Landing Performance, OPC, and Procedures Update

Flight Operations Training Handout

Supplement to FOM Revision 2-06

Contains information on changes to:

- OPC Landing Performance Information
- Landing Procedures
- Deice and Anti-ice Procedures

October 2006

Landing Performance Information, FOM and OPC Changes

The intent of this training handout is to familiarize everyone with changes to the *FOM*, OPC, and landing procedures. This guide provides detailed information on the changes to the OPC landing performance calculations and auto brake guidance. It also covers the requirements to execute a landing that meets the planned performance criteria.

Part 121 air carriers operate under regulations that require determining planned landing performance during dispatch planning. The FAA is now directing that all turbojet operators also implement procedures to calculate actual landing performance data that reflects runway conditions at the time of arrival.

The FAA further directs that turbojet operators implement procedures that calculate landing performance with an additional 15 percent safety margin beyond the actual calculated landing distance.

OPC Landing Calculation Assumptions

The landing module in the OPC has always provided guidance regarding how much of the actual runway will be required to land and stop the aircraft. Due to the very nature of the landing maneuver, it is difficult to predict the exact amount of runway that will be used. Variables such as touchdown speed, touchdown point, actual wind at touchdown, manual braking, reverse thrust deployment techniques, and the condition of the runway surface all factor into the length of runway that is required to stop the aircraft. The OPC makes the best estimate possible using a set of assumptions, and if any of those assumptions vary during the landing maneuver, the stopping distances will also vary. It is important to note that the data presented is based on the use of auto brakes.

The new FAA directive adds an additional 15 percent to our current landing calculations [(1500 feet air distance + ground distance) x 1.15]. This addition results in longer OPC-calculated landing distances and smaller stopping margins.

For example, if the current calculated landing distance on a 10,000-foot runway [WET-GOOD, Min (2) braking] is 7750 feet, the OPC will display a stopping margin of 2250 feet.

Under the new directive of an additional 15 percent safety margin, the OPC landing distance calculation for that 10,000-foot runway would be 8913 feet, displaying a stopping margin of 1087 feet.

In this example, the new safety margin would equal 1163 feet. The 15 percent safety margin applies to all normal and non-normal configuration calculations.

All OPC landing performance calculations will include the use of reverse thrust at Detent 2 for normal landings and maximum for non-normal configurations. The OPC will also multiply any tailwind component by a factor of 1.5. In addition, it will not calculate any credit for a headwind component, thus providing more margin for safety.

OPC Landing Output Screen Changes

Figure 1 represents the original (current) Landing Output screen. The new design adds/revises some features and deletes the Minimum Maneuvering Speeds displayed in the lower right-hand block of this screen.

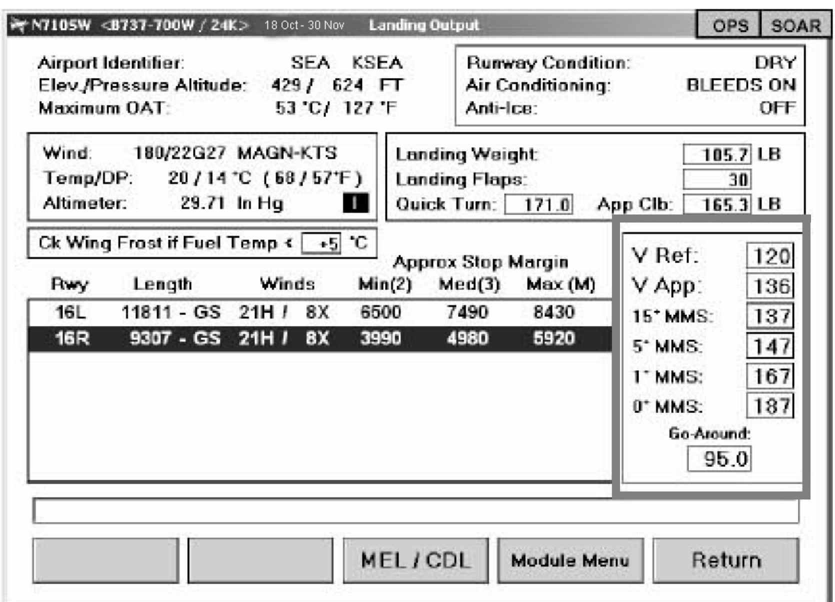

Figure 1

OPC Landing Output Screen Enhancements

- Depicts stopping margin(s) that reflect the additional 15 percent of safety margin.
- V_{APP} is renamed V_{TARGET}.
- Adds a Thrust Reverser display that will indicate:
  - Detent 2 for normal landings,
  - Maximum when a non-normal configuration has been selected,
  - and None when REVERSERS ONE OR BOTH INOPERATIVE has been selected.
- Adds the selection of AIII, displayed as either NO/YES.
- Adds the selection of RVR < 4000, displayed as either NO/YES.

Normal Landing Data

Figure 2 depicts a Landing Output screen example for a normal landing at MDW. The Runway Condition is WET-POOR and Engine Anti-Ice is ON.

Reference the two blocks at the lower right side of this screen for the following:

- In the upper block, the old V_{APP} speed nomenclature is now displayed as V_{TARGET}.
- In the lower block, note that thrust reverse defaults as Thr Rev: Detent 2. Also, HGS AIII mode and RVR < 4000 are not selected, so their display defaults to NO.

OPC-calculated landing performance at MDW and other airports with relatively short runways may be more restrictive with runway conditions less than WET-GOOD, given the added 15 percent safety pad. Depending on the weight, the data may indicate very little or a negative stopping margin. For example, Runway 31C, Max (M) setting displays a zero stopping margin.

Should a negative [bracketed] stopping margin be indicated under the Max (M) setting, landing is NOT AUTHORIZED.

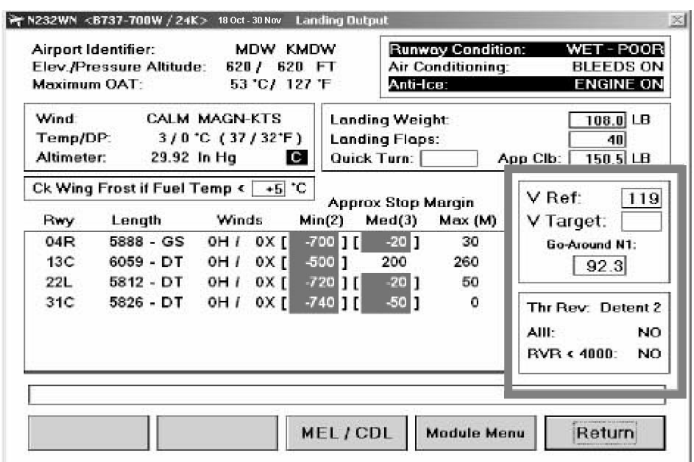

Figure 2

Figure 3 depicts a Landing Output screen example at SNA with HGS AIII mode and RVR < 4000 selected.

Looking at the lower-right block of the Landing Output screen, the Thr Rev: Detent 2 default displays, and AIII and RVR < 4000 now indicate YES. Any selection other than the default will be shown in reverse video.

Note that because the Runway Condition is WET-GOOD, and AIII and RVR < 4000 are YES, the Min(2) stopping margin is bracketed and the Information Line (IL) near the bottom of the screen displays the message for the selected runway, "Autobrakes Required. Consider alternate runway."

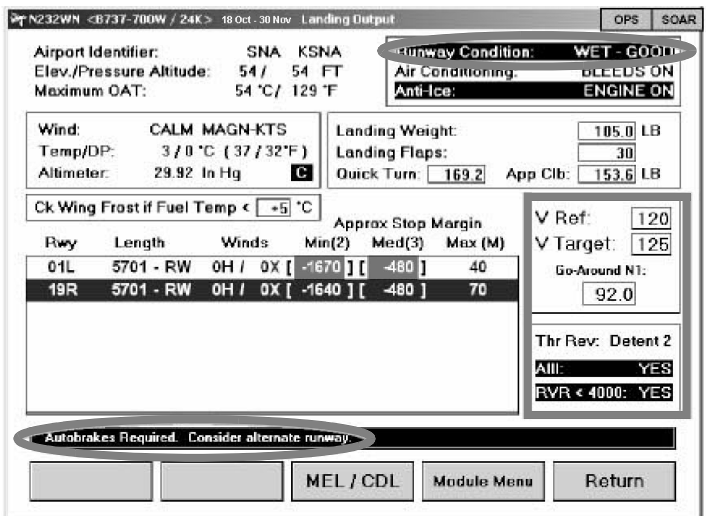

Figure 3

Non-Normal Landing Data

Figure 4 depicts a non-normal configuration landing at BDL. “Flaps: 1 OR LESS, LEDs NOT FULL EXT” has been selected.

Looking at the lower-right block of the Landing Output screen, the indication Thr Rev: Max is displayed because stopping margins for non-normal configurations are predicated on the use of maximum reverse thrust.

In this example, the Information Line (IL) also displays the message, “Brake cooling recommended prior to next takeoff.”

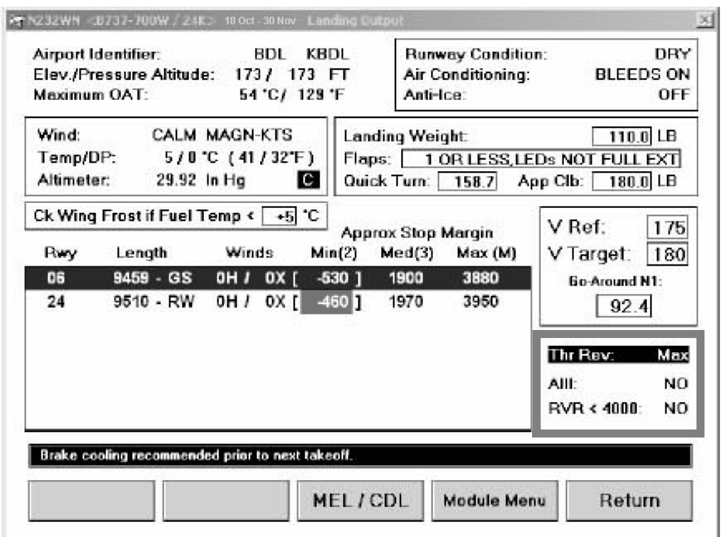

Figure 4

OPC Approximate Stopping Margins

The OPC-calculated Approximate Stopping Margin is based on, but not limited to, the following:

- Three selectable levels of auto brake decelerations rates
- 1500 feet of air distance starting 50 feet above the threshold to the touchdown point
- Touching down at V_{REF} (not V_{TARGET})

- Speedbrake deployment within 1 second of main wheel touchdown
- Thrust reverser deployment within approximately 4 seconds of main wheel touchdown
- Thrust reverser position Detent 2 maintained until 60 knots

Landing Transitions

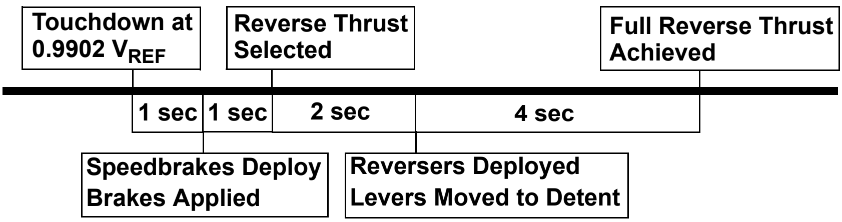

Figure 5

Factors Affecting Landing Distance

To achieve the advertised OPC landing data, the aircraft must land on target (target touchdown point) and on speed with speedbrakes and thrust reversers deployed without delay. Any excess speed, long landing, or delay in speedbrakes or reverse thrust will cause an increase in the length of runway it will require to stop the aircraft.

Touchdown

Do not float down the runway: The deceleration rate on the runway is approximately three times greater than in the air. Strive to touchdown on the 1000 foot point at V_{REF}. After the aircraft touches down, fly the nose wheel onto the runway. If the nose wheel is not promptly lowered to the runway, braking and steering capabilities are significantly degraded and drag benefits are lost. Holding the nose up after touchdown for aerodynamic braking is not an effective or authorized braking technique.

Speedbrakes

After main gear touchdown, both Pilots verify speedbrake extension. If the Captain fails to detect the automatic speedbrake deployment failure, the FO calls out “Speedbrake”; move the speedbrake lever to the UP position without delay. If speedbrakes are not raised immediately after touchdown, braking effectiveness will be reduced initially as much as 60 percent, since very little weight is on the wheels.

Thrust Reversers

The stopping margins now include the effects of reverse thrust for all Southwest B-737s unless “ONE OR BOTH REVERSERS INOPERATIVE” is selected via the OPC MEL button.

Upon landing, accomplish these normal thrust reverser deployment steps to meet calculated stopping margins:

- Thrust levers at idle
- Rapidly raise the reverse thrust levers up and aft to the interlock position
- Momentarily pause to allow the interlocks to release
- After interlocks have released, raise the reverse thrust levers to Detent 2
- Maintain Detent 2 (or maximum for non-normal configurations) until reaching 60 knots

  Note: If landing on a runway with a very large stopping margin where the ability to stop the aircraft is never in question, reverse thrust does not need to be maintained at Detent 2.

- Start reducing the reverse thrust so that the reverse thrust levers are moving down at a rate commensurate with the deceleration rate of the aircraft. The thrust levers should be positioned to reverse idle by taxi speed, then to full down after the engines have decelerated to idle.

Caution: Use care when wearing a long-sleeve shirt; the cuff may catch on the thrust levers.

It is important that the PM recognize any thrust reverser(s) malfunction or abnormality and make the new required callout, “Reverser.” During landing rollout, the PM will now call out, “60 knots.” (The 80-knot callout has been eliminated.) Boeing landing data is based on thrust reverser use until 60 knots. The 60-knot callout ensures that the PF will maintain reverse thrust (Detent 2) as needed to maximize deceleration and achieve the required stopping distance.

Note: Use maximum reverse thrust for maximum effort stops, non-normal, or emergency situations. Using wheel brakes without reverse thrust almost doubles brake energy requirements and can result in higher-than-normal brake temperatures.

When the reversers are selected inoperative in the OPC, the -700 landing data assumes high idle for the first 5 seconds after touchdown and then transitions to ground idle for the remainder of the rollout. The -300/-500 landing data assumes that the engines are at high idle for the entire ground roll. Do not allow engines to become unspooled before applying reverse thrust since this will add to the required rollout distance.

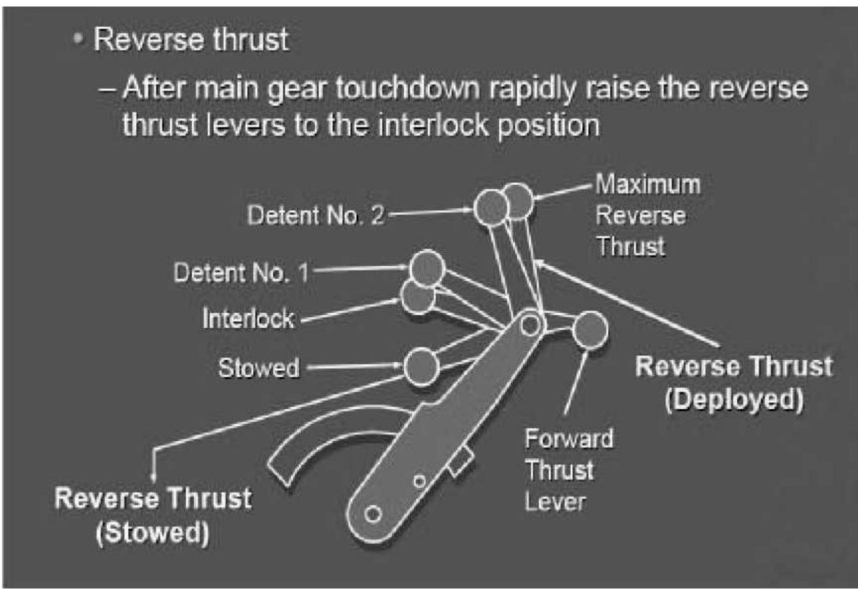

Figure 6

Braking

Use an appropriate auto brake setting when required. Anytime stopping distance becomes a concern, maximum possible deceleration can be achieved by immediately applying maximum manual wheel braking and maximum reverse thrust.

When using the auto brake system, transition to manual wheel braking at approximately 80 knots, or closer to a safe taxi speed under slippery conditions. Apply brake pedal pressure to override the auto brake system and achieve the same (or greater) deceleration rate. The higher the level of auto brakes selection, the more aggressive the override attempt must be to disarm the system and achieve a comparable deceleration rate. The -700 requires a significantly greater override pedal pressure than the -300/-500. Whenever the Auto Brake Disarm light illuminates, the PM calls out "auto brake disarm." If the Auto Brake Disarm light illuminates prior to transitioning to manual braking, the PF should immediately apply manual wheel braking. If required, apply maximum manual wheel braking.

Maximum Effort Stop

Use this technique under adverse landing conditions or whenever the Max (M) stopping margin is limited. Remember, you can always go around until the thrust reverse levers are raised, so when landing with a small stopping margin and things aren't right—go around.

- Use Flaps 40.
- Maintain a stabilized approach, and touchdown at V_{REF} as close to 1000 feet from the usable end of the runway as possible.
- Verify Speedbrake extension—Manually raise speedbrakes if they do not extend automatically.
- Use Auto Brakes set on Max and maximum reverse thrust (past Detent 2). If at anytime during landing rollout stopping distance is not assured, immediately apply maximum manual wheel braking to assure deceleration to a safe taxi speed within the remaining runway.
- Maintain maximum reverse thrust to assure deceleration to a safe taxi speed within the remaining runway.

Landing on Slippery Runways

When landing on runways contaminated with ice, snow, slush, or standing water, the most recent reported braking action must be taken into account. For a combination report, enter the lowest/worst case condition (for example, if reported FAIR to POOR, use POOR).

Pilots should keep in mind that slippery/contaminated runway advisory information is based on an assumption of uniform conditions over the entire runway. This means a uniform depth for slush/standing water on a contaminated runway, or a fixed braking coefficient on a slippery runway. The data cannot cover all possible combinations and does not consider factors such as rubber deposits or heavily painted surfaces near the end of most runways.

Friction Measurements

Ground friction vehicles used to determine runway friction measurements often provide unreliable readings when measurements are taken with standing water, slush, or snow on the runway. These vehicles might not hydroplane when taking a measurement, yet under the same conditions an aircraft may hydroplane. In this case, the ground friction vehicles would provide an optimistic reading of the runway's friction capability. Conversely, a ground friction vehicle might hydroplane when an aircraft would not, which would provide an overly pessimistic reading.

In addition, ground vehicles measure the friction of the runway at a specific time and location. The actual runway coefficient of friction may vary with changing atmospheric conditions such as temperature, precipitation, etc. Also, the runway condition changes as more aircraft operations are performed.

Until further data and guidance is developed by the industry, no known correlation has been established between MU values and braking action report definitions. On occasion, braking action reports may not be available (such as after a period of runway inactivity due to the lack of overnight operations and/or runway clearing operations). Accordingly, only in the absence of other reliable braking action information should Pilots rely on runway friction measurement device reports when determining if the runway is suitable for a safe landing.

Crosswind Directional Control On Slippery Runways (Reverse Thrust)

Reverse Thrust and Crosswind (All Engines)

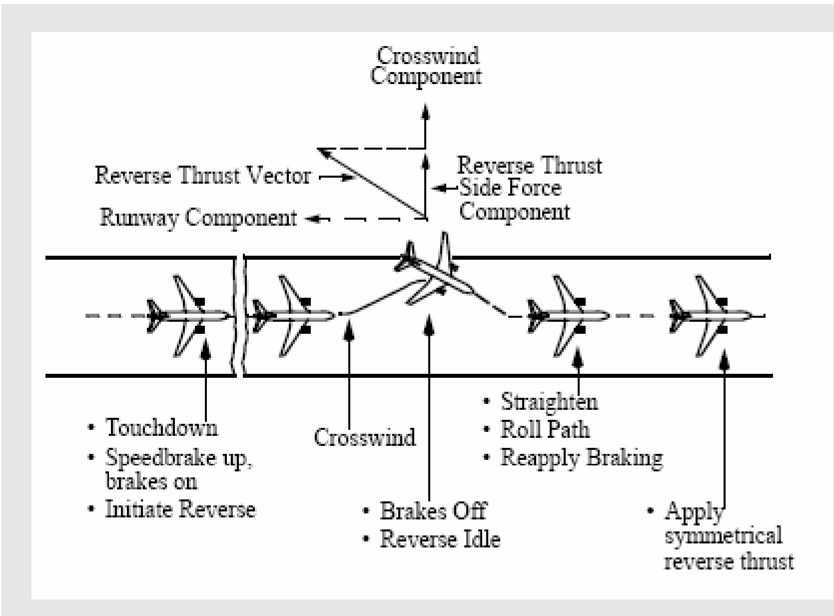

Figure 7

Figure 7 illustrates a directional control problem during a landing rollout on a slippery runway with a crosswind. As the aircraft starts to weathervane into the wind, the reverse thrust side force component adds to the crosswind component and drifts the aircraft to the downwind side of the runway. Main gear tire cornering forces available to counteract this drift are at a minimum when the antiskid system is operating at maximum braking effectiveness for the existing conditions.

To correct back to the centerline, reduce reverse thrust to reverse idle and release the brakes. This minimizes the reverse thrust side force component without the cornering forces for realignment with the runway centerline. Use rudder pedal steering and differential braking as required to prevent overcorrecting past the runway centerline. When re-established near the runway centerline, apply maximum braking and symmetrical reverse thrust to stop the aircraft.

Deicing/Anti-Icing Procedures Changes including Operations in Light Ice Pellets or Heavy Snow

Revised Deice/Anti-Ice Card

This section of the handout will familiarize Pilots with the changes to the deice/anti-ice procedures.

Guidance on how to properly conduct a Contamination Check has been expanded. Indications of deice/anti-ice fluid failure were expanded. The recommended area of the aircraft to check for fluid failure was added. Information was also added on the importance of verifying proper altitude and airspeed indications prior to pushback and engine start, especially in icing conditions. Improper or erratic indications may indicate blocked static ports.

Southwest Airlines is now using a different Type IV fluid at ALB and PHL. Those airports have purchased bulk quantities of DOW UCAR FLIGHTGUARD AD480 fluid for all of their tenant airlines. This fluid is virtually identical to SAFEWING, and using it will save Southwest Airlines a significant amount of money.

The FAA has revised its restrictions for operations in ice pellet or heavy snow conditions. Takeoff during conditions of light ice pellets or heavy snow is now authorized with certain caveats.

Finally, the Deice/Anti-Ice Card was reformatted, and steps to shutdown and engine restart for deicing at a remote location were added.

Operations in Icing Conditions

During certain weather conditions of freezing precipitation and high winds, ice may form on the inside of static ports. The exterior inspection should include a close inspection of these areas to ensure that ice has not built up inside the static ports. As a reminder, the -700 static ports are not heated.

Warning: Erroneous or unusual altitude and/or airspeed indications may be the result of blocked static ports. Do not continue operations unless all altitude and airspeed indications are normal.

When moderate icing conditions are present during prolonged ground operations, periodic engine run-ups to as high a thrust setting as practical (80 percent N_1 is recommended) must be performed to reduce the possibility of ice buildup on the engine fan blades. These run-ups should be made at 10 minute intervals for approximately 15 seconds. Additionally, prior to brake release for takeoff, execute an engine run-up to 80 percent N_1. The Flightcrew must verify stable engine operation during this run-up, or must not attempt takeoff.

Deicing the Aircraft Prior to Flightcrew Arrival

The Stations will deice the aircraft prior to Flightcrew arrival if no additional freezing precipitation is forecast. This will provide a clean aircraft for the Flightcrew and minimize delays due to deicing requirements. It is important for the terminating Flightcrew to properly position the stabilizer. If the stabilizer is not trimmed full nose down, the Station will not deice the stabilizer, and will note this on the WN654. If the stabilizer is deiced in any other position, water/diluted deice fluid may collect and then refreeze in the stabilizer balance bays. If the stabilizer has not been deiced (as indicated by the exterior preflight and the WN654), the Flightcrew should coordinate with the Station for deicing when the stabilizer is properly positioned.

Deicing After Flightcrew Arrival

The basic procedures for deicing/anti-icing the aircraft after Flightcrew arrival have not changed. There are, however, three areas where guidance has been expanded. They are the Contamination Check, Deice/Anti-Ice Fluid Failure Recognition, and operations during light Ice Pellet or Heavy Snow conditions.

Contamination Check

A Contamination Check of the aircraft must be performed if freezing precipitation occurs after the aircraft has been deiced/anti-iced. This check must be performed within 5 minutes of takeoff. There are two locations from which to perform this check depending on whether the established holdover time has been exceeded. One is from the flightdeck; the other is from the overwing window area.

If the holdover time has not been exceeded, it is assumed that the deice/anti-ice fluid is still effective in preventing a build-up of freezing precipitation on the aircraft. The Flightcrew must still perform a Contamination Check, however. This check is done from the flightdeck and focuses on representative aircraft surfaces. If the representative surfaces are verified clean, you may take off within 5 minutes. If the representative surfaces show signs of a build-up, takeoff is not permitted and the aircraft must be deiced/anti-iced again.

If the holdover time has been exceeded, it is assumed that the deice/anti-ice fluid may have failed and may no longer be effective in preventing a build-up of freezing precipitation. In this scenario, the Captain must perform the Contamination Check of the overwing area from the passenger cabin. The Captain is responsible for checking both wings, focusing on the leading edge, the wing surface, the trailing edge (particularly flight controls), and the winglets, if applicable.

After verifying that these critical aircraft surfaces are free of contamination, the Captain must inspect for signs of deice/anti-ice failure.

Deice/Anti-Ice Fluid Failure Recognition

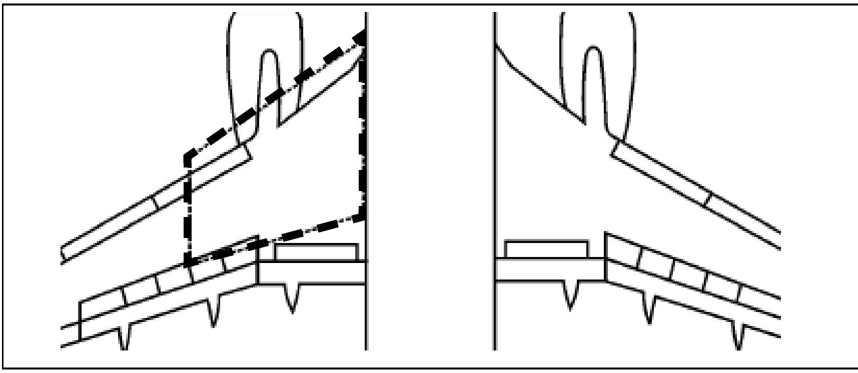

Figure 8

The Captain will inspect the Fluid Failure Recognition Area for signs of failure. This is located on the left wing root area since it is the point where the final fluid application begins, making it the oldest fluid on the aircraft.

Signs that the deice/anti-ice fluid has lost its effectiveness include:

- The wing surface changes from a smooth, translucent, glossy surface to a frost-, slush-, snow-, or ice-covered surface.
- The fluid appears to be cloudy, hazy, or ghosting.
- Straight lines are indiscernible between aircraft panels or placards on the wing surface through the fluid.
- Random snow accumulates or a graying/dulling surface appears, caused by fluid deterioration.

Light Ice Pellets or Heavy Snow

There are two weather conditions that pose exceptions to the holdover time/contamination check requirements, light ice pellets and heavy snow. The FAA previously prohibited takeoff during these weather conditions, but has recently modified their guidance to allow takeoffs under certain conditions.

- Light Ice Pellets--holdover time is set at 25 minutes. Do not take off unless:
  - The aircraft is anti-iced with undiluted Type IV fluid.
  - The intensity of the ice pellets is no greater than light.
  - There has been no other form of precipitation since the aircraft was anti-iced.
  - Takeoff is accomplished within 25 minutes of the start of the final Type IV application. If the 25 minute limit cannot be met, takeoff is not authorized and the aircraft must be deiced/anti-iced again. No Contamination Check is required since takeoff is not authorized once the 25 minute holdover time is exceeded.
- Heavy Snow--There is still no holdover time for heavy snow. Do not take off unless:
  - The aircraft is anti-iced with undiluted Type IV fluid.
  - The Captain performs a Contamination Check from the overwing area.
  - After the critical aircraft surfaces are verified clean, accomplish takeoff within 5 minutes of the Contamination Check.

Deice/Anti-Ice Card

The card has been reformatted into a dual column format similar to the Taxi Shutdown / Taxi Start checklist. The basic flow through the checklist is similar to last year's. The main difference in the new card is the addition of the steps required to shutdown and then restart the engines, if required, prior to deicing at a remote location.

Deice/Anti-ice Card

Deice / Anti-ice Plan (WN 654) .... Review
Communication with Iceman .... Establish

PRE-DEICE CHECKLIST

With Engines Shutdown

If Engine Shutdown Is Required:
APU .... Start and On Busses
Parking Brake .... Set
Start Levers .... Cutoff
Anti-ice Switches .... Off
APU Bleed .... As Required
(CA) Fuel Balance .... Manage

Configure For Deicing
Safety Zone and Jetway (if at a gate) .... Clear
Before Push Checklist .... Complete
Flaps .... _____, Green Light
Doors .... Closed, Lights Out
*APU Bleed Switch .... Off
Stab Trim .... Full Nose Down
Final Fluid Application .... Start Elapsed Timer

With Engines Operating

Configure For Deicing:
*APU .... As Required
Engine Anti-ice Switches .... On
*Engine and APU Bleed Switches .... Off
Flaps .... _____, Green Light
Stab Trim .... Full Nose Down
Thrust Levers .... Idle
Final Fluid Application .... Start Elapsed Timer

POST-DEICE CHECKLIST

*Clean Aircraft Check .... Complete
Control Column .... Cycle Three Times
Stab Trim .... ____, Set
*Engine and APU Bleed Switches (after 1 minute) .... As Required

If Engine Start Is Required

Parking Brake .... Set
Fuel .... Main Pumps On, Center Pumps On/Off, Crossfeed Closed
Packs .... Off
*Engine and APU Bleed Switches .... On
Start Engines
Accomplish the Normal After Start Flows.
(FO) Announce, "Standing By Flaps."
Accomplish the Before Taxi Checklist.

BEFORE TAXI

Electrical .... Generators On
Pitot / Probe Heat .... On
Anti-ice .... As Required
Start Switches .... Left, Continuous
Flight Controls .... Free
Start Levers .... Idle
Flaps .... ____, Green Light

CONTAMINATION CHECK

Holdover Time Exceeded Or Heavy Snow	Holdover Time Not Exceeded
Inspect wing surfaces from overwing windows within 5 minutes of takeoff. Use max illumination.	Inspect aircraft surfaces visible from the flightdeck prior to taking the runway.

(Ice Pellets and Heavy Snow-See reverse for restrictions).

If contamination is present, DO NOT TAKEOFF.
If surfaces are verified clean, takeoff within 5 minutes.

BEFORE TAKEOFF

Attendant Notification .... Complete
Transponder .... TA/RA
Packs .... As Required
Bleeds .... As Required
APU .... As Required
Recall .... Clear

ENVIRONMENTAL ICING

Reduced thrust takeoffs are not permitted.

COLD-SOAKED FUEL FROST

Use asterisk * items only.
Reduced thrust takeoffs are permitted.