DOCKETED	
Docket Number:	20-EPIC-01
Project Title:	Development of the California Energy Commission Electric Program Investment Charge Investment Plans 2021-2025
TN #:	250802
Document Title:	3D Fibers Composites, Inc. Comments - Transportation Research Concepts - Attachment 2
Description:	N/A
Filer:	System
Organization:	3D Fibers Composites, Inc.
Submitter Role:	Public
Submission Date:	6/28/2023 4:23:21 PM
Docketed Date:	6/12/2023

Comment Received From: 3D Fibers Composites, Inc.
Submitted On: 6/28/2023
Docket Number: 20-EPIC-01

Transportation Research Concepts - Attachment 2

Additional submitted attachment is included below.

Mass Production for Composite Car Wheels, Car Bodies, and eVTOLs

Nathan Han, PhD

16Mar2023

Email: hahnnathan@yahoo.com

eVTOL could surpass autos in size, ushering in an era of flying for people like sitting in cars

Image courtesy of internet

Our cost-effective automated composite mass production is key to enabling mass adaption of eVTOL. It can increase production efficiency by up to 10 times, and reduce product and equipment costs by up to 80%. A two-seat eVTOL can be made at $50000.

Composite Wheel, Chassis Tub, and eVTOL

How to Mass Produce Them at Low Cost?

Image courtesy of BMW

Image courtesy of McLaren Automotive

Image courtesy of internet

No technology breakthroughs, no mass production

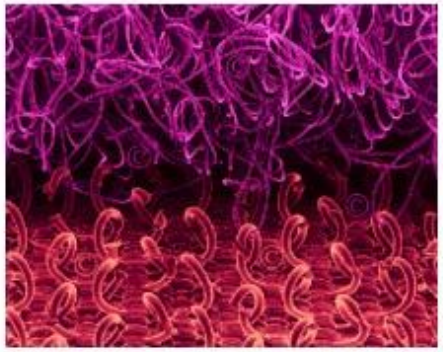
Without two major technology breakthroughs of fast curing resin and automatic layup fabrics emerged in recent years, low cost mass production can not happen in composite industry.

Parts are made: layup fabric 1 minute, curing resin 5 minutes.

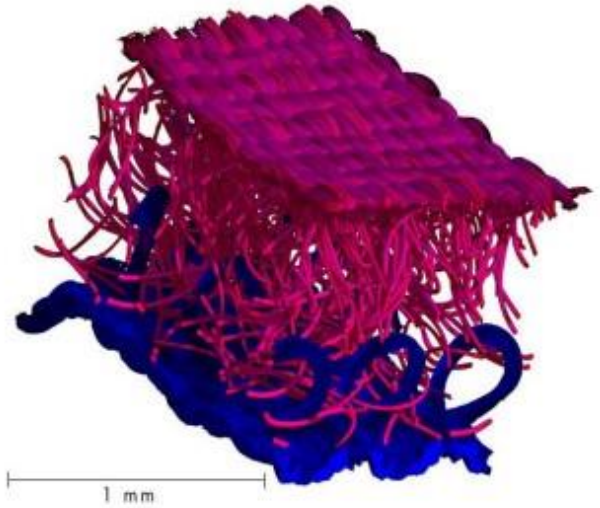
Hand Lay-up Fabrics

Hand lay-up fabric process is too slow and too expensive for a mass production.

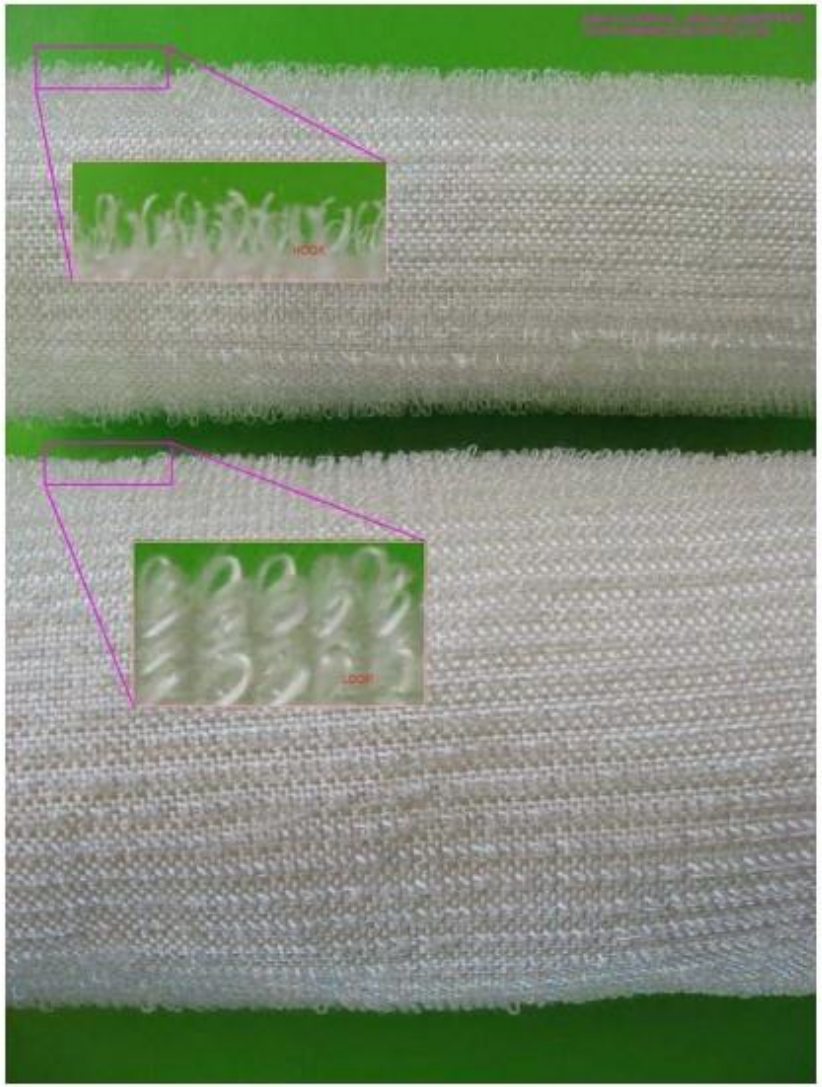
Low Cost 3D Hook-and-Loop Fabric Solution



Velcro 3D Lay Up, Low cost



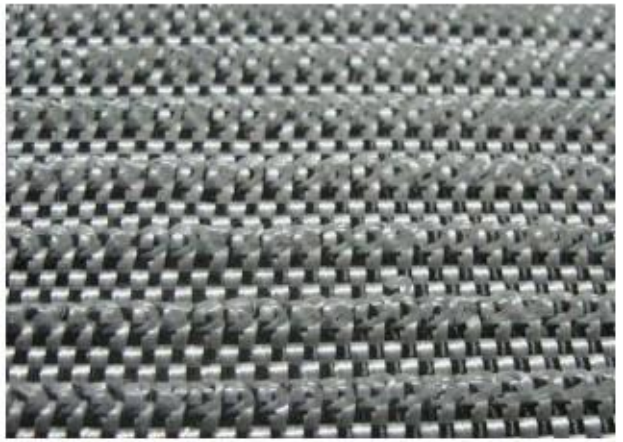
Velcro 3D Lay Up, Low cost



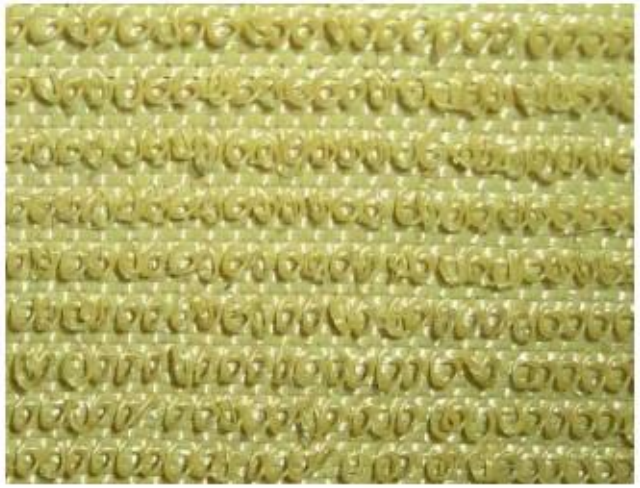
Fiberglass Han-3D-Fabrics

3D Hook-and-Loop Fabrics Named as Han-3D-Fabrics

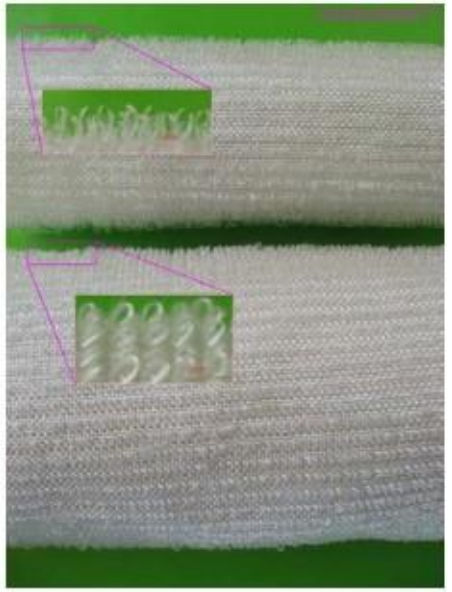
Carbon Fabrics, Aramid Loops



Carbon and Fiberglass Fabrics

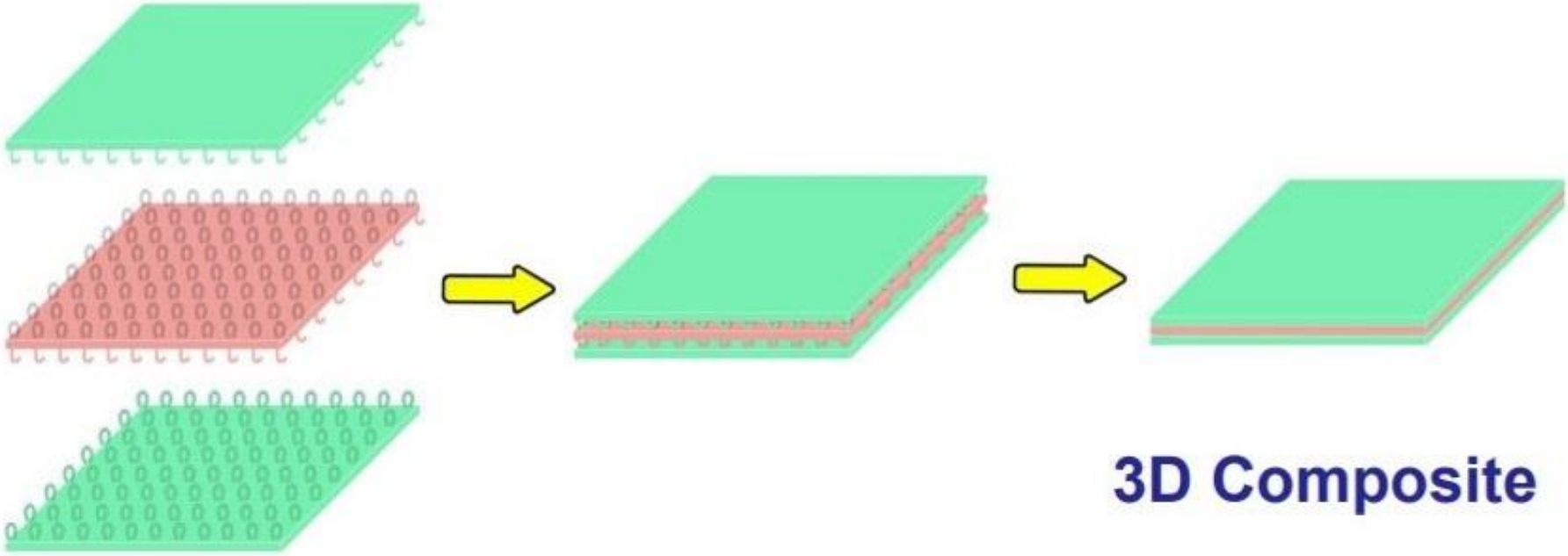


Aramid Fabrics



Fiberglass Fabrics

Hook-and-Loop Fabrics Get 3D Composites



Hook-and-Loop Fabrics

3D Composite

Increase Mechanical Properties

Tear strength
increase 50-100%

Bend strength
increase 5-10%

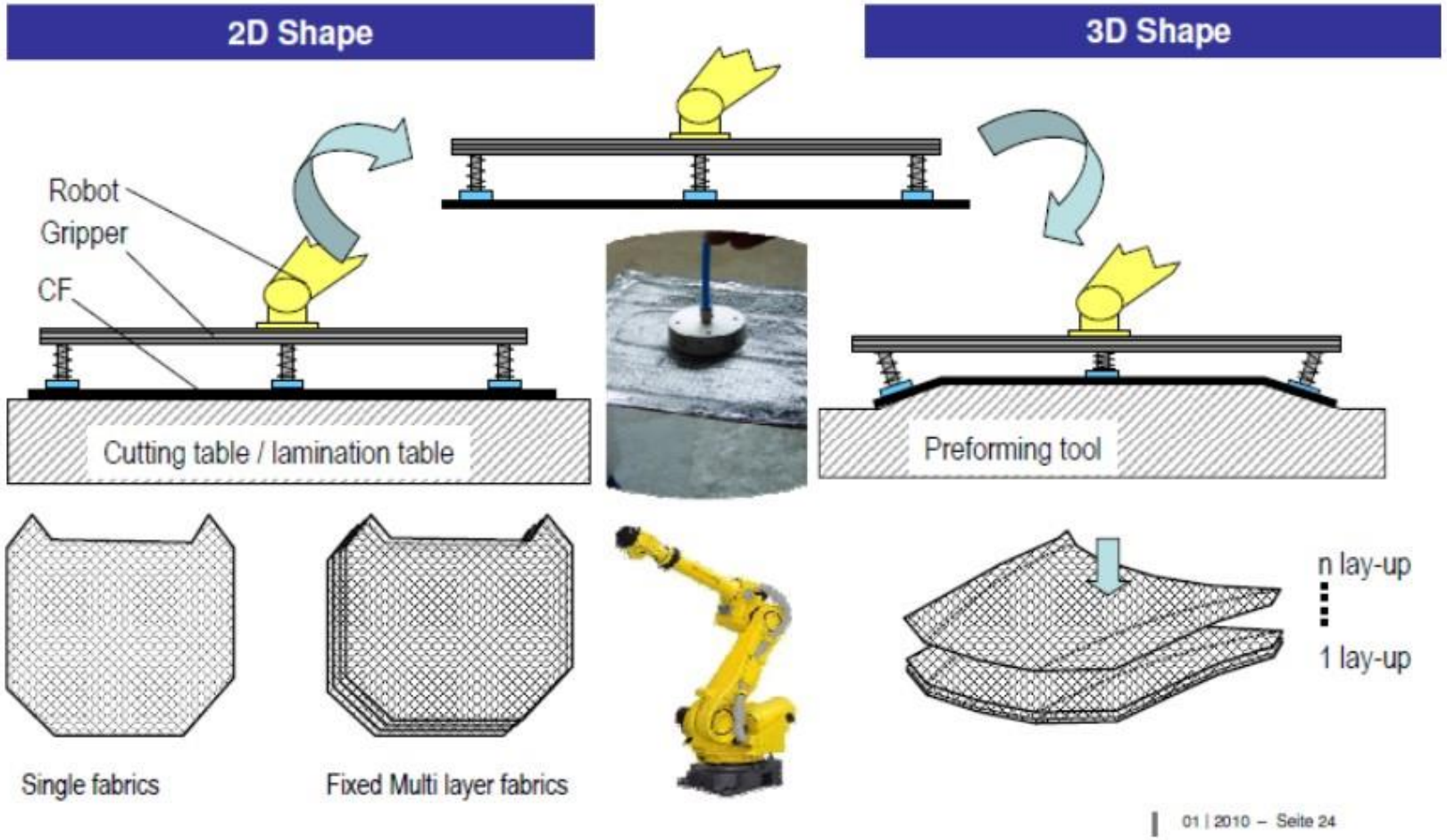
Shear strength
increase15%

Hook and loop fabric has the same
tensile strength as plain weave fabrics.

Gripping Mechanism is Critical for a Layup Robot

RTM – Preforming

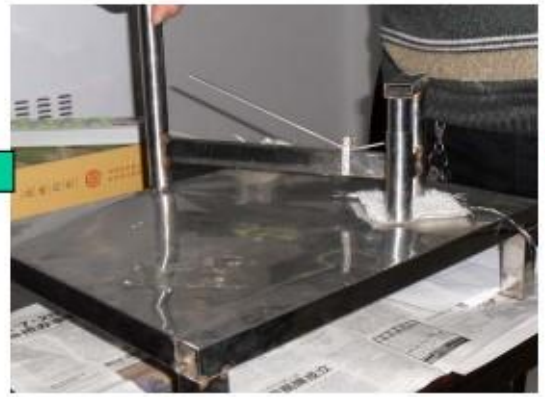
Handling



Picture cited from Dieffenbacher.
http://speautomotive.com

Han-Layup-Robot Gripper Picks up and Releases Fabrics

Pick up Fabric



Release Fabric

International Patents Pending Han-Layup-Robot Enables Automation of Laying-Up Fabrics.

Our automated fabric layup technology can reduce machine costs by 80-90%. It is 10 to 100 times more efficient compared to an ATP machine

Automated Tape Placement (ATP)
Automated Fiber Laying (AFP)

Image courtesy of internet

Our automation fabric Layup

A car wheel has a complex structure. It needs our new technologies to automatically lay up fabrics.

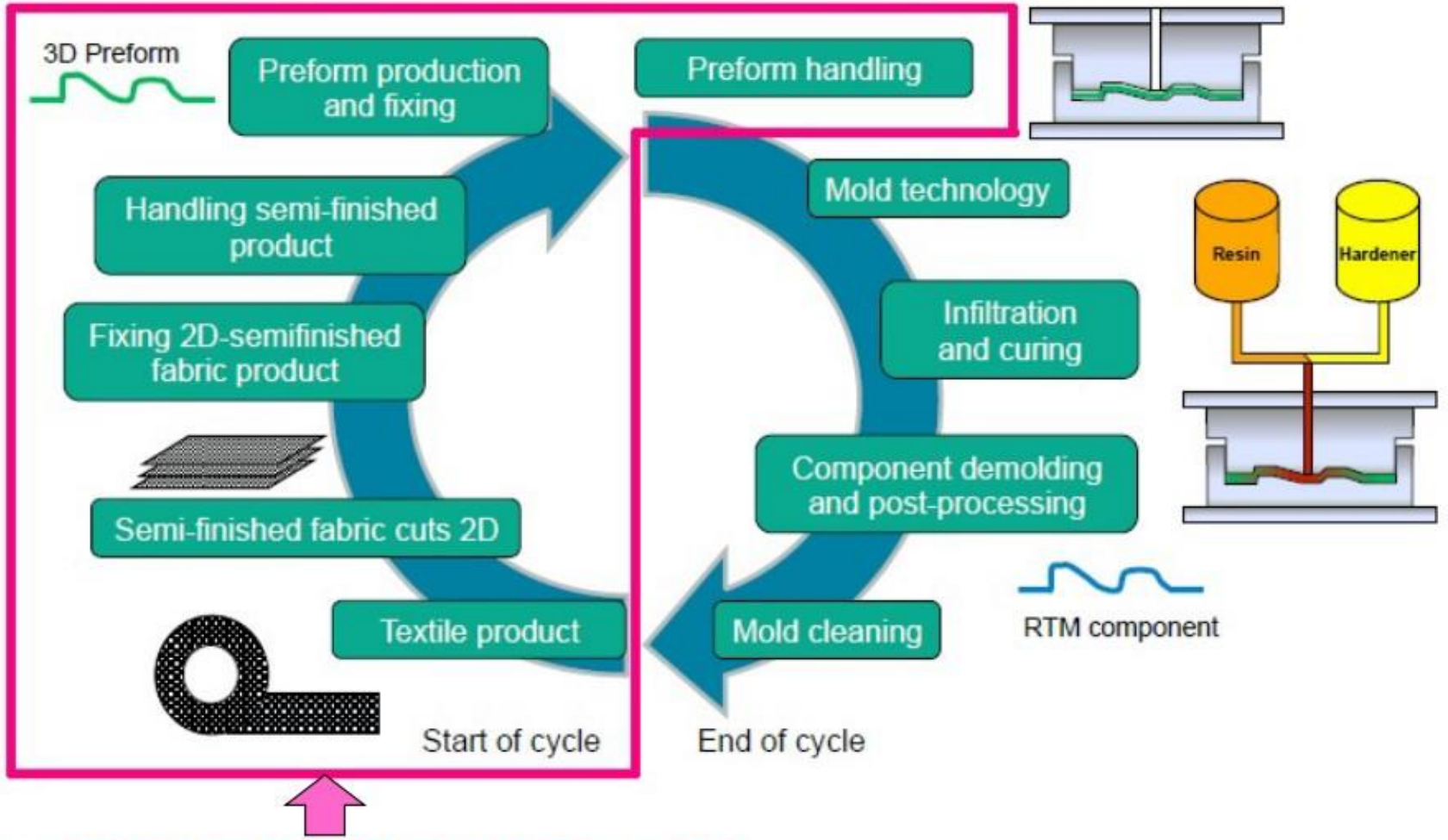
The wheel price can be reduced from $2500 to $ 500 each.

Automated Tape Placement (ATP) machines and Automated Fiber Laying (AFL) machines

They can not layup complex parts efficiently. Therefore the composite is still expensive. Now it is changed by us.

RTM Process Major Two Parts: Preforming and Curing

Resin-Transfer-Molding (RTM) – Process chain



Han-3D-Fabrics and Han-Layup Robots enable automations.

Picture cited from Dieffenbacher.
http://speautomotive.com

Mass production technologies for complicated composite structures

Mass production

Slow production

Glue panels to get a cell

Skillful automatic layup

Fast curing resin

Awkward automatic layup

Skillful automatic layup

Fast curing resin

Hand layup
Slow curing resin

Simple structure

Complicated structure

Monocoque tub needs automated low-cost mass production

Image courtesy of Mclaren

Monocoque tub can be affordable for regular family cars to protect drivers and passengers in collisions, with the potential to save 15,000 lives annually in USA.

Our technologies can automatically make monocell

One generation ahead of time

- Able to make complicated wheels and tubs, not only panels.
- Much less cost to build a mass production line.

We have the key technology to low-cost mass-produce composite bodies for F1 racing cars and BMW i3.

We aim to use this technology to help eVTOL manufacturers to build an two-seat eVTOL at a $50,000 benchmark.

Thank you

hahnnathan@yahoo.com