BISHOP INTERNATIONAL AIRPORT

REQUEST FOR PROPOSALS

CLASS VI HIGH SPEED ROTARY PLOW

MAY 2019

LEGAL NOTICE

BISHOP INTERNATIONAL AIRPORT

CLASS VI HIGH SPEED ROTARY PLOW

MAY 2019

Bishop International Airport Authority will receive proposals for "Class VI High Speed Rotary Plow".

Sealed proposals will be received until 1:00 pm on Friday May 24, 2019 at the office of the Airport Director.

Proposals must be in a sealed envelope plainly marked "CLASS VI HIGH SPEED ROTARY PLOW", Attention: Operations and Maintenance.

Specifications are available and proposals receivable at the Airport Administration Office, G-3425 W. Bristol Road Flint, Michigan 4850, Telephone: (818) 235-6560.

Bishop International Airport Authority reserves the right to waive any irregularities and to reject any and all bids on any basis and without disclosure of the reason.

Craig Williams, A.A.E.
Airport Director

REQUEST FOR PROPOSALS
CLASS VI HIGH SPEED ROTARY PLOW

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REQUEST FOR PROPOSALS

Bishop International Airport

NOTICE INVITING PROPOSALS FOR
CLASS VI HIGH SPEED ROTARY PLOW

FY19-805-

PROPOSALS REQUESTED

Bishop International Airport Authority hereby solicits proposals from qualified firms (hereinafter called either the Company or Companies) interested in providing CLASS VI HIGH SPEED ROTARY PLOW for Bishop International Airport. The Authority which owns and operates the Airport through, will accept and review Proposals from Companies and select one (1) Company to provide CLASS VI HIGH SPEED ROTARY PLOW delivered to 3425 W. Bristol Road Flint, Michigan 4850.

SCOPE

The airport is requesting sealed proposals for at least one Class VI High Speed Rotary Plow. The Class VI High Speed Rotary Plow must meet SAE standard ARP 5539 Rotary Plow with carrier vehicle. The Class VI High Speed Rotary Plow must meet specifications of the FAA Advisory Circular AC 150/5220-20A Airport Snow and Ice Control Equipment. The equipment must be capable of casting a windrow of snow a minimum of 150'. The equipment must be capable of removing a windrow created by displacement plows and snow brooms that have cleared 1h inch of snow, weighing 25 lb. per cubic foot from a runway that is 150 feet wide with an additional 50 feet of paved shoulders and is 9250 long all in 10 minutes. The equipment must be capable of a minimum of7500 tons per hour.

REFERENCES

Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publication shall be the issue in effect on the date of the purchase order. In the event of a conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Internet address: http://www.sae.org

SAE J931 SAE Jl503	Hydraulic Power Circuit Filtration Performance Test for Air-conditioned, Heated and Ventilated Off- Road Self-Propelled Work Machines

FAR and FAA Publications from FAA: Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Internet address: http://www.faa.gov.

AC 150/5200-30A Airport Winter Safety and Operations

AC 150/5200-18 Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials

AC 150/5210-SB Painting, Marking, and Lighting of Vehicles on an Airport

FMCSR Publications from FMCSA: Available from Federal Motor Carrier Safety Administration, 400 Seventh Street SW., Washington, DC, 20590; Internet address: http://www.fmcsa.dot.gov

Title 49, Chapter III, Subchapter B-Federal Motor Carrier Safety Regulations (Title 49)

Federal Spec 297 D, Rust proofing of Commercial (Non-tactical) Vehicles

RTCA Publications: Available from Radio Technical Commission for Aeronautics Inc,1828 L Street NW, Suite 805, Washington, DC 20036, Internet- http://www.rtca.org

RTCA document D0-186, "Minimum Performance Standards for Airborne Radio Communications Equipment Operating With-in the Radio Frequency Range 117.975- 137.000

FMVSS Standards-latest edition

DEFINITIONS

Axle Capacity:

The allowable load on an axle based on supportive engineering data and the best judgment of the manufacturer of the axle. Usually based on all the components in an axle system, tire-wheel-bearings-spindle, etc.

Axle Ratio:

The numerical ratio of the drive shaft speed to the speed of the axle. The numerical ratio equals the torque multiplication factor of the axle.

Axle, Dead:

A means of support for the wheels at each end that is non-driven.

Axle, Live:

A means of support for the wheels at each end that is driven.

Auger, Drum-cutter Type:

A structure used to disaggregate snow and transport it across the face of a snow blower. When used in a single stage blower, the drum cutter also casts the snow. The helical flights of a drum cutter are affixed to a relatively large diameter cylinder, or drum, that serves as or is attached to the center axis of the auger. Drum-cutters on Single Stage Snow-thrower Rotary Snowplows are also referred to as "Turbines". Drum cutter augers typically rotate on an axis perpendicular to the direction of travel.

Auger, Helical:

A structure designed to disaggregate and transport snow across the face of a snow blower, based on an open helix concept, the helix being mounted to the center axis of the auger, usually by some type of spoke arrangement. The center axis structure of a helical auger is relatively small in diameter when compared to the diameter of the helical ribbon. Helical augers typically rotate on an axis perpendicular to the direction of travel.

Auger, Screw Type:

A screw type structure designed to disaggregate and transport snow across the face of a snow blower, the flights of which are closed and connected directly to the center axis of the auger. Several parallel screw type augers are often used together.

Auger Drive:

The Auger Drive is the final mechanism(s) employed to rotate the Auger(s). An Auger Drive can be hydrostatic, hydraulic or mechanical, or a combination of hydrostatic and mechanical. Mechanical Auger Drives must be protected by the inclusion of slip clutches or shear pins. Hydrostatic drives must be protected by the inclusion of pressure protection devices.

Cab:

An enclosed area on a vehicle designed and intended to hold and carry an operator.

Capacity Rating:

Also see Performance Rating. The Capacity Rating of a Rotary Snowplow is the maximum number of tons of snow a Rotary Snowplow can blow (see Snow-blowers) or throw (see Snow-throwers) a defined Casting Distance.

Carrier Vehicle:

The prime mover for a Rotary Snowplow.

Casting Distance:

The distance from the left to right center of a Rotary Snowplow to the center of the area of most concentrated snow cast observed during casting.

Center Drive Augers:

Augers driven by a gear box located more or less in the center position of the auger axis.

Certification:

Application approval - a confirmation and testimony in writing by a qualified expertise.

Performance - manufacturer must provide certified, credible testing results.

Curb Weight:

The weight of the carrier vehicle with all factory installed equipment and in the travel position, full fuel tank(s) and a nominal 180 pound operator.

Deluge System:

A means of providing fluid to windshield(s), window(s), mirror(s), and other surfaces to improve operational visibility from the cab. Deluge systems shall be controlled from the operator station in the cab.

Differential:

The gear assembly on the drive axle that permits one wheel to tum slower or faster than the other when negotiating a tum. The gear assembly in the transfer case that allows the front drive-shaft to turn slower or faster than the other when negotiating a tum.

Differential, Automatic Locking:

The gear assembly in the transfer case that allows the front drive-shaft to turn slower or faster than the rear prop-shaft when negotiating a turn while providing maximum driving torque to both the front and rear axles. The gear assembly on the drive axle that permits one wheel to tum slower or faster than the other when negotiating a turn while providing maximum driving torque to both wheels. Automatic locking differentials provide positive drive to both driven members while not requiring operator input or control.

Differential, Manual Locking (bevel gear):

The gear assembly on the drive axle that permits one wheel to tum slower or faster than the other when negotiating a tum but with provisions for the operator to fully lock and unlock the differential action from the cab. Bevel gears provide positive drive to both driven members.

Dimensions:

AE	Centerline of rear axle/tandem to the end frame.
BA	Bumper to centerline of Front axle
BBC	Bumper to back of Cab
CA	Back of Cab to centerline of rear axle
CE	Back of cab to end of the frame (AE + CA = CE)
FH	Frame height from the ground to the top of frame
OAL	Overall Length
WB	Wheelbase

Drop Box:

A gear box (or chain box) that transmits power output to a driven implement.

Dual Engine Rotary Snowplow:

A Dual Engine Rotary Snowplow has two engines. One engine provides power to the Rotary Snowplow Head, and the other engine provides motive power.

Equipment, Auxiliary:

Any equipment, in addition to the basic chassis that is required for a piece of equipment/vehicle to perform its functions. For example, a winch would be auxiliary equipment for a tow truck.

Fan, Fan Blades: See hnpeller, hnpeller Blades.

FMVSS: An abbreviation for the Federal Motor Vehicle Safety Standard.

Front Discharge Rotary Snowplow:

A front discharge rotary snowplow locates the operator cabin to the rear of the rotary snowplow head. This provides for the snow to discharge in front of the operator.

Front/Rear Axle Disconnect:

A mechanism designed to engage and disengage torque to the axle.

Fuel Capacity, Maximum:

The maximum actual volume of fluid able to fit into on-board tanks.

Fuel Capacity, Useable:

The maximum amount of fluid able to be drawn from an on-board tank with the vehicle and tank stationary and in the fixed, operating position.

GAWR:

Abbreviation for Gross Axle Weight Rating. The rating of the lowest rated member as defined by the component manufacturer(s) from the following components: tires, suspension, hubs/wheels, rims, bearings, beam and brakes.

Gear Ratio:

The ratio of the speed of the input to a gear to the speed of the output from the gear. For a pair of gears, the ratio is found by dividing the number of teeth on the driven gear by the number of teeth on the driving gear.

Geared Speed:

The theoretical vehicle speed based on maximum governed engine RPM, transmission gear ratio(s), driving axle ratio, and tire size.

Gears, Single and Multiple Reductions:

Single reduction gearing refers to one speed reduction through the gearing component. Multiple reductions refer to more than one step of speed reduction through the gearing component.

Gradeability:

The percent grade that a vehicle will negotiate.

GVWR:

Abbreviation for Gross Vehicle Weight Rating. The sum of the Gross Axle Weight Ratings (GAWR).

HID Light:

Acronym for High Intensity Discharge light. Light created by electric arc, not a filament in a light bulb.

High Speed:

A High Speed Rotary Snowplow must be designed to perform at its maximum Capacity Rating while operating at a forward speed of at least 25 mph.

Hitch:

A device to couple/uncouplea working head or appliance to its carrier vehicle. A hitch may be provided with dedicated units to improve maneuverability, entry and exit through narrow doors, and/or improved maintainability.

Horsepower, Gross Brake (or actual delivered horsepower):

A measure of the rate at which engine power is produced. The time rate of doing work, as measured by a Pony brake or dynamometer. In other words, the amount of work done by a certain torque being exerted over a definite space of time. Brake horsepower is expressed as the torque in pound feet times the number of revolutions per minute divided by the constant 5252.

$$\text{Brake HP} = \frac{\text{torque x engine rpm}}{5252} \qquad \text{(Eq. 1)}$$

Horsepower, Gross:

The brake HP determined under conditions defined by dynamometer test of the stripped engine, that is, the brake horsepower of the engine with only those accessories and attachments necessary to the functioning of the engine during test.

Horsepower, Net:

The brake horsepower delivered to the clutch, or its equivalent, with all accessories and attachments function (including exhaust pipe, muffler and tail pipe) which are standard or regular equipment on the engine as installed in the particular chassis. Gross horsepower less the parasitic loads.

Impeller:

A Rotary Snow blower Impeller (sometimes called a fan) is a rotating device with blades or fan blades. Normally, the device is disc shaped, with the disc rotating on an axis that is parallel to the direction of travel.

Impeller Blades:

The impeller blades (or fan blades) are located proud on the forward face of the impeller disc, shaped to produce a centrifugal pumping action of drawing snow into a low pressure area, and discharging snow from a high pressure area, these areas produced as a result of blade shapes and impeller rotation.

Impeller Drive:

The Impeller Drive is the final mechanism(s) employed to rotate the Impeller. An impeller can be hydrostatic, hydraulic or mechanical, or a combination. Mechanical impeller drives must be protected by the inclusion of slip clutches or shear pins. Hydrostatic drives must be protected by the inclusion of pressure protection devices and/or shear pins.

Impeller Housing:

The Impeller Housing, also sometimes called a volute or fan housing assembly, is the shallow cylindrically shaped assembly that houses an impeller.

Loading Chute: See Spot Casting Chute.

Maximum Tire Load Rating:

The load rating at the maximum permissible inflation pressure for that tire.

Maximum Loaded Vehicle Weight:

The sum of curb weight, passengers, and cargo; equal to the Gross Vehicle Weight (GVW).

Maximum Permissible Inflation Pressure:

The maximum cold inflation pressure to which a tire may be inflated.

Maximum Speed:

The speed attainable by accelerating at maximum rate from a standing start for 1 mile.

Maximum Starting Grade:

The percent grade on which a vehicle is able to start from a complete stop.

Maximum Sustained Vehicle Speed:

Highest speed a vehicle can maintain under full load conditions on level ground.

Monocoque Construction:

A light weight type of construction where the sides of the vehicle bear a substantial part of the load in shear.

NHTSA:

An abbreviation for the National Highway Traffic Safety Administration.

New and Current Production Components:

New, unused and free of all defects and imperfections that could affect the serviceability of the finished product. Component with a manufacture date no older than 1 year prior to bid proposal.

New and of Current Production Unit, as in total unit (Chassis and attachments):

Unit whose manufacture (assembly of) started no earlier than the award date of the contract.

Payload:

The actual weight of the useful cargo carried by a vehicle.

Percent of Grade:

The figure used in computing the power requirements of a truck. Usually taken at the steepest grade a truck will be required to climb on its route. Percent of grade is

Performance Rating:

Also see Capacity Rating. The Performance Rating of a Rotary Snowplow is the minimum number of tons of snow a Rotary Snowplow can blow (see Snow blowers) or throw (see Snow-throwers) a defined Casting distance. Manufacturers must provide certified credible testing results.

Ply Rating:

A unit of measurement used in tire construction to denote strength of tires.

Power Divider:

Usually a small auxiliary gear box or chain driven device to allow distribution of drive shaft power to several different mechanical devices mounted on the same truck.

Power Take-off (PTO):

A mechanical device used to transmit engine power to auxiliary equipment. Power take- offs can be mounted on either a main or auxiliary transmission. Front-mounted and flywheel-mounted power take-offs are also used in various applications.

Power Train:

All the components that handle the engine power from the truck engine to the driving wheels. This includes transmissions, drive shafts, as well as differentials and driving axles.

Pusher Axle:

A non-driven (dead) axle installed forward of the driven axle(s) to increase the permissible gross weight, and consequently, the payload.

Rear Discharge Rotary Snowplow:

A rear Discharge Rotary Snowplow locates the operator cabin over the Rotary Snowplow Head, and forward of the snow casting mechanism. This provides for the snow to be cast from behind, or to the rear, of the operator.

Reflectors:

Glass or plastic prism lenses which reflect light.

Resisting Bending Moment (RBM):

A calculation used to compare frames of different section modulus and of different material. It is the product of the section modulus times the yield strength of the frame material. The formula expression is:

RBM = Section Modulus x Yield Strength (Eq. 2). It is readily apparent from the above formula that the yield strength of a frame is as important as the section modulus. The RBM should, therefore, be taken into account whenever frames of unlike material and section modulus are being compared.

Ribbon:

The relatively narrow flights that are formed into the helix portion of any helical auger.

Road Rolling Resistance:

Sum of the forces at the area of contact between a vehicle's tires and road surface acting against the direction of movement.

Roadside:

The left side of the vehicle when viewed from the rear. Opposite side from curbside.

Rolling Radius:

Height measured from the center of the axle to the ground.

Rotary Snowplow Head:

The Rotary Snowplow Head is the main Rotary Snowplow housing incorporating the auger, the impeller and impeller housing (if any), and the balance of the fabricated assembly.

Serial Number:

A number issued to a vehicle or to a component of a vehicle for identification purposes. See Vehicle Identification Number (VIN).

Set-back Front Axle:

The front steering axle is normally as close to the front of the vehicle as the design and wheel and tire size permit. When the front axle is purposely located farther toward the rear it is referred to as being "set back." Center line of front axle to front of front bumper is normally from 28 to 37 inches on regular models and 48 inches or more on set-back front axle models.

Self-Propelled Rotary Snowplow:

A rotary snow plow that is permanently mounted to a full time dedicated mobile chassis or prime mover that is used for no purposes other than snow blowing.

Shipping Weight:

The dry weight of a complete truck with all standard equipment including grease and oil but without any fuel or coolant.

Side Drive Augers:

Augers driven by a gear box, chain, hydraulic or hydrostatic motor from the left, right, or both sides are Side Drive Augers.

Snow Casting Chute:

The Snow Casting Chute is part of, or attached to, the Impeller assembly and/or the Rotary Snowplow Head assembly where the snow is discharged or cast. The Snow Casting Chute may, or may not be attached to a Spot Casting Chute (see def.). The Snow Casting Chute may be adjustable to allow for operator control of where snow will be thrown through a vertical arc, or it may be fixed to direct snow only in one direction. Also see Spot Casting Chute.

Spring Capacity:

The allowable load that can be supported by the spring(s).

Steering, All Wheel:

Any system that augments the steering action of a chassis, providing for power or power assisted steering controlled by the operator in the cab, on all wheels of the vehicle.

Steering, Power:

Also commonly referred to as "hydraulic steering". A Steering system that uses hydraulic pressure to control a steering axle without a direct mechanical (controlling) link between the operator's controls and the steering axle. A backup system must be provided to maintain steering at all times.

Steering, Power Assisted:

Steering gear or mechanism with a direct mechanical (controlling) connection to a steering axle that has provisions for part of the force required for operation to be provided by air, hydraulic, or other means, not including mechanical leverage (longer handles).

Stopping Distance:

The distance traveled by a vehicle from the point of application of force to the brake control to the point at which the vehicle reaches a full stop.

Structural Member:

A part of a vehicle designed primarily to support the load of a vehicle in operation.

Suction Line:

A tubular connection between a reservoir or tank and the inlet of a pump.

Synchronized Transmission:

A type of manual truck transmission with built in devices to automatically match the rotating speeds of the transmission gears.

Tag Axle:

A non-driven (dead) axle installed behind the drive axle(s) to increase the permissible gross weight, and consequently, the payload. Also termed "trailing axle."

Tandem Axle:

Two axles mounted as a group. In a dual-drive tandem, both axles have drive mechanisms and are connected to the engine power unit.

Tare Weight:

The total weight of an empty vehicle in a condition ready to receive payload.

Third Party:

A disinterested party professionally qualified to observe, understand, and/or record test data other than the manufacturer that is acceptable to the purchaser.

Tilt Cab:

A cab that pivots forward to gain access to the engine or other major component.

Tire Clearance:

Space between tires and the nearest part of the body or under-construction.

Tire Loaded Radius:

The distance from the center of the wheel to the road with tire loaded to rated capacity. Static radius applies when vehicle is at rest. Rolling radius applies for a vehicle in motion. Rolling radius is usually slightly greater than the static radius.

Torque Converter:

A hydraulic drive which transmits power with the ability to change torque.

Tractive Effort:

The maximum force developed by a vehicle power train at contact between the driven wheels and road surface with 100% traction.

Transfer Case:

Split power gear box transmitting drive to the front and rear axles.

Transmission:

Selective gearbox providing various combinations of gear ratios.

Transmission, Automatic:

A type of transmission designed to self-select and change gear ratios based on vehicle and engine speed.

Transmission, Hydrostatic:

A type of transmission that provides gear reduction between the engine and drive wheels that uses fluid under pressure to transmit power and torque rather than mechanical components.

Transmission, Manual:

A type of transmission that can function only with periodic mechanical input from an operator to select the gear reduction or drive ratio used in the transmission, and a mechanism (clutch) to disengage the power from the engine to the transmission during the mechanical shift input from the operator.

Transmission, Powershift:

A type of transmission that can function only with periodic input from an operator to select the gear reduction or drive ratio in use in the transmission. Powershift transmissions include a device that allows the change of drive ratios or gears by means of an internal device that does not require operator action to interrupt power from the engine while changing the gear or drive ratio.

Tread; Wheel Track:

The distance between the centers of tires on the same axle at the points where they contact the road surface. Duals are measured from the center of dual wheels. That portion of a tire that comes into contact with the road. The pattern of the surface of the tire that comes in contact with the road.

Truck Loading Chute:

See Spot Casting Chute.

Trunnion:

The axis, pivot point, or center point between axles. The axis or pivot point of power transmission in a steerable drive axle where the turning member joins the non-turning member of the axle.

Turbine:

See auger, drum cutter type.

Turning Radius:

One half the diameter of a circle described by the center line of the outside front tire while a vehicle maneuvers through a 360° tum.

- wall to wall
- curb to curb

Two-Speed Axle:

A driving axle arrangement whereby the driver can select one of two ratios.

Two Stage Snow blower Rotary Snowplows:

A two stage snow blower rotary snowplow uses one or more auger(s) or drum(s) in its first stage to disaggregate snow and transport snow to the ingress area of the second stage, (impeller or fan), from which the snow is cast. Two Stage Snow blower Rotary Snowplows have at least two distinct assemblies to disaggregate and to cast the snow. The two stages must vary from each other in terms of speed, and/or axis of rotation.

Vehicle Identification Number (VIN):

A number issued to a vehicle for identification purposes. Format and code of a VIN is prescribed by law to identify manufacturer, configuration, and date of production.

Volute:

See Impeller.

PROPOSED SPECIFICATIONS

Responsibility for Proposal

Each Company is responsible for carefully examining the terms and conditions set forth in this Request for Proposals, and for otherwise judging for itself all the circumstances and conditions affecting the Company's Proposal. Submission of a Proposal shall be conclusive evidence that the Company has made such examinations and investigations. Failure on the part of the Company to make such examination and to investigate fully and thoroughly shall not be grounds for any declaration that the Company did not understand the conditions of the Proposal. The Airport makes no warranties or guarantees of any type whatsoever concerning any aspect of Company's Proposal.

Proprietary Data

The Airport does not anticipate the receipt of proprietary data/material related to this Request for Proposal. However, if the Company provides same, the Airport will handle in strictest confidence all material received in response to this Request for Proposals designated "proprietary". The Airport will, upon request of the Company, enter a confidentiality agreement with the Company that will pertain to the content of the Company's Proposal defined as proprietary and will apply throughout the period during which the Airport is reviewing and evaluating Company's Proposal.
The Airport requires that the Company(s) handle in confidence any information or data received from the Airport which may be construed as proprietary to the ownership and management of Bishop International Airport.

Signature on Proposal

An individual duly authorized to represent and lawfully act on behalf of the Company must date and sign, in ink, at the end of the Proposal. The legal name of the Company must be typed above the signature of the representative.

If the Company is a corporation, the Proposal must be signed by an authorized officer(s), the title of the officer(s) signing the Proposal must be shown, and the corporate seal must be affixed to the Proposal. All signatures must be notarized.

If the Company is a partnership, the Proposal must be signed by an authorized general partner(s), using the term "Member of Firm" or "Partner". Signature must be notarized.

If the Company is an individual, the Proposal must be signed by and in the full name of the Company, using the term "doing business as (insert appropriate business name)", or "sole owner". Signature must be notarized.

Proposal Submittal

Companies shall abide by all the procedures set forth in the Request for Proposal in the preparation and submission of their Proposal. Each Company must include (4) copies of the proposal and supporting documentation. Mail or deliver this material to:

Nino Sapone, A.A.E.
Deputy Airport Director, Operations and Maintenance
Bishop International Airport
G-3425 W. Bristol Rd.
Flint, Michigan 48507
Telephone: 810/407-5613
Email: nsapone@bishopairport.org

The Proposal documents must be enclosed in a sealed envelope and state the Company's name and be clearly marked **"CLASS VI HIGH SPEED ROTARY PLOW"** on the bottom right. Proposals may be withdrawn by the Company prior to the deadline date and time established for receiving Proposals.

Airport Contact

Inquiries on all matters pertaining to this Request for Proposals or the process should be directed to:

Nino Sapone, A.A.E.
Deputy Airport Director, Operations and Maintenance
Bishop International Airport
G-3425 W. Bristol Rd.
Flint, Michigan 48507
Telephone: 810/407-5613
Email: nsapone@bishopairport.org

Inquiries shall be limited to this proposal package, or questions related to clarification of the contents of this proposal package. All clarifications will be supplied to all proposers.

Proposal Deadline

Proposals must be received at the address provided no later than
1:00 p.m. on Friday, May, 24, 2019.

TECHNICAL REQUIREMENTS:

General Description:

The airport is requesting sealed proposals for at least one Class VI High Speed Rotary Plow. The Class VI High Speed Rotary Plow must meet SAE standard ARP 5539 Rotary Plow with carrier vehicle. The Class VI High Speed Rotary Plow must meet specifications of the FAA Advisory Circular AC 150/5220-20A, current edition, Airport Snow and Ice Control Equipment. The equipment must be capable of casting a windrow of snow a minimum of 150'. The equipment must be capable of removing a windrow created by displacement plows and snow brooms that have cleared 1h inch of snow, weighing 25 lb. per cubic foot from a runway that is 150 feet wide with an additional 50 feet of paved shoulders and is 9250 long all in 10 minutes. The equipment must be capable of a minimum of 7500 tons per hour.

The components that make up a complete rotary plow unit are based on the number of stages necessary to perform the functions of disaggregating (snow gathering) and casting snow. Based on knowledge of local conditions and snow removal requirements, the purchaser may specify either a single stage or a two- stage style of snow blower.

Warranty:

The manufacturer, contractor or bidder must guarantee in writing that for a period of five (5) years from the time of first use, they will at their own expense and without expense to the purchaser, replace all failed parts and make all repairs that may be required by reason of defective design, workmanship, or material in any part of the assembly of the Class VI High Speed Rotary Plow, it's appurtenances, or associated components. The bidder is to provide assistance to the purchaser with any warranty problems that may arise with manufacturing, suppliers, or contractors.

Upon notice in writing, the contractor shall promptly repair or replace all defective or damaged items delivered under the contract. The contractor may elect to have any replaced item returned to their plant.

If they should fail as a result of improper application by the contractor, batteries, rubber and material normally consumed in operation are excluded from this guarantee but shall, in any event, be guaranteed by the contractor to the extent of any guarantee received by the contractor from his supplier. Warranty shall include all parts and labor.

Two-Stage Rotary:

Rotary-Head Box: Fabrication shall be of heavy gauge welded alloy steel designed for the type of expected service using best engineering practices. The rotary-head box shall have provisions for vehicle mounts, shoe or caster brackets, scraper blades, drive lines, controls, augers, and impeller bearing mounts and other mechanical hardware. A scraper blade shall be fitted to the lower leading edge of the box which shall be removable and made of polyurethane. The blade shall run the entire width of the box.

Input Auger:

The auger(s) shall have a minimum of two bearing supports. The ribbon blades shall be easily replaceable and made of high tensile steel. They shall be bolted or otherwise attached to the auger shaft and balanced to reduce vibration using best engineering practices.

The solid auger which or shall have multiple cutter blades mounted on the auger drive shaft. Input auger shall be designed to feed snow to the discharge impeller to be cast away from the vehicle. The solid auger drive shaft(s) shall be balanced and supported by bearings, one at each end of the auger shaft (some designs may be configured differently).

Discharge Impeller System: The impeller capacity shall be at least equal to the capacity of the input auger(s). The impeller blades shall be made of high tensile steel using best engineering practices and be balanced to reduce vibration and shock damage.

Operation of the Rotary System: The operation of turbines shall be by hydraulic, hydrostatic, or mechanical means with the speed controlled by a single operator in the vehicle cab. Power shall be transmitted to these systems via mechanisms located on either side of or in the middle of the rotary head box. To ensure efficient snow flow where an auger and impeller share the same drive shaft there shall be a reduction gear system between the two to provide a proper meshing of impeller speed and auger speed.

The blower drive may include a full torque Multi-plate clutch, controlled from the cab, for blower drive engagement. Clutch engagement may be electric over hydraulic actuation and offer protection against engaging clutch. Once selected, clutch shall automatically engage ribbon drive in forward direction. For safety, the clutch/ribbon engage button shall be illuminated GREEN when activated and the ribbon status icon on the LCD screen will clearly indicate ribbon status as visual reminders to operator of the status. Clutch shall automatically disengage if engine is shut off to avoid attempts at start up with impeller engaged.

A system shall be provided between the blower engine and the impeller to provide proper torque and speed at the impeller while allowing the engine to operate at the RPM providing maximum efficiency.

The gear box shall include helical gears with pressurized lubrication system.
CHAIN TYPE DROP BOXES ARE NOT ACCEPTABLE

Snow Casting Assembly:

The snow casting assembly shall consist of a casting chute(s) that can be directionally controlled, an impeller(s), and a control system. The casting chute(s) shall be able to rotate in either a vertical or horizontal plane, or both, as required by the purchaser. Casting distances shall range from zero to the maximum cast distance as specified by the purchaser. The snow casting chute(s) shall be designed and positioned on the carrier vehicle so as to provide maximum operator visibility. Chutes shall be controllable by a single operator from within the vehicle cab.

Rotary Head Assembly:

The rotary head assembly shall be equipped with a device that is capable of raising it a minimum of 8 inches (20 cm) from the pavement. The locking device shall be activated through the use of conveniently located controls in the vehicle cab. The drive system shall not bind, rub, or vibrate excessively when the assembly is being moved. When the vehicle is traveling, the assembly shall have a means to be locked in the raised position. Customer may specify greater heights for local conditions.

Drive Protection System:

All auger and impeller assemblies shall be protected against sudden stops or damage that may be caused from foreign objects. Protection may be in the form of automatic clutches, release overrides, and/or shear fasteners. Consideration shall be given to the location of protection devices to minimize the requirement to remove snow in order to gain access to and reset or replace the protection device.

Blower Head Drive Train:

Drive shafts, universal joints and other mechanical components of the drive train shall continue to provide power to the head assembly under normal operating conditions through the operating range of the blower head without physical damage.

Minimum Performance Requirements:

a. Anticipated Uses and/or Features of Rotary Plow (Be Specific) Priority 1 -Runway 200 x 9250
b. Capacity (tons/hour): See Appendix A - 7500 ton per hr.
c. Casting Distance (150 ft. or m@ Snow weight of25 lb./ft.^{3} or kgm.^{3})
d. Required Speed of Operation (mph or km/h) - 9250 cu 10 min or less
e. Turning Radius
    i. wall to wall 75 ft.
    ii. curb to curb 75 ft.

Additional Equipment: See Appendix C

Carrier Vehicle Description:

The term carrier vehicle represents the various self-propelled prime movers that provide the power necessary to move snow and ice control equipment during winter operations. The design of the vehicle chassis shall be based on an all- wheel drive all wheel steering concept for optimized performance and safety. Vehicle selection is determined by the purchaser for the mission to be performed and the capacity of the selected equipment. Although these units may not be designed as over-the-road highway vehicles, the following Federal Motor Vehicle Safety Standards shall apply as though they were an on-highway vehicle:

FMVSS 101	Controls & Displays
FMVSS 102	Transmission Shift Lever Sequence, Starter &
FMVSS 103	Transmission Braking Effect
	Windshield Defrosting & Defogging Systems FMVSS
FMVSS 105	104 Windshield Wiping & Washing Systems
FMVSS 106	Hydraulic & Electric Brake
FMVSS 108	Systems Brake Hoses
FMVSS 111	Lamps, Reflective Devices, & Associated Equipment
FMVSS 116	Rearview Mirrors FMVSS 113 Hood Latch Systems
	Motor Vehicle Brake Fluids FMVSS 119 New
	Pneumatic Tires
FMVSS 120	Tire Selection & Rims for Vehicles Other Than
	Passenger cars
FMVSS 121	Air Brake Systems
FMVSS 124	Accelerator Control
FMVSS 201	Systems
FMVSS 205	Occupant Protection in Interior Impacts
FMVSS 206	Glazing Materials
FMVSS 207	Door Locks & Door Retention
FMVSS 208	Components Seating Systems
FMVSS 209	Occupant Crash Protection
FMVSS 210	Seat Belt Assemblies
FMVSS 302	Seat Belt Assembly
	Anchorages Flammability of
	Interior Materials

This is a special purpose vehicle customized specifically to meet special airport operator needs such as high-volume and/or extra wide swath clearing operations.

Materials:

Materials used on a carrier vehicle shall conform to the specifications listed in the appropriate sections of Title 49, Chapter III, Federal Motor Carrier Safety Regulations. When not specifically listed, materials shall be of the best quality available for their intended commercial use. Component parts shall be new, unused, of current production to the satisfaction of the purchaser. They shall be free of all defects and imperfections that could affect the serviceability of the finished product.

Design:

Equipment shall be developed in accordance with the best engineering practices available. This includes the incorporation of ergonomic designs specifically directed at the vehicle's cab environment. Vehicle design shall include current state-of- the-art procedures that consider improved cab visibility, communications systems, interior lighting and the mitigation of noise and vibration. Design and installation of equipment shall permit easy accessibility for maintenance and service. All vehicle stress points shall be designed to distribute and dissipate shock forces.

Construction:

Vehicle construction shall provide maximum protection against structural member failures. Equipment shall withstand the cold, moisture, strains, jars, vibration, and other conditions that are likely to be encountered during operation. All components and assemblies shall be free of hazardous protrusions, sharp edges, cracks, or other elements that might cause injury to personnel or damage to equipment. Location of all oil, hydraulic, and air lines and electrical wiring shall be in protected positions properly attached to the frame or body structure. Wherever these lines pass through apertures they shall be protected with looms or grommets except where a through-frame connector is necessary.

Chassis:

The design of the vehicle chassis shall be based on an all-wheel drive, all-wheel steering concept for optimized performance and safety.

It shall have power assisted steering and a transmission with suitable load and speed ranges to accommodate severe operating conditions. Vehicle shall have heavy duty tow hooks, tow eyes, or other suitable tow connections attached to the front & rear of the vehicle. The tow hooks, eyes, or other suitable toe connections shall be attached to the frame or structure of the vehicle, and provide adequate strength to allow lifting and/or pulling the vehicle for emergency recovery situations. A pintle hook, rated at not less than the GVWR shall be permanently attached to the rear frame structure capable of towing a vehicle. All installed parts and accessories necessary for the safe operation of the vehicle shall conform to applicable provisions of Title 49.

Structural Members:

The frame shall be made of either pressed or structural steel shape and reinforced as required to prevent distortion under maximum load conditions. All frames and stiffeners shall be treated with a corrosion inhibitor and shall be primed and painted before assembly.

Dimensions and Clearances: Carrier vehicles with snow removal attachments shall have the following overall dimensions:

- Minimum Ground Clearance: The minimum ground clearance of a vehicle chassis shall be 8 inches (20 cm).

- Maximum Overall Height: Change Maximum Overall Height to read: The maximum overall height of a vehicle including discharge chutes, lights, and exhaust stacks (with rain cap up if so equipped) shall not exceed 13 feet (4.0 m) unless otherwise specified by the customer. A placard shall be installed in the vehicle cab stating the maximum overall height. If practical, the placard should be located at the top of the windshield as nearly over the steering wheel as possible to be immediately visible to the operator when looking upwards.

- Maximum Overall Width: The overall width of a vehicle including rotary plow head shall be specified by the manufacturer who shall take into consideration gates and doors to equipment shops at the airport.

- Maximum Overall Length: Maximum vehicular length may be specified by the manufacturer who shall take into consideration shop areas and maneuverability expected of the vehicle during operation.

Weight Distribution:

The gross vehicle weight of the vehicle shall be distributed over its axles in accordance with best engineering practices. The center of gravity shall be kept as low as possible under maximum load conditions. While it is loaded the vehicle shall be capable of resting on a 20% transverse grade without danger of overturning.

A copy of the calculated weight distribution shall be provided to the customer prior to construction, and the produced vehicle shall not deviate from the calculated weight distribution by more than 5% on any axle, or for the gross weight as determined by weighing the unit at a public certified scale.

Engines:

Engine and vehicle manufacturers shall provide an application approval, at the time of vehicle delivery that states the engine is suitable for use in the vehicle as configured and that the installation is approved by the engine manufacturer. The vehicle engine shall be of internal combustion type. Unless specified, the diesel engine shall be designed and tuned for operation using ASTM D 2 diesel fuel.
Anti-freeze, crankcase and gear oils, greases, automatic transmission fluid, and hydraulic oils shall be as per current SAE, API, or ASTM specifications and not proprietary products. It shall be able to meet the performance characteristics specified herein on commercial grade fuel. Dual engine vehicles shall use a common fuel. The engine shall develop sufficient torque and horsepower to meet its normal operational requirements without exceeding the no-load speed at the peak of its certified gross brake horsepower curve. Engine noise and vibration shall be reduced in the vehicle cab by use of best engineering practices and machine layout. Idle time limiters or other automatic shutdown devices designed to limit emissions, conserve fuel, or enhance operating costs must be permanently disabled if such devices could leave a unit disabled on a taxiway or runway. Permanently disabled means the disabling must be done in such a manner so as not to be easily or accidentally re-activated.

Cooling System:

The engine cooling system shall be based on either a liquid or forced air design. Internal temperatures of liquid cooled engines shall be controlled by a by- pass thermostat that regulates the flow of engine coolant. Drain cocks shall be installed at the lowest point of the cooling system and at other points necessary to completely drain the system. A sight glass or other device is required in all liquid cooling systems to allow the operator to determine that there is sufficient fluid for normal and safe operation without the need to open the system.

Coolant Temperatures:

The design and installation of the system shall assure that coolant temperatures shall remain within the engine manufacturer's operational specification (both high and low) when properly maintained and operated in ambient temperatures during snow removal operations. In areas which frequently experience temperatures below 20°, cooling system heaters, oil pan heaters, lubricating oil heaters, battery and block heaters, and cold start aides required unless otherwise specified.

Fuel System:

The fuel system shall comply with Title 49 and include all components necessary for a complete operational system. Fuel system capacity shall allow for 12 hour continuous operation.

Fuel Tank(s) and Lines:

Useable fuel capacity should be not less than a calculated value of: (total maximum brake horsepower for all engines) x (055 gals/hr./bhp) x (12 hours) x (0.8 for a 60% load factor). Normal operating hours should be eight unless a higher number is desired by the customer.

If dual tanks are used, the supply system shall be designed to ensure an uninterrupted flow of fuel to the engine(s) without input by the operator, and to allow shutoff of each tank should the crossover lines of either tank be damaged.

Dual tanks shall also have adequately sized crossover lines to allow refilling both tanks from one location. Fuel lines shall be securely fastened in place, installed to prevent chafing or strain and protected by grommets where lines project through metal apertures. Each fuel tank is to be equipped with an accessible bronze or brass drain plug or a quick drain. A properly rated fuel water separator with integral heater shall be installed in an accessible location near the tank. If the engine requires a boost pump to assure adequate fuel flow to the engine, a pressure operated switch with in-cab warning light shall be furnished to warn the operator of low boost pump pressure. The boost pump should be installed to shut off when the engine is turned off, or to have an emergency shutoff switch or circuit breaker located near the light to allow the operator to shut off the boost pump in the event of fuel leakage downstream of the boost pump.

Fuel Filler Pipe:

The fuel filler pipe(s) shall be located outside of the vehicle cab in an area accessible for refueling from the ground. A light chain shall be attached near its opening and to the filler cap to prevent loss of the cap. The filler neck shall include a screen to prevent the entry of foreign objects into the tank. Filler neck shall be capable of high flow refueling nozzle. The fuel filler cap shall be painted a color appropriate for the type of fuel, and a permanent label shall be affixed as close as practical to the fill neck(s), in an area visible to the person refueling the vehicle, stating the appropriate fuel and capacity of the tank(s). A label shall also be installed in the cab near the fuel gauge indicating which side of the vehicle must be positioned towards the fuel pumps (e.g., Fuel Fill-+).

Air Cleaner:

The air cleaner shall be of a two-stage design. The first stage incorporates a pre-cleaner while the second consists of a dry type replaceable paper filter. A restriction indicator is required in the cab for each engine air intake system.

The connection between the air cleaner outlet(s) and the engine intake(s) shall be waterproof and dust tight. The air cleaner intake shall be positioned in a manner to eliminate the ingestion of snow and other contaminants, e.g. within the hood cavity.

Exhaust System and Muffler:

The engine shall be equipped with an efficient and safe exhaust system including mufflers. Its location shall minimize noise and exhaust gases entering the vehicle cab under all operating conditions. Further noise reduction by noise suppression materials, such as muffler insulation, is encouraged. Horizontal portions of exhaust systems shall be protected, whenever possible, from corrosive agents and fuel spills. Mufflers and exhaust components positioned in or near normal operator work areas shall include appropriate guards to minimize the bum risk to airport personnel.

Exhaust systems shall be positioned on the vehicle in a manner to minimize contact with slush and snow. Muffler(s) are to be made of aluminum, aluminized steel, stainless steel, or materials coated with ceramics. Devices shall be installed to prevent snow and slush from entering vertical exhaust stacks. Customers may specify the location and direction of exhaust system discharge when appropriate for storage building ventilation systems or other operational needs.

Governor:

Engine speed shall be regulated by a governor set to provide the maximum operating speed recommended by the engine, driveline, and power train manufacturers.

Lubrication:

An engine's lubricating system shall be equipped with standard production fittings and accessories. Engine oil filter(s) shall be engine manufacturers approved design and able to accept commercial replacement elements. All engine(s) shall receive lubrication prior to delivery with lubricants designated for use under ambient temperature conditions at the point of delivery. The unit(s) shall be tagged to identify the proper lubricants and their temperature ranges.

Automatic Lubrication System:

The unit shall be equipped with a microprocessor controlled multi-point automatic lubrication system. The system shall be designed for construction equipment applications and shall be capable of distributing pressure fed, calibrated quantities of grease to all critical pivots and joints on a programmable time based delivery system. The system shall utilize independent metering for each lubrication point. The system shall have a grease storage capacity of a minimum of 2 (two) liters. The system shall include a main pump and reservoir with control unit, software, monitoring system, grease filter, and low level indicator. The unit shall operate on 12 volts DC, negative ground. The complete system shall include all high pressure distribution hoses and plumbing, distribution blocks, metering injectors, and pressure switches.

The main unit and monitoring panel shall be located in the main engine compartment. A monitor panel in the vehicle cab shall not be required. The system shall include a parameter setting and diagnostic software package and system interface cables to perform diagnostics and calibration. An automatic engine protection system to prevent engine damage due to low engine pressure, high coolant temperature, or low coolant level is required. A provision for the emergency movement of the unit from a runway or taxiway must be provided.

Accessibility:

Component Location: Engine and chassis components shall be positioned to allow easy access for inspection and maintenance purposes. Components that historically present maintenance problems or those that have the potential to cause operational problems should particularly be located in unobstructed areas. Locks, controls and fasteners shall be designed to prevent over-torqueing. Fluid capacities that must be checked during a pre-trip inspection, such as hydraulic oil level(s), windshield washer fluid level, and diesel fuel level shall be visually observable or otherwise capable of being checked without the need for tool.

- Cover Plates: Cover plates shall be equipped with either quick-disconnect fastenings or hinges.

Drive Train:

Transmission: Transmission and vehicle manufacturers shall provide an application approval, at the time of vehicle delivery that states the transmission is suitable for use in the vehicle as configured and that the installation is approved by the transmission manufacturer. The transmission shall operate smoothly and efficiently and be capable of transmitting the maximum gross torque generated by the engine to the drive wheels through all gear reductions.

Manual Transmission not acceptable.

Automatic:

Automatic or non-manual transmissions are either hydrostatic (with or without transfer case), automatic power shift, standard power shift, or fully automatic. Designs utilizing torque converters shall have a suitable torque ratio for the expected load ranges. The torque converter shall not operate at less than 70% efficiency. The gear or range selector shall have forward, neutral and reverse positions clearly identified.

Transfer Case:

The vehicle and transfer case manufacturers shall provide an application approval at the time of vehicle delivery that states the transfer case is suitable for use in the vehicle, as configured. Transfer case assemblies shall provide positive drive to the front and rear axle(s) and may be of optional single or multi-speed design. Three proven alternatives are the manual front axle disconnect type, the center differential with manual or automatic lockout type, or an overriding clutch type. The purchaser to accept the manufacturers standard transfer case(s). The transfer case may be a separate unit mounted independently or integrated with the transmission.

Axles:

The axle and vehicle manufacturers shall provide an application approval at the time of vehicle delivery that states the front and rear axles are suitable for use in the vehicle, as configured. The axle manufacturer's published rating shall at the least be equal to the load imposed at ground level when the vehicle and/or each component is in its maximum load configuration (i.e., rotary plow up and rotary plow down; and/or a material body, if any, loaded to its cubic rated volume). Each axle shall be equipped with a retarding type device to ensure a torque transfer to each wheel having traction. When appropriate, manual lockout controls shall be located in the vehicle cab. The torque capacity of each axle and differential shall be at least 10% in excess of the maximum torque that the axle may experience under any GVW operating condition. The power transmitting shaft on each steering axle shall incorporate steering joints that do not produce objectionable steering characteristics while the vehicle is operating on uneven surfaces.

Brake System:

Vehicle service and emergency braking systems shall meet Title 49 requirements for vehicles of similar design. These systems, whether air, hydraulic, or of another design, shall be complete with all necessary equipment to safely control, stop and hold a fully equipped vehicle under all normal operating conditions.
Both systems shall be readily accessible for external adjustment. Anti-lock brakes may be specified for improved safety on the airport operational areas.

Steering Mechanism:

The vehicle shall have a steering mechanism that is operated from the driver's seat. During normal operations, the mechanism shall be capable of controlling the vehicle with all equipment operating. Steering equipped with power assistance shall revert to manual operation in the event of power assist system failure, or be equipped with a dual power steering system that operates in a fail-safe rna1U1er so that the failure of one system will not lead to a loss of steering. The design of the steering mechanism should, in the event of a power assist failure, be capable of safely maneuvering the vehicle off the primary operational areas of the airport and to a park position from the maximum design speed allowed on the airport. All wheel steering may substantially increase the handling ability of the vehicle and, therefore, its productivity. All wheel steer is required allowing the operator to individually select all wheel steering, front wheel steer, rear steer, crab steer, coordinated steer.

Suspension System:

Vehicles shall be equipped with a current production model suspension system having a minimum rated capacity equal to the GVW of the carrier vehicle. When required, front and rear axles shall have auxiliary suspension springs.
Manufacturer's capacity ratings may not be arbitrarily raised to conform to the requirements of this specification. The suspension system shall exhibit no permanent set after the load is removed.

Spare Rim/Tire. A spare rim(s) and tire(s) are required. If one size and configuration of tire and wheel cannot be immediately interchanged to all positions on the vehicle, one spare rim and tire for each distinct configuration is required.

Wheels, Rims, Tires, and Tubes:

- Wheels, rim and tire ratings shall conform to The Tire and Rim Association's published recommendations.

- Tires. Each tire shall have a rated carrying capacity at least equal to the loads imposed on them in the maximum load configuration (i.e., rotary plow up and rotary plow down). Tires on each individual axle shall be of the same size. Tires between axles may vary due to loads, configurations, and engineered gearing sets. In such cases, care must be taken and all components must be viewed as a system that provides an acceptable speed match between driven axles. Tires shall have an aggressive tire tread. Tires (and tubes when applicable) shall meet the first line commercial grade requirements for the speed and type of service required. The front and rear tread widths shall not vary by more than 4%.

Hydraulic System:

The hydraulic system shall consist of appropriate rams, pumps, piping, fittings, valves, controls, fluid reservoirs, filters, coolers, and other parts essential to its full operation. The system shall be capable of hydraulically positioning equipment through the entire range of its design limits. It shall be capable of operating all controls simultaneously without a noticeable reduction in power response. All hydraulic controls shall be located in the vehicle cab. The equipment manufacturer shall avoid high pressure hydraulic lines within the cab by means of remote cable or electric over hydraulic controls whenever possible. If a high pressure line must be located within the cab, it shall be properly shielded to protect the operator to the satisfaction of the purchaser. The system shall be ruggedly constructed and able to withstand all loads imposed on it without relying on the use of mechanical locks. Adequate cooling must be included to maintain acceptable hydraulic oil temperatures throughout expected vehicle operational ranges. Filters within the hydraulic system shall conform to SAE J931.

Pump(s) and Power Takeoff:

The pump(s) shall be ruggedly constructed and powered by the engine through a power takeoff. It shall have sufficient capacity to operate the hydraulic equipment specified herein under all operating conditions and speeds. Belt driven pumps are not acceptable.

Lines and Fittings:

Only commercial quality hydraulic lines, hoses, and fittings that are capable of withstanding system working pressures under load are acceptable. Hydraulic hoses shall have a bursting pressure of three times their rated working pressure. The use of fittings, joints, and connections shall be kept to a minimum. Where local climatic conditions require, the purchaser should consider requiring arctic type hoses with temperature ratings appropriate for the location. Test gauge connection fittings shall be provided at all suitable points throughout system for maintenance and trouble-shooting. All hydraulic system components are to be shielded from engine exhaust heat, and heat shields shall be installed on the engine exhaust system to divert any possible leakage from the hydraulic system. Hoses shall be installed inside steel tubing wherever necessary to deflect the flow of fluid from exhaust and electrical system components in the event of hose rupture or leakage.

Fluid Tank:

The hydraulic fluid tank shall have a filler neck consisting of a strainer, drain plug, shutoff valve, air vent and baffles. Its capacity shall exceed the volume of oil required for the operation of any combination of attachments by 50%. A sight glass or other device shall be provided to allow the operator to verify that fluid level is sufficient for safe operation without the necessity of opening the system. An oil level warning device shall be provided in the cab for all hydraulic systems.

A label shall be installed as close as practical to the filler neck indicating the proper fluid type, viscosity and volume for servicing the hydraulic system, and the capacity of the tank.

System Winterization:

Hydraulic systems shall be designed and operated in accordance with the requirements specified in ARP1247. The hydraulic system shall meet the same low temperature requirements as the engine coolant system. Where appropriate properly sized shutoff valves shall be installed on each side of all filters to facilitate filter changing with minimal fluid loss. If filters are installed in compartments or other areas where fluid collection is possible, drain holes will be installed to allow fluid drainage during servicing.

Electrical System:

The electrical system shall be negatively grounded and installed in accordance with current state-of-the-art practices and appropriate Federal requirements. All vehicle wiring shall be in accordance with SAE J1292. All vehicle body electrical equipment, components, and wiring shall meet the requirements set forth in ARP1247. All parts of the electrical system shall be waterproof, easily accessible, securely mounted, and protected against extreme temperatures, physical damage, snow, oil, and corrosion. All electrical circuit wiring shall be made of stranded conductors with a capacity exceeding the anticipated maximum circuit loading.
Insulation of electrical wiring shall be equal to the recommended standards established for insulation materials by the Society of Automotive Engineers (SAE). All electrical circuit wires shall be identified by color or number along their entire length. The wiring codes shall match information to be provided in the supporting service manuals.

All vehicle components and systems shall operate without being affected by interference damage or disruption including detrimental effects or interference to on-board computer modules from either vehicle generated noise, or stray EMF or RMF fields encountered from any airport operations. EMF and RMF noise sources that may be generated by the vehicle, especially if such noise is detrimental to aircraft, Air Traffic Control, or air navigation equipment, shall be shielded.

Power Supply:

The carrier vehicle shall be equipped with self-regulating electric alternators having an output capacity that exceeds the anticipated electrical load. The minimum idle output of the alternator shall be 20% greater than that required by the vehicle with the engine operating at idle, heater and defroster set at low fan setting, parking and/or marker lights on, communication radio(s) on, windshield wipers operating, and either hazard flashers or Vehicle Safety Identification Lights on.

The minimum output of the alternator when operating at governed engine speed shall be 20% greater than that required by the vehicle in its operating mode with the heater and defroster set to maximum settings, headlights and marker/tail lights on, communication radio(s) on, windshield wipers at maximum setting, and the Vehicle Safety Identification Lights operating. An electrical load analysis worksheet shall be provided to the customer prior to construction showing the electrical loads during the above described conditions.

Batteries shall be securely mounted and adequately protected against physical injury, water, chemicals and exhaust heat. They shall be properly sized based on vehicle manufacturer recommendations and be readily accessible for change out and for other purposes. Enclosed battery compartments shall have adequate ventilation. Battery capacity (cranking amps, voltage, reserve power, continuous/deep cycle demand) shall be compatible with the size of the engine and the anticipated electrical load expected under normal operating conditions. An on-board self-regulating battery charger may be specified by the purchaser.

Starting Device:

The vehicle shall have an electrical starter that shall not introduce a voltage drop sufficient to adversely affect the ignition system. It shall be equipped with an overload protection device if such device is available from the manufacturer of the starter.

Ignition System:

Under extreme weather conditions a block heater or other heating device should be considered for improved ignition. A high idle control for efficient engine warm up and stand by operations shall be provided. High idle switches or throttle controls shall be designed to operate only when the transmission is in neutral.

Backup Alarm:

All vehicles that have limited rear view visibility and/or have a GVWR of 26,000 pounds shall be equipped with a backup alarm installed at the rear of the vehicle. The backup alarm shall be activated whenever the transmission is placed in reverse. The backup alarm shall be a SAE J994, Type B vehicle backup alarm. Backup alarms may be specified by the customer for other vehicles.

Rear View Camera and Monitor:

The rotary plow unit shall be fitted with a rear view camera and monitor. The camera shall be mounted at the rear of the engine compartment and fitted with a snow shield-ice bridge so as to provide an unobstructed view of the pavement trailing the vehicle. A color LCD monitor, approximately 4" x 6" shall be mounted on the right cab pillar utilizing an adjustable base. The monitor shall have an adjustable brightness to compensate for nighttime operation.

Horn:

The vehicle shall be equipped with an electric or air horn to allow the operator to provide an audible warning in an emergency.

Lighting System:

The lighting system, including reflectors, markers identification and clearance lights, shall conform to FMVSS 108 as though the vehicle were an on-highway vehicle. Customers may specify an all LED sealed wiring lighting system for reduced maintenance costs and improved lighting system reliability. In addition, task-oriented lights, and other lighting shall be furnished to help the operator identify the overall width, and when practical to project a beam of light pattern on the ground in front of the blower to assist the operator in determining those areas to be cleared and to provide adequate illumination for the operator and service personal when the unit is on darkened aeronautical areas.

Headlights:

The carrier vehicle shall be equipped with two or more sealed- beam quartz-halogen or high energy discharge type headlights with upper and lower driving beams and a foot or hand controlled switch for beam selection. If snow removal attachments obstruct forward illumination of these lights an auxiliary set of comparable lights shall be provided to overcome the obstruction. A control to select the secondary lights shall be provided in the operator cab.

- Backup Lights: There shall be at least two backup lights installed at the rear of and at either side of the vehicle that will automatically be activated when the vehicle is shifted into reverse gear.

- Vehicle Safety Identification Lights: The vehicle shall have a minimum of one flashing strobe mounted on its uppermost part (see FAA AC 150/5210-5B, Painting, Marking and Lighting of Vehicles on an Airport). The light emitted from the beacon should not reflect off rearview mirrors and into the operator's eyes.

Operator's Cab:

General: Carrier vehicle cabs shall be made of either metal or fiberglass construction. They shall be fully enclosed accommodating a single operator plus assistant/trainee (full cab). A definite separation shall exist between the engine and operator's compartment. All non-glass surfaces, such as the floor, sides, and roof of the cab, shall have insulation to reduce exterior noise. The maximum interior cab noise measured at the operator's seat shall not exceed 85 dBa under the following conditions: windows closed, heater and defrost systems at maximum operation, and carrier vehicle and equipment engines operating at maximum rated capacity. Manufacturers of the equipment are encouraged to improve upon the specified noise level. To the extent possible, the interior of the cab shall be ergonomically designed providing the operator with a pleasant working atmosphere that is devoid of the stark conditions normally associated with older equipment. All cabs shall provide at least two different routes of egress to allow the operator to exit the cab in the event of rollover or overturn.

Communications Equipment Space:

Two (2) Transceivers shall be installed in carrier vehicles to establish voice communication with other vehicles, the air traffic control tower, and maintenance. The vehicle cab shall have convenient space near the operator for the installation of a pair of transceivers. Shall have two (2) power supplies, wired off of the key switch and have independent 20 Amp resettable circuit breakers.

Radio equipment shall be supplied. Radio programming and installation by owner. Mobile radios shall be supplied with roof-type mounted antennas:

Two (2) Laird B132S 1/4 Wave Broadband Antenna, 132-525 MHz, Tunable Center Frequency, Chrome Color, 23" Overall Length, 21" Straight Whip Style with spring. Two (2) Laird MB8U %" hole, NMO style all brass mobile mount with 17' RG58U solid center antenna cable.

One (1) Icom IC-A120 VHF-AM Air Band Mobile Transceiver 118.000-136.975 MHz 8W (typical), 760 channels total. Complete with mobile mount bracket, related cables and mounting hardware and the following accessories:

HM-216 HAND MICROPHONE
SP-30 20 WATT EXTERNAL SPEAKER

One (1) Motorola CM200 Mobile Radio, UHF

Contact:

Pro Comma Inc.
6403 W. Pierson Rd.
Flushing, MI 48433
Tel. (810) 659-5000

Fire Extinguisher(s):

The vehicle cab shall have at least one 2A-1OBC interior mounted fire extinguisher that is readily accessible to the operator. Vehicles equipped with fuel tank(s), hydraulic oil tank(s), or any flammable liquid tank(s) that have a total combined volume of 200 gallons or more of flammable liquid shall be equipped with one 20 B:C: Purple K type fire extinguisher installed on the vehicle or equipment at a place readily accessible from the ground.

Operator Seat:

The vehicle cab shall provide an air ride operator seat that can easily be adjusted up and down, fore and aft, a minimum of 3 inches (7.6 cm) in each direction. The seat should also be capable of reducing the effect of vehicle vibration by featuring air-cushion shock absorbing seat systems, or systems of comparable design. All vehicle seats shall have three-point (minimum) seat belts, certified by the vehicle manufacturer to have been tested and in conformance with FMVSS requirements. Seats shall be fully upholstered with a good quality fabric.

Windows and Windshield:

An electrically heated windshield shall be provided. The vehicle cab shall maximize the use of glass, including the placement of panels if possible in the lower sections of door panels, to increase the operator's view of operational areas and ground surfaces. All installed glass shall be laminated, safety rated, and conform to all FMVSS requirements. Glass to be tinted. The location and size of the windshield shall minimize visual obstructions to the operator. The windshield shall be designed to avoid snow build up and be equipped with one or more variable speed intermittent operating wipers (standard or wet arm). The windshield wiper system shall be capable of sweeping a clear view for all occupants up and be equipped with at least one variable speed automatically operating wiper (standard or wet) that is capable of sweeping a clear view for all occupants. The windshield washer reservoir shall have a capacity of at least 1*Yz* gallons (5.6 liters). Fluid applicators shall be located to provide at least 75% coverage of the windshield. The cab shall be equipped with sun visors. Windshields and other glass surfaces in the vehicle cab used in the operation of the vehicle and/or to view pavement surfaces, including rear windows if installed, shall be cleared by means of a defroster system that is part of the cab's heating system. The standard circulating air type defroster may be complimented by electrical type heating systems for glass areas as required.

Exterior Rearview Mirrors:

Two electrically heated exterior rear view mirrors of the extension arm type shall be mounted one on each side of the vehicle cab. Rear view mirrors are to be powered and remotely controlled. Each mirror shall have an area of not less than 100 in^2 (650 cm^2).

Heater: The carrier vehicle cab shall have a heating system that is capable of maintaining a minimum interior temperature of 65 °F (18 °C) at an ambient outside temperature of -20 °F (-29 °C). Heat output shall be controllable from within the cab by a selector switch that is conveniently located to the operator. Under all conditions of heating and ventilation, the temperatures measured in the operator's immediate environment should be uniform within 9 °F (5 °C) (see SAE J1503).

Ventilation:

Ventilator/heater fan shall have blower capacity equal to one cab volume per minute. Cab ventilator intakes should be screened and positioned in such a manner to minimize the entry of snow.

Hour Meters:

Every engine permanently attached to a carrier vehicle shall be equipped with an hour meter that registers engine operation time from O to 9999 hours. Hour meters shall be prominently displayed so that they can be easily read by an operator or service personnel. The hour meters shall be of direct read design and shall only register when the engine is running.

Instrumentation:

The cab shall display an instrument panel equipped with rocker and/or toggle switches and controls (instruments) that are friendly to operators wearing bulky winter clothing. Toggle switches, where used, shall have a minimum length of l *Y1* inches (4 cm). Frequently used instruments shall be located in direct line-of-sight and within forearm reach of a medium sized person sitting in the operator's position. All instruments shall be clearly identified with labels that indicate their function. Instruments should display urgency-of-action lights, i.e., green for normal operation, amber for warning, and red for emergency. Instruments shall be illuminated by background lighting regulated by dimmer switches capable of providing infinitely variable lighting intensities. Circuit breakers shall be grouped for easy access and convenience. Typical instruments that report and track major functions of a carrier vehicle and mounted equipment are as follows:

A. Engine:

1) Voltmeter

2) Lubricating Oil Pressure Gauge(s)

3) Coolant Temperature Gauge(s)

4) Tachometer(s) including hour meter(s)

5) Starting Controls (including auxiliary cold start controls)

6) Hydraulic Oil Pressure and Temperature Gauge if applicable

7) Transmission

B. Vehicle Chassis:

1) Brake-air Pressure Gauges if applicable

2) Low-air Pressure Warning, visual and audible type if applicable

3) Light Switches and Headlight Beam Indicator

4) Speedometer with Recording Odometer

5) Fuel Quantity Gauge(s)

6) Equipment Controls

Sheet Metal Components:

General: The carrier vehicle engine, as well as its mechanical components, shall be protected wherever possible from snow, rain and other winter elements. Body and engine enclosures may be fabricated from aluminum, fiberglass, and/or steel. Self- tapping bolts are unacceptable in the construction of these enclosures.

- Steps: Four-way safety tread, open design steps are required to ascend and descend high profile carrier vehicles. These steps, together with assist handles, shall provide for constant three-point contact, and shall be of ample size to ensure safe and easy access for persons wearing bulky winter clothing.

- Walkway: A four-way safety tread, open design walkway shall be provided, as necessary, for access.

- Handrails. Handrails shall be provided as required at all steps, walkways, and work stations. They shall be made of corrosion-resistant materials or otherwise treated to prevent corrosion.

- Fenders: All carrier vehicles shall be equipped with fenders and when determined by the operator, non-sail mud flaps to prevent wheels from throwing snow and other debris.

- Drains: Plugged or free flowing drains shall be provided at all body and compartment locations where standing water can collect. Free flowing drains shall not drain onto sensitive mechanical or electrical components or on areas anticipated to be occupied by personnel during normal operations.

- Doors: Doors shall be equipped with a positive closing mechanism and, where appropriate, a locking mechanism. Top hinged compartment doors shall be held in the open position by a support arm(s).

- Gutters: The vehicle cab shall be equipped with gutters, located above the entrance doors, of sufficient length to span the door width and provide runoff protection to occupants either entering or exiting the cab.

Painting, Marking, and Lighting of Vehicles:

Painting and Marking: The vehicle shall be painted Chrome-Yellow in accordance with color tolerance charts that have been made available for FAA regional airport inspectors and key potential users in the aviation safety equipment industry (see AC 150/5210-5B). To minimize glare to the operator, the top of blower head and blower chute shall be painted flat black.

Preparation and Finish: The carrier vehicle and all mounted and towed equipment shall be cleaned first, then treated with a corrosion inhibitor, primed, puttied, sanded, and finally painted. The paint shall consist of not less than two coats of Chrome-Yellow polyurethane enamel, acrylic enamel, acrylic urethane, or similar high durability, long life paint as required by the purchaser, applied to produce full hiding.

Quality: The finished paint shall be free of "fisheye," "orange peel," chips, runs, or other imperfections that detract from the equipment's corrosion resistance and appearance.

Miscellaneous:

Plastic Plates: Plastic plates are acceptable only in locations that are not exposed to the elements and subject to weathering or excessive heat.

Information: Plates shall identify make, model, serial number, and any other relevant data.

Technical Publications: The manufacturer shall furnish two complete sets of manuals. One set of manuals shall consist of an Operator's manual, Parts Manual, and Maintenance and Service Manual.

- Operator's Manual: The operator's manual includes lubrication charts and instructions.

- Parts Manual: The parts manual identifies and lists all parts, components, and sub- assemblies used in the fabrication of the carrier vehicle and mounted equipment.

- Maintenance and Service Manual: A maintenance and service manual provides guidance to non-specialists performing routine services. The manual should also describe in detail with appropriate schematics the overhaul and major maintenance procedures required to maintain and repair the vehicle. The maintenance manuals shall include complete schematics of the electrical, air, and hydraulic systems as applicable. Number codes on wires and hoses as found on the vehicle shall match those provided in the maintenance manual schematics.

- Accessories and Tools: The carrier vehicle shall be equipped with tire tools, a jack, shear pins, and specialized tools as specified by the purchaser. They shall be kept either in a secure and readily accessible enclosure that is permanently affixed to the vehicle or in the maintenance facilities of the airport as required by the purchaser. Lug wrench and any other special tire tool required to change a flat tire.

Shear Pins: A minimum of six pins shall be provided in support of each shear pin located on the carrier vehicle and its auxiliary equipment.

Specialized Tools: Specialized tools required for routine servicing of the carrier vehicle and its auxiliary equipment.

Delivery:

Shipment: The vendor (seller) is responsible for the safe and timely delivery of the vehicle and its accessories, spare parts, and tools to the agreed place of delivery.

Marking: Carrier vehicles shall be marked for shipment in accordance with instructions agreed to by the purchaser.

Instruction and Training: The manufacturer shall, at no additional cost, furnish the services of trained personnel to the purchaser at a time and place agreed to by all parties. These individuals shall provide instructions to airport personnel sufficient to familiarize themselves with the operational and maintenance characteristics of the vehicle and its auxiliary equipment. The period of instruction shall be 24 hours or as required depending upon crew size.

APPENDIX A

PERFORMANCE TESTING

1. Objective:

The objective of this procedure is for the Manufacturer to determine the tonnage capacity and snow casting ability of this rotary snow blower. Potential suppliers of rotary plow equipment in response to requirements based on this SAE Document shall conduct capacity tests based on this procedure. Testing is not required on the production unit prior to delivery, but shall be conducted on a prototype or vehicle of similar configuration with similar components and design to that being offered.

2. Criteria:

The snow removal unit with blower attached shall make at least three snow removal passes in a windrow or snow field not less than 18 inches deep. In each pass, the snow removal unit shall clear a path not less than 500 feet long by the full width of blower head, or along the length of a constructed windrow.

Snow depth and density shall be determined in at least five intermediate locations evenly spaced along the path and an average value calculated. Whenever possible, density shall be determined from a vertical section of the snow depth.

The time required to complete each pass shall be measured by a stop watch. The volume of the snow removed shall be determined by the procedure contained in this appendix.

Measurement of snow shall be the appropriate measurement method described herein. The snow removal rate shall be calculated by means of the formula below. The cast distance shall be measured to determine the casting ability of the vehicle by methods described below. A wind speed greater than 5 mph shall be considered unacceptable for testing cast distance and cast distance testing shall be rescheduled.

There shall be no adjustment to calculated capacity based on shear strength of the snow.

In capacity testing for a unit deemed to be a "high speed" unit, the size of the wind row or depth of the snow field must be limited to allow the vehicle to reach its intended capacity at the required speed (greater than or equal to 25 mph). The maximum size must be calculated backwards from the required speed of the vehicle and density of the snow. For accuracy and applicability, high speed testing should be conducted with a constructed windrow only, designed to simulate actual conditions expected.

Examples of components and designs whose change can materially affect blower capacity include, but are not limited to, such items as impeller and ribbon dimensions, impeller and ribbon gear ratios, design, and drive systems, engine horse power, engine torque, and variations in parasitic loads required of the blower engine.

Procedure:

Equipment required:

200 ft. measuring tape
Stopwatch
Soil conservation coring tools, 12 inch for horizontal samples and sufficient length for vertical samples as test conditions may require. NOTE: Density sample accuracy increases as the inside diameter of the sampling tubes increases.
Large aluminum or plastic
spatula accurate scale
Wind speed indicator
Marker cones or bright and dark colored spray paint

Snow Field Test

Prior to each test run the wind speed shall be measured. A wind speed greater than 5 mph shall be considered unacceptable and testing shall be rescheduled.

A snow field can be an undisturbed field of snow, or snow can be moved, wind rowed and shaped to the desired configuration depth. For a snow field test, snow depth must be a minimum of 18 inches but less than the intake height of the blower. For its entire length, the snow field must be wider than the blower head and of a consistent depth to help assure accuracy of the testing

The snow field shall be a minimum of 700 feet long and clearly marked every 100 feet. The test shall be conducted through at least 500 feet of the course. Approximately 100 feet is required at the beginning of the test field to allow the operator to adjust the speed and operation of the vehicle to the conditions.
Sufficient additional snow is required at the end of the test field to assure accurate timing through the entire 500 foot test length.

The vehicle shall make a snow removing pass through the entire length of the prepared site. The time required to make the complete 500 foot pass shall be measured and recorded. A minimum of three such tests shall be conducted.

During the test, the cast distance from the centerline of the snow removal unit's path to the center of mass within the perimeter of the cast pattern shall be measured and recorded. At a minimum, this measurement shall be marked at each 100 foot interval. Because the momentum of cast snow tends to slide it further away from the blower's path, care shall be taken to mark the landing point of the center of the mass and not its final position.

FIGURE AI - Measuring the Rotary Plow's Width and Depth Pass When Employing the Field Testing Method

After the blower's test pass, measurement of the blown path is made.

The overall width of the blower's path shall be measured. This should be consistent for the entire test track.

Depth of snow is determined on both sides of the blown path. Depth measurements shall be taken at each 100 foot interval on both sides of the blower's path. Depth shall be determined by tape measure from the pavement surface to the surface of the snow on both sides of the blower's path. The measured depths shall be recorded.

The residue left after the blower passes shall be measured at each measurement site, recorded, and subtracted from the measured depth.

NOTE: It is recommended that the depth measurement be taken from the snow surface to the pavement and a separate measurement of the residue be gathered and recorded. The ability to adjust a blower to an acceptable and/or desirable level of residue is a critical factor in snow blower evaluation and should receive attention and visibility.

Snow density measurements shall be taken at a minimum of five evenly spaced intermediate locations along the test site on both sides of the blower's path, including the beginning and end of the marked course. Density measurements must be taken at each individual snowfield run immediately after the snow blowing run is complete.

Density samples shall be obtained by taking a vertical sample from the snow surface to the pavement. Snow density samples shall be taken with a soil conservation service coring tool or similar device. The volumetric capacity of the coring tool must be known and the empty coring tool(s) must be accurately weighed.

FIGURE A2 - Using the Coring Tool When Field Testing

The 24 inch coring tool shall be forcefully inserted through the snow to the pavement surface directly alongside the blown path.

If snow depth is less than the length of the coring tool, make sure the tool's bottom end rests on the pavement surface and remains there throughout this activity. Snow from around the tube is shoveled away from two sides. The third side must remain undisturbed to allow an accurate tape measurement to assess the actual volume of snow contained within the coring tool.

A flat aluminum spatula or similar tool shall be slipped between the pavement surface and the bottom of the coring tool. The coring tool and its contents of snow are moved on the spatula away from the original location and placed on a scale. Extraneous snow shall be removed from the outside of the tool and the scale's surface, and an accurate weight of the tool and its contents is taken and recorded.

If the snow field is greater than the length of the coring tool, three density core samples should be taken horizontally from each side of the test pass at each sample location. Using the 12 inch coring tool, take one sample approximately 8 inches from the pavement surface, one at mid depth, and one approximately 8 inches below the snow surface.

For accuracy of data, care shall be taken to assure all snow within the sample be included in the calculation. Conversely, care shall also be taken to assure no additional snow is packed into the coring tool. These samples are then averaged to provide a relatively accurate density for the snow.

FIGURE A3 - Weighing the Snow

The average density shall also be calculated. The average density shall fall in the within the range of 15 to 40 pounds per cubic foot for the test to be considered valid.

The capacity of the machine is determined mathematically from the data gathered using the formulas provided in the appendix.

A. Constructed Windrow Test

Snow shall be moved and wind rowed by machinery to construct a sample windrow. The depth of the wind row along its entire length at its peak shall be no less than 18 inches but no greater than the height of the blower's intake. The width at the pavement surface shall be more than half the width, but less than the full width of the blower's intake. For ease and accuracy of the test, care shall be taken to make the wind row's size and shape as consistent as possible throughout the test length. The ideal wind row for the test is triangular in cross section as it is easier to measure.

The length of the windrow shall be 700 feet minimum, clearly marked every 100 feet. The test shall be conducted through 500 feet of the course. Approximately 100 feet is required on the front end of the test field to allow the operator to adjust the speed and operation of the vehicle to the conditions. Sufficient additional snow is required at the end of the test field to assure accurate timing through an entire 500 foot test length.

The size and profile of the windrow is measured and recorded before the capacity runs.

A tape measure and portable gantry are required to gather this dimensional data. The gantry is moved along and positioned astride the wind row at each marked 100 foot interval. Measurements are taken from the known height of the gantry to the surface of the wind row. At a minimum, the apex of the wind row as well as the outer edges of the wind row shall be measured to determine the width at the base. The profile of the windrow is recorded.

FIGURE A4 - Measuring the Windrow Using a Gantry When Employing the Constructed Windrow

The density of the snow shall be measured and recorded. Density measurements shall be made at a minimum of five points evenly spaced along the length of the wind row, including the beginning and end of the marked course. Density measurements must be taken for each windrow constructed immediately prior to the snow blowing run.

Snow density samples shall be taken with a soil conservation service coring tool. The volumetric capacity of the coring tool must be known and the empty coring tool(s) must be accurately weighed.

FIGURE A5 - Using the Coring Tool on Constructed Windrow

A coring tool shall be forcefully inserted through the snow to the pavement surface at a point in the windrow that is over 12 inches deep.

With snow depth less than the length of the coring tool, make sure the tool's bottom end rests on the pavement surface and remains there throughout this activity. Snow from around the tube is shoveled away from two sides. The third side must remain undisturbed to allow an accurate tape measurement to assess the actual volume of snow contained within the coring tool.

A flat aluminum spatula or similar tool shall be slipped between the pavement surface and the bottom of the coring tool. The coring tool and its contents of snow are moved on the spatula away from the original location and placed on a scale. Extraneous snow shall be removed from the outside of the tool and the scale's surface, and an accurate weight of the tool and its contents is taken and recorded.

The average density shall also be calculated. The average density shall fall in the within the range of 15 to 40 pounds per cubic foot for the test to be considered valid.

During the test, the cast distance from the centerline of the snow removal unit's path to the center of mass within the perimeter of the cast pattern shall be measured and recorded. At a minimum, this measurement shall be marked at each 100 foot interval. Because the momentum of cast snow tends to slide it further away from the blower's path, care shall be taken to mark the landing point of the center of the mass and not its final position.

FIGURE A6 - Measuring Residue Width of Constructed Windrow

When the run is complete, the residue and spillage remaining after the blower passes shall be measured at each measurement site, recorded, and subtracted from the measured amount.

NOTE: It is recommended that the depth measurement be taken from the snow surface to the pavement and a separate measurement of the residue be gathered and recorded. The ability to adjust a blower to an acceptable and/or desirable level of residue is a critical factor in snow blower evaluation and should receive attention and visibility.

The capacity of the machine is determined mathematically from the data gathered using the formulas provided in this appendix.

FIGURE A7 - Measuring Residue Depth of Constructed Windrow

Calculations

The capacity of the snow blower shall be calculated using the following formula: Q = A x L x D x 1.8/t

Where Q = capacity in tons per hour

A = average cross-sectional area of the windrow in square feet

L = length of test run in ft. D = average density of the snow in lb. /cu ft.

t = time of test run measured in seconds

And 1.8 = a constant (3600 seconds per hr. /2000 lb. per ton).

The capacity of the snow blower is determined by calculating each of the capacity runs (no less than three) and finding the average capacity per run.

APPENDIX B
ADDITIONAL REQUIREMENTS

Engine-Jacket Water Heater: Re-circulating type with thermostatic control and weatherproof receptacle plug (minimum - 1500 watts).

Engine Oil Pan Heater: 300 watts.

Battery Warmer Pad: Approximately 50 to 100 watts per battery.

Transmission Oil Pan Heater: Wattage as recommended by the transmission manufacturer. Additional Door Handles: Handles shall be installed on lower part of vehicle cab door. Auxiliary Cab Heater and Circulating Fans
Cab air conditioning

System Windows:

- Extra Window in Lower Part of Cab Doors
- Tinted Windshield and Windows
- Liquid deluge system for side windows, windshield and rear view mirror with 20 gallon minimum capacity and easy accessible fill
- Side Window Wipers

Seats

- Bostrom "T" Seat (or equivalent for driver and passenger sides)
- Arm Rests for Operator Seat

Cab Insulation Upgrade (to reduce exterior noise below 85 dBa) Air Hom Clock

Additional Lighting:

- Auxiliary Cab Dome Light
- Roof Mounted Lights
- Door Lights
- High Intensity LED Strobe Beacon
- HID Lights

Additional Corrosion Prevention that conforms to Federal Specification 297 D, Rust- proofing of Commercial (Non-tactical) Vehicles.

Tow Chain: Tow chains shall have a minimum link size of 1/2 inch (l.3cra).

Radio Transceivers:

Radio equipment shall be supplied. Radio programming and installation by owner. Mobile radios shall be supplied with roof-type mounted antennas:

Two (2) Laird B132S 1/4 Wave Broadband Antenna, 132-525 MHz, Tunable Center Frequency, Chrome Color, 23" Overall Length, 21" Straight Whip Style with spring.

Two (2) Laird MB8U %" hole, NMO style all brass mobile mount with 17' RG58U solid center antenna cable.

One (1) Icom IC-A120 VHF-AM Air Band Mobile Transceiver 118.000-136.975 MHz 8W (typical), 760 channels total. Complete with mobile mount bracket, related cables and mounting hardware and the following accessories:

HM-216 HAND MICROPHONE
SP-30 20 WAIT EXTERNAL SPEAKER

One (1) Motorola CM200 Digital Mobile Radio, UHF.

APPENDIX C

OPERATIONAL NEEDS DETAIL SHEET

The following site and operational information is critical to assure that the rotary snow Plow manufacturer understands the exact nature of the machine that the customer needs to meet operational needs. Customers should complete this sheet to the best of their ability providing information that is as complete and accurate as possible.

Part I Operating Conditions

The unit must be capable of operating at temperatures as low as -50°F to as high as +55°F. The unit must be capable of cold soaked starting at temperatures as low as -40°F to as high as 60°F.

The unit will be stored:

Outside at temperatures as low as -50°F
Outside, at temperatures as low as 50°F while connected to electric power for installed heaters, battery chargers, etc.
Power Available is 120 Volts AC/DC _Amps___Hertz

The unit will be used to remove snow and ice

from: Runways
Taxiways
Ramp & Gate
Areas Roadways
Parking Lots

The unit will transit (transit is defined as self-powered movement with the rotary plow installed and the unit fully operational): Aeronautical areas only

If the unit must be moved off site for repair or maintenance which method will you use?
Unit will be driven with rotary plow installed to repair facility

Part II Operational Requirements

Rotary Plow Certified Performance Requirements Minimum snow blowing capacity 7500 tons/hour Minimum cast distance 150 ft.
Minimum transport speed 25 mph.
Snow Density 20 - 40 lb. /cu ft. (std) (other) 25 lb. /cu ft.
Snow shear strength o 250 o 250 - 500 **500 - 600**
Maximum turning radius 75 ft. (wall to wall)

POST SUBMITTAL EVENTS

Evaluation of Proposals

The Airport will use evaluation criteria it judges most appropriate to the review process and the relative importance of this criteria will be determined at the sole discretion of the Airport. No Company shall have any cause of action against the City or its Airport Authority arising out of a failure to secure a CLASS VI HIGH SPEED ROTARY PLOW contract with the Airport, failure by Airport to consider a Company's Proposal, or the methods by which the Airport evaluated Proposals received. The selection of the prospective Company and the decision to engage in negotiations with that Company shall be at the sole discretion of the Airport.

Exceptions

The Airport may accept proposals that have exceptions. Exceptions must be clearly identified with a justification statement. The exception must meet AIP obligations including Buy American Provisions.

Proposal Selection

The Airport intends to select one (1) Proposal for CLASS VI HIGH SPEED ROTARY PLOW, but reserves the right to accept none of the Proposals, to negotiate for modification of any Proposal with the mutual consent of the Company, to accept the Proposal which, in the judgment of the Airport, shall be deemed the most advantageous to the Airport, to waive any of the requirements of the proposal procedures explained in this document, and/or to proceed in any other manner deemed to be in the Airport's best interest. Airport reserves the right to retain all copies of Proposals submitted by prospective Companies.

Disqualification

Although not intended to be an inclusive list of causes for disqualification, any one or more of the following, among others, may be considered sufficient for disqualification of a Company and the rejection of the Proposal:

- Evidence of collusion among Companies.
- Submitting a Proposal that is incomplete, obscure or which contains irregularities, inaccuracies, or misstatements.
- Lack of business skills or financial resources necessary to successfully provide sufficient CLASS VI HIGH SPEED ROTARY PLOW as revealed by either financial statements or experience.
- Lack of responsibility as shown by past history, references, or other factors.
- Default or termination of other contracts or agreements. Other causes as the Airport deems appropriate at the Airport’s sole and absolute discretion.

Notice of Acceptance of Proposal

Upon the Airport's selection of a Proposal, the selected Company will be notified not later than Wednesday, October 11, 2018 by telephone, then Certified Mail, Return Receipt Requested, of the selection to provide CLASS VI HIGH SPEED ROTARY PLOW. Such notification shall be accompanied by the service contract to be executed. By Friday April 19, 2019 the selected Company must execute and return to the Airport the service contract along with required insurance certificates/performance bonds. Should the selected Company fail or refuse to so perform, the Airport reserves the right and shall be free to revoke such selection and to select another Company.

SCHEDULE

Proposals Due:	May 24, 2019
Selection of Company:	May 29, 2019
Notify All Companies:	May 31, 2019
Execution/Return of Agreements:	June 5, 2019
Equipment Delivery:	November 2019