

THE METEOROLOGICAL FACTORS IN THE MANAGEMENT OF AERODROM MAINTENANCE IN SUMMER SEASON

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This work deals with the meteorological factors that affect summer maintenance at the airport. The main objective is to point out what impact the weather actually has on the whole airport traffic in the summer, which accedes into decision-making about individual steps at the airport, and what resources are needed for the implementation of tasks and reparations of the manoeuvring surfaces. The actual output is the deciding algorithm about the individual tasks performed at the airport during the summer.

K e y w o r d s: Meteorological factors, summer maintenance, algorithm

1 INTRODUCTION

The airport has to be prepared for summer as well as winter maintenance. This thesis will try to analyze the meteorological factors that affect an entire airport traffic and summer maintenance procedures at the airport. The aim of this thesis is to create an algorithm deciding on maintenance during the summer months at the airport and deduce who enters the decision to carry out the necessary work.

2 METEOROLOGICAL AND CLIMATE FACTORS

2.1 Air Temperature

Air temperature indicates the thermal state of the atmosphere, it is essential meteorological element. The Ground temperature is measured in the meteorological booth at a height of two meters above the ground. The measured values are recorded in Celsius degrees,...¹ The highest value of air temperature is recorded around two o'clock in the afternoon and minimum air temperatures are measured one hour before sunrise.² Mainly daily air temperature is monitored (followed are average hourly values of the selected day, month, or year) as well as yearly course.

- *daily air temperature* - corresponds with the operation of an active surface temperature, but with a certain time delay. The amplitude of the temperature is the difference of maximum and minimum temperature measured during the monitoring period. Temperature amplitude with increasing altitude decreases and defers.¹
- *The Annual course of air temperature* - depends on an active surface and an exchange of the air masses. Basic types of annual climates: equatorial, tropical type, temperate/mesothermal climate zone, polar zone and non-periodic changes..¹

2.2 Air pressure

It is indicated in Pascals, usually in the hundreds of them, called hectopascals (hPa). Air pressure can

change several times a day by a notable percentage. More sensitive people can feel an intimidate change in their health state.¹

2.3 Wind

Wind can be defined as the horizontal component of motion in the atmosphere. It is the movement of air masses due to the uneven distribution of pressure and temperature on the Earth's surface. Wind is described as a dangerous phenomenon, because in some cases, it may affect the operation, but also the security of the air traffic. According to the wind direction, the appropriate aircraft runway is chosen, so the take-off and landing can be carried out against the wind. During airplane's take-off, the crosswind influence creates the additional aerodynamic forces that decelerate control of the aircraft due to rotational and tipping moment of the forces. The Direction and wind speed have a significant impact on the take-off, landing and the smooth flight of the aircraft. Wind can be defined as the horizontal flow of air in the atmosphere. The direction of the wind refers to the direction from which the wind blows. It is identified by either the cardinal directions or by using azimuth direction of the air, which means using the angle that contains geographical North and the direction from which the wind blows. Wind speed actually determines the track which the volume of air overcomes per time unit. It is indicated by m / s, km / h or knots.⁴

2.4 Cloudiness

Cloudiness reflects the level of coverage of the sky with clouds, and characterizing not only the overall character of the weather, but also indirectly indicates the duration of sunshine. Cloudiness has also a great importance for the heat balance of the Earth's surface.⁵

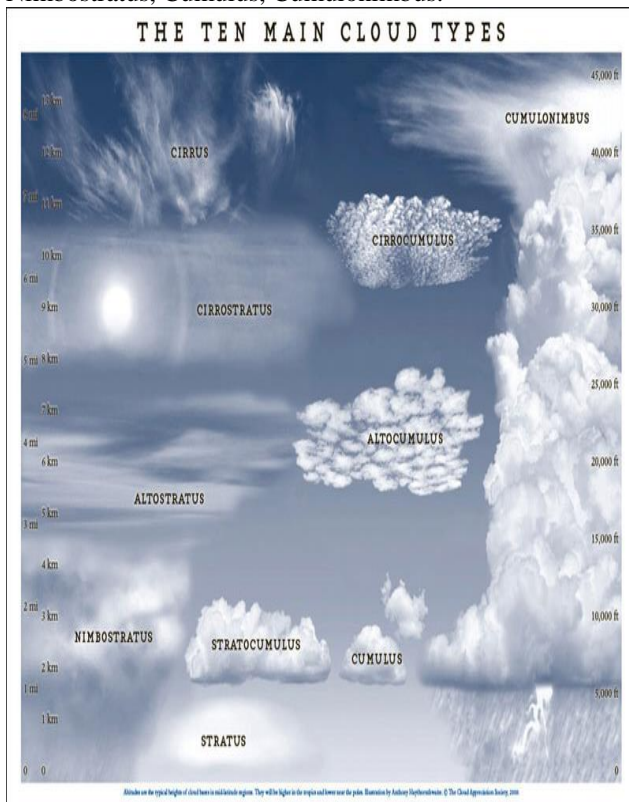
When observing cloudiness, these particular points are monitored:

- the amount of clouds that are estimated during climatological observations in tenths cloud's coverage in the sky (in whole numbers from 0 to 10), in synoptic meteorology is estimated at eighths of cloud coverage. (0-8).

- cloud density is estimated in degrees from 0 to 2 (written in the form of an exponent).
- direction of the cloud movement is determined by the world cardinal points, commonly denoted by their English initials, and the like the wind from where the clouds come
- velocity of the clouds is determined as the apparent \square angular speed and can be expressed as follows:
 - 0 motionless clouds
 - 1 slight movement
 - 2 quick pohyb⁶

The term cloud is the atmospheric phenomenon, which was formatted as the accumulation of water droplets, ice crystals, alternatively as their mixture in the air.⁴

Clouds division: Cirrus, Cirrocumulus, Cirrostratus, Altostratus, Stratocumulus, Stratus, Nimbostratus, Cumulus, Cumulonimbus.



2.5 Thunderstorms

Thunderstorm is a phenomenon where is possible to notice not only strong, intense and short rainfalls, but also the electrical discharges in the atmosphere known as the lightning accompanied by sound effects - thunders, called storm. The lighting is from the physical point of view a spark discharge. The lightening balances different electrical potentials between the clouds or between a cloud and ground. Thunderstorms are most common in tropical summer days, but it is common to see them even in spring and autumn. They are rarely noticeable at night.

Thunderstorms are characterized by a sudden oncoming, which can completely change the weather within a few minutes.³

We recognize the heat storm, showers, storm of cold front, warm front storm.³

2.6 Precipitation

The term precipitation includes rain, snow and hail. Small droplets in clouds merge together and when the sufficiently big droplets are created, they leave a cloud by raining or snowing. The temperature in some clouds may be much lower than 0 °C, thus some drops become ice crystals, but not all of them. Some drops are freezing at -38 °C. Rain droplets have a diameter ten times greater than the drizzle drops. The most powerful drops tumble nearly a meter per second, and might evaporate after 4 kilometres of downfall. It is very common that the snow before hitting the ground melts down, therefore instead of snowing, it's raining. Large chunks of ice – hail- may reach the size of small eggs when very strong storms appear, and that damages crops, roofs as well as the bonnets of cars. An average hail evidence in Central Europe is 5.2 days a year.³

Division of Precipitation:

- vertical precipitation - forming in the atmosphere, falling on the active surface due to the gravity. These include: rain, snow, hail and other.
- horizontal precipitation - including, for example, fog/mist rainfalls, grained frost, dew precipitation, rime, gray frost, hoarfrost⁶

2.7 Sunlight /Solar radiation

About 70% of the solar radiation reaching the Earth enters through the atmosphere. The remaining 30% will absorb and disperse the molecules of air. The entire electromagnetic spectrum of sunlight consists of a set of waves continuously changing frequencies. Human eye perceives this wavelength region as the spectrum of colours from purple through blue, green, yellow, orange to red.

Visible light induces a visual perception that is an absolutely necessary source to obtain visual information about the outside world. Longer wavelengths belong to infrared radiation and shorter wavelengths of radiation are ultraviolet.³ Solar radiation that reaches the Earth's surface is composed of approximately 5% of ultraviolet radiation, 50% of visible radiation and 45% of infrared radiation.⁸

3 AIRPORT MAINTENANCE DURING SUMMERTIME

The Airport maintenance is a summary of the steps for the treatment of the airfields and facilities, checking the status

of the airport and the implementation of arrangements to ensure the security and most economical operation of the airport. They are divided into:

- winter maintenance
- summer maintenance⁷

This chapter will describe summer maintenance of the airport in detail. It will discuss paved and unpaved airfields, their maintenance, inspection, current status, and what cleaning procedures are used to ensure the general maintenance.⁷

Technical security and maintenance of the airport includes:

Maintenance of grass airfields - it consists of from collecting grass mass, an adjustment of the grassland, seeding and the maintenance of grassland.

Maintenance of paved airfields - sweeping, cleaning, air cooling.

Maintenance marking airports - remove old marking, repair and renovation of already existing signs, an implementation of the new marking.

Maintenance of drainage systems of the airport - cleaning of drainage and manholes, maintenance and repair of shallow drainage channels and grates, maintenance of drainage system outlet.⁷

The maintenance of the airport in summer contains the maintenance of paved and unpaved surfaces, which has adjunct staff as well as technical support for that. Since there are different surfaces, thus activity and technical supplies for their maintenance will be different. While talking about paved surfaces, the activity is limited for cleaning surfaces and their day to day control, while grassland surfaces need a complete maintenance.⁷

3.1 Maintaining process and control of airports runaways

In maintenance of the paved airport surfaces a very important role plays a control of the conditions and status. According to these results of control, the methods and the maintaining process will be decided. Stable and high cleanliness of paved airfields is achieved by continuous and planned maintenance and cleaning.⁷

Sweeping purge

When implementing sweeping, tractor and airport sweepers are used. Their method of deployment is dependent on the number of resources that are available and the maximum possible time for continuous maintenance of the surface without endangering the safety of air traffic at the airport.⁷

Blowing purge

Cleaning of paved airfields by blowing is carried out mainly by using airport sweepers without using the brush. If dirt on the airport manoeuvring area is not firmly connected to the surface and there is no need be separated from the surface by mechanical means, usually only blower of the sweeper is used.⁷

Vacuum cleaning

This method is mainly employed to clean surfaces at the airport apron near the industrial buildings, after the storm silt, to clean surfaces after repairs, and the contact surfaces of LPP and service roads used as the prevention from dirt from roads at the airport operational areas.⁷

Control of airport traffic areas

For checking the LPP is responsible the staff of the airport control centre. Except other duties, the airport dispatcher is:

- Responsible for proper evaluation of the LPP conditions
- Responsible for carrying out the LPP inspections and if needed, very closely cooperate with the staff from the department of maintenance of runaways.
- He is also responsible for preparing and transmitting the information of prolonged nature to the head of airport dispatching department, concerning the selected administrative data, operating times and airport facilities for passengers.⁷

For carrying out the state and surface of manoeuvring areas and operability of visual aids and facilities is responsible on-duty airport worker from dispatching department.⁷

3.2 Maintaining process of grass airfields

Maintaining of grass airfields comprises of: maintaining grass airfields, repairing damaged lawns, inventory defects.

Grassy areas on the Slovak airports occupies a wide area and require very high quality maintenance to ensure desirable characteristics, therefore they belong to the most challenging element of greenery, in terms of technical performance as well as of funding.⁷

Maintaining viable unpaved runway and taxiway surfaces is done during the growing season from spring to autumn. The mowing of grassy area is done by rotating mowing-machine with subsequent collection of grass, hay or

mulch. Small terrain disparity is offset by additional soil, and if needed sowing grass as well and rolling terrain to ensure the required gradients of grass strips and also the required carrying capacity. The surface area must be sufficiently compact to avoid ruts or other interference of the surface by the moving aircraft and other mobile means. Belts carrying capacity must be able to withstand an aircraft without damaging the structure of the aircraft when it leans out from the runway, taxiway respectively.⁷

Maintenance of the land - to determine the type and dosage of fertilizer are typically used soil analysis results. For maintenance of the soil are used compound fertilizers. Fertilizer should be applied to surfaces regularly while the lawn should be dry, cut, and felt relieved. After fertilizing the lawn s watered.

Aeration – By aeration of grass airfields, older grass is removed. It is usually done in the spring and autumn months. Grass, which was released during aeration, is dumped from the airfields. Aerators are devices that are used for piercing the lawn with an intention to improve the physical properties.

Irrigation - Grass airfields are irrigated with water which is carried out depending on the humidity of the soil (optimum moisture content is 70 to 90%) following the seeding, after fertilization, or to reduce dust in areas used for air operations. Most appropriate time for watering is early morning.

Adjusting the height of grass – It is provided by mowing or mulching. Adjusting the height of grass strips on the runway and taxiway is done regularly throughout the year to enable a control of the surface of these areas. Adjusting the height of the other grassy areas are done 2x a year, when the grass reaches a height of 50-60 cm, usually at the end of May and August.⁷

3.3 Economic indicators of technical maintenance

To choose the maintenance concept is mainly influenced by economic indicators. In its assessment is taken into account: labour intensity corrections, the amperage defects, the size of maintenance costs, the storage costs of spare parts and their prices. In terms of the organization of the maintenance work at the airports, they need to stay informed about the current state of their technical devices, as well as how various means are deployed in service, planned repairs and when is the time for its disposal and variation. The heads of the stations possess a serving plan for the operation of vehicles, which monitors and evaluates the estimated annual progress of technology and its anticipated maintenance of the technical and financial aspect.⁷

4 ALGORITHM OF SUMMER MAINTENANCE AT THE AIRPORT

4.1 Deciding algorithm

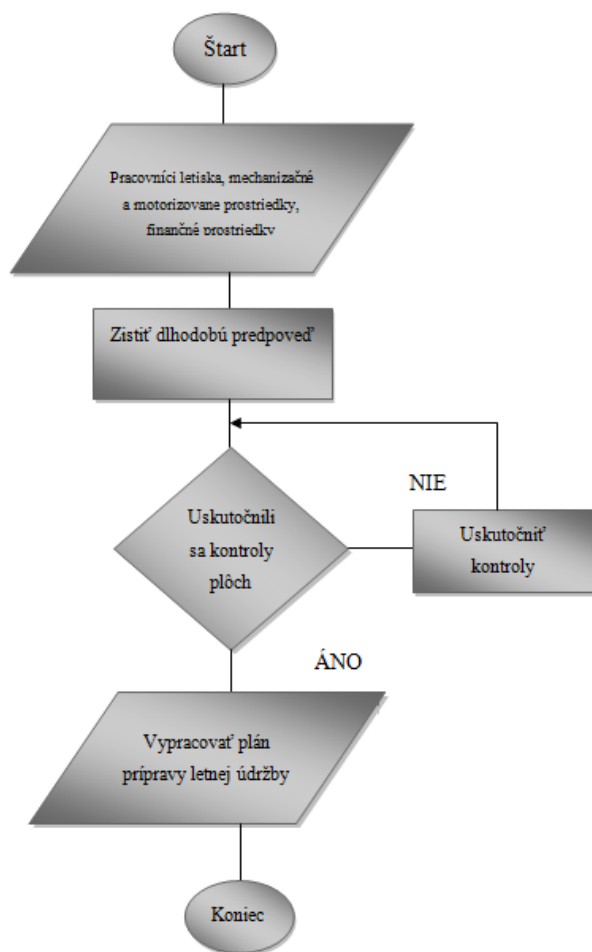
Finally, we designed a deciding algorithm of the summer maintenance at the airport. The algorithm was divided into four parts namely: goal setting, planning, organizing and control. Into the decision-making about the summer maintenance enters a director of the technical department, airport operations staff, mechanized and motorized means, weather, funds. Firstly, a long-term forecast has to be recognized and whether scheduled work can take place. It is also necessary to check the surface after the wintertime, and what needs to be repaired. The plan for preparing summer maintenance is drawn up, the number of resources that will be needed to repair areas and in what conditions they are currently in.

Means of mechanization are ready, the number of staff to carry out the repairs needs to be figured, as well as found out whether they are already trained. If not, they will be trained and work can begin. Must wait for a favorable weather in which work can be started during the summer. Workers are trained, means of mechanization are ready, therefore work can be shared between service workers. The drainage system conditions are being determined as well as the control of oil traps and drainage ditches, because it may result in a full-life gutter, or some shafts would not be able to completely close.

Furthermore, undergoing repairs of the cracks on the runway. It may appear a lifting of the concrete or transverse and longitudinal cracks on the road. Some cracks may reappear or appear new cracks on the track that extend up to several meters. An important part of the summer maintenance is the implementation of new signs.

Firstly, the weather needs to be checked, because if the road was wet or just slightly damp, poor visibility, the implementation of a new marking is not possible and must wait for better weather and dry runaway road. Old marking is redeemed. If the weather prevents to perform some work such as watering cracks on the runway, it is possible to hide part of the runway that needs to be repaired, dried and cracks can be watered.

Finally, the control of the work performed, the conditions of roads after repair work has to be checked and whether the planned work and the quality of repairs had been done on time. At the end, the actual work carried out in spring and summer will be described and the budget that was reserved for these works. If funding has not been enough, some work has to be moved to the following year.



Algoritmus 1. Ukážka prvej časti algoritmu

5 CONCLUSION

In my thesis, I was dealing with the summer maintenance at the airport and meteorological factors that disrupt the operation of the airport. I created an algorithm deciding on summer maintenance at the airport that consists of training the necessary staff, mechanization and a favorable weather as well as long-term forecast, which determines whether it is possible to carry out the work. If meteorological factors such as storms, precipitation, visibility disrupt the operation at the airport, other steps has to be ensured, so that all corrections are made in he deadline.

It is necessary to create a plan for the summer, and what areas need to be repaired and by what kind of technology. One of the most important steps is the removal of old signs and implementation of new marking. Finally, check all of the work performed and whether the funds were sufficient to carry out all these changes.

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