Improving Flight Safety Management through Digital and Intelligent Empowerment

Distinguished colleagues, dear friends, ladies and gentlemen, good morning!

It is a great pleasure to exchange views on flight safety with all colleagues here in the beautiful city of Dhaka. For a long time, the PLA Air Force has upheld the principle that aviation safety knows no borders. With an open and inclusive mindset, we have drawn on beneficial practices in the field of flight safety from the air forces and civil aviation authorities worldwide. Such exchanges and learning have contributed positively to the improvement of the PLA Air Force's flight safety management. We hereby express our gratitude to the conference organizers and to all the colleagues around the world!

Currently, global aviation safety management is accelerating the transformation toward digitalization and intelligence. The air forces and civil aviation authorities worldwide are actively exploring the in-depth application of new technologies such as big data and AI in flight safety, advancing the shift of flight safety management from the traditional experience-based model to a data-driven and intelligently-assisted one. The PLA Air Force has also carried out active exploration into digital and intelligent empowerment for flight safety management, and

developed a series of technical approaches. In practice, these efforts have effectively boosted the efficiency of safety supervision. The serious accident rate per 10,000 flight hours of the PLA Air Force shows an overall downward trend, and ranks among the world's better performers.

Next, under the theme "Improving Flight Safety Management through Digital and Intelligent Empowerment", I would like to briefly share with you the beneficial practices of the PLA Air Force in this regard.

I. Practices of Digital and Intelligent Empowerment in Flight Safety Management

With the rapid development of aviation equipment, flight training has shifted from single-batch, single-aircraft operations to large-scale collaborative operations. Pilots are evolving from aircraft handlers to operators who need to maintain situational awareness and monitor system operating status. Meanwhile, higher requirements are being placed on flight safety in high-intensity and complex environment. As human potential is gradually stretched to its limits, boosting flight safety solely by improving human capabilities has hit bottlenecks. It is imperative to leverage new technologies, represented by digital and intelligent technology, to cultivate new performance growth drivers for training quality and efficiency, as well as flight safety management.

To this end, we have consolidated data resources, including unsafe

incident records, flight parameters, meteorological conditions, and equipment maintenance data. We have carried out R&D in areas such as rapid information sharing, safety risk prediction, training monitoring and management, equipment quality monitoring, and accident simulation application, and achieved positive results. Some of our practices are shared with you as follows:

First, we have developed safety applications based on mobile platforms to realize information sharing and co-governance. The rapid sharing of unsafe incidents and timely learning from response experience play a crucial role in preventing the recurrence of similar accidents. We have developed mobile applications such as safety early-warning and safety experience exchange. By installing and using these applications, all flight, training, management and support personnel become end users. Whenever an unsafe incident occurs in any unit, safety alerts can be conveyed to all personnel through the application immediately, realizing rapid information sharing. This helps all units keep track of the development of safety situation, understand incident progress, share experience and practices, and also supports them in conducting self-inspection of potential safety hazards, and improving safety strategies. When different units encounter difficult problems, they can launch thematic discussions in the safety experience exchange section to leverage the collective wisdom of all personnel, solicit solutions to

problems and expert opinions and suggestions, assisting them in resolving doubts and difficulties in flight training and safety management with optimal approaches.

Second, we have deployed a flight safety risk management system to deliver safety risk early-warning. Monitoring and controlling known risks and forecasting unknown risks constitute effective measures to eliminate hidden hazards, avoid safety risks, and enable the shift in flight safety management from post-incident investigation to proactive prevention. This system is tailored for pilots, covering training subjects and typical missions as operational scenarios. In the system, we have established mission risk database, risk indicator framework, evaluation and decision-making model, and risk management workflow, focusing on the five dimensions of "personnel, aircraft, environment, mission and management". The system also collects objective data including personnel status, equipment condition, ATC information and weather trends. It conducts intelligent analysis via risk management models to forecast potential risks for each pilot on a given mission, determine the risk levels, clarify improvement measures and specify management authority. This achieves the closed-loop management of risks on each sortie and maximizes the safety of mission flights.

Third, we have developed a flight training safety monitoring system to enable monitoring of human errors. Human errors stand out as a

prominent trigger of safety risks. Systematic intelligent monitoring and differentiated targeted training can help eliminate safety risks and move safety controls upstream. In this system, we have built a handling quality monitoring model tailored for pilots, and in line with the training syllabus. The system monitors each pilot's handling habits, operational deviations, unsafe actions and equipment usage, generating a training safety "profile" for every pilot by collecting per-sortie flight parameters, mission plan data and crew operating information. With accumulated data and algorithmic enhancement, the system reviews patterns of training errors, accurately identifies technical shortcomings, behavioral hazards and recurring issues. It captures each pilot's training characteristics, technical difficulties and handling preferences. This helps close blind spots in manual monitoring, optimizes targeted training subjects, and refines the traditional extensive training mode of manual inspection and post-event rectification. It improves training quality and efficiency, cuts training resource consumption, and reduces human errors.

Fourth, we have deployed an aviation equipment safety supervision system to achieve targeted monitoring of equipment hazards. Aviation equipment features complex operating conditions and highly concealed potential hazards, whose service status and changing trends are difficult to identify, while traditional manual inspections inevitably leave

supervision blind spots. So, as part of the system, we have developed an equipment operation monitoring model tailored for equipment maintenance personnel, and in accordance with the equipment design manuals, and also built an integrated monitoring platform by aggregating equipment operating parameters, maintenance support data and fault records. The system enables dynamic sensing of key equipment components, sets threshold standards for core parameters, and delivers full life-cycle supervision. Through vertical and horizontal parameter comparison, it can accurately identifies early fault risks and achieves automatic hazard early-warning. The system is also capable of analyzing hazard trends and summarizing fault occurrence patterns on the basis of monitored data, advancing the shift of maintenance support from scheduled maintenance to predictive maintenance. It standardizes the management of hazards archives, consolidates supervision responsibility of each level, and forms a full-chain mechanism covering hazard discovery, reporting, disposal and review. Based on the full life-cycle monitoring results, maintenance personnel can fully grasp equipment safety trends and comparative conditions, so as to arrange equipment deployment and application in a rational manner.

Fifth, we have constructed a flight accident simulation system to deliver dynamic accident reconstruction. Every unsafe incident and flight accident carries valuable lessons and insights to draw upon.

Reconstructing and analyzing historical events and absorbing relevant lessons helps bolster flight safety. Designed for flight accident investigators, the simulation system draws upon authentic data including accident flight parameters, video footage, cockpit voice recordings and environmental conditions at the time of the occurrence. Fitted with simulated aircraft cockpits and fly-back control systems, it dynamically reconstructs the progression of flight accidents by integrating recovered incident data, flight modes, environmental shifts and control inputs. Pilots seated within the cockpit can walk through the decision-making and judgment process of the accident crew in full context from a first-person view via VR headsets. Regulators outside the cockpit can examine accident progression across multiple dimensions on 3D situational displays, toggling between lead/wingman perspectives and a bird's-eye view. This facilitates the root-cause analysis and provides means for flight accident prevention research.

II. Recommendations for Advancing Digital and Intelligent Empowerment in Flight Safety Management

Organizing international exchanges on flight safety provides an excellent platform for nations to share management experience, discuss safety governance approaches and jointly build defensive safeguards for flight safety. Through this platform, the PLA Air Force puts forward five recommendations on improving flight safety management through

digital and intelligent empowerment:

First, we will improve the data collection system to consolidate the data foundation for safety management. Benchmarking against international aviation safety data construction standards, we will remove the barriers of multi-source data including airborne sensors, aircraft maintenance, flight training, meteorological conditions and personnel status, and establish an integrated data collection network. We will formulate information standards for flight parameters, fault records and hazard inspections, achieve real-time data aggregation covering all time periods, all elements and the whole process, tackle the problems of data fragmentation and inconsistent data calibers, offering accurate data support for risk assessment.

Second, we will deepen the data integration and application to enhance the flight crews safety literacy. Drawing on data platforms and application systems, we will review the full course of flight training in detail, quantitatively assess operational shortcomings and habit deviations, and create safety profiles for flight crews. We will forge deep links between training data and safety risks, deliver targeted special training on abnormal situation handling and emergency avoidance, and accurately evaluate training effectiveness using data analysis, to improve both safety capabilities and operational capabilities, strengthening the first line of defense for flight crews' safe operations.

Third, we will promote the application of digital and intelligent technologies to improve the intelligent management of flight safety. Keeping pace with the evolution of machine and deep learning the development of algorithms, we will use AI to conduct in-depth analysis of massive historical accident cases, and automatically extract accident patterns and common hazards. Guided by risk management, we will construct risk early-warning models covering equipment, human factors, meteorology and bird strikes, and develop multi-dimensional joint intelligent agents capable of automatic data processing, self-learning and hazard identification, to achieve intelligent control across all flight scenarios, all risk types and the full life-cycle.

Fourth, we will develop intelligent maintenance methods to strengthen the management and control of equipment safety. Drawing on existing predictive maintenance experience, we will conduct health monitoring based on equipment operating data and dynamically track the safety status of key systems and components, such as engines, power supplies and hydraulic systems. Using intelligent analysis models, we will achieve equipment fault prediction and targeted maintenance, build full life-cycle data archives for equipment, standardize maintenance workflows, curb human errors and fault hazards, to lift equipment maintenance efficiency through digital and intelligent empowerment.

Fifth, we will strengthen talent system support to build a

multidisciplinary professional workforce. We will select core specialists from flight, equipment, ATC and other fields, bring together professionals in data analysis, algorithm engineering and system operation and maintenance, and deliver regular training and exchanges on digital and intelligent technologies and safety fundamentals. We will foster multidisciplinary talents proficient in flight safety, data governance and intelligent application, break down the barriers between flight safety operations and digital and intelligent technologies, and form a well-structured, fully-skilled multidisciplinary team for flight safety management, to lay a solid talent foundation for technological work in flight safety.

Digital and intelligent empowerment is an indispensable path for flight safety in new era. Only by driving safety management upgrades through digital transformation can we continuously consolidate the foundation of flight safety and steadily improve the flight safety standards.

Thank you!