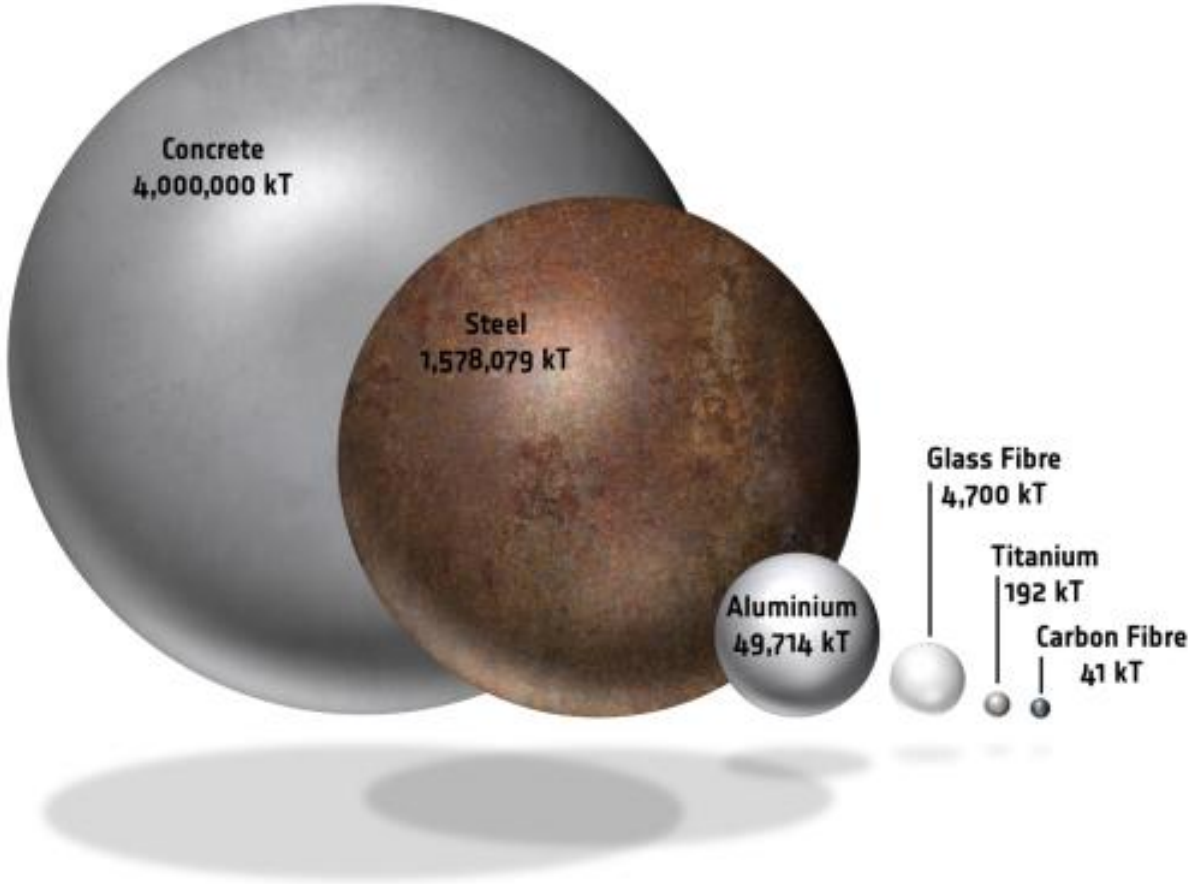
World Material Forum

9-10 June 2016 – Nancy

Thierry Merlot

Materials Production Volumes – 2013 estimates

Sources: Concrete: 2013 US Department of the Interior / US Geological Survey; Crude steel production: 2013 World Steel Association; Plastics production in 2013: PlasticsEurope (PEMRG) / Consultic; Primary Aluminium Production: 2013 International Primary Aluminium Institute; Glass fibre: JEC Composites Magazine n°58; Titanium metal ingot production: 2012 The French Titanium Association; Carbon fibre: 2013 global consumption estimates



Carbon Fiber: the smallest player at WMF BUT

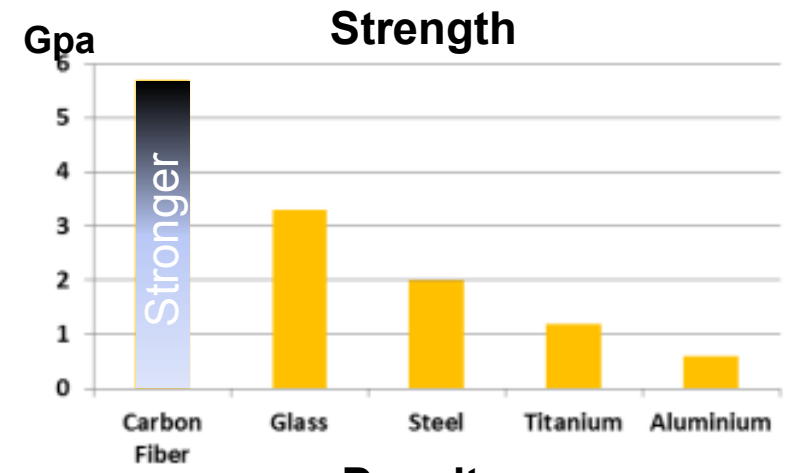
Composite Materials

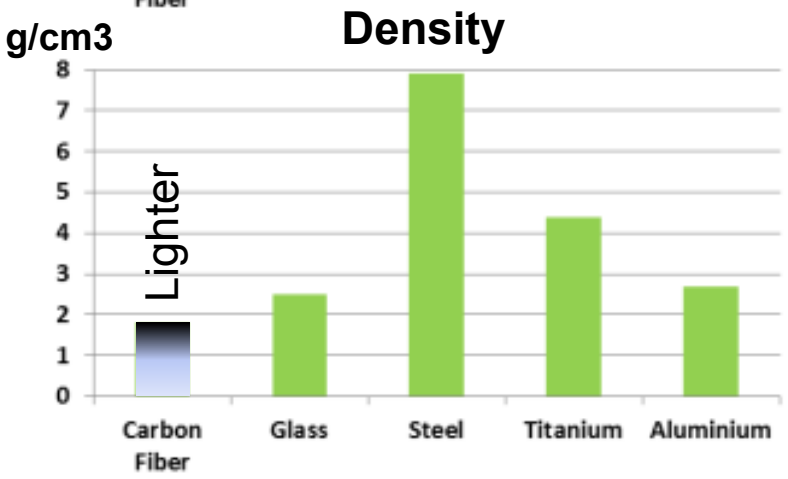
Customers want materials to be:

- Stronger (*Carbon prepreg = 5x aluminum)*
- Lighter weight *(30% lighter than aluminum)*
- Tougher with functional enhancements
- Stiffer (*Carbon prepreg = 2x glass)*
- Durability *(up-time, keep them flying)*

They also want:

- Lower total solution cost
- Lower processing time
- Lower infrastructure and overhead requirements
- Lower part count



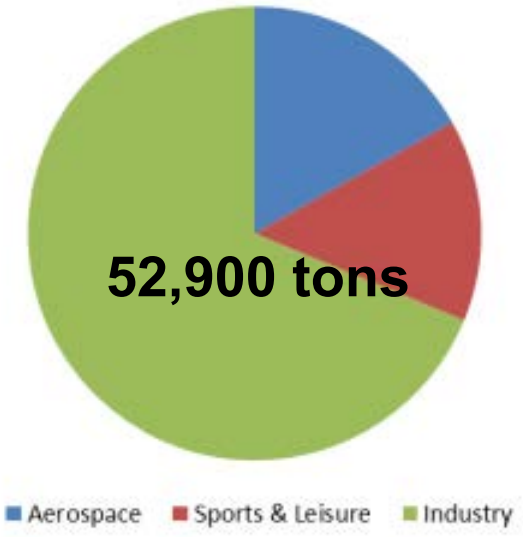


We deliver advanced composite solutions that are stronger, lighter, tougher

Carbon Fiber Market Trends

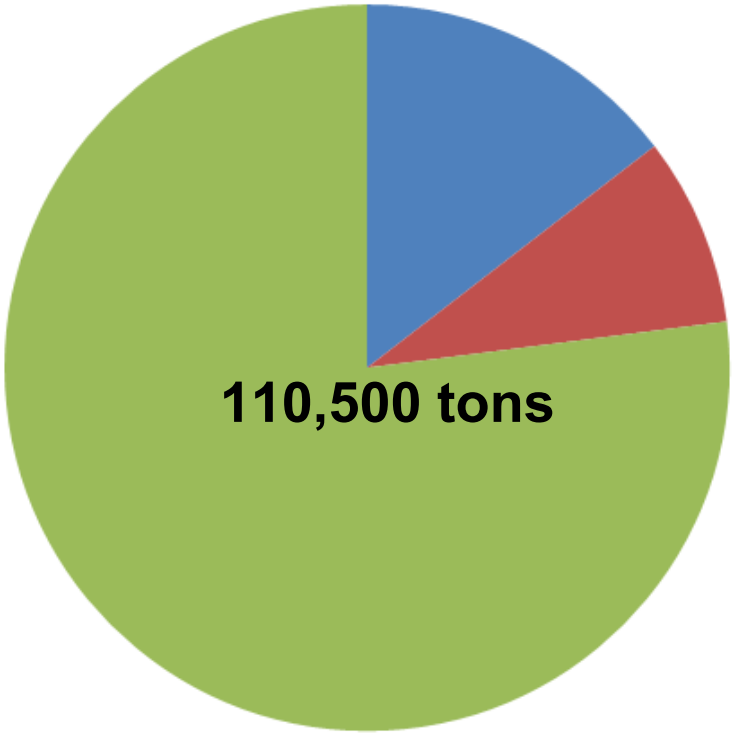
In 000s tons

2014



Industry includes Wind Energy, Automotive, Pressure vessels etc

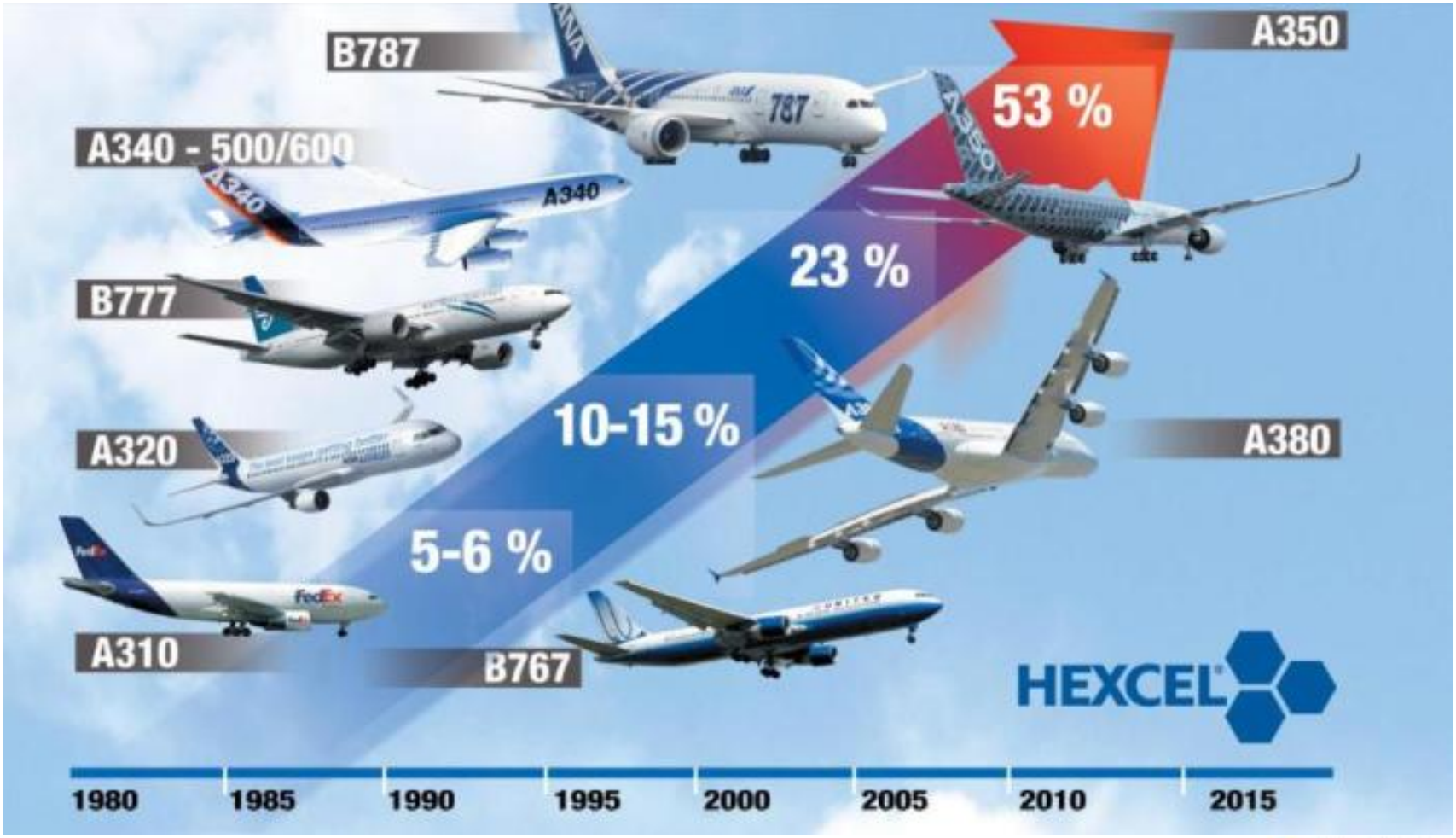
2020



Source: JEC Group Strategic Study “Carbon fibers: history, players and forecast to 2020”

Volumes x 2 in 5 years

Commercial Aerospace



Secular penetration of composites in commercial aerospace

A350 XWB program

53% Composites

- Contract with Airbus to supply carbon fiber prepreg for all the composite primary structures
- 798 aircraft on order, with 21 delivered end of April
- A350-1000 (longest fuselage version) first flight in 2016 for entry in service in 2017
- A 32m long by 6m wide the A350 XWB wing made from HexPly® M21E

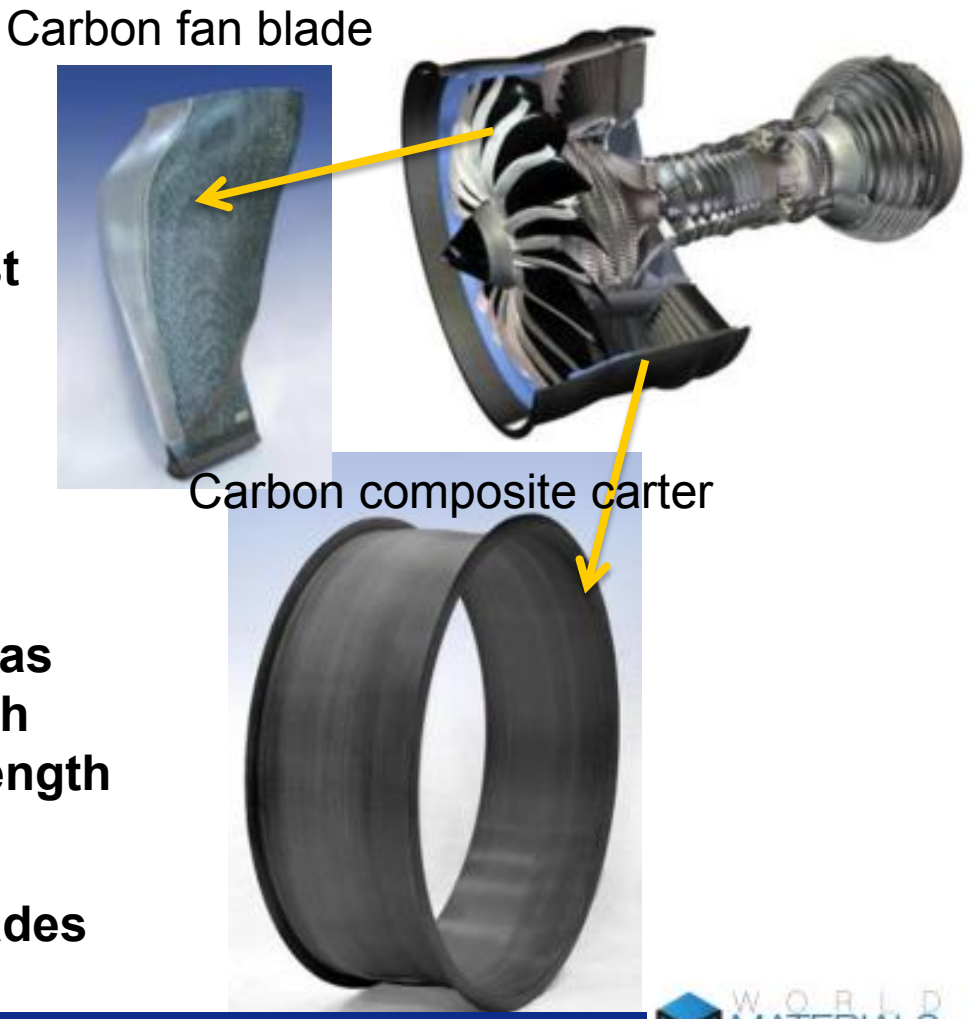
A350 XWB wing: largest single carbon composite structure

A350 XWB: examples of Carbon Primary Structures

Thermoset prepreg already used on all these primary parts

CFM International LEAP-1 Engine

- **More than 10,000 LEAP-1 engines already on order**
- **Up to 15% improvement in fuel efficiency compared to today's best CFM56 engines**
  - LEAP-1A for Airbus A320neo
  - LEAP-1B for Boeing 737 MAX
  - LEAP-1C for COMAC C919
- **Intermediate modulus fiber (IM7) was selected for its high tensile strength and modulus - and good shear strength**
- **Composite LEAP fan blades save 74kg/engine vs CFM56 titanium blades**



150 tons weight savings per year and
+5000 tons savings over the life of the engine program

Aerospace: Weight & Maintenance savings

- In addition to weight savings, carbon offers no corrosion, no fatigue
- Optimal use and longer life of aircraft made possible, with major overhaul intervals extended to 12 years

Potential to integrate functionalities: increased conductivity, dampening, noise attenuation, health monitoring, etc

Weight savings 20%, Maintenance savings 45%

BMW 7 Series B-Pillar with Hexcel Carbon Stacks

Before

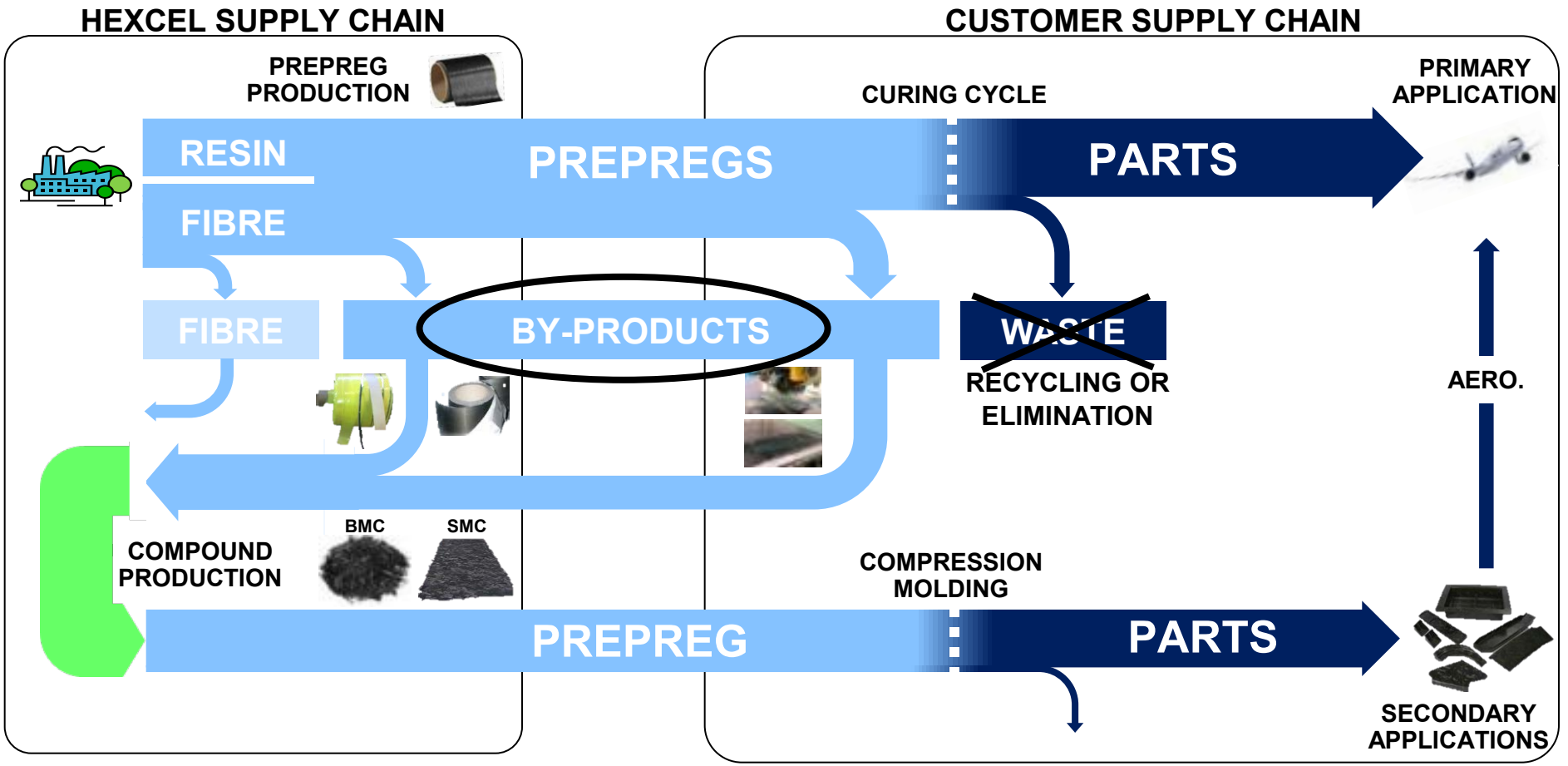
After

1st High Volume Car Carbon Prepreg Production Program
30% weight savings

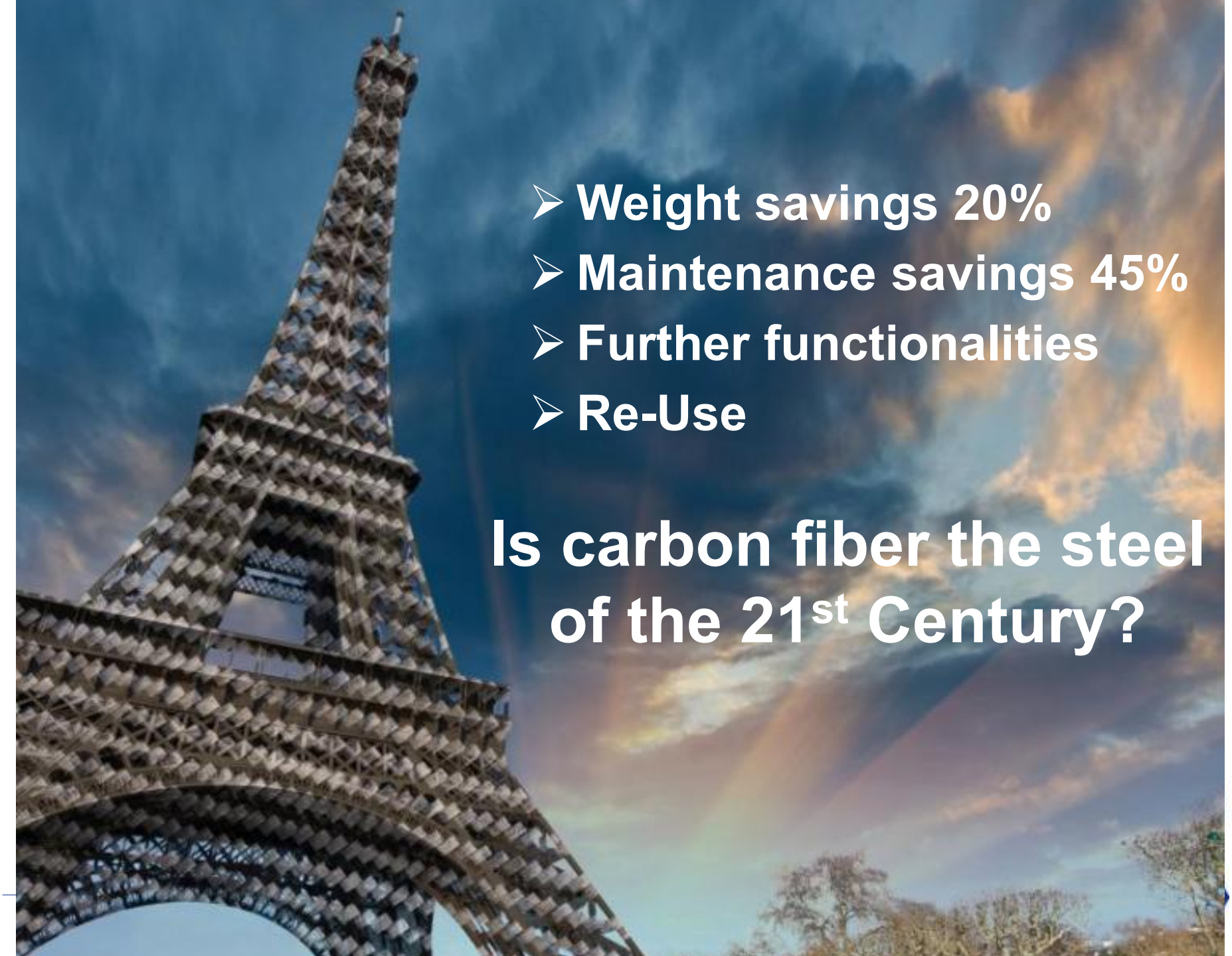
WORLD MATERIALS FORUM

HEXCEL

Re-use development approach



Creating loops of material regeneration for transitioning to circular model


➢ Weight savings 20%
➢ Maintenance savings 45%
➢ Further functionalities
➢ Re-Use
Is carbon fiber the steel of the 21st Century?

Thank you for your attention