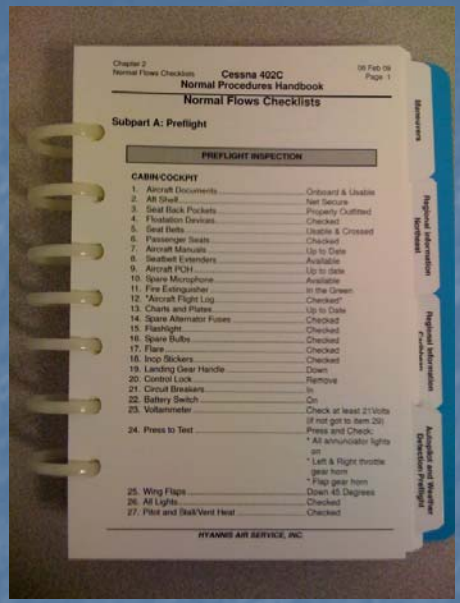
Cape Air / Nantucket Airlines

Cold Weather Operations Training Class

PRE-FLIGHT



Weather Briefing and Aircraft Preparation are part of any preflight process

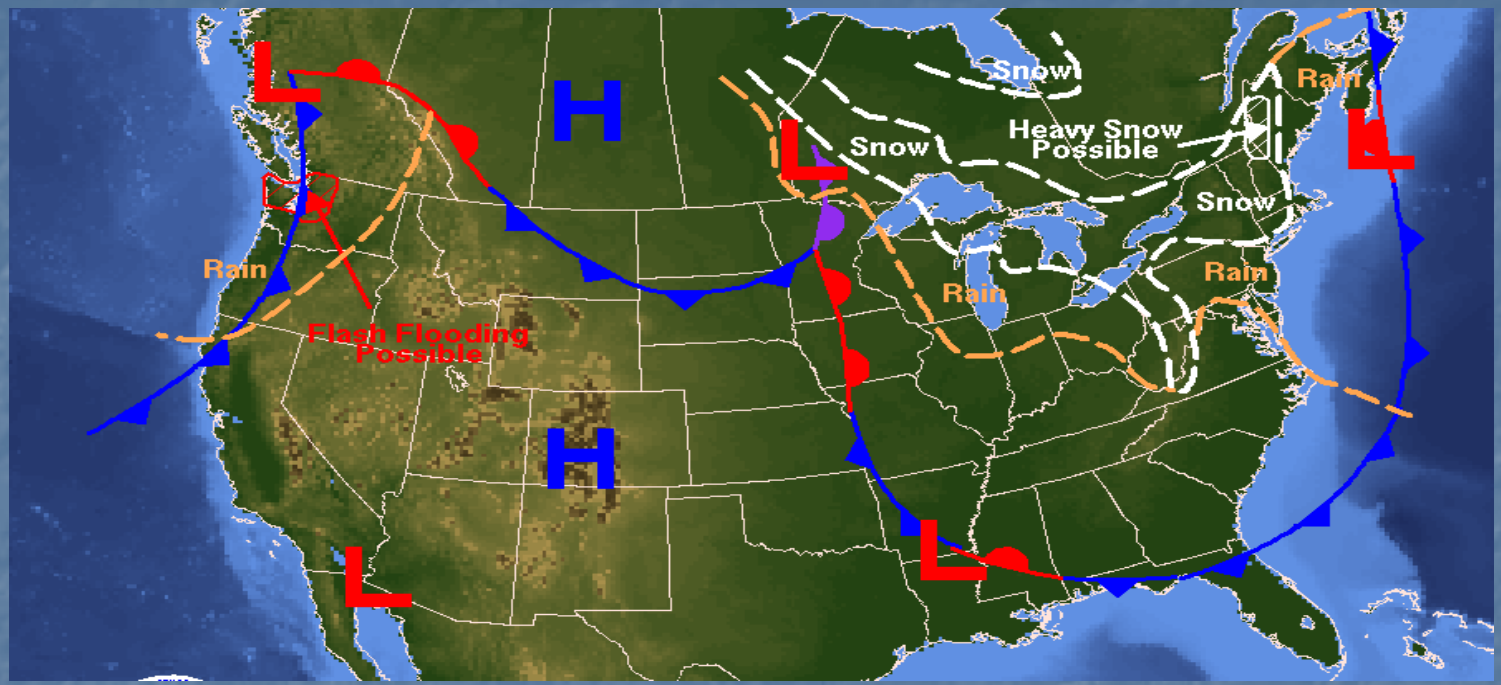
It should be remembered that the preflight process will take longer in cold weather than it does in warmer weather.

Weather Briefing

The weather briefing is a more involved process in the cold weather months. Getting weather from multiple sources gives the best "big picture" look at the situation.

- See Pages 1-3 of the CWOPM
- DUATS, DUAT, Jeppesen, FltPlan.com and FSS are all approved weather sources.
- Other sources (Weather Channel, ADDS, Non-FAA Web based sources, local TV weather programming) can be used as supplementary means to see the "big picture".
- Plan on spending more time getting weather information during the winter season.
- Make sure you have access to PIREPS (pilot reports)

General Knowledge of Weather Systems

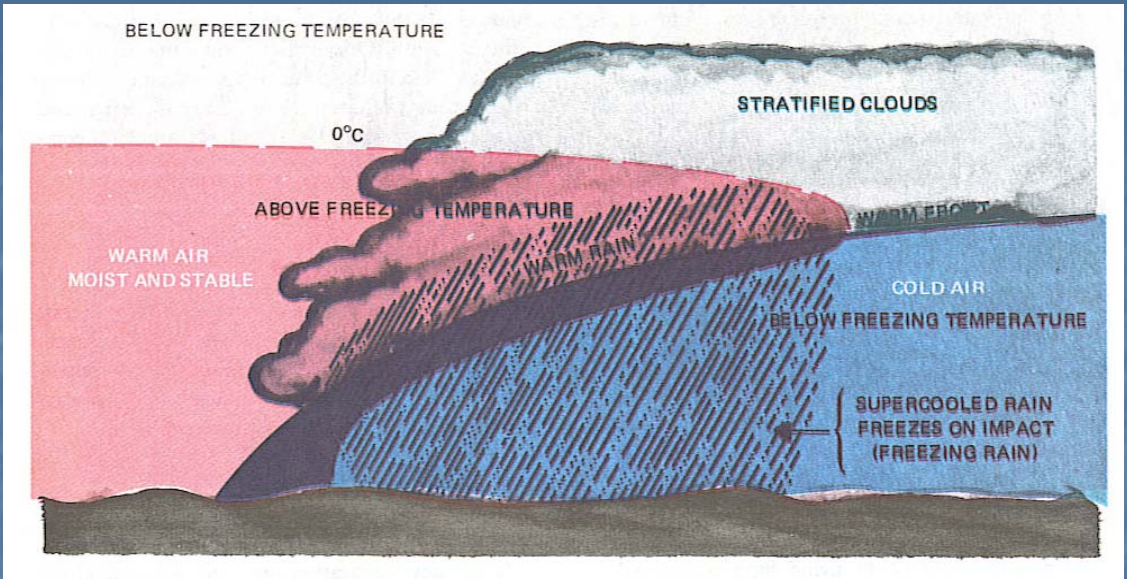


- Which way will the Low move? What frontal activity will occur as a result of that movement?
- Getting the big picture helps you better understand the forecast.
- Looking at Prognostic Charts and similar maps becomes even more important in the winter.

Low Pressure Area Movement and Frontal Activity in New England

- If a Low passes offshore of Cape Cod, expect northeast winds and plenty of moisture off the water. The relatively warm ocean feeds winter storms, so expect wind and precipitation.
- If a Low passes inland of Cape Cod, warmer air will wrap around ahead of the Low, bringing warm front conditions, with the possibility of SLD (freezing rain) ahead of the surface front.
- If a Low passes well to the North, heading from west to east, expect a cold front to trail south of the Low.

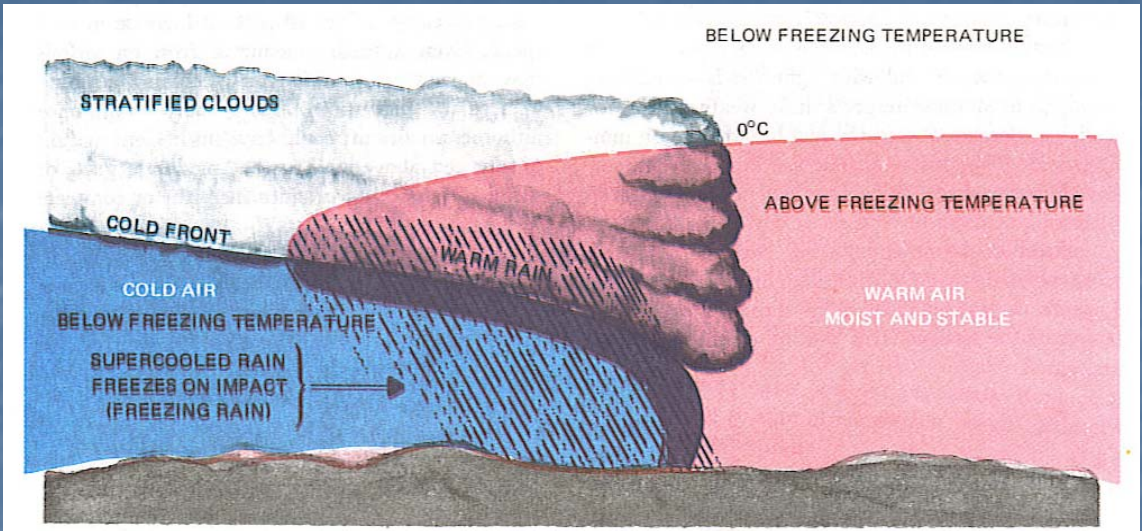
Warm Front



This is a classic warm front passage. As the warm front approaches, the warm air rises up over the cold air in front. As it does, it condenses into clouds and precipitation on a rather gentle slope, sloping down toward the surface front.

- The first precipitation will be snow as the moisture sublimates at high altitude.
- A little closer to the surface front the moisture will condense as liquid at a lower altitude, but it will fall through enough cold air to freeze into an ice pellet resulting in sleet.
- A little closer to the surface front (and at yet a lower altitude) the moisture will condense into liquid and fall through cold air, but it will not fall long enough to freeze. It will supercool and wait to freeze on contact. This is known as freezing rain.
- After surface front passage (and possibly just before), the condensed moisture will fall as pure rain.

Cold Front



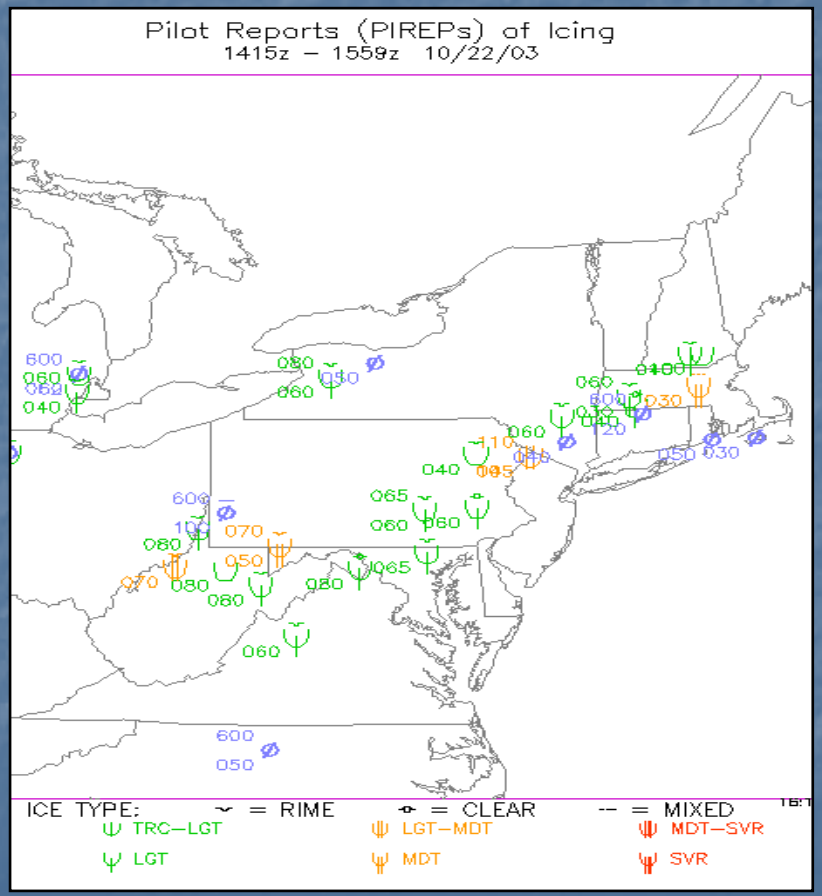
Cold front passage is usually quicker, and the effects of the front are usually more immediately in the vicinity of the front.

Cold fronts create lifting action which can suspend large water droplets in the air in clouds that have significant vertical development. The larger the droplets, the greater the rate and scope of ice accumulation.

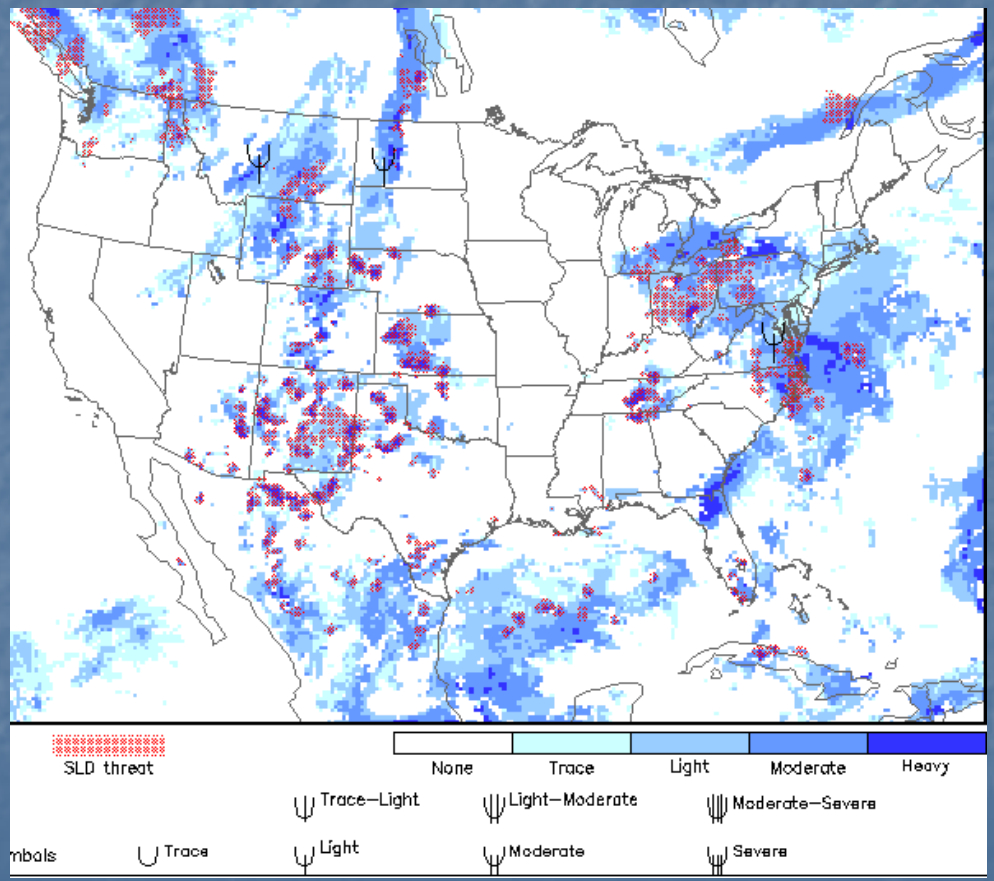
Remember: Any time there is a lifting action (orographic, cold front, clouds with significant vertical development, etc.) larger than normal water droplets will be suspended in the air. If these droplets are supercooled (temperature below freezing) they will create a much greater icing hazard than the droplets found in clouds where there is no lifting action (stratus clouds, etc.).

ADDS Icing Charts

These pictures are from the "Icing" tab on the ADDS website. This information can be used to supplement your approved briefing.

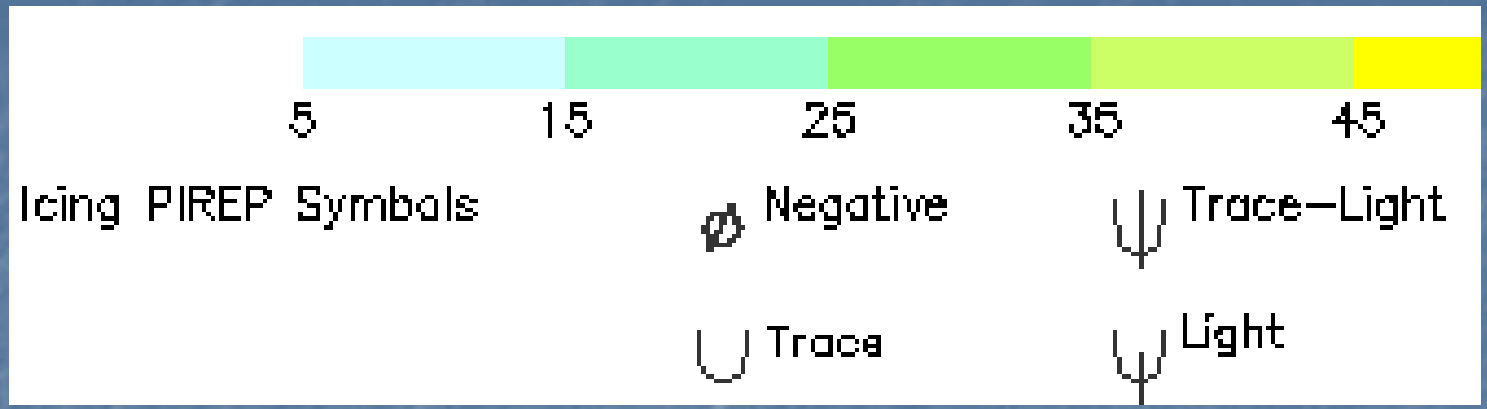


ADDS Icing PIREP Chart

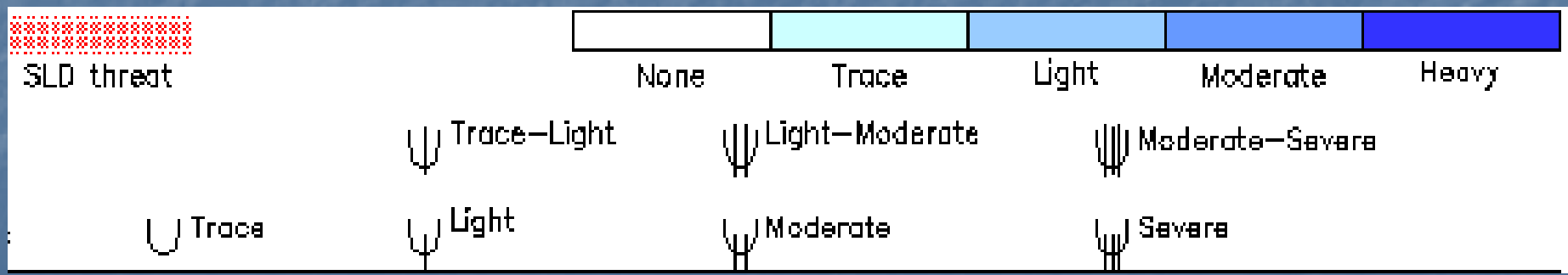


Maximum Icing Severity Chart

Icing PIREP Symbols



Icing Severity Symbols



Company PIREP

- Required any time moderate or greater icing is encountered. Inform System Operations Control (SOC).
- ANY reports of icing, cloud tops, precipitation, temperatures aloft are invaluable to your fellow line pilots. Winter weather requires us all to be more proactive in disseminating real-time weather information.
- If you don't ask, you'll never know.
- PIREPS, whether through FSS or company, are the pilot's best tool for avoiding icing conditions.

Icing Types and Intensities

Types

- *Rime Ice* – Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets found in clouds with little vertical development.
- *Clear Ice* – A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets in clouds with significant vertical development or SLD.
- *Mixed Ice* – A combination of rime and clear ice. (Mix of cloud types – fronts/occlusions)

Icing Types

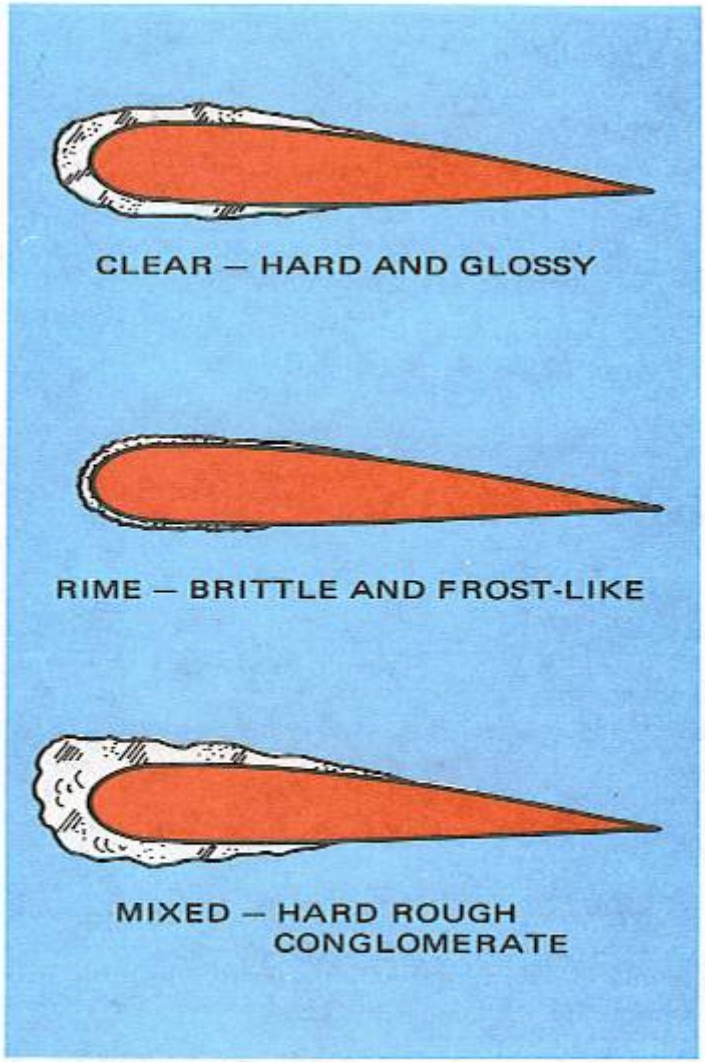


FIGURE 90. Clear, rime, and mixed icing on airfoils.

Ice Intensities

- ***Trace*** – Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not used unless encountered for up to one hour. NOTE: Per FAR 135.227, an aircraft may operate in trace icing conditions with some/all required deicing/anti-icing equipment inoperative or uninstalled.

- ***Light*** – The rate of accumulation may create a problem if flight is prolonged in this environment (over one hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.

Intensities (continued)

- ***Moderate*** – The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or diversion is necessary.
- ***Severe*** – The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary.

- Refer to CWOPM, Page 3 for a reference.
- Note how intensities are based on the effectiveness of deicing/anti-icing equipment. Therefore, what is *light to moderate* icing to a transport category aircraft may be *severe* to an aircraft with less sophisticated deicing/anti-icing equipment.

FAR 135.227

Aircraft are required to have all deicing/anti-icing equipment installed and operating properly for flight into forecast light, moderate or severe icing conditions.

However, the deicing/anti-icing equipment is not required if current weather reports and briefing information *relied upon by the PIC* indicate that the weather conditions have changed since the forecast and that light, moderate or severe icing conditions will not be encountered.

"Other" Briefing Items

Did you remember to check…

- Cloud tops/layers?
- Closest airport not affected by icing conditions?
- Temperature/dew point spreads on the surface?
- Winds and (especially) temperatures aloft???
- Are you checking the weather even though you may be on a prolonged rest between flights or without an aircraft for the time being?
- Is freezing drizzle reported or present at your departure airport? If so, you may not depart.

Aircraft Preparation

See Pages 8-16 of the CWOPM

We operate under the "Clean Aircraft Concept"

A pilot may not takeoff an aircraft that has:

- Frost, snow, or any ice adhering to any propeller, windshield or powerplant installation,
- Frost, snow, or any ice adhering to any airspeed, altimeter, rate of climb, or flight attitude instrument, or
- Snow or ice adhering to the wings or stabilizing or control surfaces.

We do not polish frost smooth. Since we have an approved ground de-icing program, we are required to remove all frost.

When is deicing required?

- Obvious frost, snow or ice on the aircraft.
- Snow is falling, or anticipated to be falling prior to departure.
- Freezing rain or sleet is present or anticipated prior to departure.
- Control surface movement is jammed or stiff, possibly from ice build-up.
- The aircraft sat on the ramp outside the hangar for several days under varying atmospheric conditions that may have contributed to ice over control surfaces, landing gear components, hinge points, or other critical areas.
- ANYTIME IT IS REQUESTED BY THE FLIGHT CREW

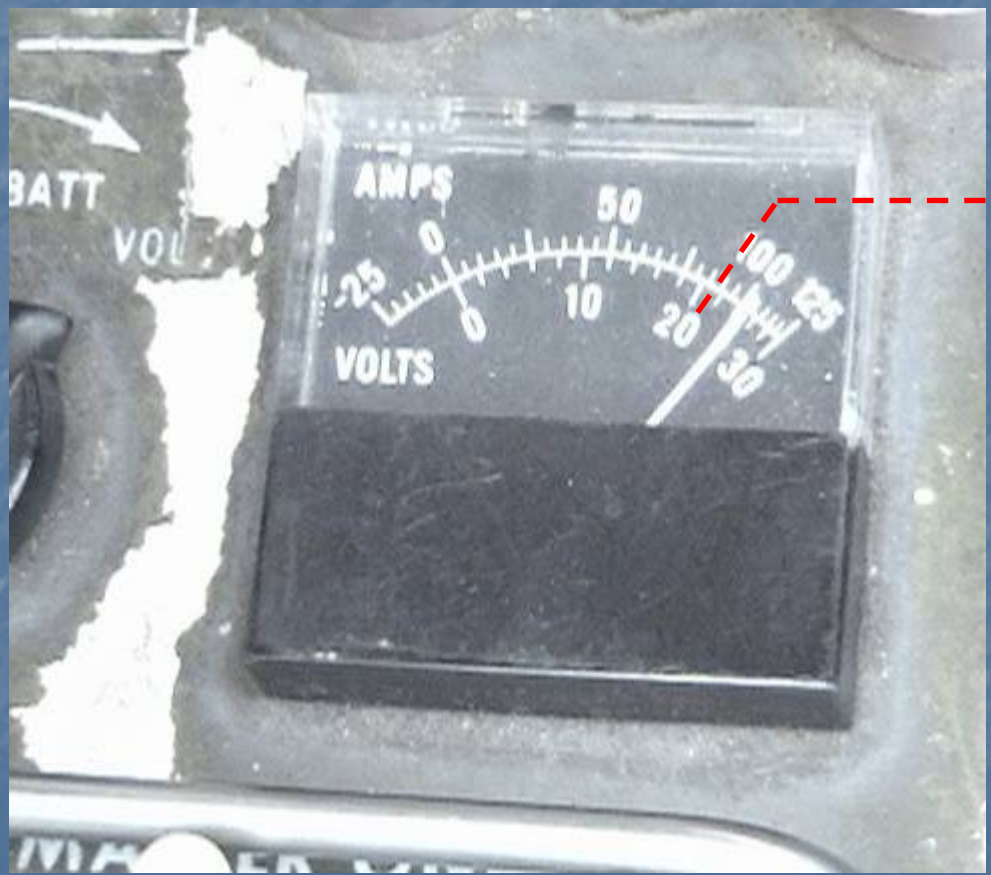
Snow and Ice Removal

- Use a logical sequence when deicing aircraft. First remove snow using a clean broom before using deice fluid. A broom removes snow most easily. Use the fluid to remove the stuff that sticks.
- Use only brooms that are reserved for aircraft deicing.
- Push/pull snow away from control surface hinges, where snow can pack in, turn to ice and interfere with control movement.
- BEWARE THE WARM HANGAR: An aircraft pushed into a warm hangar for deicing must be allowed to dry fully in the hangar. Otherwise, the newly-melted snow/ice will simply refreeze once the aircraft is pulled back outside into freezing temperatures.

Snow and Ice Removal (cont.)

- Don't forget the top of the plane, the nose and other non-lifting surfaces. Snow on these areas adds considerable weight.
- Wet snow, formed in temperatures close to freezing, is identifiable by large flakes. It is very adhesive (makes good snowballs) and is more difficult to remove.
- Dry snow, formed in temperatures well below freezing, is identifiable by small flakes. It isn't very adhesive (makes poor snowballs) and is easily removed.

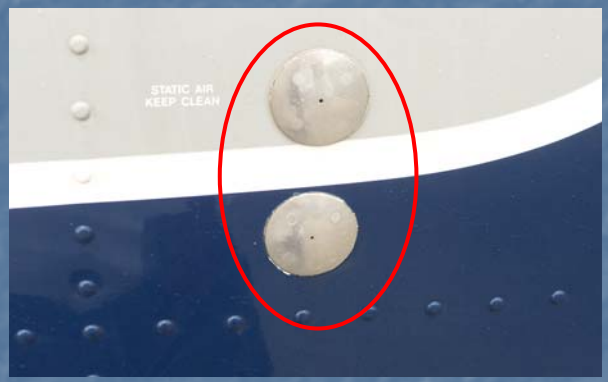
Make sure you have good battery voltage before you check flaps and lights



Voltage required for starting engine.

Ensure battery voltage will not go below 21 volts.

Pitot/Static & Stall Warning Checks



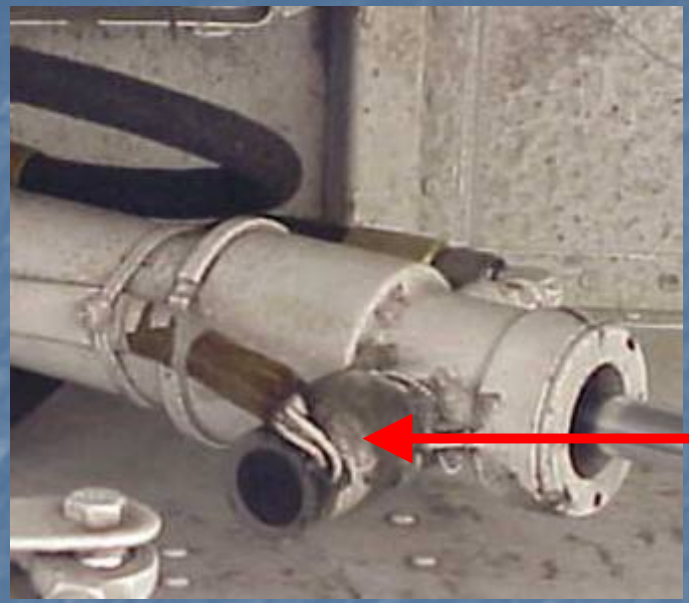
- When checking the pitot heat and stall/vent heat, remember that the pitot tube will always get warm (don't grab it!).
- On many of the planes, the static ports and stall vane won't get maximum heat until the landing gear squat switch is closed (aircraft is airborne).

Other Critical Areas

The lower surface of the horizontal stabilizer is a collection ground for snow/slush thrown up by the main landing gear tires. If this contamination freezes, it may greatly affect elevator controllability.

****Pay Close Attention to this Critical Element****

Other Critical Areas



Nose Gear Downlock Microswitch

Check the nose wheel well for slush, snow, and ice.

The nose gear downlock microswitch can become frozen shut by slush kicked up by the nose tire. If this microswitch is stuck closed, the nose gear will indicate "down and locked" no matter what the actual position of the gear is. This will require that the gear be blown down.

Operations in Ground Icing Conditions

- Ground Icing Conditions: Frozen or freezing precipitation at the surface which may adversely affect takeoff or in-flight performance.
- We must operate in accordance with our approved Cold Weather Operations Procedures Manual during times of ground icing conditions.
- Brooms may be used to remove accumulated snow during ground icing conditions; however, the aircraft must be *fully* deiced in order to comply with the Five-Minute Pre-Takeoff Contamination Check.
- Clean Aircraft Concept means *COMPLETELY* clean!

De-ice Machine & Fluid

De-ice Fluid

- Hyannis Air Service uses a pre-mixed 55/45 solution of Glycol (a freezing point depressant) and water, heated to *no less than 150° F.*
- This fluid is known as Type I De-icing fluid. Its purpose is to melt the ice and snow (the glycol keeps the deice solution from re-freezing on the aircraft)
- Although they are described in the CWOPM, Hyannis Air Service does not employ the use of Type II or higher anti-ice solutions.
- De-ice fluid should be sprayed on all lifting and control surfaces.
- De-ice fluid *should not* be sprayed on wheels, tires, brakes, and windows; or directly into openings such as pitot tubes, static ports, air inlets, engine inlets, and cowl openings.

De-icing Tips

- Have the airplane de-iced once all the passengers are on board and the aircraft is in an area where passengers don't walk.

  GLYCOL + SNOW = SLIPPERY!

- Remove any de-ice fluid that gets on your windshield or windows. The fluid may remain on the window surface, even in flight, and can obscure vision.

De-icing Tips (cont.)

Make sure that the left wing root is de-iced first. This the easiest part of the aircraft for you to see from the captain's seat. If it was the first to be de-iced, then it will be the first to re-freeze. If you look out during your Pre-Takeoff Contamination Check and see that the left wing root is clean, you can be reasonably assured that the rest of the aircraft is clean as well.

Taxiing

Before you move…

- Check the ‘vacuum pump inoperative’ buttons in the suction gauge during engine start. The check valves in the vacuum manifold are more likely to fail in cold weather.
- Confirm controls are free and correct. Is contamination interfering with control surface travel?
- If you are taxiing in an area where there are snow banks close by, make sure your landing lights are retracted.
- Do you have 100° F showing on both CHTs? *Do not* close cowl flaps to warm engines. This warms the cylinders unevenly.

Contaminated Taxiway Hazards

- Significantly reduced braking performance.
- Possibility of weathervaning in strong winds.
- Potential white-out conditions in blowing snow from wind gusts or prop/jet blasts.
- Reduced cornering traction. TAKE THOSE TURNS SLOW!!!

Run-Ups

- The aircraft heater should be checked for satisfactory operation prior to a flight where its in-flight use is anticipated
- Make sure you have 150° F on the CHTs before advancing the throttles for run-up.
- The props must be cycled in cold weather. This may not be done during a "rolling run-up".
- Pick a clear spot in the run-up area. Even with the brakes held, you'll slide on ice or snow at 1700 RPM!
- Is your de-ice/anti-ice equipment working properly?

Run-ups

- If an aircraft has been exposed to extreme cold (<20°F) for more than two hours, make sure to:
  - Start the aircraft and let CHTs reach 100° F
  - Taxi to the gate and load the aircraft.
  - Then, perform a full run-up prior to departure in compliance with normal flows.
  - DO NOT do a run-up before shutting down to load passengers
  - Do not run-up to normal temperatures and then taxi to the gate, as this can lead to condensation in and blockage of the engine oil system

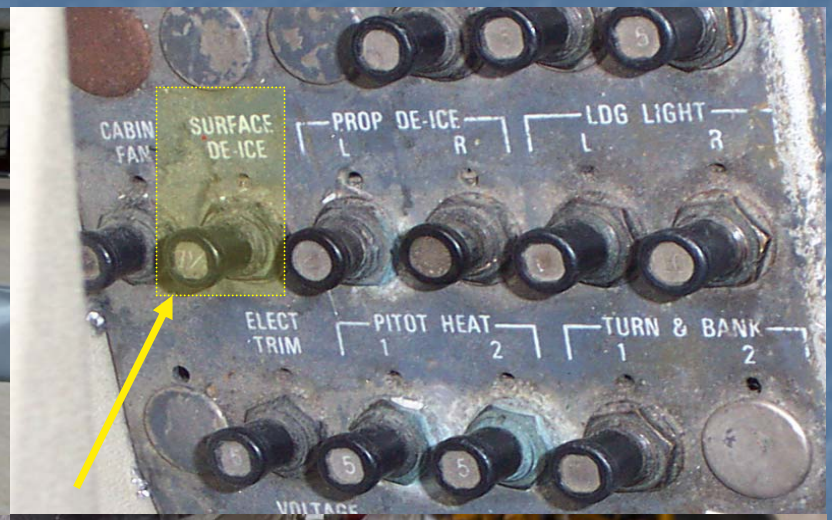
“I just did a rolling run-up to save a little time…”

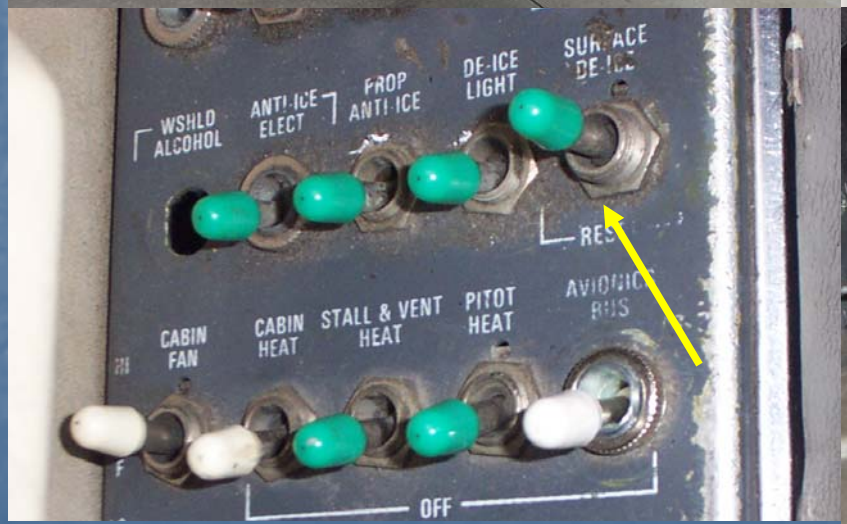
Anti-Ice and De-Ice Systems

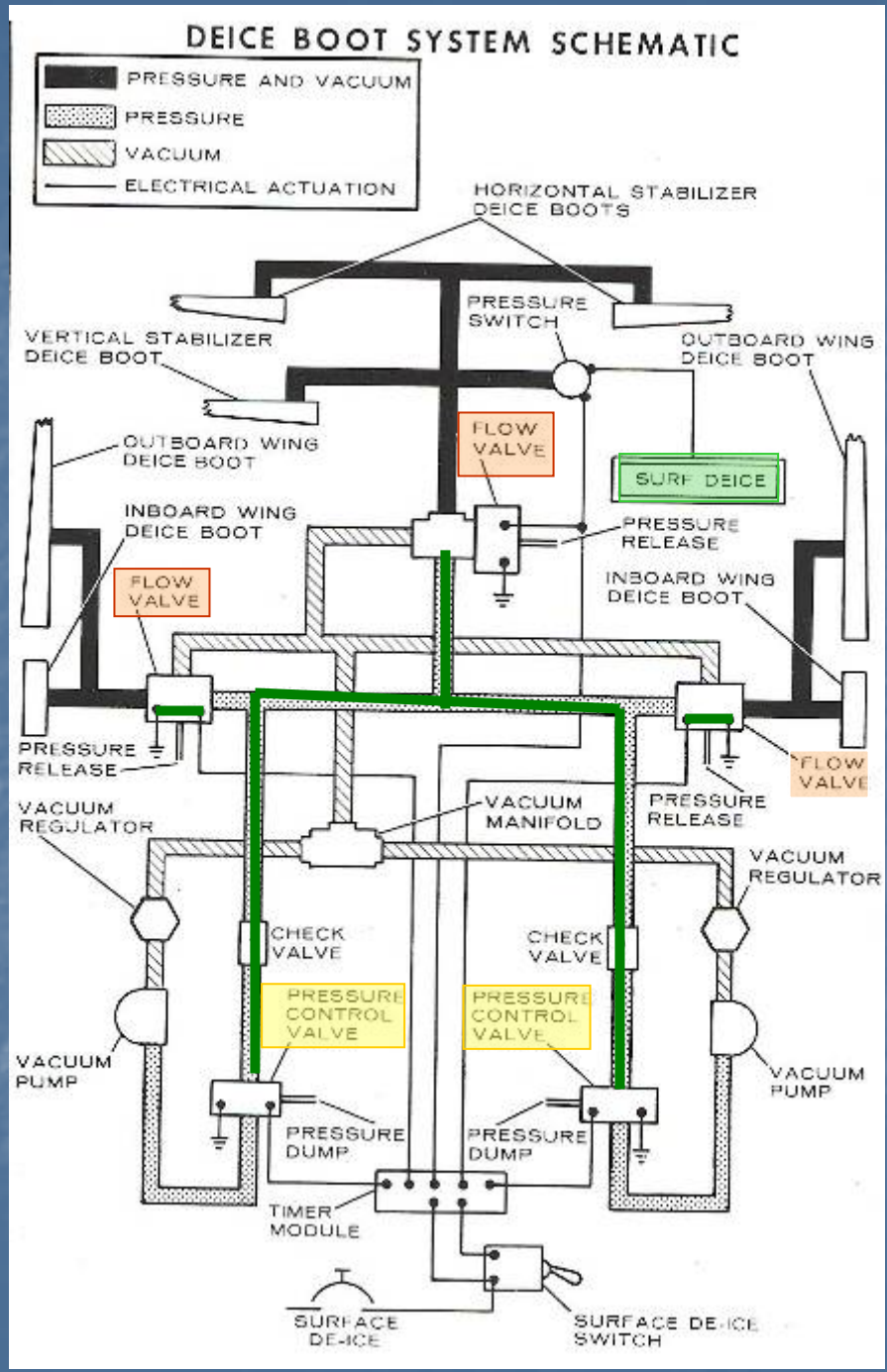
The following systems are required to be installed and operational for flight into known icing conditions:

- Wing and Tail De-Ice Boots
- Electrically Heated Windshield
- Electrically Heated Prop Anti-Ice
- Pitot Heat
- Stall/Vent Heat

De-Ice Boot System



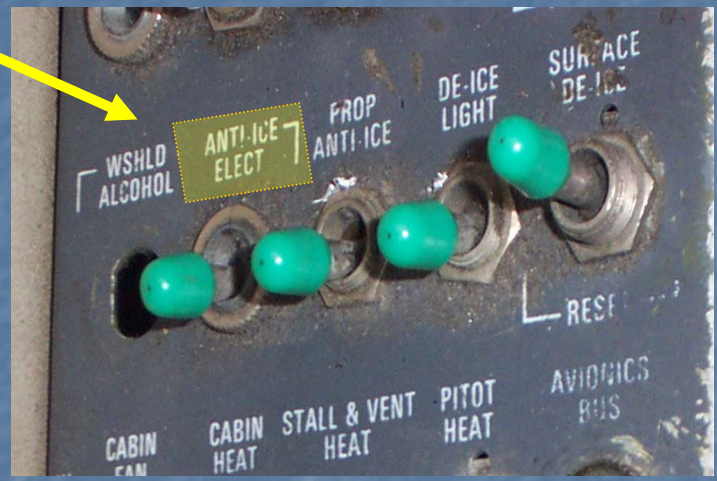


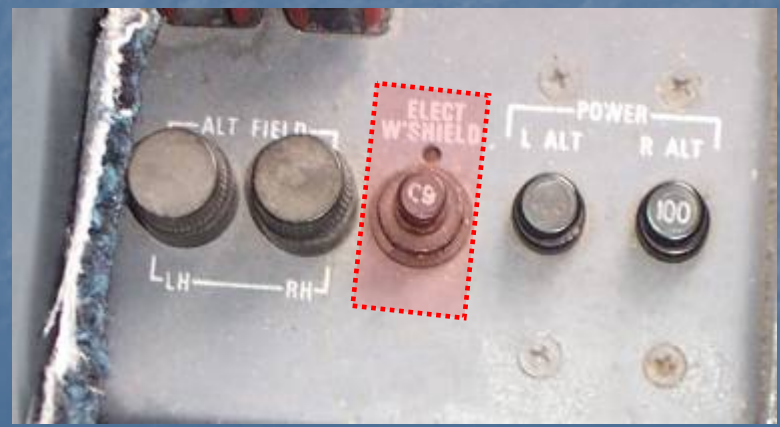

DEICE BOOT SYSTEM SCHEMATIC
PRESSURE AND VACUUM
PRESSURE
VACUUM
ELECTRICAL ACTUATION
HORIZONTAL STABILIZER DEICE BOOTS
PRESSURE SWITCH
VERTICAL STABILIZER DEICE BOOT
OUTBOARD WING DEICE BOOT
FLOW VALVE
SURF DEICE
OUTBOARD WING DEICE BOOT
INBOARD WING DEICE BOOT
PRESSURE RELEASE
FLOW VALVE
INBOARD WING DEICE BOOT
PRESSURE RELEASE
FLOW VALVE
VACUUM REGULATOR
VACUUM MANIFOLD
PRESSURE RELEASE
VACUUM REGULATOR
CHECK VALVE
CHECK VALVE
PRESSURE CONTROL VALVE
PRESSURE CONTROL VALVE
VACUUM PUMP
VACUUM PUMP
PRESSURE DUMP
PRESSURE DUMP
TIMER MODULE
SURFACE DE-ICE
SURFACE DE-ICE SWITCH

De-Ice Boot System Notes

- Wait until ¼" to ½" of ice has built up on the leading edges before blowing the boots.
- Wait at least 45 seconds between boot cycles. The boots need to fully retract against the leading edges.
- If you unintentionally hit the surface de-ice button, press the **Reset** button and the Pressure Control Valves will open.
- Visually check the boots for inflation while also monitoring the annunciator panel for the "Surface De-Ice" light.
- There is no limit on the amount of patches. Just make sure that the patches are flush with the boot and not torn.

Electrical Windshield Anti-Ice System





Electrical Windshield Anti-Ice System

ELECTRICAL WINDSHIELD ANTI-ICE SYSTEM

SECTION 1 – GENERAL

This supplement provides information which must be observed when operating the electrical windshield.

Description

The electrical windshield anti-ice system consists of an electrically heated element in the pilot's windshield, an inverter, an annunciator light, a heat sensor and a switch breaker.

The inverter, located in the right wing stub, supplies AC power to the windshield. The heat sensor cycles the power to the windshield, providing temperature control. The green function indicator light, see Figure 7-3, will illuminate during each heating cycle.

If the indicator does not illuminate periodically, check the bulb by pressing the PRESS-TO-TEST button. A secondary means of checking proper windshield operation can be made by monitoring the voltammeter. When the amp meter selector is positioned to BATT, a change in charge or discharge rate will be noted during each heating cycle.

Abnormal operation of the electrical windshield anti-ice system is indicated by the switch breaker tripping to the OFF position or failure of the indicator light to illuminate. Failure of the switch breaker to stay reset indicates that windshield anti-icing is impossible.

SECTION 2 – LIMITATIONS

If the pilot's windshield is covered with ice, do not leave the electrical windshield anti-ice switch on for more than 20 seconds. Operation in excess of 20 seconds will cause an overheat condition which can result in failure of the windshield heating element and/or permanent distortion of the windshield.

SECTION 3 – EMERGENCY PROCEDURES

Not Applicable.

SECTION 4 – NORMAL PROCEDURES

A. Before Takeoff
1. Electrical Windshield Anti-Ice Switch - ON momentarily. Check voltammeter for discharge and WINDSHIELD annunciator light for illumination.

NOTE

Turn off windshield anti-ice switch as soon as the voltammeter and the annunciator light have been checked.

B. Inflight
1. Electrical Windshield Anti-Ice Switch - ON before entering visible moisture with outside air temperature below 4.4°C (40°F).
2. Leave icing conditions as soon as possible if airplane is not equipped for flight in icing conditions.

NOTE

Since the electrical windshield anti-ice system alone does not provide adequate protection for the entire airplane, icing conditions should be avoided whenever possible unless the airplane is equipped for flight in icing conditions. Refer to Flight In Icing Conditions supplement for details. If icing is encountered, close attention should be given to the pitot-static system, propellers, induction systems, wing and stabilizer leading edges and other components subject to icing.

C. After Landing
1. Electrical Windshield Anti-Ice Switch - OFF.

Although the AFM calls for the windshield heat to be turned on before entering visible moisture at or below 40 degrees F, it is our procedure to wait until the first sign of ice, due to the high draw that the windshield heat places on the electrical system.

Electric Windshield Indications

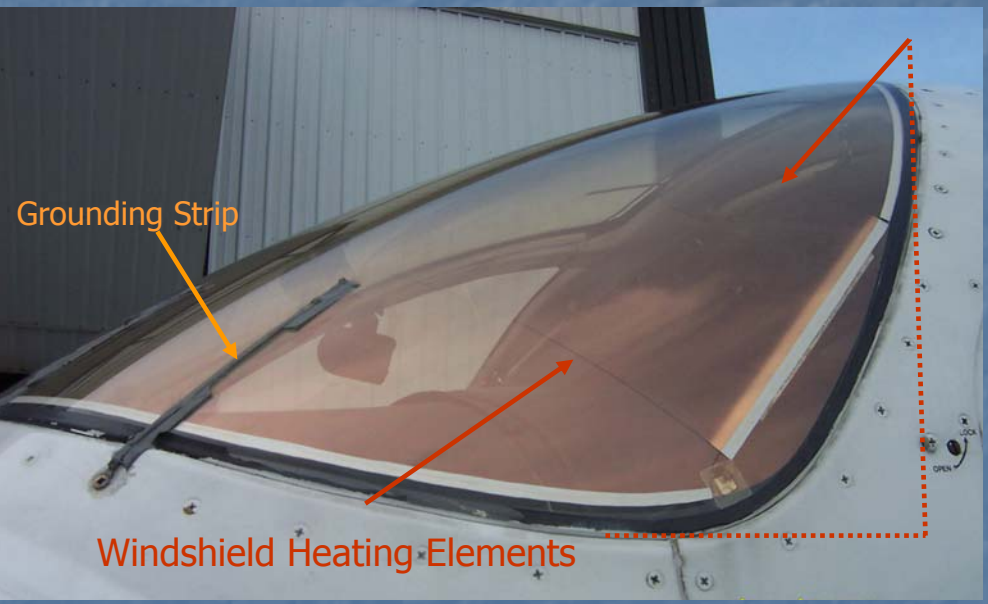
"Windshield" Annunciator Light

25 Ampere Draw (approximately)
per Alternator – 50 total

Electric Windshield Notes

- Receives AC power from an inverter located in the right wing stub (Mirror image of battery compartment).
- The windshield anti-ice system should only be run for 20 seconds on the ground in order to ensure that the windshield does not become permanently damaged.
- The thermostat may regulate current to the windshield, but only continuous airflow helps regulate temperature.
- Should be turned on at the *first sign* of windshield icing. (if the windshield's already covered – it may be too late.)
- Monitor the annunciator light and voltammeter to ensure that the thermostat is working properly. The windshield annunciator light should illuminate *during each cycle* of the windshield and will remain illuminated during the whole cycle.

Electrical Windshield Anti-Ice System



Electric Windshield Anti-Ice Panel

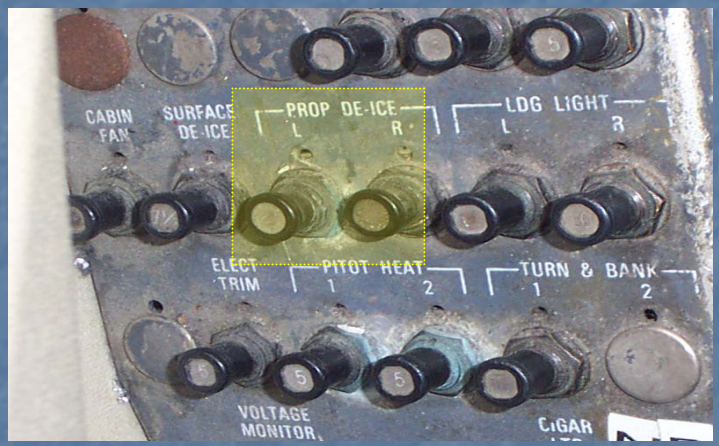
- Some of our aircraft are equipped with a Anti-Ice panel rather than an electric windshield.

Electric Windshield Anti-Ice Panel

- The system is similar to the Electric windshield in regards to its limitations and normal function.

NOTE: The ammeter WILL NOT show a 50 amp draw when the Panel is operational. Proper function can be checked by observing the green "windshield" annunciator illuminating or a slight change in charge or discharge rate when the Voltammeter is placed in the BATT position.

Propeller De-Ice System



First of all: Which is it???

- It is an *Anti-Ice* system, to be turned on whenever flight through visible moisture at or below 40° F (4.4° C), is anticipated.

Propeller De-Ice System

PROPELLER DEICE SYSTEM

SECTION 1 – GENERAL

This supplement provides information which must be observed when operating the propeller deice system.

Description

The propeller deice system consists of electrically heated boots on the propeller blades. Each boot consists of an inboard and outboard heating element, which receive their electrical power through a deice timer. To reduce power drain and maintain propeller balance, the timer directs current to the propeller boots in cycles between elements and between propellers.

The timer directs current to the propeller boots in cycles between boot elements and between propellers in the following sequence:

Heating Period No. 1 - Outboard Halves - right engine blades.
Heating Period No. 2 - Inboard Halves - right engine blades.
Heating Period No. 3 - Outboard Halves - left engine blades.
Heating Period No. 4 - Inboard Halves - left engine blades.

Each heating period lasts approximately 20 seconds.

A reading below the green arc on the propeller deice ammeter indicates that the blades of the propeller are not being deiced uniformly.

WARNING

When uneven deicing of the propeller blades is indicated, it is imperative that the deice system be turned OFF. Uneven deicing of the blades can result in propeller unbalance and engine failure.

Abnormal operation of the propeller deice system is indicated by the deice switch breaker tripping to the OFF position. Failure of the switch breaker to stay reset indicates that deicing is impossible for the propellers.

SECTION 2 – LIMITATIONS

Not Applicable.

SECTION 3 – EMERGENCY PROCEDURES

A. If uneven deicing of propeller blades is indicated by excessive vibration:
   1. Propellers - EXERCISE to MAX RPM.
   2. Propeller Ammeter - CHECK for proper operation by periodic fluctuations within the green arc.
   3. If ammeter reading for both propellers is below the green arc, indicating the propeller blades may not be deicing uniformly:
      a. Propeller Deice Switch - OFF.
   4. If ammeter reading for either propeller is below the green arc, indicating the propeller blades may not be deicing uniformly:
      a. PROP DEICE Circuit Breaker - PULL L or R circuit breaker as required.

CAUTION

Do not operate propeller deice system for prolonged periods when propellers are not turning.

SECTION 4 – NORMAL PROCEDURES

A. Preflight Inspection
   1. Propeller Heating Elements - CHECK condition and attachment.
B. Before Takeoff
   1. Propeller Deice Switch - ON momentarily. Check propeller ammeter.
C. Inflight
   1. Propeller Deice Switch - ON before entering visible moisture with outside air temperature below 4.4°C (40°F).

NOTE

Energizing the propeller deice system early in icing conditions will prevent ice build up which will be thrown off and can chip the fuselage paint.

   2. Leave icing conditions as soon as possible if airplane is not equipped for flight in icing conditions.

NOTE

Since propeller deice boots alone do not provide adequate protection for the entire airplane, icing conditions should be avoided whenever possible unless the airplane is equipped for flight in icing conditions. Refer to Flight In Icing Conditions supplement for details. If icing is encountered, close attention should be given to the pitot-static system, propellers, induction systems, wing and stabilizer leading edges and other components subject to icing.

Propeller De-Ice System (cont.)

Each prop blade has a boot on it, and underneath each boot are two heating elements:

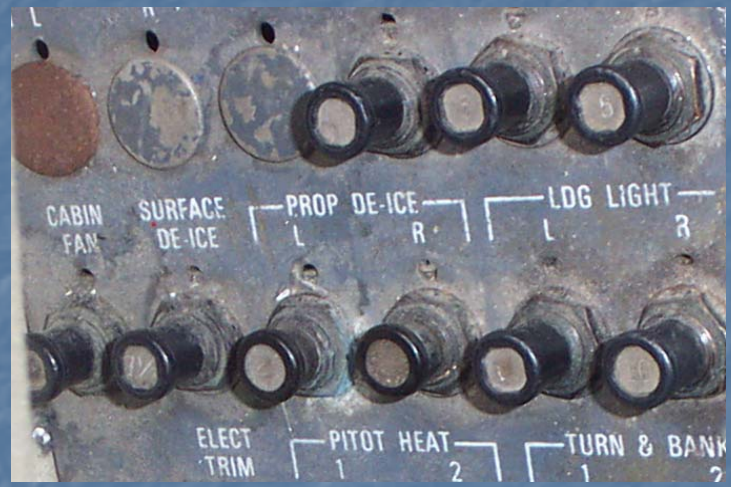
- an **outboard** (closer to the propeller tip) element.
- an **inboard** (closer to the propeller hub) element.

The system heats the four sets of elements in sequential order (the highlighted section from the AFM on the previous slide).

The outboard sections are heated first, so that the ice on the inboard sections (that may have accumulated since the last cycle) can "sling" outward by centrifugal force without getting stopped by ice on the outboard sections.

Run the system during the pre-flight (run-up) test for 80 seconds. This is long enough to observe all four cycles in their entirety.

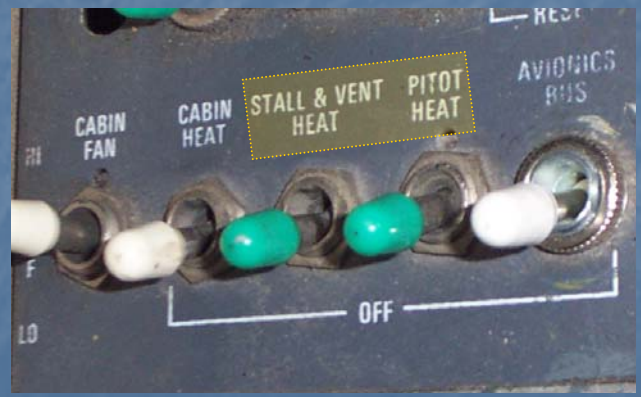
Prop De-Ice Protection Circuits



The PROP ANTI-ICE switch breaker will trip when a short is detected, shutting the system off

The PROP DE-ICE pull-type breakers can be used to isolate a faulty prop circuit, allowing you to at least keep one prop free of ice.

Pitot & Stall/Vent Heat Systems



Pitot & Stall/Vent Heat System Notes

- The Stall/Vent system heats the stall vane on the leading edge of the left wing and the *static ports* located on either side of the fuselage, towards the tail.

- The fuel tank vents are *not* heated. They are designed flush with the underside of the wing so as not to attract ice. The "vent" part of stall/vent heat is a leftover from the 402B which did have heated vents on the wing-tip tanks. Think of it as "Stall/Static Port Heat" on the 402C.

Takeoff

Make sure you have temps…

- CHT ≥ 200° F (Green Arc)
- Oil Temp. ≥ 75° F (Green Arc)
- Oil Pressure may be below Green Arc @ Idle

Takeoff Notes

- The amount of snow and slush permitted on a runway to be used for takeoff is limited to:
  - ½" slush (or standing water).
  - 3" loose packed snow (any snow that your tires would sink into).
- Pitot Heat, Stall/Vent Heat and Prop Anti-Ice should be **on** (per the flow) if flight through visible moisture ≤ 40° F (4.4° C) is anticipated.
- Advance the throttles ***slowly*** – cold oil will prevent the wastegate actuator from opening quickly, resulting in a much higher likelihood of overboost.
- Good crosswind technique is essential on a contaminated runway.

Takeoff Notes

- When departing a contaminated runway, there is an increased chance that a gear micro-switch might freeze, usually the nose gear. If you are faced with a gear down and locked light illuminated with the HYD pressure and gear unlocked lights out, be sure to run the appropriate checklist in the QRH (Page A – 5.3). Recycling the gear in an effort to clear the light in this situation is not an option as the gear down and locked light can no longer be considered accurate. It is recommended that the flight be terminated as soon as practical. In most cases, return to the point of departure is the safest course of action.

Strategies for Climbing in Ice

SECTION 5 – PERFORMANCE

A. When climbing through areas of light to moderate icing conditions, use cruise climb airspeeds and maximum climb power (full power) settings to preclude ice buildup on the fuselage undersurface and lower wing surfaces and minimize the exposure time to icing conditions.

B. During prolonged icing encounters in cruise, increase engine power to 75% or greater to maintain cruise speed as ice accumulates on the unprotected areas and preclude ice buildup on the fuselage undersurface and lower wing surfaces.

C. Prestall buffet and stall speeds increase slightly when deice boots are actuated. Maintain extra speed, especially during an approach, before actuating the boots.

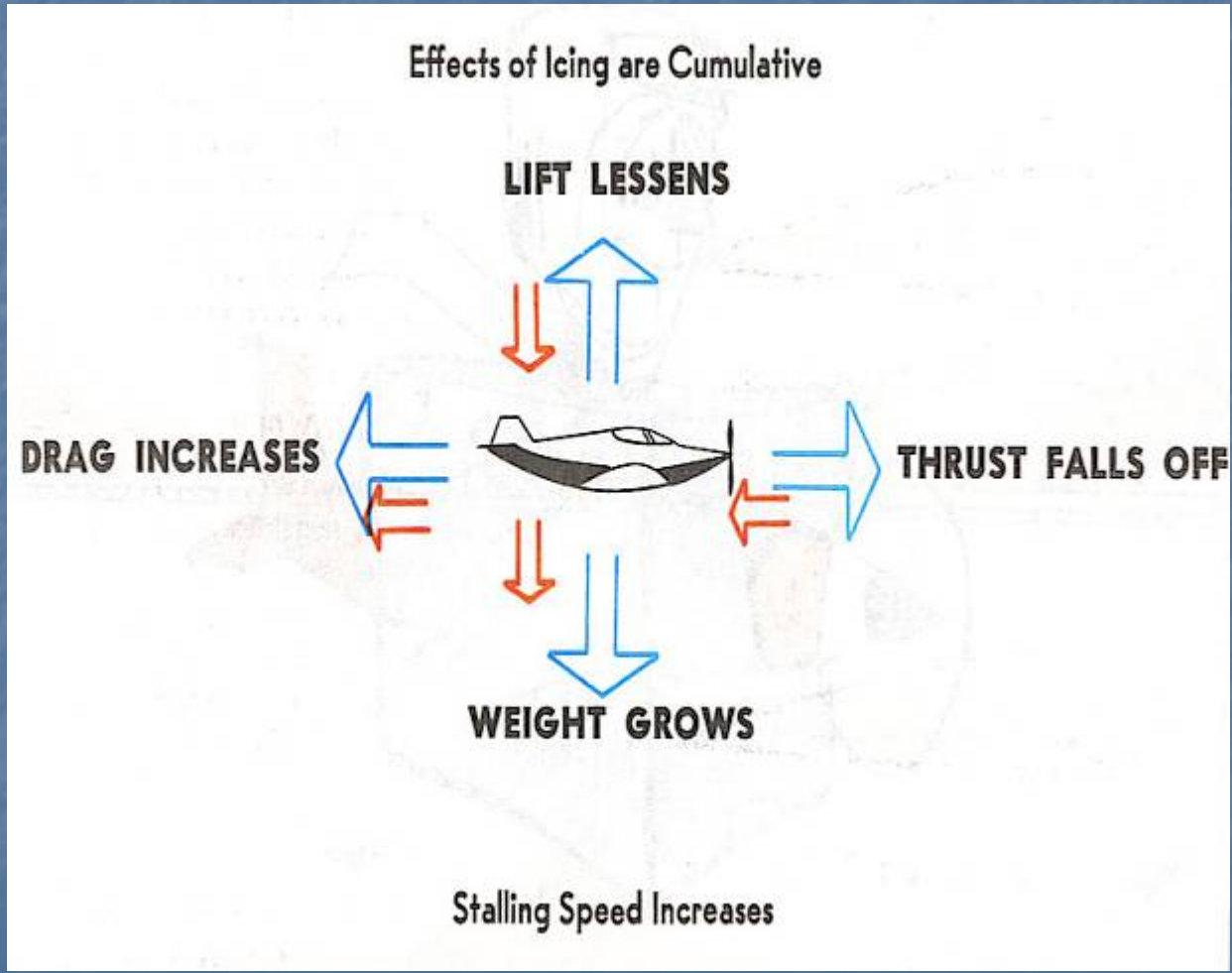
D. Maintain extra airspeed on approach to compensate for the increased prestall buffet associated with ice on the unprotected areas and the increased weight. Maintaining extra airspeed on approach will increase the landing distance.

E. Airplane general performance is decreased with ice on the unprotected areas.

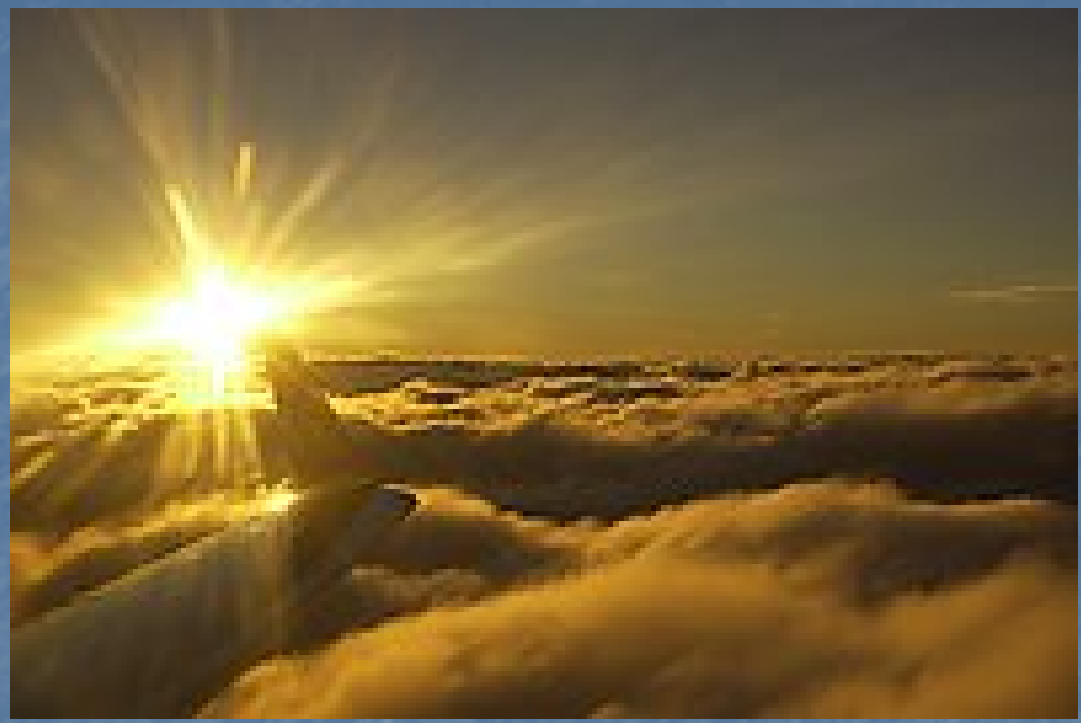
Use cruise climb airspeeds and full power to ensure a good climb rate through the icing zone. This will limit the exposure of the wing's unprotected underside to icing conditions.

Enroute

What ice does to you:



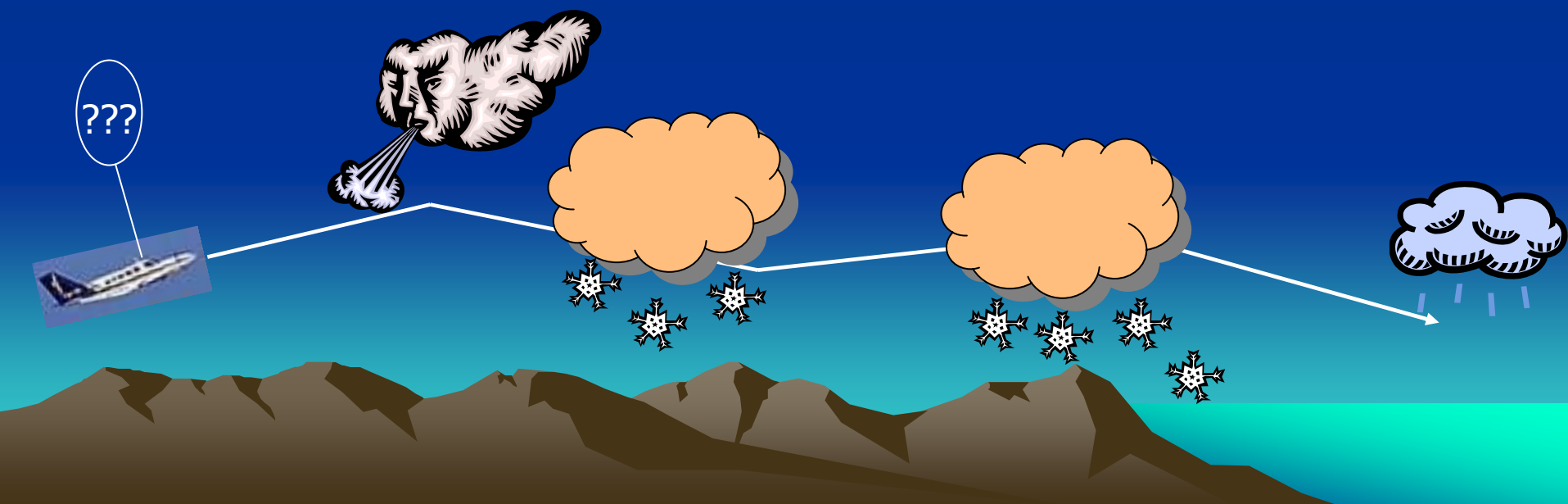
Choose altitude wisely



- This may be the view @ 6000’, while there is moderate mixed icing @ 4000’.
- Cloud top reports and temperatures aloft are essential pieces of preflight information!

Choose route wisely

- Avoid areas of high terrain. Icing caused by orographic lifting can be some of the most hazardous.
- Choose a route that allows you to select a better altitude even if it takes you out of the way. Better a 45 minute flight in the clear than a 25 minute flight fighting through the ice.



"To Climb or to Descend – That is the Question"

Factors that must be weighed:

- Most icing occurs at or slightly above the freezing level.
- What is the temperature at my altitude now? Will descending get the ice to melt? Or can I climb a short ways to get on top of this layer, or get to a temperature where it's too cold to cause significant icing?
- What is the terrain like below me?
- What are the surface temperatures? Is the maritime effect a factor?
- Am I in freezing rain? There is probably an inversion and warmer air above.
- What is the distance to my destination? What if I am 20 miles out of my destination, and the cloud tops are 4000' above me?

En Route Scenario #1

You are over Plymouth (PYM) at 4000’ en route from ACK to BOS. You are picking up moderate mixed icing in stratus clouds. The tops are reported at 8000’ and the OAT at your altitude is 0° C.

Should you choose a higher or lower altitude?

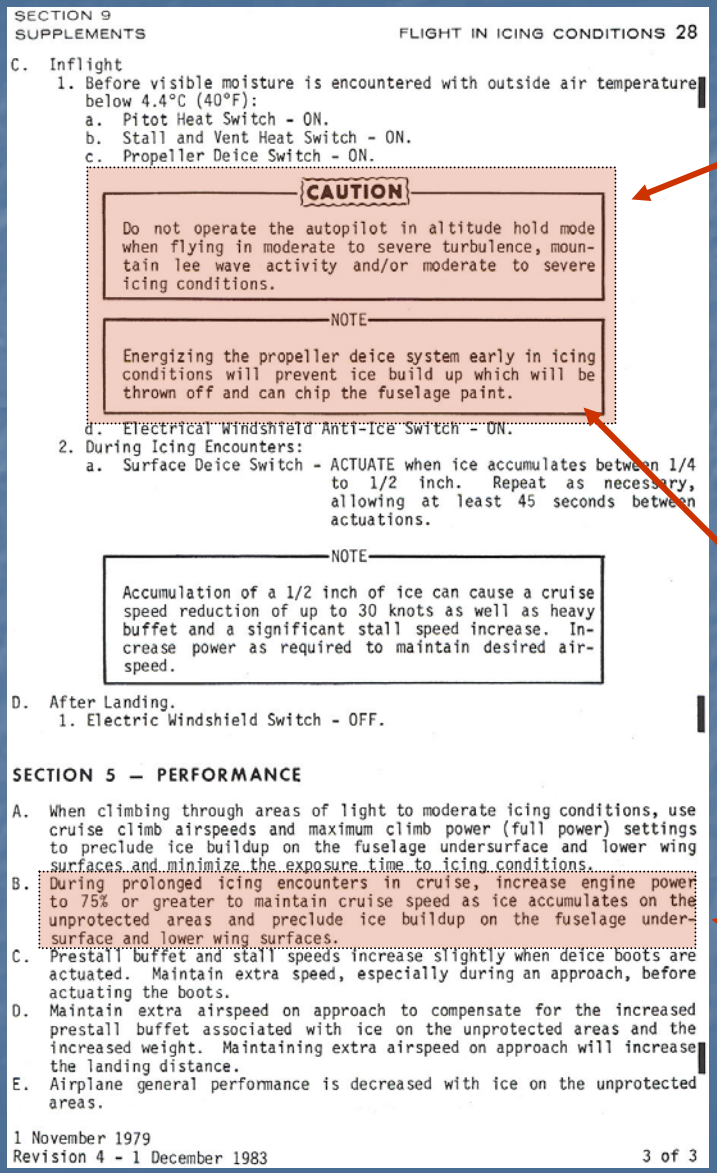
You should choose a lower altitude because the highest moisture level in clouds is usually at the top of the cloud/layer. The worst icing is right around freezing because the warmer the air is, the more moisture it can hold. If you find the OAT at your altitude right at 0°C, then going up 2000’ might not get you out of the ice unless it gets you out of the clouds. However, going down 2000’ may get you to a layer of air that’s +4°C where it’s too warm for icing.

En Route Scenario #2

While flying en route from ACK to PVD, you begin to accumulate moderate mixed icing in stratocumulus clouds at 4000', having entered IMC at 700'. The OAT at your altitude is -4° C. ATC advised that a previous aircraft had reported tops at 4700', with a second layer beginning at 5500'. 5000' is unavailable due to numerous eastbound aircraft. ATC offers you 2000' or 6000'. Based on what you know, which option should you choose?

You should choose 6000' because at that altitude the temperature would be -8°C as opposed to 0°C at 2000'. In addition, climbing would put you near the bottom of a cloud layer where there is less moisture than there would be at the top of a cloud layer.

Enroute Procedures & Strategies



SECTION 9
SUPPLEMENTS

FLIGHT IN ICING CONDITIONS 28

C. Inflight
1. Before visible moisture is encountered with outside air temperature below 4.4°C (40°F):
a. Pitot Heat Switch - ON.
b. Stall and Vent Heat Switch - ON.
c. Propeller Deice Switch - ON.

CAUTION

Do not operate the autopilot in altitude hold mode when flying in moderate to severe turbulence, mountain lee wave activity and/or moderate to severe icing conditions.

NOTE

Energizing the propeller deice system early in icing conditions will prevent ice build up which will be thrown off and can chip the fuselage paint.

d. Electrical Windshield Anti-Ice Switch - ON.
2. During Icing Encounters:
a. Surface Deice Switch - ACTUATE when ice accumulates between 1/4 to 1/2 inch. Repeat as necessary, allowing at least 45 seconds between actuations.

NOTE

Accumulation of a 1/2 inch of ice can cause a cruise speed reduction of up to 30 knots as well as heavy buffet and a significant stall speed increase. Increase power as required to maintain desired airspeed.

D. After Landing.
1. Electric Windshield Switch - OFF.

SECTION 5 — PERFORMANCE

A. When climbing through areas of light to moderate icing conditions, use cruise climb airspeeds and maximum climb power (full power) settings to preclude ice buildup on the fuselage undersurface and lower wing surfaces and minimize the exposure time to icing conditions.

B. During prolonged icing encounters in cruise, increase engine power to 75% or greater to maintain cruise speed as ice accumulates on the unprotected areas and preclude ice buildup on the fuselage undersurface and lower wing surfaces.

C. Prestall buffet and stall speeds increase slightly when deice boots are actuated. Maintain extra speed, especially during an approach, before actuating the boots.

D. Maintain extra airspeed on approach to compensate for the increased prestall buffet associated with ice on the unprotected areas and the increased weight. Maintaining extra airspeed on approach will increase the landing distance.

E. Airplane general performance is decreased with ice on the unprotected areas.

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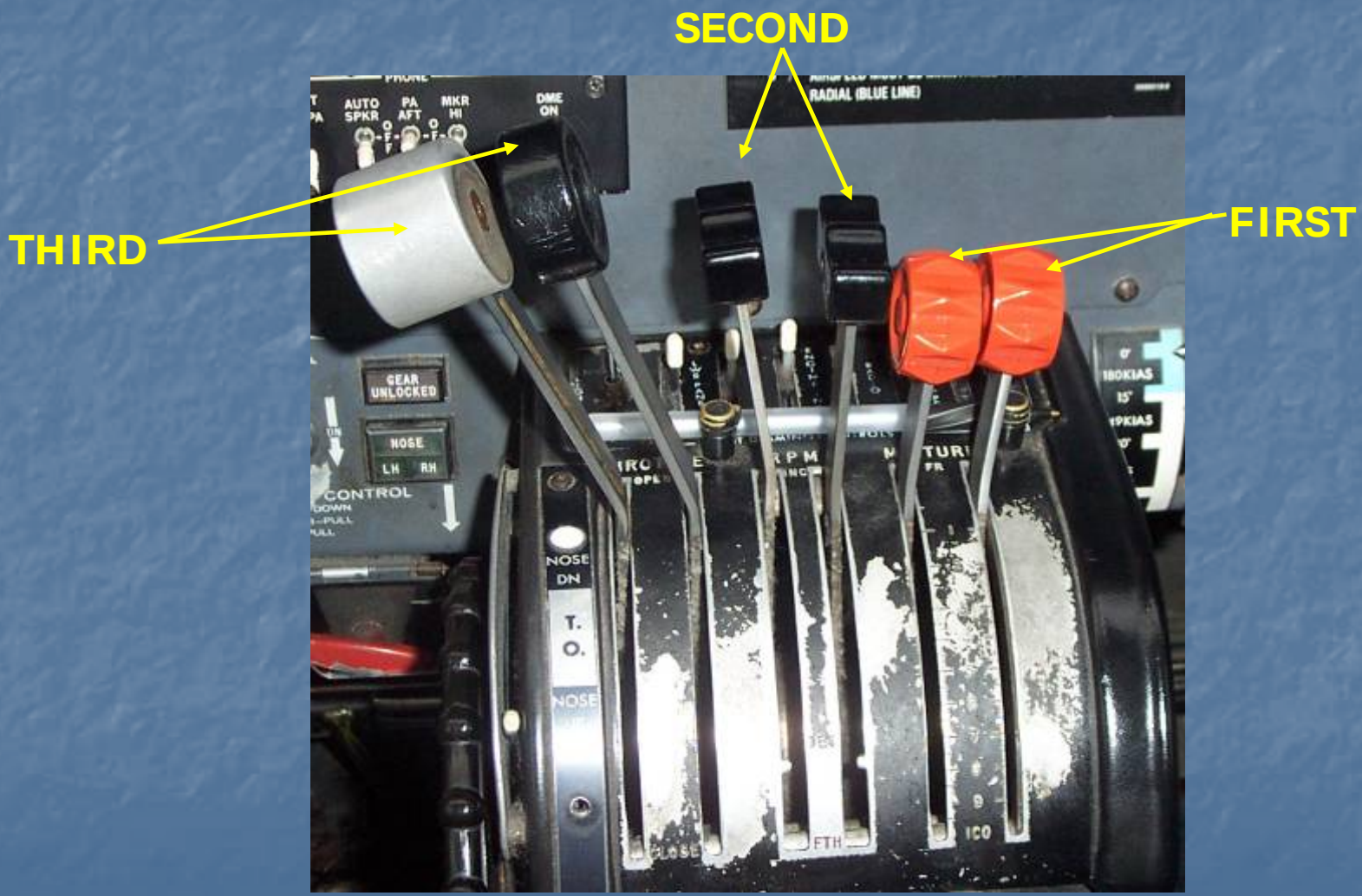
The autopilot should not be used in "moderate to severe" icing conditions because ice buildup in front of control surfaces may cause a control deflection, which the autopilot will mask by doing its best to maintain straight and level. This will occur until the autopilot can no longer counter the deflective forces that the ice is causing, and it disconnects – handing you an instant unusual attitude.

Even if the prop heat is turned on before hitting moderate icing, you will probably still hear bits of ice hitting the fuselage as ice is slung from the prop.

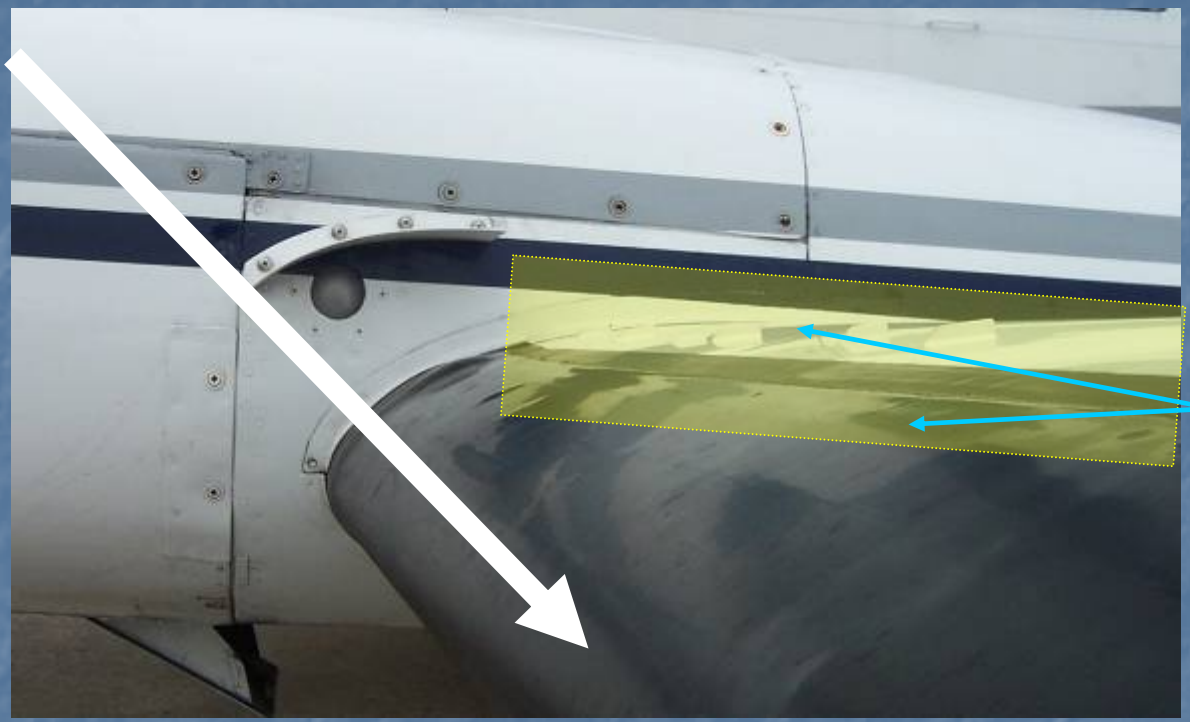
Increase the power to 75% or greater to maintain cruise airspeed in icing.

What is the correct procedure for adding power in the 402???



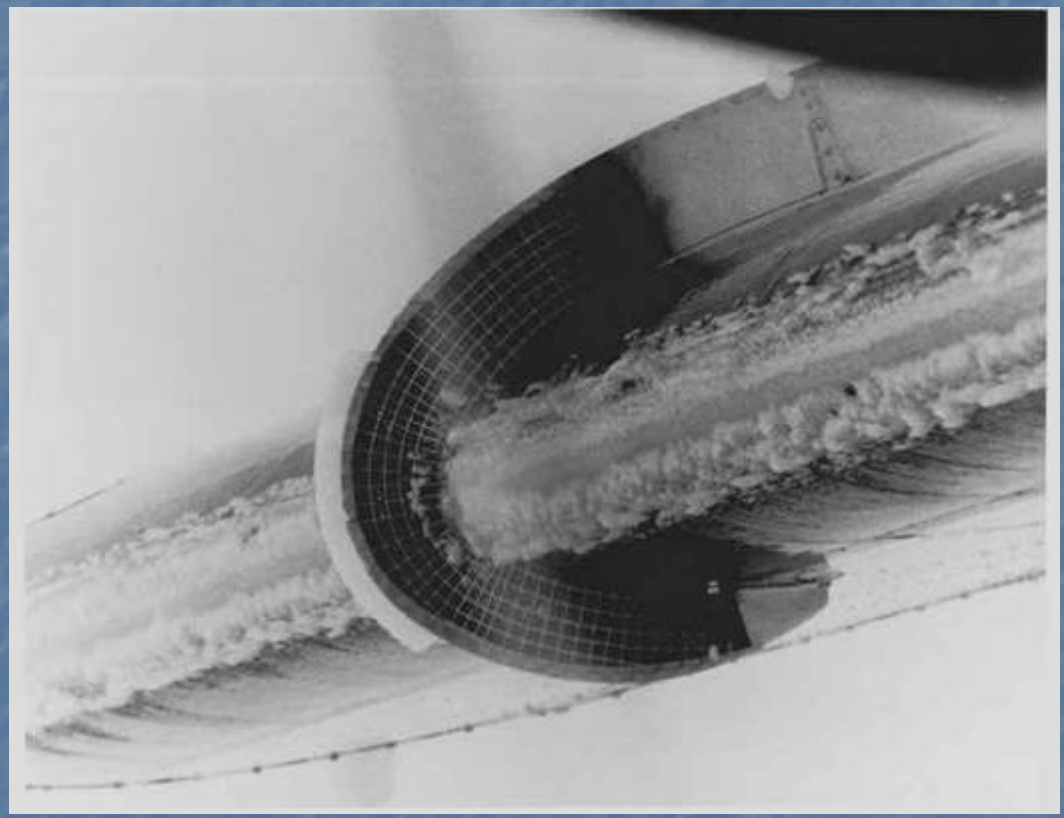
Always add power from right to left.

Night Operations



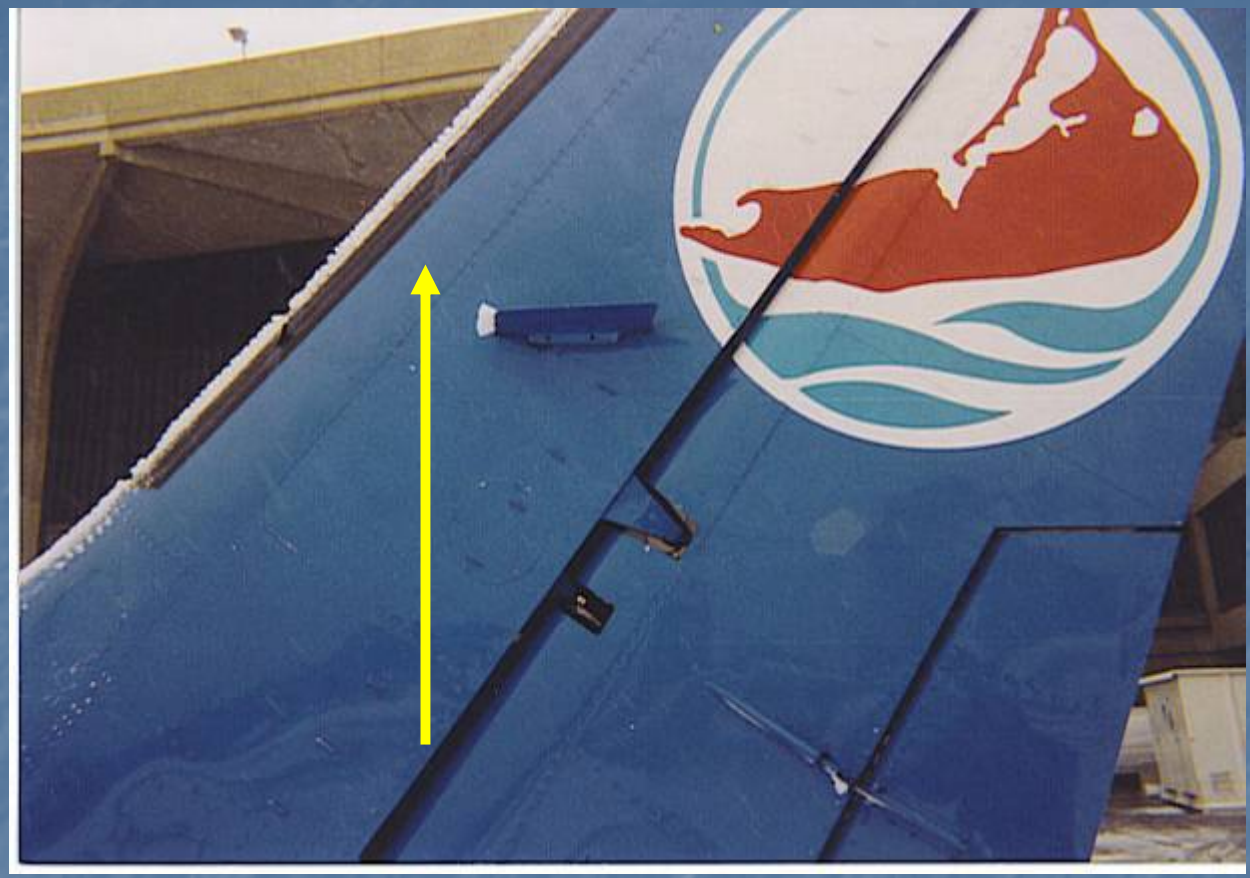
The De-Ice Light (did you check it on preflight?) illuminates the top of the boot and the VG area, but you'll need to shine a flashlight on the very leading edge to detect the first sign of ice.

Cessna calls for the boots to be activated when ¼" to ½" of ice accumulated



It's probably about time to hit the Surface De-Ice switch, wouldn't you say?

Tailplane Icing



Because of their narrower profile, tailplane surfaces will attract ice faster. Therefore, if you notice ¼" of ice on the wings, there may already be ½" or so on the tail surfaces.

Use of Autopilot

WARNING: Use of the autopilot in icing conditions may mask a control surface deflection, giving the pilot a false sense of security. Once the autopilot disengages, the pilot may be handed a serious control anomaly.

Other Enroute Notes

- Weather radar is not designed to detect snow. Dry snow, especially, will not show up reliably on your weather radar scope. Do not rely on weather radar to avoid areas of snow.
- Avoid holding in icing conditions. Holding in moderate icing conditions prolongs exposure to the ice, and can cause significant ice buildup on the underside of the wing and fuselage where it cannot be shed with de-ice equipment.
- Do not let ATC determine your fate. If you are in icing conditions that are causing you concern, let ATC know that you need to take action, and do not accept any clearances which put you in a hazardous situation.
- Turning around is ***always*** an option.

Oil Temperatures Enroute

- Oil temperatures may fall below the green arc while in cruise flight or while at an in-range power setting. This occurrence is not unusual at extreme cold temperatures and low power settings. The situation does not warrant a written discrepancy unless the oil pressure far exceeds the upper limit of the green arc as power is re-applied.

Approach and Landing

Approach and Landing Procedures and Strategies

SECTION 5 – PERFORMANCE

A. When climbing through areas of light to moderate icing conditions, use cruise climb airspeeds and maximum climb power (full power) settings to preclude ice buildup on the fuselage undersurface and lower wing surfaces and minimize the exposure time to icing conditions.

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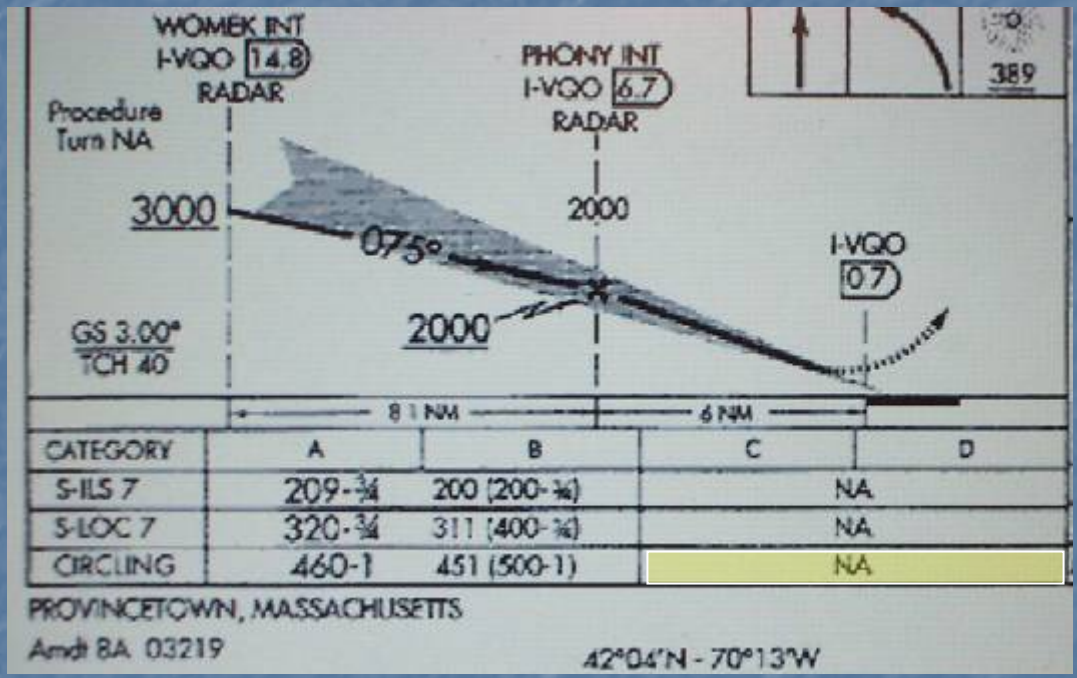
E. Airplane general performance is decreased with ice on the unprotected areas.

Balance increased approach speed with runway conditions

- Maintain a safe margin of airspeed to prevent a premature stall. This will increase your landing roll.
- If you are concerned about landing distance due to runway contamination and increased approach/landing speed – you might need to think about choosing another runway.

Circling Approaches



If circling is your only option, plan on increased ceiling and visibility requirements based on the likelihood of needing speeds greater than 120 KIAS.

Remember to look closely at the approach plate to ensure the approach is allowed.

Approach and Landing Notes

- Ice accumulation adds weight and changes the aerodynamic characteristics of the wing, thereby lowering the critical angle of attack.
- Touch down at a speed that is above landing speed in proportion to the amount of suspected airframe icing, but do not "hold it off" in a nose-high flare. Touch down in a flatter attitude.
- Brakes should be used *minimally* during landing rollout, and all turns should be made at a *slow* speed. Hitting the brakes hard or trying to make that first turnoff are surefire ways to exit the runway unintentionally.

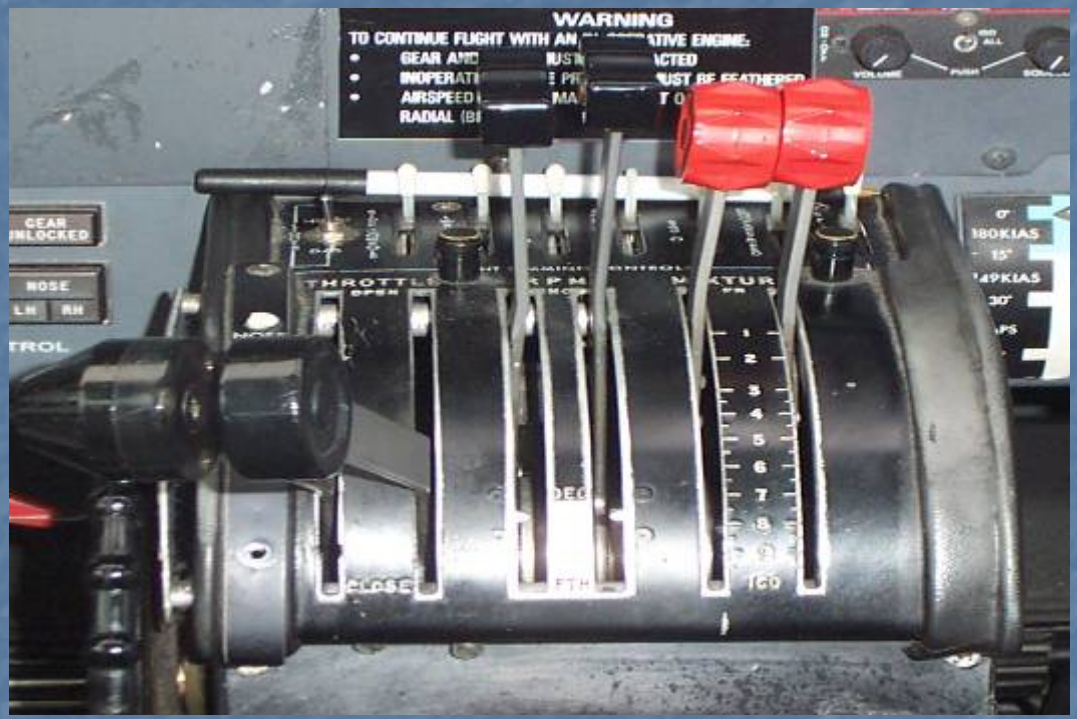
“I told you we should’ve let it roll out to the next one…”

Shutdown

Use of Parking Brake

- If you have used moderate or harder braking in slushy or snowy conditions, do not set the parking brake. Use wheel chocks instead. The snow or slush melted by hard braking may refreeze, causing the calipers to freeze shut if they are held by the parking brake.

Throttle/Mixture Position



Leave the mixtures full rich and the throttles open just enough to allow priming just in case the cables freeze.

Cowl Flaps and cold soaking

- When the OAT (including wind chill) is below 20 °F, **CLOSE** the cowl flaps following engine shut down. Remember to open them during your before starting engine flow. Leaving the cowl flaps closed after engine start to warm the engines faster is not acceptable.
- If the aircraft is to be left outside for longer than 2 hours when the OAT (including wind chill) is below 20 °F, please contact SOC to arrange a strategy to avoid cold soaking the aircraft.

Company PIREPs

Remember, if you encounter moderate or greater icing, you must give a PIREP to SOC as soon as practical.

Time-critical hazardous weather information is an essential ingredient in maintaining a safety-oriented flying environment.

“Hello, SOC? Yeah, I’ve got a PIREP for you…”

Passenger Comfort

- Heater Operation
  - For ground operation, the fan must be on high, one of the vents and the ram air (recirculation) valve must be fully open. In flight, remember to partially or fully close the ram air inlet or the heater might not be able to overcome extreme cold at altitude.

Enjoy the Winter Season!!!