

Have Paint Gun Will Travel

Marine Corps Innovates With Laser Gun Paint Spray Technology

WHEN THE U.S. military introduced Chemical Agent Resistant Coating (CARC) in the 1980s, it was to counter the Soviet threat of chemical agents on the battlefield. The Soviet Union's goal was to inflict maximum casualties while temporarily contaminating an area. To counter this, the U. S. needed the ability to rapidly decontaminate personnel and their equipment. Thus, CARC paint was engineered to prevent chemical impregnation and to aid in the rapid decontamination of equipment.

CARC, a polyurethane paint, is used today on all Marine Corps' combat, combat support and combat service

CARC during spray painting leads to immediate respiratory irritation and watery eyes. Long-term exposure can cause or aggravate respiratory problems, in particular, asthma.

For these reasons, the Marine Corps was motivated to seek an environmentally friendly and efficient application system that would ensure highest quality; one that could be efficiently managed and maintained while keeping the equipment at the peak of mission readiness.

Meeting this challenge, the Defense Logistics Agency (DLA) Office of Operations Research and Resource Analysis (DORRA) funded develop-

improving the efficiency of spray painting throughout the government.

The Marine Corps Depot with Maintenance Centers in Albany, Georgia and Barstow, California has quickly capitalized on the STAR4D technique and provides extensive training for their civilian Marines in this refinishing technique.

The Marine Corps depot community, driven not only by a need to improve the Marines' war fighting lethality and survivability, but also as a conservator of the public's financial trust, quickly realized the need to move the program beyond the perimeter fences of their depots.

DoD's goal is to reduce cost and air pollution by improving the efficiency of spray painting throughout the government.

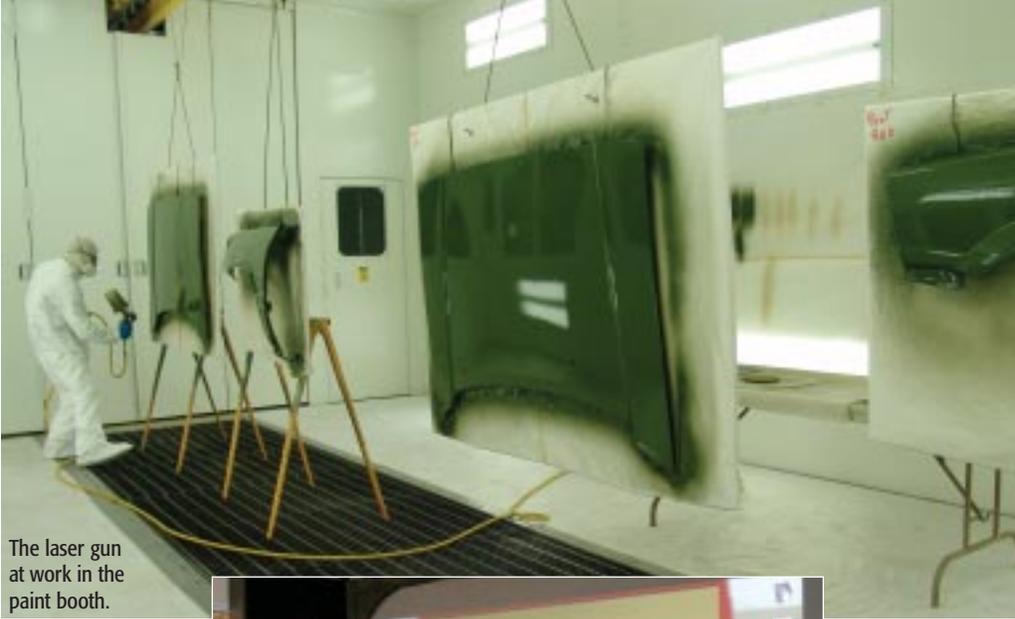
support equipment. In addition to its chemical-resistant properties, it is also extremely durable. At the same time, however, CARC is environmentally hazardous and expensive. The Marine Corps takes extraordinary steps to protect its painters from the hazards of CARC by requiring them to wear full personal protective equipment. Without this gear, the exposure to high concentrations of aerosolized

ment of the Spray Technique and Analysis and Research for Defense (STAR4D) Program at the University of Northern Iowa (UNI). STAR4D provides military coating applicators with individual, hands-on training that focuses on developing proper techniques to improve transfer efficiency and reduce overspray and waste. The Department of Defense's goal is to reduce cost and air pollution by

The Corps solution was to develop a mobile laser gun training program to take the new refinishing technique to the Fleet Marine Forces. Consisting of a laser gun, laptop computer and screen with metric displays, the programs will provide immediate feedback to the student.

New rules are anticipated in the near future from the U.S. Environmental

Protection Agency (EPA). These rules will significantly impact the Marine Corps depots, requiring retraining and recertification of all painters. These new standards will apply to proper spray application, setup and maintenance of spray equipment and maintenance records of spray painter training and reporting. The rules also require that new painters be trained and certified no later than 60 days after hiring or six months after the final rule is published, whichever is later. The EPA also states that all painters must be recertified every five years.



The laser gun at work in the paint booth.

Painter Training

The depot laser painter training is a three-day course. The two-day classroom portion covers all of the basic information about coatings, spray guns, techniques and other topics. In-the-booth painting is conducted all three days, utilizing the Corps' new LaserPaint™ technology. As the name implies, the LaserPaint™ spray gun attachment utilizes a laser to maintain a consistent distance, which allows for proper overlap and control.

The mobile training will follow the basic structure but instead of the paint booth they will use a virtual paint exercise called VirtualPaint™, using the screen, laptop and laser gun. VirtualPaint™ is a training simulator providing painters with real world application, without the real world preparation, cleaning or material usage. VirtualPaint™ allows for immediate feedback on spray techniques that painters can analyze to use when they step into the booth.

With proper training, painters are able to reduce the amount of harmful Volatile Organic Compounds (VOC) being released into the environment and the amount of paint wasted during application. Being able to correctly apply coating also reduces the time and effort of completing rework and improves corrosion protection.

Supporting this new process is a new "Coatings Technician Certification" manual. This manual represents the first Marine Corps publication addressing paint application.

The procedure for spray painting at Marine facilities involves the use of an industrial size paint booth to protect the surrounding area, and built-in fans and filters to protect the painter. The painter uses an air pressure atomized paint gun to apply the coating.



The mobile training program features a computer program called VirtualPaint™.

This type of spray painting has always involved a significant amount of waste from overspray. Some of the causes of overspray include:

- Triggering the paint gun when no part is present,
- Improper head-to-target distances,
- Incorrect angles of application, and
- Turbulent air flow conditions within the booth.

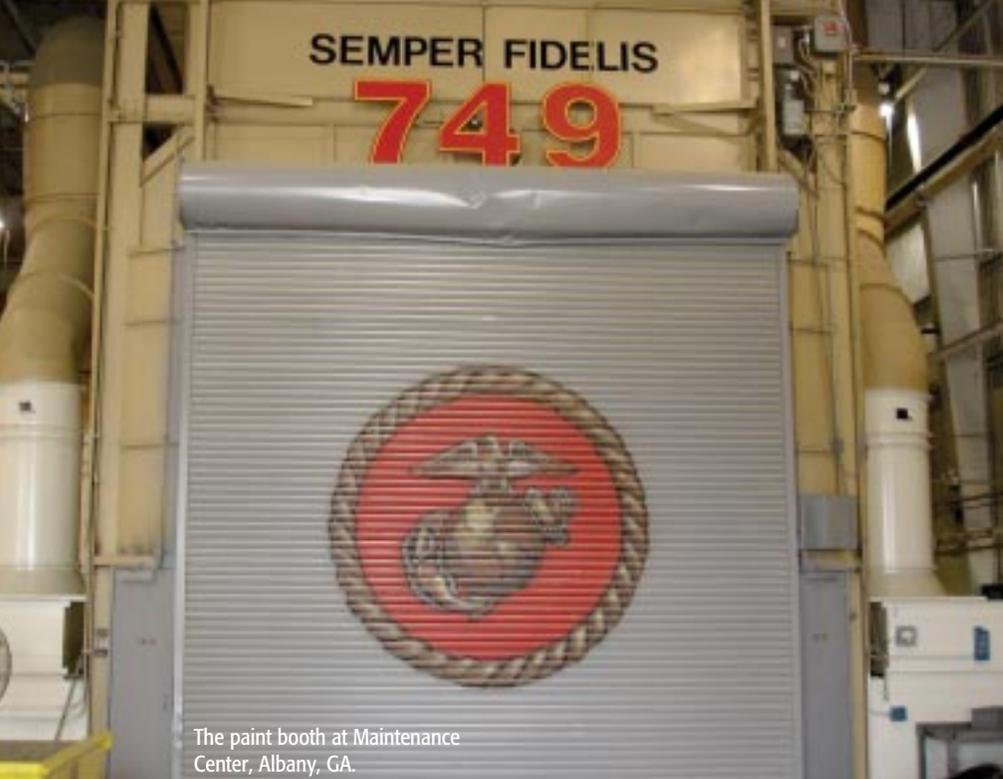
Excessive atomization is another prevalent cause of overspray. Often, spray guns have their atomizing and pattern air volumes so high that they are more efficient at fogging than painting.

Overspray not only causes material waste, it also increases filter loading and sludge, requiring more frequent filter changes and higher volumes of sludge disposal. Filter



The laser paint gun utilizes a laser to maintain a consistent distance and more even application.

University of Northern Iowa



The paint booth at Maintenance Center, Albany, GA.

loading, in particular, is troublesome because not only does it create imbalances in the flow of air through the booth, it also reduces the level of air flow, which can create significantly higher concentrations of booth vapors, airborne particulate and contamination.

In addition, paint overspray that settles onto painted parts can seriously degrade the quality of the finished product and ultimately result in increased material costs and reduced productivity.

With the STAR4D technology, the atomized paint particles are delivered at low speeds to the object being painted, so less paint is lost as overspray, bounce and blow back.

How Efficient is STAR4D?

Transfer efficiency (TE) refers to the ratio of sprayed paint that actually lands on the targeted part or component. This number is widely used in calculations involving paint application economics. The TE levels for air pressure atomized spray painting have always been relatively low, with around 15 to 30 percent of the paint actually hitting the target.

The laser training evolution undertaken by the Marine Corps has demonstrated a better than 30 percent improvement in transfer efficiency at their depots, with TE rates greater than 60. A comparable transfer efficiency is expected with the mobile painter training.

Taking a closer look at TE, a gallon of paint will have about four pounds of VOC emissions. At about \$30 a gallon, a 55-gallon drum costs about \$1,650 with 220 pounds of VOCs. With a TE of 70 percent, you will have an overspray of 30 percent at a cost of \$495 and 66 pounds of VOC emissions emitted into the environment.

From an environmental perspective, excessive paint waste correlates to higher VOC emissions and waste generation rates. The fact that finishes are often unacceptable means re-application may be necessary, which only compounds the VOC emissions. This imposes a greater regulatory burden with respect to air permitting, hazardous waste management and environmental reporting.

The Office of the Secretary of Defense and DORRA have a vested interest in

the Marine Corps' STAR4D technology due to the anticipated EPA final rule for 40 Code of Federal Regulations Part 63 that addresses management practices and equipment standards for new and existing finishing operations:

- Subpart HHHHHH—National Emission Standards for Hazardous Air Pollutants: Paint Stripping and Miscellaneous Surface Coating Operations at Area Sources
- Subpart XXXXXX—National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Nine Metal Fabrication and Finishing Source Categories

When these rules are in place, the Marine Corps must be in compliance by 10 January 2011. These rules—often called Maximum Available Control Technology (MACT) standards—require that all painters be certified through hands-on and classroom training before they are permitted to apply surface coatings to parts. In addition, the rules directly impact the Defense Land Systems and Miscellaneous Equipment (DLSME), which encompasses any materiel, equipment and components used by all the Armed Forces of the United States. DLSME includes the Marine Corps inventory of combat vehicles, tactical vehicles, military personnel items, weapons, armament and engineering, communications, base camp, ground support and launch support equipment. ⚓

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