

ASPECTS AFFECTING WINTER MAINTENANCE OF AIRPORTS

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Continuous airport serviceability is an important factor in aviation safety, especially in winter. In addition to weather conditions and density of air traffic at the airport, winter maintenance of airports is also influenced by the organization management, staffing and technical aspects. Most of these aspects are influenced by the aerodrome operator. The article is a brief description of preparation of airport winter maintenance and technical support.

Key words: winter maintenance of airports, technical equipment, sweepers,

1 INTRODUCTION

The primary task of the airport operator is to ensure maximum safety and continuity of air traffic at the airport. For take-off, landing and movement of air equipment on the airport, serviceability of airport movement areas (hereafter AMA) is important. However, alongside the increasing need to improve individual operations and work efficiency, we also need focus on serviceability of airports maintenance of equipment and efficiency of its use. With the development of air transport are placed ever increasing requirements rapid restoration of AMA operational capability. The Slovak Republic is located in the mild climate zone. In terms of air traffic, demands are placed on its maintenance in the winter. Therefore, organizational unit, ensuring the maintenance of AMA are to be equipped with such machinery, which are capable to keep all paved surfaces in operational status in bad weather [1].

2 WINTER PERIOD INFLUENCING AIR TRAFFIC

Snow, frost cover, glare ice, water and melting snow on runway (Runway - RWY) affect take-off and landing of aircrafts as well as equipment involved in maintenance of the movement areas. The responsibility of the airport operator is to maintain a clean surface of RWY and other airport movement areas as stated in the Chicago Convention Annex 14 – Airports document. Ice phenomena on the movement areas

result in the reduction or cessation of operation of the airport [2].

Every airport has to cope with two problems:

- Provide effective winter maintenance, by proper preparation and their proper deployment,
- Ensure the regularity of the equipment and resources of air traffic in the winter regardless of weather conditions. Ice is generated in the form of Runway mostly at fluctuations of the temperatures around 0° C, settling fog, drizzle, rain or wet snow falling, which often freeze on the surface of airport runways and paved during night. Imperfectly cleaned surface of the runway from snow, made by equipment and means of land protection even harder. Then this layer is melting and freezing when its result in an icy surface, which has reduced braking action.

The layer of snow on the road surface gives:

1. Resistance exerted on the wheels when starting- the magnitude of depends on the size of the specific weight and thickness of snow, characteristics of aircraft undercarriage and its tires, weight and speed of aircraft movement.
2. Worsening of aerodynamic characteristics of aircraft during take off run as a result of pollution of bearing surfaces and fuselage cussed by snow thrown from the front wheel.
3. Reduction in the braking action of the RWY surface creates a risk of extension of landing run of an aircraft.
4. Deterioration of aircraft control and stability at take off or roll. Operation in winter is difficult not only for the workforce but also places increased demands on equipment.

The equipment is influenced by:

1. Low air temperature - causing an increase of oil viscosity, a decreased battery capacity, which has an impact on the engine starting speed and hence the run of the engine.
2. Humidity, aggressive environment using chemical de-icing materials - as a consequence some parts of the corrode equipment. This can be avoided only by good surface protection technology.
3. Icy surface of the AMA - equipment is harder to control skids and the tires slips are fragment.

2.1 Check

For airport operators - airport companies are responsible for checking AMA airport control staff. They are responsible for carrying out checks on the airport's area, the correct evaluation of conditions on airports area, issuing NOTAM (Notice to Airman) SNOWTAM (Notice to Airman Snow) in accordance with applicable standards and for the preparation and submission of information of long-term nature, related to the selected airport administrative data.

Regular monitoring of movement areas and equipment, at least two times per 24 hours and at least 30 minutes before the first flight on a given day, and depending on the density of traffic, usually 12 hours after the first inspection [1].

Irregular checks which are related to removal of deficiencies on the AMA and the changing states of movement areas or inspection on request (personnel management of air traffic - ATM, captain of the aircraft). Extraordinary inspection is performed only in case of important national flights. Carrying out controls of state and surface of movement areas and operational state of visual aids and equipment is the responsible employee of airport dispatching staff on duty.

2.2 RWY system monitoring

According to the requirements of Annex 14, RWY must be surface of kept clean to guarantee a good braking action. At many international airports monitoring is made by a system of runway status indication of RWY in

winter. The system must be able not only to indicate the presence of ice on the surface of RWY, but especially to predict the conditions of icing. Modern systems use as input data inputs from sensors of automatic stations, which monitor air temperature and dew point temperature, cloud amount and height, wind speed, rainfall, temperature of road surface, temperature at a depth of road and residues of de-icing agents on the surface of RWY. The system is able to predict the state of the road for 24 hours. Forecast can be manually entered into the system to get alternative predict.

Based on the forecasts, one can:

- Whether the air temperature falls below 0° C,
- When the ground temperature falls below 0° C,
- Whether when temperature drops below 0° C road surface will be wet,
- How long the road surface temperature stays below 0° C,
- Whether de-icing substances residues from past applications prevent the creation of surface ice.

For each road there are critical "cold" places which get frozen rather than the remainder of the road surface. By termovisual scanning of the road surface monitoring system can be simplified, improved its reliability and reduce costs for its setup [2].

3 PLANNING AND ORGANIZATION OF AIRPORTS WINTER MAINTENANCE

Winter maintenance of airports (further only WMA) includes a series of measures to maintain

a permanent operational capability of airfields in winter. It must be planed, organized and carried out in order to maintain the operating capacity of AMA under all weather conditions.

To achieve continuous operational airport's area one should ensure:

- Timely and perfect preparation of airfields for the operation in the winter,
- Quality preparation techniques equipment and tools for the WMA,
- Timely and complete material supply,
- High-quality training of personnel staff,

- Draw up a plan of winter maintenance of the airport.

Maintenance of airports in the winter is greatly influenced by the job done during the previous (preparation) period [3].

3.1 Preparation of airfields for WMA

Prerequisite of quality preparation of AMA for winter operations is in detect the condition. Because of this two times a year (before and after WMA) inventory of defects of airport areas and their drainage is made. After evaluating the inventory (quantification, qualification and classification of defects) and refinements of the airport company's financial options with regard to the safety of air traffic it comes proceeded to repairs. These repairs will be carried out by suppliers under the supervision of the head of maintenance of areas. Great attention is paid to fillers of joints in cement-concrete surfaces and cracks in bituminous areas where water in crack followed by freeze caused extensive damage to the surface. Also great emphasis is placed on good drainage of AMA. Easy drainage of water reduces the risk of creating icy phenomena on airport's area [3].

3.2 Preparation of persons for WMA

Winter maintenance of the airport involves dozens of staff from various departments of the airport, whose activities must be coordinated. Steering committee, which is coordinating the various activities of the winter maintenance, is made up mainly of airport operators, air meteorological services, ATM staff and of airlines representatives.

Training of staff to ensure perform WMA on areas shall include in particularly:

- Radiotelephone procedures -> Radio communication – correspondence,
- Technological processes of removing snow and ice -> procedures differ for different types of snow and runway in use,
- Using equipment -> Each worker has to have a thorough knowledge of assigned technical resources in all weather conditions,

- Airport -> staff must by perfectly knowledge about of the principles of the movement on AMA [3].

Actual operation of the shift is governed by the "Masters of WMA, who are responsible for the timely and quality preparation of airport's area to operation and safety of various activities related areas of maintenance.

3.3 Preparation techniques for WMA

Winter term adverse by affects to the operation of land-based support equipment. Preparation is carried out in the months of September-October of that year under guidance of the Head (Director) of maintenance. To the airport facilities of mechanization means one to meet the economic criteria, and so the scope of airport security is tailored to the prevailing meteorological conditions and air traffic density therefore not sufficient to cope with calamity situations. In case of extreme conditions, is air traffic at the airport is cancelled.

The number, nature and type of resources to WMA depend on the size of airport's area, type of airport and its importance. To insure winter maintenance of an international airport with 24 hour operation is necessary to have at ones disposal the minimum resources listed in Table. 1. [2]

Table 1 The optimal numbers of resources for WMA at an airport with one RWY

Airport sweeper	2 - 3 pieces
Tractor with sweeper snow plough	2 – 3
Vacuum sweeper	1 – 2
Versatile road shooter	1
Applicator of liquid de-icing materials	1 – 2
snow blowers	2 - 3
Heavy all-terrain vehicle (Dump) with plough	1 - 2
Sweepers tractor (tractor) with a plough	2 - 3
measurer of braking effects on RWY	1 – 2

terrain car	1
de-icing equipment	1
fertilizer	1 - 2

Technical support must create such conditions and assumptions that technology was earmarked primarily kept and repaired. Resources used for maintenance of the airport are mostly special structure. Technical Status and operational capacity is essential to timely and effective deployment to the service. This requires much attention even by daily maintenance and treatment immediately after the application.

4 WMA EQUIPMENT

Sweepers are the basic kind of techniques intended to maintenance - cleaning paved airfields. In conjunction with the snow plows, they are effective devices for removal of snow and pieces of ice from airfield surfaces.

The following types of sweepers are currently in use on the Slovak airports:

1. Airport sweepers. Special Aerodrome runs sweepers designed to make rapid and effective cleaning of the AMA. Usually used in sets of 2 or 3 inline when they are able to purify 10-meter strip of land in one stream. In addition to the active brush sweepers, they are equipped with an effective blower to fan-cooler AMA without using brushes.
2. Vacuum sweepers. In most cases, they are used to sweeping, cleaning (high pressure water washing) and removing (vacuum) dirt from the AMA.
3. Tractor sweepers are used mainly for cleaning (sweeping) areas near buildings, check-in areas (aircraft, aircraft stands) and service roads.

De-icing equipment is designed for cleaning paved airfields from dirt, snow, ice and its residues. It works on the principle of operating the pressure of hot exhaust air from a jet engine. To increase the quantity of gas, the engine is equipped with generators, which also reduces the temperature of the gas and thus prevents damage to purified surface.

Measuring equipment (Friction Meter) is designed to measure the friction coefficient of paved surfaces in difficult weather conditions (during rain, snow and ice) and rubber. According to the protocol on the outcome of measurement the current braking effect of the measured surface (ground) is evaluated.

Snow plows are used to move snow from the road surface and AMA, sloppy snow removal after the use of chemicals and also removal of the fresh snow.

Snow blowers are devices for the removal of snowdrift and trough created by another technique (such as snow plows) either open air outside of purified surface or to the transportation means which move snow to landfill.

Multipurpose road shooter (or fertilizers) is designed to smooth and controllable spreading chemical de-icing material (powder or granular), resulting in the thawing ice on airport's area.

Particular groups of airport maintenance equipment are tractors. Since the Slovak airports are operated by different brands and types of tractors, they are characteristics more on their performance.

The first performance order is about tractors from 50 to 60 kW (68 to 82 HP). Classic representatives of this group are Zetor Proxima, Klas Axios or John Deer 5020. Thanks to they economy of operation and agility, they are mainly used at airports to check maintenance areas, aircraft, aircraft stands and targeted communications.

The second performance family is about tractors from 80 to 120 kW (109 to 163 HP). Representatives of this group are Klas Axios and John Deer 6030. Due to its performance in the winter, they are used at the airports tractors of airport sweepers and various equipments. Compared to tractor unit used in the past - heavy goods vehicles (TATRA 815) they are particularly dexterous and efficient.

5 CONCLUSION

Planning, organization, management and actual implementation of the winter maintenance of airports is an important task of the airport operator in winter. Using an airport due to the

default WMA has resulted both in a financial loss of the airport, but also a loss of confidence in the individual air carriers providing scheduled air service. The more aircraft move at the airport, the more attention is paid to its maintenance. For example, at the international Prague - Ruzyn airport are earmarked for the needs of WMA 18 employees in one shift.

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