

INFORMATION TECHNOLOGIES FOR ENSURING OPTIMAL COMMUNICATION BETWEEN DISPATCH SERVICES DURING WINTER AERODROME OPERATIONS

Olimova G.O. , Jabborov R.B.

Tashkent State Transport University, Tashkent, Uzbekistan

olimovagozal528@gmail.com, jabborov_r@tstu.uz

Abstract

Winter aerodrome operations are characterized by rapidly changing weather and runway conditions. Snow, ice, freezing precipitation, low temperatures, strong winds, and reduced visibility create additional risks and require continuous coordination between air traffic services, aerodrome operations, meteorological services, and runway maintenance teams. Under these conditions, timely and reliable information exchange is essential for aviation safety and operational continuity.

This article examines the role of information technologies in improving communication between ATC services during winter aerodrome operations. Particular attention is given to integrated information systems, meteorological monitoring, digital runway condition reporting, geographic information systems, and mobile communication technologies.

Keywords: information technologies, aerodrome operations, winter operations, dispatch services, air traffic services, runway condition, GRF, RCR, information exchange, aviation safety.

Introduction

Safe and efficient aerodrome operation depends on the coordinated work of several technical and dispatch services. This coordination becomes especially important during winter, when snow, ice, frost, freezing rain, low temperatures, strong winds, and reduced visibility can rapidly change runway and taxiway conditions. Such changes can affect aircraft performance, braking capability, runway availability, ground vehicle operations, and airport capacity.

Winter operations therefore require continuous monitoring and rapid exchange of information. Air traffic services need current information about runway conditions,

meteorological services provide information about weather changes, while aerodrome inspection and maintenance teams assess and improve the condition of movement areas.

The International Civil Aviation Organization (ICAO) Global Reporting Format (GRF) provides a standardized approach for assessing and reporting runway surface conditions. The Runway Condition Report (RCR) is an important part of this process and provides operational information concerning runway condition to relevant aviation personnel.

Information technologies can improve this process by connecting different information sources into a common operational environment. Digital communication platforms, automated weather systems, runway monitoring technologies, geographic information systems, and mobile devices allow information to be collected and distributed more efficiently.

Winter Aerodrome Operations and Information Exchange

Winter aerodrome operations can be considered an information-intensive process because the condition of the movement area may change within a short period of time. During snowfall or freezing precipitation, information concerning runway and taxiway conditions must be regularly updated.

Meteorological services provide information about temperature, precipitation, wind, visibility, and weather forecasts. Runway inspection personnel assess contamination, snow, slush, ice, frost, and other surface conditions. Maintenance teams provide information about snow removal and anti-icing operations. Air traffic services provide information about aircraft movements and runway use.

These information flows are interconnected. A delay in one part of the communication chain can affect the entire operational process. For example, if a significant deterioration in runway condition is not transmitted in time, air traffic controllers may continue to use outdated information. Similarly, if maintenance teams do not have accurate information about aircraft movements, snow-removal activities may be organized inefficiently.

Figure 1. General information exchange between aerodrome dispatch services during winter operations.

The main information flow can be represented as:

Meteorological monitoring → Runway inspection → Runway Condition Report → Information processing → Air Traffic Services/ATIS → Flight crew.

At the same time, operational information moves in the opposite direction:

Aircraft movement information → Air Traffic Services → Aerodrome operations → Snow-removal and maintenance teams.

The integration of these two flows provides a more complete picture of the operational situation.

Information Technologies in Winter Aerodrome Operations

One of the most effective solutions is an integrated airport information system. Such a system combines information from different operational services and provides authorized personnel with access to common data. Information about runway conditions, weather, aircraft movements, maintenance activities, and operational restrictions can be displayed through a single interface.

The main advantage of an integrated system is the reduction of repeated manual information transmission. Different services can work with the same updated information, while changes in the operational situation can be recorded electronically. The system can also generate automatic notifications when important operational parameters change.

Automated meteorological observation systems are particularly useful during winter. They continuously measure parameters such as temperature, wind, visibility, and precipitation. When these systems are connected to an airport operational platform, meteorological information can be transmitted directly to dispatch services.

Runway condition monitoring is another important area. Digital inspection systems and sensors can provide information about pavement temperature, moisture, and surface conditions. Mobile devices can also be used by inspection personnel to enter observations directly into the central information system.

Geographic Information Systems (GIS) can further improve operational awareness. A GIS-based interface can display runways, taxiways, aprons, maintenance areas, and the location of snow-removal vehicles on a digital airport map. This allows dispatchers to understand not only the content of information but also its geographical location.

Global Reporting Format and Digital Runway Information

The ICAO Global Reporting Format is an important element in the standardization of runway condition information. It provides a common methodology for assessing and reporting runway surface conditions.

The Runway Condition Report contains information about the condition of each runway third. Depending on the situation, it includes the Runway Condition Code (RWYCC), contaminant coverage, contaminant depth, and standardized descriptions of the runway surface.

The use of standardized information is particularly important for digital systems. When operational information has a common structure and terminology, it can be entered into databases, transmitted electronically, displayed on digital interfaces, and processed by decision-support systems.

The general process can therefore be described as:

Runway assessment → RCR preparation → Information verification → Digital transmission → Distribution to operational users.

The use of standardized information reduces the possibility of different interpretations by different services. It also creates better conditions for the integration of airport information systems.

Optimization of Communication Between ATC Services

The efficiency of information exchange can be assessed according to several basic characteristics: timeliness, accuracy, completeness, accessibility, and reliability.

Timeliness is especially important because runway conditions can change rapidly. Information should therefore be updated as soon as a significant change is detected.

Accuracy depends on the quality of the initial observation. Digital technologies cannot replace correct inspection procedures and qualified personnel. The information entered into the system must be verified and reliable.

Predictive analysis can provide an additional level of support. By combining weather forecasts, current runway conditions, aircraft movements, and maintenance information, the system can help identify possible operational problems before they occur.

Benefits of Information Technologies

The integration of information technologies provides several important advantages for winter aerodrome operations.

First, it improves aviation safety by providing timely information about runway and weather conditions. Second, it reduces communication delays and the need for repeated telephone or radio messages. Third, it improves coordination between air traffic services and maintenance teams.

Digital systems also help optimize the use of snow-removal equipment and personnel. Dispatchers can monitor the progress of maintenance activities and determine which areas require additional treatment.

Another advantage is improved situational awareness. A common operational interface allows different services to see the same current information. This supports faster and more coordinated decision-making.

Finally, digital systems provide an electronic record of operational events. These data can be used for subsequent analysis, evaluation of winter operations, and staff training.

Practical Recommendations

For effective implementation of information technologies, airports should develop an integrated operational information platform connecting meteorological, runway condition, aircraft movement, and maintenance information.

Digital systems should support standardized RCR and GRF information. Mobile technologies should be provided to runway inspection and snow-removal personnel so that information can be transmitted directly from the movement area.

GIS-based interfaces can be used to provide dispatchers with a visual representation of the airport and current operational conditions. Automatic alerts should notify responsible personnel about significant changes in weather or runway conditions.

It is also important to maintain alternative communication methods in case of technical failures. Radio and telephone communication should remain available as backup channels.

Personnel training should be considered an essential part of technological implementation. Dispatchers and operational staff must understand both the capabilities and limitations of digital systems.

Conclusion

Winter aerodrome operations require continuous coordination between dispatch and operational services because weather conditions can rapidly affect runway availability and aircraft operations. Timely and accurate information exchange is therefore an important element of aviation safety.

Information technologies provide effective tools for improving this process. Integrated airport information systems, automated meteorological monitoring, digital runway condition reporting, GIS, and mobile communication technologies can create a common operational information environment.

The use of standardized GRF and RCR information provides an important foundation for digital integration. Standardized runway condition data can be processed, transmitted, and distributed more efficiently between aerodrome operators, air traffic services, aircraft operators, and flight crews.

The proposed information model combines data collection, verification, centralized processing, distribution, and decision support. Its implementation can reduce communication delays, improve situational awareness, optimize winter maintenance activities, and support operational decision-making.

Thus, information technologies should be considered not only as communication tools but also as an important component of modern aerodrome management. Their effective integration can contribute to safer, more coordinated, and more efficient winter aerodrome operations.

References

1. International Civil Aviation Organization. *Annex 14 — Aerodromes, Volume I: Aerodrome Design and Operations*. Montreal: ICAO.
2. International Civil Aviation Organization. *Annex 15 — Aeronautical Information Services*. Montreal: ICAO.

3. International Civil Aviation Organization. *Doc 9981 — Procedures for Air Navigation Services — Aerodromes (PANS-Aerodromes)*. Montreal: ICAO.
4. International Civil Aviation Organization. *Circular 355 — Assessment, Measurement and Reporting of Runway Surface Conditions*. Montreal: ICAO.
5. International Civil Aviation Organization. *Global Reporting Format (GRF): Runway Surface Conditions*. Montreal: ICAO.
6. International Civil Aviation Organization. *Annex 3 — Meteorological Service for International Air Navigation*. Montreal: ICAO.
7. European Union Aviation Safety Agency. *Easy Access Rules for Aerodromes — Regulation (EU) No 139/2014*. EASA.
8. Airports Council International. *ICAO Global Reporting Format (GRF) for Runway Surface Conditions for Airport Operators*. ACI/ICAO.