International Civil Aviation Organization

Fifteenth Meeting of the FANS Interoperability Team – Asia (FIT–Asia/15)

Bangkok, Thailand, 24 – 27 June 2025

Agenda Item 5: Data Link Developments and Guidance Material

LANDING INFORMATION DELIVERY OPERATION IN CHINA

(Presented by China)

SUMMARY

This paper presents China's operational experience with the Landing Information Delivery (LID) system, which digitally provides landing-related data (e.g., STAR, runway assignments) to flights 50 minutes prior to estimated landing time. It demonstrates significant efficiency improvements, higher prediction, and security redundancy.

1. INTRODUCTION

1.1 Accurate landing information exchange between pilots and controllers is critical during final approach phases. Conventional reliance on VHF voice communication, susceptible to signal interference and linguistic ambiguities, often leads to delayed or erroneous message delivery. To mitigate this, the Landing Information Delivery (LID) system employs air-ground data link technology based on ARINC623 protocol – a character-oriented standard, enabling digital transmission of complex ATC instructions (e.g., route amendments, altitude changes) and real-time retrieval of Flight Management System (FMS) datasets, including predicted trajectories, Standard Terminal Arrival/Departure Routes (STAR/SID), and Arrival Runways (ARWY).

1.2 Since 2019, China has successfully carried out flight validation of All-Phase Datalink ATC Service based on compatible FANS 1/A and ACARS ATS protocols in Zhengzhou, Guangzhou, Haikou, Shanghai and other regions. The validation covers Datalink-Flight Information System (D-FIS), emergency communication, datalink similar callsign, hazardous weather warning, etc., which will support the technical feasibility of the near-term planning goal of fully exploiting the existing system capacity of China to provide datalink emergency contact and information services in major airspace, and to explore the development path of China civil aviation datalink-voice hybrid application in the forthcoming datalink ATC service implementation roadmap.

1.3 With the rapid development of aviation, enhancing flight safety and operational efficiency remains a core industry priority. To improve safety redundancy, current procedures involve ACC control controllers manually pre-delivering STAR and ARWY to inbound flights via voice communication. However, voice-based methods suffer from high frequency occupancy and human error risks. To address this, China has developed the Landing Information Delivery (LID) system, leveraging air-ground data link technology and ARINC623 protocols to enable digital pre-release of STAR/ARWY. The system is compatible with existing air traffic control automation platforms.

2. DISCUSSION

LID Function Operation Concept

2.1 The LID function is activated by the Terminal Control Center, requiring coordination with approach controllers to confirm operating modes and ensure system-wide synchronization. Controllers can monitor LID status in real time to align information delivery with operational demands.

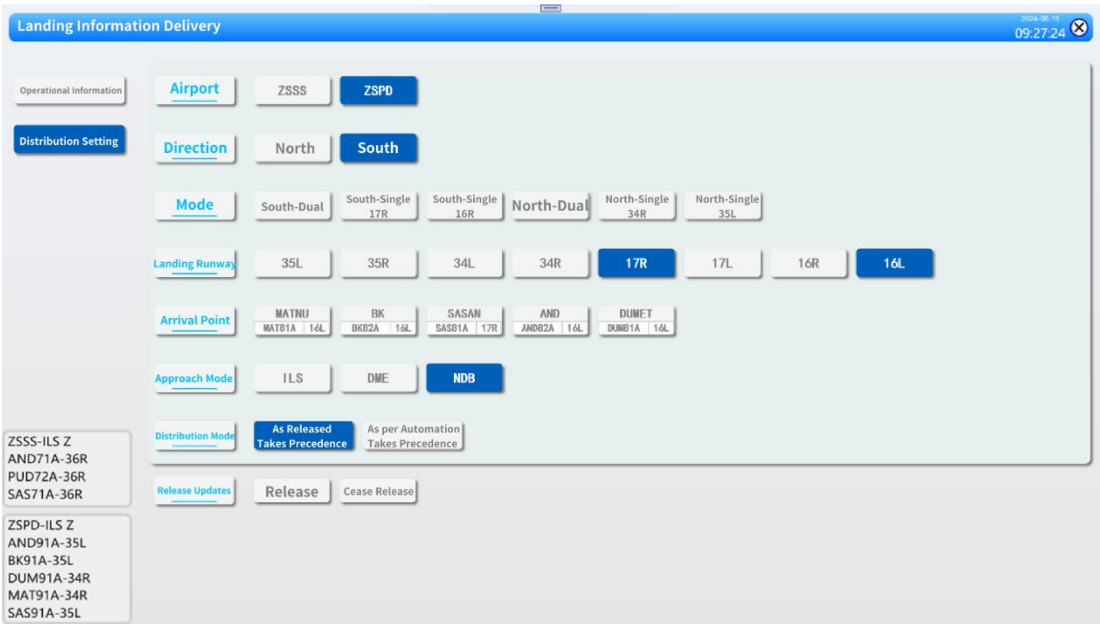

Figure 1: LID Interface

LID System Architecture

Layered Architecture

2.2 There are a couple of layers structured in the LID system.

2.3 **Data Collection Layer** utilizes air-ground data links (e.g., ACARS, cross-border data sharing) to acquire real-time ELDT (Estimated Landing Time), STAR (Standard Terminal Arrival Route), and ARWY (Assigned Runway) data from airborne systems.

2.4 **Processing Layer** is composed of Trajectory Matching and Calibration Mechanism. The former dynamically associates runway direction, STAR, and approach types (e.g., ILS/DME/NDB) based on predefined "operation mode presets", the latter proactively retrieves current airborne settings and triggers alerts (red borders) for inconsistency with published data.

2.5 **Publication Layer** features automation and manual configuration- synchronizes with ATC **automation** systems and user-defined operation modes.

2.6 **User Interface Layer** provides dual display modes (airport: ZSSS/ ZSPD/ ZNST or waypoint-based) and categorizes flights by status (e.g., under approach control).

System Integration

2.7 The system deeply integrates with ATC automation systems for dynamic runway and STAR adjustments, supporting configurable database for customized waypoint-runway mappings.

Information Processing and Publication Mechanisms

2.8 The data source of the mechanism includes real-time airborne feedback (ELDT, STAR, ARWY), ATC automation system updates (e.g., approach sector handoffs).

2.9 Exception Handling includes: labels flights as "uncolored" (if airborne data is unavailable), and highlights discrepancies via red borders and clickable details.

2.10 Publication Logic includes triggers and dynamic adjustments. Triggers refers to automatic publication 50 minutes before estimated landing or upon runway mode changes, dynamic adjustment features "One-click" application of preset operation modes (e.g., south/north runway combinations) and manual override of automated mappings (e.g., STAR or runway reassignment).

Current Challenges

2.11 Data Link coverage limitations with gaps and runway allocation.

2.12 **Cross-Border Gaps:** Such as flights from Japan/ROK may experience VHF data link outages during descent, delaying LID updates.

2.13 **Static Runway Allocation**: Heavy reliance on preset modes limits intelligent optimization (e.g., prioritizing runways closer to parking gates based on real-time traffic).

2.14 **Information scope constraints:** current publications exclude post-landing instructions (e.g., rapid exit taxiways) or taxiway hazard alerts.

2.15 **Operational workload:** Frequent manual interventions in "publication-driven" mode increase controller burden.

Future Development Plans

2.16 Global Standardization

a) **FF-ICE Integration**: Advocate for incorporating LID data fields (STAR, ARWY, taxi instructions) with FF-ICE (Flight and Flow Information for a Collaborative Environment) standards.

b) **Cross-Border Data Proxies**: Collaborate with neighboring states to use VHF networks, ensuring LID delivery before Top of Descent (T/D).

2.17 **Intelligent Enhancements:**The initiative focuses on implementing AI-driven allocation by developing predictive models to optimize runway assignments. These models will intelligently factor in real-time traffic flow patterns, prevailing weather conditions, and gate proximity to enhance efficiency. Additionally, the scope includes expanding the types of information provided digitally. Specifically, post-landing requirements and timely taxiway alerts will be published to pilots, delivered via established digital channels such as CPDLC (Controller–Pilot Data Link Communications) or electronic flight bag (EFB) compatible digital charts.

2.18 **System Resilience** Enhancing system resilience is critical. A key measure involves integrating redundant communication pathways, including HFDL (High-Frequency Data Link) and satellite links. This integration aims to ensure robust and uninterrupted cross-border data transmission, mitigating the risk of single-point failures. Furthermore, the strategy incorporates deploying machine learning capabilities to achieve self-optimization. These systems will continuously analyze instances of calibration failures and autonomously refine the underlying matching algorithms to improve overall system performance and reliability.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper.

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