A World Class leader in Aerospace Composites

2003
Capacity and Capability

NORTHWEST COMPOSITES

2003
C&D Aerospace is a privately held company founded in 1972 by James E. Downey supplying aircraft interior products for 31 years to airframe manufacturers and the world’s airlines.

NWC’s Relationship with C&D: Common ownership (Partners). NWC is non-dependant on C&D, but both companies utilize resources from one another as needed.
All growth has been achieved through retained earnings – *no acquisitions.*

Sales Growth

1999 = 150 M
2000 = 400 M
2001 = 450 M
2002 = 350 M

The C&D family encompasses 16 facilities with over 2500 employees throughout Southern California, Seattle, Europe, Mexico, South America & Canada.

2003
Overview
NWC Overview

• Established 1987
• Expand the successful composite technology gained through the supply of interiors into more advanced composite components.
• Privately Held Company
  Non-Union
NWC Overview

- 100% Aerospace
- 235,000 Square Feet of Manufacturing
- 2004 - $60 M Projected Sales
  - 2003 - $59 M Annual Sales
  - 2002 - $69 M Annual Sales
  - 2001 - $76 M Annual Sales

![Sales Chart]

2003
NWC Overview

• 2004 – 430 Employees
  – 2003 - 410 Employees
  – 2002 - 380 Employees
  – 2001 - 510 Employees

• Large Growth Potential
  – Less than 50% Unutilized Capacity
Customer Make Up

- The Boeing Company
  - Everett, Renton, Wichita, Philadelphia, Winnipeg, and St. Louis
- Northrop Grumman
- BAE Systems
- Goodrich Landing Gear
- American Airlines
Customer Make Up

- Delta Airlines
- Bombardier
  - DeHavilland
  - Canadair
- Northwest Airlines
- Embraer
- Gulfstream

2003
Customer Make Up

- Alenia Aeronautica
- Heroux- Dev Tek
- Vought
Major Programs
Autoclaves

2003
C-17 Main Landing Gear Pods & Strut Doors
83 End Item Panels with Hardware
Major Autoclave Programs
757 Fixed Leading Edge & Trailing Edge

86 End Item Composite Panels with Assembly

2003
Major Autoclave Programs
MD 80/MD 90

MD 80, MD 90 WTBF & Metal Formers
Major Autoclave Programs
737 Components

Landing Gear Doors
Air Conditioning Doors
Under Wing Panels
Dorsal Fin

2003
Major Autoclave Programs
JSF X-35 / 757 APU Inlet Ducts

Joint Strike Fighter X-35
757 APU Inlet Ducts
BAE SYSTEMS
777 Track Fairing Assemblies

48 End Item Compression Molded Assemblies

2003
Major Programs
Interiors

• 767 NLI – New Look Interior
Major Interior Programs
767 NLI

Full Interior
- Outboard Stowbins
- Inboard Stowbins
- Sidewalls
- Ceiling Panels
- Air Grilles
- Doorway Linings
- PSU’s
- Main Cabin Lighting

NWC: Design/Certify/Build
Major Interior Programs
American Airlines Bin Extension Kit

Retrofitted Entire Narrow Bodied Fleet
260 - MD 80
130 - 757
Major Interior Programs
Embraer 170/190

Design/Certify/Build

Full Up Interior
and
Integrated Systems

2003
NWC Responsible For:
Cockpit Doors, Galleys, Closets, Lavatories, Bins, Sidewalls, Door Surrounds, Air grilles, Ceiling Panels, PSU’s, Insulation, Baggage Lining, Restrain Nets, Wire Harness and Lighting

Systems Management:
Smoke Detection/Fire Suppression, Water & Waste, Escape Slides
Major Interior Programs
777 Flight Deck & Door Liners

2003
NWC Start Up Program – January 2002

Full Interior

Ceilings

Sidewalls

Dado Panels

Side Ledge

Window Reveals

Cargo Compartment Panels

NWC : Design/Certify/Build
Major Programs
Fortified Ballistic Cockpit Doors

- Bullet Proof SAF Panel Design
- Bullet Proof Viewer
- Fortified Hinge
- Access Request Panel
- Bullet Proof High Strength Latch
- FAA Compliant Blowout Panels with Pressure Sensitive Latching Mechanism
- Fortified Door Post with Striker and Solenoid
Capability and Capacity

Pre Preg Kit Cutting

(1) 35’ x 72” American GFM
(2) 35’ x 72” Cutting Edge
Capability and Capacity

Hand Lay Up

2003
Capability and Capacity

Autoclaves (Inside Dimensions)

(1) ea 12’ x 45’ 700 degrees, 250 PSI
(3) ea 10’ x 20’ 680 degrees, 220 PSI
(1) ea 6’ x 15’ 550 degrees, 190 PSI
(1) ea 2’ x 4’ 550 degrees, 190 PSI
Capability and Capacity

Oven Cure

(4) ea 550 degree Ovens 9’W x 8’3”H x 20’D
Crushed Core / Compression Molding

(2) 250 T Wabash Press (28”x30” Platten, 24” DL, 24” Stroke)
(1) 400 T W/W Press (36”x38” Platten, 32” DL, 24” Stroke)
(3) 400 T Wabash Press (48”x72” Platten, 60” DL, 24” Stroke)
(1) 700 T Baldwin Press (70”x106” Platten, 72” DL, 36” Stroke)
(1) 720 T W/W Press (65”x144” Platten, 72” DL, 36” Stroke)
(1) 750 T W/W Press (63”x99” Platten, 72” DL, 36” Stroke)
(1) 300 T Burkle MOP Press (52”x99” Platten, (2) 6” DL)
NDT (Non Destructive Testing)

(1) ea Multi-Axis C-Scan 118” x 58”
(1) ea 2 Axis C-Scan 107” x 63”
(1) ea A-Scan
(1) ea Pulse Echo
CNC Routing

(4) ea 3 Axis Thermwoods 65” x 144” x 12”
(4) ea 5 Axis Thermwoods 65” x 120” x 36”
Capability and Capacity

CNC Machining Center
(1) ea 5 Axis Rambaudi Ramspeed H Mill
177” x 106” x 49” Travel
• (1) Mori Seiki Horizontal CNC Mill
• (2) 3 Axis Cincinnati-Arrow 1500 CNC Mills
• (2) 3 Axis Bridgeport-ZXT CNC Mills
• (1) Bridgeport-EZPATH CNC Lathe
• (1) Strippit 1000XP/20 – 20 Ton/20 Station CNC Turrit Punch
• (1) Diacro 150-10 Hydraulic Press Break – 120” long
• (1) Cincinnati Milacron 1200 Hydraulic Press Break – 60” long
Northwest Composites vast tooling experience and expertise is an invaluable component of our overall capabilities. NWC’s tooling capabilities range from simple templates to BMI composite tooling & complex jig & fixtures.
NWC Tooling Capabilities

- Master Models
- High Temp Lay Up Molds
- Vacuum Form Molds
- Matched Metal Dies
- CNC Router Fixtures
- Check Fixtures
- Bonding & Assembly Jigs & Fixtures
- Hand Router Fixtures & Drill Jigs
- Templates
• All Tooling Designed and Fabricated In House
• Tool Designs Created in CATIA
• 10 Pattern Makers on Staff
  – All Pattern Makers Rated for Soft Tooling, Hard Tooling and Jig & Fixture Fabrication
  – Average of 18 years experience in high temp epoxy and graphite tool fabrication
  – Theodolite and Laser Tracker Capabilities
Strong Commitment to Research and Development of new composite materials and processes

5000 Square Feet dedicated R&D area

Specializing in
- VARTM (Vacuum Assisted Resin Transfer Molding)
Research & Development
New Materials and Processes

- Raw Material Value Chain
  - Prepregs are expensive
• Current size of parts is limited by industry autoclave size (Larger parts equal less configurations)
• Industry is calling for larger parts

Numerous parts become one
Requires less fasteners
Less Weight
Less Processing
Less Drop Off
• Future programs – Exploring less expensive materials and processing which has been driven by competition (Airbus / Boeing)
• VARTM – Vacuum Assisted Resin Transfer Molding
  – Utilizing typical lay up mold (High-temp materials not req’d)
  – Place dry fabric on lay up mold with ply orientation
  – Premixed resins are drawn across dry fabric utilizing vacuum pressure
  – Oven or room temperature cure
Research & Development
747 Bull Nose Assembly

747 Bullnose - Existing Metallic Design
Research & Development
747 Bull Nose Assembly (VARTM)

Infusion Process

2003
Research & Development
747 Bull Nose Assembly (VARTM)

747 Bullnose
VARTM Composite Design

2003
### 747 Nose Gear Bullnose Summary

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Metallic (Existing)</th>
<th>VARTM (New)</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (lbs)</td>
<td>28</td>
<td>16.35</td>
<td>41.61%</td>
</tr>
<tr>
<td>Part Count (Excluding Rivets)</td>
<td>523</td>
<td>197</td>
<td>62.33%</td>
</tr>
<tr>
<td>Part Numbers (Excluding Rivets)</td>
<td>203</td>
<td>62</td>
<td>69.46%</td>
</tr>
</tbody>
</table>
Research & Development
C-17 Main Landing Gear Pod (VARTM)

Core lay up Process
Dry Fiber lay up Process
Resin Infusion Process
Finished Product

2003
## 17P2A5093-3 Raw Material Cost Comparison

<table>
<thead>
<tr>
<th></th>
<th>Autoclave Prepregs</th>
<th>VARTM (Resin Infusion)</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollars per ft²</td>
<td>$108.70</td>
<td>$69.57</td>
<td>36%</td>
</tr>
</tbody>
</table>
Research & Development
VARTM Infusion W/ Integral Stringers

VARTM Infused Panel With Integral Stringers
VARTM Samples

C-17 Post Door - Carbon

757 Fixed Leading Edge - Glass

7E7 Integrated Bulk Head (Conceptual)

777 Horizontal Stabilizer Rib

2003
VARTM Samples

7E7 Horizontal Stabilizer
Leading Edge
(Conceptual)

7E7 Horizontal Stabilizer
Leading Edge
(Conceptual)

2003
• 62 Engineers
  – 43 Design
  – 8 Stress & Certification
  – 8 Process
  – 3 Tool Design
  – Experience averages over 12 years
• CAD Systems
  – CATIA – 46 Work Stations
    • (10) Version 5
    • (36) Version 4.2.4
  – Capability of setting up separate environments to suit our customers CATIA requirements
    • CATIA used for 3 Dimensional Models
  – AutoCAD 40 Work Stations
    • AutoCAD 2000 used for 2 Dimensional Details
Stress Engineering

- FEMAP and Nastran
  - FEMAP for Pre and Post Processor
  - Nastran as the Solver
- All Stress Engineers have Experience within Primary and Secondary Aircraft Structures
- Generation of FAA Approved Material Allowables
  - Sandwich Panels, Laminates, Inserts, Joint Testing, In Plane Shears, etc.
Certification

- Stress
  - Interface Load Testing
  - FEA Validation
  - Static Testing
  - Cycle Testing
  - Functional Testing
  - DER on site
Certification

- Flammability
  - OSU Chamber
  - Conditioning Chamber
  - Smoke Density & Toxicity
  - Vertical/Horizonal/45° Burn
Summary

- Northwest Composites is an industry leader in aircraft composites manufacturing
- Structural composites to full interiors
- High quality standards
- Excellent on time delivery performance
- Engineering design and certification capabilities
- Just In Time (JIT) Supplier
- Cost Competitive
Jerry Goodwin  
Northwest Composites  
General Manager  
(360) 653-2211  
jgoodwin@nwcomposites.com

Jason Scharf  
Northwest Composites  
R&D Manager  
(360) 653-2211  
scharf@nwcomposites.com

Cage Code 0A8Y4