



ICAO

International Civil Aviation Organization

SEVENTH MEETING OF THE ASIA/PACIFIC AIR TRAFFIC MANAGEMENT AUTOMATION SYSTEM TASK FORCE (ATMAS TF/7)

Bangkok, Thailand 2-4 June 2026

Agenda Item 4: ATM Automation System Implementation Experience by States

4.5. Integration with External Systems

RESEARCH AND APPLICATION OF AIR-GROUND DATA LINK-BASED LANDING INFORMATION INTERACTION TECHNOLOGY FOR INBOUND FLIGHTS

(Presented by China)

SUMMARY

This paper introduces the operational concept and practical application of the Landing Information Deliver (LID) function based on Air-Ground data link for inbound flights. The LID function enables the pre-delivery of Standard Terminal Arrival Route (STAR) and Arrival Runways (ARWY) to flight crews during the cruise phase, establishing an efficient, accurate, and bidirectional digital information channel between flight crews and air traffic controllers.

1 INTRODUCTION

1.1 Since 2019, successful flight validations of full-phase data link air traffic services compatible with FANS 1/A and ACARS ATS protocols have been conducted in Zhengzhou, Guangzhou, Haikou, Shanghai, and other regions. The validation covered Data Link-Flight Information Services (D-FIS), emergency communications, similar call signs, and dangerous weather warnings. In 2026, China published the <China Civil Aviation Data Link Air Traffic Services Implementation Roadmap>, which encouraged air traffic control units to promote the provision of data link air traffic information services on demand as a supplement to traditional voice communications. Considering the capability of aircraft airborne equipment, landing information delivery represents a highly feasible application scenario.

1.2 With the rapid development of the aviation industry, the enhancement of flight safety and operational efficiency has consistently been a core objective for airlines and ATC authorities. To improve flight safety and provide crews with additional operational redundancy time, ACC Controller can proactively transmit Standard Terminal Arrival Routes (STAR) and assigned arrival runways to inbound flights. However, voice communication not only occupies radio frequency resources but is also susceptible to human factors. To provide higher-quality air traffic control services, research on Air-Ground data link-based arrival information interaction technology for inbound flights was initiated, exploring the application of the ARINC623 protocol and developing the Landing Information Deliver (LID) function.

1.3 The application of the LID function reduces communication time, alleviates workload for both controllers and pilots, and the early delivery and digital expression of information significantly improve operational safety. Furthermore, as a practical application scenario of the ACARS (Aircraft Communications Addressing and Reporting System) functionality, this function is positioned for

customized and proactive push services for arrival information. Considering actual ATC operational procedures, upon successful verification, this function can be integrated into ATC Automation System in future.

2 DISCUSSION

LID Function Concept and Architecture

2.1 Prior to aircraft landing, obtaining accurate landing information is crucial for both flight crews and controllers. Traditionally, landing information has been primarily transmitted via Very High Frequency (VHF) voice communication, which is susceptible to communication interference and language barriers, potentially resulting in delayed information delivery or errors. To improve operational efficiency and information accuracy, the Landing Information Deliver (LID) function based on Air-Ground data link was developed.

2.2 The transmission of LID information is primarily based on the ARINC623 protocol, which is a character-oriented Air-Ground data transmission protocol enabling the transmission of large volumes of complex control instructions and flight information between ground and air. The advantage of this protocol lies in its ability to achieve rapid and accurate information transmission via data link, greatly reducing misunderstandings and errors caused by voice communication. Through the ARINC623 protocol, the ground control system can transmit real-time control instructions to aircraft in flight and obtain key information from the Flight Management System (FMS), including predicted trajectories, arrival and departure procedures, and arrival and departure runways.

2.3 The LID function architecture comprises the ground-based control system, the airborne Flight Management System (FMS), and the connecting Air-Ground data link. The ground system is responsible for generating and transmitting arrival information, while the airborne system receives information and provides feedback when necessary. The reliability and coverage of the Air-Ground data link directly determine the overall performance of LID; therefore, during system design, the stability and real-time capability of the data link must be ensured. Additionally, LID features the capability to integrate with other ATM systems, enabling seamless coordination between arrival information delivery and other control operations.

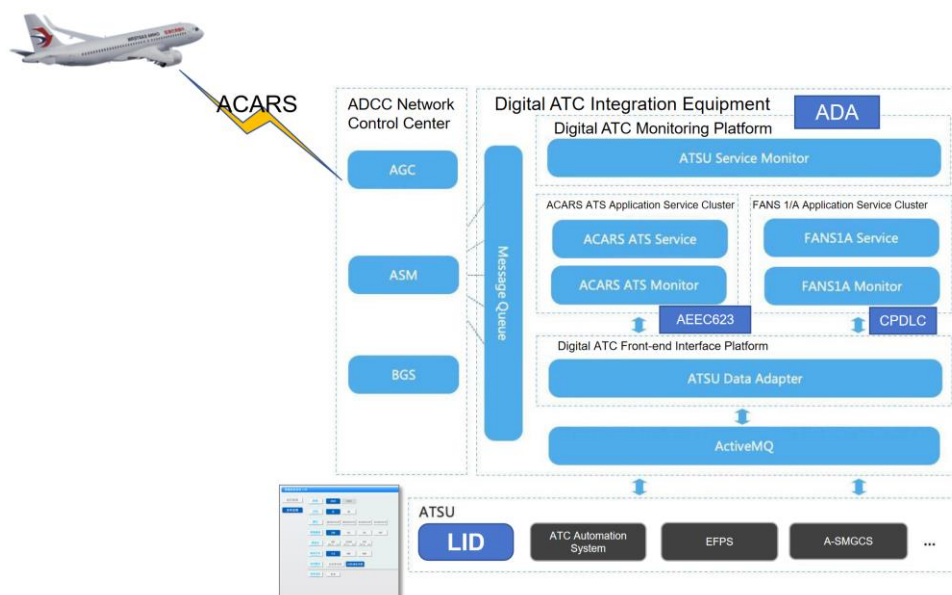


Figure 1: System Architecture

2.4 In the LID function, the control system can transmit predetermined arrival procedures and arrival runway information to aircraft airborne equipment via uplink messages. These uplink messages are typically written in standard formats to ensure that information can be correctly identified and interpreted by the onboard system. Currently, the content delivered includes: Standard

Terminal Arrival Routes (STAR), assigned arrival runways, approach types (APP), and parking stands (GATE).

2.5 The activation of the LID function is the responsibility of the Terminal Control Center. Upon activation, controllers can continuously monitor and coordinate LID operations, ensuring that landing information delivery and execution are closely aligned with actual operational requirements.

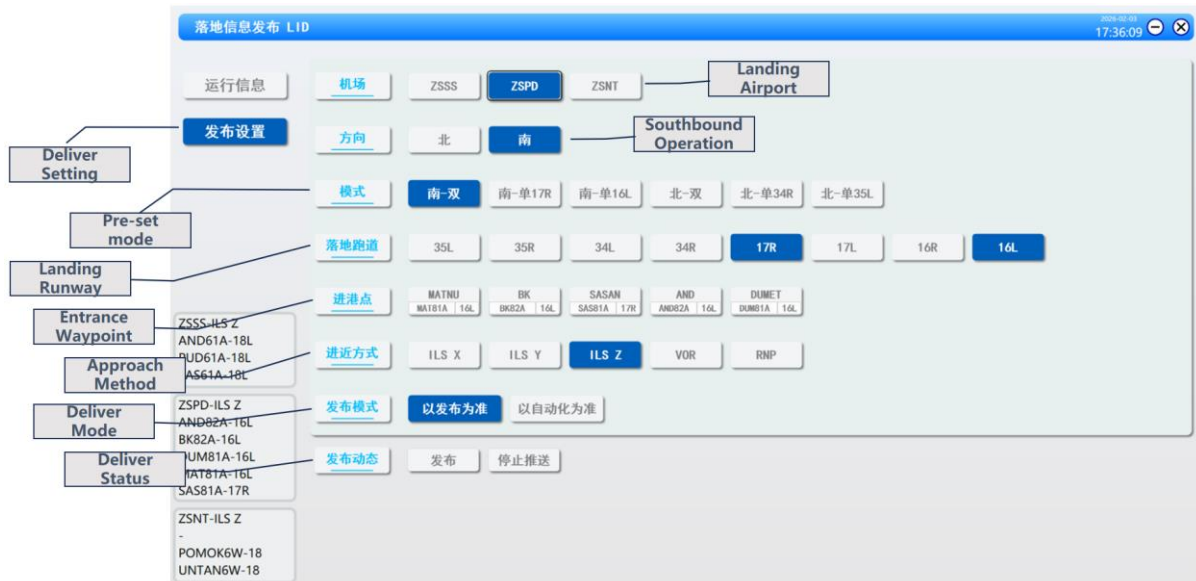


Figure 2: LID Function - Operational Mode Publishing Interface

2.6 LID delivers landing information to flight crews in digital format via the Air-Ground data link. After the aircraft has been departed for a certain duration, the ground control system sends a request to the airborne equipment to obtain the Estimated Landing Time (ELDT). This function supports automatic push of landing information to the cockpit at a configurable time before landing (currently 50 minutes for Shanghai Terminal).



Figure 3: Airborne Equipment Message Reception

2.7 Upon receiving the information, flight crews can pre-program the relevant procedures into the onboard flight management computer without immediately verifying with ACC controllers upon initial contact with APP controller, flight crews simply report the received arrival runway and

arrival procedures. If the reported information aligns with controller requirements, the approach controller can directly instruct the crew to proceed as published; if not, the controller will issue new arrival procedures and runway assignments. For certain aircraft, the airborne equipment's current STAR and Arrival Runway settings may be requested 5 minutes after pushing the LID information.



Figure 4: Workflow

2.8 Through this approach, the LID function ensures both the timeliness of information delivery and consistency between final operations and actual operational requirements.

LID Main Functions and Application Status

Data Exchange with Airborne Equipment

2.9 The LID function achieves data exchange with airborne equipment via the Air-Ground data link. When the ground system sends uplink messages to the airborne equipment, the airborne equipment automatically replies with MAS (Automatic Status Acknowledgement) messages to indicate the current information reception status. When ground-base station signal degradation occurs, the LID function will initiate re-transmission attempts. Additionally, when the flight crew confirms LID information, they proactively push CDA (Manual Acknowledgement) messages to the ground to confirm successful receipt by the flight crew.

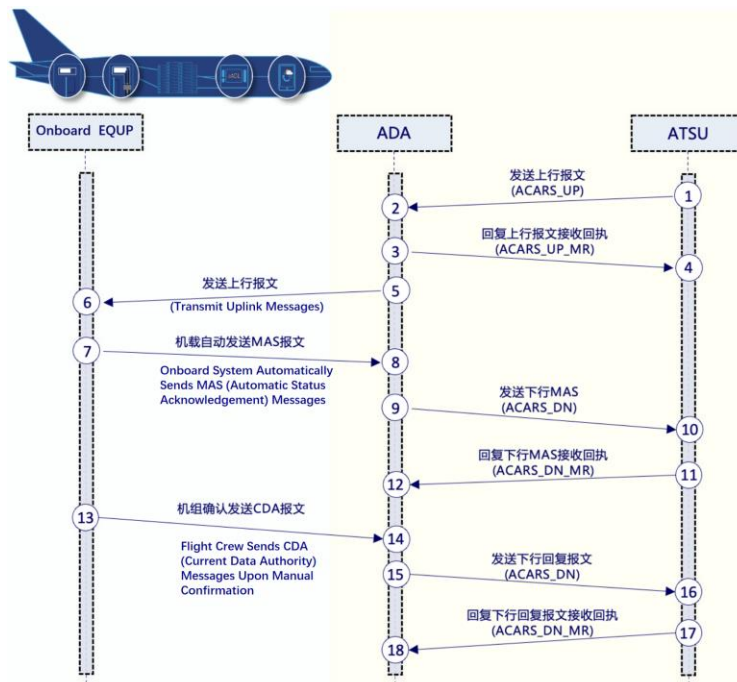


Figure 5: Message Exchange Process
Landing Information Discrepancy Alert

2.10 As introduced before, the LID function is capable of requesting the currently configured landing runway and arrival procedure from airborne equipment. It attempts to retrieve airborne device data a certain period after message delivery. If the data acquired from downlink messages is inconsistent with the previously pushed information, the system will retransmit the planned arrival procedure and landing runway data to the airborne equipment via uplink messages, prompting the crew for verification.

2.11 Such uplink and downlink messages jointly form the foundation of two-way air-ground communication, enabling ground controllers to real-time monitor crew operations and airborne system configurations. The operational interface also provides corresponding airborne equipment downlink information display. When the arrival data currently configured on the airborne equipment as indicated in downlink messages is inconsistent with the pushed LID information, the interface generates corresponding alerts.



Figure 6: Flight Airborne Equipment Downlink Data Display and Alerts

Progress of LID Operational Implementation

2.12 To verify the operational performance and stability of the LID function in practical application, multiple test phases were designed.

2.13 In July 2024, tests were conducted on individual flights and aircraft types, and exchanges with flight crew members confirmed the feasibility of ground-aircraft interaction. In October, the test scope was expanded to cover additional aircraft types, achieving daily coverage of approximately 460 flights with favorable feedback. Starting from November 11 2024, public trial operation was launched in accordance with the released NOTAM, covering all inbound flights landing at Shanghai Pudong International Airport and Shanghai Hongqiao International Airport., with continuous system function optimization. Airport gate information transmit function was newly added, extending service coverage from air to ground and covering the full lifecycle of the flight.

2.14 Since 17 March 2025, LID services have been extended to Nantong Airport, covering all arrival flights at airports within Shanghai Terminal's jurisdiction, with daily service for approximately 1,230 aircraft and peak service reaching 1,300 aircraft, reducing VHF communication time by approximately 6.5 hours, alleviating VHF channel resource constraints, significantly enhancing control sector safety margins, and improving information transmission accuracy.

2.15 Data analysis shows that approximately 94% of airborne avionics can automatically respond to LID messages with a successful reception status; around 84% of aircraft are capable of downlinking manually confirmed acknowledgement messages; and about 30% of aircraft can downlink arrival procedures and landing runway configured on board.

CONCLUSIONS AND OUTLOOK

2.16 Currently, the LID public trial operation in Shanghai has overall validated the feasibility of the LID function based on Air-Ground data link, achieving pre-delivery of arrival runways, arrival procedures, approach types, and parking stands information, bringing tangible benefits to both airlines and ATC. The implementation of this tool have also accumulated valuable experience for ATM Automation System new function module upgrades. Going forward, we will maintain in-depth communication with airlines and flight crews to extend the application of this tool to the departure phase. Verification tests on departure-related information were conducted last September and October. It is anticipated that the LID function will further reduce workload for both controllers and flight crews, playing a more important role in future airspace management.

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
