MONITORING SYSTEM OF ICING ON AIRFIELDS

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The main objective of this article is to discuss the need to install a monitoring system of icing on airfields. Article discusses about the connection of individual weather systems that are part of the airport. Importance of their connection lies in ensuring the safety and fluidity of planes movement on airfields. In the last section it suggests installing and implementing a system for monitoring the condition of the surface airfields on the fictional airport.
K e y w o r d s: Icing, winter maintenance, meteorological systems, data screening, systems' installation

INTRODUCTION

Icing is a meteorological phenomenon that significantly affects the safety and fluidity of movement of aircraft in the air but also in the airport movement area. Icing, as dangerous phenomenon for the first time in aviation came into wider public awareness of the world in 1928 when in the Arctic Ocean crashed due to overload icing airship "Italia", led by General Umberto Nobile. Since then, the ice became complication in aviation. Information about icing phenomena, mostly called in the term "icing", are contained in a number of reports for aviation purposes. Icing is studied in terms of its origin, the impact of the runway characteristics, and also in terms of its predictions.

2 ICING ON THE AIRPORTS

The least dangerous are dew or wetting, which basically do not show to the deterioration of the braking action and usually arise on the grass, but not on concrete or asphalt surfaces airport. Grassland provides more moisture than the concrete surface. Dew or hoar-frost are neither sufficiently abundant to form a thicker layer. Hoar-frost mostly melted under intense pressure wheel loader heavy aircraft.

To remove an ice coating on the runways and movement areas are used various technical equipment and the chemical materials. Airports mostly use snow ploughs, snow cutters and various chemical materials, which are applied on the airport movement area and thereby prevents their re-freezing.

Figure1Snow ploughs on RWY

For pilots is a very important indication of the breaking action, which in situations with a contaminated runway are attached to the report METAR as Appendix. This appendix is called SNOWTAM. SNOWTAM are actually reports closely related to NOTAM, but with the difference that affect information concerning snow and icing other phenomena at the airport. Their validation period is 24 hours. New SNOWTAM is issued whenever there are substantial changes in the occurrence of icing phenomena and climate braking action on the runway.

2.1 Measuring of braking action

Accurate and reliable data about the characteristics of anti-slip properties of the runway surface can be obtained using the facility for measuring of the coefficient of continual friction. Coefficient of friction on the runway has to be measured always, when the runway is covered wholly or partially with water, snow, or ice and measurement should be repeated for each significant change in braking conditions on the airport road.

Measuring of the coefficient of friction is the basis for determining the frictional conditions at the airport movement area. Coefficient of friction is the maximum value that should occur when the wheel of measuring facility brakes, but still rotates. Whereas the airports in the world are using different facilities to measure the coefficient of friction, uniformity, it is recommended to keep the slip of the testingwheel in the range of 10 to 20%.

MEASURED COEFFICIENT μ	PREDICTED BREAKING AFFECT	CODE
0,40 <	Very good	5
0,39 – 0,36	Good	4
0,35 – 0,30	Satisfactory	3
0,29 – 0,26	Sufficient	2
0,26 >	Not sufficient	1

Figure 2 Coding of friction coefficient

From Annex 14 results that the airport operator has obligation to sufficiently provide winter maintenance. Otherwise there may be a breach of aviation safety, the restriction or even suspension.

3 METEOROLOGICAL SYSTEMS ON THE AIRPORT

3.1 Automated weather observation system

Airport operation in bad weather is a major concern as for pilots, as well as for airport staff and flight dispatching. It have to work in perfect cooperation. Airport as a whole is volume large and it is therefore not possible to make the information between the aircraft and the airport provide a system that monitors meteorological situation at the airport and its surroundings. At the same time these systems tell you what climate change is possible in the near future. The airport dispatching can be prepared for emergency and provide ideal conditions for aircraft movements on the operational areas.

3.2 Aviation weather decision support system

In order to provide air traffic controllers and aeronautical meteorologists with accurate operational information AWDSS processes the data and information from various sources: local systems AWOS ARWIS and LLWAS, meteorological radar, surface observations from networks WMO / ICAO meteorological satellites, etc.

3.3 Runway visual range system (RVR)

RVR system performs automatic assessments of the status of visibility on the runway, and their report the competent airports. Provide flight dispatchers and other airport staff to prepare for the upcoming state when visibility take-off on the runway and its surroundings reaches low values.

3.4 Aeronautical Climatological Database

Climatological database (CLDB) is a database system designed to address the needs of meteorological institutes to store a large volume of long-term meteorological, climatological and environmental data.

CLDB stores all collected information in a single structure, thus avoiding data inconsistencies and shortcomings. It provides convenient access to data for all users and other software systems. There is no need for data storage and any other misleading data formats.

4 AIRPORT RUNWAY WEATHER INFORMATION SYSTEM (ARWIS)

To remove the icing can be use a variety of materials, either technical or chemical. The best way how to quickly detect frozen coating on the surfaces is the installation of the weather information system on surfaces.

4.1 Functions of the system

System ARWIS provides airport authorities essential information about the quality of airfields. It checks and predicts the status and condition of airfield (ice, freezing rain, snow accumulation and melting) by implementing of collection of current measurements with data from sensors and forecasts from model of integrated system. Measurements and Forecasts based on early warnings contribute to the safety of flight operations and assist in the planning of maintenance activities on the airfield.

4.2 Data sensors

ARWIS can interconnect many types of sensors and control panels. Active / passive interference runway surface and subsurface sensors or optical intrusive sensors provide runway surface or subsurface temperature, freezing points, a layer of water film and runway conditions (dry, wet, wet, remaining salt, freezing rain, ice, icing, etc.).

Passive sensor:

Passive runway sensor is embedded in the surface. The two parts of the cover are based on a combination of sensor / electronics unit. Recorded the following variables: road surface temperature, water film, road conditions (dry / damp / wet / ice or snow / residual salt / freezing rain).

Figure 2 Passive sensor

In combination with the connections converter, the sensor can be integrated into new and

existing UMB networks. Sensor is addressable and can therefore be used in the network.

Active sensor:

Active sensor is also embedded in the surface and determines the temperature of freezing through the sensor of active cooling and heating of surface. Measured freezing temperature is independent of the concentration of road salt. Sensor consists of two parts allows to change / rotate the combined sensors / electronic units for the type of maintenance at any point of time in a few minutes. The sensor can be integrated into new and existing UMB-network using the converter.

Figure 3 Active sensor

5 INSTALLATION OF SYSTEM ARWIS

Installation of system "ARWIS" on the runway requires some calculations and measurements to ensure that the components of this system were built properly in the right place. The main determining factor is of course the length of the take-off runway. From this fact depends where and how many sensors need to be installed.

The exact location of the sensors at the beginning of the runway is 300 meters from the runway threshold. It is the same in case of the sensor at end of the runway. The third set of sensors is planted in the position of runway center of gravity, which is actually the exact middle of the take-off runway.

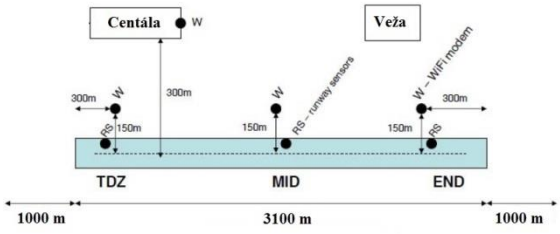

Figure 4 Model of installation of system ARWIS on the RWY

Link contact between the sensors and devices for receiving information and data from these sensors is based on the wireless links. These wireless transmitters are located 150 meters from the runway. Wireless connection, the information displayed in the center of monitoring condition of the runway. There all the values and data system assumes "AWOS", which part is a system "ARWIS". After the evaluation of data and information that appears in messages that determine runway surface conditions and is required immediate maintenance of runway.

5.1 Implementation of systems installation

For installation of these systems are being used construction companies focusing on building construction (roads, highways, airport movement areas, etc.). It is necessary to establish a precise plan, which development is in responsibility of Civil Engineers.

This plan must include precise procedures, calculations and measurements, where and how to perform a system installation.

5.2 Data monitoring

Display monitors in the center of processing meteorological data receive all the latest information obtained from sensors embedded on airfields. Thanks to the information that is collected through the system "ARWIS" know predetermine the situation on the surface of airfields. The system works in such a way that the data can be displayed not only on one but on several paths at once. Basic data that appear are: runway surface temperature, freezing point, water column, surface condition.

CONCLUSION

The aim of this article was to present the weather systems at airports, through which workers can detect or predict airporticing phenomena at airports. Highlight the cooperation of individual systems, which are designed to monitor individual meteorological and climatological phenomena in the vicinity of airfields and near the airport.

Important article was to show the exact characteristics and functioning of these products that are an important part of planning of airport operations.

The work draws the reader into a situation when the airport is ran by adverse climatological or meteorological conditions. This highlights the importance of these weather systems, their functionality and results. The linking of systems provide almost one hundred percent safe operation of the airfields.

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