Airplane and Carbon Fiber Recycling

Boeing considers the full life cycle of our airplanes to support our commitment to sustainability—from design and assembly to in-service operation and end-of-service retirement. As we use more carbon composite material, we're reducing waste to landfills by streamlining manufacturing and recycling.

Airplane retirements

- **Boeing supports responsible** airplane retirements. We've been working for many years to refine our product designs to enable the disassembly of parts and materials recovery.
- **We also work with partners** accredited by the Aircraft Fleet Recycling Association on disassembly projects to ensure safety and environmental best practices are followed.
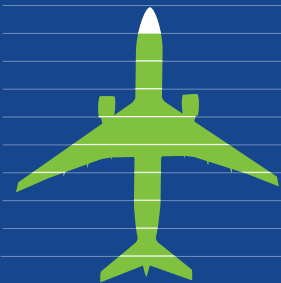- **Our collaboration promotes** strong environmental performance and continued innovation.

Recycling

The 2015 ecoDemonstrator program dismantled a 757 to learn more about airplane recycling.

- **Nearly half of the weight** of a recycled airplane represents parts. These are resold to operators for their in-service fleets under strict regulations enforced by the U.S. Federal Aviation Administration and European Aviation Safety Agency.
- **The raw material supply chain** gets much of the remaining recycled material. Some portions of the aircraft include interior components embedded with flame retardants required by regulatory authorities for safety reasons. No technology exists today to successfully extract that content, but research and development is under way to explore solutions.

Sustainable manufacturing

Half the weight of a 787 Dreamliner is made from lightweight carbon composite fiber. This material contributes significantly to the airplane's superior fuel efficiency.

- **Boeing worked with two business partners** in May 2018 to conduct the world's first dismantling of a composite fuselage airplane. Our experience from this project is helping the industry to determine the best approach for composite airplane recycling.
- **We're optimistic current recycling rates** can be maintained as knowledge and technology advances. Airplanes with substantial composite material: Boeing's 787 and 777X, and the Airbus A220 and A350.
- **We also recover excess** cured and uncured carbon fiber from our manufacturing processes. Boeing provides this material to ELG Carbon Fibre Ltd., which recycles it for manufacturers of electronics and automobile parts and other products.

600 airplanes
a year were recycled before COVID-19—representing the vast majority of retired commercial aircraft.

90%
Nearly all of a Boeing commercial airplane is recyclable by weight for parts reuse and scrap.

1 million pounds
of carbon composite waste is being diverted from landfills every year—thanks to a first-of-its-kind partnership between Boeing and a recycler in the United Kingdom.

Airplane and Carbon Fiber Recycling

Boeing is focused on building and servicing our products in a way that emits less carbon, uses less energy and water, creates less waste, and protects human and environmental health. Sustainable manufacturing practices are a key part of this focus.

Creating a new supply chain

From carbon fiber to car parts.

- **Boeing extensively studied** how to reduce waste from its carbon composite manufacturing. We took action as 777X wing production ramped up and excess composite material was forecast to grow to 7% of solid waste to landfill.

- **Processes to minimize waste** were pioneered at the Composite Wing Center (CWC) in Everett, WA. Boeing also launched a pilot project to provide excess material from the CWC to a UK recycler.

- **ELG Carbon Fibre stood out** in the industry for its unique ability to recycle cured and uncured material. Working together, Boeing and ELG created a new supply chain that provides recycled carbon fiber to other manufacturers.

- **Boeing and ELG formed a partnership** in late 2018 based on the pilot project's success.

- **About 1 million pounds of excess** a year goes to ELG instead of landfills. That represents the majority of Boeing's excess composite material. It comes from all 10 manufacturing sites in the United States, plus Canada and Australia.

Diverting waste from landfills

These Boeing sites participate in the carbon composite material recycling effort:

- Winnipeg, Canada: Parts and assemblies
- Auburn, WA: Development and testing
- Everett, WA: 777X wings
- Frederickson, WA: Empennages
- Philadelphia, PA: Rotorcraft
- Salt Lake City, UT: Empennages
- St. Louis, MO (2 sites): 777X composites and military aircraft
- Bridgeport, WV: Aurora Flight Sciences personal air vehicle
- Mesa, AZ: Apache helicopter composites and proprietary programs
- Charleston, SC: Fuselages
- Melbourne, Australia: 787 wing and other parts

![AFRA AIRCRAFT FLEET RECYCLING ASSOCIATION]

Boeing is a founding member and strong supporter of the Aircraft Fleet Recycling Association (AFRA).

AFRA is the leading global voice on aircraft retirements. The association accredits companies to its standards for safety and environmental best practices in aircraft disassembly and recycling.

Seeing more of the world
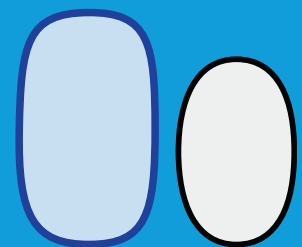
787   A350

Carbon composite material is not only lighter than aluminum, it's stronger. This allows for larger windows on an airplane.

The 787 Dreamliner and Airbus A350 both have carbon composite structures. Boeing designed its windows 40% larger and positioned them higher in the cabin. This gives all passengers a view outside and improves their connection to the sky.

For more information: Amy Bann, Tia Benson Tolle, or Paul McElroy