

University of Northern Iowa

Iowa Waste Reduction Center



Iowa Waste Reduction Center (IWRC)

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

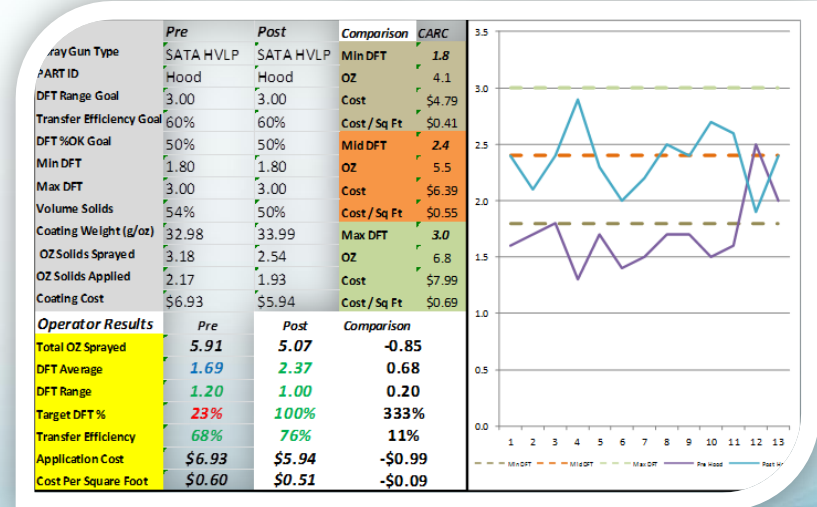
- The IWRC is an non-profit organization that provides non-regulatory assistance, environmentally focused education and products.
 - Services
 - On-Site Review
 - Iowa Air Emissions Assistance Program
 - Iowa Waste Exchange
 - STAR4Defense
 - Coating Application Research & Training
 - Products
 - VirtualPaint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



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
 - Its 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

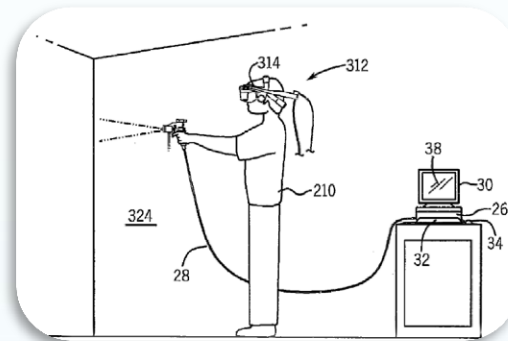
- Training Value
 - Novice sprayer reduce the learning curve to understand the fundamentals of spray technique
 - Experienced sprayer learn how to improve bad habits
- Simplify the Challenges of Traditional Painter Training Methods
 - Provide hands-on spray application training in a classroom
 - Increase 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

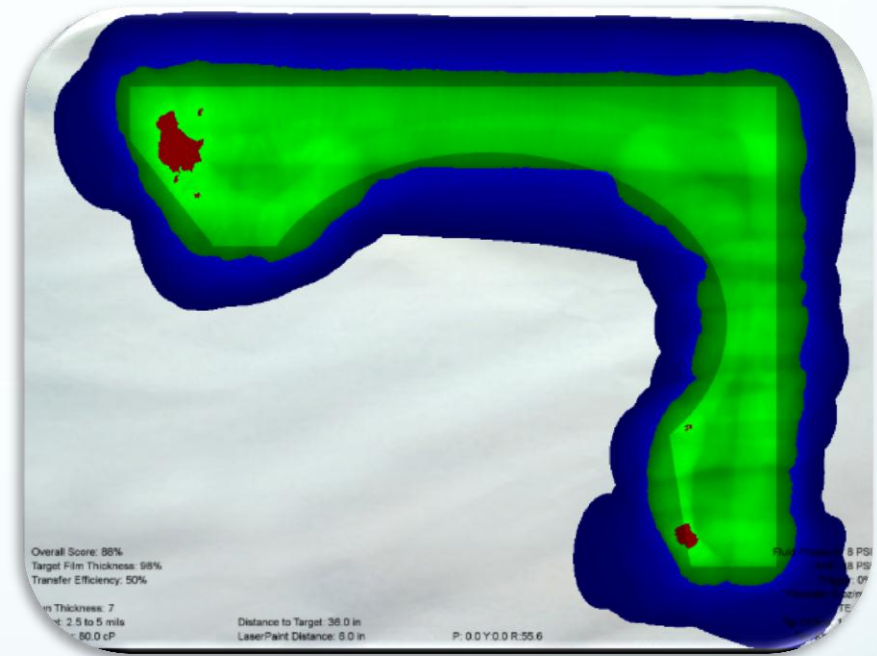
- 1990's
 - IWRC first considered the benefits of simulation and spray application training.
 - Development costs & hardware limitations prevented the concept from becoming a reality.
- 2006
 - High demand for IWRC training services for the military led to the development of the VirtualPaint System.
 - 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

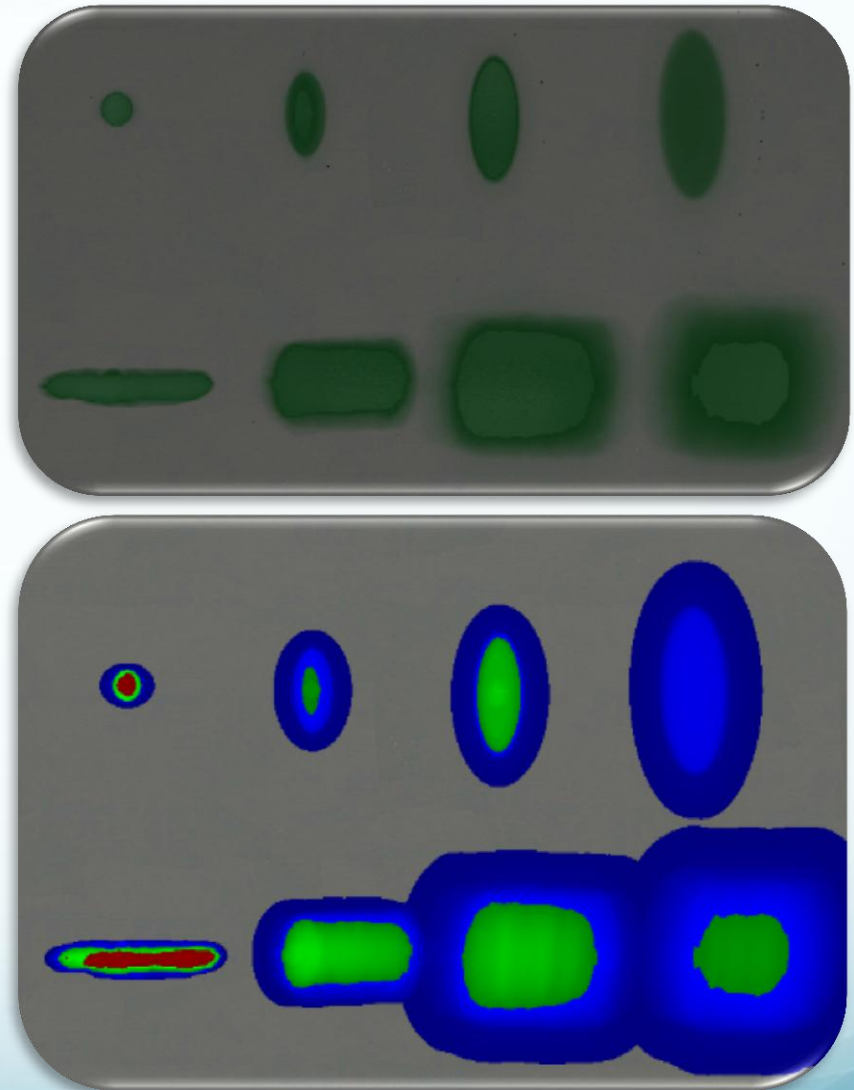
- Coating
 - Viscosity
- Equipment
 - Trigger %
 - Tip Orifice Size
 - Tip Fan Angle Size
 - Fluid Pressure
 - Air Pressure
 - Fan Knob
- Spray Gun Position & Orientation
 - Gun-to-part distance
 - Gun Angle



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

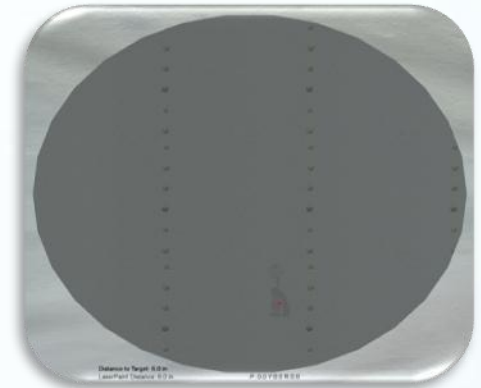
- Enhanced software development capabilities
 - Improve system performance
 - Enhance graphics
 - Accuracy of performance feedback
 - Develop new parts and substrate types
- Three years of paint model development to improve spray model data
 - Simulates Pressure, Gravity, Air-Assisted Airless and Airless 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

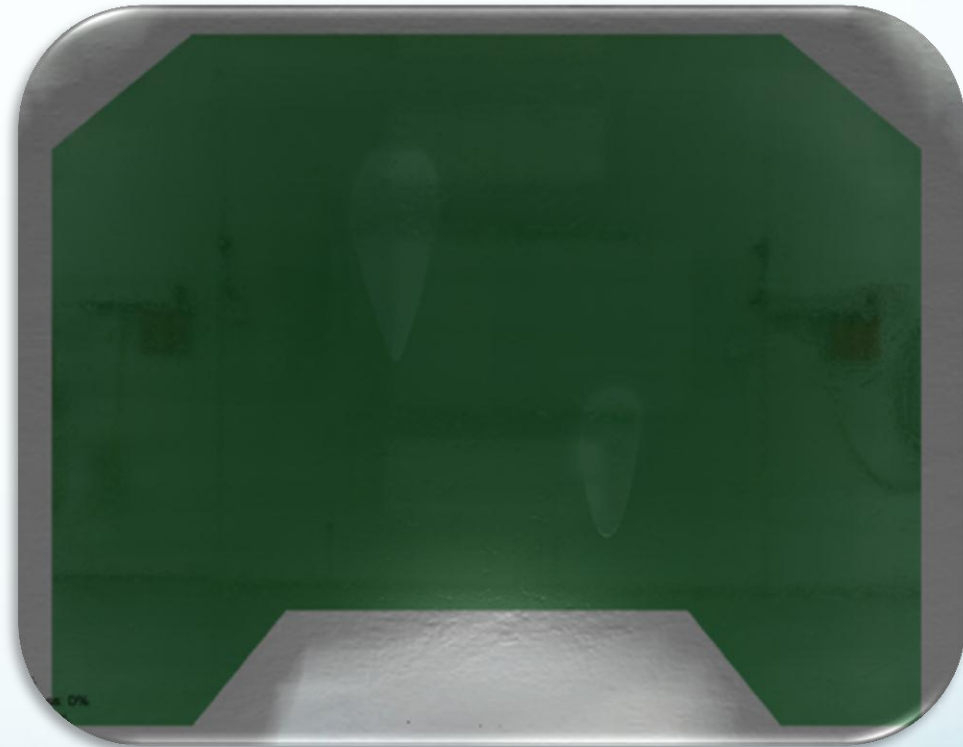
- Virtual Coatings
 - Paint Model Inputs
 - Viscosity
 - % Volume Solids
 - Target Film Thickness
 - Run Thickness
 - Coverage Thickness
 - Visual Appearance
 - Color
 - Coverage
 - Gloss
 - Run
 - Orange peel
 - Simulated drying effects
- Virtual Parts
 - Part models
 - Substrate types



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 and 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.

