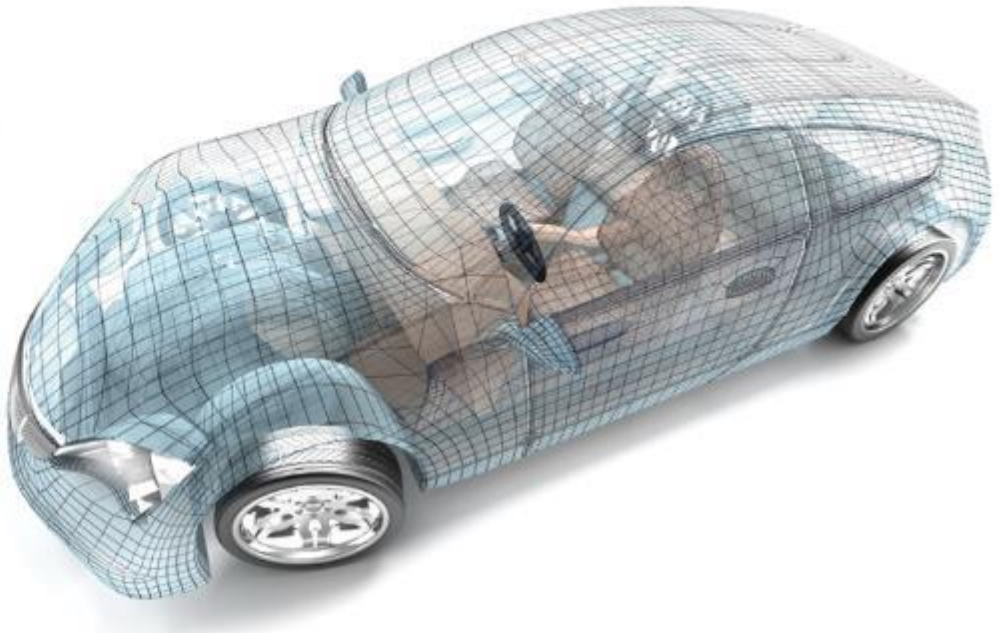
TCC 2020

THERMOPLASTIC COMPOSITES CONFERENCE

APRIL 29 – MAY 1, 2020 | SAN DIEGO, CA, USA
HYATT REGENCY LA JOLLA AT AVENTINE

AGESIA

STRUCTURAL COMPOSITE TECHNOLOGY



TRANSITION FROM THERMOSET TO THERMOPLASTIC COMPOSITES IN ROAD AND RAIL TRANSPORTATION EQUIPMENT .

Presented By: JAN VERHAEGHE
AGESIA BV BELGIUM

Scope of the presentation

Why thermoset composite structures did not succeed to replace metal structures in transportation equipment?

Barriers of commercial success.

How thermoplastic composite structures can overcome these barriers.

Basic assumptions

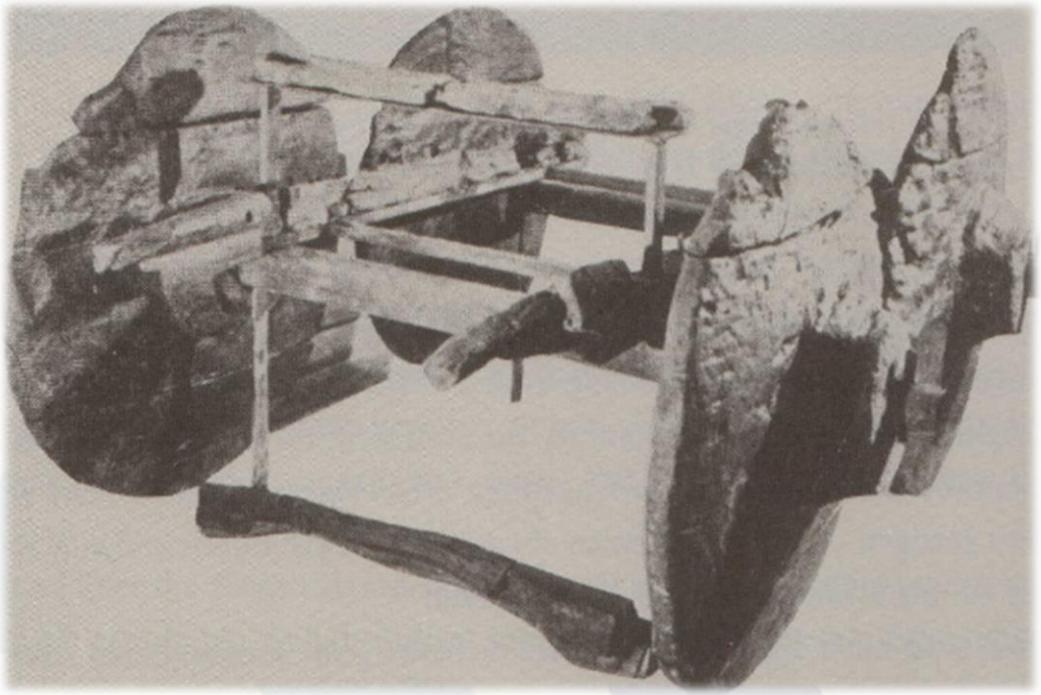
Avoid Black metal composites.

Think in commodity transportation equipment

The solution requires new materials and production technology

Reduced weight of transportation equipment becomes an argument to pay more

Think in fibres



2000 BC

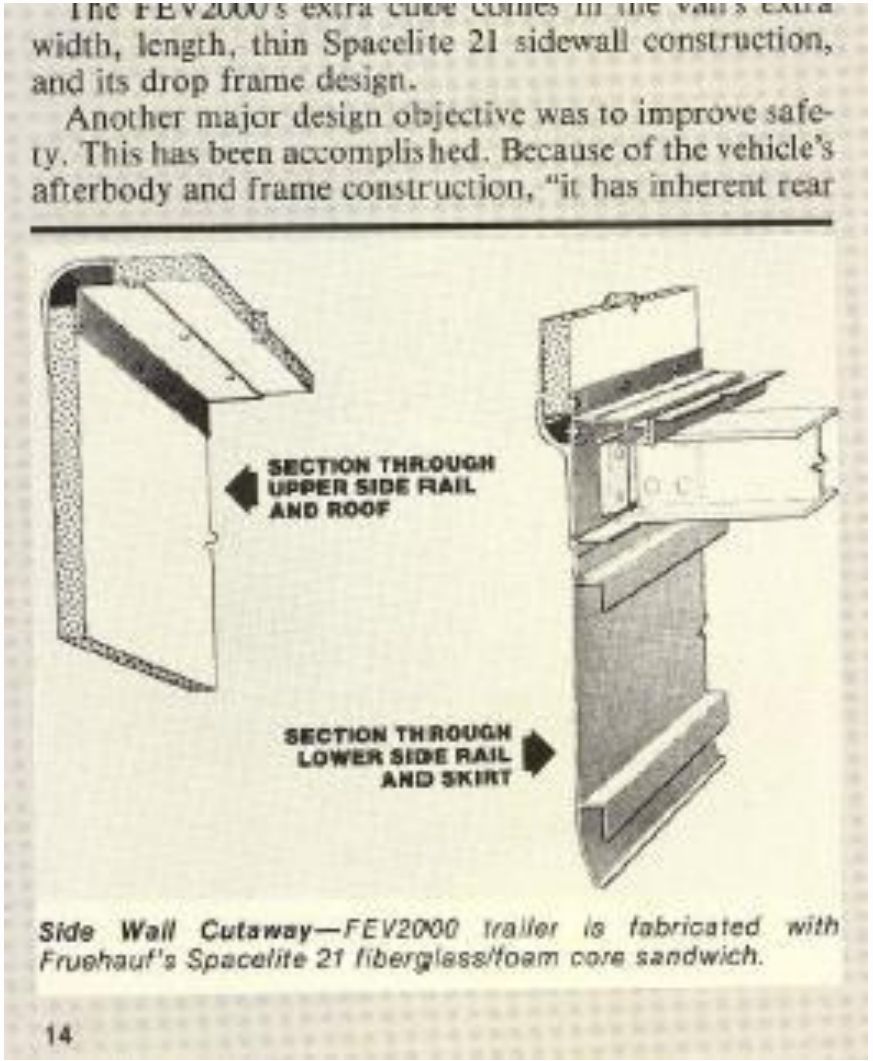
1850 : Conestooga wagon : Composite construction
Careful choice of wood combinations and fibre directions

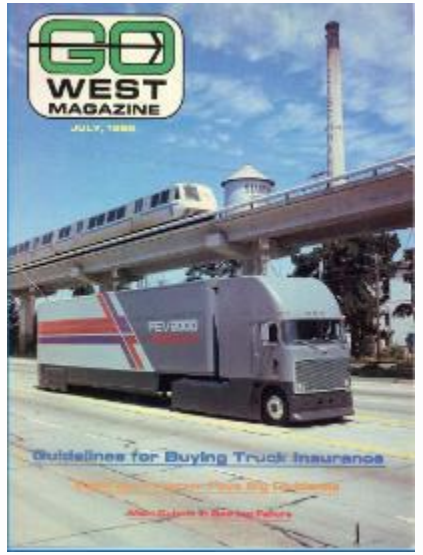
Since WW1: wood replaced by steel.

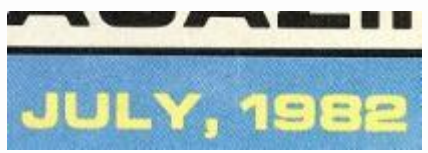
4000 years experience lost in one generation

MATERIAL GAME CHANGERS IN RECENT HISTORY

- 1968: first aluminium trailers
- 1980: use of sandwich elements







FAILED EXAMPLES of trailers in composite in the 90thies

- working prototypes & “innovation award winning”
- “one of a kind” not designed for serial production, too expensive
- “applause but no sales”

SUCCESSFUL EXAMPLES of trailers in 1996 & 1998

- working prototypes & “innovation award winning”
- designed for serial production, close to market price
- Interested investors

composit trailer
light-weight transport
Structural Composites Technology

start industrialization & Introduction of 3D sandwich technology

40 trailers build
in serial production

AEMA Composites Manufacturing

Introducing an affordable composite trailer to a conservative market

31 May 2006 | Jan Verhaeghe

Making an affordable trailer in composite means in reality introducing new technology to a conservative market. There is no doubt that every university in the world with a minimum of composites expertise can design and make a prototype trailer out of composite materials. Making this trailer do the job for a certain period is something else. Manufacturing it on an industrial scale, selling it to the market, and making a profit out of it is another thing altogether. No one has done this except for **Compositrailer** in Belgium.

Compositrailer's production facilities in Belgium.

This step towards industrialisation is bringing about a radical change in the total culture of the company. It changes the thinking of the engineers, the way of working in the shop, the handling of materials and last, but not least, the approach to customers and the market. This is radical innovation. Making a trailer work is a small part of the effort involved in bringing that trailer through an industrialisation process to the market in a profitable way.

The trailer on the road.

Radical innovation

There is a huge difference between radical innovation and incremental innovation. Changing a car door or hood from sheet metal to a composite part of sheet

Features

Composite applications

You might also like...

NEWS

Winners announced for 2017 CAMX Award

The Composites and Advanced Materials Expo (CAMX), taking place in Florida, Orlando, has announced the winners of the fourth annual CAMX Award.

14 December 2017

Comment now

NEWS

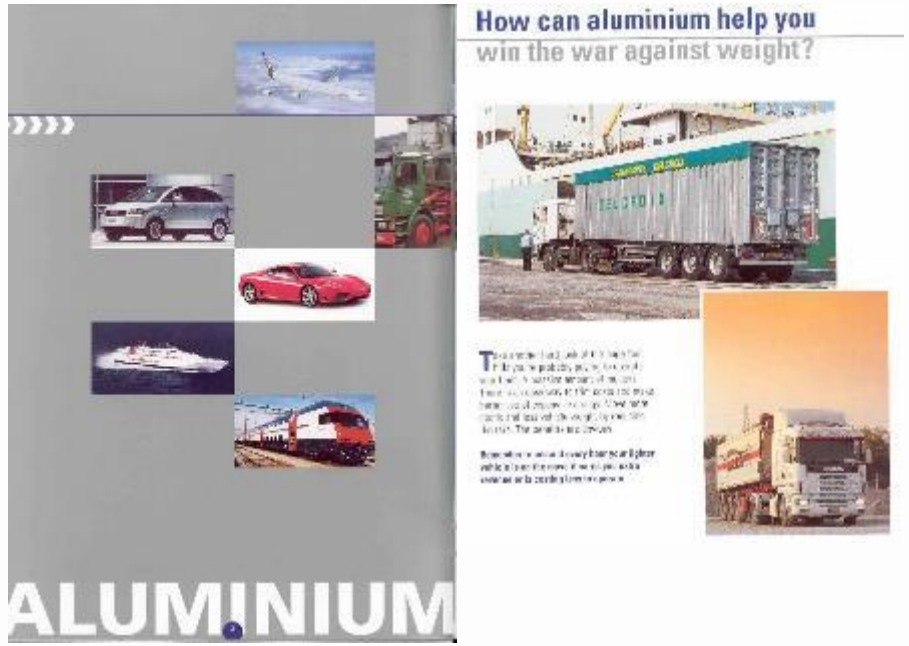
Epoxy prepreg solution for aero

https://www.materialstoday.com/composite-applications/features/introducing-an-affordable-composite-trailer-to-a/

BARRIERS OF COMMERCIAL SUCCESS

1. Incremental improvement of aluminium technology
2. Complexity in joining
3. Integration difficulties of auxiliary parts
4. Limited repair capabilities
5. Chasm of the market
6. Limited capability to create attractive designs

Thermoset composites proved a lack of flexibility to amend these barriers within reasonable time and cost



benchmarket in 2000:

Aluminium trailer :	9.000 kg	55.000€
Compositrailer :	6.000 kg	65.000€

benchmarket in 2004:

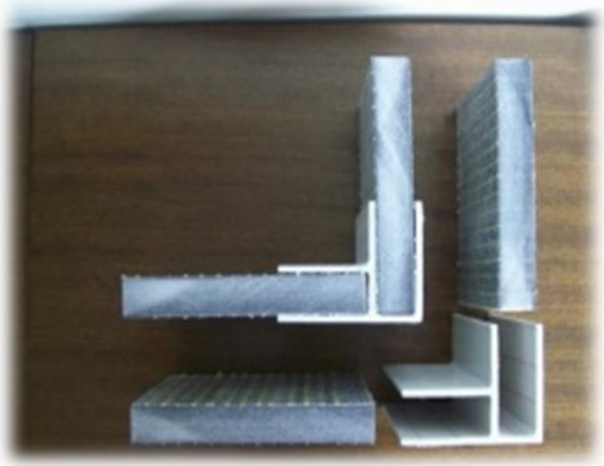
Aluminium trailer :	7.800 kg	48.000€
Compositrailer :	6.000 kg	65.000€

Competition did not come from composite but from aluminium lobby

Complexity in joining

- Impossible to maintain high quality joints within cost frame
- Impossible to repair out of the specs joints

- Fatigue in glue



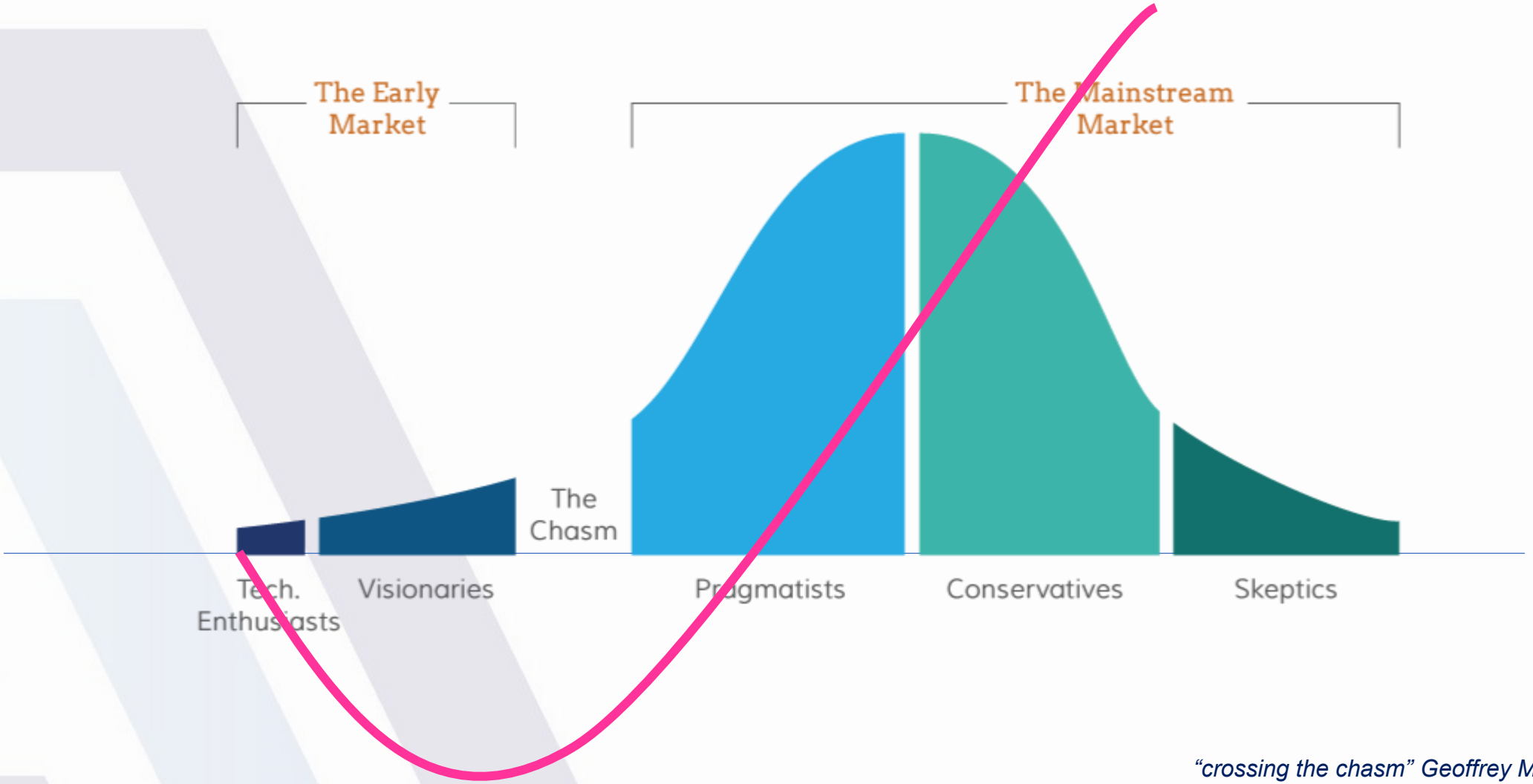
Integration difficulties of auxiliary parts

- Auxiliary parts are designed to join with metal structures, not adapted for gluing.

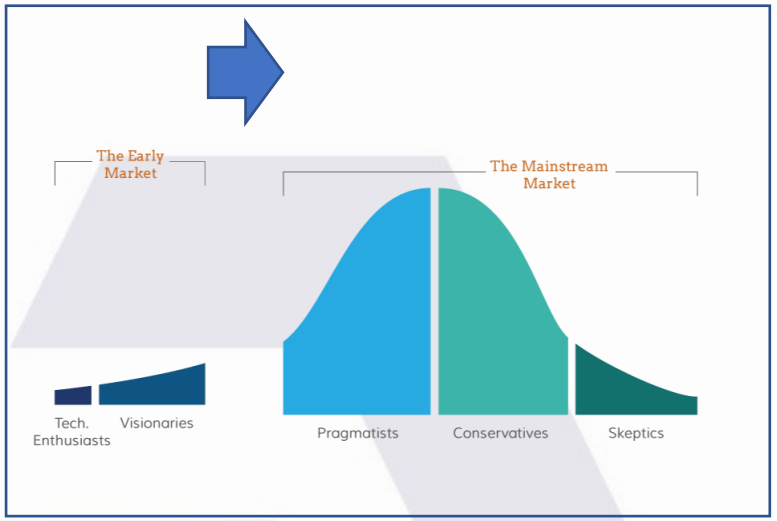
Limited repair capabilities

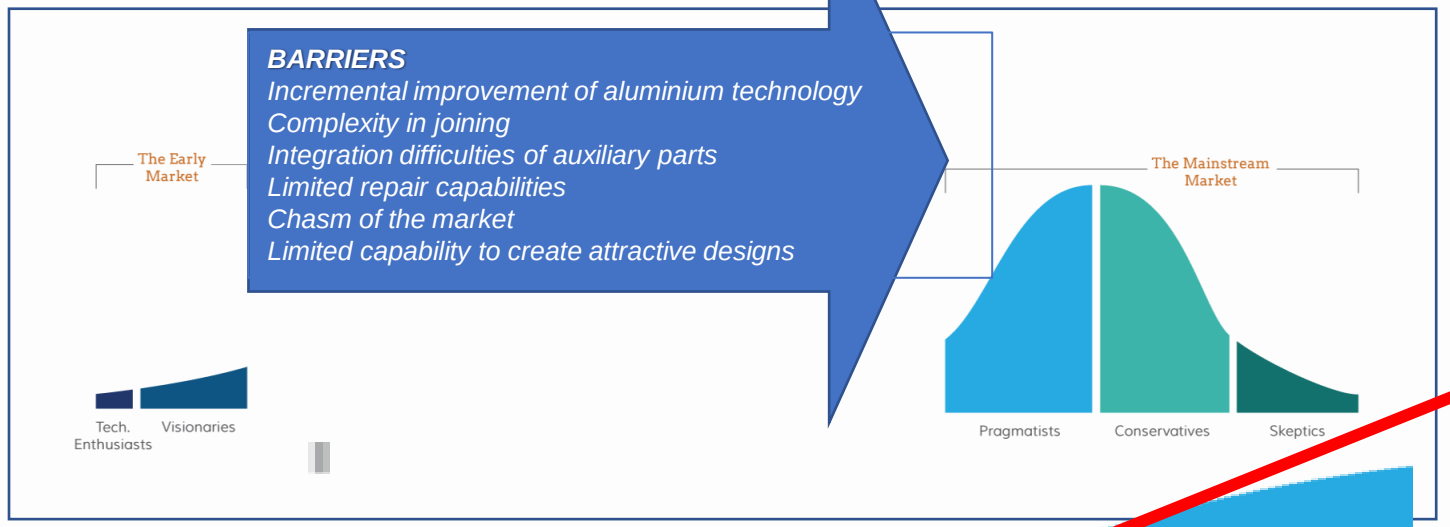
- Rough handling of transportation equipment
- Some damages are impossible to repair
- Repair requires specialized shops.

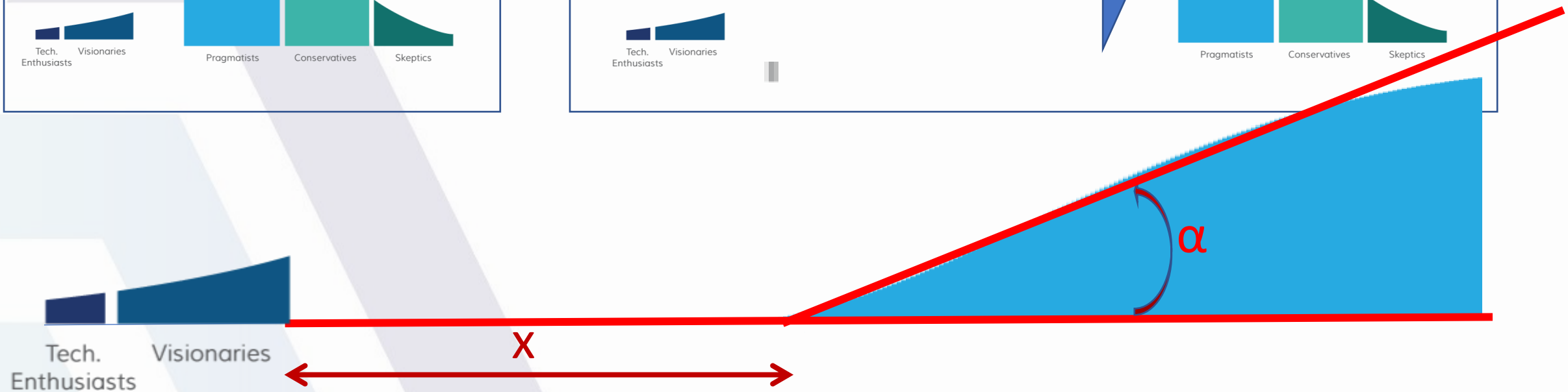
Classic model of chasm of innovation



"crossing the chasm" Geoffrey Moore







- $\alpha = f(1/x)$: The longer X: increasing chances of never take up
- shortening the valley of death requires flexibility
- thermoset composites offering limited flexibility

Icons quotes

Brand Goldsworthy: Long term vision

After looking to the trailer video in 2002,

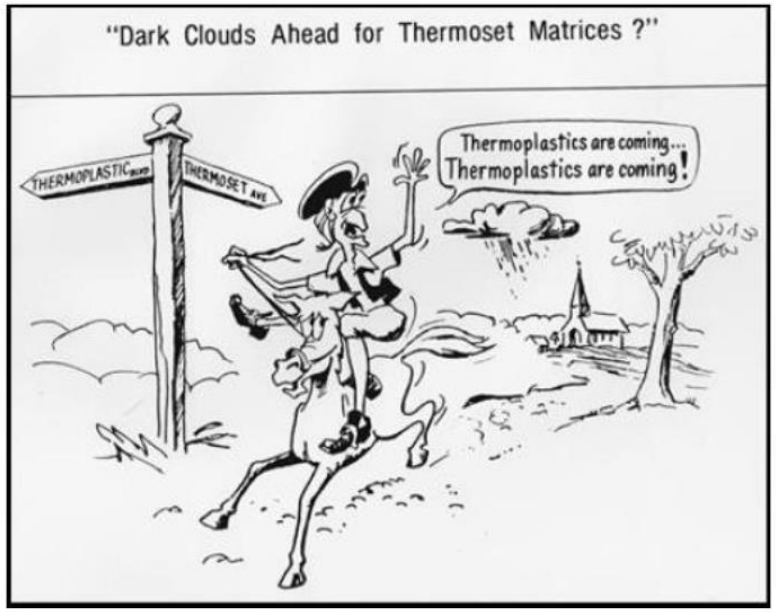
“My dear friend, your project will only be successful once you switch to thermoplastics”

Clem Hiel 2002: Near Term Reality

“Jan, slow down, thermoplastic composite technology is not ready yet.“

THERMOPLASTICS TECHNOLOGY IS READY!!

for implementation in transportation equipment overcoming the barriers by taking into account the learnings



The winner is whoever can profitably produce that part within Spec at the lowest overall cost to the customer.

Material & Technology for Structures with Thermoplastic Composites is available

- PA composites
  - Gap between glass/PP and carbon/PE,PEEK in structural application
- High tech production technologies
  - welding instead of gluing
  - forming instead of expensive constructions
  - flexible design for implementing auxiliary parts

Adapting technology from aerospace

Thermoset Production area is completely different from a Thermoplastic Production area

POSITIONING AGESIA

Performance

Carbon/PEEK,PEI, PEKK
Tape structures

Glass/PA-6
Structures
Multilayer
organosheets

Glass/ vinylester
structures

Glass/ PP
structures

AGESIA
STRUCTURAL COMPOSITE TECHNOLOGY

cost

IMPROVED POSITIONING AGESIA

Performance

Carbon/PEEK,PEI, PEKK
Tape structures

Glass/PA-6
Structures
JM organosheets

Glass/PA-6
Structures
Multilayer
organosheets

Glass/ vinylester
structures

Glass/ PP
structures

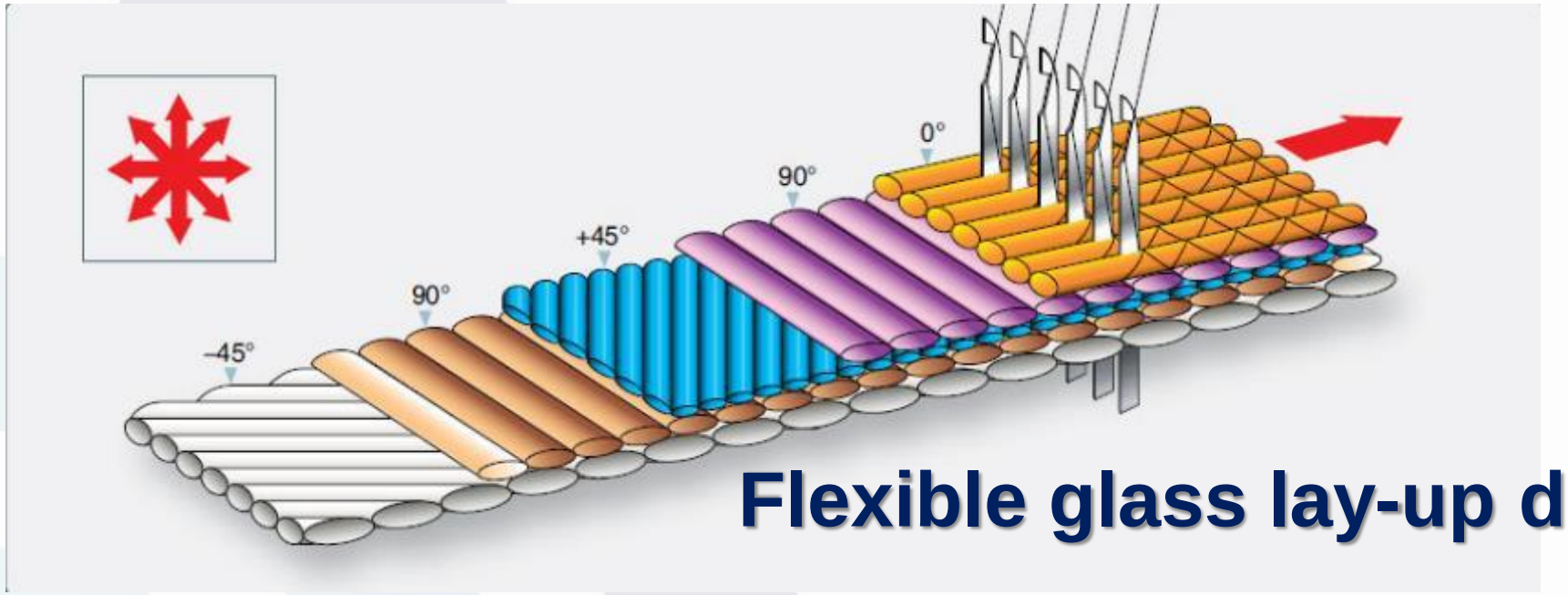
cost

SEARCH FOR GLASS / PA MATERIALS

Agesia's organosheet requirements:

- High fibre content
- Flexible fibre lay-up design
- Impact resistance
- Very low creep
- High Temperature resistance
- Minimum water absorption
- Recyclable

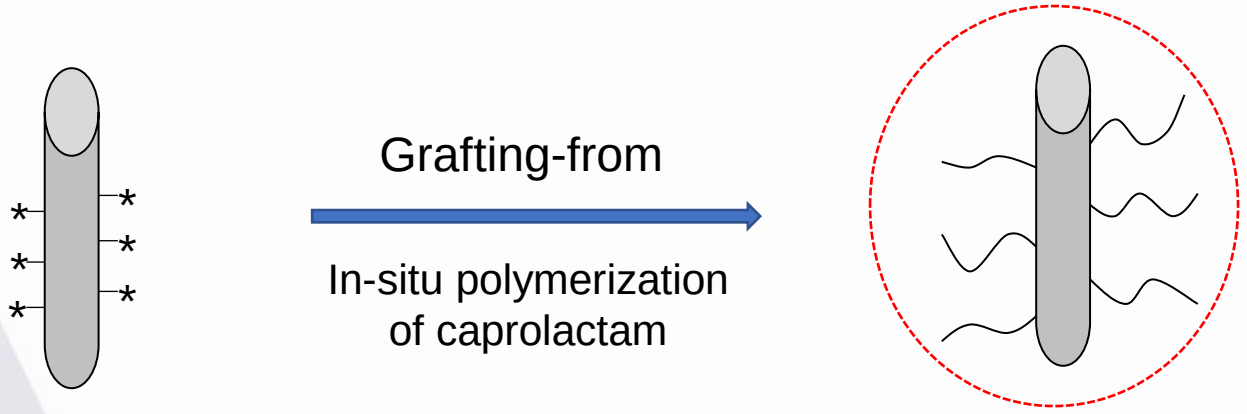
Multilayer UD/tape organosheet versus JM organosheet



Flexible glass lay-up design

- Continuous woven fabric
- Continuous non-crimped fabric (also known as MAX)
- Chopped roving

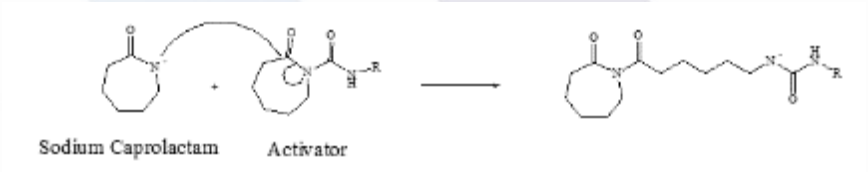
JM Reactive Glass Technology

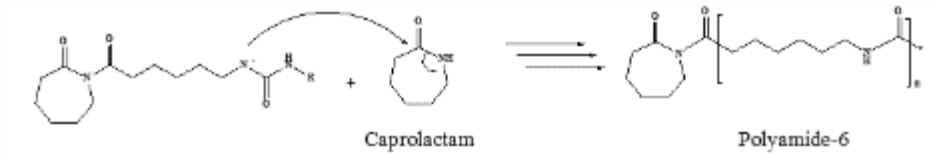


Standard glass fiber bonded with activator groups

Glass fiber grafted with polyamide-6

Polyamide 6 via in-situ polymerization of caprolactam results in a strong covalent bonding at fiber-matrix interface

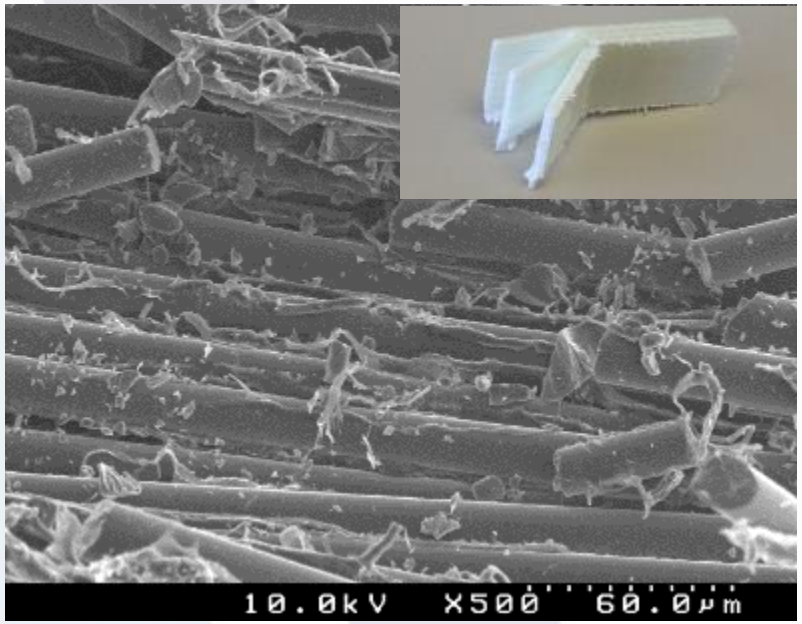




Courtesy of Johns Manville

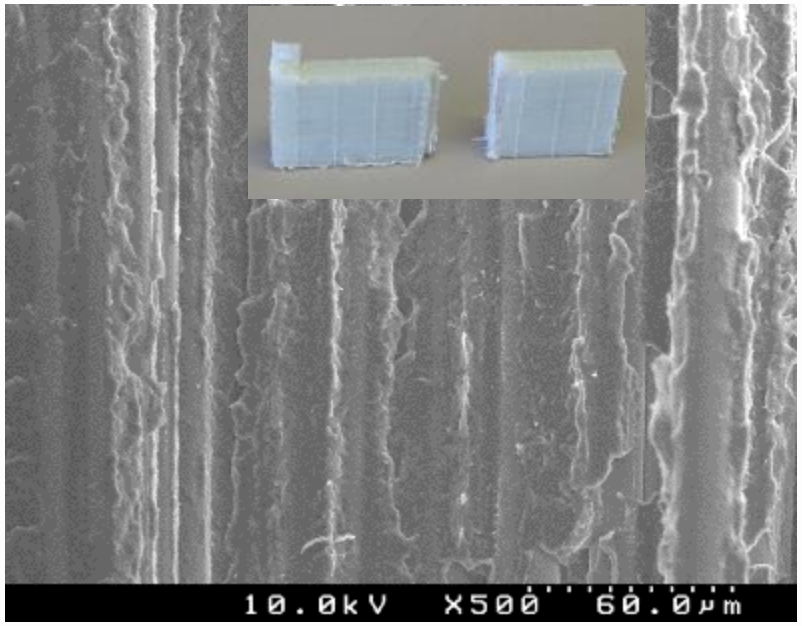
IMPACT RESISTANCE

Standard
Non-Reactive Glass



Weak fiber-resin bonding;
Failure at fiber/matrix interface

JM Reactive Glass
StarRov® 886

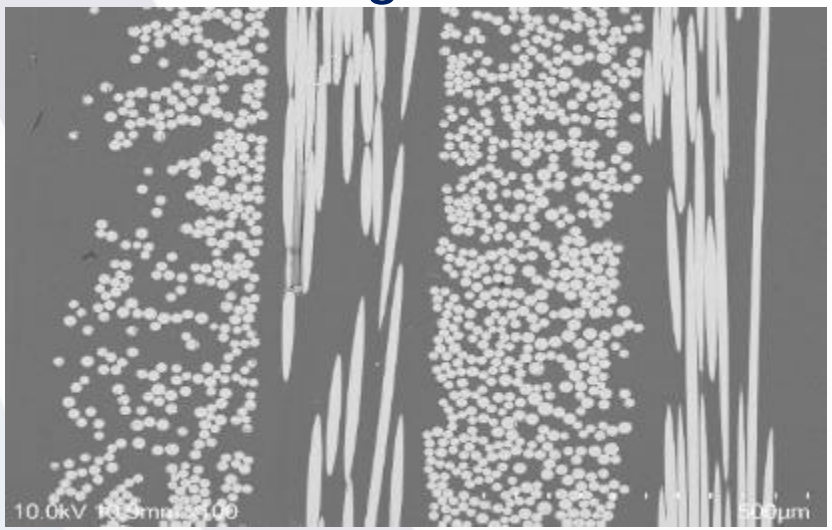


Strong fiber-resin bonding
Failure in resin matrix

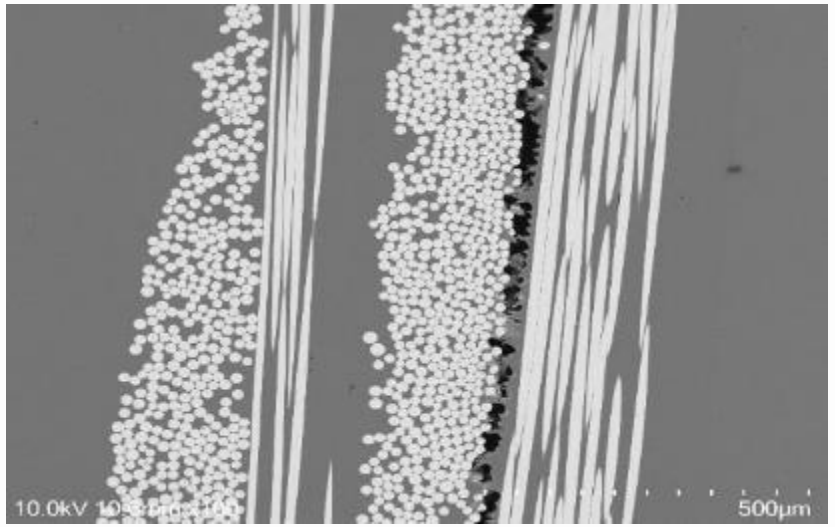
Courtesy of Johns Manville

MULTILAYER VERSUS JM

JM Organosheet



Commercial Organosheet

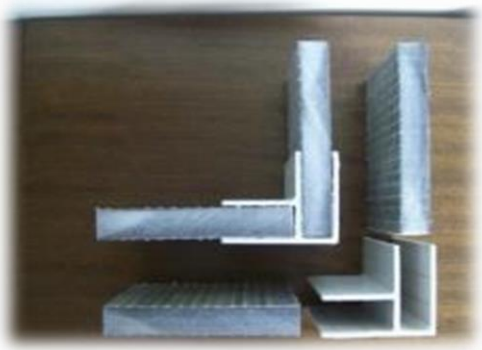


Courtesy of Johns Manville

No voids: optimal matrix

Thermoset composite engineering principles by JV

- Create mass reproducible components
- Integrate the needed functions
- Use sandwich panels (3D stitched) as structural elements
- Use pultruded profiles as connectors
- Design “dummy proof” glue connections
- Avoid delamination by designing glue surfaces in load direction
- Minimalize rivets and bolts



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- Avoid delamination by designing glue surfaces in load direction
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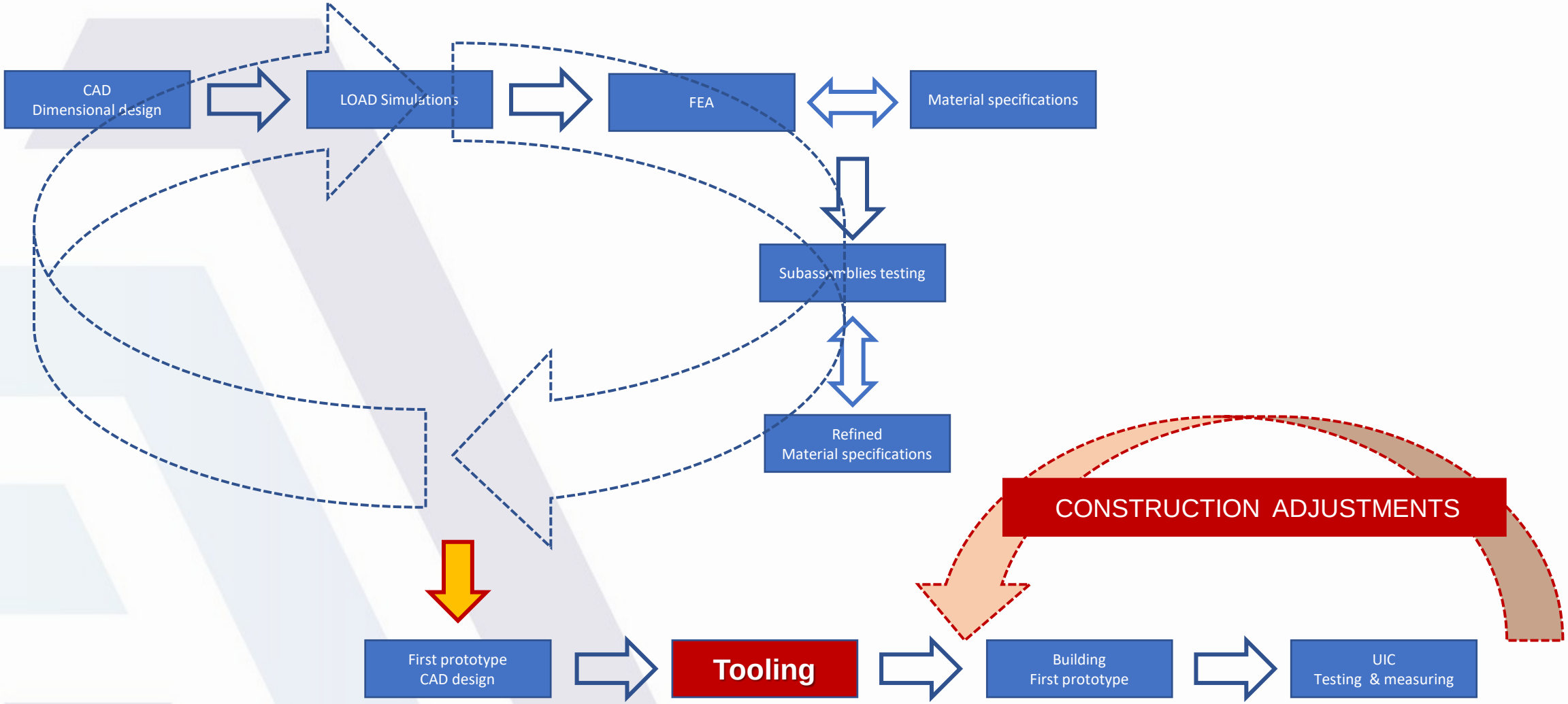
- Costly tools
- No flexibility for modifications after design
- Achilles heel: glue
- Auxiliary parts connections need interfaces (adding weight and cost)

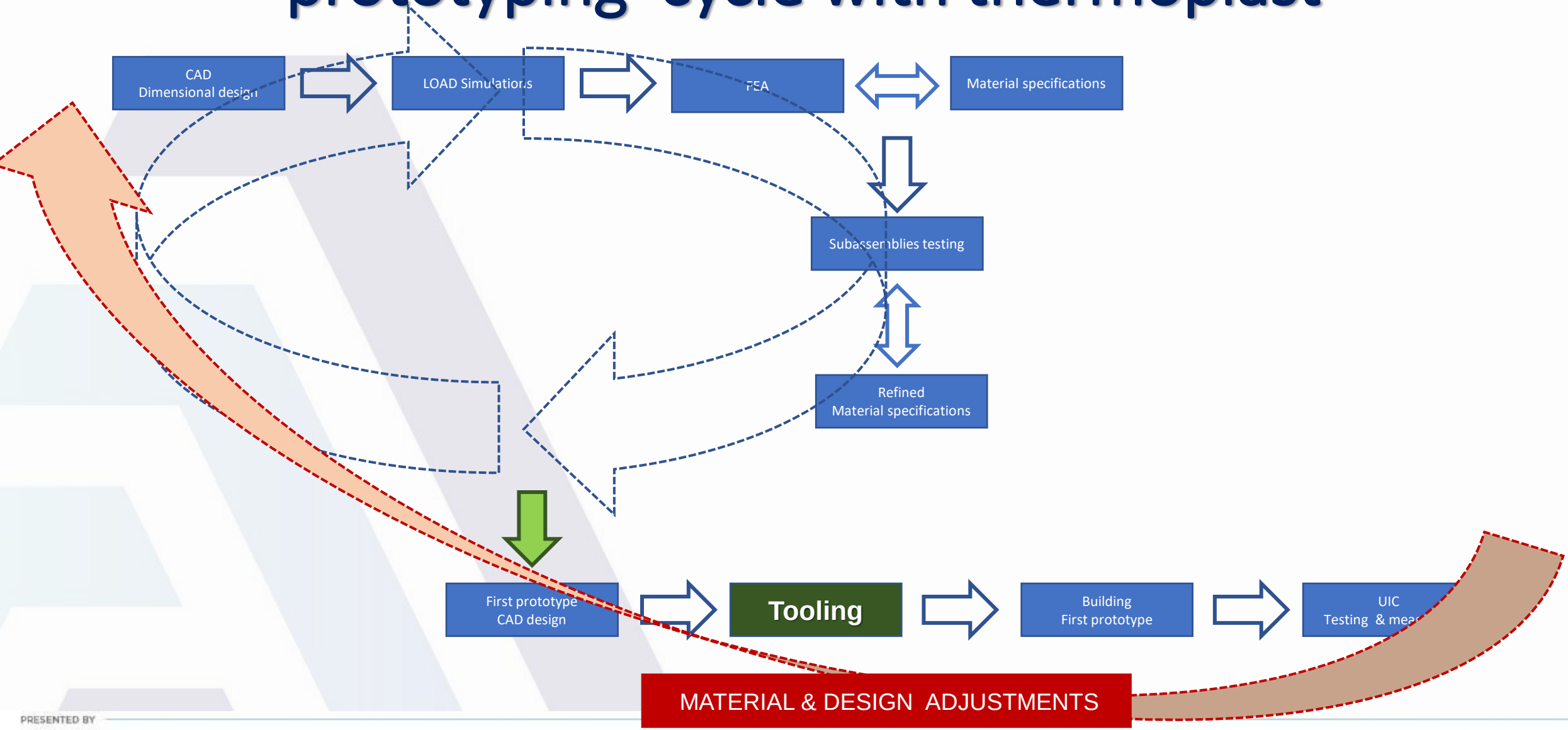
Engineering advantages with thermoplastic composites

- No need of costly tooling
- Increased flexibility of design and redesign
- Welding and forming capabilities
- Connections for auxiliary parts can be integrated
- Aesthetic design **“use alike”** and **“look alike”**

prototyping cycle with thermoset



prototyping cycle with thermoplast



AGESIA' S MISSION

By reducing weight and by developing recyclable systems, Agesia wants to reduce carbon emissions and pave the way for more sustainable logistic systems.

AGESIA' S VISION

AGESIA values long-term collaborations greatly.
To mastermind sustainable logistics, transportation and shipping methods, AGESIA strongly believes in cocreation based on a continuous customer and user input.

AGESIA DEVELOPS

- Production technology
- Structural components such as sandwich panels and beams.
- Dynamic loaded structures e.g. containers, aerospace tooling,…..

AGESIA covers the process from the feasibility study up to the technology level needed for serial production.

FOOD FOR THOUGHT

Non-aerospace thermoplastic composite applications

facilitates the acceptance of thermoplastic composites into aerospace industry!

Thank you

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