International Civil Aviation Organization

Sixth Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF/6)

Bangkok, Thailand 2-4 June 2025

Agenda Item 5: ATM Automation System Implementation Experience by States

5.2. ATM Automation System Implementation Issues Sharing

OPTIMIZATION OF STCA IN COMPLEX AIRSPACE ENVIRONMENT

(Presented by China)

SUMMARY

Short-Term Conflict Alert (STCA) is the most critical alert in the Air Traffic Management Automation System (ATM-AS). With the increasing flight traffic, the complication of the airspace environment, and the access of more abundant surveillance data, STCA needs to adapt to the new technical environment and operational requirements, ensuring that it can provide key decision - making support for air traffic controllers through real - time monitoring, conflict prediction, and warning generation.

1. INTRODUCTION

1.1 STCA is the most important alert function of ATM-AS. The original goal of STCA is to monitor the air traffic situation in real time, predict and warn of potential short-term conflicts, thereby providing air traffic controllers with an additional layer of safety protection and preventing mid-air collisions.

1.2 Since Reduced Vertical Separation Minimum (RVSM) was implemented in China in November 2007, STCA needs to adapt to the new technical environment and operational requirements to ensure its effectiveness and reliability in complex and high-density airspaces.

2. DISCUSSION

The Expansion of STCA

The Architecture of STCA

2.1 As illustrated in Figure 1, STCA should obtain information from Surveillance Data Processing, from Environment Data Processing and possibly from Flight Data Processing in order to generate alerts. Surveillance data is used to track the status of aircraft in real time. Flight data is used to determine the flight categories for which alerts are generated and the corresponding parameters. Environment data is used to set the alert airspace range and alert conditions.

2.2 Alerts should be generated at least at a Controller Working Position of the control sector(s) working the aircraft. Status information regarding the technical availability of STCA is to be provided to all Working Positions. Selectable options of STCA related to eligibility, configuration and technical availability may be available at Controller and Supervisor Working Positions. All pertinent STCA data should be recorded for offline analysis. As shown in Figure 1.

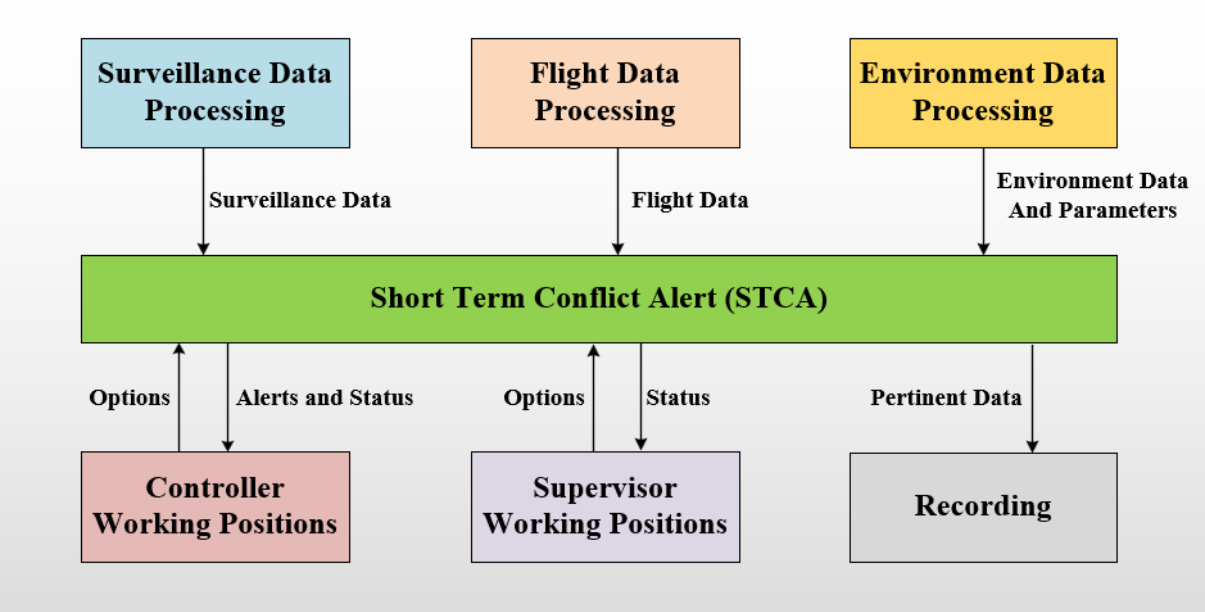


Figure 1 STCA Context Diagram

2.3 Surveillance Data

a) State vector and tracked pressure altitude information: to predict or detect hazardous situations.
b) Intent Data
Selected Vertical Intent: to increase relevance of conflict prediction.

Note: Although Selected Vertical Intent downlinked from the aircraft will sometimes be QNH corrected, it is commonly referred to as the Selected Flight Level (SFL).

2.4 Flight Data

a) Type/category of flight/flight rules: to determine the eligibility for alert generation and the corresponding parameters.
b) RVSM status: to apply appropriate parameters in RVSM airspace
c) Concerned sector(s): to address alerts
d) Cleared/Block Flight Levels: to increase the relevance of alert generation
e) Number of aircraft: to apply appropriate parameters for formation flights
f) Manually entered Flight Levels: to compensate for missing pressure altitude information

2.5 Environment Data

a) Airspace volumes
b) Alerting parameters

Implementation of the Optimized STCA

2.6 **Optimization STCA Based on Vertical Intention**

In order to avoid generating false predicted conflicts, the Cleared Flight Level (CFL)/Mode S Selected Altitude (SFL) is used in STCA when the track is currently climbing/descending to this flight level, in the following circumstances:

a) When CFL≠SFL， STCA will not take CFL/SFL into account
b) Only SFL is valid, STCA will take SFL into account
c) Both SFL and CFL are valid ， SFL=CFL， STCA will take CFL/SFL into account

2.7 Forward Detection of STCA Based on Heading Guidance (HG) Intention

When the HG intention from DAPs is validly received, STCA should prioritize HG data. When the track velocity vector does not actually cause a heading maneuver, the system will proactively use the heading intention to trigger the forward detection alarm of STCA. As shown in the Figure 2, the actual heading of TEST102 is 170°. Due to the heading intention 187° from DAPs, a forward detection alarm of STCA is generated in the system.

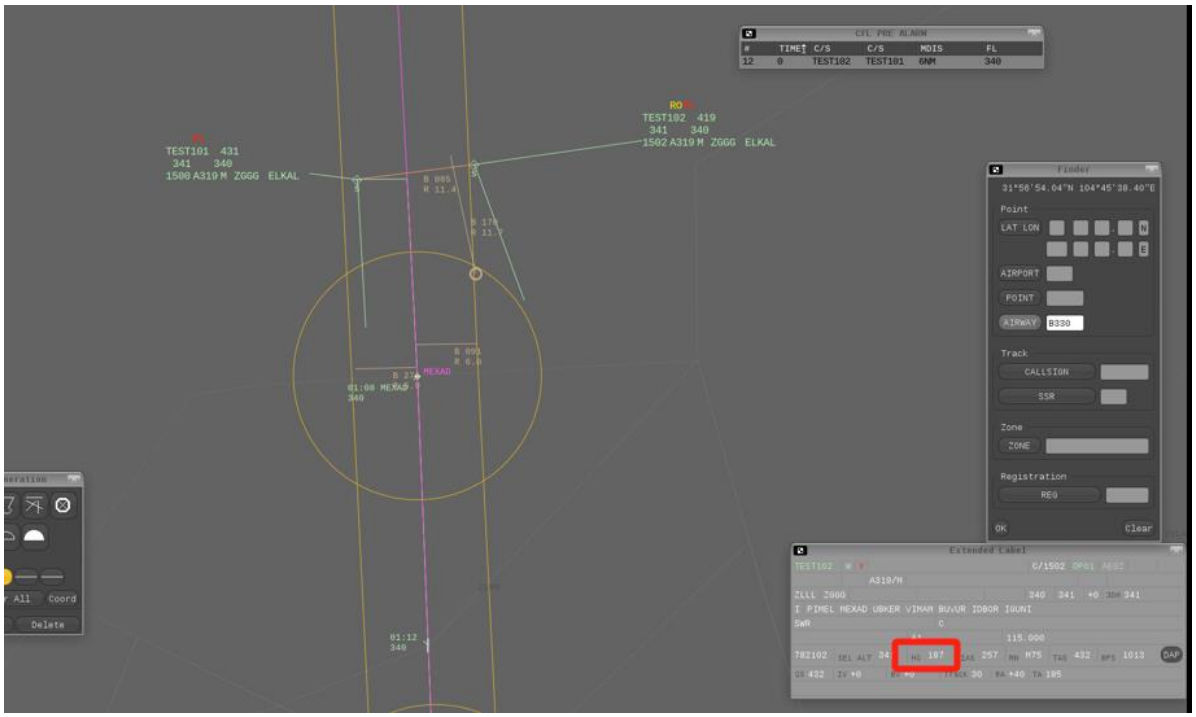
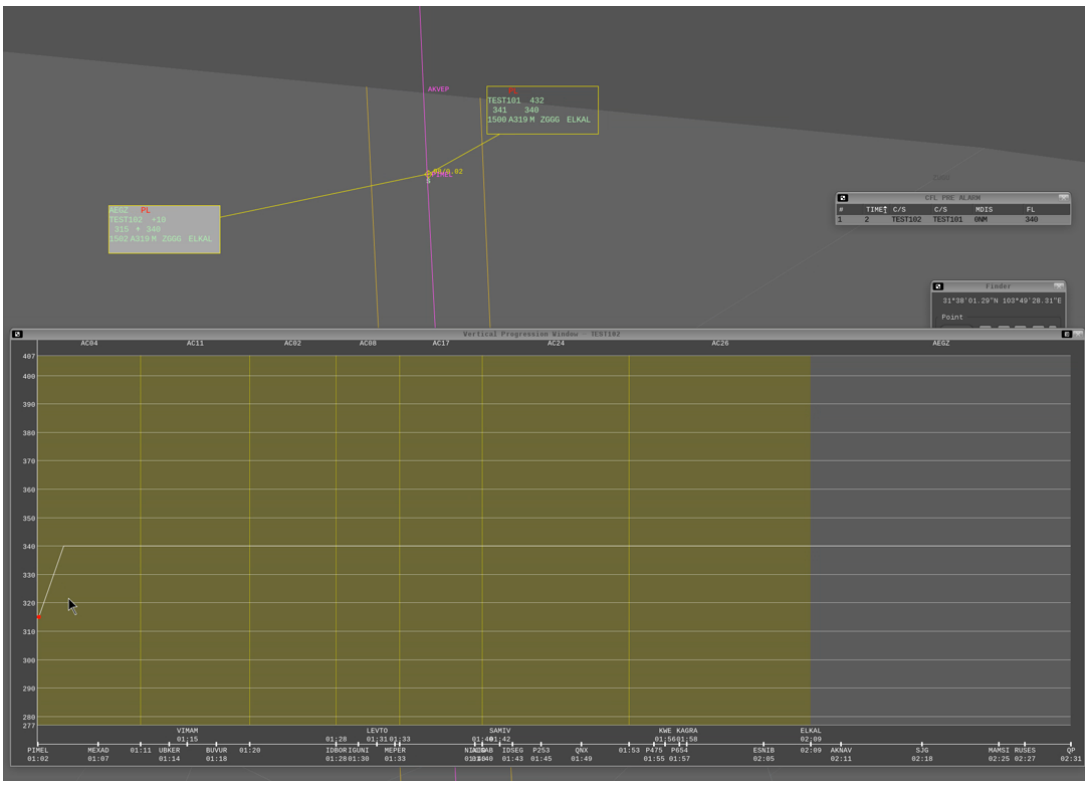


Figure2 Forward Detection of STCA Based on Heading Guidance (HG) Intention

2.8 Forward Detection of STCA Based on the CFL Instruction

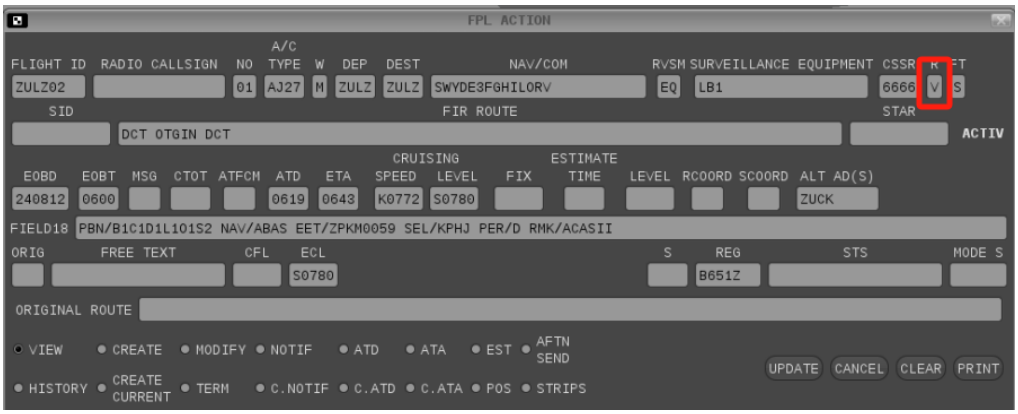
The CFL serves as an important instruction issued by air traffic control to aircraft in the air. The CFL needs to be issued verbally, repeated by the flight crew, confirmed verbally, and then entered by the air traffic controller into the label of the track in the ATM-AS. Air traffic controllers bear a great deal of responsibility for the issuance of CFLs. Before issuing a CFL instruction for a specific altitude, conducting crossing detection and conflict detection can serve as a forward warning for STCA, aiming to avoid the issuance of incorrect CFL instructions and nip potential conflicts in the bud. As shown in Figure 3.

Figure3 Forward Detection of STCA Based on the CFL Instruction

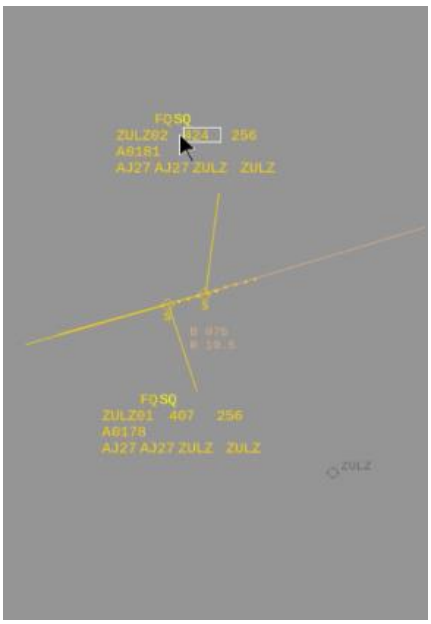


2.9 Optimize STCA for Formation Flights

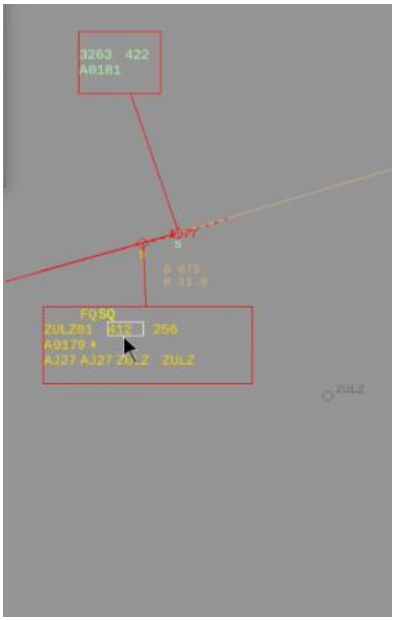
With the implementation of remote approach, terminal control will undertake the tasks of monitoring and commanding formation flights. The horizontal interval of formation flights will inevitably be smaller than the horizontal interval threshold for regular scheduled flights. By defining a specific area, STCA will not be generated between VFR (Visual Flight Rules) flights. As shown in Figure 4.



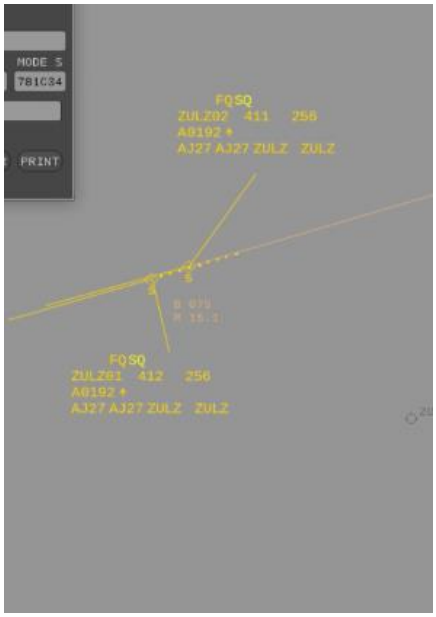
VFR flights



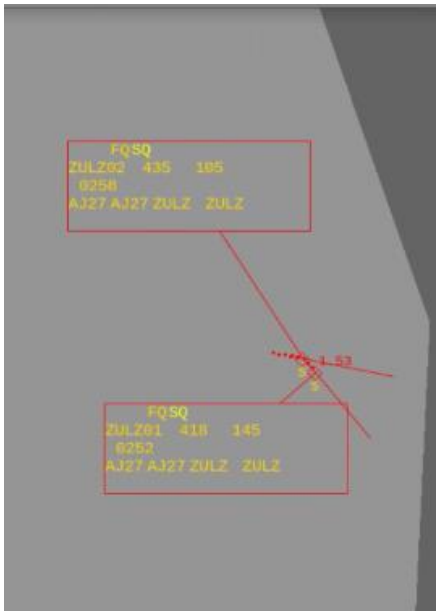
STCA inhibition between formation flights



STCA triggered again



STCA inhibition between formation flights



Formation flights out of the region

Figure 4 STCA among Formation Flights

2.10 Optimize STCA in the Proximity Airspace of Independent Parallel Approach

With the complication of the control procedures in the proximity airspace, the horizontal interval monitoring of STCA is gradually refined by Re-Categories wake turbulence in China (RECAT-CN) or the traditional wake turbulence separation, and the vertical interval monitoring of MSAW (Minimum Safe Altitude Warning) is gradually refined by APM (Approach Path Monitor). When the Independent Parallel Approach（IPA） control procedure is activated, NTZ (No Transgression Zone) area is activated by the suppression of the lateral interval monitoring of STCA for parallel runways.

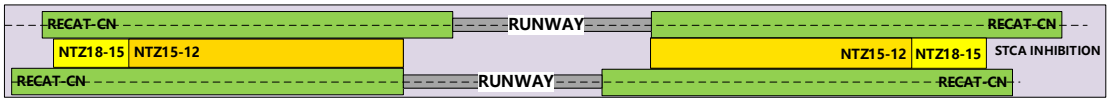
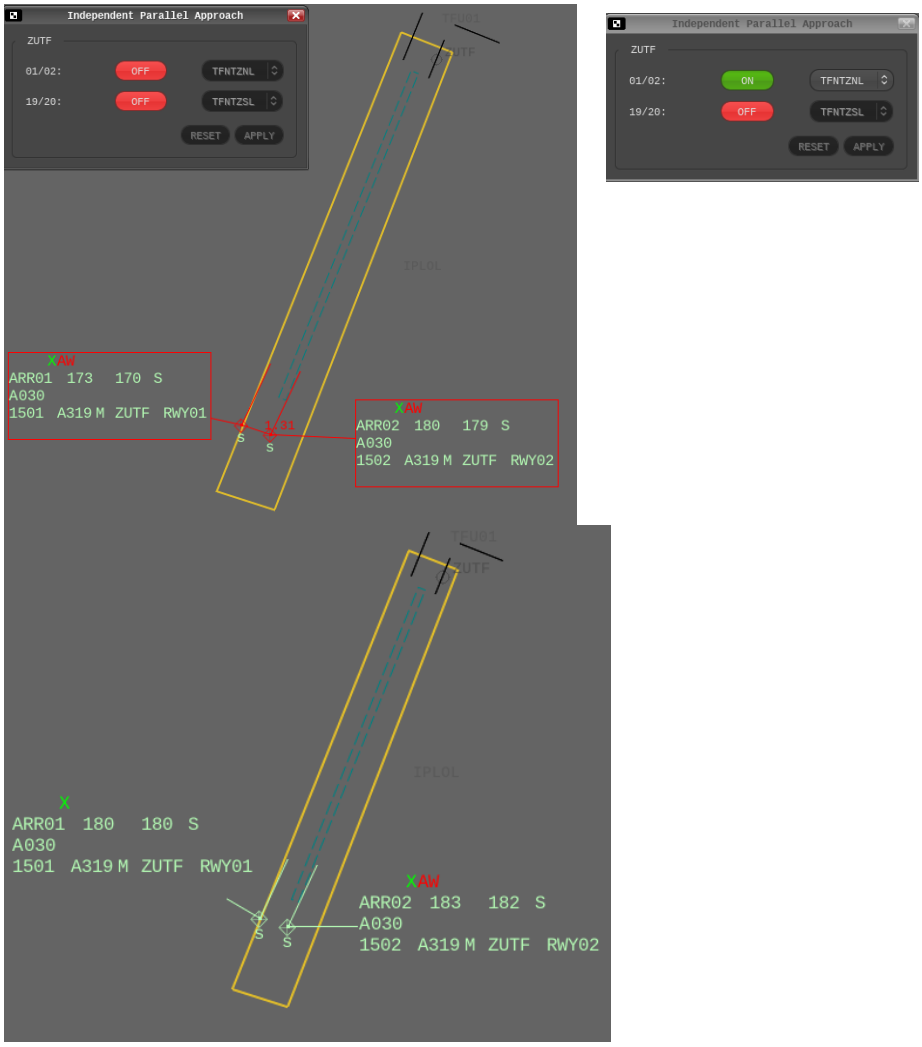


Figure5 IPA mode

IPA Linkage Mode:

a) IPA mode is activated, it is necessary to verify whether the runway operation mode meets the requirements.
b) IPA mode is activated, the STCA suppression zone corresponding to the NTZ area shall be enabled.
c) IPA mode is activated, the horizontal separation is the responsibility for RECAT-CN or the traditional wake turbulence separation.
d) IPA mode is activated, the vertical separation is the responsibility for APM.
e) IPA mode is deactivated, the STCA suppression zones on the upwind leg and the downwind leg of the airport shall be turned off, and the oblique distance monitoring of the parallel runways shall be generated by STCA.



IPA mode is deactivated IPA mode is activated

Figure6 Schematic diagram of IPA mode

Prospect

2.11 With the continuous evolution of ATMAS, the continuous increase in flight traffic, and the continuous enrichment of surveillance data, the extended STCA architecture is going to be continuously deepened in the future. STCA needs to adapt to the new technological environment and requirements, always focusing on the core objective of improving air traffic safety. Through real-time

monitoring, conflict prediction, and warning generation, STCA provide critical decision-making support for air traffic controllers.

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 matter as appropriate.

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