May 2000

Environmental Technology Verification Report

Laser Touch and Technologies, LLC
Laser Touch™ Model LT-B512

Prepared by
National Defense Center for Environmental Excellence
Operated by
Concurrent Technologies Corporation

for the
U.S. Environmental Protection Agency
Under Contract No. DAAE30-98-C-1050 with the U.S. Army (TACOM-ARDEC)
via EPA Interagency Agreement No. DW21938399

Notice

This document was prepared by Concurrent Technologies Corporation (*CTC*) under Contract No. DAAE30-98-C-1050 with the U.S. Army Tank-automotive & Armaments Command, Armaments Research Development and Engineering Center (TACOM-ARDEC), Task 208, SOW Task 4. The U.S. Environmental Protection Agency (EPA) and the U.S. Army are working together under EPA Interagency Agreement No. DW21938399. This document has been subjected to EPA's technical peer and administrative reviews and has been approved for publication. Mention of corporation names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products.

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Under Contract No. DAAE30-98-C-1050 (Task 208, SOW Task 4)
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Foreword

The Environmental Technology Verification (ETV) Program has been established by the U.S. Environmental Protection Agency (EPA) to evaluate the performance characteristics of innovative environmental technologies across all media and to report this objective information to the states, buyers, and users of environmental technology. EPA's Office of Research and Development (ORD) has established a 5-year pilot program to evaluate alternative operating parameters and determine the overall feasibility of a technology verification program. ETV began in October 1995 and will be evaluated through September 2000, at which time EPA will prepare a report to Congress containing the results of the pilot program and recommendations for its future operation.

EPA's ETV Program, through the National Risk Management Research Laboratory (NRMRL), Air Pollution Prevention and Control Division (APPCD) has partnered with Concurrent Technologies Corporation (*CTC*) under an ETV Pilot Project to verify innovative coatings and coating equipment techniques for reducing air emissions from coating operations. Pollutant releases to other media are considered in less detail.

The following report describes the verification of the performance of the Laser Touch and Technologies, LLC Laser Touch™ model LT-B512 targeting device for manual spray application systems.

Table of Contents

List of Tables

List of Figures

List of Associated Documents

Laser Touch™ model LT-B512 Data Notebook (Available from *CTC* upon request)

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

ETV JOINT VERIFICATION STATEMENT

TECHNOLOGY TYPE: **LASER TARGETING DEVICE**

APPLICATION: **MANUAL SPRAY APPLICATIONS**

TECHNOLOGY NAME: **Laser Touch™ model LT-B512**

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The United States Environmental Protection Agency (EPA) has created the Environmental Technology Verification Program (ETV) to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved, cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups consisting of buyers, vendor organizations, and states, and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The ETV Coatings and Coating Equipment Program (CCEP), 1 of 12 technology areas under ETV, is operated by Concurrent Technologies Corporation (*CTC*), in cooperation with EPA's National Risk Management Research Laboratory. The ETV CCEP has recently evaluated the performance of a manual spray application targeting device. This verification statement provides a summary of the test results for the Laser Touch™ model LT-B512, manufactured by Laser Touch and Technologies, LLC.

VERIFICATION TEST DESCRIPTION

The ETV CCEP evaluated the pollution prevention capabilities of the Laser Touch™ model LT-B512 targeting device for manual spray painting operations. The test was conducted under representative factory conditions at the Iowa Waste Reduction Center's (IWRC) Painting and Coating Compliance Enhancement (PAC^{2}E) facility. This test was designed to verify that the Laser Touch™ model LT-B512 can provide an environmental benefit over unassisted manual spray application systems while maintaining or improving the finish quality of the applied coating. To quantify these benefits, several painters with varying degrees of experience were asked to coat test parts as they normally would to establish their unassisted baseline, then they were trained on the use of the Laser Touch™ model LT-B512 and asked to coat the same type of parts using the targeting device. The Laser Touch™ model LT-B512 was verified to provide an improvement of the painter's transfer efficiency (TE) and/or improve the finish quality of their finished parts. The improvement in TE leads to a reduction in paint usage and a subsequent reduction of volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions and solid waste disposal.

In this test, the Laser Touch™ model LT-B512 was tested under conditions recommended by Laser Touch and Technologies, LLC, the equipment's manufacturer. The test parts are 121.9 cm (48 in.) long, 101.6 cm (40 in.) wide and 1.5 to 1.7 mm (0.060 to 0.066 in.) thick. One type of part is completely solid, which is called the 'Full' part. The second type of part consists of an outside frame with a horizontal and a vertical members that meet in the center of the part, which is called the 'Window' part. Laser Touch and Technologies, LLC selected Sherwin-Williams® Polane® HS Plus white single-stage polyurethane enamel as the test coating. The coating was mixed 3:1:0.48 with Sherwin-Williams® Catalyst V66V55 and Sherwin-Williams® Reducer MAK R6K30. The manual spray gun used by all painters was an Accuspray® Model 19 high-volume, low-pressure (HVLP), pressure feed gun equipped with a 0.9 mm (0.036 in.) fluid tip, a 0.9 mm (0.036 in.) fluid needle and a #7 air cap. Each painter coated seven 'Full' and seven 'Window' parts during both the unassisted baseline and the Laser Touch™ model LT-B512 test. The parts were sprayed one at a time. Coated test parts were used for painter transfer efficiency (TE) and finish quality analyses. The TE improvement of the Laser Touch™ model LT-B512 versus that of an unassisted baseline was verified using American Society for Testing and Materials (ASTM) method D 5286.

The details of the test, including a summary of the data and a discussion of results, may be found in Chapters 4 and 5 of the “Environmental Technology Verification Report: Laser Touch and Technologies, LLC - Laser Touch™ model LT-B512,” which was published by *CTC*. A more detailed discussion of the test conditions, test results, and data analyses can be found in the "Environmental Technology Verification Data Notebook: Laser Touch and Technologies, LLC - Laser Touch™ model LT-B512," which is also published by *CTC*. Contact Robert J. Fisher of *CTC* at (814) 269-2702 to obtain copies of this statement, the Verification Report, or the Data Notebook.

TECHNOLOGY DESCRIPTION

The Laser Touch™ model LT-B512 was tested, as received from Laser Touch and Technologies, LLC, to assess its capabilities. The Laser Touch™ model LT-B512, which weighs 184.3 g (6.5 oz), attaches to any manual spray gun using an adapter bracket designed for each particular gun. The device is enclosed in a sealed housing to prevent the chance of electrical ignition of any solvent vapors. The device is battery operated and emits two laser beams that converge at the desired distance-to-target. The distance is set by positioning the spray gun in front of a flat vertical surface. When the gun is the desired distance from the surface, a rubber plug is removed from the side of the device allowing access to the set screw. The set screw is adjusted so that the two laser beams converge into a single point of light on the vertical surface. The plug is replaced and the Laser Touch™ model LT-B512 is ready for use.

The Laser Touch™ model LT-B512 is one of Laser Touch and Technologies, LLC's Laser Touch™ targeting devices. At the time of this verification test, the retail price of the Laser Touch™ model LT-B512 was $799.

VERIFICATION OF PERFORMANCE

The performance characteristics of the Laser Touch™ model LT-B512 include the following:

Environmental Factors

- Relative Transfer Efficiency (TE) Improvement: The Laser Touch™ model LT-B512 provided an increase in TE up to 15.8 percentage points, at an average of 5.7 percentage points, which equates to a relative improvement up to 38.8% over the unassisted baseline, at an average of 11.1%. The average standard deviation for each painter's TE data was 1.5 percentage points.

- Emissions Reduction: The TE improvement of the Laser Touch™ model LT-B512 equates to a reduction of volatile emissions of 0.1 kg per kg of solids applied when compared to the unassisted baseline. The specific quantitative reduction in paint usage, volatile organic compound (VOC) or hazardous air pollutant (HAP) emissions, solid waste, and cost due to increased TE depends on numerous factors such as paint formulation, process line and paint booth design, and the products being coated.

- Cost Savings: The TE improvement of the Laser Touch™ model LT-B512 provides an economic advantage in terms of reduced paint usage and solid waste generation. In this verification test, the TE improvement equates to a reduction of 0.2 L of paint used and 0.2 kg of solid waste generated per kg of solids applied when compared to the unassisted baseline. Cost savings result from the reduced paint usage and solid waste disposal.

Marketability Factors

- Dry Film Thickness (DFT): Based on the Sherwin-Williams® literature, Laser Touch and Technologies, LLC recommended the target DFT to be 0.8–1.5 mils. The DFTs for all tests were determined from twelve points measured on 5 random parts selected for each part type (i.e., 5 parts from each type in the unassisted baseline and 5 parts from each type in the Laser Touch™ model LT-B512 test). The DFT of the Laser Touch™ model LT-B512 parts for all ten painters averaged 1.6 mils with a standard deviation of 0.3 mil. The average DFT for the unassisted baseline parts for all ten painters was 1.6 mils with a standard deviation of 0.3 mil.

- Gloss: The gloss was measured per ASTM D 523 Test Method at three points on five parts per part type. The test method has a range of 0–100 gloss units. The target value of 80 gloss units at a 20° angle was based on the Sherwin-Williams® literature and recommendations from Laser Touch and Technologies, LLC. The Laser Touch™ model LT-B512 parts for all ten painters had an average of 83.3 gloss units with a standard deviation of 3.3 gloss units. The unassisted baseline parts for all ten painters had an average of 80.5 gloss units with a standard deviation of 7.9 gloss units.

- Visual Appearance: IWRC personnel assessed the visual appearance of all 28 parts sprayed for each painter. The intent of this analysis was to identify any obvious coating abnormalities. The visual appearance of the Laser Touch™ parts was determined to be better than that of the unassisted baseline parts, with more even coating coverage and reduced appearance of striping.

SUMMARY

The test results show that the Laser Touch™ model LT-B512 provides an environmental benefit over unassisted manual spray applications by increasing a painter's TE, thereby reducing VOC/HAP emissions, paint usage rates, and solid waste generated, and by maintaining or improving the applied coating's finish quality. As with any technology selection, the end user must select appropriate paint spray equipment for a process that can meet their associated environmental restrictions, productivity, and coating quality requirements.

Original Signed on
May 18,2000

E. Timothy Oppelt
Director
National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency

Original Signed on
June 7,2000

Brian D. Schweitzer
Manager
ETV CCEP
Concurrent Technologies Corporation

NOTICE: EPA verifications are based on evaluations of technology performance under specific, predetermined criteria and appropriate quality assurance procedures. EPA and *CTC* make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of commercial product names does not imply endorsement.

Acknowledgments

CTC acknowledges the support of all those who helped plan and implement the verification activities and prepare this report. In particular, a special thanks to Michael Kosusko, EPA ETV CCEP Project Manager, and Shirley Wasson, EPA ETV CCEP Quality Assurance Manager, both of EPA's National Risk Management Research Laboratory in Research Triangle Park, North Carolina.

CTC also expresses sincere gratitude to Laser Touch and Technologies, LLC, the manufacturer of the Laser Touch™ model LT-B512, for their participation in, and support of this program and their ongoing commitment to improve organic finishing operations. In particular, *CTC* would like to thank Nick R. Horan, President, and Scott M. Schmidt, Regional Vice President. Laser Touch and Technologies, LLC is based in Waterloo, Iowa.

In addition, *CTC* would like to thank the Iowa Waste Reduction Center, of the University of Northern Iowa, for the use of their facilities and contributions of personnel and materials for the performance of this verification test.

SI to English Conversions

SI Unit	English Unit	Multiply SI by factor to obtain English
°C	°F	(1.80 E + 00), then add 32
L	gal. (U.S.)	2.642E - 01
m	ft	3.281E + 00
kg	lbm	2.205E + 00
kPa	psi	1.4504E - 01
cm	in.	3.937E - 01
mm	mil (1 mil = 1/1000 in.)	3.937E + 01
m/s	ft/min	1.969E + 02
kg/L	lbm/gal. (U.S.)	8.345E + 00

List of Abbreviations and Acronyms

ASTM	American Society for Testing and Materials
CAS	conventional air spray
CCEP	Coatings and Coating Equipment Program
CTC	Concurrent Technologies Corporation
DEP	Department of Environmental Protection
DFT	dry film thickness
DOI	distinctness-of-image
EPA	United States Environmental Protection Agency
ETV	Environmental Technology Verification
HAP	hazardous air pollutant
HVLP	high-volume, low-pressure
ID	identification
IWRC	Iowa Waste Reduction Center
NDCEE	National Defense Center for Environmental Excellence
NIST	National Institute for Standards and Technology
P2	pollution prevention
PEA	performance evaluation audit
PLC	programmable logic controller
QA/QC	quality assurance/quality control
RTI	Research Triangle Institute
SAE	Society of Automotive Engineers
SCAQMD	South Coast Air Quality Management District
TE	transfer efficiency
TNRCC	Texas Natural Resources Conservation Commission
TQAPP	Testing and Quality Assurance Project Plan
TSA	technical system audit
VOC	volatile organic compound

Section 1
Introduction

1.1 ETV Overview

Through the Environmental Technology Verification (ETV) Pollution Prevention (P2) Innovative Coatings & Coating Equipment Program (CCEP) pilot, the United States Environmental Protection Agency (EPA) is assisting manufacturers in selecting more environmentally acceptable coatings and equipment to apply coating materials. The ETV program, established by the EPA as a result of the President's environmental technology strategy, *Bridge to a Sustainable Future*[1], was developed to accelerate environmental technology development and commercialization through third-party verification and reporting of performance. Specifically, this pilot targets coating technologies that are capable of improving organic finishing operations, while reducing the quantity of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) generated by coating applications. The overall objective of the ETV CCEP is to verify pollution prevention and performance characteristics of coatings and coating equipment technologies and to make the results of the verification tests available to prospective technology end users. The ETV CCEP is managed by Concurrent Technologies Corporation (*CTC*), located in Johnstown, Pennsylvania. *CTC*, under the National Defense Center for Environmental Excellence (NDCEE) program, was directed to establish a demonstration factory with prototype manufacturing processes that are capable of reducing or eliminating materials that are harmful to the environment. The ETV CCEP worked in conjunction with the Iowa Waste Reduction Center (IWRC) of the University of Northern Iowa to complete this verification test.

The ETV CCEP is a program of partnerships among the EPA, *CTC*, the vendors of the technologies being verified, and a stakeholders group. The stakeholders group comprises representatives of end users, vendors, industry associations, consultants, and regulatory permitters.

The purpose of this report is to present the results of verification testing of the Laser Touch and Technologies, LLC, Laser Touch™ model LT-B512 targeting device, hereafter referred to as the Laser Touch™, which is designed for use in manual spray application systems. The test coating chosen by Laser Touch and Technologies, LLC was Sherwin-Williams® Polane® HS Plus white single-stage polyurethane enamel. Where possible, analyses performed during these tests followed American Society for Testing and Materials (ASTM) methods, or other standard test methods.

1.2 Potential Environmental Impacts

VOCs are emitted to the atmosphere from many industrial processes, as well as through natural biological reactions. VOCs are mobile in the vapor phase, enabling them to travel rapidly to the troposphere where they combine with nitrogen oxides in the presence of sunlight to form photochemical oxidants. These photochemical oxidants are precursors to ground-level ozone or photochemical smog.[2] Many VOCs, HAPs, or the subsequent reaction products, are mutagenic, carcinogenic, or teratogenic, i.e., cause gene mutation, cancer, or abnormal fetal development.[3] Because of these detrimental effects, Titles I and III of the Clean Air Act Amendments of 1990 were established to control ozone precursors and HAP emissions.[3,4]

Painting operations contribute approximately 20% of stationary source VOC emissions. These operations also contribute to HAP emissions, liquid wastes, and solid wastes. End users and permitters often overlook these multimedia environmental effects of coating operations. New technologies are needed and are being developed to reduce the total generation of pollutants from coating operations. However, the emerging technologies must not compromise equipment performance and finish quality.

CTC is serving as the verification organization for the ETV CCEP because of their commitment to environmental excellence and helping the U.S. industrial base achieve world-class agility and competitiveness. *CTC* provided direction and oversight for all testing and analyses performed at the Painting and Coating Compliance Enhancement (PAC^2E) facility operated by IWRC in Cedar Falls, Iowa. *CTC* personnel also performed an audit of the testing and analyses completed during this test. The equipment at the PAC^2E facility includes full-scale, state-of-the-art organic finishing equipment, as well as the laboratory equipment required to test and evaluate organic coatings. The equipment and facilities have been made available for this program for the purpose of testing and verifying the abilities of the Laser Touch™.

1.3 Laser Touch™ Technology Description

The Laser Touch™ model LT-B512 is manufactured by Laser Touch and Technologies, LLC. The Laser Touch™ model LT-B512 is used as a pollution prevention tool that enhances the efficiency of manual spray painting applications. The Laser Touch™ model LT-B512 may contribute to reduced air emissions through improved transfer efficiency (TE), increased productivity and less rework through improved finish quality. These benefits also lead to reduced paint usage, solid waste disposal, and spray booth maintenance costs and a cleaner work environment with improved operator visibility.

This innovative technology emits two laser beams that overlap at a preset distance from the spray gun and help the painter judge and maintain the proper spray distance. The laser beams also help with targeting, which can greatly improve the 50% overlap painting technique, thereby increasing consistency in the coating's film thickness.

1.4 Technology Testing Process

CTC developed a technology-specific Testing and Quality Assurance Project Plan (TQAPP) for the Laser Touch™, with significant input from the vendor and IWRC staff. After the vendor concurred with, and the EPA and *CTC* approved, the TQAPP, IWRC performed the verification test under the direction and observation of ETV CCEP personnel. The Verification Statement, which is produced as a result of this test, may be used by Laser Touch and Technologies, LLC for marketing purposes or by end users planning on using the Laser Touch™. The Verification Statement for the Laser Touch™ is included on pages v–viii of this report. A Data Notebook has been compiled by *CTC*, which includes a more detailed discussion of the test conditions, the test results, and the data analyses. The Data Notebook is available from *CTC* upon request.

1.4.1 Technology Selection

Organic finishing technologies that demonstrated the ability to provide environmental advantages were reviewed and prioritized by the ETV CCEP stakeholders group. The stakeholders group is composed of coating industry end user and vendor association representatives, end users, vendors, industry consultants, and state and regional technical representatives. The stakeholders group reviewed the pollution prevention potential of each candidate technology and considered the interests of industry. The Laser Touch™ was found to have pollution prevention potential and can be utilized by any application employing manual spray application systems.

1.5 Test Objectives and Approach

The testing was performed according to the Laser Touch™ model LT-B512 TQAPP. This project was designed to verify that the Laser Touch™ model LT-B512 is capable of providing the end user with a pollution prevention benefit while maintaining or improving the applied coating's finish quality. This project supplies the end users with the best available, unbiased technical data to assist them in determining whether the Laser Touch™ meets their needs.

The quantitative pollution prevention benefit, in terms of improved TE, depends on innumerable factors that are often unique to each coating production line. Attempting to verify every possible combination of these factors is unrealistic. For this verification test, a specific combination of these factors was selected by *CTC*, IWRC, EPA, Laser Touch and Technologies, LLC, and the ETV CCEP stakeholders. The data presented in this report are representative only of the specific conditions tested; however, the test design represents an independent, repeatable evaluation of the pollution prevention benefits and performance of the technology. To determine the environmental benefit of the Laser Touch™, each participating painter's TE obtained using the Laser Touch™ is quantitatively and qualitatively compared to that painter's TE obtained without using the targeting device (see Section 4).

All processing and laboratory analyses were performed at the PAC^{2}E facility by IWRC staff under the direction and observation of ETV CCEP staff. TE was calculated to determine the relative pollution prevention benefit of the technology. DFT, gloss, and visual appearance were evaluated to verify finish quality. The finish quality of the Laser Touch™ parts was compared to the parts prepared without using the Laser Touch™.

1.6 Performance and Cost Summary

This verification has quantitatively shown that the Laser Touch™ is capable of providing an environmental benefit over the unassisted manual spray operation (see Table 1). This environmental benefit was quantified through the ability of the Laser Touch™ to apply a coating at a higher TE. This verification test has also shown that the Laser Touch™ provides the end user with similar or improved finish quality. The increased TE reduces paint usage and solid waste generation. The reduction in paint usage translates into a reduction in VOC and HAP emissions. The extent that emissions and wastes are reduced depends on each individual application, which must be determined on a case-by-case basis.

Table 1. Verification Factors for the Laser Touch™ model LT-B512

	Goals	**Result**
Relative Transfer Efficiency Improvement (%)	Measurable improvement over unassisted application	Up to 38.8%
Dry Film Thickness (mils)	0.8 to 1.5 (per coating's product data sheet)	Ave. Laser Touch™ = 1.6 Ave. Unassisted = 1.6
Gloss (gloss units at a 20° angle)	>80 out of 100 (per coating's product data sheet)	Ave. Laser Touch™ = 83.3 Ave. Unassisted = 80.5
Visual Appearance	Equivalent or better finish quality over the unassisted baseline.	Laser Touch™ parts were the same or better than the unassisted parts.

The list price of the Laser Touch™ at the time of this verification test was $799. Other than slightly increasing the weight of the manual spray gun, the Laser Touch™ does not impact the existing spray application setup or air delivery system. The operating costs of the Laser Touch™ include only routine maintenance/cleaning and batteries. The economic advantage of the Laser Touch™ is realized when reduced paint usage and solid waste generation are considered. Table 2 lists the average values for data used to calculate the environmental benefits of utilizing the Laser Touch™ and Table 3 shows the environmental benefits realized by using the Laser Touch™.

Table 2. Data Used to Calculate Environmental Benefits

	Average of All Painters	
	Laser Touch™	**Unassisted**
Coating Density (kg/L)	1.278	1.280
Wt. % Solids (%)	73.67	73.70
VOC Content (kg/L)	0.336	0.337

Table 3. Benefits Realized from Relative TE Improvement

	Average of All Painters		
	Laser Touch™	**Unassisted**	**Difference**
TE (%)[a]	64.9	59.2	+5.7
Solids Sprayed (kg)[b]	1.5	1.7	-0.2
Paint Usage (L)[b]	1.6	1.8	-0.2
VOC Emissions (kg)[b]	0.5	0.6	-0.1

[a] Average of each of the ten painters' averages.

[b] Per kg of solids applied to a product.

Section 2
Description of the Technology

2.1 Technology Performance, Evaluation, and Verification

The overall objectives of this verification study are to verify pollution prevention characteristics and performance of the Laser Touch™ targeting device and to make the results of the verification tests available to the technology vendor for marketing to prospective technology end users. The Laser Touch™ is designed for use with manual spray application systems. The device uses two convergent laser beams to indicate distance and position of the spray gun relative to the substrate being coated. For this verification study, the manual spray gun used was an Accuspray® Model 19 HVLP spray gun, using a pressure feed delivery system with the cup connected directly to the spray gun. The Model 19 was configured with a 0.9 mm (0.036 in.) fluid tip, a 0.9 mm (0.036 in.) fluid needle, and a #7 air cap. The default setting for the fluid adjustment was three turns open and for the fan pattern adjustment was two turns open. The painters were allowed to adjust the fluid flow, air pressure, and fan pattern to meet their application method so that they may each apply the best possible coating finish; however, the output air pressure at the cap was maintained at or below 10 psig to ensure that the HVLP spray gun was within recommended operating conditions. Each painter also chose the best gun-to-target distance that meets his/her coating application method. The Sherwin-Williams® Polane® HS Plus white single-stage polyurethane enamel was chosen by Laser Touch and Technologies, LLC as the test coating.

CTC, the independent, third-party evaluator, worked with IWRC, Laser Touch and Technologies, LLC, and the EPA throughout the verification test. *CTC* personnel were on site during testing to provide oversight and audit the testing. *CTC* prepared this verification report and were responsible for performing the data review and analyses associated with this verification.

2.2 The Laser Touch™ Test

This verification test is based on the ETV CCEP Laser Touch™ model LT-B512 TQAPP. Laser Touch and Technologies, LLC worked with IWRC and *CTC* to identify the optimum performance measures for this test. The TQAPP was drafted using the vendor-supplied information and was submitted to EPA for review of content. Following the initial EPA review and incorporation of comments, the vendor was given the opportunity to comment on the specifics of the TQAPP. Any information pertinent to maintaining the quality of the study was incorporated into the TQAPP. The final draft of the TQAPP was reviewed by the vendor and technical peer reviewers, then approved by the EPA and *CTC* prior to the start of verification testing.

Testing was conducted by IWRC staff under the direction and observation of ETV CCEP personnel from *CTC*. All information gathered during verification testing was analyzed, reduced, and documented in this report. TE and finish quality measurements of the Laser Touch™ and the relative TE improvement over the unassisted baseline were the primary objectives of this report. The data comparison highlights the pollution prevention benefit of the Laser Touch™, as well as its ability to maintain or improve the coating's finish quality. A portion of the test data has been quality audited by the ETV CCEP Quality Assurance (QA) Officer to ensure the validity of the data.

2.3 Laser Touch™ Technology

This section contains information on Laser Touch™ current applications in industry, the advantages and benefits of the technology, and information on technology deployment. The product data for the Laser Touch™ unit is as follows:

ITEM #: LT-B512
DESCRIPTION: Laser Touch Unit

The Laser Touch unit is an innovative production tool that enables you to utilize the most advanced technology available. By attaching the Laser Touch unit to your spray gun, the spray gun now becomes a precision laser guided tool. Having a visual guide for the critical parameters such as proper gun to part distance, gun angle, lead and lag, edging and overlap, allowing you to make adjustments in real time.

WT. 6.5 oz

2.3.1 Applications of the Technology

The Laser Touch™ targeting device is relatively universal in its application to manual spray application systems. The Laser Touch™ simply attaches to the body of a manual spray gun, is set at the appropriate distance to target, and is ready for use.

2.3.2 Advantages of the Technology

The Laser Touch™ is designed to reduce the variability in a painter's application technique. The Laser Touch™ helps the painter maintain consistent gun to target distance. The Laser Touch™ also aids the painter in targeting the edges of the part being coated, tracing intricate sections of the part, and tracking previous passes to ensure the proper overlap. The reduced variability leads to improved TE, and subsequently, reduced VOC emissions.

Consistent application of the coating through improved overlap and tracking lead to improved TE and sustain a cleaner environment for the operator. Improved TE leads to lessened VOC/HAP emissions, paint consumption, waste disposal, material costs, and spray booth maintenance.

2.3.3 Disadvantages of the Technology

The primary disadvantage to the Laser Touch™ is that it adds weight to the manual spray gun. The increase in weight may increase the rate at which fatigue affects the painter, and the painter may require more frequent rest periods. Fatigue normally leads to poor application practices and therefore, reduced TE and finish quality. However, the Laser Touch™ may counteract this effect by providing the painter constant feedback on his/her application method. Laser Touch and Technologies is working on new models that will greatly reduce the weight of the device.

2.3.4 Technology Deployment and Costs

The Laser Touch™ has few limitations on its distribution to the various finishing industries. The equipment is cost effective because its capital and operating costs are paid back through reduced paint and solid waste expenses.

Section 3
Description and Rationale for the Test Design

3.1 Description of Test Site

The IWRC operates the PAC^{2}E facility primarily as a training center for painters employed at small- to medium-sized businesses. The PAC^{2}E facility equipment consists of a wet spray booth, a powder booth (not used in this verification), and an infrared cure oven, which are all connected by an overhead conveyor. The facility also includes a mixing/cleaning room and an enclosed classroom.

3.2 Evaluation of Laser Touch™ Performance

The overall objectives of this verification test were to establish the pollution prevention benefit of the Laser Touch™ relative to the TE of unassisted manual spray painting (see Section 4 for a discussion of the unassisted baseline), and to determine the effectiveness of the Laser Touch™ in maintaining or improving the finish quality of the applied coating. Finish quality cannot be sacrificed in most applications, regardless of the potential environmental benefits; therefore, this study has evaluated both of these performance aspects. Results from the Laser Touch™ verification testing will benefit prospective end users by enabling them to better determine whether the Laser Touch™ will provide a pollution prevention benefit and meet their finish quality requirements.

3.2.1 Test Operations at the PAC^{2}E Facility

The standard test parts used for this verification test are flat aluminum parts. The chemical and mechanical properties of the aluminum parts have been tested according to ASTM Methods E1251[5] and B557[6]. The test parts are 121.9 cm (48 in.) long, 101.6 cm (40 in.) wide and 1.5 to 1.7 mm (0.060 to 0.066 in.) thick. One type of part is completely solid, which is called the 'Full' part. The second type of part consists of an outside frame with a horizontal and a vertical member centered in their respective planes, which is called the 'Window' part. The parts received pretreatment at an outside source. All test parts have two 1.3-cm (1/2-in.) holes punched near the top corners to suspend the parts from the hooks on the conveyor line. The parts are spaced 1.8 m (6 ft). apart on center. The conveyor advances until a part is centered in the paint booth, and then stops while the painter applies the coating.

The test consisted of twelve painters recruited from local industries, who had varying degrees of experience and training, but none of the participating painters had any previous experience with the Laser Touch™ device. Twelve painters participated in the verification test; however, only ten of those produced a sufficient number of valid test parts (i.e., 5 parts of each type with no runs, sags, or drips). The two painters who did not produce the required valid test parts were the initial participant (not numbered) and Painter #7. The data presented in this Verification Report, and associated Verification Statement and Data Notebook, represent the results of the ten painters that produced the required valid samples.

There were two runs for each painter; one run performed without the targeting device (Run 1 or Pre-Test), and one run using the Laser Touch™ (Run 2 or Post-Test). Each run consisted of seven parts from each of the two types. Therefore, a total of 14 parts were coated per run and each painter coated a total of 28 parts. This enabled both total and run-to-run variation to be determined for each response factor. The statistical analyses for all response factors were performed by ETV CCEP personnel using a statistical software package.

The painters were given informal, basic training on the operation and use of the Laser Touch™ targeting device. The training session did not attempt to correct the painters' form or their application methods, only to provide them with the information necessary to interpret the visual feedback provided by the device.

The test coating chosen by Laser Touch and Technologies, LLC was the Sherwin-Williams® Polane® HS Plus white single-stage polyurethane enamel that was designed to contain less than 336 g/L VOC, as applied. The VOC content was determined by assuming that all volatiles in the coating were regulated compounds. The test coating was chosen because it is a common industrial coating. The coating data sheet can be obtained from Sherwin-Williams®. Prior to each run, the test coating was prepared in the laboratory according to the manufacturer’s instructions. The Coatings Solids Log found in the process data sheets located in Appendix C of the Laser Touch™ model LT-B512 Data Notebook shows the mixing ratio (base:catalyst:reducer), the volume mixed per batch, the coating temperature, and the viscosity before and after spraying. To ensure comparability among tests, the test coating was prepared using the same procedures for the Laser Touch™ tests and all unassisted baseline tests. Due to the short pot life of the Sherwin-Williams® Polane® HS Plus white single-stage polyurethane enamel, one batch was mixed for each run. Each painter started with a new batch of coating at the beginning of each run with the exception of two painters who experienced equipment malfunctions, which required an additional batch of coating be mixed during their test runs. Viscosity and temperature measurements were taken before each run. Samples were taken at the beginning of each run for weight percent solids, density, and volatile content measurements (all data are listed in the Laser Touch™ model LT-B512 Data Notebook). After the coating was mixed, the pressure cup was filled and weighed. The batch container was used to refill the pressure cup as needed between parts.

Upon completion of pretreatment, parts were stored until they were needed for testing. The parts were then engraved with an identification number, weighed, and suspended from the conveyor so that they could be transferred to the wet spray booth. A timer mechanism on the conveyor positioned the parts in the wet spray booth in the proper position. Each part was stationary in the wet spray booth while the painter applied the coating. The paint was generally applied in one coat, but a few painters used a second coat applied in a pattern that was 90° from the first (cross hatch).

The booth air velocity was measured in close proximity to the parts. The air velocity through the booth was expected to be between 0.5 and 0.9 m/s (100 and 175 ft/min). The velocity measured near the parts may vary greatly because of turbulence adjacent to the parts and disruption of air currents caused by the measurement activity itself. The pressure drop across the filters was also checked prior to each run and at the end of the test. To ensure that the filter bank system was functioning properly, a pressure drop across the filter bank greater than 1.0 cm of water indicated that the system required service.

The processed parts were moved to the cure oven where the parts were force-cured at approximately 80 °C for a total of 94 minutes in two stages.

TE was determined using the average weight gain for five of the seven coated parts of each type, with and without the Laser Touch™, per the ASTM standard. Coated test parts were analyzed for DFT, gloss, and visual appearance.

3.2.2 Test Sampling Operations at the PAC^{2}E Facility

IWRC staff recorded the date and time of each run and the time at which each measurement was taken. Upon removing cured parts from the racks, they were checked for DFT, gloss, and visual appearance before being stacked, each being separated by a layer of packing material.

The DFT measurements were taken at approximately the same location on each type of part by using a cardboard template. The template was intended to assess the overall film thickness and not gradients in the film over small areas. The data from these measurements can be found in Appendix C of the Laser Touch™ model LT-B512 Data Notebook.

Gloss of the coated parts was assessed in a manner similar to the DFT measurements. Visual appearance was checked while the parts were suspended from the conveyor and while they were laying on a table.

3.2.3 Sample Handling and Quality Assurance/Quality Control Procedures

After the test coating components were mixed, temperature, viscosity, density, VOC content, and percent solids analyses were performed. Data were logged on bench data sheets, precision and accuracy data were evaluated, and results were recorded on laboratory data sheets. Another IWRC staff member reviewed the data sheets before sending them to *CTC* for QA review and statistical analysis by ETV CCEP personnel.

Each apparatus used to assess the quality of a coating on a test part was set up and maintained according to the manufacturer's instructions, and/or the appropriate reference methods. Actual sample analyses were performed only after setup was verified per the appropriate instructions. As available, samples of known materials, with established product quality, were used to verify that a system was working properly.

3.3 Data Reporting, Reduction, and Verification Steps

3.3.1 Data Reporting

Raw data were generated and collected manually and electronically by the analysts at the bench and/or process level. Process data were recorded on process log sheets during factory operations. The recorded data included original observations, printouts, and readouts from equipment for sample, standard, and reference QC analyses. The analyst processed raw data and was responsible for reviewing the data according to specified precision, accuracy, and completeness policies. Raw data bench sheets, calculations, and data summary sheets for each sample batch were kept together.

3.3.2 Data Reduction

A preliminary data package was assembled by IWRC. The data package was submitted to the ETV CCEP for review to ensure that tracking, sample treatment, and calculations were correct. Part of that data package included the calculation of TE, which used the initial and final weights of the paint cup, as well as the initial and final weights of the parts. The TE for each painter and the relative TE improvement was calculated using the equations shown below.

$$\text{TE (\%)} = \frac{\text{(weight gain of each part)} \times 100}{\text{(weight of paint solids sprayed)}}$$

$$\text{TE}_{\text{RI}}\ \text{(\%)} = \frac{(\text{TE}_{\text{Laser Touch™}} - \text{TE}_{\text{Unassisted Baseline}}) \times 100}{\text{TE}_{\text{Unassisted Baseline}}}$$

TE_{RI} - the relative TE improvement over the unassisted baseline
$\text{TE}_{\text{Laser Touch™}}$ - the average TE for each painter while using the Laser Touch™
$\text{TE}_{\text{Unassisted Baseline}}$ - the average TE for each painter's unassisted baseline

Figure 1. Transfer Efficiency Equations

3.3.3 Data Verification

A preliminary data report was prepared and submitted to the *CTC* Laboratory Manager, who then reviewed all final results for adequacy in meeting project QA objectives. The ETV CCEP Technical Project Manager was notified of the results of the review and statistical analysis. After the ETV CCEP Technical Project Manager reviewed the results and conclusions, the Verification Statement/Verification Report was written by the ETV CCEP, sent to the vendor for comment, passed through technical peer review, and submitted to EPA for approval. The Verification Statement was disseminated only after agreement by the Laser Touch and Technologies, LLC.

Section 4
Unassisted Baseline

Prior to introducing the painters' to the Laser Touch™, the painters were asked to coat a series of 'Full' and 'Window' parts (see Section 3.2.1 for description) to establish their TE and finish quality baseline. Painters were given the opportunity to practice with the spray gun and coating to become accustomed to the characteristics of the system. Once a painter became comfortable applying the coating to the parts, they began coating the actual test parts prepared for the baseline. The parts coated during the baseline were checked for the same performance criteria as the parts coated using the Laser Touch™. These performance measurements include TE, DFT, gloss, and visual appearance.

Section 5
Results and Discussion

This section presents an overview of the verification test results, including an analysis of environmental benefits of the Laser Touch™ and a summary of data quality. Laser Touch™ data generated during this test are compared to the unassisted baseline data in order to establish the relative environmental benefit of the Laser Touch™ and the acceptability of the finish quality of the applied coating. The manner in which the data were compared is explained. Subsequently, the actual tabulation, assessment, and evaluation of the data are presented. The accuracy, precision, and completeness data, the process and laboratory bench sheets, raw data tables, and calculated data tables are included in Section 5 of the Laser Touch™ model LT-B512 Data Notebook.

5.1 Potential Environmental Benefits and Vendor Claims

The primary purpose of this test is to verify that the Laser Touch™ improves a painter's TE while maintaining or improving the applied coating's finish quality. However, Laser Touch and Technologies, LLC makes no claims on the actual TE improvement obtainable by the Laser Touch™ because each application is unique. An improvement in TE and/or finish quality would lead to reduced paint usage, and therefore, reduced VOC/HAP emissions and solid wastes, both of which result in end user cost savings.

5.2 Selection of Test Methods and Parameters Monitored

IWRC performed the laboratory testing required for this verification test. IWRC possesses the skills, experience, and laboratory equipment required by this verification test. Test procedures, process conditions, and parameters to be monitored were selected based on their correlation to, or impact on, TE or finish quality.

5.2.1 Process Conditions Monitored

The conditions listed below were documented to ensure that there were no significant fluctuations in conditions during each painter's portion of the verification test. With the exception of a 13% drop in the relative humidity during one of the test days, no significant differences were recorded. A more detailed discussion of the data is presented in Section 3 of the Laser Touch™ model LT-B512 Data Notebook. Table 4 shows the maximum and average variation observed for all painters.

Table 4. Average and Standard Deviation of Process Conditions

	Average	Standard Deviation
Factory relative humidity (%)	30	6
Spray booth relative humidity (%)	30	6
Factory temperature (°C)	23	2
Spray booth temperature (°C)	24	1
Spray booth air velocity (m/s)	0.84	0.10
Part temperature (°C)	22.5	1.8
Cure Time (minutes)	94	0
Average Coating Viscosity, as applied (s)	55.31	2.43
Average Coating Temperature, as applied (°C)	22.6	1.6
Average Weight Percent Solids (%)	73.68	0.87
Average Volatile Content (g/L)	336	8
Average Coating Density (g/L)	1279	22

5.2.2 Operational Parameters

A number of operational parameters were also monitored because they often vary from painter to painter. The dynamic input air pressure and output cap air pressures were the same from run to run for each painter. The few variations in the distance-to-target values had no apparent effect on the TE of the painters or the finish quality of the coated parts.

The average dynamic input air pressure was 39 psig with a standard deviation of 4 psig. The distance-to-target ranged from 10.2 - 20.3 cm, with an average of 15.7 cm and an standard deviation of 2.1 cm. The output cap air pressure also varied slightly from painter to painter with an average of 7.5 psig and a standard deviation of 1.2 psig. A more detailed discussion of the data is presented in Section 3 of the Laser Touch™ model LT-B512 Data Notebook.

5.2.3 Parameters/Conditions Monitored

Other parameters and conditions were monitored to ensure that they remained relatively constant throughout each painter's portion of the verification test. Constancy was desired in order to reduce the number of factors that could significantly influence TE calculations and evaluation of finish quality. Most of these parameters were relatively constant for each painter. However, those parameters that were not relatively constant for any painter did not significantly impact the result for that painter. A more detailed discussion of the these parameters is presented in Section 3 of the Laser Touch™ model LT-B512 Data Notebook.

5.3 Overall Performance Evaluation of the Laser Touch™

The Laser Touch™ test parts are better in appearance than the unassisted baseline parts with reduced appearance of striping and reduced appearance of light areas observed during visual examination of the parts. It was determined that the Laser Touch™ would satisfy the finish quality requirements of the applied coating. The finish quality of the Laser Touch™ parts indicates that the TE values obtained for the Laser Touch™ tests are representative of the actual operation of the equipment. The DFT and gloss values obtained for the unassisted baseline are similar to those for the parts from the Laser Touch™; therefore, the comparison of the TE data from the Laser Touch™ and the unassisted baseline is valid.

<u>The test results indicate that the Laser Touch™ was able to provide an environmental benefit over an unassisted baseline, while maintaining or improving the finish quality of the applied coating.</u>

5.3.1 Response Factors

Responses to the process conditions and parameters were considered to be important due to their effect on, or ability to evaluate, TE and finish quality; therefore, these responses were documented, and the appropriate tests required to identify these characteristics were performed. Any response that was characterized using laboratory equipment followed accepted industrial and ASTM standards. Table 5 presents the average results for the response factors. A more detailed discussion of the data is presented in Section 3 of the Laser Touch™ model LT-B512 Data Notebook.

Table 5. Laser Touch™ and Unassisted Baseline Response Factor Results

	Unassisted Baseline				**Laser Touch™**			
	’Full’		**’Window’**		**’Full’**		**’Window’**	
	Avg.	**SD**	**Avg.**	**SD**	**Avg.**	**SD**	**Avg.**	**SD**
Average DFT of All Painters (mil)	1.6	0.3	1.5	0.4	1.6	0.4	1.7	0.5
Average Gloss of All Painters (units)	81.7	9.3	79.2	13.4	83.3	6.0	83.3	5.6
Average TE (%)								
Painter #1	70.1	2.5	48.4	2.4	78.9	1.2	56.5	2.4
Painter #2	72.9	0.7	47.9	0.9	76.8	0.8	57.6	0.8
Painter #3	71.1	2.4	49.4	3.9	73.1	0.7	48.3	1.2
Painter #4	62.2	1.9	36.3	1.2	71.6	1.1	50.4	1.7
Painter #5	71.3	0.6	52.6	2.0	75.5	0.9	54.2	1.8
Painter #6	80.5	1.2	64.3	2.7	80.0	0.7	64.7	3.8
Painter #8	75.7	0.9	53.4	0.9	80.9	1.2	59.0	1.6
Painter #9	76.1	1.4	56.8	1.3	75.2	1.5	56.4	2.0
Painter #10	69.6	1.2	45.9	0.6	76.2	0.9	54.3	1.0
Painter #11	62.0	1.5	42.0	1.4	75.7	1.2	57.7	2.2

Avg. - average
SD - standard deviation

The average DFTs for both the Laser Touch™ and the unassisted baseline parts were 1.6 mils. Both averages exceeded the target range of 0.8 - 1.5 mils. The painters were instructed to target 1.0 mil DFT. During the practice sessions, they were shown the visual appearance of that DFT's equivalent in the wet coating. Although many painters exceeded the target range, the variability between Run 1 averages and Run 2 averages for each painter did not exceed 0.5 mil, and the variability in DFT for each painter had no apparent effect on the respective TE data.

Gloss was measured to assess finish quality. Five parts from each type were evaluated for each run. The average of the gloss measurements for the Laser Touch™ was 83.3 gloss units and the average for the unassisted baseline parts was 80.5. The gloss data indicate that the coating finish applied by the Laser Touch™ model LT-B512 is similar to those applied to the unassisted baseline parts. All but six average gloss values were above the target of 80 (out of 100) gloss units. The average gloss fell below 80 for two Run 1 'Full' parts, three Run 1 'Window' parts and one Run 2 'Full' part. The lowest average for any painter was 64.5 on an unassisted baseline 'Window' part. The low gloss readings corresponded to the striping effect noticed on several panels.

The TE for each painter represents his exact test conditions. The calculation of TE uses the total amount of paint sprayed and the weight gain of the coated parts, both determined through gravimetric weight measurements. The data show that the Laser Touch™ model LT-B512 can improve TE up to 15.8 percentage points, at an average of 5.7 percentage points, which translates to a relative improvement up to 38.8% over the unassisted baselines, at an average of 11.1%.

The response factor data in Table 5 show the performance of painters, both with and without the use of the Laser Touch™. The data indicate that, on average, the TE of painters was improved by using the Laser Touch™, but not at the expense of finish quality. Therefore, the comparison of the TE data from the unassisted baseline and the Laser Touch™ test is valid.

5.3.2 Assessment of Laboratory Data Quality

The Laser Touch™ results for TE, DFT, and gloss were compared to the unassisted baseline data. The information gathered was considered to be statistically valid and significant such that the advantages and limitations of Laser Touch™, per these test conditions, could be identified with a high degree of confidence. It can be stated with greater than 95% confidence that the Laser Touch™ provided equivalent or improved TE with similar or improved coating finish quality than the unassisted baseline.

5.4 Technology Data Quality Assessment

Accuracy, precision, and completeness goals were established for each process parameter and condition of interest, as well as each test method used. The goals are outlined in the TQAPP.

All laboratory analyses and monitored process conditions/parameters met the accuracy, precision, and completeness requirements specified in the TQAPP, except for the deviations listed in Section 2 of the Laser Touch™ model LT-B512 Data Notebook. None of these deviations were found to have a significant effect on the results. The definition of accuracy, precision, and completeness, as well as the methodology used to maintain the limits placed on each in the TQAPP, are presented below. The actual accuracy, precision, and completeness values, where applicable, are presented in Section 5 of the Laser Touch™ model LT-B512 Data Notebook.

5.4.1 Accuracy, Precision, and Completeness

Accuracy is defined as exactness of a measurement; i.e., the degree to which a measured value corresponds with that of the actual value. To ensure that measurements were accurate, standard reference materials, traceable to the National Institute of Standards and Technology (NIST), were used for instrument calibration and periodic calibration verification. Accuracy was determined to be within the expected values listed in the TQAPP. Accuracy results are located in Table 22 of the Laser Touch™ model LT-B512 Data Notebook.

Precision is defined as the agreement of two or more measurements that have been performed in exactly the same manner. Ensuring that measurements are performed with precision is an important aspect of verification testing. The exact number of test parts coated is identified in the TQAPP, and the analysis of replicate test parts for each coating property at each of the experimental conditions occurred by design. Precision was determined to be within the expected values listed in the TQAPP. All precision data are listed in Tables 24, 25, 26, and 27 of the Laser Touch™ model LT-B512 Data Notebook.

Completeness is defined as the number of valid determinations and expressed as a percentage of the total number of analyses conducted, by analysis type. IWRC's laboratory was striving for at least 90% completeness. Completeness is ensured by evaluating precision and accuracy data during analysis. All laboratory results for finish quality were 100% complete. All results were reviewed and considered usable for statistical analysis. Completeness results are shown in Table 23 of the Laser Touch™ model LT-B512 Data Notebook.

5.4.2 Audits

The ETV CCEP QA Officer conducted an internal technical systems audit (TSA) and a performance evaluation audit (PEA) of the Laser Touch™ and unassisted baseline tests. Also, prior to any comparison studies, the ETV CCEP QA Officer audited a portion of the data generated during the Laser Touch™ and unassisted baseline testing.

The TSAs verified that IWRC's personnel were adequately trained and prepared to perform their assigned duties, and that routine procedures were adequately documented. The ETV CCEP QA Officer examined copies of test data sheets that recorded information such as process conditions, spray booth conditions, equipment setup, and coating preparation, and also reviewed laboratory bench sheets showing data for coating pretreatment weights, densities, and percent nonvolatile matter.

The ETV CCEP QA Officer audit found that the Laser Touch™ and unassisted baseline testing were conducted in a manner that provides valid data to support this Verification Statement/Report. Several deviations from the original TQAPP were identified by the TSA and PEA and are discussed in Section 2 of the Laser Touch™ model LT-B512 Data Notebook.

Section 6
Vendor Forum

[Laser Touch and Technologies, LLC has been offered the opportunity to comment on the findings of this report. Their comments are presented in this section of the report and reflect their opinions. *CTC* and EPA do not necessarily agree or disagree with the vendor's comments and opinions.]

The ETV CCEP testing process is significant because it recognizes that relative improvements in TE can result in reductions in VOC emissions and the amount of material used in the coating process, which results in dollars saved. The report states, "The relative improvements in TE over the unassisted baseline can result in reductions in VOC emissions generated, the amount of paint used, and solid waste created from a given application process."

If the Laser Touch model LT-B512 verification material costs were extrapolated to one gallon of coating used per hour at a cost of $35.80/gal, eight hours per day for five days per week and fifty weeks per year, the savings in material would amount to $4,306.80 per year. When using the ETV CCEP average test results of 12% TE improvement. The return on investment would be accomplished in less than three months. The savings of $4,306.80 does not include the reduced waste disposal costs and the reduction of VOCs and HAPs.

<u>Transfer Efficiency (TE) Results</u>

The "average applied TE" improvement of 12% using the Laser Touch model LT-B512 in the report could be misconstrued. The average improvements during testing would have been greater had the painters been allowed to use cross hatching, a hiding technique, during the pretests. The verification was designed to challenge the Laser Touch model LT-B512 in a worst case trial. Large parts tend to have higher average applied TE than medium and small size parts. Testing performed by the IWRC following the same pre and post test control group design on medium sized parts demonstrated average applied TE improvements of 35.5% using the Laser Touch model LT-B512. Manufacturers using the Laser Touch model LT-B512 on small parts have reported material savings up to 50%. In addition, the 73% high solids content coatings, used in the verification, are more forgiving to improper spray technique than are lower solid content coatings.

<u>Mil Build and Gloss Measurements</u>

The average mil build and gloss measurements did not accurately reflect the improvements in finish quality due to the test method selected by the IWRC and approved by LT&T. Mil build and gloss measurements were taken with a template that had a tendency to fall on areas that the painters would be predisposed to concentrate their spray passes and consequently more material was deposited on the measurement points.

LT&T customers consistently report increased consistency in average mil build due to use of the Laser Touch model LT-B512.

Painter Training

An area of concern was the lack of training and education on spray gun setup and spray technique the spray technicians had received from the participating manufacturers. The report states, “ In addition, only two painters had attended technical schools for training, and the remaining painters had no official training.” One of the painters stated their entire painting training consisted of “here’s how you mix the paint, here’s the spray gun, there’s the part, go paint it.”

The Laser Touch model LT-B512 performs the best with spray technicians who have some idea of proper spray technique. The optimum performance of the spray gun and Laser Touch model LT-B512 will be found consistently with spray technicians who understand the importance of proper spray gun setup, the correct wet mil build, 50% overlap, spray gun targeting, spray gun orientation to the part, and the importance of minimizing the spray gun’s lead and lag. The importance of understanding how to use the spray gun and Laser Touch model LT-B512 to maximize TE cannot be overemphasized.

Targeting

Several companies are observing TE improvements superior to those documented in the report due to the targeting feature of the Laser Touch model LT-B512. Verification procedures did not allow the spray technician to change the size of the spray pattern in the pre-and post-test. Companies have found that the size of the spray pattern can be adjusted to fit the part, greatly reducing overspray and material usage.

ETV CCEP Program

Laser Touch model LT-B512 and Technologies would like to acknowledge EPA's dedication in improving the environment, by researching new and advanced technologies through programs such as the ETV CCEP. In addition, LT&T would like to thank CTC for their participation in the ETV CCEP and maintaining the integrity of the test results. LT&T would also like to extend its gratitude to the IWRC for their donation of the proper facility for the ETV CCEP testing, as well as their expert staff support for completing the ETV CCEP test in a well-controlled environment.

LT&T agree that the ETV CCEP test reflects the positive numbers a manufacturer will benefit from even in a worst case scenario. Actual results, when the Laser Touch model LT-B512 is introduced to an existing system, have seen dramatic improvements, not only in the reduction of HAPs, but also in the improvement of finish quality and material costs.

Section 7
References

1. Bridge to a Sustainable Future: National Environmental Technology Strategy, U.S. Department of Energy, National Science and Technology Council, 1995.

2. Curran, T., et al., National Air Quality and Emissions Trends Report, 1990, EPA-450/4-91-023, NTIS PB92-141555, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, November 1991.

3. Clean Air Act Amendments of 1990, Title III - Hazardous Air Pollutants, November 15, 1990.

4. Clean Air Act Amendments of 1990, Title I - Attainment/Maintenance of National Ambient Air Quality Standards (NAAQS), November 15, 1990.

5. American Society for Testing and Materials (ASTM), E1251 - Standard Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Argon Atmosphere, Point-to-Plate, Unipolar Self-Initiating Capacitor Discharge, Philadelphia, PA, 1994.

6. American Society for Testing and Materials (ASTM), B557 - Standard Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products, Philadelphia, PA, 1994.