Revolutionizing the Teaching and Learning of Welding Fundamentals through the Integration of Virtual Simulation

Ryan Anderson, Assistant Professor Agricultural Education
Wade Miller, Professor Agricultural Education
Gaylan Scofield, Director Brenton Center and Distance Education
Agricultural Education and Studies

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Signature of Agricultural Education and Studies Reviewing Administrator

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Signature of Project Leader: Ryan Anderson, 515-294-4139, randrsn@iastate.edu
Justification for Funding

The Agricultural Education and Studies department is currently offering one class that prepares pre-service teachers to teach agricultural mechanics. The class currently focuses on four major components: woodworking, electricity, small engines and welding. This equates to roughly four weeks of welding instruction for students who are about to teach secondary students how to weld. Welding is one of the primary components currently being taught by secondary agricultural educators in Iowa. With the addition of the VRTEX 360 virtual reality welding system, students learn welding skills more quickly and efficiently. The increases in student learning of welding will open up more time to learn additional topics to better prepare them to enter into the classroom.

The VRTEX 360 has several benefits that would be very beneficial to student learning. This machine allows students to learn the basic fundamentals of SMAW, GMAW, and FCAW welding processes. The program utilizes 5 different welding coupons (Flat, Tee, Groove, 2" pipe, and 6’ pipe) that can be welded in flat, horizontal, vertical and/or overhead positions. It would take roughly 20 class periods to effectively learn how to perform those welds. The VRTEX 360 is equipped with a performance and evaluation tool that tracks the students’ welding position, arc length, work angle, travel angle, travel speed and provides instant feedback on the technique areas that need improvement. The instructor can also program the VRTEX 360 to provide an overall score and individual weld technique score for each technique parameter tracked; provided the students with more specific details on weld improvements. The performance and evaluation portion of the VRTEX 360 alone is absolutely must have for any instructor of beginning welders. This provides the one on one feedback that even the best welding instructors wished that could provide to all of their students at any one time.

The acquisition of a VRTEX 360 in addition to aiding student learning would also assist the proposer in developing curriculum for secondary agricultural education programs, introduce innovative research projects for graduate students, develop additional support for external grant opportunities, develop workshops (In-service teachers, University employees, students from other majors, etc) and most importantly aid as a recruitment tool for the University. We would be one of, if not the first Agricultural Education department in the country to offer this technology to our students prior to entering the teaching profession. The benefits to the University and to student learning are difficult to fully capture, the proposer has attached the product flyer, upgrade package and quote for further investigation for the benefit of the committee members who may not immediately recognize the technical terms associated with welding.
Project Overview

Purpose

The Virtual reality arc welder is a computer based educational training tool designed to allow students to practice their weld technique in a simulated environment. The VRTEX 360 provides an effective transfer of welding skills to the welding booth while reducing our carbon footprint associated with traditional welding training. The Virtual welder utilizes a combination of realistic puddle simulation and arc welding sounds tied to the student's movement provides a realistic, hands-on training experience. The simulator allows students to virtual weld utilizing both Arc and Mig welding processes along with over sixteen joint configurations. The most important feature that this system offers in instantaneous feedback to the operator utilizing virtual cues to improve welding performance. The system would be utilized thoroughly in AGEDS 450, 488 and numerous workshops. The number of College of Agriculture Students that would utilize this system is roughly 150 per year.

General Student Benefit

This system will enhance student welding performance by providing instantaneous feedback to the user. This will increase the welding skills of the students while reducing the amount of welding materials and metal being consumed in the class therefore reducing our carbon footprint. The virtual welder will allow students to learn the basic fundamentals of welding prior to entering a welding booth, thus reducing potential safety hazards associated with beginning welders.

Innovation

The need for workers to enter the welding industry has been steady throughout the past five years and projections indicate the need will continue to grow. Industry has indicated a need to enhance the learning curve of entry level welders while reducing training costs. Lincoln Electric was recently awarded the innovation of the year award for The VTREX 360 for its impact on training entry level workers to enter the welding industry. Our intention for this grant to is enhance the learning curve of entry level agricultural education teachers prior to teaching welding at the secondary level.

New Technologies

The proposer has utilized the VRTEX 360 virtual welder at several tradeshows over the past two years and notes that it is extremely user friendly. However, the proposer has developed close professional relationships with regional and national training representatives from Lincoln Electric who have volunteered to assist the proposer with any set-up, training, and troubleshooting issues that may arise.

Facilities

The Virtual Welding Simulator would be housed at the Agricultural Education and Studies Mechanization laboratory located on the 450 farm. Space has been allocated within the facility to house
the equipment. The simulator may at times be transported to other locations throughout the state of Iowa for workshops and other training activities.

Integration and Sustainability

The VTREX 360 is a stand-alone computer based educational tool that will be utilized to enhance welding skills to a variety of users including but not limited to: Iowa State students, faculty, employees, secondary teachers, and many others. The virtual simulator will be paired with the welding equipment recently donated to the Agricultural Education and Studies Department, allowing students to utilize both virtual and actual welding equipment in the same location.

Cost Efficiency

Lincoln Electrics' VRTEX 360 Virtual reality arc welding trainer is the only virtual welding program currently available on the market. The virtual welder is currently being utilized by the U.S. Military, Welding schools, and industry. Vermeer Inc., located in Pella Iowa is currently utilizing this system to train their employees and have experienced increased learning curves and reduced material wastes. The VRTEX 360 is also equipped with a weldometer that will track material usage and verify cost savings of consumable materials that would have been utilized by the students as well.

Support and Maintenance

Space has been allocated at the Agricultural Education and Studies Laboratory to house the equipment. The project proposer will maintain all maintenance required for daily upkeep. The VTREX 360 comes with a one year warranty. The proposer will attempt to resubmit supporting grants from outside agencies to add additional virtual welders and software updates.

Budget

The proposer is requesting a 60% match for the purchase of a VRTEX 360 Virtual Reality Arc Welding Trainer to be utilized for student learning. The Agricultural Education and Studies department will provide 40% matching funds from the department technology funds account. The proposer will also attempt to secure outside funding to support the software upgrade packages.

Table 1. Itemized Budget

<table>
<thead>
<tr>
<th>Description of Item</th>
<th>Number</th>
<th>Unit Cost</th>
<th>Total Cost CAC</th>
<th>Total Cost AGEDS</th>
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<td>Personnel</td>
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<td>Other (Hazardous Materials fee)</td>
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</table>
The Revolution in Welding Training is Here...

The VRTEX™ 360 is a virtual reality arc welding trainer. This computer based training system is an educational tool designed to allow students to practice their welding technique in a simulated environment. It promotes the efficient transfer of welding skills to the welding booth while reducing material waste associated with traditional welding training. The combination of realistic puddle simulation and arc welding sound tied to the welder’s movement provides a realistic and exciting, hands-on training experience.

**FEATURES**

- **Flexibility**
  - Multiple welding processes.
  - Variety of joint configurations.
  - Multiple welding positions.

- **Innovation**
  - High tech welding training tool.
  - Magnatron™ technology.
  - ProFlo™ technology creates realistic puddle modeling.

- **Classroom Performance - Train Welders Faster**
  - Visual cues give real-time technique feedback.
  - Advanced scoring system for student evaluation.
  - Instructor cam allows virtual weld inspection.

- **Eco Friendly**
  - Turn your welding program green.
  - Track cost savings with the Weldometer™

- **Service and Support**
  - Annual upgrade package (optional).
  - 24/7 phone support.
The VRTEX™ 360 is a VRAW™ (Virtual Reality Arc Welding) training solution. VRAW™ Solutions change the way welding training is accomplished. These solutions represent the most advanced simulation technologies to train skilled welders. The goals of VRAW™ Solutions are to:
- Recruit and retain the next generation of skilled welders.
- Improve the image of welding.
- Make welding education fun.
- Train welders faster.
- Reduce material cost.
- Create green welding programs.

The VRTEX™ 360 represents the next generation in Virtual Reality Welding Training. This product was developed in a partnership between Lincoln Electric and VRSim, experts in the field of Virtual Simulations. The VRTEX™ 360 is based on the VRSim SimWelder and has replaced it in the market with new capabilities and advanced features to position it as the premiere virtual welding training tool. Lincoln Electric and VRSim will continue to work together to provide new and exciting features for the VRTEX™ 360.

In a virtual reality environment, a user experiences immersion, or the feeling of being inside and a part of that world. He is also able to interact with his environment in meaningful ways. A VR simulation immerses the student in a virtual environment and allows them to focus exclusively on the task at hand. Skilled welders draw on information gathered through sight, sound and feel in order to make a good weld. The VRTEX™ 360 replicates these cues accurately so the student can learn their importance and easily and efficiently transfer these welding skills to the real welding booth.

### WELDING IMMERSION

<table>
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<tr>
<th>Sense</th>
<th>Skill</th>
<th>VR Advantage</th>
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</table>
| Touch | - Striking an arc.  
- Understanding body position.  
- Learning specialized welding techniques. | - Student strikes virtual arc on VR coupons.  
- VR welding stand can be positioned many different ways to simulate various welding situations.  
- Different welding techniques can be used and scored including whip and weaving techniques. |
| Sight | - Reading the puddle.  
- Following the joint. | - Realistic puddle simulation closely represents the puddle movement.  
- Bad welding technique results in visual discontinuities including porosity and undercut. |
| Sound | - Using the sound of the arc to help the welder determine if good welding technique is being used. | - VR Welding sound is tied to the student’s movements.  
- Good technique results in a crisp arc sound where a long arc length pops and spatters. |
Simulation technology appeals to the next generation of welders and allows for welding career exploration in a classroom environment without the need for a dedicated welding area. The VRTEX™ 360 can be used by instructors to aid first time welding students in the development of proper welding skills and can help experienced students learn more about their welding technique and to expand their skill set.

**Magnatron™ Technology**
- Allows student to weld on real 3D coupons
  - The haptic feedback adds realism to the simulation and allows for simulation of processes that require touching the electrode to the base metal such as when using stick electrodes that require a drag technique and when making the root pass in pipe.
- Accurate positional data results in scores that help students improve their technique and translates to real welding lab success.

**ProFlo™ Puddle Modeling**
- Technology allows student to learn to "read the puddle". Puddle simulation reacts to student movement.
- Advanced computational system creates life-like puddle.
- Simulates sparks, slag, grinding (on pipe) and weld cooling.
- Virtual weld discontinuities appear in the weld when improper welding technique is used.
INNOVATION

Simulate real field welding experiences with Virtual Environments
Becoming a skilled welder takes practice. Welding skills cannot be taught solely through the use of simulation; however, VR can be used as part of a welding training program to enhance and expedite the training process.

Virtual Welding Training can increase throughput by helping instructors teach more effectively and students learn quicker. This allows more time to teach additional topics.

**Student Tools**
- Visual Cues: Optional graphic overlays give students real-time welding technique feedback.
- Welding machine interface prepares students for welding lab.
  - Work Area/ Welding Booth Preparation.
  - Welding Machine Set Up
    - Process Selection, Wire Feed Speed/ Amperage, Voltage, Polarity, Gas Selection and Flow Rate.
  - Welding Actions – Trim Wire, Get a new Electrode, Quench Metal, and remove slag.

**Instructor Tools**
- Instructor Mode – A key is required to enter the instructor preference mode.
  - Either use Lincoln Electric Welding School defaults – Train your students the way Lincoln does in their welding school.
  - Or customize your system – Fine-tune student experience through modification of preferred welding technique, weld procedures and tolerances. Modify these parameters to match how you teach welding.
  - Access the Weldometer™
    - Track material usage
    - Verify cost savings
    - Track student arc time
- Instructor Cam – The Instructor Cam can be used while the student is welding or used for visual inspection after the weld has been completed. Use this feature to visually inspect welds made on the VRTEX™ 360 for porosity, undercut and proper bead placement.
- First Pass™ Welding Curriculum – Helps instructors integrate VR Welding into traditional welding training. Recommendations on amount of time spent in the VR welding lab versus traditional booth time, welding lessons and supporting resources and curriculum.
- Student Reports
  - Save student reports to USB memory to track student progress.
  - Identify areas of technique improvement.
**Scoring System**

- Record and verify student work.
- Scores each weld based on how accurately the student performs the welding technique set by the instructor.
- Identifies areas of potential discontinuities and visual indications can be seen in virtual weld.

The VRTEX™ 360 graphs the students' welding technique and color codes results. Parameters include:

- Position in the joint
- Contact Tip to Work Distance (CTWD) / Arc Length
- Work Angle
- Travel Angle
- Travel Speed

Student results are compared to correct welding technique selected by the instructor.

The student receives an overall score and individual weld technique score for each technique parameter tracked.

The weld discontinuity graph indicates where potential discontinuities may have resulted due to improper welding technique.

Records the percentage of weld having discontinuities allowing for pass/fail correlation to code.
FLEXIBILITY

Simulates multiple welding processes including:

- **SMAW**
  - E6010 (Fleetweld® 5P+)
  - E7018 (Excalibur® 7018)

- **GMAW**
  - Short Arc [0.035 in. (0.9 mm) SuperArc® L-56]
  - Axial Spray [0.045 in. (1.1 mm) SuperArc® L-56]
  - Pulse [0.045 in. (1.1 mm) SuperArc® L-56]
  - STT® [0.045 in. (1.1 mm) SuperArc® L-56]

- **FCAW**
  - Gas-shielded [0.045 in. (1.1 mm) UltraCore® 71A85]
  - Self-Shielded [5/64 in. (2.0 mm) Innershield® NR-232]

**Multi Position**
- Independent table and arm height adjustment

**Joint Configurations**

- Flat Plate
- Tee Joint
- Groove Joint

- 6 inch Diameter Schedule 40 Pipe
- 2 inch Diameter XXS Pipe

For all possible joint configurations offered go to: www.vrtex360.com
CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers’ particular purpose is specifically disclaimed.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

PRODUCT SPECIFICATIONS

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<th>Product Name</th>
<th>Product Number</th>
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<th>Input Current</th>
<th>H x W x D inches (mm)</th>
<th>Net Weight lbs.(kg)</th>
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<td>Machine: 71 x 30 x 50 (1803 x 762 x 1270)</td>
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Space recommended to operate system: 8 x 8 x 8 ft.
Std. and Alt. models needed in multiple system installations.

ECO-FRIENDLY

Turn your welding program GREEN:

VR Welding Technology:
- Reduces material waste
- Saves energy
- Tracks material and cost savings using the Weldometer™

Potential Cost Savings in:
- Base Material
- Electrodes
- Shielding Gas
- Consumable Parts
- Energy Consumption

Service and Support That You Can Count On

24/7 Phone Support 1-888-935-3878 • Online Support FAQ’s • Warranty and Replacement Programs

Protect and leverage your investment and take advantage of future developments with the purchase of an optional upgrade package:
- Software patches, upgrades and support.
- Annual upgrade package that includes new product features and other enhancements.
- First Pass™ Welding Curriculum Upgrades.
- Advanced notification of new Lincoln Electric educational materials, seminars and classes.

Service and support that you can count on.
- 24/7 Phone Support.
- Online Support FAQ’s.
- Warranty and Replacement Programs.

CUTTING PERFORMANCE DATA

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Virtual Coupon

Real Welding Coupon

PROD UCT SPECIFICATIONS

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Annual UPGRADE Package 2010 & 2011

New Functionality
New Environments and New Graphics
New Process Puddle Modeling
New Consumable Simulations
Tools to verify your Return on Investment

Tools to verify your Return on Investment
Instructor and student tools top the list of planned feature upgrades.

What to look for in 2010 and 2011 —
• Virtual Bend Testing
• Welding Technique Video Replay
• New Visual Cues
• Additional Instructor Cam Features
• Diagnostic Utilities

First Pass™ Virtual Reality Welding Training Curriculum helps integrate the VRTEX™ 360 into traditional welding training programs. Also included, cutting edge training materials for welding instructors.

What to look for in 2010 and 2011 —
• Lesson Plans
• Welding technique DVD’s
• Welding Books
• Educational Aids
• Software Welding Info Links — embedded curriculum
Environments and Graphics —
Virtual Environments immerse the student in the Virtual World. New environments keep training exciting and provide an opportunity for career exploration.

What to look for in 2010 and 2011 —
- New Virtual Training Environments — Process piping, construction, factory and motorsports.
- Interactive Elements in the Environments

Process Puddle Modeling —
Teach your students to read the puddle. As technology advances, so will the appearance of the welding puddle.

What to look for in 2010 and 2011 —
- Improvements in the visualization of the 64 current joint configurations weld puddles.
- Additional Heat Affected Zone Modeling

Consumables —
Basic electrodes were a good start but there are many electrode classifications on the market, each with their own unique characteristics.

What to look for in 2010 and 2011 —
- Fleetweld® 37 — E6013
- Additional base material and electrodes
- New gas/ wire consumable combinations

Return on Investment Tools —
Track the rewards of Virtual Welding Training.

What to look for in 2010 and 2011 —
- ROI Calculator — Allows you to ring up a dollar savings figure using pricing and usage unique to your school.
- 22 Gauge Material Thickness — New material thicknesses extend the VRTEX™ 360 to cover additional training topics.
How the Annual Upgrade Program Works

- The Annual Upgrade Package is good for one year and includes two releases.*
- Discounts are available for multi-system and multi-year purchases.
- Catch-up program available — The Annual Upgrade Package does not need to be purchased at the time of VRTEX™ 360 purchase; however, the customer must back pay all years of subscription to bring system up to current software version before participation.

Additional benefits:

- Stay on the leading edge of technology – take advantage of the latest developments.
- Customer feedback is prioritized to direct future upgrade packages.
- Advanced notice of Lincoln Electric programs for welding educators.
- Protect your investment.

**How to install updates:**
1. Insert USB Memory Stick received in the upgrade package into the front of the VRTEX™ 360
2. Navigate to the log in screen and turn the key on the front of the machine to enter Instructor Mode
3. Select “Upgrade” box
4. Select “Upgrade Software”
5. When upgrade is finished, shutdown the system and restart.

* Lincoln Electric will use our best efforts to complete and provide both releases within the year period. Updates described in this literature will be made available in the release of Lincoln Electric’s choice. Lincoln Electric reserves the right to change, modify or cancel one or more of the updates.

The Annual Upgrade Package is non-transferable and one package cannot be shared among multiple VRTEX™ 360 machines. The package does not include new system hardware, does not take the place of an extended warranty program and does not cover repair or service of the VRTEX™ 360 beyond standard warranty.

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March 14 2011

Quote No. 20076053

To: Michael J. Byerly
For: Ryan Anderson, Assistant Professor, Agricultural Education and Studies, Iowa State University

Attached is an electronic copy of the virtual welding simulator quotation you requested.

Appropriate supplemental information has been provided.

When you send the order in for processing, referencing the quote number and list the line items being purchased by part number as they appear on this quote.

Thank you for your cooperation. If you have any questions, please let me know.

Yours very truly,

Andrew Caldarone
<table>
<thead>
<tr>
<th>QTY</th>
<th>PRODUCT NUMBER</th>
<th>PRODUCT DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AD1332-1</td>
<td>VRTEX 360</td>
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</table>

VRTEX 360 VIRTUAL REALITY WELDING TRAINER UNIT SIMULATES SMAW (E6010 & E7018), GMAW (SHORT ARC, SPRAY, PULSE AND STT), FCAW-S AND FCAW-G IN MULTIPLE POSITIONS (FLAT, HORIZONTAL, VERTICAL AND OVERHEAD) AND MULTIPLE JOINT CONFIGURATIONS (FLAT PLATE, TEE JOINT, GROOVE JOINT, 2" DIAMETER XXS TUBE, AND 6" DIAMETER SCHEDULE 40 PIPE). EACH UNIT INCLUDES THE FOLLOWING

- VR WELDING MACHINE INCLUDING:
  - COMPUTER - 4U RACKMOUNT
  - WINDOWS XP PROFESSIONAL SP3
  - INTEL CORE 2 QUAD PROCESSOR
  - 2 X 2GB DDR2 MEMORY
  - SOLID STATE HARD DRIVE
  - 2 NVIDIA QUADRO FX 3700 GRAPHICS CARDS
  - 19" LCD MONITOR
  - TRACKING SYSTEM
  - VR WELDING STAND - MULTI-POSITION
  - VIRTUAL SMAW ELECTRODE HOLDER WITH RETRACTABLE STICKELECTRODE
  - VIRTUAL GMAW/FCAW GUN
  - VR WELDING HELMET INCLUDING FACE MOUNTED DISPLAY WITH 3D STEREOCOSCOPIC OUTPUT
  - COMPLETE SET OF VR WELDING COUPONS INCLUDING FLAT PLATE, TEE JOINT, GROOVE JOINT, 2" AND 6" DIAMETER PIPE.
  - INTERACTIVE GRAPHICAL USER INTERFACE FOR SYSTEM SETUP AND USE.
  - 3 VIRTUAL WELDING ENVIRONMENTS
  - WELDING SIMULATION SOFTWARE
  - INSTRUCTOR MODE WITH ADVANCED MENUS
  - ENGLISH AND METRIC UNITS
  - VIRTUAL EQUIPMENT AND TECHNIQUE TOLERANCE SETTINGS
  - WELDOMETER™ - TRACK VIRTUAL MATERIAL USAGE:

TOTAL SYSTEM PRICE: $46,500
### Recommended Options:

<table>
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<tr>
<th>QTY</th>
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<th>PRODUCT DESCRIPTION</th>
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<td>SOFTWARE UPGRADE PACKAGE, 1 YR</td>
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**THIS SOFTWARE UPGRADE PACKAGE INCLUDES:**

- SYSTEM UPDATES INCLUDING:
- OPERATING SYSTEM UPDATES
- DRIVER UPDATES
- PERIPHERAL SOFTWARE UPDATES
- SOFTWARE ENHANCEMENTS
- ANNUAL FUNCTIONALITY UPGRADE PACKAGE WHICH MAY INCLUDE:
  - NEW VIRTUAL ENVIRONMENTS
  - NEW WELDING JOINT CONFIGURATIONS
  - NEW VR WELDING COUPONS
  - SIMULATION OF ADDITIONAL WELDING CONSUMABLE TYPES
  - ADDITIONAL WELDING CONSUMABLE DIAMETERS
  - WELDING CURRICULUM UPGRADES WHICH MAY INCLUDE:
    - LESSON PLANS
    - WELDING DEMONSTRATION VIDEOS
    - WELDING CURRICULUM RESOURCES
    - WELDING EDUCATION MATERIALS
  - ADDITIONAL SERVICE AND SUPPORT FEATURES

ADDITIONAL YEARS OF SERVICE MAINTENANCE MAY BE PURCHASED PRIOR TO THE EXPIRATION OF THE PREVIOUS PLAN THROUGH AUTOMATION SERVICE DEPARTMENT.

**NOTE:**

THE SOFTWARE UPGRADE PACKAGE DOES NOT COVER UPGRADES THAT REQUIRE ADDITIONAL SYSTEM HARDWARE.

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Delivery:

Estimated shipping date is 8-12 weeks from the time of order based on current product development timelines and production schedule activity. Actual shipping timeline may vary, and is to be determined based on product and production schedule. The above prices are in effect for thirty (30) days from date of quotation. Delivery will be confirmed upon receipt of order.

Terms/Conditions and Transfer of Title:

This quote only applies for VRTEX360 systems sold in the United States of America. All prices are F.O.B. point of shipment, with Freight Prepaid by Lincoln Electric in the continental United States of America. Title to the shipment is transferred to the Buyer at the time the carrier accepts the shipment.

Standard Automation Division terms for a VRTEX360 unit is 100% due net-30 days after shipment, unless otherwise approved by Automation Division Management.

Prices do NOT include state and local taxes.

UCC Filing may be required.

Equipment Installation and Isolation:

VRTEX360 technology is based on magnetic tracking technology that may be adversely influenced by nearby magnetic fields or high frequency. For best operating characteristics and longest unit life, take care in selecting the installation site. When installing the equipment, avoid locations exposed to high humidity, dust, dirt, or high ambient temperature (95 degrees F). High frequency stabilized arc welding machines inherently radiate power at frequencies that interfere with radio communications, and computers.

VRTEX360 should be located away from high frequency generating machines, and metallic objects, such as metal building columns, which can impact the systems magnetic field or act as an antenna which will pick up, conduct, and reradiate high frequency. Radiation from power lines, though generally small, can also be present, therefore all electrical power or lighting wiring within 50 feet of the welding area shall be enclosed in a grounded rigid metallic conduit. In the event VRTEX360 is affected by interference, it is the user's responsibility to take steps to isolate and/or eliminate the interference.

VRTEX360 units are designed to operate in an 8'x8'x8' space for each system. If multiple units are required to operate together a unique frequency transmitter can be installed during the manufacturing process at Lincoln Electric to reduce interference.

An uninterruptible power supply (UPS) may be required for the protection of the system from power irregularities or disruption.

Software:

The VRTEX360 is a stand alone appliance. It is designed to operate the provided VRTEX360 welding simulation software only. The addition of any other software packages or updates to the VRTEX360 computer (including but not limited to operating system patches or additional software programs) that have not been authorized by the Lincoln Electric Company for use on the VRTEX360 may VOID your system warranty.

On Site assistance:

Prices do NOT include on-site customer installation or training unless otherwise stated. Lincoln Electric Automation can provide on-site customer training and installation assistance at a cost of $1,120 per eight hour day Monday through Friday. All hours beyond eight (8) in one day or forty (40) in one week, as well as all Saturday hours, will be charged at an overtime rate of $195 per hour.
All Sunday and holiday hours will be charged at a premium rate of $260 per hour. In transit travel time is billed at $85/hour regardless of the time incurred. Travel time charges begin when the technician departs from Lincoln Electric and ends when the technician arrives at the customer's facility (or hotel). Return travel time begins when the technician leaves the customer's facility and ends when the technician returns to Lincoln Electric or home. Travel time is in addition to the time at the customer's facility. The customer is not billed for time that is neither travel time nor on site work time, such as overnight hotel stays, mealtimes, etc.

End-User Warranty Period

LECO will assume parts expense of correcting defects during the full warranty period. All warranty periods start from the date of purchase to the original end-user or from the date of manufacture if the original invoice cannot be provided, and are as follows:

1 Year
- All VRTEX360 welding components including control panel interface, SMAW device, and GMAW device.
- All VRTEX360 replacement parts
- Equipment manufactured for LECO is subject to the warranty period of the original manufacturer.
- Expendable Parts - LECO is not responsible for replacement of any expendable part required due to normal wear.

Conditions of Warranty - To obtain warranty coverage:

The End User must contact LECO about any defect claimed under LECO's warranty prior to correction. Determination of warranty on equipment will be made by LECO.

Warranty Repair:

If LECO confirms the existence of a defect covered by this warranty, the defect will be corrected by repair or replacement at LECO's option. At LECO's request, the end-user must return to LECO "Goods" claimed defective under LECO's warranty.

Warranty/Service Freight Costs:

For equipment, the end-user customer is responsible for shipment both to and from LECO.