Iowa Waste Reduction Center (IWRC)

Program of Business and Community Services, a division of the University of Northern Iowa’s College of Business Administration.

- The IWRC is an non-profit organization that provides non-regulatory assistance, environmentally focused education and products.
  - Services
    - On-Site Review
    - Iowa Air Emissions Assistance Program
    - Iowa Waste Exchange
    - STAR4Defense
    - Coating Application Research & Training
  - Products
    - VirtualPaint
    - LaserPaint
20 Years of IWRC Painter Training

Training Mission: Transform sprayers into skilled applicators

- Training Programs
  - STAR (Spray Technique Analysis & Research)
  - PACE (Pollution Prevention and Coatings Compliance Enhancement)
  - STAR4D (Spray Technique Analysis & Research for Defense)
- Keys to delivering effective applicator training
  - Blended delivery methods
  - Focus on the fundamentals
  - Measure success / improvement

VirtualPaint®

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Using Technology to Achieve Success

Spray Application Products that Enhance Consistency & Efficiency

- LaserPaint
  - What is it?
    - Spray gun attachment to help improve spray technique.
  - How does it work?
    - Projects two laser dots that converge targeting distance & gun-to-part overlap.

- VirtualPaint
  - What is it?
    - Training simulator for spray application skill development.
  - How does it work?
    - When the spray gun trigger is pulled, the software simulates spray patterns based on real-world input variables.
    - VirtualPaint provides immediate feedback on film consistency, transfer efficiency and a variety of other metrics.
LaserPaint

Simplify The Challenge of Spray Gun Distance Control

• Uses
  • Spray Technique Training
    • Teaches sprayers consistent spray gun distance and spray pass overlap.
  • Production Spraying
    • It’s important that sprayers are comfortable using the LaserPaint so that it is not a distraction.
    • The laser dots must be adjusted to the correct distance and properly aimed at the center of the spray pattern.

• Benefits
  • Film thickness consistency
  • Transfer efficiency
The VirtualPaint System

IWRC Vision for Spray Simulator Training

- Training Value
  - Novice sprayer reduce the learning curve to understand the fundamentals of spray technique
  - Experienced sprayer learn how to improve bad habits
- Simplify the Challenges of Traditional Painter Training Methods
  - Provide hands-on spray application training in a classroom
  - Increase individual hands-on training opportunities
  - Customize training scenarios based on specific skill development needs of the user
  - Visually simplify film thickness accumulation
  - Measure performance metrics that are difficult to calculate using actual coatings
  - No distractions, no mess & no waste
- Safety
- Reduce Training Expense
  - Eliminate expenses and time for preparation and clean-up
  - Eliminate material expenses
- Non-biased Performance Assessment
  - Identify skill level of new hires as well as their ability listen and improve performance.
The VirtualPaint System

Software Development

• 1990’s
  • IWRC first considered the benefits of simulation and spray application training.
  • Development costs & hardware limitations prevented the concept from becoming a reality.
• 2006
  • High demand for IWRC training services for the military led to the development of the VirtualPaint System.
    • Software Versions
      • 2D Simulation
        • Pressure Feed
        • Airless
        • Blasting
      • 3D Simulation
• 2007
  • IWRC began selling The VirtualPaint System to continue development.
• 2012
  • Expanded the software development team by partnering with software developers from National Laboratory to design new VirtualPaint software.
The VirtualPaint System

Spray Model Input Data

- Coating
  - Viscosity

- Equipment
  - Trigger %
  - Tip Orifice Size
  - Tip Fan Angle Size
  - Fluid Pressure
  - Air Pressure
  - Fan Knob

- Spray Gun Position & Orientation
  - Gun-to-part distance
  - Gun Angle
The VirtualPaint System

Spray Pattern Simulation

- Dimensions
  - Wet Region
  - Dry Region

- Spray Gun Inputs
  - Flow rate
  - Air pressure
  - Fan adjustment
  - Spray gun position and orientation

- Paint Deposition
  - Film Thickness Accumulation View
    - Green = Target thickness achieved
    - Red = Above target film thickness
    - Blue = Below target film thickness
    - Black = Exceeding the run thickness
The VirtualPaint System

Performance Results

- Overall Score 0-100
  - % Target Film Thickness
  - % Transfer Efficiency
    - Deductions
      - Time
      - Quality Defects
      - Rework
  - Material Tracking
    - Oz Sprayed
    - Oz Wasted
  - Application Cost
    - Material Sprayed
    - Material Wasted
    - Material applied over target thickness

Student Name:
Overall Score: 88%
Paint Sprayed: 2.3 oz ($3.62, $1.82 waste)
Average Thickness: 3.97 mils
Minimum Thickness: 2.39 mils
Maximum Thickness: 5.76 mils
Target Film Thickness: 98%
Transfer Efficiency: 50%
Overspray: 41%
Droplet Fallout: 14%
Elapsed Time: 00:00:51
Coating Name: John Deere Topcoat
Description: John Deere Topcoat
Viscosity: 34 sec Zahn #2 (80 cP)
Cost Per Gallon: $200
Percent Solids: 50.82
The VirtualPaint System

Evaluating Six Years of VirtualPaint Training

- Training Success
  - Spray Gun Technique
    - Accurately track spray gun movement
    - Demonstrate the result of good and bad technique
  - Film Thickness Accumulation View
    - Users think about spray application differently
  - Competition
    - “Game aspect” interactive, engaging & challenging
  - Measure Success
    - Non-biased performance assessment

- Training Limitations
  - Customization options
  - Paint simulation graphics
  - Paint model simplicity
  - Spray gun set-up
  - Real world complexities
The Next Generation of VirtualPaint

New VP8 Software

- Enhanced software development capabilities
  - Improve system performance
  - Enhance graphics
  - Accuracy of performance feedback
  - Develop new parts and substrate types

- Three years of paint model development to improve spray model data
  - Simulates Pressure, Gravity, Air-Assisted Airless and Airless methods of application.
  - Increase performance feedback capabilities and accuracy

- Re-design user interface
  - New painting modes
  - User customization
  - Reporting
VirtualPaint – VP8 Software

User Interface Customization

- Virtual Coatings
  - Paint Model Inputs
    - Viscosity
    - % Volume Solids
    - Target Film Thickness
    - Run Thickness
    - Coverage Thickness
  - Visual Appearance
    - Color
    - Coverage
    - Gloss
    - Run
    - Orange peel
    - Simulated drying effects
- Virtual Parts
  - Part models
  - Substrate types
VirtualPaint - VP8 Software

Enhanced Graphics

- VirtualParts
  - Substrate types
  - Models

- Virtual Coatings
  - Color
  - Coverage transparency
  - Coating opacity
    - Clear coat
  - Distinct pattern shapes
  - Gloss
    - Reflection
      - Spray booth
      - Spray gun
  - Orange peel
  - Runs
  - Simulated Drying Effect
VirtualPaint - VP8 Software

**User Interface Spray Modes**

- **Practice**
  - User can paint parts without lesson limitations. Results are not saved to the database.

- **Testing**
  - User completes a lesson plan a receives a cumulative grade.

- **Competition**
  - User completes a lesson plan and their performance is ranked.

- **Training Improvement**
  - User completes a lesson plan before and after training and the cumulative report compares the results.