

Exhibit 2

BIRMINGHAM AIRPORT AUTHORITY

Diesel Powered High Speed Airport Runway Sweeper

It is the intent of these specifications to describe a street sweeper in sufficient detail to assure that product reliability, design integrity, technical soundness and sweeping performance is provided. The unit provided shall be new, of current manufacture, and the model and series must have been in production a minimum of ten (10) years. All parts not specifically mentioned, which are necessary to provide a complete street sweeper, shall be included in the bid and shall conform in strength and quality of material and workmanship to what is normally provided to the trade in general.

The unit shall be delivered completely assembled, serviced and ready to operate. The bidder shall have a qualified service representative in attendance with the sweeper during startup operation to make any adjustments and give instructions to assure proper operation of the sweeper.

The sweeper shall be warranted to be free from defective materials and workmanship for a period of 12 months or 1,000 hours from date of delivery.

The unit bid shall be a regenerative air sweeper mounted on a truck chassis capable of highway speeds.

COMPLIANCE TO SPECIFICATIONS

The bidder shall indicate their compliance with a “**YES**” or non-compliance with a “**NO**” for each line item specification. Any space left blank shall be considered non-compliance. Any **EXCEPTIONS** to these specifications must be clearly cited in writing and attached on a separate sheet of paper by the bidder. No deviations below “minimum” or above “maximum” specifications will be accepted.

MANUALS/TRAINING

- _____ The bidder shall supply one sweeper operator’s manual and one sweeper parts and service manual on paper and one set on an electronic format with each unit.
 - _____ The bidder shall supply one operator’s for the auxiliary engine on paper.
- Manufacturer shall have available certifiable training course for complete maintenance and operation of sweeper at the manufacturer’s facility. The training course is provided at no additional charge.
- _____ Manufacturer must have scheduled a minimum of 20 training courses per year for convenience of customers scheduling. The course shall be specific to the model bid.
 - _____ Bidder shall provide video operator instruction/safety/maintenance procedures on an electronic format with the unit.

PAINT - COLOR

- _____ The entire unit shall be painted with manufacturers standard white paint applied over a suitable primer. Pick-up head, gutter brooms and truck frame shall be painted black.

REGENERATIVE AIR SWEEPER

POWER UNIT - DIESEL

- _____ The sweeper power unit shall be a diesel fueled, liquid cooled, charge air-cooled, turbocharged electronic Final Tier 4 emissions John Deere PowerTech™ PWL 4.5L industrial engine, Model 4045HFC04. Engine displacement shall not be less than 275 cubic inch developing not less than 99 HP @ 2200 RPM and 315 ft. lbs. torque @ 1600 RPM. Engine shall be 4.2" bore and 5.0" stroke.
- _____ Cylinder construction shall be wet sleeve type.
- _____ Engine shall be equipped with a radiator fan, auxiliary drive, and engine mounted exhaust filter
- _____ Spin on replacement type oil filter remote mounted for easy access
- _____ Unit shall have a fuel/water separator and fuel filter remote mounted for easy access with water-in-fuel monitoring that will display a warning in the cab of the sweeper.
- _____ 12 volt ignition, electric starter and minimum 90 amp alternator
- _____ Engine electronics shall use John Deere ECU module and CAN SAE J1939 data link for communication.
- _____ An engine ECU shall have a multi-point engine protection system that will derate/shutdown when an engine problem is detected such as high coolant temperature, low coolant level, high air cleaner restriction or low oil pressure.
- _____ Engine controls shall be located inside cab.
- _____ Unit shall share a 51 gallon fuel tank with chassis engine.
- _____ Unit shall share batteries with chassis engine.
- _____ Unit shall have a heavy-duty dry type air cleaner with replaceable Donaldson PowerCore® element, safety element, and integral pre-cleaner scavenged to the regenerative air system.
- _____ The in-cab display shall include an air cleaner restriction gauge which displays percentage restriction and includes an audible alarm and visual message when filter restriction reaches a serviceable level.
- _____ Engine shall be programmed for isochronous governor feature for engine speed control.
- _____ A heat exchanger assembly will provide adequate cooling for three different systems: engine coolant system, engine intake charge air and hydraulic system oil. It must be modular in design for ease of maintenance with each cooler located side-by-side rather than stacked in series. Air will be circulated through the heat exchanger assembly by an engine mounted fan.
- _____ A 5.4 gallon (volumetric), 3.8 gallon (useable), right mid-ship mounted DEF tank shall supply diesel exhaust fluid to Selective Catalytic Reduction (SCR) system.

DUST SEPARATOR – HIGH CAPACITY

- _____ Separation of the dirt from the air stream shall be accomplished within the hopper by means of a multi-pass cylindrical centrifugal single chamber dust separator with a minimum size of 20" diameter and 61" width. The separator shall be designed so that it will not plug with normally encountered debris.
- _____ The dust separator shall have a minimum 24" x 61" curved, easy to open door allowing inspection and cleaning of the interior. The door shall have an abrasion resistant bonded rubber lining material for long life.
- _____ The dust separator shall incorporate a high capacity chamber to accumulate the separated material. The chamber shall be a minimum 16" x 24" x 61".
- _____ The entire dust separator inlet area shall be lined with a bolt-in replaceable, wear resistant rubber liner for long life.

HOPPER

- _____ Hopper size to be approximately seven and three tenths (7.3) cubic yard volumetric measurement.
- _____ A 61" x 84" steel screen of not less than 13 gauge shall be provided.
- _____ Dumping shall be accomplished by means of hydraulically actuated cylinders attached to a rear door which shall have a minimum opening of 84" x 44" with a raker bar moving inside hopper as door is opened and closed to dump debris behind the rear wheels.
- _____ Hydraulic cylinder movement shall be controlled with the use of an electric toggle switch located on the side of the hopper so discharging of debris may be viewed during dumping.
- _____ The hopper floor shall have a minimum of 22 degree slope.
- _____ Hopper door shall be opened and closed hydraulically and be held in the closed position by means of a lock valve located in the hydraulic dump circuit.
- _____ A 9.75"x 29" inspection door shall be provided on both left and right side of the hopper for easy viewing inside hopper and insertion of large debris.

- _____ Hopper shall be maintained airtight through use of rubber seals on all doors and openings.
- _____ Hopper suction inlet roof area shall have a bolt on replaceable Ultra High Molecular Weight (UHMW) wear resistant liner 3/8"x11"x10'.
- _____ An SAE Class 1/California Title 13 compliant amber LED beacon light shall be mounted on the rear of the sweeper hopper. The beacon light shall have a protective limb guard.
- _____ Two (2) work lights shall be mounted at the rear of the hopper to illuminate the dump area.
- _____ Two (2) amber LED flashing warning lights shall be mounted at the rear of the hopper.

HYDRAULIC SYSTEM

- _____ The hydraulic system shall be adequate for use within the design requirements of the sweeper. The system shall include a minimum 25 gallon reservoir, sight gauge, temperature gauge, 80 mesh suction strainer, spin-on replaceable full flow oil filter, restriction indicator, hydraulic cylinders, gutter broom drive motors, control valves, relief valves, oil cooler, hydraulic hoses and standard fittings.
- _____ The multiplex control system shall include a hydraulic oil temperature shutdown which provides the operator an audible and visual indicator through the in-cab display and shuts off the gutter brooms when hydraulic oil reaches a high temperature. The in-cab display shall also include a hydraulic oil temperature gauge.
- _____ Mobil DTE 25 ULTRA hydraulic oil shall be provided for extended service life.
- _____ The hydraulic pump shall be driven by the auxiliary engine.
- _____ Pressure shall be 2500 PSI maximum for gutter brooms and 1500 PSI maximum for pick-up head and dump door.
- _____ An auxiliary hydraulic system shall be furnished which electrically operates the hydraulic system without running the auxiliary engine to raise/lower the gutter broom(s), pick-up head and open/close the dump door.

BLOWER

- _____ Heavy duty, wear resistant, high strength cast aluminum alloy turbine type open face blower computer balanced within 4 grams shall be provided to create air pressure and suction.
- _____ Blower wheel shall be covered with wear resistant rubber for long life.
- _____ Blower shall be mounted on anti-friction bearings, sealed and lubricated for life. If bearings are not sealed, then an automatic lube system must be furnished.
- _____ Blower shall be driven from PTO off auxiliary engine by heavy duty power belt which shall be adjustable for tension.
- _____ Blower housing shall be a bolt on design and shall be lined with a bolt-in wear resistant, replaceable rubber liner for long life.
- _____ Blower not to exceed 3200 RPM to insure smooth efficient performance.

PICK-UP HEAD

- _____ A spring balanced, all steel fabricated 87" x 32" high velocity debris entrainment area. Pick-up head shall be provided with up stops, extension struts and drag links.
- _____ The pick-up head shall have a separate replaceable front and back chamber where pressurized air is blasted from the back chamber through an elongated blast orifice to the airfield surface.
- _____ Blast orifice flange shall be bolt-on design, so that flange is easily replaced and shall have slots so that blast orifice gap is easily adjusted without removing pick-up head from sweeper.
- _____ Pick-up head shall have a 14" diameter (minimum) quick disconnect pressure inlet port located on left side of pick-up head.
- _____ A 14" diameter (minimum) pressure hose attached between pick-up head inlet port and urethane transition at blower housing shall be provided.
- _____ A 10" diameter (minimum) suction hose, attached to a steel transition at the hopper, shall extend down to the right side of the pick-up head and shall be attached to the pick-up head suction nozzle ring.
- _____ Pick-up head shall be equipped with reversible, 2" wide, adjustable, side mounted, integral alloy steel and carbide runners for maximum pick-up ability and long life. Skid runners to be warranted for 2 years/2,000 hours prorated.
- _____ Pick-up head shall be raised and lowered hydraulically by a single switch on the control panel.
- _____ Suction inlet in sweeper hopper shall be lined with a bolt-in, wear resistant, replaceable, full length rubber liner and high impact areas in hopper will have hopper wall liners for long life.
- _____ Use of full-length broom to accomplish high speed performance not acceptable.

PERFORMANCE REQUIREMENTS

- _____ Test area shall be a paved, dry, clean surface 140 sq. ft.
- _____ Sand Pick Up: The sweeper shall pick up commercially procured dry sand, of the 1.5 to 2.5 mm size, from paved surface covered with a density spread of 0.5 lbs./sq. ft. over an area of 140 sq. ft. Pick up requirements shall be no less than 95% of sand (dry weight) at vehicle speed of 15 MPH.
- _____ Pea Gravel Pick Up: The sweeper shall pick up not less than 95% by weight of pea gravel at a vehicle speed of 15 MPH. This requirement shall be represented by a spread of 140 sq. ft. with a density spread of 0.5 lbs./sq. ft. The gradation of pea gravel shall be such that 100% passes thru a 3/8" screen and 98% on a USS No. 8 sieve.
- _____ Stone Pick Up: At a vehicle speed of 15 MPH, the sweeper shall pick up and retain ten (10) stones having a nominal diameter of 2", and placed in two (2) rows of five (5) each, 24" apart, with the rows being 36" apart.
- _____ Solid Steel Cylinder Pick Up: At a vehicle speed of 15 MPH, the sweeper shall pick up and retain ten (10) solid steel cylinders, 1" diameter x 3" long, placed in two (2) rows of five (5) each, 16" apart, with the rows being 36" apart. This test shall be run with the suction hood and vacuum system only.
- _____ Joint Cleaning: At a vehicle speed of 15 MPH, the sweeper shall remove no less than 40% by weight of dry sand (specified above) from a rectangular cross section joint 1/2" wide x 1/2" deep x 78" long when traveling at right angles to the joint.
- _____ Miscellaneous Pick Up: At a vehicle speed of 15 MPH, the sweeper shall pick up and retain not less than 54 of the following items. Seven (7) each of the items shall be spaced on 7 ft. x 10 ft. level asphalt or concrete pad marked with a 1 ft. x 2 ft. grid pattern.
 - _____ 1/2" diameter steel ball bearing
 - _____ 1/2" long steel finishing nails
 - _____ 1/2" ID steel washers
 - _____ 1/4" x 2" long steel cap screws
 - _____ 1/2" steel hex nuts
 - _____ 1/2" long pieces of crumpled steel aircraft safety wire
 - _____ 2" x 2" x 1/8" thick aluminum sheet
 - _____ 1/4" diameter x 1" long aluminum rivets

GUTTER BROOM(S)

- _____ Twin gutter brooms shall be 43 inch minimum diameter, polypropylene bristle filled vertical digger type for removing debris from gutter area.
- _____ Each gutter broom shall have 1- LED spot light and 1-10" parabolic mirror.
- _____ Gutter broom(s) shall be hydraulic motor driven and shall be positioned laterally and vertically by one hydraulic cylinder.
- _____ Gutter broom down pressure shall be automatically adjusted to load by a pressure sensing sequence valve in line with gutter broom torque motor.
- _____ Each gutter broom shall have adjustment for bristle contact pattern and wear.
- _____ Each gutter broom shall have lateral flexibility to swing rearward 15" when encountering the impact of an immovable object thus avoiding damage to the broom assembly.
- _____ Each gutter broom shall have a spring adjustment to allow downward compensation for bristle wear and shall be free floating to follow street contour.
- _____ Each gutter broom shall be held in the up and transit position by use of an electric lock valve attachment. Upward motion of gutter broom shall be regulated by an adjustable flow control valve.
- _____ Each gutter broom shall be controlled from inside the cab by a single switch.

DUST CONTROL WATER SYSTEM

- _____ Water tanks shall be 220 gallons total capacity, constructed of recyclable polyethylene for strength and puncture resistance, be 100% rustproof, be of bolt-in design for easy removal, and have a water level sight gauge.
- _____ Water from tank to be filtered by 80 mesh cleanable filter located between tank and water pump.
- _____ 12V electric motor driven pump delivering up to 5.0 GPM with a 25 PSI system relief pressure and with an electronic solid state liquid level sensor to automatically shut off pump and trigger an audible alarm and warning message on the touchscreen display when water is depleted.
- _____ Electric solenoid water control valves shall be cab controlled. Spray system shall include spray nozzles to be located as follows: minimum of 4 on outside of pick-up head; 2 for each gutter broom; 1 inside hopper. Water nozzles to be located on outside of pick-up head and suction tube for easy inspection and superior dust control.
- _____ Water tank shall have anti-siphon/anti-pressure filler neck with air gap.
- _____ Flexible 20 foot (minimum) long water fill hose with 2½ inch coupling for filling water reservoir and hose storage rack shall be provided. Water fill hose shall include a stainless 100 mesh cleanable filter.
- _____ Shop air purge system shall be furnished to facilitate purging dust control system during freezing conditions.
- _____ Hydrant wrench shall be furnished.

OPERATING CONTROLS

- _____ The sweeper electronic control platform shall be CAN controlled utilizing a multiplex control system.
- _____ The multiplex control system shall be equipped with a multiplex module with diagnostic LED indicators for all Inputs and Outputs as well as network and power LEDs to assist in troubleshooting.
- _____ The multiplex module shall be equipped with overcurrent protection for all outputs.
- _____ All module Inputs and Outputs as well as network and power status shall be accessible through the in-cab display.
- _____ All operating controls for sweeper including hopper dump switch shall be mounted inside truck cab and readily accessible to the operator.
- _____ All main sweeping functions shall be multiplexed with LED diagnostics and integral solid-state circuit protection to reduce overall wiring and enhance operator feedback.
- _____ In-cab controls shall consist of, but are not limited to, gutter brooms, pick-up head, engine throttle, water system, water system nozzles, dump door, and work lights.
- _____ Dump control includes a single weatherproof toggle located on the exterior of sweeper on the blower side on the hopper, mid-ship.
- _____ Auxiliary engine controls shall be mounted on control console.
- _____ A 5.7 inch viewable (minimum) multi-function, high resolution, LCD, color touchscreen display shall be pedestal mounted to display gauges consisting of, but not limited to engine RPM, engine oil pressure, engine temperature, battery voltage, and instantaneous fuel rate.
- _____ For sweeper on board diagnostics (OBD), the in-cab display shall provide detailed text descriptions of sweeper faults as well as provide input/output status and stored output faults.
- _____ For auxiliary engine OBD, the in-cab display shall provide a detailed message about auxiliary engine faults providing SPN, FMI, and a text description of the fault at minimum.
- _____ The display shall provide a visual indicator icon for the following: Pick-up head down, dust suppression water pump, low water, water system winterization.
- _____ The in-cab sweeper display shall incorporate resettable and non-resettable hour meters for the auxiliary engine; left and right gutter brooms; pick-up head; water pump; and blower for collecting data about sweeping route performance and maintenance.
- _____ The in-cab sweeper display shall incorporate resettable sweeper and auxiliary engine service timers, which will trigger service reminders for engine oil, engine air filter, fuel filters, hydraulic filter, hydraulic oil.
- _____ The in-cab display shall include a minimum five (5) User-defined custom reminders
- _____ A minimum of three (3) custom reminders shall be timed by hours
- _____ A minimum of two (2) custom reminders shall be timed by days.

- _____ The in-cab display shall include a sweeper odometer that is active when the pick-up head is down and the auxiliary engine is above idle.
- _____ The sweeper odometer shall include a non-resettable odometer and resettable odometer, hour meter, and average sweeping speed.
- _____ The in-cab display shall log the following events by date, time, event title, and engine hours: hour meters resets, custom reminders resets, service reminders, service hour meter reset, overspeed events, hydraulic oil alerts, engine faults, sweeper output faults, sweeper odometer resets, winterization and de-winterization events, and fuel usage statistics resets.
- _____ Overspeed warning system shall be equipped to alert the operator when sweeping at an excessive speed and can be adjusted from 5-20 mph with a PIN code.
- _____ The in-cab display shall include fuel usage statistics for the auxiliary engine which displays trip fuel usage, fuel trip hours, average fuel economy, and instantaneous fuel rate.
- _____ The in-cab display shall include an on-screen guide for winterization procedures specific to the dust control system equipment. The display shall tag the system as winterized once the guide has been completed and will remove the winterized tag once the system senses water.
- _____ Audible alarms and visual indicators shall include, but are not limited to indications of the following: low dust control water, exceeding maximum recommended sweeping speed, auxiliary engine fault codes and derates such as low coolant or high engine temperature, and sweeper output faults such as low voltage.
- _____ All main electrical systems, i.e. ignition, lights, hydraulic, etc. shall be separately fused to isolate electrical problems to fused area and speed service.
- _____ All external wiring, harnesses and terminations shall be of a sealed, weather-tight design utilizing heat-shrinkable components. Additionally, where feasible, all connectors shall utilize solid, cold-formed, nickel-plated copper alloy contacts with gas-tight crimps (Deutsch).
- _____ Dump Switch In-cab is located on the control panel to activate dump operation from inside cab.

ADDITIONAL EQUIPMENT

- _____ Camera/Monitor System: Alliance Wireless Technology (AWTI), slim line series with 7" color monitor mounted in cab with one rear view camera.
- _____ LED work lights shall be provided with (1) pointing to the left gutter broom and (1) pointing to the right gutter broom, and (2) pointing behind the sweeper from the rear.

CHASSIS

GENERAL

- _____ Chassis/cab shall be conventional with a tilt hood. Frame to be straight full channel steel rails (50,000 PSI). Gross vehicle weight rating to be not less than 31,000 lbs. Curb weight with cab, fuel, water, oil and tires shall be approximately 9,850 lbs. Standard truck cab enclosed and equipped with safety glass all around and two individual, adjustable, high back air seats with lumbar support and safety orange seat belts.

WARRANTY

- _____ Base vehicle coverage is 24 months/unlimited mileage.
- _____ Engine (diesel) coverage is 36 months/unlimited miles.
- _____ Drive train coverage is 24 months/unlimited mileage.
- _____ Allison transmission coverage is 36 months/unlimited mileage.
- _____ Frame coverage is 84 months/unlimited mileage.
- _____ Cab corrosion coverage is 60 months/unlimited mileage.

(Warranty coverage is 100% parts and labor unless otherwise noted as provided by chassis manufacturer.)

WHEELBASE

- _____ Chassis shall have a maximum wheelbase of 165".
- _____ Special frame drilling and brake chambers relocation.

AXLES

- _____ Front axle to be minimum of 10,000 lbs. with suspension of 10,000 lbs.
- _____ Rear axle shall be 21,000 lbs. 2 speed with a ratio of 6.17/8.42, suspension to be minimum of 31,000 lbs. vari-rate with 4,500 lbs. capacity multi-leaf auxiliary rubber spring.

STEERING

- _____ Dual operator controlled integral power steering with cruise control, tilt and dual gauge package.
- _____ Diameter of steering wheel will be minimum 18".

BRAKES

- _____ Service brakes to be full air with 18.7 cfm air compressor.
- _____ Air tank drain valve, manual with pull cable.
- _____ Front brakes shall be 15" x 4".
- _____ Rear brakes shall be 16½" x 7".
- _____ Shall have automatic slack adjusters front and rear.
- _____ Parking brakes shall be spring actuated, double diaphragm, 30" MGM Chambers air chambers, with warning light.
- _____ Brake chambers, spring relocated to rear of rear axle for maximum ground clearance.
- _____ 4-Channel anti-lock brake system shall be provided.
- _____ An air dryer with heater shall be furnished.

CAB

- _____ Cab shall have in-dash chassis manufacturer's factory installed air conditioner for operator comfort with a fresh air filter.
- _____ Cab to have individual driver and passenger air, high back adjustable seats with lumbar support.

- _____ Dual sun visors, coat hook, storage pocket on driver door, 12V receptacle, electric horn, electric windshield washer and 2 speed electric wipers with intermittent wiper switch shall be provided.
- _____ Chassis shall be equipped with fresh air heater, defroster, dual 7" x 16" remote controlled heated electric powered mirrors, and two separate 10.5" diameter parabolic mirrors.
- _____ AM/FM stereo radio with clock and auxiliary input shall be provided.
- _____ Chassis Hour Meter shall record truck engine hour operation.
- _____ Power windows and door locks shall be provided.

ELECTRICAL

- _____ Shall consist of two, multiple beam headlights with dash beam indicator, daytime running lights, instrument panel, taillights, stop lights, front and rear turn signals, and self-canceling signal switch, equipped for four way flashing. Taillights, stop lights and signal lamps may be in combination.
- _____ Shall have two 12volt (1900 CCA total) maintenance free batteries.
- _____ Shall have a 160 amp alternator.
- _____ LED stop/turn/tail and clearance lights and markers
- _____ Battery disconnect switch shall be provided.

ENGINE/EXHAUST

- _____ Shall be in-line six cylinder, turbocharged diesel with a minimum 200 HP at 2400 RPM, 6.7L, 520 lb./ft. torque @ 1600 RPM.
- _____ Dry type single element air cleaner with restriction indicator in cab and safety element.
- _____ Automatic glow plug with indicator light shall be supplied.
- _____ Automatic shutdown/engine protection system shall be provided.
- _____ Horizontal aftertreatment device, right frame mounted. Includes single horizontal tail pipe.
- _____ A 7 gallon, DEF tank shall supply diesel exhaust fluid to Selective Catalytic Reduction (SCR) system.

FUEL

- _____ A 51 gallon tank shall be supplied and shall supply fuel to both engines.

TIRES AND WHEELS

- _____ Heavy duty first line quality tubeless tires to be minimum 11R x 22.5, L/R G rating with duals in rear for adequately carrying full load of sweeper and maximum stability.
- _____ Wheels to be 10 hole disc 22.5 x 8.25.

TRANSMISSION

- _____ Shall be heavy duty Allison 2500 RDS electronic, six-speed automatic, with external oil filter.
- _____ Shall have synthetic transmission fluid.
- _____ Shall have a transmission temperature gauge in cab.