation of ADS-B within their airspace to ensure safe and smooth integration of ADS-B into ATMS
  - after all relevant safety assessments and reviews are satisfactorily completed.
- Discussed in previous SURICG and SEA-BOB ADS-B WG meetings; incorporated into the ADS-B Implementation Guidance Document (AIGD)

ADS-B Implementation Roadmap

Surveillance Implementation Coordination Group (SURICG) of APANPIRG recognized ADS-B as a cost-effective solution to fundamentally overcome limitations of radar surveillance technology



Collaboration

Hong Kong China collaborated closely with IATA and updated the ICAO in 2009 to mandate ADS-B in phases

Mandate

Announcement of mandate on ADS-B equipage for aircraft flying within HKFIR since July 2010

Initial Phases

ADS-B integrated with ATMS for operational use in southern portion of HKFIR in November 2016

Remaining Phases

ADS-B progressively integrated with ATMS for the entire HKFIR by Nov 2018

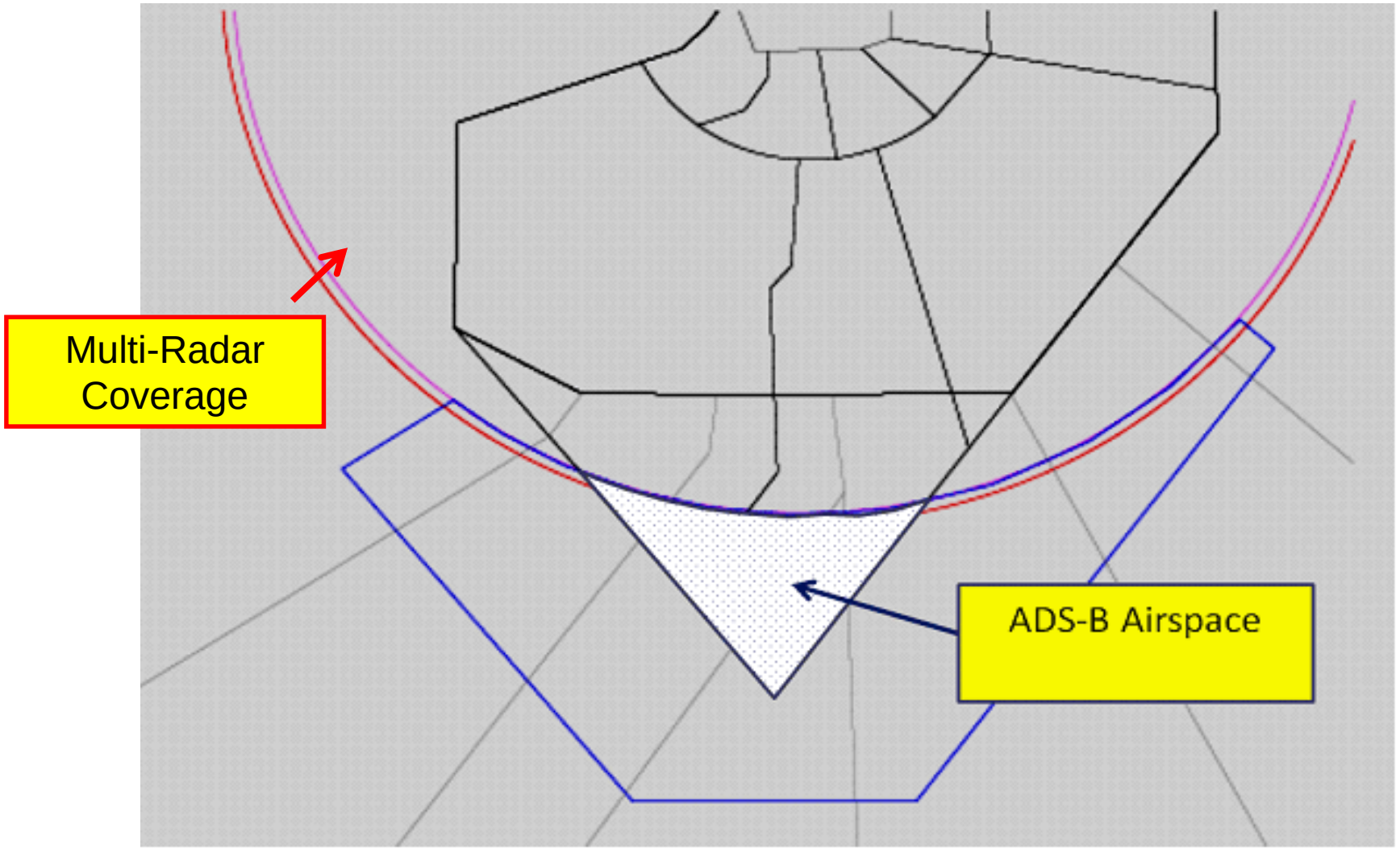
Gradual Phased Implementation of ADS-B Data into Hong Kong FIR

Gradual and prudent phased implementation approach to ensure safe and smooth integration of ADS-B with existing radar sources into ATMS

Phase	Airspace	Complexity	Sep Minima	Status
1a	Non-Radar Airspace (NRA). Minimum overlap with radar (5NM max)	Non-complex.	10 NM	Implemented from 14 Nov 2016
1b	Non-radar + partial radar airspace. Triangular portion of FIR	Non-complex.	10 NM	Implemented from 17 Jan 2017
1c	Enhanced SDP volumes around Inner Holding Patterns + ELATO area	Non-complex.	5 NM	Implemented from 30 Mar 2017
2a	Whole of Area +TMC airspace	Complex.	5 NM	Implemented from 17 Aug 2017
2b	Final Approach / Initial Departure Phases	Non-complex.	3/2.5 NM	Implemented from 2 May 2018
2c	APP / DEP airspace	Complex.	3/2.5 NM	Implemented from 1 Nov 2018

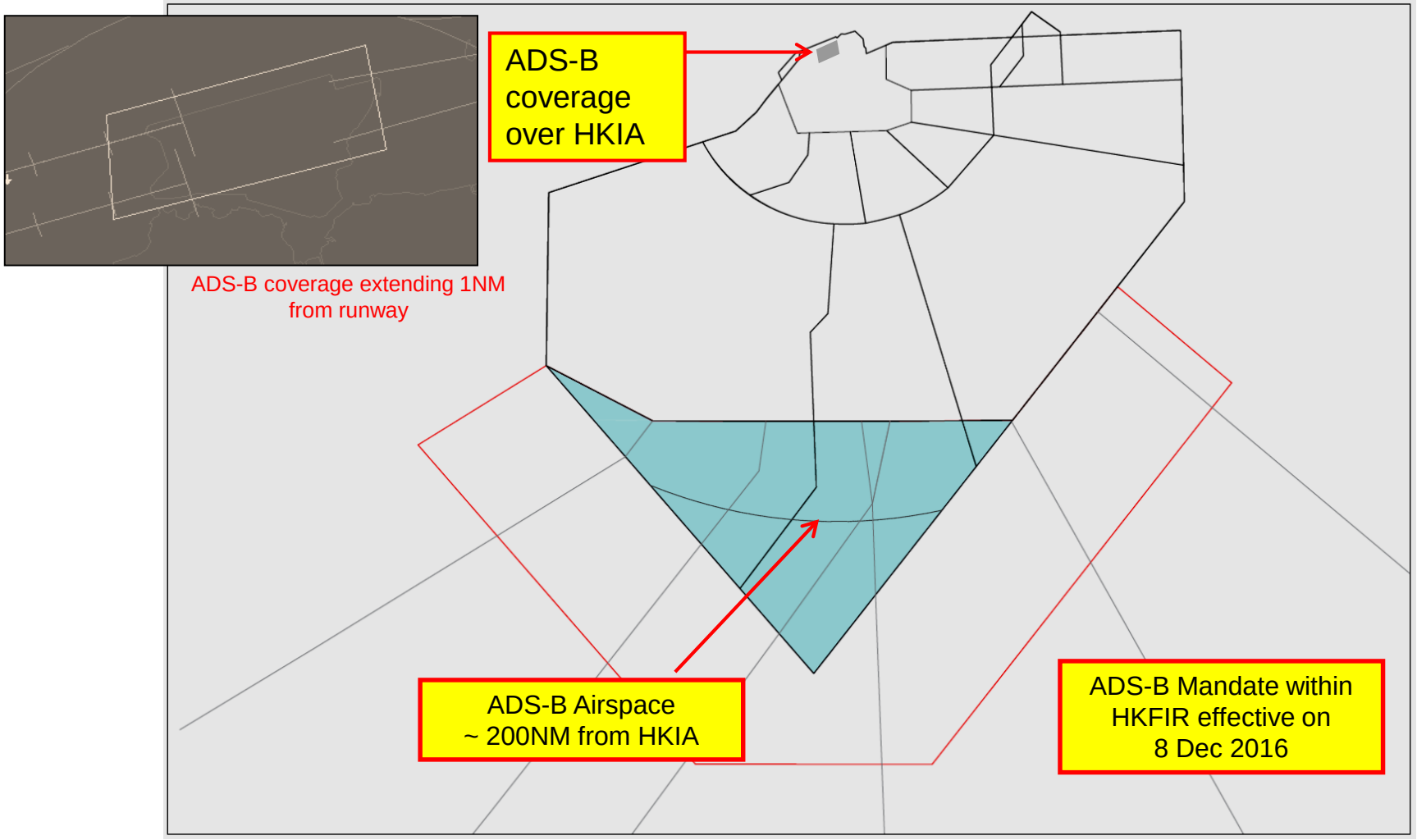
Phased Implementation of ADS-B in Hong Kong

1a. ADS-B Coverage after 14 November 2016



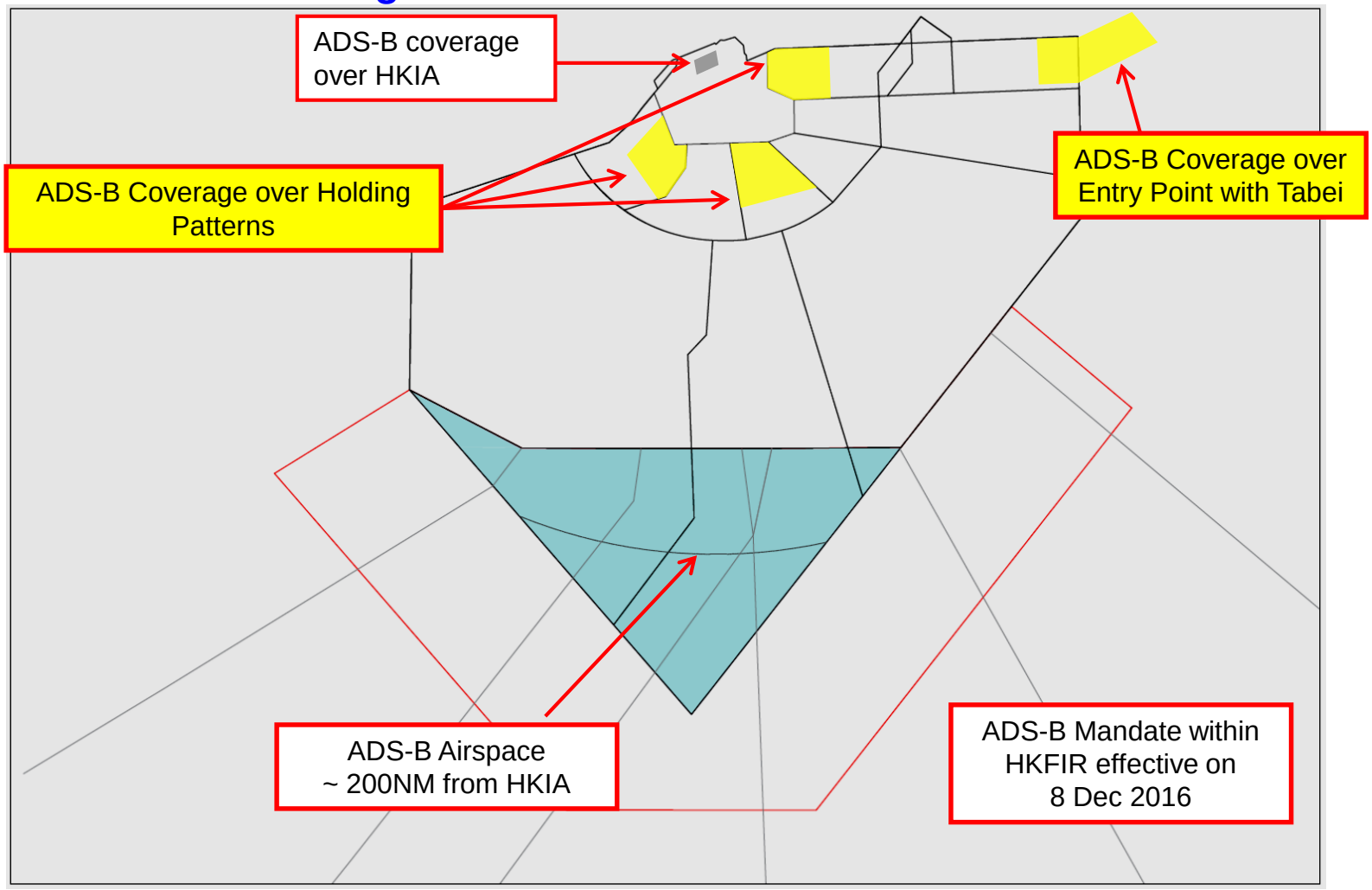
Phased Implementation of ADS-B in Hong Kong

1b. ADS-B Coverage after 17 January 2017



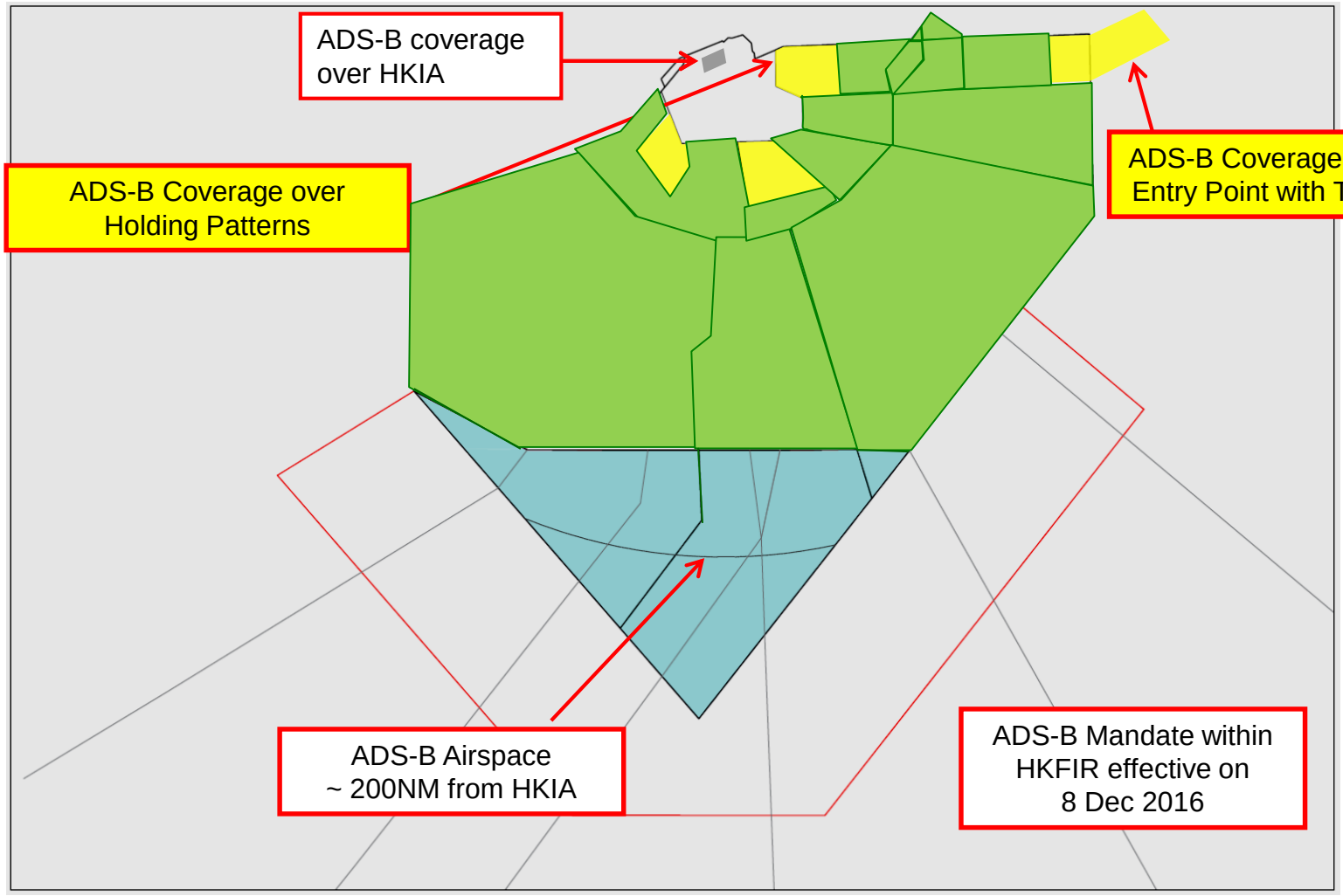
Phased Implementation of ADS-B in Hong Kong

1c. ADS-B Coverage after 30 March 2017



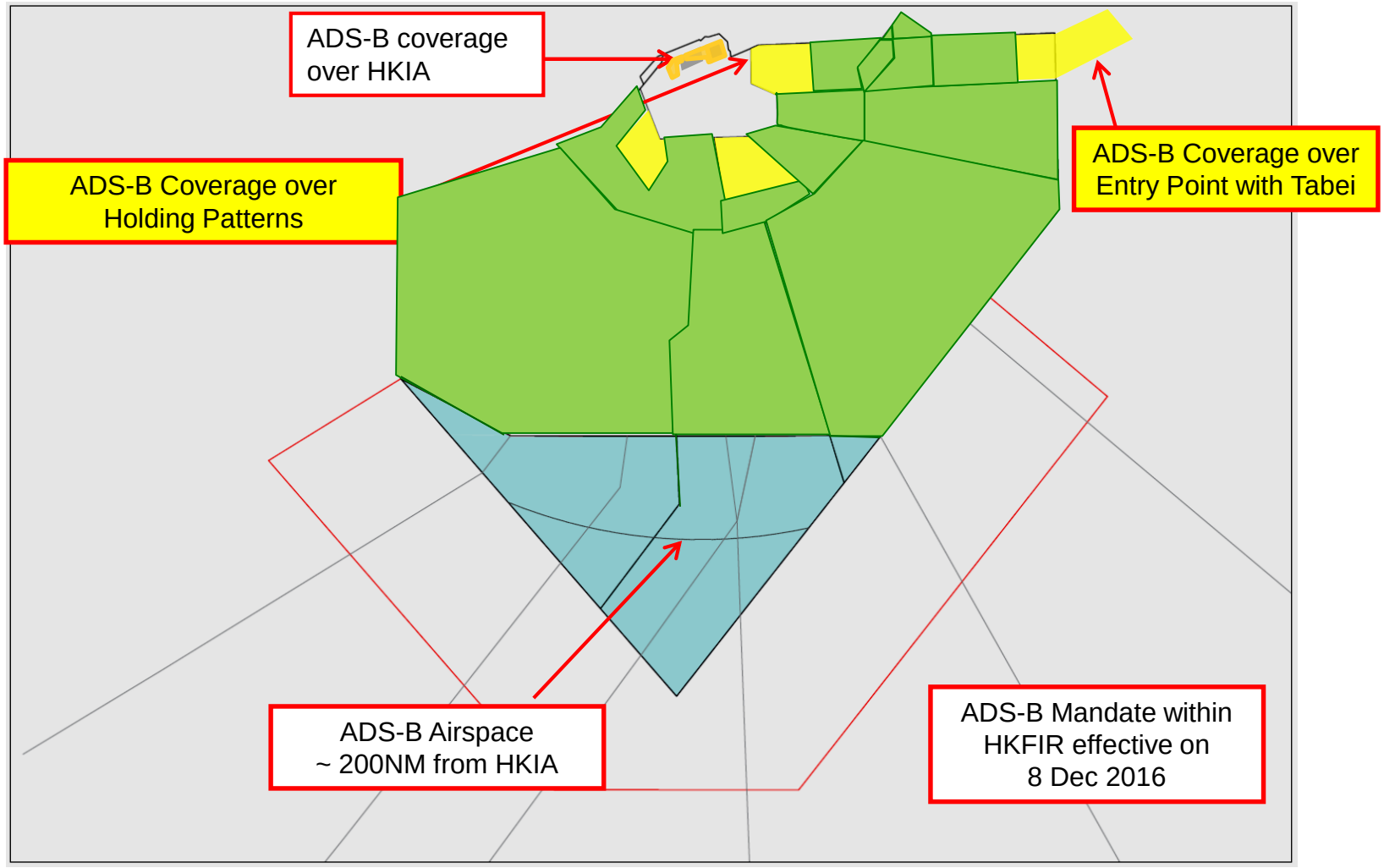
Phased Implementation of ADS-B in Hong Kong

2a. Full ADS-B Coverage in Terminal and Area Airspace after 17 August 2017



Phased Implementation of ADS-B in Hong Kong

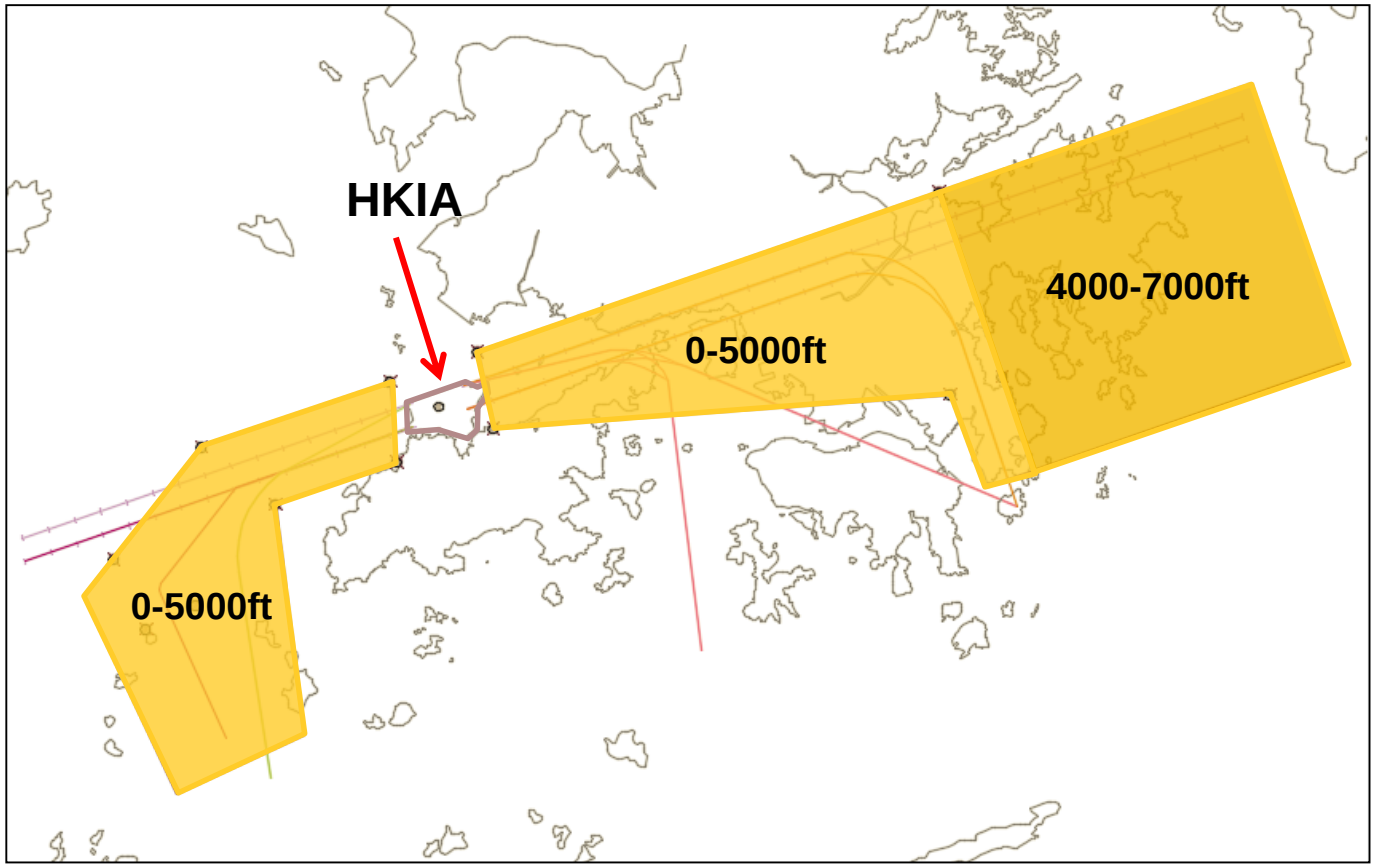
52b. Full ADS-B Coverage in Final Approach Path after 2 May 2018



Phased Implementation of ADS-B in Hong Kong

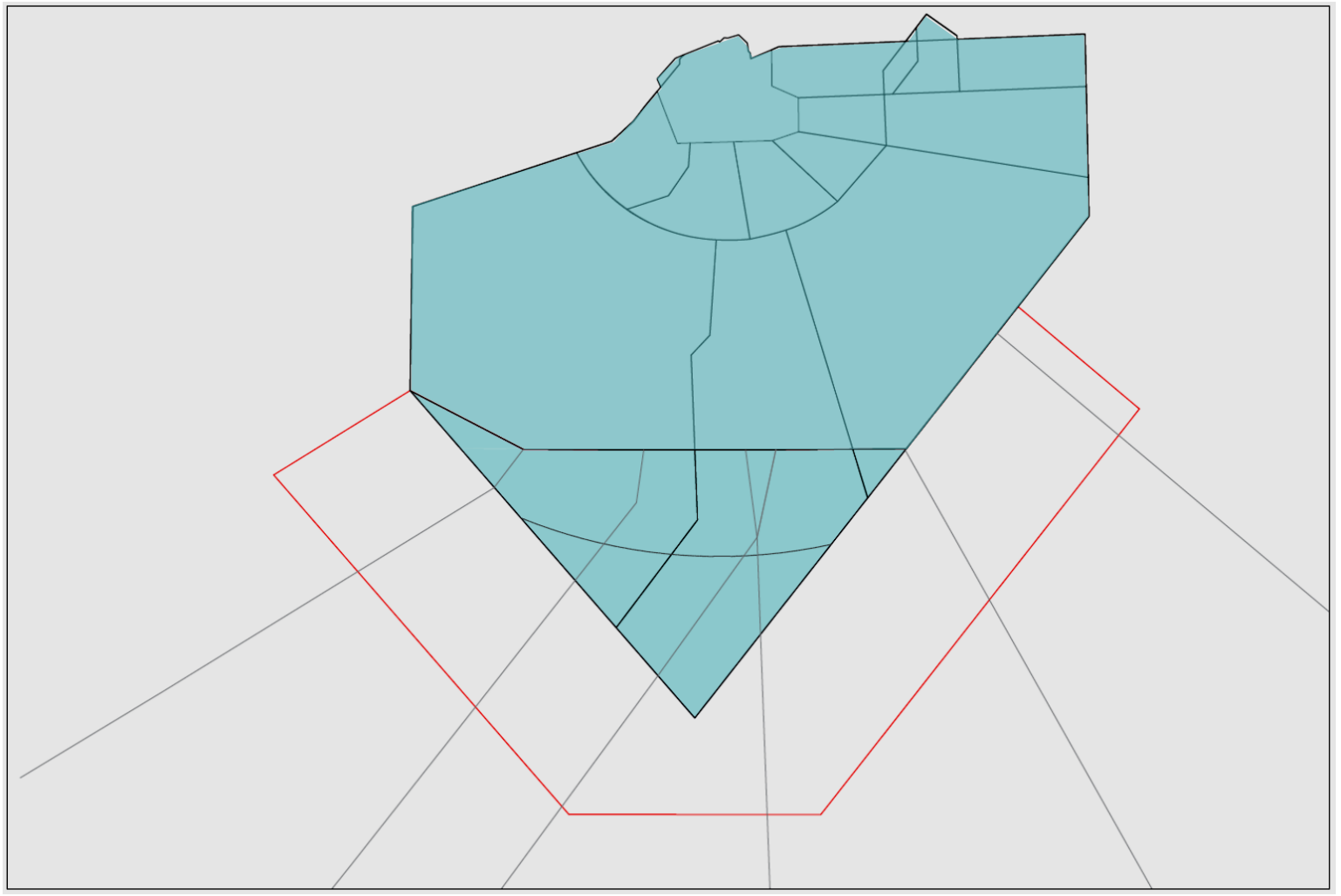
ADS-B Implementation: Final Approach Path

- Aims at improving positional accuracy and response of speed changes of aircraft in the final approach path using ADS-B



Phased Implementation of ADS-B in Hong Kong

2c. Full ADS-B Coverage in whole HKFIR Airspace after 1 November 2018



Evaluation and Safety Assessment

Key areas

- Reliability, Maintainability, Availability of ADS-B ground infrastructure
- The probability of detection, the accuracy and the integrity of the ATS surveillance system(s) are satisfactory
- Early publication of mandate to ensure adequate equipage
- Operational Separation Standards
  - Able to meet Positional Accuracy and Integrity requirements in Cir 326
- Verification
- Continuous monitoring of avionics and mechanism in place to address bad avionics
- Transition of Phases, Notification to Frontline, AIP etc

Evaluation and Safety Assessment

- Risk-based and evident-based safety assessment process in meeting the operational needs and combating limitation of traditional radar technology

- **Basis of Assessments**
  - ICAO PANS-ATM
  - ICAO APAC Regional AIGD
  - ICAO Circular 326
    Assessment of ADS-B and Multi-lateration Surveillance to Support Air Traffic Services and Guidelines for Implementation
  - ICAO APAC Regional Baseline ADS-B Service Performance Parameters
  - Eurocontrol Specification for ATM Surveillance System Performance

Evaluation and Safety Assessment

- AIGD
  - Describes complex airspace as having the following characteristics:
    - ✓ Higher aircraft density
    - ✓ Higher route crossing point density
    - ✓ A higher mixture of different aircraft performance levels
    - ✓ A higher rate of aircraft manoeuvring
- Circular 326
  - Technical assessment required if complex airspace involved
- Certain Phases of Implementation involved complex airspace
  - Complex airspaces have existing multi-radar coverage into MST

Evaluation and Safety Assessment

- **Proof:**

  No degradation of MST accuracy in the presence of ADS-B

- **Methodology for Technical Assessment in Complex Airspace**
  - Statistical approach by checking the actual performance of MST tracks using targets of opportunity
  - Calculate Root-Mean-Square (RMS) Error between
    - MST positions of ATMS
    - GPS positions of raw ADS-B data
  - Accuracy Analysis
    1. Benchmarking with international standards required for that airspace
    2. Comparison between multi-radar tracks and multi-surveillance tracks

Way Forward

Way forward

- Continue to work with CAAs/airlines to monitor and address bad avionics
- Mandate for low-flying GA/Helicopters published in January 2018 via AN-102F (forward-fit by 8 June 2018, retrofit by 31 January 2023). Continue to work with the industry for realizing the mandate
- Share experience with other States who wish to implement ADS-B
- Explore space-based ADS-B to enhance resilience

Thank you


• Safe • Orderly • Efficient
• Airworthy • Teamwork
Committed to a Safe, Efficient and Sustainable Air Transport System