STATEMENT OF WORK (SOW)
for
Two Lathes

1.0 BACKGROUND

1.1 U.S. Army Combat Capabilities Development Command (DEVCOM) is advancing technology for use on cannon tubes manufactured within the at the Watervliet Arsenal. This process is being used to eliminate the carcinogenic hexavalent chromium plating from the Defense Industrial Base (DIB). U.S. Army Tank-Automotive & Armaments Command (TACOM)'s Watervliet Arsenal (WVA) is supporting and transitioning new processes for reduction of environmental hazards in the manufacture cannon tubes while eliminating hazards that can affect human health and the environment. These lathes will be a component in this overall process.

2.0 PURPOSE

2.1 This Statement of Work is to define the requirements and deliverables to be used in the selection and procurement of (2) identical lathes for new technological process of manufacturing cannon tubes utilizing environmental alternatives to be installed at WVA. Labor and equipment required for move-in, installation, leveling, and training of the lathes shall be provided and performed by the system manufacturer.

3.0 REQUIREMENTS

3.1 The contractor shall provide two (2) identical lathes with the following required minimum specifications:

3.1.1 Capacities
- 3.1.1.1 Center height: 600mm (23.6 in.)
- 3.1.1.2 Swing over bed: 1,200mm (47.2 in.)
- 3.1.1.3 Distance between headstock and ring steady rest max: 12,500 mm (41 ft.). Note: this provides the accommodation for the required max. and min. component sizes in ring steady rest. There shall be at least a left self-centering steady rest (SS-L), a right self-centering steady rest (SS-R) and a ring steady rest provided.
- 3.1.1.4 Distance between headstock and ring steady rest min: 5,450 mm (17.88 ft.). Note: this provides the accommodation for the required max. and min. component sizes in ring steady rest. There shall be at least a left self-centering steady rest (SS-L), a right self-centering steady rest (SS-R) and a ring steady rest provided.

3.1.1.5 **Max. tube diameter accepted: 508mm (20 in.)**
3.1.1.6 Max. weight of components (in headstock, one intermediate steady rest and ring steady rest): 10,000 kg (22,000 lbs.)

3.1.2 Technical Specifications
3.1.2.1 Main Headstock
3.1.2.1.1 Range of spindle speeds: 0-500 RPM
3.1.2.1.2 Range of spindle speeds at constant torque: 5.4-500 RPM
3.1.2.1.3 Range of spindle speeds at constant power: 54-500 RPM
3.1.2.1.4 Number of speed ranges: 3
3.1.2.1.5 Standard speed range shifting: automatic by M function
3.1.2.1.6 Driving power of AC brushless main motor in S1: 51 kW (68 HP)
3.1.2.1.7 Max torque: 9,000 N*m (6,496 ft.*lbs.)
3.1.2.1.8 Spindle nose DIN 55027: 15 in. size
3.1.2.1.9 Spindle hole: 160 mm (6 3/10 in.)
3.1.2.1.10 Dia. of 4-jaw independent chuck (steel): 800 mm (31 1/2 in.)
3.1.2.1.11 Min clamping Dia.: 100 mm (3 15/16 in.)
3.1.2.1.12 Max clamping Dia.: 508 mm (20 in.)
3.1.2.2 Bed
3.1.2.2.1 Width of bed at guideways: 520mm (20 ½ in.)
3.1.2.2.2 Width of bed at base: 620 mm (24 2/5 in.)
3.1.2.2.3 Height of the bed: 650 mm (25 3/5 in.)
3.1.2.2.4 **Total bed length: 27,330 mm (89.6 ft.)**
3.1.2.2.5 Number of bed sections: 3
3.1.2.3 Saddle
3.1.2.3.1 Main dimensions (LxW): 850mm x 850 mm
3.1.2.3.2 Rapid traverse: 4000 mm/min
3.1.2.3.3 Stepless variable working feeds: 1-4000 mm/min
3.1.2.3.4 Maximum Z-axis working stroke: 19,550 mm
3.1.2.3.5 Maximum Z-axis working+extra stroke: 22,000 mm
3.1.2.3.6 Motor size: 50 N*m (36.88 ft.*lbs.)

Note 1: The machine shall be according to metric standards.
Note 2: All hydraulic and electrical components to be selected from prominent suppliers that are readily available.

4.0 TECHNICAL DESCRIPTION OF REQUIREMENTS – Each of the two lathes will have the following:

4.1 Bed with (4) flat guideways in cast iron and hardened ways:

4.1.1 The bed rests on the floor along its entire length.
4.1.2 Clamping and leveling points are arranged with a short distance between them.
4.1.3 The bed is to be case from an electric arc furnace in an alloy cast iron with 1-1.5% of copper. It shall be stress relieved to eliminate any tensile residual stresses and risk of deformation.
4.1.4 The cross section of the bed shall be heavily ribbed and shall contain phenolic resins in order to damper vibration and increase machine stability.
4.1.5 The slideways shall be induction hardened up to ~50 HRC and precision ground to a high standard of accuracy.
4.1.6 The sidewalls of the bed shall contain helical racks for longitudinal transmission of steady rests.
4.1.7 The total bed is to be divided into three (3) sections.

4.2 Headstock (cast iron):

4.2.1 The spindle rotation of the headstock is to be controlled by a brushless motor and shall be fitted on a base anchored to the foundation and separate from the bed in order to eliminate vibrations from the bed to the lathe.
4.2.2 A digital drive shall be provided for gradual acceleration, deceleration, and braking.
4.2.3 The headstock shall be provided with a three-speed gearbox, which allows for maximum power of the motor over a wide speed range.
4.2.4 The shifting between the gear steps shall be carried out by M function.
4.2.5 All gears and shafts shall be manufactured out of Ni-Cr-Mo steel, heat treated, and ground.
4.2.6 Both helical and straight gears shall have proper involute correction to enable a smooth rolling motion.
4.2.7 All gears shall be lubricated through an independent pump through a drip and mist system.
4.2.8 A safety interlock shall be provided to prevent spindle rotation in the event of a pressure drop in the lubrication circuit.
4.2.9 Push buttons shall be provided to enable intermittent rotation of the spindle in order to facilitate loading and setup operations.
4.2.10 The main headstock shall be provided with an interlocked spindle location pin to prevent rotation when loading and fixturing components.

4.3 Main spindle:

4.3.1 The main spindle shall be manufactured out of Ni-Cr-Mo steel and heat treated, hardened, and precisely machined.
4.3.2 The main spindle shall be supported on multiple positions to appropriate rigidity.
4.3.3 Appropriate cylindrical roller bearing/s shall be provided in order to enable a fine radial setting and a perfect axial backlash adjustment.
4.3.4 All bearings provided shall be individually force lubricated with adjustable flow.

4.4 Travelling ring steady rest w/pass-through hole of 508 mm Dia.:

4.4.1 One (1) 4 –jaw chuck travelling steady rest shall be provided.
4.4.2 This ring shall slide on the bed by means of an independent gear motor.
4.4.3 This steady rest shall consist of a wide dimensioned and high rigidity body which is fitted to a ring having a wide bore.
4.4.4 This ring shall rotate on precision bearings and has the ability to be finely adjusted to 0.01 mm (0.0004 in.)
4.4.5 The steady rest shall be equipped with a pump to provide forced lubrication of the bearings as well as time lubrication of the slideways.
4.4.6 The steady rest shall be fitted with an automatic clamping system with the following requirements:
4.4.6.1 Hollow spindle hole: 508 mm (20 in.)
4.4.6.2 Min. & max. clamping capacity: 508mm (3.93 in. – 20 in.)
4.4.6.3 Weight admitted on the steady rest: 6,000 kg (13,227 lbs.)
4.4.6.4 Dia. of 4-jaw chuck: 800 mm (31.5 in.)

4.5 Two (2) self-centering steady rests w/75-508 mm Dia.:

4.5.1 Each self-centering steady rest shall consist of:
4.5.1.1 Sliding base positioned along the base by a motor.
4.5.1.2 Unit holding the roller arms, mounted on the base slide. Movement of the base shall occur through an independent motor and a rack and pinion system, the same as with the C-type steady rest.
4.5.2 The top unit shall include a cam-and-lever mechanism to enable good clamping accuracy and repeatability.
4.5.3 The C-type steady rest, sliding base shall be provided with automatic clamping and automatic lubrication of the slideways.
4.5.4 The requirements are:
4.5.4.1 Capacity: 75-508 mm (2.95 in. – 20 in.)
4.5.4.2 Max admitted weight: 3,000 kg (6,600 lbs.)

4.5.4.3 Diameter of rollers: 90 mm (3.54 in.)
4.5.4.4 Width of rollers: 50 mm (2 in.)

4.6 Saddle:

4.6.1 The saddle shall be freely moving along the bed section, as defined between the ring steady and the bed right end side. This will have a max. working stroke of 19,550 mm and an extra stroke of 22,000 mm
4.6.2 The saddle shall consist of a large cast base and shall provide maximum rigidity during travel.
4.6.3 The counterways of the saddle shall be lined with anti-friction and self-lubricating fiber strips to prevent stick slip, even at slow speed rates.
4.6.4 An independent electro pump and tank shall be provided to monitor lubrication of the ways.
4.6.5 A flashing light indicator shall be provided to warn of low oil levels.
4.6.6 Transmission of the saddle shall be performed by two pinions working on two opposed helical racks.
4.6.7 A brushless servomotor shall be provided with an encoder. This shall be driven by digital drives to provide both feed and rapid traverse along the longitudinal axis in both directions. Positional precision shall be on the order of 0.1mm (0.00394 in.)
4.6.8 Quality wipers shall be fitted on the saddle to prevent penetration of impurities.
4.6.9 A flat top plate (850mm x 850 mm) shall be provided and bolted to the saddle. This should include T-slots for easier positioning and locking of additional devices.

4.7 Main operator control panel:

4.7.1 The lathe shall be provided with a remote-control panel housing all of the control required to operation the lathe from the NC unit in automatic mode, m.d.i., and jog.
4.7.2 The panel shall be fitted with an electronic handwheel to operation the spindle in manual mode.
4.7.3 The panel shall be mount on a support separate from the lathe at a position that is mutually agreed upon.

4.8 Control panel for headstock:

4.8.1 The lathe shall be equipped with a push-button panel fitted on the headstock.

4.9 Hydraulic power pack:

4.9.1 The lathe shall be equipped with a sole hydraulic power pack near the main headstock.
4.9.2 All necessary servo-controls and malfunction alarms shall be provided.
4.9.3 A separate “open circuit” power pack shall be provided to provide lubrication for the slideways for the steady rests and “ring steady”.
- 4.9.3.1 Warning lights shall be provided to alert the operator to lack of lubrication.
- 4.9.3.2 A float indicator shall be provided in order to display lack of lubrication.

4.10 Safety guarding:

4.10.1 The lathe shall be provided with a working area that has appropriate protections, including:
- 4.10.1.1 Sliding guard on the chuck with a suitable interlock
- 4.10.1.2 Rear protection wall
- 4.10.1.3 Side fences with interlocked gates
- 4.10.1.4 Photo sensors on operator side of lathe

4.11 Electrical equipment:

4.11.1 All electrical equipment shall be enclosed in a separate cabinet.
4.11.2 Divided in section including power, PLC, and auxiliary functions.
4.11.3 Digital drive for the main motor in order to provide gradual accelerations, decelerations, and braking.
4.11.4 A programmable PLC unit, integrated into the CNC, which operates as an interface between the lathe and the control unit and external production devices.
4.11.5 The following safety devices shall be provided at a minimum:
- 4.11.5.1 Micro-switches monitoring the correct meshing of speed ranges.
- 4.11.5.2 Warning light/s for hydraulic power pack.
- 4.11.5.3 Warning light/s for slideways lubrication system.

4.11.6 The CNC screen shall show clear messages and/or alarm/s if anomalies are detected.
4.11.7 A diagnostic system shall be provided to facilitate troubleshooting and minimize downtime.
4.11.8 The electrical cabinet shall be provided with air conditioning.
4.11.9 The operating voltage shall be 480 V +/-10%.
4.11.10 The operating frequency shall be 60 Hz +/- 2%.

4.12 Control Unit – Siemens Sinumerik "One":

4.12.1 The lathe shall be equipped with a modular 32-bit microprocessor CNC Siemens Sinumerik "One" continuous path control for turning operations with PLC and operating system on PC-card.
4.12.2 The CNC unit shall be fitted with one (1) remote control panel to be positioned near the lathe in a mutually agreed upon location.

4.13 Operation and displays:

4.13.1 The language and displays shall be in English.
4.13.2 The display shall provide information such as:
- 4.13.2.1 Actual block
- 4.13.2.2 Spindle revolutions
- 4.13.2.3 G functions
- 4.13.2.4 Auxiliary functions
- 4.13.2.5 All setting data such as part programs, user data, and machine data
- 4.13.2.6 Alarms and messages
- 4.13.2.7 Program running

4.13.3 The lathe shall display what operating mode it is in (i.e. "Automatic", "Jog", or "MDA").

4.14 Programming:

4.14.1 The vendor shall provide a Siemens programming language editor to DIN 66025 with a comprehensive range of high-level language elements.
4.14.2 The programming shall provide extensive parameter technology, program generation parallel to machining, DRT (Differential-Resolver-Function), constant cutting speed (G96), and minimum (G25) and maximum (G26) programmable limitation of the spindle revolutions.
4.14.3 The NC user memory shall be approximately 3 MB for part-programs and technology cycles.

4.15 Communications:

4.15.1 Two (2) Ethernet 10/100 Mbit/s (RJ45)
4.15.2 Four (4) USB 2.0
4.15.3 One (1) PROFIBUS/MPI interface
4.15.4 Extensive archiving procedures

4.16 Operating modes:

4.16.1 The operating modes shall include “Automatic”, “Jog”, and “MDA”.

4.17 Operating Components:

4.17.1 An OP015 flat operator panel with 15 in. color display (or better) shall be provided.
4.17.2 A 19 in. machine control panel shall be provided.
4.17.3 A PCU 50.5 with Win7 EmbSys (64 bit) operating system, 80 GB hard disk, 4096 MB RAM, and software OPERATE shall be provided.

4.18 Run-off and acceptance testing of the lathe:

4.18.1 A runoff and acceptable testing shall be planned at the vendor factory in the presence of Benet/WVA representatives. This testing shall include:
  4.18.1.1 A geometrical test according to ISO 1708 standards.
  4.18.1.2 2 hours of operational testing (DRY RUN)
  4.18.1.3 Check out of contractual specifications.
4.18.2 At the end of the run-off test, the Gov’t shall issue written (PRELIMINARY) acceptance.
4.18.3 The final run-off testing, consisting of the same parameters listed in Section 4.18, will be performed at the WVA. When all testing has been completed and standards are proven to be met, the Government shall issue a written (FINAL) acceptance once.

5.0 FOUNDATION – the following applies to each lathe:

5.1 Each lathe foundation is the Government’s responsibility.
5.2 Each lathe foundation shall be built according to the following drawings provided by the lathe vendor:
  5.2.1 Layout of the foundation drawing staring the distance between the leveling wedges, carrying out of the pits to house the tie-rods, slopes, and levels.
  5.2.2 Technical specifications with allowed loads and deformations.
5.3 Drawings specified within Section 5 shall be furnished to the Government within 30 calendar days of the ordering of the lathes.

6.0 DELIVERY REQUIREMENTS

6.1 Unless otherwise specified, the lathes shall be delivered to:

6.2 Freight and rigging shall be included.
6.3 The delivery will be duty free (52.232.23 Assignment of Claims Cause).
6.4 Period of Performance
6.4.1 Orders for both lathes should be submitted upon award of the contract (anticipated to be during month of September of 2023).
6.4.2 Fulfillment, delivery, installation, of each Lathe is listed below
6.4.2.1.1 Production of the first Lathe should take approximately 14 months.
6.4.2.1.2 Delivery of the first Lathe is anticipated to take approximately 1 month. However, delivery of the first Lathe shall not take place until after confirmation of the foundation (discussed in Section 5) is in place (anticipated to be during the month of January 2025).
6.4.2.1.3 Installation is anticipated to take approximately 3 months.
6.4.2.2.1 Production of the second Lathe is anticipated to take approximately 28 months (14 months following the order of the first Lathe).
6.4.2.2.2 Delivery of the second Lathe is anticipated to take approximately 1 month. However, delivery of the second Lathe shall not take place until after confirmation of the foundation (discussed in Section 5) is in place (anticipated to be during the month of January 2026).
6.4.2.2.3 Installation is anticipated to take approximately 3 months.

7.0 INSTALLATION

7.1 Prior to each lathe's installation, the foundation shall be completed to the OEM specifications. This is the responsibility of the Gov't.
7.2 The installations shall be performed by specialized OEM personnel in the contractually agreed location and assembly, alignment, and leveling of the lathes and their accessories.
7.3 Anchoring bolts and leveling wedges shall be provided to provide appropriate horizontal and vertical adjustment for each lathe.

8.0 WRITTEN DELIVERABLES – The following written deliverables will be supplied utilizing the English language.

8.1 Operation Manuals for each lathe
8.2 Training manuals, materials, documentation for each lathe
8.3 Foundation drawings/blueprints as specified in Section 5 for each lathe
8.4 Dimensional drawings/blueprints regarding for each lathe supplied via a 3D model in STEP (STandard for the Exchange of Product model data) or equivalent programming format.

9.0 TRAINING

9.1 The training site will be at WVA and will be at least 5 days in duration for each lathe.
9.2 The training will be provided for a minimum of 13 personnel for each lathe including but not limited to: WVA personnel involved with machine operation, mechanical maintenance, hydraulic maintenance, electric maintenance, CNC maintenance, and programming.

10.0 MAINTENANCE SET

10.1 Each lathe shall be supplied with tools to enable periodic preventative maintenance including a test mandrel, test bar, and “dual use” sliding base (to serve as an optical collimator and dial gauge).

11.0 WARRANTY

11.1 The integral warranty for each lathe shall start from the signature of the final acceptance, be at least 12 months in length, and cover all defects with regard to material and workmanship.