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Snow Removal

Like disaster plans, snow/ice removal programs may atrophy unless used or reviewed on a periodic basis. The author offers a refresher on the basic tenets of good winter awareness for airport personnel.

By

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Snow Removal Plan

As the old saying goes, "Prior Planning Prevents Poor Performance."

A snow removal plan is essential in attaining and maintaining an acceptable level of runway friction. In conjunction with a snow removal plan, many airports have formed "snow committees" that normally operate under the direction of the airport manager. The size of these committees may vary to reflect the size and traffic of the respective airport, but it is essential that maximum utilization be made of various airline flight operations departments, fixed base operators and other technical organizations such as the National Weather Service and U.S. FAA flight service stations.

These committees are of great value in coordinating daily and long-term priorities concerning snow removal activities. In the spirit of "prior planning," the snow committee should meet before the arrival of winter to critique the effectiveness of the previous winter's snow plan and coordinate needed changes for the future.

Since there is a great deal of variance among airports, a standard snow removal plan is difficult to develop and, in some cases, of marginal value. If a plan is to be developed, the best method is to assign the task to a person or persons who are knowledgeable about the physical aspects of the airport, the surrounding area and the type of equipment that will be used.

One basic source many airport operators in the U.S. have found useful in developing snow and ice control procedures is the U.S. Federal Aviation Administration Advisory Circular 150/5200-13. In Appendix I of this document, a sample snow removal plan is provided. It briefly discusses a number of areas, including:

- Responsibilities and Supervision.
- Snow Removal Vehicles.
- Snow Removal Operations.
- Ice Control Procedures.
- Runways, Taxiways, Ramps and Access Roads.
- Access Roads and Auto Parking Areas.
- Slush Control Program.
- Cleanup Operations.

More in-depth information on each of these topics may be obtained from the publications of the annual International Aviation Snow Symposium sponsored by the Northeast Chapter of the American Association of Airport Executives. The

symposium is held each year in April at Allentown, Pa., and its publications address problem areas and new concepts in a timely manner.

Determining The Need For Snow Removal

Since world weather patterns have been changing, one key question that is being asked more often is, "At what snow accumulation level is it worthwhile to establish snow removal operations at the airport?" According to the FAA advisory circular, a number of factors must be considered in making this determination, including the incidence of snow, amount of snow, density of snow and the volume and type of air traffic.

Weather data available in the U.S. from the National Oceanic and Atmospheric Administration (NOAA) and in other countries from their respective weather services indicate that airports having a mean annual snowfall of 15 inches or less usually receive two inches or less of snow per storm. The data also indicate that locations that accumulate more than 15 inches per year have storms with an average snowfall of between two and six inches.

Ice normally is formed as a result of alternate freezing and melting of snow during the coldest months of the year. When the snowfall is not sufficient to require removal and the temperature varies above and below the freezing level, the potential for ice formation is at its greatest. These slight variances in temperature above and below the freezing point can result in the formation of icing conditions with little or no warning.

Ice also develops when compacted snow is not removed, and the freezing and melting cycle permits water to seep through the porous surface. The primary cause of snow/ice packing and the formation of ice ridges on runways, taxiways and ramp areas is the failure to begin snow removal operations promptly, which allows the freeze/thaw cycle to aid in the formation of ice. The major effects on aircraft operations are poor braking action and loss of directional control.

Hazards of Slush

Slush normally occurs during a snowstorm, when the surface temperature is above freezing, or just after a snow storm, when ambient temperatures rise above freezing. Slush is extremely detrimental to aircraft performance. Landing and takeoff performance is degraded, and slush ingestion into engines occasionally causes flameouts. The FAA suggests that turbojet aircraft should not attempt a takeoff when water, slush or wet snow accumulation of more than one-half inch in depth covers an appreciable part of the runway.

That wording in a U.S. FAA advisory circular leaves a great amount of latitude for the pilot to determine his course of action, but it limits the options of the airport manager in that he should initiate snow removal operations prior to an accumulation of one-half-inch of wet snow/slush or two inches of dry snow, if his airport serves turbojet aircraft. The advisory circular recommendation is slightly different for airports limited to serving piston or turboprop aircraft in that it says that snow removal operations should begin prior to the accumulation of one-half inch of wet snow/slush or **four** inches of dry snow.

Snow Removal Considerations

Once the various economic and safety factors are evaluated and an airport's need for snow removal has been established, the decision should be made as to whether to implement a snow removal program. This program may be large or small, depending upon the size of the airport, amount of snow, traffic density, mission, etc.

If one thinks about it long enough, one will conclude that just about everything done around an airport has a safety implication of one sort or another. This is particularly true with respect to snow and ice removal from the aircraft and from the runways, taxiways and ramp areas on which they operate.

Although the state-of-the-art in all-weather flying and airport snow removal have advanced significantly in recent years, avoidable accidents and incidents still occur with regularity.

Fortunately, most of these mishaps are not fatal, but many do cause personnel injuries and substantial damage to aircraft or airport equipment. So far as snow removal from runways, taxiways and ramps is concerned, there are two main hazards that can have catastrophic consequences if adequate precautions are not taken:

- The effects that snow-removal-vehicle operations have on navigational signals, i.e., the course and glide path information emanating from ILS localizer and glide slope antennas. Disruption or attenuation of these signals can have a disastrous effect, particularly during marginal weather conditions.

- Lack of adequate communications between snow removal vehicles, air traffic control (ATC) facilities and aircraft concerning the location of snow removal vehicles during clearing operations.

The lack of integrated ground and flight operations during a snowstorm was a contributing factor in an accident that occurred when an airplane crashed during an unsuccessful go-around after a near-collision with a snowplow on the runway. It was a classic case of multiple factors leading to a disaster, with the conflict between airplane and snowplow representing only the final link in a chain of preventable events.

The findings of the subsequent accident investigation were

numerous and included some that addressed deficiencies in airport operations. The following are the applicable airport safety-related items:

- The estimated time of arrival (ETA) of the aircraft at the destination airport calculated by ATC was considerably in error and resulted in a traffic conflict between the arriving aircraft and a snow removal vehicle working on the runway.

- The flight crew did not report by radio when beginning the final approach, permitting the incorrect ETA to remain undetected.

- Regulatory provisions concerning pilot position reporting during instrument approaches were inadequate.

- Interfaces between the organizations providing air traffic services and airport services were not well developed to provide a reliable, fail-safe flight information service.

- Rescue efforts at the accident site were hampered by the lack of a fire fighting vehicle capable of negotiating deep snow and a shortage of trained rescue personnel.

Obviously, no single party involved was completely to blame. Nor were any completely blameless. It is appropriate that each party involved with airport operations review the part he would have played had the accident happened at his particular airport.

Since snow and ice removal are of paramount importance to safe airport operations, this second bulletin of a two-part snow removal series looks at a number of related topics, including snow removal around in-pavement lighting, runway/taxiway edge lighting, ramps and ILS equipment. Snow removal from the pilot's point of view also is discussed, along with a look at a near collision on a snowy Christmas Eve.

In-Pavement Lighting

There are other, nuts-and-bolts considerations that also must be addressed by a well-rounded airport winter operations plan, and protection of visual guidance and navigation aids is an important example.

In-pavement lighting, especially that found at Category II instrument landing system/approach facilities, is a great landing aid to the pilot, but it becomes a challenge so far as snow removal is concerned. Unfortunately, there are too many variables to formulate a patent solution for removing snow and ice from in-pavement lights. Each airport snow removal plan must be tailored to its particular requirements. Climate, equipment availability, operations and budget all must be considered in the overall plan. But one common topic that continually comes up when the subject of in-pavement lights is discussed is the type of snow blade (rubber or steel) that should be used to clear areas with in-pavement lights.

Initially, operators were hesitant to use steel blades because of their potential for breaking lights, but, with the advent of lighting units with hardened tops and improved plowing techniques, the breakage problem has been reduced significantly.

The continuing problem seems to be the bounce effect encountered with the steel blade. As the bladed vehicle is driven over areas with implanted lights, a bouncing effect occurs, because the protrusion of the lights just above the level of the pavement precludes a smooth operation. This results in an uneven clearing of snow and ice to the point where it is sometimes unacceptable and has to be redone with chemicals or sweeping.

Utilization of rubber tipped blades does permit a more even clearing, but their removal capability is less. Consequently, most operators tend to prefer steel blades. Fortunately, the problems with in-pavement lighting normally are associated with the larger airports, where a wider variety of snow removal techniques is available.

One solution to removing snow from in-pavement lights is to use the two-tiered technique of first clearing with a steel or rubber-tipped blade and then using a sweeper or chemicals to complete the job. This technique has worked well at larger airports but is difficult for small airports with limited snow removal capability to upgrade their lighting capability.

Runway Edge Lights

Snow plows also are a hazard to runway and taxiway edge lights. Fortunately, there are various ways of dealing with the problem, depending upon local conditions. Since good lighting is such an integral part of the overall safety needs of an airport, it is essential that lights be just as clear of ice and snow as that of the runway surface. This particular point has been tragically illustrated far too many times, and many airport operators can recall a serious incident or accident related to poor lighting that caused deaths, serious injuries and/or damage to aircraft and airport equipment.

One method of dealing with this problem is to take advantage of below-freezing temperatures to prepare for winter snow removal operations. This involves clearing the first snow from an area 30-to-40 ft. on either side of the lights immediately after the snowfall. This permits the ground to freeze more quickly and deeply, giving it a hardness that can stand up to the weight of heavy snow removal equipment.

It is essential that the new fallen snow be removed before beginning this operation, because the snow acts as an insulator and does not allow the ground to freeze deep enough to withstand the weight of the snow removal equipment. Once the ground is clear of snow and has frozen solid, subsequent

snowfalls can be removed by plowing or blowing and by the creative use of windrows.

This method is effective primarily in colder areas, where the temperatures remain at, or below, freezing for a substantial portion of the winter. The frozen ground makes it possible to utilize snow removal equipment off the runways and taxiways to build windrows. The windrows are made on either side of the lights with the aid of snow blowers and small trucks equipped with snow blades for working in close proximity to the lights.

Elongated Post Lights

Although many airport managers shun shoveling snow by machine from around individual lights, others find it to be an efficient technique in areas where elongated 24-inch light posts are in place. As a result, the standard 12-inch post is being replaced at many snow-belt airports with the 24-inch post, because the cost of the longer posts is small when compared with that of the manual labor required to dig snow from around the individual light units.

In addition to digging from around these posts, it is advisable to keep runway lights illuminated on an around-the-clock basis, because the heat of the lights melts ice and snow from the lenses. Experience has shown that the added cost of the electricity used is marginal when compared with the other means of removing snow and ice from the lenses.

ILS Snow Removal

Snow and ice removal from ILS and localizer and glide-slope antennas can be as much of a problem as that of clearing runway surfaces, taxiways and ramps. The importance of navigation aids cannot be neglected during snow removal operations, because snow and ice often accumulate on and around ILS equipment, causing it to become inoperable.

Prior to removing snow from electronic navigation equipment, air-traffic-control facilities — control tower, approach control, the flight service station — should be contacted to be sure that no instrument approaches are in progress at the time. This will ensure that only reliable navigational signals will be received by an aircraft's receiving equipment. The local FAA airways facilities office also should be consulted and maintenance manuals examined prior to the initiation of any such work. Ground personnel also should only be allowed to work around electronic devices when there is no danger from radiation or landing aircraft.

Utilization of snow fences, where practical, can help reduce the time and effort that normally goes into snow removal efforts around airport navigational facilities. This will minimize equipment down time and reduce the number of required manhours, increasing overall efficiency and reducing costs.

Wind and snow drift patterns from previous winters should be evaluated carefully to assure that the fences are installed so that they provide maximum benefit.

Pilot's Viewpoint

Regardless of what our endeavor in life may be, we all have the feeling that we know what is best for us, and most persons involved in aviation are very particular about their job accomplishments. Despite this, it is a prudent step for airport management to consult with the pilot, the primary benefactor — or victim — of snow removal endeavors and decisions.

In an informal survey of a representative cross-section of airline, commuter and general aviation pilots, the following concerns were noted:

- Clearing the active runway should be the top priority in all snow-removal efforts. Next in importance are the taxiways and ramp areas. Ramp areas are particularly important, because aircraft are parked close together and any sudden loss of control could spell disaster in the form of a ground collision. Normally, one seldom hears much about taxiway and ramp accidents, because they seldom involve loss of life.

- More attention should be paid to general-aviation ramps. These areas are severely neglected in many areas, primarily because the number of passengers per aircraft is small. The common complaint voiced in the survey was that the "big guys" get all the attention. Often the airport automobile parking lot receives more snow removal service than the general aviation parking ramp. Granted that all access areas need snow removal, the ultimate safety of all segments of the traveling public should be a prime consideration.

- There is a need for a standard runway friction measurement, which continues to be a serious airport deficiency around the world. Airports and airlines are now investing in various runway surface friction-measurement means such as diagonally-braked vehicle, Tapley meter, Skiddometer and Mu Meter to keep a close check on runway friction coefficients. The readings from the Mu Meter, as one example, are scaled from zero to 1.0, with 0.5 as the dividing line. If a pilot is given a reading below 0.5, he knows that the runway condition is not good. A reading of above 0.5 is good. There is still no set standard with respect to runway friction measurement between military and civil aviation in the U.S., and, needless to say, there is little continuity among countries.

The need still remains for a worldwide standard that everyone can understand and utilize effectively when making safety decision concerning aircraft performance

vis-a-vis runway conditions. [Ed. Note: An update issue of the Flight Safety Foundation's *Flight Safety Digest* will feature a presentation entitled, "Joint FAA/ NASA Aircraft/Ground Vehicle Runway Friction Program." The author calls for continuing testing of runway friction performance of aircraft and ground vehicles in light of improved tires and brakes.]

• All snow removal vehicles should be equipped with lights and radios so that the tower or flight service station can keep track of them and alert landing aircraft as to their location. Such a step also would provide a means of determining whether all vehicles are operating properly and whether the drivers are safe. At remote locations with extremely cold winters, the installation of proper lights and radios is particularly important because of the severe conditions that confront the vehicle operators.

• Damage liability should be limited. Litigation and U.S. FAA enforcement actions resulting from aircraft accidents are increasing, and, as many airport managers have learned from personal experience, the airport authority is not exempt. Part 139 of the Federal Aviation Regulations specifically points out that safety responsibility with respect to snow, slush and water rests with the airport.

Responsibility also rests with the aircraft operator, but in many cases he is the victim of what is not reported or done, particularly with respect to ramp and taxiway safety. The increasing costs involved points out the fact that minor accidents of the fender-bender variety are becoming extremely expensive to all parties concerned.

• There is a need for a better understanding of the economic impact on aircraft operations. It doesn't require a highly trained mathematician or economist to determine that, as the snow on the runway increases in depth, the number of passengers that will be carried decreases. In a time of slim margins of profit for many of the world's airlines, it is imperative that no paying passengers be unnecessarily deplaned before takeoff because of penalties imposed by snow-covered runways.

A good example of this is that a fully loaded DC-9 which will carry 130 passengers under dry runway conditions must have its takeoff weight reduced by 26 paying passengers, if only a quarter of an inch of wet snow accumulates on the runway. Besides decreasing revenues, this causes increased delays and schedule disruptions for passengers and airlines alike.

All together, a good snow/ice program benefits airport, ATC, pilot, and–most of all–the passengers. ♦

Ramp Accidents Can Be Prevented

A reminder of what causes ground service vehicles to go bump into aircraft, and some measures to avoid those encounters of the expensive kind.

Ramp accidents continue to plague the air transportation industry, causing large economic losses, many injuries and an occasional loss of life. These accidents involve vehicle and aircraft collisions with one another or with fixed objects. Estimates of the cost of these ground mishaps worldwide range up to $170 million (U.S.) annually.

An early Flight Safety Foundation membership survey found that aircraft damaged by service vehicles was a major area of concern because this type of accident takes the principal airline revenue generating source out of service. Other areas of concern which continue to remain valid include:

- Speeding vehicles;
- Crowded ramps;
- Engine noise;
- Jet blast;
- Lack of designated vehicle routes;
- Foreign object damage;
- Cost of personnel injuries; and,
- Forklift operations.

Although some of these potential situations are unavoidable, given the physical constraints under which most airlines operate, a large number of these incidents could be reduced and

some eliminated if better accident investigation techniques and follow-up actions were taken.

The following are a few preventive measures some airlines have found to be useful:

- Well defined procedures for all ramp operations;
- Equipment inspections;
- Licensing of all equipment operators;
- Use of marshallers to direct vehicle movement near the aircraft;
- Positioning of physical barriers around parking aircraft;
- Modification of flight line vehicles with telescopic extenders; and,
- Improved ramp lighting.

The military also suffers from ground mishaps and, as a result, does not permit vehicles within a certain radius of an aircraft unless a ground marshaller is present. Even so, forklift operations still cause problems.

There is little doubt that the airline ground mishap rate can be reduced significantly if such accidents are investigated thoroughly and improved procedures, training and concepts of discipline are implemented.♦

AIRPORT OPERATIONS

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