Attachment 7

Operations Group Chairman's
Factual Report

DCA06MA009

Home Study Training Package

Document #3

TO: All Pilots

FROM: Flight Training Center

DATE: November 7, 2005

SUBJECT: Single Engine Taxi, Auto Brakes and More

This document is a companion to Revision 3-05 of the *Flight Operations Manual* (FOM). It is being delivered with a CD to provide additional background and reference information to help Pilots understand the new Single Engine Taxi, Auto Brake, and Deice procedures. On the CD, Pilots will find an introductory video by Bob Torti, a video of the Deice/Anti-Ice and Taxi Shutdown & Taxi Start Checklists in use, and examples of the new Checklists and performance cards being distributed at the same time. Please don't start using the new procedures until the new checklists are on the aircraft and the FOM revision has been posted.

We hope the transition to these new procedures will be as smooth as the April 2004 normal procedure changes. Towards that end we are providing many of the rationale for the various changes. If you still have questions – please call our Information Hotline at 800-447-9291 and an Instructor Pilot will answer your question.

Taxi Shutdown and Taxi Start
Procedural Considerations and Risk Mitigation

This procedure provides the opportunity to conserve fuel during extended taxi delays.

Rationale: **Operational.** Over two years have gone by since the SNORT team decided not to include a specific Taxi Shutdown/Restart procedure. Since then, the cost of fuel has soared. In addition, we are now operating out of more congested airports. That trend will, in all likelihood, increase. With fuel prices of $2.25 per gallon, we estimate savings of approximately $8,000,000 per year by shutting down an engine (or engines) for extended delays after pushback or during taxi in. After several months of operational experience, we will analyze FDAP data to help quantify how many flights are encountering delays and what percentage are shutting down one or both engines to determine actual savings.

Procedures

These procedures contain a provision to taxi out on a single engine.

Rationale: **Operational.** Many of our taxi delays present the opportunity to achieve significant fuel savings by shutting down an engine while continuing to taxi in "Conga Lines" and "Elephant Walks."

Accomplish normal pushback, engine start, and initial taxi on both engines. Do not shut down an engine until clear of the gate, ramp, alleyways, and congested areas.

Rationale: **Operational.** Following our current pushback, engine start, and initial taxi procedures will mitigate the risks associated with high breakaway thrust settings in congested areas. Even though some other carriers leave the gate on one engine and allow the First Officer to start the other during taxi, the decision was made to minimize risk by leaving the gate

area on two engines and to continue to have both Pilots involved in all engine starts. To enable both Pilots to devote their full attention to engine start and to mitigate potential taxi errors, a decision was made to accomplish the restart from a parked position.

High thrust and resulting jet blast may occur while taxiing and maneuvering. This procedure may not be appropriate in all situations.

Rationale: **Operational.** It may not always be wise to shut down an engine as soon as possible after leaving congested areas. Aircraft weight, required turns, and ramp and taxiway conditions may make it prudent to delay taxi on a single engine. For example, it may be better to keep both engines running to expedite crossing or taxiing on active runways. Good situational awareness and sound judgment will aid in deciding the best course of action.

Ramp and taxiways must be WET-GOOD or better (not authorized if contaminated, slippery, or icy).

Rationale: **Operational.** High thrust settings on one engine will introduce a turning moment away from the operating engine. Slick conditions could cause the nose wheel to lose traction and result in a loss of directional control. Rubber deposits and wet paint can exacerbate the loss of nose gear tire traction.

The APU must be fully operable.

Rationale: **Engineering, Operational, and Human Factors**. APU use provides adequate cabin and avionics cooling/heating. It provides power to the equipment cooling fan, galley power, and cabin reading lights in the classic fleet. The change standardizes next generation and classic fleet procedures and eliminates the need to imbed crossbleed starts within the Checklists. The estimated fuel savings are based on the APU running.

Three-minute engine cooling is not required for engine shutdown on taxi out.

Rationale: **Engineering**. After initial start, taxiing at or near idle power does not create hot areas in the engine and accessory sections that require cooling before the engine can be shut down.

Consider engine(s) shutdown for delays of approximately 15 minutes or longer.

Rationale: **Operational.** The collected data from Schedule Planning indicated an average taxi-out time of 10.2 minutes. Aircraft delayed longer than 15 minutes averaged about 20 minutes of delay. Over the course of a year, these delays amounted to 2,500,000 gallons of fuel that could potentially be saved during taxi out.

Single engine taxi is permitted for runway crossings.

Rationale: **Operational.** Once the aircraft has forward momentum, crossing runways is relatively benign. As previously mentioned, some situations may require you to keep both engines running until crossing active runways to minimize thrust required and facilitate an expedited crossing at busy airports.

If in a line of aircraft shut down the number one engine and continue the taxi out.

Rationale: **Engineering and Operational.** Leaving the number two engine running on classic aircraft allows for maximum heating and cooling in the passenger cabin. Shutting down the same engine on both classic and next generation aircraft promotes standardization.

Maintain situational awareness and manage single engine thrust based on proximity of other aircraft, slope, turning radius, and taxi conditions.

Rationale: **Operational.** Excessive thrust can result in damage to ground equipment, other aircraft, and personnel. In addition, distraction, confusion, or rushing can lead to improper aircraft system configuration, taxiway excursion, or conflict with another aircraft.

When a parking area is available and a lengthy delay is anticipated, shut down both engines.

Rationale: **Operational** This best practice maximizes fuel savings by shutting down both engines when prolonged delays are encountered.

Re-compute takeoff performance and update the FMC route as necessary.

Rationale: **Engineering and Operational.** Ambient conditions and the departure runway often change following delays. Ensure that OPC performance data and the FMC route accurately reflect departure conditions and routing.

Start engine(s) approximately 5 minutes prior to anticipated departure.

Rationale: **Operational and Human Factors.** Data collected from Check Airman line tests indicates that it takes about 2 minutes to accomplish Checklists and complete an engine start. By allowing 5 minutes, you can comfortably restart the engine and not be distracted or feel rushed. During this time, the perception will be that you are losing position in the line, but in actuality you will only be two or three aircraft lengths behind.

Checklists

The Taxi Shutdown and Taxi Start Checklist card was designed to be the sole tool that leads the Crew through the various shut down and restart possibilities.

Rationale: **Human Factors.** Simulator testing revealed that Crews had difficulty knowing when to refer back to the Normal Checklist card after restarting engines.

The Checklists are read and done.

Rationale: **Operational and Human Factors**. Testing revealed that following Supplementary Normal Procedures and QRH conventions minimized risks and was the easiest to use. In addition to starting and bussing the APU and shutting down the number one engine, accomplishing the remainder of the Checklists with brakes set minimizes risks associated with distractions.

The FO reads each Checklist item, and the appropriate Pilot accomplishes the action. The first two steps of the "Single Engine Shutdown" Checklist and the first step of the "Dual Engine Shutdown" Checklist may be accomplished while moving. However, the entire Checklist must be completed with the aircraft stopped and the parking brake set.

Reposition switches only as directed in the Taxi Shutdown Checklist.

Rationale: **Engineering, Operational, and Human Factors.** The intent is to minimize Checklist steps needed to restart engines and resume taxi. This minimizes error and distraction. Do not accomplish "Flaps Up" flows. Leave flaps, transponder, start switches,

flight/ground switch, window and probe/pitot heat as previously configured. Engine ignition is deactivated with the start levers in cutoff.

Pressure bumps will be negligible if the flight/ground switch is left (in flight) and will prevent an annoying bump after takeoff if the switch is out of position. There is no danger to personnel from probe/pitot heat when away from the gate. Finally, there is no engineering need to turn off electric hydraulic pumps or window heat. The consequences could be more severe if these switches were left off or incorrectly positioned for takeoff. Following the Taxi Shutdown/Restart Checklists will direct appropriate configuration of affected systems.

These Checklists are designed for three taxi out scenarios:

1. Shut down number one engine and continue to taxi with number two running. Restart number one, taxi, and takeoff.

2. Shut down number one, and then shut down number two. Restart both engines, taxi, and takeoff.

3. Shut down both engines, restart them both, taxi, and takeoff.

Restart both engines whenever both engines have been shut down.

The Checklists do not address restarting only the number two engine to resume taxi after both engines were shutdown. Start both engines, reassess the length of delay, and shut down number one if required using the Taxi/Shutdown Checklist.

Rationale: **Operational and Human Factors.** These Checklists address almost all of the taxi/shutdown possibilities our operation faces on a recurring basis. However, we did not address the taxi out, shutdown both engines, and restart number two to resume single engine taxi. This situation will occur very rarely. Designing a Checklist to cover this scenario diverges from relatively straightforward procedures and is best done with a Checklist of its own. We may "grow" into that procedure at some time in the future. If you find yourself in that situation, start both engines using the Taxi Start Checklist, and then shut down number one if it appears you will continue to encounter a lengthy delay.

On taxi in, observe three-minute engine cooling time.

Rationale: **Engineering and Operational.** Whenever possible, allow the engines to cool 3 minutes after clearing the runway. Expensive repairs resulting from damage to the fuel nozzles, turbine blades, and hot sections of the engine will negate fuel savings with premature shutdown. In the case of a very short taxi to the gate, allow engines to cool at least 1 minute before shutdown. Schedule Planning data indicates an average taxi in time of 4 minutes, with the average delay over 3 minutes of 5.5 minutes. With almost one million yearly flights, this has the potential to save close to two million gallons of fuel.

Normally, shut down number two engine for taxi in.

Rationale: **Operational.** Follows current procedures.

AUTO BRAKES

Auto Brake use for landing is authorized.

Rationale: **Operational**. The Auto Brake system is a valuable tool for stopping the aircraft. With the retirement of the –200 fleet, there is no longer a significant difference in the Auto Brake systems installed on SWA aircraft. An analysis of brake energy absorption was performed, and we determined that intelligent use of Auto Brakes should not have an impact on brake wear.

Procedures

Auto Brakes (if operational) *must* be used when *both* the MIN stopping margin is less than 500 feet *and* the runway is not DRY.

Rationale: **Operational**. We chose the margin of 500 feet for two reasons. First, the margin ensures that the majority of braking will be accomplished, (and the aircraft at a safe taxi speed), prior to reaching the runway threshold paint markings (an area of reduced friction under WET conditions). Second, the 500 foot margin allows for the variability of Pilot technique when transitioning from Auto Brakes to manual braking, which may change the actual stopping margin. The OPC computes stopping margin based on a fixed deceleration rate maintained to a full stop on the runway. The variability is introduced because the Pilot will transition to manual braking at different speeds and will apply differing amounts of pedal pressure, which affects the deceleration rate.

We made the distinction between DRY and WET because of the friction characteristics of the runway in these conditions. On a DRY runway, the friction (stopping capability) is generally good on all portions of the runway. On a WET (WET-GOOD, FAIR or POOR) runway, the friction is reduced, especially at the end of the runway because of paint markings and rubber deposits. Using Auto Brakes on a runway with reduced braking action will ensure that braking deceleration begins immediately after touchdown. Although the Pilot may theoretically commence manual braking immediately after touchdown, in reality, most Pilots will inadvertently delay brake application. With aircraft speed at approximately 200 feet per second at touchdown, a delay of only 3 or 4 seconds will result in 600-800 feet of "wasted" runway.

> **Note: Use of Auto Brakes is not required when the MIN stopping margin is less than 500 feet and the runway is DRY or when the runway is WET and the MIN stopping margin is 500 feet or greater.**

Auto Brake use in all other situations is at the Pilot's discretion.

Rationale: **Operational and Human Factors**. The Flight Operations Department did not want to develop a cumbersome set of restrictions or guidance on Auto Brake use. We expect each Pilot to analyze the conditions for each landing and make an intelligent choice regarding Auto Brake use. In many situations, the MIN stopping margin may be significant. In these cases, it may make sense to use manual braking, delay brakes application until 80 knots, and then use light braking to slow to taxi speed. This scenario will result in brake wear reduction when compared to the use of Auto Brakes. Indiscriminate use of Auto Brakes, particularly above level 2, will increase brake wear and cost.

Conversely, in situations where the MIN stopping margin is small, it may make more sense to use Auto Brakes. Current FOM guidance requires the PF to apply brakes immediately after touchdown when the MIN margin is negative. FDAP data indicates that Pilots often apply the

brakes harder than necessary in these situations and achieve actual stopping margins in excess of MED braking. If Auto Brake level 3 were used in these situations, the system would apply brakes as required to meet the OPC predictions, and the brakes would absorb less kinetic energy.

There are some situations where it may be beneficial to use Auto Brakes. In each situation we expect the Pilot to analyze all factors and make an intelligent decision. Some examples are:

- Strong, gusty crosswinds
- A condition (engine inop) where rudder requirements may affect uniform brake application.
- Landing from a Cat III approach.
- Non-normal landing configuration with increased approach speeds.

We want our Pilots to be "in the loop," use Auto Brakes wisely, and maintain proficiency in manual braking techniques.

Use the lowest Auto Brake setting resulting in a stopping margin of 500 feet or more.

Rationale: **Operational**. As previously stated, the 500 foot margin allows for the variability of Pilot technique when transitioning from Auto Brakes to manual braking, which may change the actual stopping margin. The OPC computes stopping margin based on a fixed deceleration rate maintained to a full stop on the runway. Variability is introduced because the Pilot will transition to manual braking at different speeds and will apply differing amounts of pedal pressure, which has an effect on deceleration rate.

The OPC Landing Output screen has been modified to accommodate Auto Brake use. First, the stopping margin labels have been changed. They will now read: Min(2), Med(3), and Max(M), indicating that the old labels Min, Med, and Max equate to Auto Brake levels 2, 3, and MAX. Second, the OPC programming has been changed so that any stopping margins of less than 500 feet will be displayed in reverse video. (Negative margins will continue to have brackets as well.) Finally, when the landing runway is highlighted, the OPC will consider the runway condition and the Min(2) margin. If both triggers occur (WET and Min(2) margin less than 500 feet), the OPC will display the message "Auto Brakes Required."

If a stopping margin of 500 feet cannot be achieved with any Auto Brake setting, landing is still authorized using an Auto Brake setting of MAX as long as a positive stopping margin is indicated by the OPC. (This assumes that the Auto Brake system is operational. Manual braking is permitted if the Auto Brake system is inoperative.)

Rationale: **Operational**. We want the flexibility to land anytime the OPC computes a positive stopping margin, indicating that the landing can be safely accomplished from a stopping perspective. The Crew must analyze all factors when deciding to land under these conditions.

Use of Auto Brake level 1 is not authorized.

Rationale: **Operational and Human Factors**. The OPC is not programmed to compute level 1 stopping margins. The OPC stopping margins of MIN, MED, and MAX equate to Auto Brake levels 2,3, and Max. The "brakes on" speed with Auto Brake level 1 is approximately 80 knots because reverse thrust and aerodynamic drag provide a higher deceleration rate until the aircraft has decelerated to this speed. Therefore, most Pilots will transition to manual braking before Auto Brake application at level 1. Consequently, there is no real advantage to using this setting.

Apply brake pedal pressure to override the Auto Brake system and achieve the same (or greater) deceleration rate.

Rationale: **Operational and Human Factors**. The intent is to override, not merely disengage, the Auto Brake system. If only enough pedal pressure is applied to merely disengage the Auto Brake system, a pronounced loss of deceleration, particularly at levels 3 and Max, will occur. This loss of deceleration will negatively impact the actual stopping performance of the aircraft and will result in a noticeable lurch that negatively impacts passenger comfort.

There are three other methods of disengagement: advancing either thrust lever, stowing the speedbrake lever, and turning the Auto Brake select knob to OFF. These methods are not authorized except for thrust lever disengagement during rejected landings. Using the speed brake lever is contrary to our procedures and removes down force from the main gear. Using the select knob requires one Pilot to go head-down and reposition a switch during the landing rollout.

The –700 Auto Brake System seems to be more difficult to disengage than the classics'.

Rationale: **Engineering.** On the classic fleet, a normal amount of pedal pressure is required to override the Auto Brake system (after a 2-3 second delay). On the –700s, the brake system was redesigned to include a 2 stage pedal pressure vs. brake pressure scale. On the low end, it takes four times more pedal force for a given brake pressure change than it does on the high end. This means that the –700 requires about 87% more pedal displacement (7.1 vs. 3.8 degrees in the classics) and 44% more pedal force (43.4 lb vs. 30.8 lb in the classics) to achieve the 750 psi brake pressure necessary to affect disengagement.

The PM will monitor the AUTO BRAKE DISARM light (if Auto Brakes are used for landing). When the AUTO BRAKE DISARM light illuminates, announce, "Auto Brake disarm."

Rationale: **Operational and Human Factors**. If the disarm light illuminates prior to manual braking, a system malfunction is indicated, and the PF must immediately begin manual braking.

On a normal landing, the disarm light will illuminate shortly after the PF initiates manual braking. The callout serves as a confirmation to the PF of a successful override.

> **Note: If the disarm light illuminates after landing (before manual braking), a malfunction is indicated, and the system should be written up and deferred.**

Considerations

The use of Auto Brakes will not prevent runway "excursions."

Rationale: **Operational and Engineering.** The Auto Brake system cannot compensate for a poorly executed landing. The Pilot remains responsible for landing the aircraft no later than 1500 feet down the runway to ensure the validity of OPC calculated stopping margins. There comes a point in every landing when even maximum braking will not stop the aircraft prior to the end of the runway. In reality, Max will rarely be the recommended Auto Brake setting for landing, and if it is, there is very little margin for error. The Pilot is responsible for making the correct "Continue" vs. "Go-around" decision.

DEICING

Flaps will always be extended prior to deicing when the Pilots are present.

Rationale: **Operational**. If the aircraft is deiced at the gate with the flaps up the non-exposed areas of the leading edge devices and trailing edge flaps are not treated. Extending the flaps prior to taxi exposes the untreated areas to freezing precipitation with no holdover protection. To eliminate this situation, we will now extend the flaps prior to deicing whether the aircraft is at or off the gate. This will require the Crew to accomplish the Before Push Checklist to obtain the desired takeoff flap setting and position the flaps prior to deicing. In cases where the flaps were left at 15 because of contamination, they will remain at that position for deicing and then be repositioned when the after start flow is performed prior to the Before Taxi Checklist.

If the aircraft was deiced prior to the Pilots arriving at the aircraft, the aircraft will be deiced with the flaps retracted, and the WN 654 will be left on the flightdeck to notify the crew deicing has been performed. If precipitation is falling that requires subsequent deicing, it will be performed with flaps extended.

The deicing card has been modified to include the Before Taxi and Before Takeoff Checklists.

Rationale: **Human Factors.** There are documented cases of Crews forgetting to accomplish a required Checklist or accomplishing the wrong Checklist after deicing. We have changed the deice card to make it a sole source document to prevent these errors. When deicing is necessary, the Crew will use the deice card for all Checklists from the start of deicing to takeoff. The card is arranged to sequentially guide the Crew through the appropriate Checklists: Pre-deice, Post-deice, Before Taxi, Contamination Check, and the Before Takeoff Checklist.

The Cold Weather Terminating Checklist has been moved to the reference information area of the normal Checklist card.

Rationale: **Human Factors.** The information has previously been printed on the deice card. The deice card is a preflight document. The Cold Weather Terminating Checklist is accomplished post-flight, therefore this information is now printed on the normal procedures Checklist card, adjacent to the Shutdown Checklist.

The Cold Weather Terminating Checklist now requires the outflow valve to be left in the OPEN position for overnights.

Rationale: **Operational.** With the outflow valve closed (as previously required), airflow through the tail section of the aircraft was prevented and the aft lav and galley water lines would freeze. With the outflow valve open, the warm air can flow through the tail section and prevent this situation.

PERFORMANCE CARD

The layout and contents of the Performance card have changed.

Rationale: **Operational.** A review team determined that some of the items were seldom used, so they were eliminated; other items were pertinent and more time critical, so they were added.

A 1000 foot RVR section has been added to Takeoff Visibility Requirements. One inoperative transmissometer is permitted for 300 RVR operations (the two operative devices must meet the minimum RVR value).

Rationale: **Operational.** This change reflects our current OpSpec.

The MU scale has changed.

Rationale: **Operational.** We have adopted the ICAO MU scale values for GOOD, FAIR, POOR, and NIL. This scale eliminates the overlapping categories such as POOR to NIL,which has no corresponding OPC landing performance information. If an overlapping descriptive braking action report is given, Pilots will use the more limiting of the terms.

The "Cruise" chart has been modified.

Rationale: **Operational.** The Cruise chart now contains performance information that is valid for all temperatures of ISA +15 degrees C and colder. The chart contains data for Optimum altitudes as well as 1.3 G and 1.5 G buffet limit altitudes rounded *down* to the nearest usable flight level. The low speed and high-speed buffet margins are included for 1.3 and 1.5 G altitudes. The narrower the margin the closer the aircraft is to an absolute limit for a given weight. This information is not intended to replace the OPC but may be used to provide quick-reference for altitude capability.

QRH

The Spindle Failure scenario has been added to the Uncommanded Rudder/Yaw/Roll Checklist.

The recommended landing configuration is now Flaps 1 with a speed of Vref 40+40. A go-around is mandatory when a spindle failure is suspected (this has been added as a memory item).

Rationale: **Engineering and Operational.** The Checklist placement and configuration is conformal with the Boeing Checklist. The mandatory go-around is a Flight Operations decision. We want to minimize the risk of the remaining spindle failing at low altitude by reconfiguring and landing the aircraft with a flap setting that unloads the good spindle.

The Aborted Engine Start Checklist has been streamlined and memory items reduced.

Rationale: **Engineering.** The changes are conformal with the Boeing Checklist. The memory item reduction is the result of an effort at Boeing to eliminate unnecessary memory steps.

The MEL note for non-deferrable systems has been changed.

Rationale: **Operational.** Although the actual systems may remain non-deferrable, the lights or gauges associated with these systems may be considered inoperative and deferred, providing the provisions of the MEL are met. The current note appears inflexible in this regard. The new note will have more permissive language.

737-700 TAXI SHUTDOWN / TAXI START CHECKLIST

Use these checklists for single engine taxi or to shut down both engines for extended pretakeoff delays.

SINGLE ENGINE SHUTDOWN

Note: The first two steps of this procedure may be accomplished while taxiing or prior to performing checklist.

APU ..... Start and On Busses
Start Lever #1 ..... Cutoff
Parking Brake ..... Set
Anti-ice ..... As Required
Isolation Valve ..... Close
APU Bleed ..... On
Fuel Balance ..... Manage

DUAL ENGINE SHUTDOWN

Note: The first step of this procedure may be accomplished while taxiing or prior to performing checklist.

APU ..... Start and On Busses
Parking Brake ..... Set
Start Lever(s) ..... Cutoff
Anti-ice ..... Off
Isolation Valve ..... Open
APU Bleed ..... On
Fuel Balance ..... Manage

Use this checklist to restart one or both engines.

TAXI START

Note: Start both engines to resume taxi if both were shut down.

Parking Brake ..... Set
Fuel ..... Main Pumps On, Center Pumps On/Off, Crossfeed Closed
Passenger Signs ..... On
Pack(s) shut down engine(s) ..... Off
Isolation Valve ..... Close if starting #1 engine
Auto if starting both engines

Start Engine(s)
Accomplish Normal After Start Flows
(FO) Announce, "Standing By Flaps."

BEFORE TAXI

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

BEFORE TAKEOFF

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

737-300/-500 TAXI SHUTDOWN / TAXI START CHECKLIST

Use these checklists for single engine taxi or to shut down both engines for extended pretakeoff delays.

SINGLE ENGINE SHUTDOWN

Note: The first two steps of this procedure may be accomplished while taxiing or prior to performing checklist.

APU ..... Start and On Busses
Start Lever #1 ..... Cutoff
Parking Brake ..... Set
Anti-ice ..... As Required
Isolation Valve ..... Close
APU Bleed ..... On
Fuel Balance ..... Manage

DUAL ENGINE SHUTDOWN

Note: The first step of this procedure may be accomplished while taxiing or prior to performing checklist.

APU ..... Start and On Busses
Parking Brake ..... Set
Start Lever(s) ..... Cutoff
Anti-ice ..... Off
Left Pack ..... Off
Isolation Valve ..... Auto
APU Bleed ..... On
Fuel Balance ..... Manage

Use this checklist to restart one or both engines.

TAXI START

Note: Start both engines to resume taxi if both were shut down.

Parking Brake ..... Set
Fuel ..... Main Pumps On, Center Pumps On/Off, Crossfeed Closed
Passenger Signs ..... On
Pack(s) shut down engine(s) ..... Off
Isolation Valve ..... Close if starting #1 engine
Auto if starting both engines

Start Engine(s)
Accomplish Normal After Start Flows
(FO) Announce, "Standing By Flaps."

BEFORE TAXI

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

BEFORE TAKEOFF

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

FAA Approved Nov 1-05
S/N 1080610

Taxi Shutdown/Start Quick Reference Guide

This procedure provides the opportunity to conserve fuel during extended taxi delays. It contains a provision to taxi out on a single engine. High thrust and resulting jet blast may occur while taxiing and maneuvering. This procedure may not be appropriate in all situations.

Guidelines

Consider engine(s) shutdown for delays of approximately 15 minutes or longer.

- Accomplish normal push back, engine start, and initial taxi on both engines.
- Do not shut down an engine until clear of gate, ramp, alleyways, and congested areas.
- Braking action on ramp and taxiways must be WET-GOOD or better. Single Engine Taxi is not authorized if contaminated, slippery, or icy.
- The APU must be used for engine shutdown on taxi out.
- Three minute engine cooling not required for engine shutdown on taxi out.
- Single engine taxi permitted for runway crossings.
- Maintain situational awareness and manage single engine thrust based on proximity of other aircraft, slope, turning radius, and taxi conditions.
- If in a line of aircraft, shut down the #1 engine and continue the taxi out.
- When a parking area is available, consider shutting down both engines.
- After both engines have been shut down, always restart both engines to continue taxi for takeoff.
- The #1 engine may be shut down again if in a taxi line and the estimated time to takeoff is approximately 15 minutes or more.
- Monitor fuel requirements and balance as needed.
- Start engine(s) approximately 5 minutes prior to anticipated departure.

Checklists

Note: Reposition switches only as directed.

The taxi shutdown and taxi start checklists are:

- Read and do.
- Accomplished with the aircraft stopped and the parking brake set.
- Designed for three taxi out scenarios.
  1. Shut down #1 engine and continue to taxi with #2 running. Restart #1, taxi, and takeoff.
  2. Shut down #1, then shut down #2. Restart both engines, taxi, and takeoff.
  3. Shut down both engines, restart them both, taxi, and takeoff.

Taxi In

- Observe three minute engine cooling.
- Crossing runways permitted for single engine taxi.
- Normally shut down #2 engine for taxi in.

Deice/Anti-ice Card

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

PRE-DEICE CHECKLIST

Engines Shutdown

Safety Zone and Jetway (at a gate) ..... Clear
Before Push Checklist ..... Complete
Flaps ..... ____
Doors ..... Closed, Lights Out
*APU ..... As Required
*APU Bleed Switch ..... Off
Stab Trim ..... Full Nose Down
Start Time ..... Note

Engines Operating

*APU ..... As Required
Engine Anti-ice Switches ..... On
*Engine and APU Bleed Switches ..... Off
Flaps ..... ____
Stab Trim ..... Full Nose Down
Thrust Levers ..... Idle
Start Time ..... Note

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

Start Engines (if required).
Complete After Start Flows.
(FO) Announce, "Standing By Flaps."

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 Not Published

Inspect wing surfaces from overwing windows within 5 minutes of takeoff. Use max illumination.

Holdover Time Not Exceeded

Inspect aircraft surfaces visible from the flightdeck prior to taking the runway.

If contamination is present, do not takeoff.
If surfaces are clean, takeoff without delay.

BEFORE TAKEOFF

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

ENVIRONMENTAL ICING

Use maximum thrust takeoff after deicing/anti-icing.

COLD-SOAKED FUEL FROST

Use asterisked "*" items.
Reduced thrust takeoff permitted.

Type I Fluid Dillution Chart
(Propylene Glycol is SWA Standard)

Mixture Should be Heated to 160° - 200°F			
Freezing Point		Mixture	
ETHYLENE GLYCOL°C	PROPYLENE GLYCOL°C	GLYCOL %	WATER %
-15	-12	30	70
-19	-16	35	65
-23	-19	40	60
-29	-23	45	55
-37	-29	50	50
-43	-37	55	45
-46	-42	60	40

Type I

FAA TYPE I HOLDOVER TIME GUIDELINE

TABLE 1. FAA GUIDELINE FOR HOLDOVER TIMES SAE TYPE I FLUID MIXTURES AS A FUNCTION OF WEATHER CONDITIONS AND OUTSIDE AIR TEMPERATURE (OAT)

CAUTION: THIS TABLE IS FOR DEPARTURE PLANING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

Outside Air Temperature		Approximate Holdover Times Under Various Weather Conditions (hours: minutes)								
Degrees Celsius	Degrees Fahrenheit	Active Frost	Freezing Fog	Snow/Snow Grains			Freezing Drizzle*	Light Freezing Rain	Rain on Cold Soaked Wing**	Other‡
				Very Light**	Light **	Moderate**				
-3 and above	27 and above	0:45	0:11 - 0:17	0:18-0:22	0:11 - 0:18	0:06 - 0:11	0:09 - 0:13	0:02 - 0:05	0:02-0:05	
below -3 to –6	below 27 to 21	0:45	0:08 - 0:13	0:14-0:17	0:08 - 0:14	0:05 - 0:08	0:05 - 0:09	0:02 - 0:05	CAUTION: No holdover time guidelines exist	
below -6 to –10	below 21 to 14	0:45	0:06 - 0:10	0:11-0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:05		
below -10	below 14	0:45	0:05 - 0:09	0:07-0:08	0:04 - 0:07	0:02 - 0:04				

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
** This column is for use at temperatures above 0° C (32° F) only
‡ Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain, hail
**** TO USE THESE TIMES, THE FLUID MUST BE HEATED TO A MINIMUM TEMPERATURE OF 60°C (140°F) AT THE NOZZLE AND AT LEAST 1 LITER/M² (≈ 2 GALS/100FT²) MUST BE APPLIED TO DEICED SURFACES**
SAE Type I fluid/water mixture is selected so that the freezing point of the mixture is at least 10° C (18° F) below OAT.

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST WILL REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- **SAE TYPE I** FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2005

Type IV Safewing

TABLE 4F. FAA GUIDELINE FOR HOLDOVER TIMES CLARIANT SAFEWING MP IV 2001 TYPE IV FLUID MIXTURES AS A FUNCTION OF WEATHER CONDITIONS AND OAT

CAUTION: THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

Outside Air Temperature		Manufacturer Specific Type IV Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)						
Degrees Celsius	Degrees Fahrenheit		Active Frost	Freezing Fog	Snow/ Snow Grains	Freezing Drizzle*	Light Freezing Rain	Rain on Cold Soaked Wing**	Other‡
-3 and above	27 and above	100/0	12:00	1:20-3:20	1:00-1:55	0:55-1:55	0:40-1:00	0:15-2:00	
		75/25	5:00	1:20-2:00	0:35-1:00	0:35-1:10	0:25-0:35	0:10-1:25	
		50/50	3:00	0:15-0:40	0:10-0:20	0:10-0:20	0:05-0:15	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	12:00	0:45-1:35	0:30-0:50	***0:55-1:35	***0:30-0:45		
		75/25	5:00	0:30-1:00	0:20-0:35	**0:40-1:10	***0:20-0:30		
below -14 to -25	below 7 to -13	100/0	12:00	0:20-0:45	0:15-0:30				
below -25	below -13	100/0	**SAFEWING MP IV 2001 Type IV** fluid may be used below –25° C (-13° F) provided the freezing point of the fluid is at least 7° C (13° F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of **SAE Type I** when **SAFEWING MP IV 2001 Type IV** fluid cannot be used.						

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

* Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
** This column is for use at temperatures above 0° C (32° F) only
*** No holdover time guidelines exist for this condition below -10° C (14° F)
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, and hail

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- **SAFEWING MP IV 2001 TYPE IV** FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2005

See the *FOM*, "Supplemental Procedures: Weather Procedures: Cold Weather Operation" for Type II and Alternate Type IV charts.

 DOCUMENT # 4

****

F.O.M. REVISION 3-05 AUTOBRAKES, SINGLE ENGINE TAXI AND DEICE PROCEDURES HAVE NOT BEEN FORMALLY ISSUED AND THEREFORE ARE NOT EFFECTIVE. A NEW NORMAL CHECKLIST AND DEICE CARD DATED NOV 1 HAS BEEN PLACED PREMATURELY ON A FEW AIRCRAFT.

IF A NEW NORMAL CHECKLIST AND DEICE CARD HAS BEEN PLACED ON AN AIRCRAFT PROCEED AS FOLLOWS:

- USE THE NORMAL PROCEDURES CHECKLIST. DISREGARD THE AUTOBRAKE WORDING. ***** USE OF AUTOBRAKES IS NOT YET AUTHORIZED FOR LANDING *****

- DO NOT USE THE NEW DEICE REFERENCE CARD. ***** USE THE CHARTS AND PROCEDURES IN F.O.M. CHAPTER 4 *****

ANY QUESTIONS, PLEASE CALL YOUR DISPATCHER OR THE CHIEF PILOT ON CALL.

****

SWIFT WEATHER PACKET 11/28/05, 10:21:24Z

****

* FLIGHT-SPECIFIC WEATHER ~~PACKAGE~~
* Flight 1611, BWI - MDW
* Alternates
* T/O : NONE
* Landing : MCI/NONE
* Driftdown: NONE
*
*
* LUV: $16.43 at 11/25/2005 1:00pm EST [Down 0.00%]

****

OLD FORMAT PRIOR TO 11-29-05 ATTACHED TO RELEASES BY DISPATCH

ARRIVAL INFORMATION:

SURFACE OBSERVATIONS

SPECI KMDW 281013Z 14013KT 9SM FEW011 BKN028 OVC046 12/1
AO2 RAE09 P0001 $
SPECI KMDW 281004Z 14014KT 7SM -RA FEW013 BKN031 OVC046
RMK AO2 P0001 $
METAR KMDW 280953Z 14012KT 6SM -RA BR SCT018 BKN029 OVC0.. ../..
A2951 RMK AO2 TSB0859E51 SLP992 TS MOV NE P0027 T01220106 $
SPECI KMDW 280921Z 14015KT 7SM -TSRA FEW016 BKN034CB OVC095 12/10
A2953 RMK AO2 TSB0859 OCNL LTGCGIC N-E TS N-E MOV NE P0021 $
SPECI KMDW 280900Z 16010G20KT 3SM +TSRA BKN018CB BKN055 OVC070 13/10
A2955 RMK AO2 TSB0859 FRQ LTGICCG S-W TS S-W MOV NE P0010 $
METAR KMDW 280853Z COR 16012KT 9SM -TSRA FEW018 BKN055 BKN075 13/10
A2956 RMK AO2 RAB53 SLP009 P0000 60000 T01330100 56026 $
SPECI KMDW 280822Z 13016KT 10SM SCT020 BKN060 13/10 A2954 RMK AO2 $
METAR KMDW 280753Z 13012KT 10SM OVC020 13/10 A2956 RMK AO2 SLP008
T01280100 $
SPECI KMDW 280745Z 14013G21KT 10SM BKN020 13/10 A2957 RMK AO2 $

TERMINAL FORECASTS

TAF AMD KMDW 280920Z 280906 15012G22KT 3SM TSRA OVC015CB

Type I Fluid Dillution Chart
(Propylene Glycol is SWA Standard)

Mixture Should be Heated to 160° - 200°F			
Freezing Point		Mixture	
ETHYLENE GLYCOL°C	PROPYLENE GLYCOL°C	GLYCOL %	WATER %
-15	-12	30	70
-19	-16	35	65
-23	-19	40	60
-29	-23	45	55
-37	-29	50	50
-43	-37	55	45
-46	-42	60	40

Type I

Guideline for Holdover Times Anticipated for SAE Type I Fluid Mixtures as a Function of Weather Conditions and OAT.
CAUTION: THIS TABLE IS FOR DEPARTURE PLANING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		Approximate Holdover Times Under Various Weather Conditions (hours: minutes)								
°C	°F	Frost*	Freezing Fog	Very * Light Snow◆◆	Light * Snow◆◆	Moderate* Snow◆◆	**Freezing Drizzle	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
-3 and above	27 and above	0:45	0:11 - 0:17	0:18-0:22	0:11 - 0:18	0:06 - 0:11	0:09 - 0:13	0:02 - 0:05	0:02 - 0:05	CAUTION: No holdover time guidelines exist
below -3 to -6	below 27 to 21	0:45	0:08 - 0:13	0:14-0:17	0:08 - 0:14	0:05 - 0:08	0:05 - 0:09	0:02 - 0:05	CAUTION: Clear ice may require touch for confirmation	
below -6 to -10	below 21 to 14	0:45	0:06 - 0:10	0:11-0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:05		
below -10	below 14	0:45	0:05 - 0:09	0:07-0:08	0:04 - 0:07	0:02 - 0:04				

C = Degrees Celsius
F = Degrees Fahrenheit
OAT = Outside Air Temperature
FP = Freezing Point

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.
* During conditions that apply to aircraft protection for ACTIVE FROST
** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain, hail
◆ Snow includes snow grains
◆◆ TO USE THESE TIMES, THE FLUID MUST BE HEATED TO A MINIMUM TEMPERATURE OF 60°C (140°F) AT THE NOZZLE AND AT LEAST 1 LITER/M² (= 2 GALS/100FT²) MUST BE APPLIED TO DEICED SURFACES
SAE Type I fluid/water mixture is selected so that the FP of the mixture is at least 10 °C (18 °F) below OAT.

CAUTIONS:
- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY,
- OR JET BLAST WILL REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN
- TEMPERATURE IS LOWER THAN OAT.
- **SAE TYPE I** FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR -- AND DOES NOT PROVIDE -- PROTECTION DURING FLIGHT.

Effective: October 1, 2004

Type IV Safewing

Guideline for Holdover Times Anticipated for CLARIANT SAFEWING MP IV 2001 Type IV Fluid Mixtures as a Function of Weather Conditions and OAT
—Viscosity of Neat 100% Fluid Tested 18,000cP, 20 °C, 0.3 RPM, Spindle SC4-34/13R, 10ml fluid, 15 min.
CAUTION: THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		Manufacturer Specific Type IV Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)						
°C	°F		Frost*	Freezing Fog	Snow◆	Freezing Drizzle***	Light Freezing Rain	Rain on Cold Soaked Wing	Other‡
above 0	above 32	100/0	18:00	1:20-3:20	1:55-2:00	0:55-1:55	0:40-1:00	0:15-2:00	CAUTION: No holdover time guidelines exist
		75/25	6:00	1:20-2:00	0:50-1:25	0:35-1:10	0:25-0:35	0:10-1:25	
		50/50	4:00	0:15-0:40	0:10-0:20	0:10-0:20	0:05-0:15	CAUTION: Clear ice may require touch for confirmation	
0 to -3	32 to 27	100/0	12:00	1:20-3:20	1:00-1:55	0:55-1:55	0:40-1:00		
		75/25	5:00	1:20-2:00	0:35-1:00	0:35-1:10	0:25-0:35		
		50/50	3:00	0:15-0:40	0:10-0:20	0:10-0:20	0:05-0:15		
below -3 to -14	Below 27 to 7	100/0	12:00	0:45-1:35	0:30-0:50	**0:55-1:35	**0:30-0:45		
		75/25	5:00	0:30-1:00	0:20-0:35	**0:40-1:10	**0:20-0:30		
below -14 to -25	Below 7 to -13	100/0	12:00	0:20-0:45	0:15-0:30				
Below -25	below -13	100/0	**SAFEWING◆ MP IV 2001 Type IV** fluid may be used below –25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of **SAE Type I** when **SAFEWING◆ MP IV 2001 Type IV** fluid cannot be used.						

°C = Degrees Celsius
°F = Degrees Fahrenheit
OAT = Outside Air Temperature
VOL = Volume

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.
* During conditions that apply to aircraft protection for ACTIVE FROST
** No holdover time guidelines exist for this condition below -10 °C (14 °F)
*** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, and hail
◆ Snow includes snow grains

CAUTIONS:
- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY,
- OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN
- TEMPERATURE IS LOWER THAN OAT.
- **SAFEWING MP IV 2001 TYPE IV** FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

Effective: October 1, 2004

See FOM Supplemental Procedures: Cold Weather Operations for Type II and Alternate Type IV charts.

DEICING/ANTI-ICING

ENVIRONMENTAL ICING: **Use maximum thrust takeoff after deicing/anti-icing**
COLD-SOAKED FUEL FROST: **Use asterisk (*) items**
Reduced thrust takeoff permitted

Prior to **DEICE/ANTI-ICE**
Review Deice/Anti-ice Plan (WN654 or FOM Deice/Anti-ice Plan)
Establish Communication with Deice Designee

CHECKLIST

PRE DEICING/ANTI-ICING

Engines Shutdown		Engines Operating	
* APU	As Required	* APU	As Required
* APU Bleed Switch	OFF	Engine Anti-ice	ON
Doors	As Required	* Bleeds	OFF
Stab Trim	Full Nose Down	Stab Trim	Full Nose Down
Start Time	_____	Thrust Levers	Idle
		Start Time	_____

POST DEICING/ANTI-ICING

* Clean Aircraft Check	Complete
Control Column	Cycled Three Times
Stab Trim	_____ Set
* Bleeds, after 1 min	As Required

PRIOR TO TAXI - Accomplish **BEFORE TAXI** Checklist

Prior to Takeoff when freezing precipitation is present
Accomplish **CONTAMINATION CHECK**

Holdover Time Not Expired	Holdover Time Expired
Inspect aircraft surfaces visible from the flight-deck before taking the active runway.	Inspect wing surfaces from the overwing windows within 5 minutes of takeoff. Use maximum illumination.

If contamination is evident **Do Not Takeoff**
If surfaces are free of contamination Takeoff Without Delay

TAKEOFF LIMITATIONS

Do not takeoff under the following conditions:

- Greater than light freezing rain
- Known or probable severe icing conditions
- Braking action reported as "nil"
- A thrust reverser is inoperative and the runway is contaminated with clutter or the braking action is less than "good"

Or when runway is covered with greater than:

- 1/2 inch water or slush
- 1 inch of wet snow
- 4 inches of dry snow

COLD WEATHER TERMINATING

Stabilizer Trim 0 To 2 Units Nose Down
Outflow Valve Closed
Water Storage Containers (APU running with bleed on) Drained