AEROSPACE PROCESS CONTROL FOR AUTOMOTIVE COMPOSITES:
Defect Prevention, Data Collection & Documentation

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Agenda

- Aerospace Ahead of Automotive Composites
- Aerospace Process Issues
- LASERGUIDE ProjectorVision in Aerospace
- Applying LASERGUIDE ProjectorVision in Automotive
- Process Control functions and Composite Part Optimization
- Conclusions
Aerospace ahead of Automotive Composites

- 20 Years
- Widespread use of high performance composites since early 1990’s
- Composite benefits
  - Low Weight
  - High Strength
Aerospace Process Issues

- Cost
- Process Uncertainty
  - Fiber Orientation
  - FOD
  - Fiber Distortions
  - Out Time
  - Debulk

Aerospace Process Control for Automotive Composites
Composites Costs

- Overdesign
  - Material
  - Weight
- Overprocess
  - Excess time for certainty
“The wing damage that grounded Boeing’s new composite 787 Dreamliner occurred under less stress than previously reported - and is more extensive… An engineer familiar with the details said the damage happened when the stress on the wings was well below the load the wings must bear to be federally certified to carry passengers.” The Seattle Times
Aerospace Fiber Orientation

- Critical for part performance
- Difficult to measure
Aerospace FOD

- Universal Problem
- Environmental Issue
- Human Factors
Aerospace Fiber Distortions

- In Plane
- Out of Plane (Wrinkles)
Other Aerospace Process Issues

- Correct Material
- Proper Debulk
- Acceptable Out-Time
Aerospace Approach to Composites Process Issues

- Laser Projector Fabrication Management System
  - LEAN Assembly
  - Defect Prevention
  - Data Collection
  - Documentation
LASERGUIDE ProjectorVision

- Optical Aiming System
- Driven by Design Data
- “Templates of Light”
- Aimed Vision
  - Calibrated
  - Analyzes Features
- Data Collection
  - Material Batch
  - Out-Time
  - Debulk Cycle

Aerospace Process Control for Automotive Composites
Fiber Orientation

- LASERGUIDE: Automatically verifying and documenting critical fiber orientations since 2002
- Many problems detected and resolved
- Recurring costs for manual inspection eliminated

Fiber Orientation Within Tolerance

Aerospace Process Control for Automotive Composites
FOD (Foreign Objects and Debris)

- Identified at the earliest possible point
- Problem location automatically identified
- Addressed at lowest possible cost
Fiber Distortion (TRL 5)

- In-Plane (Marcelling)
- Out of Plane (Wrinkles)
- Automatic identification of problem location
Data Collection and Documentation

- Barcode
- Manual Entry
- Wireless Reporting
- Single Point
- Maximum Traceability
  - Ply-by-Ply
  - Automatic
ProjectorVision in Automotive

- Stand alone system for development
- Integrated in automated systems

LASERGUIDE integrated with Aerospace Automatic Fiber Placement
Part Optimization

- Design is isolated from manufacturing
- Design is isolated from quality control
- No as-built information used in design
Aerospace Process Control for Automotive Composites
Aerospace Process Control for Automotive Composites

Virtual World
- Design
- Model: Ideal + margin for manufacturing variations
- Analysis
- Driving Optimization

Real World with ProjectorVision
- Manufacturing
  - "As built" data for model & optimization
- Quality
  - Measured quality data

Quality Results
- High information Content
- Physical Proof
- Quantitative
- Precise: Less Scrap
- Automatic: Faster

Value
- Cost

Aerospace Process Control for Automotive Composites
Conclusions

- ProjectorVision benefits for Aerospace are useful for Automotive Composites
- Applying as-built data to the design model improves part optimization
  - Reducing uncertainty in manufacturing
  - Fiber orientation measurement and verification
  - FOD prevention
  - (Future) fiber distortion detection
Thank You!  Questions?

Aerospace Process Control for Automotive Composites