



SPECIFICATIONS FOR 2, HEAVY DUTY AIRPORT MULTI-TASKING SNOW REMOVAL VEHICLES with HEAVY DUTY SINGLE FRAME 4X4 CHASSIS, FORWARD MOUNTED CAB, 24-FOOT FLARED PLOW WITH HANDS FREE HITCH and 22-FOOT HIGH PERFORMANCE UNDERBODY MID-MOUNT BROOM.

The requirements listed for the Airport Snow Removal Vehicles with snow plow and mid-mount broom as outlined are based upon the current Federal Aviation Administration (FAA) Advisory Circular (AC) 150-5220-20A and is designed to facilitate the purchase of equipment that has been found to be acceptable to the FAA for use on airports.

MATERIAL - All components used in the manufacture and assembly of the specified equipment/vehicle shall be new and of high quality and grade. Re-manufactured parts shall not be utilized.

DECALS - The contractor shall not affix advertising decals, stickers or other signs to the specified equipment. Vehicle mud flaps, when specified, shall be installed with the blank side facing outward.

BRAND NAMES - Whenever in the specification proprietary names, manufacturers, trade names or catalog numbers are specified, such reference is made for the purpose of defining the minimum performance, quality and other salient characteristics of the desired item. Where "brand names" are specified, the term "or equal" shall be deemed to follow. Such reference is not intended to be restrictive in nature. The contractor may offer any material, item or process deemed equal with respect to the required minimum characteristics of the specified "brand name". The Owner reserves the right to make the final determination of equivalency.

MANUALS/ DOCUMENTS - As a minimum, the successful bidder shall provide the following product documentation and support information on paper and USB memory sticks upon delivery, two copies of each:

1. Operation, Maintenance, and Troubleshooting manuals
2. Manuals for equipment supplied by other sources
3. Parts manual identifying every part on the unit including schematics for electrical and hydraulic systems.

WARRANTY - The Contractor guarantees that any defective component discovered within a twelve (12) month period following the date of the final acceptance shall be replaced at no expense to the Owner. The warranty for this period shall cover all parts, labor, and shipping costs for the repair and replacement of any defective component. The Owner agrees to give prompt notice of any discovered defect. The Contractor shall promptly, without undue delay, remedy such defects. The Contractor shall serve as the Owner's agent for service under any standard manufacturer warranty.

MATERIAL SAFETY DATA SHEETS - The Contractor shall submit applicable Material Safety Data Sheets (MSDS) for all chemical products supplied with the acquired equipment/vehicle.

PRE-DELIVERY INSPECTION - The Owner reserves the right to perform a pre-delivery inspection of the equipment/vehicle at the Contractor's facility. The purpose of the inspection is to verify compliance with critical requirements of the technical specifications. The vendor shall provide up to \$1,000 for the reasonable travel expenses associated with this inspection. This inspection shall not serve as the final acceptance inspection.

DELIVERY - Delivery of the vehicle/equipment shall be made as soon as possible, but not to exceed 300 calendar days of the date of the Notice-to-Proceed or issues Purchased Order. Delivery shall be F.O.B. destination to the address noted herein below. C.O.D deliveries will not be accepted. All vehicles/equipment shall be off loaded at the designated location (South Bend International Airport) at vendor's expense:

ACCEPTANCE - Acceptance of the furnished equipment/vehicle will be based on combination of submitted manufacturer certifications and acceptance tests conducted at the time of delivery. The Contractor shall provide manufacturer certification for components and systems identified within the technical specification. The Contractor shall prepare and furnish the Owner a signed written certification that the components constituting the whole of the equipment being provided comply with the applicable performance, design and construction requirements of the technical specifications.

ON-SITE ACCEPTANCE TESTING - At no additional expense to the owner, the Contractor shall, upon delivery of the equipment/vehicle, have an authorized representative conduct an operational test of the furnished equipment in the presence of the Owner. The Contractor shall demonstrate that all features and components are in proper working order and operate as intended by the Technical Specifications. This demonstration is in addition to any other stated acceptance tests within the technical specifications and as required by the Owner.

TECHNICAL SPECIFICATIONS

These specifications contemplate the furnishing and delivery of two new Heavy-Duty Airport Multi-Tasking Snow Removal Vehicles, Heavy Duty Single Frame 4x4 Chassis, Forward Mounted Cab, 24 foot Airport Runway Plow with Hands Free Hitch and High Performance Under body, Mid-Mount Broom with air blast, and indicate in general the type, size, and quality desired. Specifications are not intended to be restrictive or inclusive of any manufacturer.

Only "Integral Non-Articulating" vehicles shall be allowed.

Modular example and requirement: 4x4 plow single frame chassis with all-wheel steering.

Integral Non-Articulating example and requirement: 4x4 all-wheel steer plow with a Heavy Duty single frame 4x4 chassis with mid-mount broom and air blast

Bid submittals that do not include required documentation as identified throughout this specification shall be deemed non-responsive and shall be cause for dismissal.

Unit to be bid shall be a new current 2021 model.

Bidder shall include with submittal detail literature/product summary sheets detailing proposed "Modular" or "Integral Non-Articulating" unit.

This vehicle shall be all wheel drive and must be designed, assembled and manufactured in the United States, for the specific purpose of snow removal. The total engine horsepower on board shall be 1000 hp minimum. The configuration shall be two engine design with front mounted plow, mid mounted broom, forward mounted cab design with near center steering, chassis drive engine behind the cab and rear mounted broom engine. This vehicle shall comply with all applicable FMCSR (Federal Motor Carrier Safety Administration) and FMVSS (Federal Motor Vehicle Safety Standards) quality/safety standards, and requirements of the FAA Advisory Circular 150/5220-20A and FAA Advisory Circular 150/5210-5D.

This multi-tasking vehicle shall be designed for one-man operation. The design of these units shall ensure positive tire-to-ground tractive effort while brooming and doing full wall-to-wall turn-arounds. The unit shall have a net clean width of 18.0 feet after the broom.

All parts and components of this unit shall be engineered to sustain the maximum load limits and severe operating conditions encountered in snow removal, while resulting in minimum wear and failure.

These specifications require the doing of all things necessary or proper for, or incidental to the furnishing of said unit. All items of design and equipment not listed in these specifications, but involved in carrying out their intent, are required to be furnished by the bidder, the same as if these items were specifically mentioned and described in these specifications. The unit must be fully assembled and tested prior to delivery by a qualified factory representative. Vehicle shipping costs to the airport is the responsibility of the Bidder. Bidder is responsible for any costs or arrangements as required for the safe unloading of equipment upon delivery. A qualified factory trained representative shall be onsite at time of delivery to supervise the safe unloading.

Disqualification of Bid Proposals

The Owner reserves the right to reject any or all bids, as determined to be in the best interest of the Owner.

Causes for rejection of proposals include but are not limited to:

- Submittal of an irregular proposal;
- Submittal of more than one proposal from the same partnership, firm or corporation;
- Failure by Bidder to submit the bid prior to the stated time and date for receipt of bids;
- Failure by Bidder to furnish satisfactory bid guarantee;
- Failure by Bidder to provide all information required of the bid forms;
- Failure by Bidder to comply with the requirements of bid instructions;
- Failure by the Bidder to demonstrate good faith efforts in obtaining participation by certified DBE firms;
- Determination by the Owner that Bidder is not qualified to accomplish the project work;
- Determination by the Owner that the Bidder has placed conditions on or has qualified their proposal;
- Discovery of any alteration, interlineations or erasure of any project requirement by the Bidder;
- Inclusion of the Bidder on the “Excluded Parties Listing System” as maintained and published by the General Services Administration;
- Evidence of collusion among bidders.

Chassis

General

The operator shall be positioned near cab center for visibility in high speed snow removal operations.

The front plow to front axle dimension shall be kept as close as possible. This cab location and the axle to plow dimension are necessary to have the operator as far forward as good engineering practices will permit, allowing greater visibility and maneuverability while clearing contaminants from runways and taxiways.

The chassis shall be designed to permit easy and safe mounting and dismounting of the unit for operators and service personnel. Grab bars shall be installed as required for safe mounting and dismounting by personnel following OSHA standards of 3-point contact during all mount and dismount activities. This shall include a minimum 1-inch diameter vertical grab bar behind each door, to include round tactile material for improved grip. The inside of each door shall include a minimum 1-foot grab handle positioned under the window. It shall be made of minimum 1-inch diameter material, round only (no sharp edges or corners) for safety. All sheet metal, cowling, steps and fenders shall be free of sharp edges and protrusions and include ample supports and bracing to prevent distortion and cracking. All steps or walkways shall be raised lug or expanded metal type construction.

Frame

The frame shall be single frame design or manufacturer's standard product offering dependent on type bid. The frame shall be of Grade 8 (or better) bolted construction, with heat treated, minimum 110,000 psi yield strength, single channel carbon manganese steel rails, connected by an adequate number of cross members to resist frame distortion. The frame shall be the industry standard nominal 34-inch width. An integral front frame extension shall be provided. There shall be no notches in the frame to accommodate the extension. Frame liners, wrappers, fish plating, or bolt on extensions are not acceptable. The center frame over the broom structure shall be fabricated from tubular steel and formed plate attaching to high strength steel channels.

A full width rear bumper is required to protect the rear of the vehicle. Bumper shall have an approximate 12-inch height to offer ample protection at rear of the vehicle. There shall be two tow eyes or tow hooks mounted on the rear of the vehicle frame. If the vehicle becomes disabled, the tow eyes/hooks shall be able to be used to pull the vehicle off the runway without inflicting damage to the vehicle. Mud flaps shall be provided behind both axles and in front of the rear axle to reduce snow and debris on truck.

Chassis Engine

The engine shall be a four stroke EPA compliant diesel type, six cylinders, developing a minimum of 450 horsepower and shall be equipped with latest diesel electronic control and engine management system. The engine shall be provided with full flow, replaceable oil filters, heated fuel water separator, high idle and cruise control, engine manufacturer's standard fuel filtration system, and emergency (power derate) system with indicator and buzzer, in event of high water temperature and/or low oil pressure. A dry type two stage air cleaner is required with under hood air intake to prevent snow ingestion. Air intake must be switchable to outside air for operation during warmer operations. The air intake filter canister(s) shall be located under the chassis engine hood.

The exhaust must be mounted in a way to protect the crew from burns.

Additionally, switches shall be provided on the dash control panel within easy reach of the operator to allow the operator to select either high engine idle when the vehicle is in a stationary position or cruise control when the vehicle is moving. Either function shall be automatically disabled if the operator utilizes the brake or throttle pedals or parking brake control valve.

The carrier engine access cover shall be the manufacturer's standard type enclosure. Lowering shall be accomplished by means of an orifice release to provide a slow and safe lowering of the hood.

Cooling system, hydraulics and other required elements of the power pack shall be protected by a fiberglass hood. Daily maintenance points shall be clustered at an easily accessible point. The engine cover shall be of adequate size to allow convenient access to the daily maintenance items.

Chassis Engine Cooling System

The cooling system shall consist of a heavy-duty combination charge air cooler, engine coolant radiator, transmission oil cooler and hydraulic system cooler with vertical flow for maximum cooling with the top & bottom tanks, and side members welded together to form a rigid frame. The radiator and cooler assembly shall be mounted with vibration isolators alongside of the engine. The transmission cooler shall have a low temperature bypass to allow rapid warm up of the transmission. The engine cooling system shall be filled with permanent type antifreeze protecting the system to -34 degrees F. Certification and proof of carrier engine cooling tests is required.

Fuel System

The tanks shall be constructed of heavy gauge steel or aluminum and be properly fastened to the frame. A four-inch diameter filler neck with chain connected cap and brass tank drain plugs shall be provided. For each fuel system, the twin fuel tanks shall be interconnected, single side fuel fill, 30 GPM fill rate with shut-off valves at each end. A Racor (or similar) heated fuel/water separator shall be installed in the supply line to each engine.

Available total fuel capacity shall be sufficient to ensure an average operational time span of 12 hours with both engines under full load before there is a need to refuel.

Transmission

The transmission shall be an Allison (or similar model) RDS four-speed automatic minimum and shall be supplied with the appropriate torque converter for this application. Shifting shall be accomplished via a touch pad shift control within easy reach of the operator. A low transmission oil level sensor system shall be installed and lower engine to an idle when activated.

Chassis Drive Line

The chassis driveline shall consist of the manufacturer's standard production four-wheel drive system.

Axles (modular plow chassis or integral non-articulating chassis)

The front axle shall be a full floating, torsion flow drive/steer type, with a single reduction hypoid gear design, minimum 27,000 pound GVW rating at the ground, minimum 10" ground clearance, capable of withstanding the loads of the unit being bid. A driver controlled traction differential unit is required in the front axle.

The rear axle shall be a full floating, torsion flow drive/steer type with a single reduction hypoid gear design, minimum 25,000 pound GVW rating at the ground, minimum 10" ground clearance, capable of withstanding the loads of the unit being bid. A driver controlled traction differential unit is required in the rear axle.

For extended life, the steering-drive wheel ends shall be bolted to and removable from the center section of the axle housing. The permanently lubricated cardan drive type joints shall be enclosed in a ball and socket, manufacturer's standard design. The trunnion pins shall be supported by high capacity low friction sealed spherical bushings to insure long life and smooth steering at all cramp angles. DOUBLE REDUCTION TYPE AXLES AND HUBS WILL NOT BE ACCEPTABLE.

Four Wheel Steering System (modular plow chassis or integral non-articulating chassis)

Front axle steering shall be Sheppard (or similar) integral hydraulic power assist gear type. The steering gear shall be rated for heavy duty service. For safety, a mechanical linkage shall be maintained between the operator's steering wheel and front axle, allowing manual steering in the event of a hydraulic or electrical system failure.

The electronic over hydraulically controlled rear axle steering system shall operate in conjunction with the mechanically controlled front wheel steering system. This system must consist of the following components and operating features:

- ☑ A mechanical front steering system with hydraulic assist
- ☑ Front and rear driving, steerable axles
- ☑ Various hydraulic control valves, wheel position sensors, speed sensor and a steering cylinder located on the rear axle
- ☑ ECU (electronic control unit) is integral to the vehicle ECU

Four-wheel steering shall be electronically coordinated through the standard steering wheel. The operator shall be able to select the desired mode of operation "on the go" with provisions made for safe transition from one mode to the other. A selector within easy reach of the operator shall provide the option of front steer only, crab steer, or

coordinated front/rear steer. Additionally, a thumb switch control on the joystick shall be provided for controlling rear steer only.

The system shall include safety provisions for dampening of all wheel steer effects at higher speeds, but it shall also allow full operation while the vehicle is moving at lower speeds. An indicator shall be provided in the cab to display mode selected and rear wheel position. Safety dampening of all wheel steer effects shall be related to vehicle speed.

System shall include the manufacturer's standard design for an integrated lock-out control (to disable steering modes) as may be required by management personnel. All of the four-wheel steering system controls are to be located in the cab easily accessible to the operator. The all wheel steering system must be preprogrammed with multiple steering modes for improved maneuverability. The driver must have the option to select one of the following modes of operation "on the go" based on the driving conditions at hand:

1. **Front Steer:** When in the front mode the vehicle behaves like a conventionally steered vehicle. In this mode, the rear axle is locked and does not steer. Use this mode when enhanced maneuverability is not needed or during operation at speeds greater than 10 mph.
2. **Coordinated Steer:** This mode gives the operator the tightest turning radius of any of the available modes. When the front axle is steered, the rear axle turns in the opposite direction of the front, which reduces the turning radius and enhances maneuverability. This mode also has a deadband feature. Deadband allows the vehicle front axle to be turned a predetermined number of degrees in either direction before the rear axle steers. The deadband varies per the speed of the vehicle.
3. **Crab Steer:** When the front axle is steered, the rear axle steers in the same direction as the front axle. This makes the vehicle travel in a diagonal motion, sometimes called "crab walking". This mode can be useful for parallel parking or for counteracting side forces applied to a vehicle, such as during low speed snow plowing or brooming operations. This mode also has a speed controlled variable deadband.
4. **Operator Controlled Rear Steer.** When in this mode, the rear axle shall be controlled only by a dedicated control in the cab, independent of the front wheel position. This mode is required for backing the vehicle or when the vehicle is moving large amounts of snow and more implement angle is desired. The hydraulic locks shall remain operational; however, the mechanical lock is disengaged (unlocked) at all times when in this mode.
5. **Auto-center feature:** Assists in relocating the rear axle to the straight ahead position after use of the operator controlled rear steer mode.
6. **Switching Between Modes:** The mode switch shall be active at all times. However, the ECU shall not switch modes unless the front axle crosses center for operator safety. If the front axle does not cross center the system shall remain in the previous mode until the front axle crosses center. The rear wheels must also be in the straight-ahead position before the mode change occurs.
7. **Wheel Position Indicator:** The system must include a wheel position indicator which shows the front and rear axle position at all times.
8. **Mode Indicator:** The mode indicator feature shall consist of one of four icons on the operator display indicating which mode is selected and whether rear axle is locked

9. Managers Password: A password or key switch shall be provided which will allow supervisory personnel to “lockout” or “enable” operation of the all-wheel steer system. This password is included to ensure that only those operators who are qualified to operate the vehicle all wheel steering system are permitted to do so.

Springs (modular plow chassis or integral non-articulating chassis)

The unit shall be the manufacture’s standard design and be rated according to the expected conditions and loads to be imposed.

Brakes (modular plow chassis or integral non-articulating chassis)

The service brakes shall be fully air actuated, drum and shoe type with a minimum 16 CFM air compressor and documented to conform to FMVSS 121, S-cam type front and rear. The parking brakes shall be spring actuated, air released at the rear service brake air chambers with the air switch mounted within the cab and in easy reach of the operator. An electronic anti-lock brake system is required, 4 Sensors-4 Modules. The air system for this unit shall be equipped with frame mounted, heated air drier system. Remote cable drains shall be provided for each air tank. DISC BRAKES AND DRIVELINE BRAKES ARE NOT ACCEPTABLE. When necessary, in addition to the brake system traction control, the engine shall also derate until traction is reestablished.

Wheels and Tires (modular plow chassis or integral non-articulating chassis)

This unit shall be equipped with proper sized wheels and tires for the GVW rating of the unit being bid. Single wheels shall be furnished for the front and rear axles. Aluminum disc wheels preferred but steel disc type are acceptable. Wheels shall have an 11-1/4" bolt circle. The tires shall be open shoulder traction tread 445/65R22.5 or equal. Supplied tires must be readily available from commercial truck tire outlets. No military surplus wheels/tires will be accepted.

Cab

This unit shall have a fully enclosed, thermally and acoustically insulated (83 db as measured 6" from the driver’s ear at full engine RPM), fiberglass, aluminum, and glass cab. Adequate space for the convenient installation of two communication radios shall be provided. Minimum cab height shall be 132" as measured from the ground to the top of the cab.

The cab of this unit shall be provided as follows:

1. A tilt/telescoping steering column.
2. Manufacture’s standard heated windshield, minimum 2550 square inches. Side windows shall be power roll down type, one on each side of cab in each door, 6 square feet each. Rear window shall be minimum 3 sq. ft, stationary type.
3. Rear corners of cab shall include sight windows for visibility of processed runway surface.
4. Four peep windows are required in the cab front fascia below the windshield to assist operator in monitoring plow and casters.
5. All windows shall be tinted safety glass, DOT approved and stamped.
6. Minimum four electric variable speed wipers, providing operator absolute, clear line of vision, providing a minimum of 80% swept surface of the windshield. Wipers are required on right and left side windows.

7. Six-quart Heated reservoir for wet arm wipers required. System shall include an automated sequence which soaks the windshield and performs wiper sweep with the press of a single button, minimizing dry wipe.
8. High output, fresh air type heater/defroster/air conditioner with multispeed fan motor, mounted behind the operator to minimize visibility obstructions to the front. Cab heater with defroster shall be capable of maintaining a 50-degree F inside temperature at sea level when the ambient temperature is -20 degrees F.
9. The HVAC system shall include a screened, vent near cab rear for fresh air intake into the HV unit. Air flow of 380 CFM minimum required. Vent controls shall be provided from panel selection including inside or outside air intake.
10. Cab doors shall be provided with stainless steel piano type hinges. Hinges shall be bolted to the door and bolted to the cab frame. Hinges shall not be welded to doors and/or cab. Interior lower panels of doors shall include a nonmetallic liner to assist in sound absorption. Side sight peep windows required in lower portion of each door, minimum of 70 square inches each. Glass pane in each skin of door required.
11. Auxiliary power outlets (2 minimum) required near center of cab for access by operator or passenger.
12. Inverter 12vDC
13. Dual, heated, motorized West Coast type mirrors operated from the operator position in the cab
14. Self-canceling turn signals with hazard switch.
15. Key type starter switch for chassis engine. Integrated safety checks shall prevent starting when an unsafe condition is detected.
16. Coat hooks.
17. Cup holder shall be located within easy reach of the operator.

18. The operator seat shall be air ride, high back, fully adjustable in the horizontal and vertical positions, left side arm rest, adjustable lumbar support, cloth covered, load adjustable and furnished with 3-point type safety belts. Custom right side adjustable arm rest shall contain joystick for implement and, if equipped, all wheel steer control. Arm rest control shall include a vertical stow feature to facilitate easy egress/ingress of operator. A detent or similar device shall hold arm rest in the stowed position, with release control provided for operator.

19. An air ride, high back, fully adjustable in the horizontal and vertical positions, adjustable lumbar support passenger seat shall be provided to the left of the driver. It shall also be equipped with three- point type safety belts; arm rests are not required.

20. All digitally controlled electrical circuits shall be protected by solid state circuitry and logic. Power supplies to control modules shall be protected by manual and automatic reset circuit breakers. Master wiring circuitry boxes shall be mounted behind operator. Circuit breakers controlling all analog circuits shall be easily accessible.

21. The interior of cab shall be fully insulated. The floor of the cab shall be insulated with thermal-acoustical sound barrier floor mat.

22. Master connection point for radios in center of cab, within reach of operator and passenger.

23. Electric horn or air horn.

24. Multiple access panels in upper console to allow easy access to switch and wiring connections. Instrumentation shall be centered on a color liquid crystal display mounted to the tilt/telescoping steering wheel. Available information shall include:

1. Speedometer/odometer

2. Tachometer and hour meter that registers when engine is running only.

3. Voltmeter.

4. Air pressure gauge, dual system

5. Time

6. Fuel level with low level indicated by color: yellow at 15% remaining, red with audible alarm at 5% remaining.

7. Warning Icons required for: Low Air Pressure, ABS Fail, ABS Communication Lost, Engine Stop, Engine fail warning, Low voltage, Engine overheat, Engine low oil pressure, Engine air intake restriction, Transmission overheat, Transmission fail, Control system node communication lost, Transmission communication lost, Parking brake applied, Traction lock engaged, Windshield washer fluid low level indicator, Message center for fault messages affecting operation, Hydraulic temperature warning, Hydraulic fluid level low, Left and Right turn indicators, High beam indicator. A summary of fault messages with most probable resolutions shall be provided in the service manuals required elsewhere in this specification. Multiple selections of display shall be provided for operation and maintenance. Fault codes shall be "notify of failure" with operator attention drawn to the area of fault. Display of ground speed required. Display shall include selectors to page through digitally displayed instrumentation for maintenance and routine pre-operation check list procedures. Full in-depth diagnostics shall be available from the operators control screen. A laptop computer with required cables and programming shall be provided shall be provided. In-depth, diagnostic functions for engines and transmissions shall not be required. Bidder shall include an accurate description of available diagnostic features to be included with a laptop.

Electrical and Lighting Electrical system shall be multiplex technology for efficiency and maximization of control parameters. All lighting on this vehicle shall conform to FMVSS. All lighting shall be 12 volts, and shall include, but not be limited to, the following:

1. Two fender mounted headlights w/ integral turn signals per FMVSS.
2. Dual LED stop, tail, turn, clearance and backup lights per FMVSS. Back up alarm with auto adjustment for noise level.
3. In lieu of providing an FAA compliant amber strobe/warning beacon, the wiring shall be center mounted on forward portion of cab roof to the end point of use. The OWNER shall supply and install a beacon of their choosing.
4. Cab dome light.
5. Variable intensity instrument lighting, push button control with ramp up through approximately 16 steps.
6. All instruments and controls shall be labeled in a manner to remain legible for the life of the unit and shall be illuminated.
7. Two headlights with high/low beam and integral turn signals mounted on a light bar near front outside corners of cab near leading edge. Light bar shall be vertical and made of round material to allow infinite positioning and aiming of auxiliary lighting as specified. Deutsch type sealed connector required at each light bar to pass electrical connections through cab shell.
8. One 12-volt, 240-amp minimum alternator with built-in regulator.

On Board Diagnostics and Electronic Control System

Functional control of vehicle shall be centered on an electronic control system utilizing a data bus. Reliability and precision operation of the unit requires heavy reliance on solid state circuitry and components and minimized reliance on traditional multipin “physical switch” type relays. Electronic control systems shall include on board diagnostic assistance and other features to simplify the operation, troubleshooting, and repair of the chassis.

Electronic control modules shall be of the highest reliability and durability for use in mobile equipment. System shall comply with the following:

- 1) High amp manual resettable circuit breaker protection is required upstream from the electronic control modules;
- 2) Y’ connectors from the data bus to the modules shall be physically labeled in the vehicle for ease of maintenance and troubleshooting;
- 3) Control boxes shall include a dual external LED tattletale, one LED displaying constant illumination indicating power supply, and one LED displaying a “heartbeat” indicating internal proper function
- 4) A timer module shall serve to keep electronic modules live for 5 minutes after last cycle of door switches indicating egress from vehicle. This unit shall maintain heartbeats and power indicators at modules and their function without the key switch on. After a 5-minute period without a change of status in door switches, unit shall automatically shut down completely.
- 5) Data bus terminal resistors shall be EXTERNAL to control modules for ease and economy of replacement. Terminal resistors within the control boxes shall NOT be used as part of the electronic system structure

6) Certifications of testing and durability of electronic modules; a. EMI-RFI (meeting mil-spec of 150 volts/meter) b. spray survival for 1,000 hours' minimum (ASTM B117) c. Water immersion d. High temperature tested at 125% overload for 100 hours, minimum e. Vibration tested to 50 g's

7. ECM shall be overload and reverse polarity protected with self-diagnostic capabilities

8. Field Effect Transistors (FETs) shall provide power output to electrical functions, acting as a solid-state relay and circuit breaker in one

9. FETs shall shut off automatically in the event of short to ground, cycling on and off to test itself for proper function to avoid damage while allowing search and repair of fault

10. Individual FET ratings and over-current protection to be programmed to values of 1 to 15 amps depending on task assignment.

On Board Diagnostics Features and Performance

Electronic control system shall include and enable diagnosis of chassis and engine systems by means of the LCD dash display or laptop computer. Transmission diagnostics shall be accessible through blink codes from the transmission pushbutton shift selector. Chassis anti-lock brake diagnostic codes shall be accessible through blink codes using the chassis ABS indicator on the display and the ABS blink code switch.

System shall include the following at a minimum:

1. Message area on LCD to display error message to operator as any system function fails. Available during operation on operations screen.

2. Error message toggle if more than one failure is present.

3. Password registration with chassis OEM's Service Department.

4. Memory retention of failures until cleared by maintenance personnel with password access

5. Real time operational indicator of system function on diagnostics/maintenance screens There shall also be diagnostic connection ports for advanced chassis, engine, and transmission diagnostics.

Plow and Broom Controls The control for the plow and broom shall be the same. The hydraulic pump for the controls shall be driven by the chassis engine and provide flow and pressure capacity for all systems. The operator's control shall be an integrated with the chassis and broom. All switches shall be lighted rocker style. It shall have all necessary functions to operate the plow and shall have at a minimum the following, multifunction CAN controlled joystick with multi-switch head for plow and broom lift/lower and left/right swing. Low hydraulic oil level warning light

Plow and Hitch General - These specifications describe a Power Reversible Plow with a flared discharge and polymer moldboard, manufactured expressly for airport runway high speed and ramp plowing. This plow shall be rigidly built of new material suited for continuous work under extreme conditions of snow removal. The front attachment plow hitch to the chassis shall be a "Hands Free" type. It shall allow hands free interchange of the plow and other attachments from the operator position in the cab. It shall be hydraulically operated (plow lift, swing, and lock) and designed for power reversible runway plows. The plow moldboard and push frame must be capable of being completely removed or attached from the vehicle's cab without leaving the operator's seat and without the need to disconnect or reconnect hydraulic lines and connections by the operator. It shall be automated and fully repeatable. The entire process of hitching or unhitching shall be possible by one man and shall be positive connected with hydraulically operated lock pins. There shall be three sections of the

hitch: 1) Chassis side, 2) module, and 3) moldboard side. All hydraulics and structure for plow lift, swing, oscillation, and lock shall be on the module section, which shall be located between the chassis and the moldboard sections of the hitch. The moldboard section shall be a J-Hook style coupling. Provisions shall be made to allow the module portion to be readily removable from the chassis.

Plow Hitch: Chassis Side On the front chassis frame rails, shall be a DIN plate style coupler for connection of the module. It shall consist of two side (cheek) plates of adequate size bolted to the chassis frame rails with a welded 0.63-inch-thick push plate. This flat mounting push plate shall have two top mounting pockets to accept the mating portion of the module and slots for four 1-inch diameter swing bolts.

Plow Hitch: Lift, Swing, Oscillation Lock Module The module (hydraulics and structure for the plow lift, swing, oscillation, and lock) shall be mounted and unmounted from the chassis by means of a chassis mating DIN plate hitch of a size to support the weight and operation of the plow. The entire process of removing or installing the module shall be possible by one man. All hardware shall be grade 8 (or better).

Lift: The plow lift system of the module shall be a parallel lifting type consisting of two parallel tubular lift arms of 3-inch x 3-inch x 0.31-inch wall steel tubing. The design shall incorporate a dual acting plow lift cylinder. The hydraulic double acting plow lifting cylinder shall be 4 inch bore 15.75-inch stroke with a 2-inch diameter rod. This lift cylinder will also serve to “hands free” remove and attach the plow moldboard. The plow lift hydraulic system will be furnished with a relief valve to prevent no more than 200 PSI down pressure. The lifting cylinder arrangement shall incorporate a mechanical transport lock that shall take the weight of the plow off the hydraulic cylinder during plow transport and shall act as a safety in the event of a hose failure during transport.

Swing: The plow swing system of the module shall be equipped with two telescoping type hydraulic cylinders enabling the plow to be angled left, right or straight ahead. Maximum angle to the left or right shall be 32 degrees. The telescopic hydraulic cylinders shall be of the two-stage type. For corrosion protection, the tubular stage shall be chrome plated and the rods shall be nitride. The cylinders shall be heavy duty to allow for heavy snow plowing under severe conditions and shall be equipped with a double acting hydraulic cushion valve mounted on the plow to protect the cylinders from damage. The cylinder mounting bolts shall be 1.00-inch diameter. The hydraulic port in the angling cylinders shall be 0.75-16 standard straight SAE “O” ring thread. The hoses used shall be standard 0.50 inch SAE 100R2 rated. The swing pin (center and vertical) shall be 2-inch diameter by 31.75 inch in length with top and bottom yokes. There shall be a DX type bushing installed in the center of each yoke assemblies for low friction movement of the swing pin. The two parallel tubular lift arms shall be attached to the top and bottom yoke. The yokes / lifting arms connections shall have a hardened steel sleeve bushing.

Oscillation:

The plow oscillation system of the module shall incorporate a drive frame that allows oscillation of the plow with respect to the chassis in order to follow the pavement contour. The plow shall oscillate a minimum of 2 degrees overall. The oscillation mechanism shall consist of two front facing vertical plates which can pivot and slide. When the plow is carried in the raised position and angled right or left the plow shall remain approximately level to the pavement.

The front plate shall be steel plate with a bushing on the top for the oscillation pivot tube and slots cut in the bottom for the oscillation slide bushings. The back plate shall consist of a formed plate and backing plate to form a boxed section. The oscillation pivot tube and oscillation slide bushings shall be welded in place facing forward on the boxed section. The back side of the boxed section shall attach to the plow swing pivot pin (center vertical).

A poly plate shall be sandwiched between the two oscillation plates to reduce friction and wear. No metal on metal. The oscillation assembly (two plates) shall be held together with five bolts, 1.0-inch diameter with backing plates and lock nuts. There shall also be two rubber cushions bolted to the plow push frame to limit and cushion the end of oscillation travel.

Lock:

The plow lock system of the module shall aid in the hands-free attachment of the plow moldboard and to positively secure the plow moldboard to the hitch module. The top of the front oscillation plate shall have a steel receptacle with a tapered sideways lead in to accept the J-hooks of the moldboard. The bottom of the front oscillation plate shall incorporate an outward acting, horizontal, double acting hydraulic lock cylinder operated from cab with a switch. At the ends of the cylinder shall be lock pins. When activated, the lock pin translates into the mating holes in the plow moldboard push-frame. The lock pins shall be tapered to pull the moldboard and the module together to form a positive lock. The lock pins will be capable of being installed without the need of an additional hydraulic cylinder to push the moldboard away. A proximity sensor with confirmation light in the cab shall also be provided to confirm the pins are locked on the holes.

Plow Hitch: Moldboard Side

The plow push frame will have two J-hooks each that will allow the operator to lower the plow hitch, drive forward into the hooks, and then pick up the moldboard. At the bottom of the push frame shall be the mating holes for the lock pins to secure the moldboard to the plow hitch.

The moldboard and push-frame frame, once detached, will rest on the ground on the caster tires and the cutting edge only. No blocking shall be needed to prevent roll.

Plow Push Frame

The push frame shall be of severe duty design with no less than three horizontal steel rectangular tubes. There shall be six urethane cushions on the bottom of the plow frame compressed to a length of 4 inch by means of six bolts – 1.25 inch in diameter and six lock nuts. For durability and safety on the runway, each cushion assembly shall have

a 1.50 inch OD hardened steel sleeve tube over each bolt for sliding inside the push frame. This prevents over compression of the urethane cushion when assembling and prevents wear of the bolt. The urethane cushions mount to a pivot weldment that connects the push frame to the moldboard via four pivot pins. The pivot pins shall be 1045 CR steel, 1.50 inches in diameter.

The swing stops shall have a poly liner installed to allow free oscillation of the plow frame. When swung to 32-degrees, the plow push frame shall stay against the stops as the operator raises and lowers the plow, no additional swing adjustment needed.

Four heavy-duty braces on top of the plow frame shall allow the plow and cutting edge angle to be adjusted to positions of 65, 75, and 85 degrees from horizontal for optimum snow handling performance.

Moldboard Assembly

The moldboard shall not be less than 50 inches high in the center portion and not less than 70 inches high at the discharge ends when the moldboard is set at 65-degree attack angle, nor less than 24 feet long at the cutting edge, and formed so as to lend itself to high speed plowing operations. In order to offer a low coefficient of friction and resistance to both corrosion and impact, the moldboard sheet shall be formed from 0.38-inch thick VHMW unwelded polyethylene sheet. When set at 75 degrees, the moldboard shall overhang the cutting edge by a minimum of twelve inches the entire length of the plow.

The sheet shall be formed from a polyethylene material that is made from new resin (recycled material is not acceptable), and shall be color impregnated and ultra violet stabilized to a manufacturer's standard color for best visibility in snow removal operations. Welding of sheet is not allowed.

Moldboard reinforcement shall include a full length formed angle across the top front of the steel shell and minimum of 12 vertical ribs tying the upper shell to the cutting edge mounting angle and its reinforcement. There shall be two ribs at each of the four push points, and four ribs at the end of each flared end of the plow. The minimum of 12 steel vertical ribs shall be made from 0.25-inch thick plate and have a varying cross section, becoming wider as they approach the cutting edge mounting angle. There will be a 0.75-inch thick formed cutting edge support of varying section not less than 73 inches long. There shall be no span between reinforcing ribs in excess of 3.5 feet.

The vertical ribs shall provide support and frame work for a series of window openings in the rear steel moldboard backing frame, tying top reinforcement to the bottom reinforcement. Window opening design shall provide long term, stable backing support for the moldboard, and help prevent moisture buildup behind the polymer plow face.

The polymer moldboard shall be bolted to this durable framework for maintenance of proper snow handling shape. Moldboard shall consist of three separate polyethylene sheets, one for the center section and one for each flared end of the plow. Polyethylene to be retained by 0.625-inch diameter carriage bolts with locking hardware to avoid loss on the operations area of the airfield.

Means of moldboard attack angle adjustment shall be incorporated so to provide 65, 75 and 85 degree settings (from ground plane to back of cutting edge) for use with either steel, carbide, rubber or urethane cutting edges throughout the life of the plow.

Spray Guard Deflector

A spray guard/deflector shall bolt to the top discharge point at the moldboard flange or reinforcement, tangential to the upper radius of the modified "J" style moldboard to direct snow forward, down, and toward the trailing edge of the plow. It shall consist of a heavy-duty rubber belting, 0.40-inch thick x 12.00 inches wide, and shall include a metal retaining strap, 0.25-inch thick x 2.00 wide, with necessary mounting hardware. The hardware shall be of the locking type to minimize opportunity for loss on the aircraft operating areas of the airport. Provisions shall be provided in the mounting system to adjust the spray guard perpendicular to the moldboard on a case by case basis as desired by the airport for seasonal variation in operations.

Cutting Edge

Shall be tungsten carbide inserted rubber (JOMA 6000 or equivalent). The inserts shall be beveled on both sides and the blade shall be not less than 0.75-inch-thick by 6 inches wide. The cutting edge shall be supplied in multiple 3 and 4 foot sections to assemble the overall length for ease of installation and handling. The cutting edge will be supplied with a two 0.50 x 3.00 thick backing plates and two 0.50 x 3.00 inches wide hardened retaining strips.

Caster Wheel Assembly

Casters shall be capable of swiveling 360 degrees. Wheel and tire assemblies shall be the plow manufacture's standard design for airport use. Descriptive product literature shall be included with the bid submittal.

Vertical adjustment shall be accomplished through two caster barrel arrangements. The outer barrels of the barrel arrangements shall be heavy duty steel tubing, not less than 4.25 inch OD x 3.75-inch ID, provided as part of the major caster mounting bracketry as a welded unit. Inner tubes shall be from not less than 3.25 inch OD x 2.25-inch ID for grease/lubrication fit. Inner tubing to be ground and hard chrome plated to mate with honed outer steel tube housing. Inner tube shall be held centered in outer tube by means of heavy duty nylon rings at top and bottom. The screw adjustment rod shall be heavy threaded rod fitted with jam nut for maintaining adjustment from not less than 1.375-inch diameter stainless steel, threaded rod.

Each caster assembly shall be equipped with an adjustable brake dampener so to minimize wheel wobble.

Stands

The moldboard shall have a pair adjustable leg stands to be used for plow removal / storage with the other remaining weight on the caster tires. They shall aid in raising the cutting edge during change. They are required for safety and storage reasons. Drive Frame=Low gloss black in color

Broom General

The broom head shall provide a swept path of 18.0 feet at full angle. It shall be 46 inches in diameter and 22-feet in length and be capable of producing a minimum of 4024 Ft-Lbs of torque at maximum hydraulic pressure of 5075 psi and 500 RPM, with an air blower system capable of producing a minimum of 13,400CFM at 231 MPH. The broom head and air blower shall be hydrostatic drive with infinitely variable speed hydraulic pumps and fixed displacement motors. The broom shall have the ability to

remove snow, ice, slush, sand and other debris at rated speeds up to 40 MPH depending on conditions. To confirm this, the following must be supplied with the bid.

1. The exact proposed broom and air blower drive power system components including engine, gearbox, and hydrostatic pumps and motors must have in field proven experience. No prototypes shall be allowed. The location and serial number along with contact and phone number of at least 2 airports must be supplied with the bid.
2. Engineering hydraulic power calculations confirming the broom speed and available torque values must be supplied with the bid. This includes sizes and specifications of all components from the engine to the broom shaft including specification sheets for the broom and air blower hydrostatic pumps and motors showing type, size, and manufacture. Efficiency losses must also be accounted for. The calculations must be understandable, complete, logical, and in a mathematical order per the Society of Automotive Engineers (SAE) and the Fluid Power Society standard formulas and practices. The burdened of proof is the responsibility of the bidder.

Failure to provide the above information for whatever reason will result in disqualification.

Engine Assembly

The engine used to power the broom head and air blower system shall be a six-cylinder turbocharged diesel engine rated a minimum 450hp. It shall be liquid-cooled, EPA emission certified, and equipped with electronic controls for fuel injection and engine management including an automatic shutdown system and an electrical connector for engine diagnostics.

The engine shall be provided with a full-flow replaceable oil filter and bypass filter, 12-volt starter, master battery switch, and a dual air intake two-stage air cleaner.

1. External turbine type pre-cleaner
2. Primary dry element and safety element

The dual air intake shall allow the system to draw under hood air to prevent snow ingestion, outside air for peak performance or a blend of both to modulate engine intake air temperature. The air intake filter canister(s) shall be located under the engine hood.

The exhaust system with rain-cap shall be mounted on top of engine enclosure. The heavy-duty cooling radiator and heavy-duty charge air cooler shall also be mounted. Antifreeze shall have protection to minus 34 degrees Fahrenheit with distilled water for anti-corrosion purposes and supplemental coolant additive for cavitation and corrosion protection. The cooling fan shall have an automatic thermostat (high / low) control. The fan shall periodically and automatically reverse for the purpose of eliminating snow accumulations on the radiators. The fuel tanks shall be capable of holding enough diesel fuel for 12 hours of operation. A fuel water separator with 200-watt heater to remove water and contamination in the fuel supply shall also be supplied. Application approval from engine manufacture must be included with bid submittal.

Engine Enclosure

The engine enclosure shall cover the chassis including wheels / fenders, engine, and control panel to eliminate snow accumulation. It shall be weatherproof design and

totally enclosed to eliminate snow ingestion. Airflow through the enclosure must be controlled. The engine enclosure shall be pressurized using the cooling fan for the radiator and charged air cooler. To provide easy access to engine for servicing and repairs, the enclosure shall be of the manufacturer's standard design. An auxiliary electric motor / pump shall be provided to operate all the broom control functions and the engine enclosure if applicable without running the broom engine. Access doors if required by design shall also be provided in the enclosure to enable routine maintenance inspections as well as providing access to the fuel tank filler, battery box and the service control station. The doors must have a provision to hold them open or closed as desired. A pendant control if required by design to raise and lower the enclosure assembly shall be provided. The pendant shall be provided with a minimum 12-foot cable length. Two switched lights in the enclosure, one on left, one on right side shall be included. The platforms shall be continuous along full length inside the engine enclosure, both sides, allowing access to all components requiring periodic maintenance. Steps and assist handles shall be provided for access to both the left and right side platforms.

Broom Hitch

The broom hitch shall provide low friction, free flotation, shock absorbing, and weight transfer for the broom head.

The low friction, free flotation is required so that it is independent of broom chassis for vibration and bounce considerations and to accommodate surface irregularities. A parallel arm system with four horizontal pins shall be used. The two arms shall be box construction for torsional stiffness with 2-inch diameter pins on greaseable low friction bushings, DX prelubricated type (no metal on metal).

To maximize vehicle tractive effort, braking, steerability, and overall handling of the broom chassis, the broom chassis shall carry approximately 50% of the broom weight by utilizing a weight transfer system. A pair of hydraulic cylinders shall support the parallel arms of the hitch. Pressure in the hydraulic cylinders provides the lift necessary to transfer approximately 50% of the broom weight to the chassis. A control valve adjusts the oil in and out of the cylinders to provide the same weight transfer no matter what the surface irregularities. The vertical stroke of the cylinders and thus the hitch shall be 12" minimum.

The pair of hydraulic cylinders shall also "free float and dampen" the parallel arms of the hitch to minimize broom bounce at high vehicle speeds. The broom hitch must have hydraulic cylinders to provide an active shock absorbing systems.

Broom Angle

The broom head shall be capable of swinging 35 degrees left or right, selectable from an operator's joystick. Using a longer broom than specified to accommodate swept path for larger swing angles are unacceptable due to storage and maneuverability reasons.

Means of dual swing arms with four pivot points, which ensures the weight of the broom head remains approximately on the chassis centerline regardless of the position of the broom head. The broom pattern shall not vary more than 0.5-inches end to end for the whole width of the broom.

Broom Oscillation

The broom oscillation shall provide true flotation left to right for the broom head so that it is independent of broom chassis to accommodate surface irregularities and thus minimize brush pattern variation during operation. It shall have at least 8 degrees (+4, -4) of free-floating oscillation from left to right. The ability of the broom head to oscillate shall be provided by means of a spherical bearing assembly and low friction nylon pads.

Broom Elevation and Brush Pattern Adjustment

The broom head elevation shall be a vertical lift type such that the relationship of the broom hood and deflector to the ground does not change except the height. The horizontal angle does not change. The elevation action shall have adequate stroke to achieve ground clearance during transport when not in use. The lift shall be powered utilizing two hydraulic lift cylinders, one on each end of the broom frame, controlled by the operator's joystick. The lift cylinders shall be equipped with a counterbalance valve, which prevents the broom head from creeping down.

There shall be an automatic broom pattern control system with adjustment from cab. A time-based system shall be used to readjust the broom pattern by counting the time in the broom down position. When the preset time is reached, the broom head will index down a preset amount. At that time the timer is reset and restarts counting. Time running in the up mode is not counted. Manually adjusting the pattern from the cab or broom head will reset the timer.

A manager-controlled activation / deactivation setting shall allow operator to adjust broom pattern from inside the cab when activated. Manual adjustment (Push a button) increases the pattern in predetermined increments. Same for pattern decrease. These broom pattern adjustments can be achieved in the cab while moving and without raising the broom head. There shall be an additional pattern control switch at the broom head for control from outside.

Broom Head

The brush itself shall be 46 inches in diameter and 22 feet long comprised of two 11 foot sections. The broom head frame must sustain the loads imposed by the snow removal capacity of the unit. It shall be fabricated from steel tube-in-tube design with minimum 0.38 inch walls and include provisions for grease between the mating surfaces. The hydrostatic broom drive shall be dual end drive. Power shall be supplied from two variable displacement hydrostatic pumps mounted on the engine's gearbox. Two high-speed hydrostatic motors each connected to a planetary reduction gearbox shall be mounted within the inner diameter of the broom cores outer ends to minimize overall width. The motor gearbox connections shall utilize a static o-ring seal, wet spline type. No dynamic seal shall be used for reliability purposes. The motors shall not support the broom core loads and the planetary gear box shall be hydraulic oil bath lubricated (case flushing type).

Speed of broom shall be infinitely variable from 0 to minimum 500 RPM. Available torque at the broom shaft shall be 4024 ft-lbs minimum hydraulic pressure of 5075 psi for maximum snow moving capabilities. Engineering hydraulic power calculations confirming these values must be provided with the bid. Power shall be transmitted to the broom core from the gearboxes utilizing keyed tapered hubs to prevent any looseness in the connection for vibration concerns and high strength molded urethane

drive cogs into replaceable hardened steel core drive sprockets of the core. Hardened steel pilot plates shall support the radial loads.

The broom rotational speed shall also compensate for bristle wear to maintain a constant bristle tip speed relative to vehicle speed no matter what the brush diameter. Manual override capabilities shall also be supplied.

A maximum 2-inch gap between broom core sections shall be obtained by using a center bearing assembly utilizing the same components as the drive ends. The center bearings shall be encased in a sealed housing and be provided with oil bath lubrication. Manual greasing of bearings is unacceptable. The left and right side core sections shall be connected to each other by a center shaft so the two sections rotate at the same speed, and that the power produced by each of the end drive assemblies is transmitted across the full length of the core assembly

The broom end plates shall be steel fabricated using thick welded steel plate construction with thick steel tube for mounting the broom drive gearboxes. The end plates shall be reinforced horizontally and vertically using formed channel. The broom end plates shall be secured to broom frame with four 1-inch diameter grade 5 or better bolts.

The unbolted end plates shall slide outward to allow easy access for core and bristle replacement. The slide mechanism shall be round telescoping tube in tube design. A second square tube shall slide on a plastic slide providing additional support and allowing repeatable location of brush centerline alignment during broom core remove and replace operations.

Broom Cores

The two core sections must be split core design for easy handling and efficient (tight) wafer stacking and sustain the loads imposed by the snow removal capacity of the unit. They shall be tubular steel construction with four drive bats, equally spaced around a tube to center each brush wafer. The drive sprockets shall be replaceable hardened steel. Each core shall be individually dynamically balanced to acceptable values at rated RPM.

The brush on the cores shall be full width and designed for runway operation and shall be field replaceable with maximum ease without the use of special tools. The wafers shall be a 50/50 combination of polypropylene and wire. The bristles shall be fastened in a radial wafer fashion to a steel ring. Polypropylene bristles shall be fastened to the steel ring by fusing their base to form a solid loop about the circumference of the ring, then mechanically holding them in place by wrapping the top of the ring over the fused bristle ends to form a dovetail. Wire bristles shall be fastened to the steel ring with wire. The polypropylene bristles shall be 0.075" x 0.105" oval shaped with an 8-pound total wafer weight minimum. The wire bristles shall have a mean diameter of 0.018 inches, galvanized, with a carbon content of 0.81 to 0.86 percent and a 10-pound total wafer weight minimum. All wafers shall be within 50 oz-in static balance and marked at the heavy location

Broom Casters

There shall be four single tire caster assemblies. Each caster assembly shall be free to rotate 360 degrees. The radial pneumatic tires shall be 180/70R8 16 ply. Spring-loaded adjustable automotive type disk brake shall be supplied per caster to prevent caster shimmy at all sweeping speeds. Caster hubs shall be oil filled to provide oil bath

lubrication to the caster bearings. No greasing necessary or allowed. The caster assembly shall be non-suspension type allowing the brush to follow the ground contours as close as possible. The broom head caster support will be mounted to the main broom frame behind the brush and within the swept path

Broom Hood

The broom hood shall shield the top half of the brush completely and fabricated from heavy-duty sheet steel securely bolted to the broom frame. It shall be non-clogging design to prevent ice buildup during freezing slush removal operations at rated speeds. It shall provide the necessary quick access to the brush for replacement of bristles and for inspection. There shall be an adjustable and replaceable stripper bar across the front of the broom to prevent snow carryover. The stripper bar shall be near tangential to the broom outside diameter. The adjustment to bristle diameter wear shall be performed using two mechanical acme thread jacks, one each end of the scoop and broom frame. The adjustment shall position the stripper bar to the bristle diameter. A stationary hanging rubber deflector shall be mounted in front of the brush. There shall also be an integral broom hood "shaker" or vibrator to remove accumulated snow off the broom hood.

Air Blower The forced air blower shall be dual centrifugal impeller type with dual inlets and dual outlets. It shall be mounted on the broom head with the nozzles directly behind the brush. The complete swept path shall be covered by the air flow. It shall produce minimum of 13,400 CFM total at 231-mph velocity air out both sides at the same time. Both nozzles shall blow in same direction at any given time. Deflectors at the nozzle ends shall direct the flow to one side or the other. The nozzle deflector's control shall be hydraulic and interlocked with the broom head angle to blow in the direction of broom casting thus controlled by the operator's joystick. The nozzle deflectors change direction as the broom swings. A separate control shall allow the nozzle deflector's direction opposite of the broom angle by choice. An additional control shall permit blowing without broom operation. The velocity and CFM at each nozzle shall be certified by an independent test facility and supplied with the bid. The centrifugal impellers shall be independently driven via hydrostatic motors. The two motors, one for each impeller, shall be mounted directly to the impeller shaft. Power to the motors shall be supplied from a variable displacement hydrostatic pump mounted on the engine's gearbox allowing infinite control of blower speed from 0 to 100%. Both impeller / shaft assemblies shall be dynamically balanced at the rated RPM. All controls for the air blower shall be remotely operated from within the cab.

Hydraulic System All hoses for all systems shall be properly sized and strength to work with the pressure and volume of oil required. All hydraulic positioning functions (broom head lift, broom head swing, deflector, and air nozzle lift) shall be equipped with a hydraulic position locking system. A counterbalance valve shall be used for the broom lift and a pilot operated check valve for the other functions including broom swing left and right, and air nozzles left and right. All hydraulic functions of the broom shall be electric over hydraulic valving. Connectors to the solenoids shall be

interlocking type to provide a secure connection, which can withstand normal pressure washing procedures. Fluid and components shall be design for temperature to -20 degrees F ambient cold start. The hydraulic fluid reservoir shall be 50-gallon minimum. All filters below tank fluid level shall be installed with provisions to allow filter changes with minimum loss of oil.

Proper filtering shall be done on both the high pressure and low pressure circuits. There shall be a minimum of 5-micron absolute rating on the hydrostatic pumps' filters and placed in the charge pressure lines. There shall be a clogged filter indicator light on the cab control panel indicating filter replacement.

The hydraulic oil cooler shall be mounted at the rear of the engine enclosure and shall be separate from the engine radiator to ensure adequate airflow. The dedicated fan for the hydraulic oil cooler shall be hydraulically driven with automatic thermostat (high/low) control for correct temperature under all conditions, winter and summer. It shall be controlled by a thermostatic switch to avoid excessively cold oil operation and designed such that thermostatic failure results in the cooling fan being engaged. A pressure relief shall allow cold hydraulic oil to bypass the cooler for shorter warm up times. A hydrostatic oil temp gauge and warning light for low hydrostatic oil level shall also be supplied.

Broom Controls and Instrumentation

The operator's control for the broom in the chassis cab shall use the same display as the chassis. One display total in the Cab for both the chassis and auxiliary equipment. It shall have a Monitor, Diagnostic and Control (MDC) for the broom. It shall use CAN (Controller Area Network) serial bus system technology. As stated the MDC station must incorporate diagnostics which displays what is wrong with a particular system. All systems for the broom and broom engine must be part of the diagnostics. All functions and displays must be in easy reach of the operator and integrated into the chassis instrumentation.

The control in the chassis cab shall have all the necessary functions to operate the broom and air blower and shall have the following:

- 1) A 1 broom engine emergency stop push button.
- 2) Multifunction CAN controlled joystick with multi switch head for plow and broom lift/lower and left/ right swing. Broom controls integrated with electric over hydraulic plow controls for simple operator control. It shall also incorporate the shaker on/off and the display control: broom only, air blower duct only, or both. The swing, lift and blower nozzle shall be microprocessor controlled (no relays). Automatic one touch for cycle complete control. Moving the joystick in the opposite direction can reverse the cycle. A switch shall allow the operator to use the automatic control or disengage the system.

3) Broom controls and displays:

Touchpad with sealed pushbuttons or rocker style switches

Broom engine main operating screen

Engine, broom and air blower speed control and display

Oil pressure with visual and audible warning alarms

Coolant temperature with visual and audible warning alarms
Hydraulic oil temperature with visual and audible warning alarms

Engine tachometer

Voltmeter and warning indicators

Air filter restriction warning and alarm

Alarms for engine diagnostics and visual warning indicators and displayed faults

Mode selector: auto / manual

Broom rotational speed tachometer

Status display for:

Broom / air duct coordination

Weight transfer system

Front and rear steering position

Menu selection screen: specific MDC function screens are accessed through this screen

Video screen

Enables a video system to be manually turned on and off

Lighting screen

Daytime / nighttime display screen brightness selection

Joystick / touch pad screen: this screen mimics the features of the joystick

Brush lift up / down

Broom swing left / right

Deflector up / down

Mode auto / manual

Broom on / off

Blower on / off

Shaker hood/vibrato on / off

Auxiliary gauge panel: this screen is used for systems monitoring

Engine, broom and air blower speed control and display

Percent engine power

Engine hour meter

Inlet air temperature

Broom hydrostatic pressure

Settings screen

Joystick control: broom only, blower duct only, or both

Air blower nozzle direction: coordinate / opposite broom swing

Weight transfer with audible alarm when in the off position

Core life hours

Maintenance hours

Broom hydrostatic pressure

Automatic broom pattern control

Pattern increase / decrease
Broom height position

Engine diagnostics screen

- a. Display active faults
- b. Active fault codes
- c. Output diagnostics: this screen is for display only and shows the controller output diagnostics.
- d. Individual system output test function
- e. Output diagnostics last 25 fault history
- f. Setup screen: this screen allows authorized personnel to change the vital settings without the use of a notebook computer and is password protected. If required by design a laptop computer shall be included to allow identical capabilities

Controls located in the broom engine enclosure shall be the following:

Single circuit breaker with Master Battery disconnect

Chassis Options

1. Windshield Deluge System. A windshield deluge system is required to maintain operator visibility during snow removal operations.
2. Consolidated Fluid Drain Lines. For ease of maintenance, drain lines for all fluids which must be routinely be changed shall be routed to one of two locations; either the area behind the cab, or the rear area of the vehicle. At a minimum, drain lines shall be provided for chassis and auxiliary engine oil and coolant, and all hydraulic oil reservoirs. Each drain line shall be clearly labeled and be equipped with a quarter turn ball valve and a screw on cap.
3. Air conditioning for summer cooling and to improve windshield defogging in winter. A separate button shall engage the air conditioning compressor to provide dry, heated air to maximize defroster effectiveness.
4. Rear view color camera and monitor system. Uses the broom MDC display for the monitor. Operator selectable on / off.
5. A 2A 10BC Fire Extinguisher, mounted in the cab, is required.
6. One spare chassis tire and wheel. If the vehicle is equipped with more than one configuration of wheel and tire combinations, a spare shall be provided for each configuration. If applicable one spare tire and wheel assembly for the tow broom shall also be included.
7. Passenger and driver doors wipers, to be heated
8. 8-inch reflective white stripe

Plow and Hitch Options to Be Included

1. Trip moldboard
2. Spare caster tire, wheel, axle, and bearings
3. Spare cutting edge

Broom Options to Be included

1. Broom speed tachometer in cab
2. LED marker lights shall be located at each end of the broom head. They shall be visible to the operator in the rear-view mirrors during sweeping operations and use amber LED's on the front of the light assembly with red LED's facing the rear.
3. Spare broom core assemblies (2 sections) in order that the cores can be preloaded with new segments for quick change during snow operations
4. Spare broom wafer refill kit
5. Set of 4 broom carts for easy broom core loading
6. One spare broom caster wheel, tire, bearings and axle assembly

General Communication Radios In lieu of providing an airport communication radio, the OWNER shall supply and install the airport communication radio of their choosing. **Paint** The complete vehicle shall be painted at a minimum with one (1) coat of metal primer and two (2) coats of FAA approved Chrome Yellow acrylic urethane. The entire broom head shall be low gloss black to aid in melting ice and snow.

Owner's Manual The successful bidder shall provide the following product documentation and support information on paper and USB memory sticks upon delivery, two copies of each: Operation, Maintenance, and Troubleshooting manuals Manuals for equipment supplied by other sources Parts manual identifying every part on the unit including schematics for electrical and hydraulic systems.

Training The unit must be fully assembled and tested prior to delivery. Vehicle shipping costs to the airport is the responsibility of the Bidder. A qualified factory representative must fully install, start-up, and tests the unit prior to training. Training shall be performed by a factory trained and authorized technician. The training shall be performed at the customer's site and shall be 8 hours' minimum for operators training and an additional 8 hours' minimum for mechanics training (mechanics shall attend the operating training first). The purpose of this training is to review safe and effective procedures for use and maintenance of the machine, review and test all systems, assure the full function of the machine. Training will be in small groups – both classroom and hands on training is required.

Warranty The bidder shall warrant his equipment as to the specified capacities and performance, and to be free from all defects in design, material and workmanship. All labor, transportation cost and defective parts shall be replaced free of cost. THIS GUARANTEE SHALL CONTINUE FOR ONE (1) YEAR AFTER COMMENCEMENT OF ACTUAL OPERATION OF THE EQUIPMENT. No exceptions to the guarantee requirement will be accepted. Additionally, the engines and transmission shall be warranted for a minimum of two (2) years.

Component Sourcing Because of the critical nature of this machinery, it is essential that the complete unit and all components be newly manufactured and unused. To this end, the purchaser reserves the right to compare serial numbers of engines, transmissions, transfer cases and axles with the current production records of the component manufacturers. Any component found to be used, or not of current production will be rejected. The contractor (bidder) will replace the component in question with an appropriate and acceptable new replacement component at his own expense.

Prototypes and Experience The airport sponsor requires this specified piece of equipment in order to maintain the airfield during large and small snow events. It will be a central and critical element in the fleet and in the effort to accomplish the airport's published snow plan. Experience building equipment of this nature is mandatory as is a track record of recent manufacture and performance success for machines similar to that specified.

Therefore, location and contact lists are required in the bid package to enable the airport sponsor to contact at least 2 United States airports that have operated similar snow removal equipment from the manufacturer within the last two years. Contacts must be for equipment which has been delivered prior to the announcement of this bid. Airport will contact all individuals referenced to ensure product conformance, reliability and product support.

Quality and Safety Standards

Each bid must include the vehicle manufacturer's certification that the vehicle meets or exceeds the following requirements based on documented test results. Documented test results shall be provided upon request.

FMVSS 571-103 Windshield defrosting and defogging systems

FMVSS 571-121 Air brake systems.

FMVSS 571-207 Seating systems.

FMVSS 571-210 Seat belt assembly.

FMCSR 393.94 Vehicle interior noise levels.

FMVSS 571-101 Controls and displays.

FMVSS 571-108 Lamps, reflective devices and associated equipment.

FMVSS 571-120 Tire selection and rims for motor vehicles other than passenger cars.

FMVSS 571-206 Door locks and door retention components.

FMVSS 271-209 Seat belt assemblies.

FMCSR 393-65 Fuel systems and fuel tanks.

FMCSR 205 Glazing for windows.

FMCSR 302 Flammability of interior materials.

Service, Parts, and Technical Support

Because of the critical nature of this machinery and the specialized design of the equipment, warranty service, parts availability and technical support is considered an integral part of its purchase. All bidder's must provide information on who/where the airport can service the entire unit including the chassis, and any auxiliary equipment provided thereon.

Therefore, the following is required in the bids package:

- 1) Documentation on how prompt warranty service, parts availability and technical support will be provided.
- 2) List of key personnel and Service Technicians available for this project. The Service Technicians must be factory trained and be completely trained to perform pre-delivery start-up service, repair service, and maintenance of the unit offered. The Service Technicians must hold current and valid certifications from the manufacturer.

Technical support contact name and phone number.