DCM Clean-Air Goes in Space

Space Shuttle door requires composite repair

RE-ENTRY temperatures up to 430°C on the 29 October 1998, the last flight of the Discovery Space Shuttle, caused burn-through on the orbital manoeuvering system (OMS) pod door. The door is constructed of carbon fibre/epoxy skins over aramid core and required a two layer doubler to repair.

A small burn-through area on a carbon fibre/epoxy door requires sanding to complete repair on the US Space Shuttle. (Source: FlightSafety.)

According to Bill Wendorff, materials and process engineer for United Space Alliance, prime contractor to NASA for the Space Shuttle Programme, the damaged area is about 7.6 cm by 150 cm at the transitional area between the core and solid laminate. The door itself is 97 cm wide by 183 cm long. Wendorff states that the door bears load and so is considered a structural component; he adds that repairs to the composite shuttle components have been relatively rare. United Space Alliance has more expertise in repair of the metal components onboard the shuttle fleet, and is working with Fred Banke of FlightSafety, a Florida based composite repair depot and international trainer in composite repair design and methodology, to complete the repair.

The repair required precision sanding of five plies of carbon fibre/epoxy, at 0.15 mm per ply, says Banke. The company used a sander with integral dust capture shroud, patented disc/holder design, and HEPA-filtered vacuum system from DCM Clear Air Products of Texas, USA. "Sanding carbon fibre creates a fine dust that floats in the air and can corrode surrounding aluminium components or become conductive if it gets into avionics," says Banke. "The DCM equipment eliminated that problem and worked better than hand sanding."

Wendorff explains that a two-layered doubler is being designed and fabricated by The Boeing Co, California, USA, to finish the repair.

A five-ply insert will fit into the sanded area, and another five-ply doubler will be adhesively bonded with epoxy film adhesive over the insert, adding a 5 cm margin beyond the rectangular insert to complement adhesion. Final cure of the repair area will be accomplished at 120-135°C under 1 bar vacuum.

Banke drew upon his expertise in composite aircraft repair to map the area of internal damage using a Barcol hardness meter and coin tap test. "Transition areas in composite parts may see damage because there are changes in general thickness between core and laminate, as well as shape differences such as tapered core next to solid laminate," says Banke.

Corvette adds SMC in new model

THE INTRODUCTION of the 1999 Corvette hardtop by General Motor's Chevrolet Division adds the third model in a range of Corvettes that are part of the fifth-generation design.

Though the latest model preserves the classic Corvette body styling achieved primarily through sheet molding compound (SMC) body panels, the hardtop actually features an additional 15 kg of SMC in the roof compared to the convertible.

Composites account for approximately 17% of the hardtop's weight of 1480 kg. Styling and performance enhancements debuted in 1997 with the two seater coupe followed in 1998 by the convertible.

The hardtop represents the first fixed-roof Corvette since the legendary second generation of Sting Rays 1963-1967. Flexible low-density SMC, introduced in the 1997 coupe's rear quarter fenders and door outer panels, resists impact and offers a Class A surface finish. This continues in the hardtop, including skins over balsa core in the vehicle floor pan.

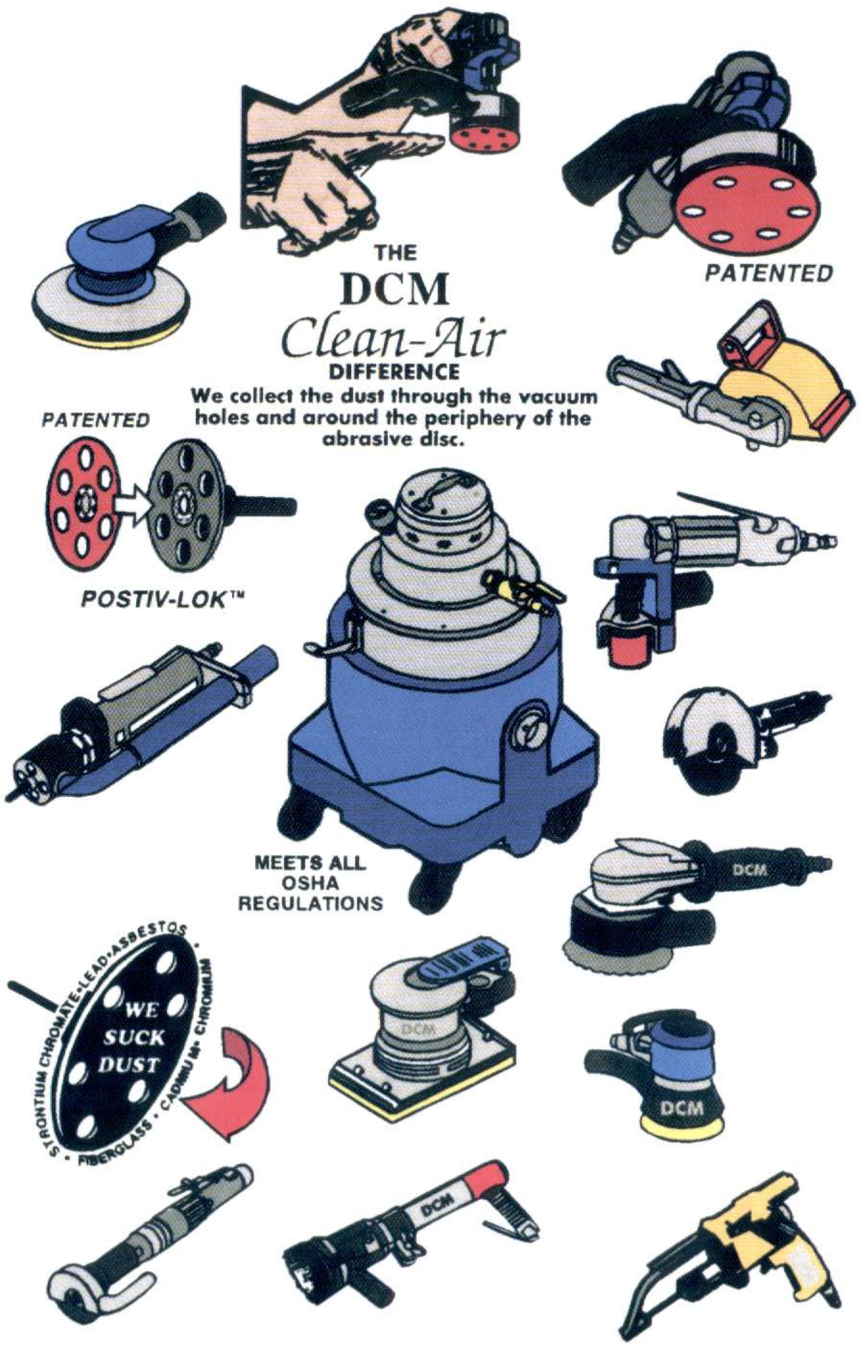
The fifth-generation range of Corvette sports cars use SMC.

The total amount of low-density SMC (specific gravity of 1.3) has been increased, notably in the roof inner panel; all the inner panel skins are now reported in this material, with the outer panels thinned to 2.25 mm.

The coupe also featured front and rear bumper fascia reaction-injection moulded with wollastonite-filled polyurethane/polyurea; again this is also on the hardtop. Chevrolet reports that the SMC in all three C-5 Corvettes offers excellent stiffness and weight ratio and dimensional stability.

DCM Clean-Air Products

MEETS ALL OSHA REGULATIONS



THE COMPANY WE KEEP:

AASI Aircraft
ACF Industries
Aerojet Ordinance
Aerostructures Corporation
Aker Plastics
Air Canada
Alliant Tech-Systems
American Airlines
Arizona Public Services
Auto-Air Composites
Avondale Shipyards

Bell Helicopter Company
BFGoodrich/Tolo Division
Bombardier
Boeing Corporation
Boeing Helicopter
Burlington Northern/Santa Fe

C&D Aerospace
Cade Composites
Canada Air
Central Louisiana Electric
Chrysler Technologies
Cobalt Boats
Composite Structure
Con Edison
Consumers Power
Corrosion Engineering Servs.

Dee Howard Company
Delta Airlines
Department of Defense
Dietzel Aerospace
Dow U.T. Composite
Duracell, Inc.
Dyncorp

EBC Gulf Coast, LLC
EG&G Florida, Inc.
Engineered Fabrics Corp.
Exide Corporation

Federal Express Corp.
FM Industries, Inc.
Foam Matrix
Ford Motor Co
Foretravel, Inc.

General Dynamics Corp.
General Electric Company
General Motors
GSA
Groen Corporation
Gulfstream Aircraft, Inc.

Hess Oil Company
Houston Power & Light
Howmet Corporation
Hughes Missile Systems
Huntsman Corporation

IBM
Inland Fisher Guide Corp.

Kenworth Truck Company
Kerr McGee Coal Corp.

Laborers ACG
Lawrence Livermore Labs
Liberty Mutual Ins Co
Lockheed Martin
Lucas Aerospace Cargo

Martin Marietta Corp.
McDonnell Douglas Corp.
MEMC Electronic Materials
Michelin Tire
Mitsubishi Caterpillar
MTS Mass Transfer Systems

NASA
National Steel Shipbuilding
Niagara Mohawk Power
North Americn Coach
Northrop Grumman
Northeast Utilities System
Northern States Power Co.
Northwest Airlines

OH&S Canada
OMC Fishing Boat Group
Optical Coatings
OSHA
Oxford Fedl Correction Inst.

Pacific Gas & Electric Co.

Peterbilt Corporation
Phillips Chemical
Polaroid Corporation
Pratt & Whitney
Primex Technologies
Prism Contracting Inc.
Protherm Services
Public Service Electric/Gas

R. Cubed Composites
Ratheon/E-Systems
Redwood Painting Corp.
Reynolds Metal Company
Rockwell Corporation
Rolls Royce

Safety Master Corporation
SAIC
Schweizer Aircraft Corp.
Sikorsky Aircraft Corp.
Southern Insulation
Spectra Physics Corp.
Sperry-Sun Drilling Srvcs.

Tarrant County Jr. College
Texas Dept. of Transportation
Thermal Insulation
Toledo Edison
Toyota Motor Manufacturing
Trinity Industries
Trinity Marine Group
TRW
TSL Aerospace Technologies
TU Electric

Union Carbide Corporation
Union Pacific Railraod
Union Tank Car Compay
United Airlines
UPS
U.S. Air Force
U.S. Army
U.S. Coast Guard
U.S. Marine Corps
U.S. Navy
U.S. National Guard
U.S.P.F.O.

DCM *Clean-Air*™ Products, Inc.

9605 Camp Bowie West, Fort Worth, Texas 76116. (800) 624-4518, (817) 696-0044, Fax (817) 451-0615