Technical Airworthiness Authority – Operational Airworthiness Authority Advisory (TAA-OAA Advisory)	
Title	**TAA-OAA Definition and Guidance for Icing Conditions**
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RDIMS File	**2182D-1027-812-6-Vol 1** **AEPM 1463915 (English)** **AEPM 1432343 (français)**

1. Purpose

1.1 This joint Technical Airworthiness Authority (TAA) - Operational Airworthiness Authority (OAA) Advisory provides clear definitions and guidance with respect to Icing Conditions, snow conditions and other forms of frozen precipitation.

2. Applicability

2.1 This advisory is applicable to all aircraft fleets operated by the Canadian Armed Forces (CAF).

2.2 This advisory establishes the baseline against which the TAA and OAA interpret a prohibition or permission granted in an Approved Flight Manual (AFM) and/or Aircraft Operating Instructions (AOI) for flight in icing and/or snow conditions. It provides supplementary guidance and procedural means to operate in such conditions. The information contained herein shall be read in conjunction with the AFM and/or AOI for each fleet. Where a conflict exists between this advisory and an AFM/AOI, the AFM/AOI shall take precedence.

3. Related Material

3.1 Definitions

a. Approved Flight Manual (AFM). The term AFM applies equally to fixed-wing aircraft and rotorcraft. For those fleets that do not have an AFM, those sections of the AOI that contain TAA-approved Technical Airworthiness Data (TAWD) can be assumed to be the equivalent of the AFM.

b. Aircraft. The term Aircraft applies equally to all fixed-wing aircraft and rotorcraft, regardless of weight.

c. Area Forecast Amendment (AIRMET). Information message to advise pilots of the occurrence or expected occurrence of weather phenomena, which may affect the safety of aircraft operations and which were not already included in the Graphic Area Forecast (GFA).

d. Graphic Area Forecast (GFA). A series of temporally adjusted weather charts, each depicting the most probable meteorological conditions expected to occur below 24 000 ft over a large area within a specified timeframe.

e. Aerodrome Meteorological Report (METAR). An aerodrome report describing the actual weather conditions, at a specified location and at a specified time, as observed from the ground.

f. Pilot Report (PIREP). An in-flight pilot report of actual weather conditions encountered during flight.

g. Significant Weather Charts (SIGWX). Charts showing for the mid and high levels occurring or forecast weather conditions considered to be of concern to aircraft operations.

h. Aerodrome Forecast (TAF). A description of the most probable weather conditions expected to occur at an aerodrome, together with their most probable time of occurrence.

i. Significant Meteorological Information (SIGMET). Information message issued by a meteorological watch office to advise pilots of the occurrence or expected occurrence of specified weather phenomena that may affect the safety of aircraft operations.

j. Static Air Temperature (SAT). The air temperature that would be measured by a temperature sensor that is not in motion relative to that air. For the purposes of this advisory, for in-flight use, SAT, Free Air Temperature (FAT), Outside Air Temperature (OAT), true outside temperature and ambient temperature are interchangeable.

k. Weather Check Flight. A flight conducted to validate forecasted weather conditions over a specific geographic area. Such flights shall be defined and conducted in accordance with local flying orders.

3.2 **Regulatory References**

a. C-05-005-001/AG-001 – *Technical Airworthiness Manual* (TAM);

b. Federal Aviation Administration (FAA) Advisory Circular 91-74A – *Pilot Guide: Flight in Icing Conditions*, dated 31 December 2007;

c. B-GA-007-001/PT-D01 – *Air Command Weather Manual*, dated 30 May 2008;

d. Environment Canada – *AWARE: The Atmosphere, The Weather and Flying,* January 2011;

e. National Transportation Safety Board (NTSB) Order EA-585, NTSB 940 – *Administrator vs. Bowen* (1974);

f. NTSB Order EA-603, NTSB 950 – *Administrator vs. Bowen, Petition for Reconsideration* (1974);

g. NTSB Order EA-3770 – *Administrator vs. Groszer* (1993); and

h. FAA Letter of Interpretation – *Office of the Chief Counsel to Ms Leisha Bell (Aircraft Owners and Pilots Association)*, dated 16 January 2009.

i. Federal Aviation Regulation (FAR) 121.321 – *Operations in Icing*, dated 13 March 2013 (Effective 21 October 2013);

j. Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008;

4. Discussion

4.1 **Background**.

a. As stipulated in the TAM (Regulatory Reference 3.2a), aircraft may include allowances or prohibitions for Flight in Icing Conditions. The TAM does not, however, provide a definition for such conditions. These allowances or limitations with respect to icing are generally documented in the AFMs.

b. In some cases, the AFM does not provide a clear definition of what constitutes Icing Conditions. Furthermore, the wording used in AFMs is inconsistent: references are made to Icing, Icing Conditions, Known Icing Conditions or Forecast Icing Conditions, suggesting they are different.

c. The training material available to the operators at Regulatory References 3.2b through 3.2d provides most of the necessary knowledge on the physics of the atmosphere, ice formation and its effects on aircraft. However, it fails to establish a clear and unambiguous definition that could be used by all operators.

d. This is not a problem unique to the Department of National Defence (DND), and many safety and regulatory agencies, such as the NTSB and the FAA, have long faced this issue. The guidance in this advisory is developed based on DND experience, as well as guidance developed over the years by other agencies, which can be found in Appendix A.

4.2 **TAA-OAA Position**. Below are the definitions and interpretations of terms and conditions to be used when referring to aircraft limitations/allowances or to supplement current AFM and operational limitations, guidance and procedures where they exist:

a. The following combinations of terms shall all be interpreted as Icing Conditions:

(1) Icing (Conditions);

(2) Known Icing (Conditions);

(3) Flight in Icing (Conditions);

(4) Actual (Observed) Icing (Conditions); and

b. The following definitions shall be used in the interpretation of all Icing Condition-related material and in conjunction with para 4.2.c of this advisory.

(1) Fog: Suspension of condensation that causes visibility to be reduced to less than 1000 m.

(2) Liquid Precipitation: Rain, freezing rain, drizzle, freezing drizzle, recirculating spray and mixed precipitation (a mixture of snow and any other form of liquid precipitation).

(3) Visible Moisture: All forms of cloud, fog and liquid precipitation.

c. The following interpretations shall be used in conjunction with those above for the purposes of predicting whether a flight is likely to encounter icing or not:

(1) Icing Conditions will be considered to exist when:

(a) There are weather reports in which Icing Conditions are forecast, unless provisions of paras 4.2.f or 4.2.g apply;

(b) Icing Conditions are observed or reported;

(c) Any form of frozen precipitation (to include all forms of snow, hail, ice pellets, snow grains, etc.) that adheres to any aircraft surface.

(2) Icing Conditions will be considered very likely to exist in visible moisture at a SAT of +5°C and below.

(3) Icing Conditions may also exist if induced, such as by hovering in recirculating snow at a temperature greater than -5°C.

d. In determining Forecast Icing Conditions, operators shall use all weather forecasts and reports reasonably available to them, including, but not limited to, SIGMET, METAR, GFA (see exceptions at para 4.2.f below), AIRMET, SIGWX, TAF and PIREP.

e. Since PIREPs are samples of the atmosphere limited in time and space, they should not be used on their own to negate a forecast of Icing Conditions.

f. When allowed by local Flying Orders, Weather Check Flights, which give due consideration to all available environmental factors, should be used instead, to confirm or invalidate a forecast of Icing Conditions in a specific area. Such a weather check must take into account the rate of change of weather conditions and sample the atmosphere where flight is intended.

g. The following shall be considered with respect to Graphic Area Forecasts (GFAs) only:

(1) Areas of moderate or severe icing are graphically depicted as defined in Regulatory Reference 3.2.d. The spatial extent is clearly indicated horizontally and vertically.

(2) When icing is expected to be light, it is indicated in the comments box rather than on the depiction itself. This format does not provide sufficient granularity to assess the likelihood of encountering these conditions at the local level.

(3) It is therefore probable that significant areas of clear air (i.e., non-icing conditions) will exist within a region where light icing is forecast. For this reason, a GFA of light icing shall not be included in the definition of Icing Conditions in para 4.2.c (1), above. For example, with an ambient temperature of -5^{O}C at ground level, during daytime and a GFA showing nil-to-light icing above the freezing level, Icing Conditions will not exist in those areas clear of visible moisture.

h. An aircraft prohibited from Flight in Icing Conditions may be flown in areas of forecast icing provided the pilot can remain clear of visible moisture. Planning for such a flight must take into account that avoidance of visible moisture is exacerbated by poor ambient lighting conditions (e.g., night, low sun with hazy conditions, heavy overcast cloud, etc.).

i. An aircraft certified for Icing Conditions shall be operated with consideration to the fact that icing certification verifies only certain Icing Conditions. Despite being certified, Icing Conditions may be encountered that could exceed the aircraft's capability (e.g., supercooled large droplets).

j. Operators are encouraged to file relevant PIREPs, particularly when encountering actual conditions that are significantly different from those expected. Detailed PIREPs that have broad extent in time and space are most useful when considering the risk of encountering Icing Conditions.

k. If the application of this TAA-OAA Advisory adversely affects operational capability, then a RARM shall be completed to quantify the risk associated with operating the aircraft in Icing Conditions.

APPENDIX A
TO JOINT TAA-OAA ADVISORY 2014-01
DATED 26 JUNE 2014

Background to Legal and Regulatory Positions

1. FAA and NTSB Legal Positions

1.1. The NTSB has upheld for many years a legal definition of "known icing conditions" that refers not to ice currently accreting, but to the information available to the pilot before and during the flight, information which may include forecasts (Regulatory Reference 3.2.e):

> "*We do not construe the adjective 'known' to mean that there must be a near certainty that icing will occur, such as might be established by pilot reports. Rather we take the entire phrase to mean that icing conditions are being reported or forecast in reports which are known to a pilot, or of which he should reasonably be aware."*

1.2. This has been further reinforced by the NTSB in Regulatory Reference 3.2.f, where it is stated that to construe a restriction on flight in known icing conditions as not being a limitation to fly in forecast icing conditions renders the limitation meaningless and has little effect as a safety measure.

1.3. When weighing between reports and forecasts, the NTSB has further ruled that it is not at a pilot's discretion to "pick and choose" between a forecast and anecdotal PIREPs (Regulatory Reference 3.2.g):

a. "*While PIREPs are valuable in planning (and are used in developing the SIGMETs), they are only one factor to consider. We, thus, do not agree with respondent's claim that a pilot report will establish the absence of icing with "near certainty*."; and

b. "*For similar reasons, pilots may not, in the face of icing forecasts for an area, reasonably rely on anecdotal information regarding freezing levels. Weather reporting is not the exact science that respondent's theory would have us assume*."

1.4. The FAA has expressed a similar position to the NTSB (at Regulatory Reference 3.2.h) with respect to forecast icing being known icing. It also provides a rationale that illustrates the Regulator's intention to preventively keep aircraft away from icing, not reactively, given the severity of the icing hazard to aircraft:

a. "*If the composite information indicates to a reasonable and prudent pilot that he or she will be operating the aircraft under conditions that will cause ice to adhere to the aircraft along the proposed route and altitude of flight, then known icing conditions likely exist*"; and

b. "*Flight in known icing conditions by an aircraft not approved and equipped for such operations presents a significant safety hazard. By the time the ice adheres to the aircraft (or more appropriately is observed to adhere to the visible parts of the aircraft*), *it may be too late for the pilot to take actions to assure the further safety of the flight*".

2. Regulatory Positions

2.1. The FAA clarifies that icing conditions are those conducive to icing. It further provides a quantitative means to estimate them, in Regulatory Reference 3.2.i:

> "*After October 21, 2013, no person may operate an airplane with a certificated maximum takeoff weight less than 60,000 pounds in conditions conducive to airframe icing unless it complies with this section. As used in this section, the phrase "conditions conducive to airframe icing" means*

visible moisture at or below a static air temperature of 5 °C or a total air temperature of 10 °C, unless the approved Airplane Flight Manual provides another definition."

2.2. European Regulations at Regulatory Reference 3.2.j stress that flight through icing conditions, known icing conditions and forecast icing conditions shall only be allowed in an icing certified aircraft. They also stress that all reasonably available information (which would include forecasts) shall be used. The relevant paragraphs are as follows:

"*2. Flight preparation*

2.a. A flight must not be commenced unless it has ascertained by every reasonable means available that all the following conditions are complied with;

[…]

2.a.5. In case of flight into known or expected icing conditions, the aircraft must be certified, equipped and/or treated to operate safely in such conditions."