Hexcel
Light weighting & Recycling

Brett Schneider, Hexcel

HEXCEL IS A **GLOBAL LEADER** IN ADVANCED COMPOSITES TECHNOLOGY

2016 Sales | **$2.004 billion**

U.S. 42% | Europe 41% | Other 17%

- **Technology leader** with a broad range of materials/products/qualifications
- **Leading position** in all our key markets
- Excellent **customer relationships**
- Sustainable **competitive advantages**
- Growing share of **long-term growth** markets
- Focused on **operational excellence**

SCOPE AND BREADTH

Leading composites manufacturing company

19

MANUFACTURING SITES

Two more under construction

4

CONTINENTS

Americas, Europe, Asia, Africa

6,200+

PEOPLE

54% in U.S., 45% in Europe

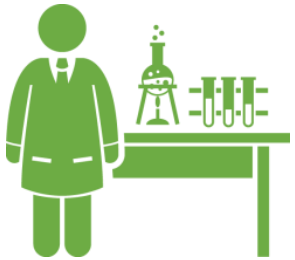
68

YEARS IN BUSINESS

Founded in a California garage in 1948

TECHNOLOGY **INNOVATION CREATES OPPORTUNITIES** FOR THE FUTURE

We are expanding our leading technology positions through direct effort, funded research, collaboration, investments and acquisition



DOUBLE-DIGIT RESEARCH & TECHNOLOGY INVESTMENT

GLOBAL CENTERS OF R&T EXCELLENCE

BROAD AND EXPANDING PATENT PORTFOLIO

UNIVERSITY COLLABORATIONS

Engaged in active collaborative with leading university and government research centers

PhD PROGRAMS

Supporting doctorate studies at key academic institutions

➢Direct Effort, Funded Research, Collaboration, Investment and Acquisition

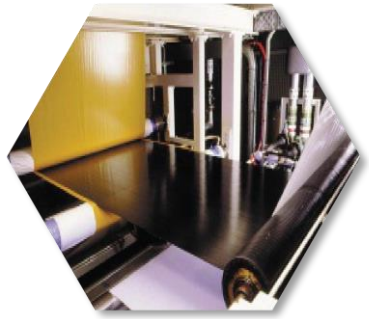
WE HAVE AN
UNRIVALED RANGE OF PRODUCTS

Everything from carbon fibers and reinforcement fabrics to prepregs, honeycomb core, tooling materials and more . . . from raw materials to fly away parts . . . vertical integration is a strength and a differentiator.

REUSE Path for CFRP Materials and Parts

CARBON FIBER
A320neo sharklets
LEAP fan blades/case
F-35 wings

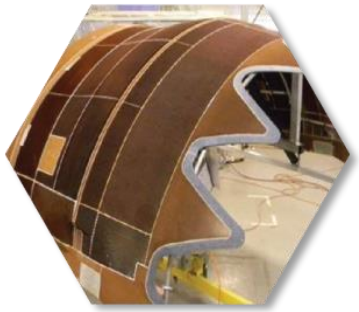
REINFORCEMENTS
Aerospace primary and secondary structures
Aircraft radomes
787 stringers



CARBON PREPREGS
Aerospace primary and secondary structures
A350 fuselage and wings
GE90 fan blade
BMW 7 Series B-pillar

HONEYCOMB
Rotorcraft blades
Aircraft flooring
Nacelle structures
Acousti-Cap®

GLASS PREPREGS
Wind turbine blades
Aerospace wing-to-body fairings
Aerospace secondary structures

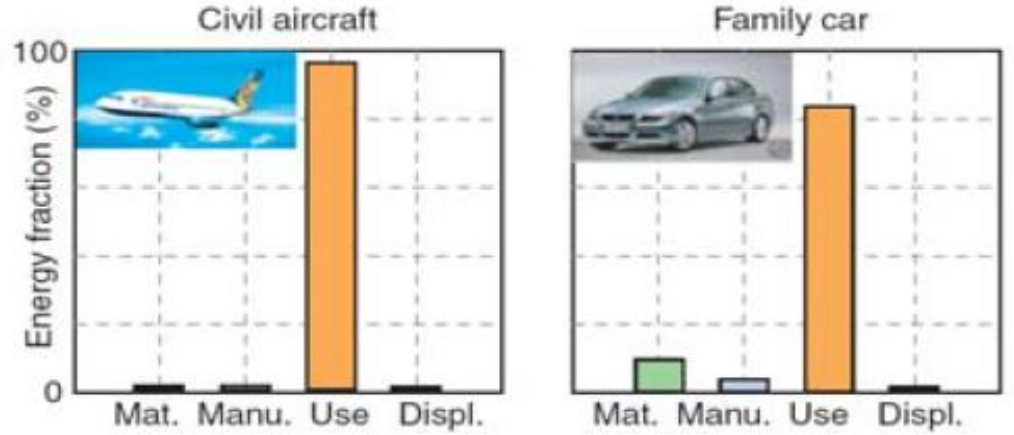


ENGINEERED PRODUCTS
Structural assemblies
Machine/shaped core
Tooling system
Compression molded parts

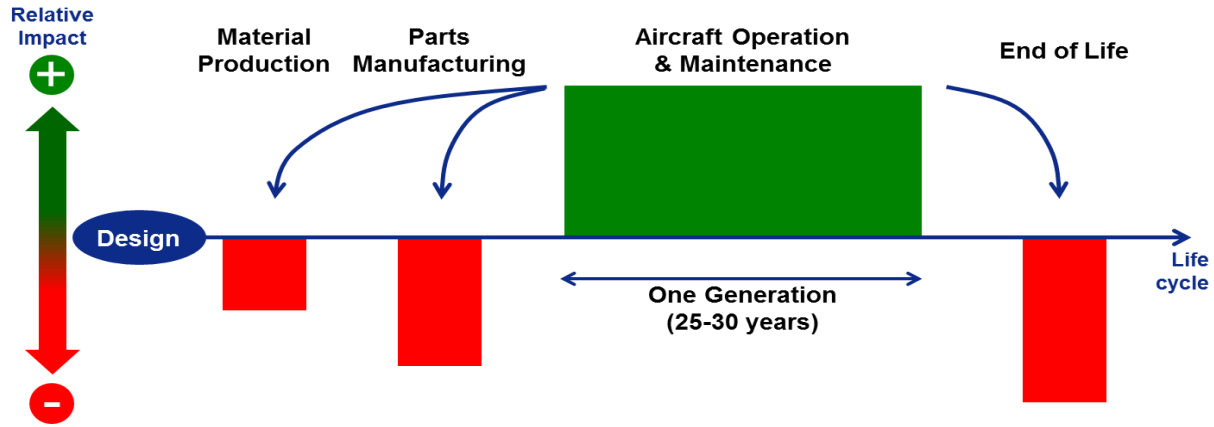
Strong | stiff | lightweight | fatigue resistant | corrosion resistant

Light weighting for Life Cycle Impact will Continue

- In all transportation, Life Cycle Analysis identifies the USE phase as the most environmental impacting phase to reduce emissions (> 80%)
- Light weighting for significant impact will continue
- Addressing manufacturing and end-of-life phases to reduce total impact is important now
- **Industry MUST define controllable Reuse processes, product forms and material properties that are valuable beyond original use applications**
- ReUse products can be certified for specific applications



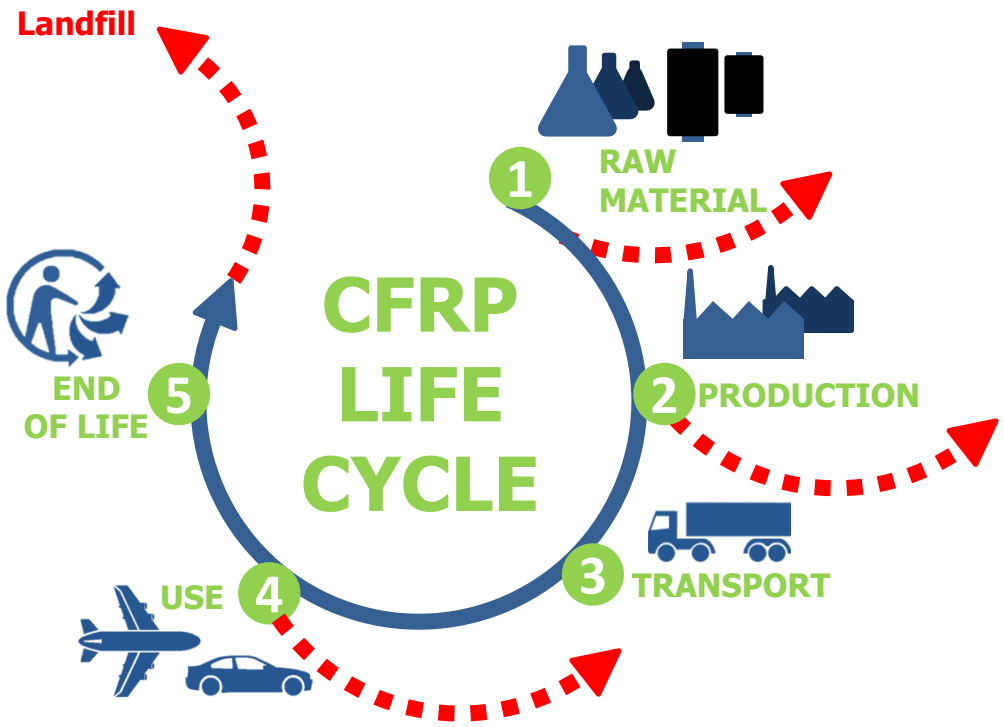
(Karel Van Acker et Ignaas Verpoest de K.U.L. 2011)



CFRP is significant contributor to USE phase impact reductions, we want to reduce total footprint

Closing the CRFP Life Cycle Loop

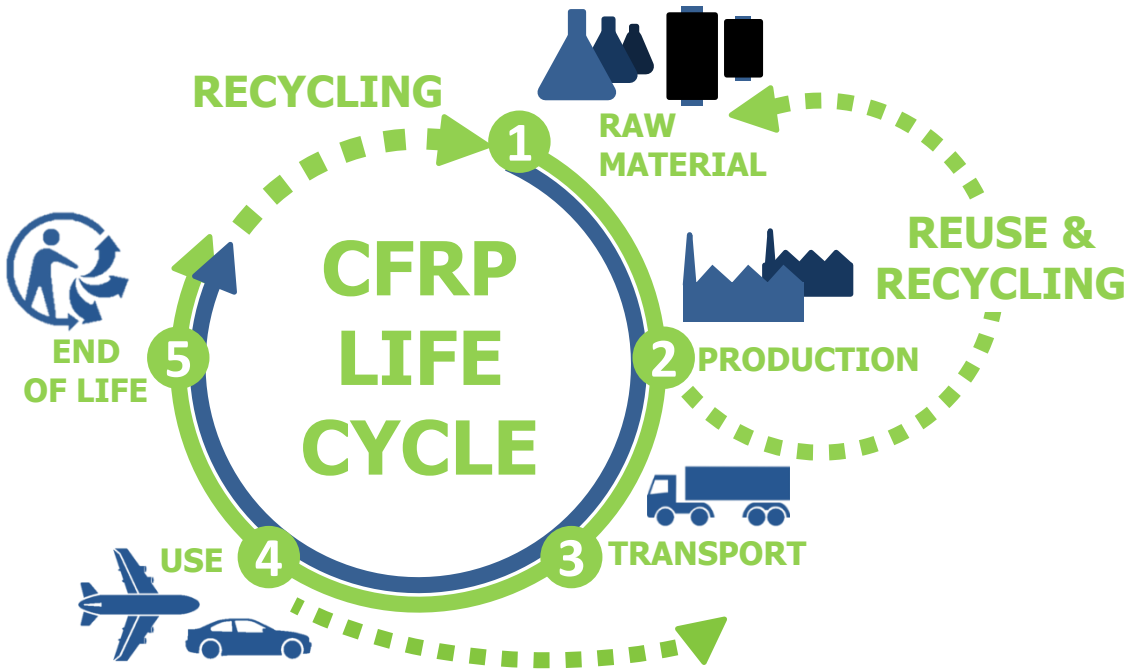
Current: Reduce Waste throughout supply chain



Virgin raw materials

Wasted material **ELIMINATION**

Developing: Create Restorative Loops with materials and processes utilizing key retained material properties

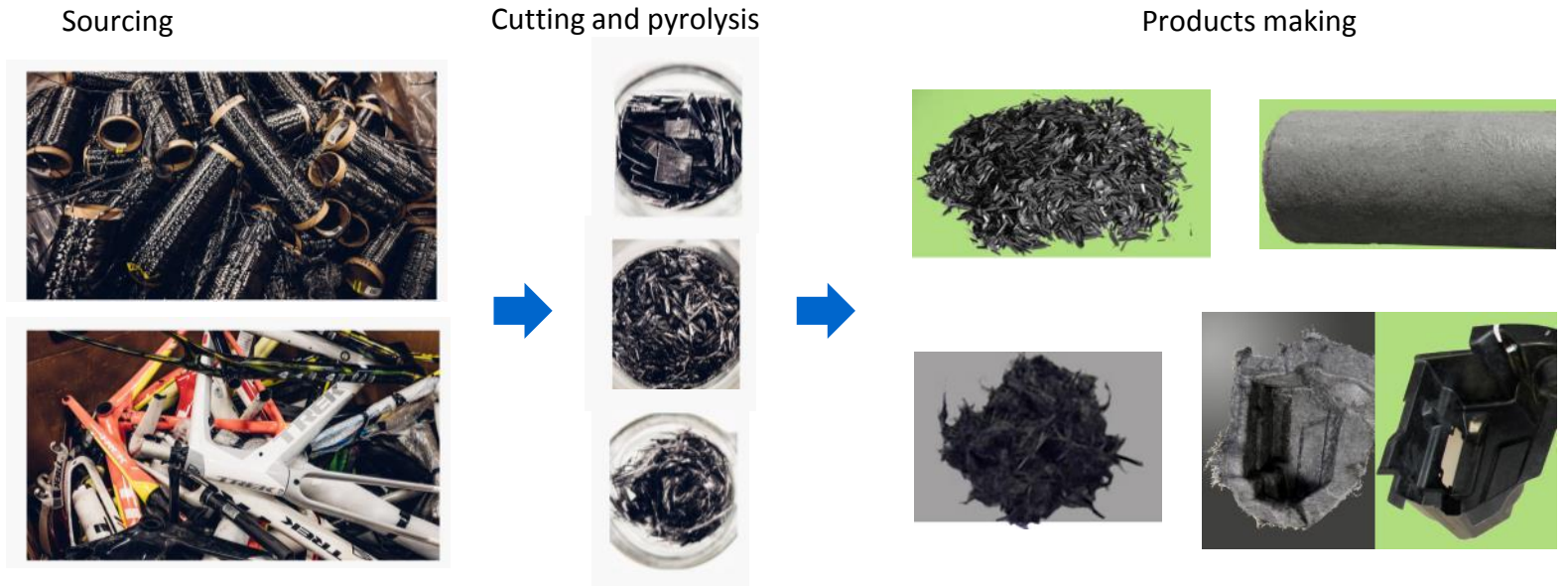


Eco-designed products

Restorative loops **REUSE**

Recycling and repurposing carbon fiber

- Hexcel has taken an investment in Carbon Conversions Incorporated (CCI)
- Sourcing: Manufacturing Processes, Post-production and End of Life
- Process: Conventional cutting and pyrolysis processes combined with patented processes
- Products: Today is chopped and seeded fibers, non-wovens and 3D preforms



Specific technology portfolio for high added value material forms

Recycle and Reuse with Carbon Conversions and Hexcel

- **Recycle** (dry carbon fiber and cured CFRP from manufacturing and end of life)
- **Reuse** (dry carbon fiber and uncured prepreg)

CONVENTIONAL RAW MATERIALS SUPPLIERS + MANUFACTURERS

Shredded DRY / Cured / Uncured CFRP

Pyrolysis

Recovered CF

Milled & chopped fiber, pellets and mats

USEFUL RAW MATERIALS

CERTIFIED RAW MATERIALS + REUSE MATERIALS → HEXCEL

REUSE RAW MATEIRALS WITH QUALIFIED PROCESSES → NEW PRODUCT RANGE → NEW APPLICATIONS

HEXCEL → CERTIFIED PRODUCTS FOR OEMS → CUSTOMERS, PARTS PRODUCERS (OEM, SUBS…)

Enabling Reuse and Recycle is normal, qualified material flow management

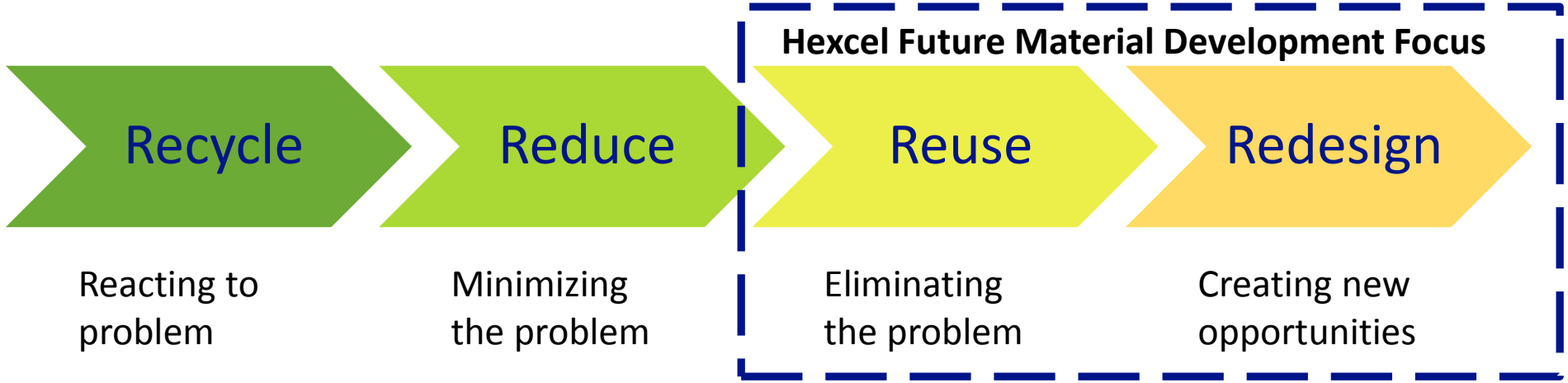
Future Story to Success

70% of costs of product development, manufacture and use are decided in early design stages (1991 National Research Council Report titled “Improving Engineering Design”)

Recycling and Reuse is viable today – if Designers are open to using **qualified CFRP product forms**

Government support and regulations will continue to help encourage design adoption

Hexcel and CCI providing a familiar and qualified Reuse portfolio of CFRP materials to designers



Reducing eco-impacts and enhancing performance with material portfolio and design

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