## Composites Technology & Applications Overview: 
**Plus Special Automotive Technology Focus**

### Day 1

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| **Introduction**                                  | - Who are the attendees? Who is the Instructor?  
- What is SAMPE – and other organizations       |
| **Composites “Market” – What does it entail?**    | - What are the 3 major markets?  
- What does each market contain?  
- How does tooling support each market?  
- Where are the growth areas?  
- What does the future look like in each? |
| **Fiber materials across the industries**          | - What are the critical fibers today?  
- What are their properties, typical costs, where used, why used there, etc.?  
- Fiber limitations – any known?  
- What is “sizing”, “coupling agents”, and fiber “interfaces”? Why are they important? |
| **Textiles and fabrics – key material forms for manufacturing** | - What nomenclature defines these?  
- What are the various forms?  
- What is unique about each form (drape, strength, cosmetics, knockdown factor, etc.)? |
| **Resin materials – those important “glues”**      | - Thermosets vs. thermoplastics – differences  
- Temperature ranges of interest and markets?  
- Processing differences – and markets too!  
- Discussion of all the key families – properties, process methods, limits, costs, etc. |
| **Manufacturing – traditional FRP methods**        | - FRP vs. Advanced Composites – overview of differences  
- Some basic processes – contact molding, filament winding, pultrusion, chop & spray, SMC, BMC, etc.  
- Process overviews – and – applications coverage with examples |
| **Composites Test Methods**                        | - What tests are needed the most?  
- What test data do material suppliers most often provide – and why?  
- Methods for tension, compression and shear  
- Fracture mechanics tests for defects and damage assessment  
- Physical tests (DSC, Tg, fiber-resin-void content, and other important parameters) |
| **Tooling Technologies**                           | - Where are metal tools used and why?  
- While “heavier” than composites, what advantages do metal tools still have?  
- Where are composites used as tooling materials and structures?  
- What aspects need to be considered when using composite tools?  
- What other new materials are out there for “tooling” to produce composites?  
- What are their properties and what makes them unique? |
| **Manufacturing – introduction to Vacuum Bagging and Hand Layup** | - Coverage of vacuum bagging and hand layup  
- What is the process – and the variables?  
- Out-of-autoclave? Where is the fit – autoclaves? |

### DAY One – Summary, Wrap-up, Questions

### Day 2

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| **Day 2 Start-up – Questions from the students**  | - Any questions from Day 1?  
- Any topics you want clarified? |
| **Design and analysis – at least a brief review of key concepts** | - Briefly – how does micromechanics, laminate plate theory (LPT) and structural analysis all fit together?  
- What is “quasi-isotropic”, or QI, behavior?  
- What is “balance and symmetry” and why is it important? What is the “potato chip” effect?  
- Quick look at “failure criteria” and what it means for test programs to establish design allowables  
- Joints – bonded vs. bolted – what criteria to use?  
- Some overall “Best Practices” |
| **Automotive Composites Technology – Special Focus Topic** | - The resins and fiber reinforcements are different – but where are they different?  
- Resin families and types used  
- Thermosets vs. Thermoplastics  
- Other systems being developed  
- “Rapid cure” and “snap-cure” systems  
- Work on reducing “cure cycle times”  
- Fiber reinforcement forms and issues:  
- Differences from traditional “aerospace” materials  
- Fiber types, fiber lengths and forms  
- Glass- vs. Carbon-fiber materials  
- Alternative carbon fiber properties  
- Manufacturing methods ARE different:  
- HP-RTM, HP-CRTM and T-RTM  
- GMT, LFT and numerous others  
- “Over-molding”, “Surface-molding”  
- Manufacturing – Resin Infusion and Liquid Molding processes  
- This is a big area – how do the terminologies differ internationally?  
- What has changed with this technology over last 20+ years?  
- Coverage of RTM, VARTM, SCRIMP and VIP  
- Coverage of RFI and SQRTM  
- Comparison of the above methods, where they fit into the industries and markets – numerous examples … plus some variants (like TERTM, RARTM, etc.)  
- Design & analysis approaches and challenge areas  
- Sandwich and Core Technologies – making things lighter, yet stiffer in bending  
- What are “sandwich construction and structures”?  
- How are these unique to lightweighting and bending stiffness improvements?  
- What are the critical components (laminates, adhesives, core materials, etc.)?  
- Closeout and termination issues  
- Manufacturing – Automated Tape Laying, Fiber Placement and Robotics – the growth areas!  
- ATL, AFP, ATP and Robotics – what are these processes?  
- Videos of recent developments  
- Manufacturing with fiber placement – advances in technology – why this is important today |

### DAY Two – Summary, Wrap-up, Questions
AUTOMOTIVE PHOTOS

Hyundai “Intrado” Concept Car

LFT – Long Fiber Thermoplastic Structure
Thermoformed Thermoplastic Composites Panel (90 seconds)

process cycle time < 90 sec

Thermoformed CF/TP Truck Bed Liner
“Bumper-Stop” Composite Springs

Hemp Natural Fiber Composite Structures
Seat Pan Using Injection Resin Molding System

BMW Carbon Fiber RTM Structural Parts
KraussMaffei “Overmolded” Class A Finished Composite Parts

Composite Flywheel Energy Storage Systems for Engines