COLD WEATHER

General

THE KEY TO A SAFE COLD WEATHER OPERATION IS TO ADHERE TO THE CLEAN AIRCRAFT CONCEPT; DO NOT TAKE-OFF WITH ANY ICE, FROST, SNOW OR SLEET/SLUSH ON THE UPPER SURFACE OF WING AND TAIL.

Ground Icing Conditions

Ground icing conditions are considered to exist when the Outside Air Temperature (OAT) is below +6 deg C (42 deg F), and either the difference between OAT and dewpoint temperature is less than 3 deg C (5 deg F), or visible moisture (fog, rain, drizzle, sleet, snow or ice-crystals) is present. In addition, ice can form on a 'cold-soaked' wing at temperatures well above +6 deg C (42 deg F) in conditions of high humidity or visible moisture. Be alert to rapidly changing weather conditions, as e.g. sleet or snow may not melt everywhere, or may refreeze on a 'cold-soaked' wing or horizontal tail.

When the OAT is below −25 deg C (−13 deg F), however, ice accumulation or ice-build-up will not occur, due to low humidity. Therefore icing conditions cease to exist.

Some uncommon forms of ice accumulation are discussed below:

- Thin layers of ice resulting from frost (overnighting under a clear sky and temperature just below freezing) or freezing fog may cause 'sandpaper' roughness on wings and horizontal tail surfaces. This roughness may cause deterioration of the aerodynamic properties of the wing and tail to such an extent that a safe take-off is not possible.
- When the tanks contain sufficient fuel of sub-zero temperature, as may be the case after a long flight, sleet, rain or water condensation can freeze on the wing upper surface during the groundstop or when taxiing out for take-off (even if the OAT is well above freezing), forming a smooth ice layer that may not be visible from certain angles.
  The top of this layer may appear wet, hiding the ice underneath. This form of ice may not be visible from a distance, in poor lighting conditions or at night. Absence of such contamination must be verified during the exterior inspection and prior to take-off.
- Relatively warm fuel, uplifted during a stop, may cause dry snow to melt on the wings. This melted snow can refreeze when the temperature is below freezing, forming an invisible ice layer underneath the snow. Never assume that snow will be blown off during the take-off roll.

Exterior Inspection

NOTE: A black stripe is painted on the leading edge of the outer wing. The wing inspection lights are directed towards this stripe. The purpose of this stripe is to help the cockpit crew to check for ice build up on the wings during flight. Do not use the leading edge black stripe to determine whether the wing upper surface is clean while the aircraft is on the ground.
When SBF100-51-004 is carried out, the black stripe is extended across the wing upper surface to the trailing edge. The purpose of this stripe is to help qualified personnel to detect contamination of the wing upper surface prior to take-off.

Carry out the exterior inspection as mentioned in chapter Checklists.

Additionally:
- Remove all protective covers.
- Check that the following areas are clear of ice / frost / snow or slush:
  - fuselage;
  - wings, stabilizer, elevator and all other control surfaces and surrounding areas;
  - gear and gear doors;
  - flaps, flap vanes and flap shrouds;
  - stall promoter strips and wing fences;
  - air conditioning intakes and exhausts;
  - fuel tank vents;
  - angle of attack vanes, pitot heads and static ports;
  - engine and APU intakes.
- Check engine fan rotates freely.

NOTE: 1. Water rundown following snow removal may refreeze forward of the static ports and may cause airflow disturbances and, consequently, errors in instruments and systems using static air pressure.
2. Dispatch with frost at the underside of the wing is allowed on condition that the frost layer does not extend outside the fuel tank area and its thickness does not exceed 3 mm (0.125 inch).

De-icing / anti-icing

DE-/ANTI-ICE IF ANY CONTAMINATION IS PRESENT ON THE LEADING EDGE OR UPPER SURFACE OF THE WING AND HORIZONTAL TAIL SURFACES.

For the application of de-/anti-icing fluids, refer to the applicable instructions for use from the fluid suppliers. The fluids which may be applied are published in the Fokker 100 Consumable Item List and/or Fokker 100 Service Letters.

Ensure that the least possible time elapses between de-icing and take-off. De-/anti-icing may be done with engines at idle and/or APU running. Before de-icing, switch the air conditioning packs OFF Keep engines at idle and switch APU off if not required for on ground wing leading edge heating system (if installed). When using a 'taxi-through' de-icing facility, use lowest possible engine thrust.

After the de-/anti-icing, the leading edges and upper wing surfaces should be physically (hands-on) checked for ice / frost / snow or slush. The flight crew should verify if such a check has been made This physical (hands-on) check may be replaced by the use of either on ground wing leading edge heating system (if installed) or the alternative take-off technique as specified in chapter Limitations.

After de-icing, switch the packs back ON. During taxiing out cycle the flaps fully down and up prior to setting for take-off. Check flight controls and stabilizer for full and free movement before take-off. The APU should not be started immediately following de-icing. Allow a few minutes for draining of the de-/anti-icing fluid and dissipation of the de-/anti-icing fluid vapor.

To unfreeze the engine fan apply external heat. To remove ice from the fanblades, either external heat or de-icing fluid should be used. Refer to maintenance manual for de-icing procedures. After applying de-icing fluid, the airconditioning packs should be switched ON after both engines have been started.

Hold-Over Time

Hold-over time is the estimated time that de-icing or anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow or slush on the treated aircraft surfaces. For actual hold-over times, refer to the applicable instructions of the fluid suppliers and/or possible more conservative regulations enforced by local authorities. Hold-over time is a function of such variables as ambient temperature, surface temperature, wind conditions, fluid thickness and most importantly the rate of precipitation, which adds moisture and dilutes the fluid. With continuing precipitation, in any form, hold-over time will eventually run out and ice and snow may begin to accumulate and adhere to the previously protected surfaces. The hold-over time may be shortened considerably with heavy precipitation. Also extreme winds and jet blast can degrade the protective fluid film and shorten hold-over times or, because of drying out of the fluid, can have a negative effect on the flowing off of the fluid from the wings during the take-off roll. The objective is that the hold-over time be greater than the anticipated time between anti-icing and take-off, based on existing conditions. Hold-over time begins when the last application of the anti-icing coating is started. The determination of the hold-over time to use is the responsibility of the captain.

Engine Starting

Minimum oil temperature for starting is −50 deg C. Below this temperature, the engine has to be preheated.
If the oil temperature is below −20 deg C the following start procedure is recommended:
- Motor the engine for 30 seconds.

When the engine has stopped rotating:
- Start engine.
- Check N1 indicating.
- At 20 per cent N2 or maximum attained N2 select fuel lever to OPEN.

If N1 rotation is not confirmed, abandon the start and apply external heat to unfreeze the fan. Ice can form on the fan rotor path lining causing freezing of the blade tips to the fan casing.

CAUTION: HIGH TGT'S MAY BE EXPECTED WHEN STARTING A "COLD-SOAKED" ENGINE.

Oil pressure will be slow to rise and may reach higher than normal values. If no oil pressure is indicated at idle RPM, shut the engine down and allow internal heat to warm up the oil. Do not apply thrust for taxiing until oil temperature is above −30 deg C.

If idle N2 is below normal, advance the affected thrust lever slightly to obtain normal idle speed. Monitor TGT while doing this.

Starting a "cold-soaked" engine requires a longer time until light-up and may be accompanied by white smoke from the engine exhaust during the start cycle.

At extremely low temperatures the generators may not supply steady AC power during the first minutes after starting. If this results in a generator fault, wait approximately 2 minutes before resetting.

If ground icing conditions exist (see page 1 of this subsection), select engine anti-icing ON after engine start.

On Ground Wing Leading Edge Heating (if installed, post mod SBF100-30-018)

The on ground wing leading edge heating system is automatically activated when either engine anti-icing system is switched ON. The criteria for activating the on ground wing leading edge heating system are identical to the criteria applicable for engine anti-icing. As the on ground wing leading edge heating system demands additional bleed air, it is advisable to keep the APU running when the on ground wing leading edge heating system is activated. The on ground wing leading edge heating system is deactivated automatically during take-off or manually when either engine anti-icing system is switched off.

CAUTION: DO NOT USE THE ON GROUND WING LEADING EDGE HEATING SYSTEM FOR DE-ICING PURPOSES. THE ON GROUND WING LEADING EDGE HEATING SYSTEM IS INTENDED TO BE USED IN ADDITION TO APPROVED DE- OR ANTI-ICING PROCEDURES AND IN ADHERENCE TO APPLICABLE HOLD-OVER TIMES AS REQUIRED BY NATIONAL OPERATIONAL REGULATIONS.

NOTE: After activating the on ground wing leading edge heating system by selecting either engine anti-icing to ON, the TOGA EPR target may temporarily drop approximately 0.04 EPR. The original TOGA EPR target, however, is still valid and will be displayed latest after TOGA selection for take-off, when on ground wing leading edge heating system is automatically deactivated.

Taxiing

When the aircraft was parked in snow or slush at temperatures below freezing, brake disc freezing may occur. Have the ground crew confirm that all four main wheels rotate when starting to taxi. Do not power back.

More than normal 'break-away' thrust may be required when tires have frozen to the ground.

Maintain greater than normal distance between aircraft when taxiways are slippery Taxi slowly, do not make abrupt or large steering inputs. Be prepared to use reverse thrust if brakes become ineffective.

Do not use reverse thrust to control taxi speed when taxi tracks are covered with snow or slush. Snow or slush which may be blown up, may refreeze on wings and flaps causing possible loss of lift or control problems during a subsequent take-off.

In freezing fog conditions an increase in vibration level even beyond the VIB HI alert may be observed during taxiing as a result of fan icing. To shed fan ice and operational circumstances permitting, advance thrust levers to approximately 75 N1, pause momentarily and retard

NOTE: The engine vibration may initially increase The fan should normally shed ice and vibration will reduce

Prior to take-off, a "cold-soaked" engine (first flight of the day) requires a 4-minute warm up period at low (taxi) thrust before applying take-off power.

Prior to take-off

Take-off shall not be attempted unless the pilot in command has ensured that the wings, tail, control surfaces, engine intakes and other critical surfaces of the airplane are free of ice, frost and snow, as required in chapter Limitations subsection 2.05.01.

WARNING: SMALL QUANTITIES OF ICE OR OTHER CONTAMINATION (EQUIVALENT TO MEDIUM GRID SANDPAPER) ON THE UPPER PART OF THE LEADING EDGES OF THE WING CAN CAUSE SIGNIFICANT LOSSES IN MAXIMUM LIFT AND CAN CAUSE THE AIRPLANE TO STALL AT A LOWER THAN EXPECTED ANGLE OF ATTACK. STALL SPEEDS CAN BE INCREASED BY UP TO 30 KNOTS AND DRAG CAN BE INCREASED CONSIDERABLY, RESULTING IN CONTROL PROBLEMS, WING DROP OR EVEN A COMPLETE STALL SHORTLY AFTER LIFT-OFF.
BECAUSE A CONTAMINATED WING CAN STALL BELOW THE ANGLE OF ATTACK FOR STICK SHAKER ONSET, IT IS NOT ENSURED THAT THE STICK SHAKER WILL BE ACTIVATED BEFORE THE STALL.

Take-off

- If the take-off is delayed such that the hold over time is exceeded, reinspect the wings from outside and repeat the de-/anti-icing treatment if necessary.
- Use TOGA (rated) thrust. Do not use FLEX thrust in icing conditions.
- If necessary, wing anti-icing can be preselected prior to take-off. The system will become active approximately 60 seconds after lift-off. Apply the relevant performance restrictions.
- In icing conditions and the temperature below +1 deg C (+34 deg F), the following procedure is recommended to shed possible fan ice:
  Advance the thrust levers manually to approx 75 per cent N1, pause momentarily and pull the TOGA triggers (ATS operative; with ATS inoperative set take-off thrust manually).

NOTE: The engine vibration may increase above the alert level. The fan should normally shed ice and vibration reduces.

The alternative take-off technique

This is an alternative to the normal take-off technique.

CAUTION: THIS TECHNIQUE PRESUPPOSES THE ACCOMPLISHMENT OF DE-ICING/ANTI-ICING PROCEDURES AND ADHERENCE TO APPLICABLE HOLD-OVER TIMES AS REQUIRED BY NATIONAL OPERATIONAL REGULATIONS, AND CAN BE USED IN LIEU OF A PHYSICAL (HANDS-ON) CHECK OF THE CONDITION OF THE WING AFTER DE-ICING.

When taking off in icing conditions and SUFFICIENT RUNWAY LENGTH AND OBSTACLE CLEARANCE MARGIN ARE AVAILABLE, the following technique is available to add stall margin during take-off and initial climb:

- Select the largest flapsetting that is permissible for the take-off weight / altitude / temperature conditions.
- Use TOGA thrust. Do not use FLEX thrust.
- At V_R rotate slowly (less than 3 degrees per second) to 10 degrees pitch attitude.
- When positively climbing, select gear UP.
- DO NOT EXCEED 10 DEGREES PITCH UNTIL AIRSPEED IS ABOVE V_2 + 20 kt.
- When above V_2 + 20 kt, slowly increase the pitch attitude, keeping the speed above V_2 + 20 kt.
- Retract flaps at or above V_{FR} + 20 kt.

NOTE:
1. THE AVAILABLE FIELD LENGTH SHOULD EXCEED THE TAKE-OFF DISTANCE REQUIRED BY REGULATION FOR THE ACTUAL GROSS WEIGHT BY AT LEAST 20 (TWENTY) PER CENT. Also the 20 per cent increase in take-off distance must be accounted for in the obstacle clearance analysis. WEIGHT MUST BE OFF-LOADED, IF NECESSARY, TO MEET THESE CONDITIONS.
2. Do not follow the Flight Director pitch command during rotation for take-off and initial climb if this results in exceeding the recommended maximum pitch angle of 10 degrees before reaching the speed of V_2 + 20 kt.
3. Do not engage the autopilot until leaving the AFCAS TO mode.
4. For the case of an engine failure, refer to the applicable procedure in section 7.09.01, chapter Flight Techniques, section Abnormal Operation.
5. During take-off the first indication of wing contamination will probably be airframe buffet when the pitch angle is increased above 10 degrees, followed by wing drop and lack of sufficient climb rate. DO NOT EXCEED 10 DEGREES PITCH UNTIL SPEED IS ABOVE V_2 + 20 kt.

In Flight Icing Conditions

In flight, icing conditions are present when Total Air Temperature (TAT) is below +6 deg C (+42 deg F) down to and including −25 deg C (−13 deg F) and visible moisture is present.
The use of the anti-icing systems at temperatures below −25 deg C (−13 deg F) at higher altitudes is at pilot's discretion.

Climb - Cruise - Descent

Engine anti-icing may be activated when icing conditions exist and/or following an "ICING" alert at MFDS.
The system may be switched off one minute after leaving the icing conditions or when the "ICING" alert is no longer showing.

An increase in the engine vibration level may be observed during icing conditions. The fan will normally shed any ice formation and the vibration should diminish. To assist in ice shedding (and operational circumstances permitting), disconnect ATS, quickly retard one thrust lever at a time to idle. Hold it there for approx 5 seconds and then advance the thrust lever momentarily to 85 per cent N1. This procedure will eliminate or reduce the vibration, and the thrust levers may be readjusted thereafter to their original positions and ATS reselected.

Wing and tail anti-icing systems should be activated when icing is observed. The system has been designed for continuous operation and may be used for ice shedding provided ice build up on wings does not exceed 1,5 cm / 0.5 inch. If a thicker layer has developed because of late activation, the shed ice may be ingested by the engines. If this is the case select RELIGHT ignition before activating the wing anti-icing system.

With ATS engaged, engine thrust is maintained at the level required to provide the anti-icing systems with bleed air of adequate pressure.

Approach

Before approach, wings and stabilizer must be free of ice.
If prolonged icing is encountered during descent, confirm correct engine response prior to commencing approach for landing.

During approach, with a ground OAT reported to be below −25 deg C (−13 deg F), it is not recommended to switch the anti-icing systems to ON even when TAT is increasing momentarily from below −25 deg C (−13 deg F) to above −25 deg C (−13 deg F) as this, on a "cold-soaked" wing, may result in refreezing of moisture after landing.

Landing

With landing gear down, flight idle RPM is increased to approx 70 per cent N2 (approach idle). The resulting increase in engine thrust may necessitate landing with flap 42 instead of flap 25 in low weight/low temperature conditions.

Parking

Park in a clear or sanded area and have the wheel chocks placed in position. Before shut down, idle the engines until TGT's have stabilized. This may take up to a minute, depending on the thrust level used during taxiing. To prevent brake freezing, do not use the parking brake.

If the aircraft is to be left unattended for an extended period, take the following actions:
- Install protective covers and plugs.
- Check engine intakes, melted snow / ice may refreeze.
- Drain all galleys and toilets.
- Close all doors and windows.

OPERATION ON CONTAMINATED RUNWAYS

General

Contaminated runways are defined in performance certification rules and operational rules. Although the definition may slightly differ between these rules, in general contaminated means runways covered or partly covered with a certain depth of standing water, slush, loose snow (wet, dry or powder snow), compacted snow or ice.
In addition to the above a runway may be considered contaminated in the following conditions:

- A runway with an irregular slope in length and or width will have poor drainage. While the runway may look wet, patches of water and or slush will be collected in the lower runway areas.
- A runway with an irregular/damaged surface may look wet, however water will be collected in puddles.
- A runway with a smooth/slippery surface (rubber deposits/oil) or a recently resurfaced runway covered with a thin layer of water (less than 3 mm), slush or loose snow, may have considerably reduced friction (slippery wet runways).
- In heavy rain showers even on runways with a good drainage.

The effects of these contaminants on aircraft operation are:

- A reduction in directional control due to reduced tire cornering force/reduced lateral runway friction (especially when aquaplaning).
- A degradation of braking efficiency due to reduced tire/runway friction (especially when aquaplaning).
- When taking-off from runways contaminated with water, slush or loose snow a reduction in acceleration capability due to wheel spray drag and displacement drag of the contaminant.
- Aquaplaning may occur at high ground speeds on runways covered with water, slush or wet loose snow.

In view of the above, sound judgement should be exercised when evaluating operation on a contaminated runway. The total of the individual effects and their magnitude will influence the judgement.

The magnitude of the effects of runway contamination are determined in general by :

- The contaminant type (standing water, slush, loose snow, compacted snow, ice);
- The contaminant depth;
- The runway lay out;
- The runway longitudinal and transverse slope;
- The runway surface condition and texture, grooved or non-grooved runways;
- The weather conditions (cross wind, gust, actual precipitation);
- The aircraft characteristics (tire pressure, landing gear layout, engine position);
- The aircraft configuration (flaps, reversers, autobrakes, speedbrakes).

Crosswind tends to push the aircraft to the downwind side of the runway, at the same time, as the aircraft behaves like a weather vane, causing the aircraft to yaw into the wind. In an aborted take-off as well as in landing when using reverse thrust, the combination of yaw and reverse thrust creates an additional side force which also pushes the aircraft downwind. The counteracting side force required to keep the aircraft on the centerline is provided by the tire cornering force.
On slippery runways, in aquaplaning conditions or with locked wheels, the tire cornering force is considerably reduced So when under these conditions the aircraft slides to the downwind side of the runway with the nose in the direction of the centerline (the aircraft skids), release the brakes and reduce thrust to reverse idle or even forward idle. Use rudder pedal steering to regain control, left rudder is required when left of centerline and right rudder when right of centerline to initially come parallel with the centerline. Only then reapply brakes and symmetrical reverse thrust as required to stop the aircraft. If possible return to and realign with the centerline.

Runway reports normally provide the type of contaminant, braking action and runway friction. The braking action/runway friction reports are commonly used as the guideline in the decision to operate on such a runway. It is known that these reports are not always reliable and the effect of reported braking action/runway friction may differ between aircraft type. Sound judgment should be exercised. In the take-off and approach briefing the runway characteristics, the type of contaminant, the depth of the contaminant, the braking action and the wind should be discussed.

The recommended maximum wind components for take-off and landing are:

Friction coefficient	Braking Action		Crosswind component (kt)	Tailwind component (kt)
0.40 and above	5	good	35	10
0 39 - 0.36	4	good/medium	25	10
0.35 - 0.30	3	medium	15	7
0.29 - 0.26	2	medium/poor	10	5
0.25 - 0.10	1	poor	5	0

NOTE: The windcomponents given in the above table are recommended maximum wind components. The data may be used while taxiing out for take-off or initial approach to determine the suitablility of the runway. When lined up for take-off or in the final approach, variations in winddirection and or speed may result in exceedance of these recommendations. This is acceptable provided these variations are minor.

Take-off from Contaminated Runways.

In a take-off from a contaminated runway acceleration will be reduced due to displacement and nose wheel spray drag. Do not raise the nose gear out of the slush as the increase in aircraft drag may be more than the nose wheel spray drag.

To avoid structural damage:
A take-off with 0 degrees flapsetting is not allowed if more than 25 percent of the runway surface area within the required runway length and width is covered by either:
- Standing water (s.g. 1.0) with a depth of more than 0 125 inch (3 mm).
- Slush (s.g. 0.85) with a depth of more than 0.14 inch (3.5 mm).
- Wet loose snow (s.g 0.5) with a depth of more than 0.25 inch (6 mm).
- Dry loose snow (s.g. 0 2) with a depth of more than 0.59 inch (15.0 mm).

A take-off with 8 or 15 degrees flapsetting is not allowed if more than 25 percent of the runway surface area within the required runway length and width is covered by either:
- Standing water (s g 1.0) with a depth of more than 0.5 inch (12.7 mm).
- Slush (s.g. 0.85) with a depth of more than 0.588 inch (15.0 mm).
- Wet loose snow (s.g. 0 5) with a depth of more than 1.0 inch (25.4 mm).
- Dry loose snow (s.g. 0.2) with a depth of more than 2.5 inch (63.5 mm).

Take-off may be further limited by performance requirements.

To reduce the adverse effect of contamination drag on take-off distance the largest permissible flap setting is recommended, ensuring the lowest V_1 , V_R and V_2 speeds with a consequent reduction in required take-off distance. Moreover, the engines are better shielded from possible wheel spray.

On runways contaminated with water, slush and wet loose snow, aquaplaning may occur at ground speeds close to take-off speed. This will have a positive effect on acceleration however in case of an aborted take-off it will have an adverse effect on stopping distance and directional control.

The following procedure is recommended:
- Use TOGA (rated thrust). FLEX thrust is not allowed.
- Select AUTO ignition - or for aircraft not so equipped select CONT ignition (not required for aircraft with the automatic relight system).
- If required select engine anti-icing ON.

- When taking off in slush or loose snow, delay gear retraction slightly to allow wheels and brakes to be blown free of slush or snow.

If the take-off has to be aborted:
- Apply full brakes to take advantage of the anti-skid system. Initial deceleration after brake application may be slow. Do not pump the brakes. Under all runway conditions the anti-skid system will stop the aircraft in a shorter distance than the pilot will be able to by modulating the brakes.
- Apply Max Reverse.
- If directional control problems occur, release the brakes, reduce to reverse idle or even forward idle, use rudder pedal steering to initially come parallel with the centerline. Only then, reapply brakes and symmetrical reverse thrust as required to stop the aircraft.
- Avoid large and abrupt rudder pedal or nose wheel tiller inputs as these can result in overcontrol and skidding.
- If necessary, Max Reverse may be used until standstill.

Landing on Contaminated Runways.

When landing on contaminated or slippery wet runways, whether manual or autoland, speed control is important. With the use of speedbrakes at 100 ft speed bleed off will be improved. The speed over threshold will be closer to V_{REF} and touchdown speed will be lower This will result in a shorter air distance, a positive touchdown, the best condition for wheel spin up, a shorter ground distance, and reduced chance on aquaplanning.
In crosswind and/or gusty wind conditions consider to disengage the autopilot (if engaged) immediately after nose wheel touchdown.

In case of thunderstorms and heavy rain showers it should be considered to delay the landing until weather and runway conditions improve.

The following procedure is recommended for a manual landing:
- Select AUTO ignition - or for aircraft not so equipped, select CONT ignition (not required for aircraft with the automatic relight system).
- Use flap 42 for landing.
- Use longest runway available taking into consideration runway slope and recommended maximum wind component.
- Ensure V_{REF} + 5kt + wind correction is selected before passing 500 ft RA.
- As an option select speedbrakes out at 100 ft, hold thrustlevers to cross the threshold at or close to V_{REF}.
- Over the threshold verify/reduce thrust and ensure that thrustlevers are in idle position at touchdown.
- Avoid long landings. Do not bleed off excess speed during the flare.
- Select Idle Reverse thrust symmetrically and without delay immediately after touch down (to ensure manual liftdumper extension as a back up) and lower the nose gear as soon as possible.
- After the nose gear is on the ground, apply brakes firmly and symmetrically. Initial deceleration after brake application may be slow. Do not pump the brakes. Under all runway conditions the anti skid system will stop the aircraft in a shorter distance than the pilot will be able to by modulating the brakes.
- Be prepared to select Max Reverse. If conditions require, Max Reverse may be used until standstill.
- Keep slight forward pressure on the control column to improve nose wheel steering effectiveness.
- If directional control problems occur, release the brakes, reduce to Idle Reverse or even forward idle, use rudder pedal steering to initially come parallel with the centerline. Only then, reapply brakes and symmetrical reverse thrust as required to stop the aircraft.
- Avoid large and abrupt rudder pedal or nose wheel tiller inputs as these can result in overcontrol and skidding.
- Reduce to taxi speed before leaving the runway.

NOTE: After landing in slush or snow conditions do not raise the flaps beyond 25 degrees before it is checked that the flaps and flap vanes are free of ice and impacted snow.

HOT WEATHER

For improved cabin cooling it is recommended to keep the APU running until cleared for take-off and to start the APU shortly before landing.

The use of "overspeed" V_2's will increase the climb limited take-off weight.

Operating a series of short flights may cause excessive brake temperatures as the energy absorbed at each landing is accumulated and brake cooling with gear up is negligible. To prevent ground delays due to overheated brakes, it is recommended to lower the gear early on the approach, to use the longest runway compatible with the wind component and to adhere to the recommended landing technique.

During ground operation, select the recirculation fans (if installed) off if OAT is above 15 deg C / 59 deg F.
Select air conditioning ECON mode off when passengers are boarding.

WINDSHEAR

General

This paragraph contains recommendations and procedures which the aircraft manufacturer considers best suitable for early recognition and avoidance of windshear, and recovery from a windshear encounter.
However, Fokker Services does not guarantee that application of the recommended procedures always results in a safe recovery from all possible windshear conditions.

NOTE: The recovery techniques as described in this section are not valid for aircraft equipped with a windshear detection and recovery system.

Windshear is a rapid change in wind speed and/or direction over a short distance along the flight path. Windshear causes a severe hazard to aircraft during take-off, approach, and landing.
Windshear results from a large variety of meteorological conditions such as temperature inversion, sea breezes, frontal systems, topographical conditions, strong surface winds, rain showers and thunder storms. The most dangerous type of windshear is known as a downburst or its smaller, even more vicious form, the microburst.
A microburst is a violent downward burst of air spreading out horizontally upon reaching the surface. It can occur where convective weather exists. However, the probability of an encounter is low, due to its local appearance and the fact that it lasts only a few minutes. Its effect on aircraft performance and flight path, however, can be disastrous. Microburst activity may be expected when one of the following phenomena is observed:

- Local strong winds as indicated by dust devils, roll clouds or tornado like features.
- Heavy precipitation visible on weather radar.
- Rain showers, lightning or virga.

Windshear Effects

The immediate effect of a decreasing headwind or increasing tailwind shear is a decrease in IAS and therefore a loss in performance capability of the aircraft. Due to the loss of speed, the aircraft tends to pitch down to regain trim speed If such a performance decreasing shear is encountered during final approach, the aircraft tends to drop below the glide path and land short of the runway. If encountered after lift-off, insufficient climb performance and no further speed increase or loss of speed may result in the aircraft hitting obstacles in the take-off path.
An increasing headwind or decreasing tailwind shear will increase IAS and aircraft performance. The aircraft will tend to pitch up in order to regain trim speed. When such a performance increasing shear is encountered during final approach, a long landing and a possible runway overrun may occur. A performance increasing shear, however, is frequently followed by a performance decreasing shear. If the pilot corrects for the effect of the first shear (nose down, thrust reduction) he will be caught in a very unfavorable situation if subsequently a performance decreasing shear is encountered Vertical windshears or downdrops exist in every microburst.
Downdrafts in excess of 3000 fpm, which are beyond the performance capability of transport category aircraft, may exist in the center of a strong microburst.
Short duration reversals of vertical wind direction, which are associated with the microburst, may cause momentary stick shaker activation, and airframe buffet at speeds well above normal.

Take-off Precautions

If weather conditions are such that a windshear is possible or if a windshear has been reported: DO NOT TAKE-OFF.

If weather conditions are such that a windshear may probably occur but a safe take-off is thought to be still feasible, the following precautions should be considered:

- Do not use flexible thrust, use TO thrust. This shortens the take-off roll and provides the best climb performance.

- Select the longest runway but give due consideration to obstacles and crosswind and tailwind limits. This ensures maximum runway length available to accelerate to V_R; it results in more ground clearance during initial climb and maximum stopping distance if it is decided to reject the take-off.
- Flap 15 gives the best performance if the shear is encountered on the runway (lowest V_R). Flap 0 gives the best climb performance. Flap 8 is recommended as the best compromise for the situation.
- Increased speed at rotation improves the capability to recover from a shear directly after lift-off. Increased speed improves the flight path and reduces potential exposure to flight close to stick shaker speed. It is recommended to accelerate on the runway to 10 to 20 kt beyond the calculated V_R and to rotate to the normal take-off pitch attitude. This technique produces a higher initial climb speed which slowly bleeds off to the normal climb speed. The speeds set at the PFD speed scale should be kept at the value calculated for the actual weight and flap setting.

WARNING:
IF A PERFORMANCE DECREASING SHEAR IS ENCOUNTERED DURING THE TAKE-OFF ROLL, RECOGNIZABLE BY ABNORMAL SLOW BUILDUP OF SPEED, DO NOT ACCELERATE TO THE INCREASED VR BUT ROTATE AT THE NORMAL V_R. IN NO CASE SHOULD ROTATION BE DELAYED BEYOND 600 M / 2000 FT FROM THE RUNWAY END.

WARNING:
DO NOT ACCELERATE TO A HIGHER INITIAL CLIMB SPEED AFTER LIFT-OFF. REDUCING PITCH AT LOW ALTITUDE IS HAZARDOUS IF A WINDSHEAR IS ENCOUNTERED.

- The flight director provides pitch commands or the autopilot provides steering to follow a target speed schedule. This is in conflict with the windshear recovery technique which is primarily based on pitch attitude control. Therefore, when taking off in a possible windshear environment do not use AP or FD below 1500 ft AGL.

Summarizing, the following take-off precautions should be taken:
- Use TO thrust.
- Use longest runway.
- Use flap 8.
- Consider using increased V_R.
- No FD/AP.
- Select CONT ignition (not required for aircraft with the automatic relight system).

Approach and Landings

If weather conditions are such that a high risk of a windshear exists, or if a windshear has been reported: DO NOT APPROACH OR LAND.
If weather conditions are such that a windshear may possibly exist but a safe approach and landing is thought to be still feasible, the following precautions should be considered:

- A stabilized approach should be flown from at least 1500 ft AGL in order to be able to recognize unacceptable flight path trends as early as possible.
- When controlling thrust manually, do not immediately reduce thrust in case of a sudden increase in speed. Increased speed is advantageous when recovering from a performance decreasing shear. However, in absence of such a shear, the higher approach speed must be accounted for on landing.
- Use the most suitable runway, clear of the possible shear area and compatible with crosswind and tailwind limits. A longer runway provides a larger margin for increased ground roll distance due to increased approach and touchdown speed.
- A vertical profile guidance system such as ILS glide slope or VASIS is highly desirable as it enhances windshear recognition by providing timely indications of vertical flight path deviation.
- Flap 25 for landing provides the best overall recovery performance.

- Increased speed improves climb capability and reduces the potential for flight at stick shaker speed during windshear recovery. Before deciding to increase the approach speed, consider runway length and condition (dry or wet), availability of reverse thrust, antiskid, lift dumpers and speed brake. Conditions permitting, increase the approach speed by 10 to 20 kt.
  Put the aircraft on the runway at the normal touchdown point, do not float.

NOTE: An automatic approach with increased approach speed may result in automatic speed reduction and MFDS SPEED alerts. To prevent automatic speed reduction, disconnect or override ATS. Consequentially, ALAND capability may be affected.

- The use of AP and ATS is recommended. These systems relieve pilot workload and allow more time to monitor instruments and weather. However, using AP and particularly ATS is only beneficial if properly monitored. In the absence of proper monitoring, these systems mask the onset of a shear through lack of pilot awareness of control inputs being made.

Summarizing, the following approach and landing precautions should be taken:
- Fly a stabilized approach.
- Minimize thrust reductions.
- Use the most suitable runway.
- Use ILS or VASIS for glide slope monitoring.
- Consider flap 25 for landing.
- Consider increased approach speed.
- Monitor AP and ATS.
- Select CONT ignition (not required for aircraft with the automatic relight system).

Windshear Recognition

Early recognition of windshear is crucial as time available for recovery close to the ground is minimal. Pilots should be aware of the normal airspeed and vertical path indications for take-off and landing so that windshear induced deviations are more readily recognized. During the take-off roll, monitor speed buildup. After lift-off, monitor pitch attitude, rate of climb, speed and speed trend. During approach, monitor speed and speed trend, rate of descent, pitch attitude, glide slope deviation and thrust lever position. Abnormal airspeed fluctuations may be the first indication of a windshear.
Be prepared to execute the recommended recovery procedure immediately if deviations from the normal target condition exceed the following values:

Take-off:
- IAS +/– 15 kt or
- vertical speed +/– 500 ft or
- pitch +/– 5 deg

Approach:
- IAS +/– 15 kt or
- vertical speed +/– 500 ft or
- pitch +/– 5 deg or
- glide slope +/– 1 dot or
- unusual thrust lever position for a significant period of time.

Inform ATC as soon as possible after exiting the shear. A pilot's report is of vital importance as the shear may increase in intensity and the next aircraft may not have the performance capability to recover.

NOTE:
1. With AP and ATS engaged pitch deviations and unusual thrust settings are the primary cues for windshear onset as IAS loss and glide slope deviations are effectively compensated for.
2. If the aircraft is equipped with IRS, this system may be used for early windshear detection. Great variations in wind speed, wind direction, ground speed or FPV are usually the first indications of windshear. Do not use these parameters for windshear detection on aircraft equipped with AHRS.

Recovery during Take-off Roll

Recognition of shear during the take-off roll is difficult since speed is changing rapidly. Slow or erratic speed buildup or unusual speed fluctuations may be indicative of a windshear.
The 'go/no-go' criteria based on V_1 may not be valid in windshear conditions since groundspeed may be considerably higher than airspeed. It may therefore not be possible to stop within the remaining runway if the take-off is rejected. Prior to V_1, the take-off should only be rejected if it is ensured that sufficient stopping distance is available.
In view of the proposed recovery technique the following is recommended:

- Immediately apply full throttle thrust and simultaneously disconnect ATS.
  Do not reduce thrust until aircraft safety is ensured.
- Rotate at V_R . However, in a severe shear, V_R may not be reached.
  In this case, rotate not later than 600 m / 2000 ft from the runway end.
  The aircraft ia able to become airborne approx 10 kt below V_R. After lift-off rotate to 15 deg pitch.

Summarizing the take-off roll windshear recovery technique:

- Apply full throttle thrust, disconnect ATS.
- Rotate at V_R, but not later than 600 m / 2000 ft remaining.
- After lift-off rotate to 15 deg pitch.
- Follow AFTER TAKE-OFF RECOVERY technique.

Recovery after Take-off and on Approach

The recovery technique is developed with the objective to keep the aircraft flying as long as possible in the hope of exiting the shear. In order to obtain this, maintaining vertical flight path is the primary target. Speed control is of secondary concern. The recommended recovery technique should be initiated immediately any time the vertical flight path is reduced to below 1000 ft AGL.

In view of the recovery technique the following is recommended:

- Immediately apply full throttle thrust and simultaneously disconnect ATS.
  Do not reduce thrust until aircraft safety is ensured.
- Disengage AP and change pitch with a normal rate towards an initial target attitude of 15 deg in take-off; 12 deg in approach. Increase pitch beyond target attitude only to avoid ground contact. Accept low airspeed and temporary sink rate. Always respect stick shaker. Use intermittent shaker as the upper limit. If attitude has been lowered to below target value to stop the stick shaker, increase pitch attitude again to target value as soon as the shaker stops.
- When a sustained climb has been achieved, select go-around flap (42 to 15, or 25 to up) and gear up.

NOTE:
1. When encountering a windshear all attention of the PF is required to fly pitch attitude. As such, the PNF should call out radio altitude and inform the PF that the aircraft is "descending" or "climbing".
2. When a performance increasing shear is encountered during approach, perform the normal go-around procedure without delay. If during this go-around a sink rate develops, follow the AFTER TAKE-OFF RECOVERY technique.

Summarizing the after take-off/on approach windshear recovery:

- Apply full throttle thrust, disconnect ATS.
- Adjust pitch to 15 deg after lift-off; 12 deg on approach.
- Always respect stick shaker.
- After sustained rate of climb has been obtained, select go-around flap and gear up.

SEVERE TURBULENCE

Known or forecasted areas of severe turbulence should be avoided whenever possible. However, if severe turbulence is encountered, the aircraft should be flown at the recommended rough airspeed. This is the optimum speed for protection against excessive structural loads and provides sufficient margin between the low speed buffet and Mach buffet at high altitude.
If moderate to severe turbulence is expected, it is advisable to select a cruise level below the maximum operating altitude in order to increase the buffet margin.

Flap and gear extension should be delayed as long as possible since the aircraft structure can withstand higher g-loads in the clean configuration.
'Fasten seat belt' signs should be on prior to entering the area of known or forecasted turbulence. In turbulence, also switch on the 'no smoking' sign.

Turns will increase 'g'-loading. Avoid making turns and if necessary use the lowest possible bank angle.

Adjust thrust to maintain the required rough airspeed. Once the proper thrust setting is obtained, disconnect ATS and do not change thrust except when necessary in case of extreme speed variations. The speed brake can be used to reduce speed quickly.
The AP is the best means for aircraft control in severe turbulence; no specific mode has to be selected.
In manual flight, trim the aircraft for the required speed, after that do not change stabilizer position. Control the aircraft with the elevator. Avoid large elevator inputs. Ride out the turbulence and allow altitude changes unless terrain clearance becomes critical.

Summarizing:

- Set speed at 250 kt / M.65.
- Switch SEAT BELT / NO SMOKING signs to ON.
- Select CONT ignition (not required for aircraft with the automatic relight system).
- Select ENGINE ANTI-ICING as required.

When at speed:

- Disconnect ATS.

VOLCANIC ASH

Flight in areas of known volcanic activity must be avoided. This is particularly important during night or in IMC when volcanic ash is not visible. If volcanic activity is reported, check all NOTAMs and ATC directives for current status of volcanic activity. Plan the flight on the upwind side of the volcanic cloud. Airborne weather radar cannot detect volcanic dust.
Volcanic dust may be difficult to detect at night or in IMC. However, the following phenomena have been reported by flight crews:

- Smoke or dust appearing in the flight deck.
- An acrid smell, similar to electrical smoke.
- Multiple engine malfunctions such as stalls, rising TGT and flameout.
- St Elmo's fire and static discharges around the windows.
- Landing lights casting sharp, distinct shadows in clouds.

If volcanic ash is encountered, reduce thrust (to idle if practical). Select relight ignition and leave the area immediately. If TGT rises abnormally at idle, which is indicative of a pending engine stall, shut down the engine.
Volcanic dust may cause rapid erosion and damage to the internal engine components, causing surge, thrust loss and high TGT. Retarding thrust to idle lowers the TGT and will reduce debris buildup on compressor and turbine blades and improves engine stall margin. Further improvement in engine stall margin is obtained by switching on anti-icing systems.
It may be necessary to shut down and relight the engine to prevent exceeding TGT limits. If an engine fails to relight, repeated attempts should be made. A successful start may not be possible until clear of the volcanic ash. Following a successful relight or when clear of volcanic ash, slowly accelerate each engine in turn and monitor engine operation. Volcanic ash may block the pitot system and result in unreliable airspeed indications.
Volcanic dust is very abrasive and can cause serious damage to engine and leading edges of wing and tail. Windows become opaque, obstructing vision. Landing light effectiveness may be reduced. If volcanic ash abrades the front windows so that forward vision is obstructed, consider diverting to an airport where an automatic landing can be made.

Ground operation at airports affected by volcanic ash:

- Limit reverse thrust to the minimum practical.
- Braking may be less effective if volcanic ash has fallen on a wet surface.
- Avoid static engine operation above idle.
- Use minimum thrust during taxiing.
- Avoid operation in visible dust. Allow dust and ash to settle before taking off.
- Use APU for engine starting only, not for air conditioning.
- Do not use wipers to clean dust and ash from the front windows.