



SUSTAINABLE  
AEROSPACE  
TOGETHER





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On the cover: Habitat restoration in Seattle; Reginald Douglas at St. Louis paint shop; ecoDemonstrator sustainability test bed; Jacqueline Mercier, Defense Procurement. (Boeing photos)

# President and CEO Message

## Sustainability

Alongside our strong commitment to safety, quality, and integrity, sustainability is tightly woven into the fabric of our values, our culture and our aerospace industry. Aviation is integral to our modern world, touching many sectors of the global economy and enabling personal human connections. That’s why we title our report “Sustainable Aerospace Together.” Each of us has a role to play to ensure we make the world better for future generations.

In this report, you’ll see examples of our collective efforts and partnerships to advance environmental stewardship, human development and inclusion — underpinned by transparency at every level as we strive to make aerospace more sustainable, together.

### Working Together for the Environment

Collaboration with global industry partners, the energy sector, governments, nongovernmental organizations, higher education institutions and other stakeholders to advance sustainable solutions is more necessary than ever. To increase education around the commercial aviation industry’s carbon footprint, and its ambition to reach net-zero carbon emissions by 2050, Boeing created an innovative visual data modeling tool known as Cascade, which you will learn more about in this report. Cascade models the climate impact of the commercial aviation industry and explores paths to decarbonize and reach net zero by 2050.

Within our manufacturing operations, it is not just what we build, but how we build our products. We increasingly look at every stage of the product life cycle through a sustainability lens. Our people have worked hard to reduce our environmental impact by investing in conservation and procuring more renewable electricity.

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# President and CEO Message

## Working Together for Our Employees and Communities

We also continue our focus on providing a transparent, inclusive workplace culture in which teammates' voices are heard and managers are empowered to make meaningful change when necessary. Our latest progress and efforts in 2022 are seen within our **Global Equity, Diversity & Inclusion** report, including an increase in women's representation in our global workforce and racial/ethnic minority representation in the U.S. workforce and connecting incentive compensation to inclusion.

We routinely **encourage use of our Seek, Speak & Listen habits in internal interactions**. Quarterly enterprise culture surveys indicate that a majority of our **teammates are comfortable discussing concerns with managers and feel comfortable telling others at work when they have made an error**. Our goal is to provide a safe environment so that **each employee's voice is heard**.

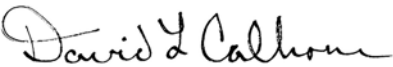
Our employees are also at the heart of our **community work**. Through our global community engagement efforts across

Boeing, we support science, technology, engineering and math (STEM) education initiatives; assist military members, veterans and their families; promote environmental stewardship; advance racial equity; and provide for communities in need — including disaster recovery and relief.

## Transparency at Every Level

We continue to **prioritize safety, quality, integrity and sustainability** every step of the way. Trust is earned one airplane and one interaction at a time. Our leadership team also works closely with the Boeing Board of Directors to help ensure industry standards and ethical practices are followed. Our Board and specifically the Governance & Public Policy Committee provides oversight and holds us accountable to our sustainability policies, practices and strategy.

We are in the era of **more sustainable aerospace**, and together, we look forward to achieving it.



**David L. Calhoun**  
President and CEO

## Our Values

### How We Operate

Start with engineering excellence

Be accountable — from beginning to end

Apply Lean principles — eliminate traveled work

Crush bureaucracy

Reward predictability and stability — everywhere in our business

### How We Act

**Lead on safety, quality, integrity and sustainability**

**Foster a Just Culture grounded in humility, inclusion and transparency**

**Import best leadership practices**

**Earn stakeholder trust and preference**

**Respect one another and advance a global, diverse team**

**Innovate and operate to make the world better**

[Read more about our values](#)



# CSO Message

## Mapping the Sustainable Aerospace Future Together

Decarbonizing aerospace is both the challenge and opportunity of our lifetime. We have long maintained that decarbonizing aerospace will take everything — technology, policy, capital, energy, entrepreneurship — and everyone — employees, customers, financiers, regulators, academics and business partners. For that reason, we just convened global thought leaders and decision-makers from across these communities to review our progress to date and discuss the way forward toward achieving Sustainable Aerospace Together.

Aerospace is more than an industry. We connect people around the globe and promote an understanding of different cultures; we protect through national security and humanitarian relief; we contribute to the global economy with jobs, trade, technology and commerce; and we inspire young minds to seek careers in STEM. Commercial aviation also generates about 2.5% of the world’s carbon emissions and 12% of transport emissions, so we must find ways to further decouple forecasted growth of aerospace from greenhouse gas emissions (GHG) ... and continue to do so safely and transparently.

The engagement was energizing and encouraging as sector leaders leaned into the issues and potential roadblocks that could slow the commercial aviation industry’s progress toward meeting its net-zero 2050 ambition. What struck me was the collective decision in tackling this issue together for the greater good of the industry and humanity at large. It was also a reminder that this hard to abate industry has historically solved hard challenges — from inventing flight to discovering the universe. It’s with humility and resolve that we collectively take on the challenge of more sustainable aerospace.

During the event, we also launched a public version of Cascade, a web-based application that uses public aviation and energy data to visualize how **various approaches might be combined to lower emissions**. It was rewarding to see our partners and stakeholders engage with the tool, and we can’t wait for the global user community to further refine Cascade over time. We invite everyone to check it out at [SustainabilityTogether.aero](https://SustainabilityTogether.aero).

This Sustainable Aerospace Together Forum was a culmination of many activities and events that took place throughout 2022 with the same common theme — together. We made important progress over the past year with valued partners around the globe.

### Together ...

**We launched Cascade.** At the Farnborough International Airshow in July 2022, we announced Cascade and provided a live demonstration of Version 1.0. Cascade was developed to visualize the climate impact of aviation across the world and explore scenarios to most effectively decarbonize commercial aviation by 2050: fleet renewal, operational efficiency, sustainable aviation fuel (SAF) and new aviation technologies such as transonic truss-braced wing structures, hybrid-electric, all-electric or hydrogen airplanes. This tool allows stakeholders across the industry — in particular customers and policymakers — to make informed decisions and trade-offs about how to best reach the commercial aviation industry’s net-zero 2050 ambition. We look forward to the additional feedback from the recent public launch and will continue to invest in Cascade through collaborating with founding members of the Community to include IATA, NASA, University of Cambridge’s Whittle Laboratory and the MIT Laboratory for Aviation and the Environment.



Chris Raymond, Chief Sustainability Officer

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Neil Titchener, Ellen Ebner and Chris Raymond unveil the public version of Cascade during the Sustainable Aerospace Together Forum in Renton. (Boeing photo)



The Sustainable Aerospace Together Forum, presented by Boeing in partnership with the Financial Times, brought together the aviation, energy, finance and policy sectors. (Boeing photo)



Boeing President and CEO Dave Calhoun discusses the importance of working together for a sustainable aerospace future with Boeing communicator Elisa Hahn at the pre-forum reception. (Boeing photo)

**We advanced SAF.** Nearly all industry and governmental decarbonization road maps conclude that SAF is the biggest lever we have to reduce GHG emissions from commercial aviation. Our company is focused on multiple areas to catalyze SAF scaling, including investing in airplane efficiency and compatibility, purchasing SAF for our own fuel use in our operations, engaging global regulators on smart policies, promoting robust sustainability criteria, and investing in Cascade to further industry partnerships and policy advocacy to scale up SAF supply and bring down cost.

We continue to make progress on the technical journey working with our suppliers to ensure our commercial airplanes are 100% SAF compatible by 2030. We are seeing exciting SAF innovation occurring in sustainable feedstocks and partnering on technologies including waste-and-biomass-based SAF, power-and-biomass-to-liquid and power-to-liquid enablers that can make existing and future SAF pathways more sustainable over time.

We purchased 5.6 million gallons (21.2 million liters) of blended SAF to support our commercial operations. The challenge remains scaling SAF availability and lowering its cost. Together, we’ve made important progress this year on building the industry. Governments around the world are unlocking policy mechanisms to scale SAF, including a blending mandate and corresponding offtake requirement in Europe, and incentives such as the Blenders Tax Credit for SAF producers in the U.S. These policies and incentives are beginning to attract necessary capital to scale production.

Finally, the Boeing ecoDemonstrator team partnered with NASA on emissions testing to better understand SAF and contrails.

**We advanced the future of flight.** While SAF is a necessary lever to decarbonize commercial aviation, we have a “SAF and” view and not a “SAF or” approach to achieving the commercial aviation industry’s net zero goal by 2050. Together with partners, we continue to explore the safety and viability of other renewable energy carriers and technologies for aircraft. You’ll read about several of these developments in this report, including our Wisk joint venture’s announcement of the world’s first self-flying, all-electric four-passenger vertical takeoff and landing (eVTOL) air taxi. As Wisk’s go-to-market aircraft, the latest generation of this aircraft represents the first-ever candidate for type certification by the U.S. Federal Aviation Administration of an autonomous eVTOL. We also value our partnerships around the world to advance sustainable technologies, such as the new Boeing Research and Technology center in Japan with a focus on sustainability. We are also honored to be selected by NASA for the Sustainable Flight Demonstrator program, which will inform future designs that could lead to breakthrough aerodynamics and future efficiency gains.

The aforementioned Boeing ecoDemonstrator program embodies our “together” theme and is celebrating its 10-year anniversary this year. The ecoDemonstrator takes promising technologies out of a lab and tests them in operational environments with a variety of partners,

including airline customers, suppliers and regulatory agencies. From the first ecoDemonstrator in 2012 through this year’s effort, the ecoDemonstrator program will have evaluated more than 225 technologies with approximately one-third of those getting implemented. Projects include technologies that reduce fuel use, emissions and noise, enhance safety and incorporate more sustainable materials.

Sustainable Aerospace starts within our four walls and Boeing continues to make progress on our 2025 operational targets as outlined on [Page 53](#).

See [Page 7](#) for a more comprehensive snapshot of our accomplishments last year and [Page 45](#) for an overview of how we partnered around the globe to advance sustainable aerospace together.

Together as an industry, we’ve made modern jet travel a reality, helped defend freedom around the world, and made space exploration possible. We now enter the era of more sustainable aerospace. The foundation we are laying now will be carried forward by future generations to preserve and grow the societal benefits of this industry. We are proud to be on this journey — together — with so many capable and committed partners around the globe.

**Chris Raymond**  
Chief Sustainability Officer



# Sustainable Aerospace Together

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January 2022



Wisk secured \$450 million from Boeing to advance certified autonomous electric flight

February



Purchased 2 million gallons (7.6 million liters) of SAF for Boeing's commercial airplane operations

April



Announced multiyear commitment to Yale Center for Natural Carbon Capture

May



Named ENERGY STAR Partner of the Year

June



Unveiled 2022 ecoDemonstrator, a 777-200ER serving as a test bed for 30 new technologies to help decarbonize aviation

July



Debuted Cascade, a data modeling tool that visualizes how to get to a net-zero carbon emission future for commercial aviation



Boeing and MIT announced research project to help decarbonize aerospace



Became founding member of UK Innovation Hub to drive SAF development



Boeing and Mitsubishi Heavy Industries partnered on innovative climate change solutions



Announced research project with the University of Cambridge to further advance Aviation Impact Accelerator



Boeing and Alder Fuels partnered to scale SAF globally



Debuted future flight concepts at Farnborough Airshow

August



Opened Japan Research Center and expanded sustainability partnerships



Announced as the aviation sector champion in First Movers Coalition, global alliance established by the U.S. government and World Economic Forum

September



Boeing and Wisk unveiled concept of operations for urban air mobility



New Boeing Additive Manufacturing facility in Auburn, Washington, uses 3D printing to produce essential components, reducing waste

October



Wisk unveiled world's first autonomous, four-seat, all-electric, vertical takeoff and landing air taxi



ecoDemonstrator program collaborated with NASA to test SAF emissions



ecoDemonstrator technology testing featured in Aviation Week

November



Partnered with Avolon, an aircraft leasing company, to scale SAF in Ireland

January 2023



Selected for NASA Sustainable Flight Demonstrator award

# Connecting Globally to Advance Sustainable Aerospace



## Americas

**Brazil** — Boeing Sustainability Forum: Boeing celebrated its 90th anniversary in Brazil at an inaugural summit with the Roundtable on Sustainable Materials and Brazilian-American Chamber of Commerce in São Paulo in September.

### U.S.

- Summit of the Americas: Hosted a roundtable on sustainable aviation with IATA as part of Summit of the Americas in Los Angeles in June.
- Decarbonizing Aviation “Everything for Zero”: Hosted an event in Washington, D.C., in November, sharing Boeing’s vision and a Cascade demo with U.S. and non-U.S. policymakers, legislators and think tanks.

## Asia-Pacific

**Australia** — Indo-Pacific Clean Energy Forum: Co-hosted a high-level SAF panel discussion in July in Sydney.

### China

- Peking University Institute of Energy’s Report Launch: Supported the report launch in October, which compiled results of SAF research.
- Boeing participated at the 1st China Civil Aviation Green Development Forum, which was sponsored by CAAC and in the Annual Civil Aircraft Industry International Forum.

**Japan** — Boeing Tokyo Sustainability Summit: Hosted a two-day sustainability summit to celebrate a new research center opening in August.

**Indonesia, Malaysia, Vietnam** — Supported aviation industry forums and workshops with regulators, airlines and academics, sharing key aviation decarbonization priorities and strategies.

### Singapore

- Singapore Airshow: Engaged with key industry and policy stakeholders to advocate for sustainable aviation initiatives and partnerships.
- Singapore Sustainable Air Hub Report: Contributed key sustainability insights as part of international advisory panel established by the Civil Aviation Authority of Singapore.

## Europe

### Belgium

- European Parliament Sustainability Event: Organized a joint event with Ryanair in October, engaging with members of the Parliament, media, industry and EU stakeholders about ongoing policies and regulations that contribute to accelerating SAF supply and use.

- Conference on National Armaments Directors: Joined NATO’s first Industry Symposium on Climate Change and Capabilities, which brought together over 150 representatives from NATO Allies and industry. Participants discussed the military challenges of a climate changed world, navigating the energy transition and the national security opportunities of technologies like SAF.

**Germany** — Berlin Air Show: Briefed media about Boeing’s work to decarbonize both commercial and defense products.

### United Kingdom

- Farnborough Airshow: Unveiled Cascade and announced several sustainability initiatives, including partnerships with University of Sheffield Energy Innovation Centre, Cambridge – Aviation Impact Accelerator, Alder Fuels, Mitsubishi Heavy Industries and MIT. Joined UK Ministry of Defense and industry partners to discuss how sustainability enhances operational effectiveness and resilience.
- Jet Zero Council: Boeing hosted the Council meeting in London in February 2023, showcasing both Boeing’s UK presence and the Cascade modeling tool, which informs future climate policy choices such as UK SAF mandates.

**Republic of Ireland** — Airfinance Journal Dublin: Joined a panel on carbon offsetting and operational strategies for carbon reduction.

## Middle East & North Africa

**United Arab Emirates** — Power-to-Liquid Report Launch: Supported and joined the launch event of the Power-to-Liquid roadmap led by the UAE government in July.

**Egypt** — COP27: Engaged government, industry, civil society partners and local and international media.

**Bahrain** — Energy & Sustainability Forum MENA 2023: Joined panel and discussed opportunities for alternative fuels, rising importance to diversify and build out low-carbon fuels and green chemical industry to create development opportunities.



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# APPROACH & GOVERNANCE

Transparent and Accountable

Boeing global headquarters in Arlington, Virginia campus just outside Washington, D.C. (Boeing photo)



# Company Profile

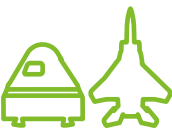
## The Boeing Company

As a leading global aerospace company, Boeing develops, manufactures and services commercial airplanes, defense products and space systems for customers in more than 150 countries. As a top U.S. exporter, the company leverages the talents of a global supplier base to advance economic opportunity, sustainability and community impact. Boeing’s diverse team is committed to innovating for the future, leading with sustainability and cultivating a culture based on the company’s core values of safety, quality and integrity and sustainability. Learn more at [boeing.com](https://www.boeing.com).



### Commercial Airplanes

This business develops, produces and markets commercial jet aircraft, principally to the commercial airline industry worldwide. We are a leading producer of commercial aircraft and offer a family of commercial jetliners designed to meet a broad spectrum of global passenger and cargo requirements of airlines. This family of commercial jet aircraft in production includes the 737 standard-body model and the 767, 777 and 787 widebody models. We ended production of the 747 widebody model in 2022. Development continues on the 777X program and the 737-7 and 737-10 derivatives.



### Defense, Space & Security

This business engages in the research, development, production and modification of manned and unmanned military aircraft and weapons systems for strike, surveillance and mobility, including fighter and trainer aircraft; vertical lift, including rotorcraft and tilt-rotor aircraft; and commercial derivative aircraft, including anti-submarine and tanker aircraft. In addition, this segment engages in the research, development, production and modification of the following products and related services: strategic defense and intelligence systems, including strategic missile and defense systems, command, control, communications, computers, intelligence, surveillance and reconnaissance, cyber and information solutions, intelligence systems, satellite systems, including government and commercial satellites and space exploration.



### Global Services

This business provides services to our commercial and defense customers worldwide. Boeing Global Services sustains aerospace platforms and systems with a full spectrum of products and services, including supply chain and logistics management; engineering, maintenance and modifications; upgrades and conversions; spare parts; pilot and maintenance training systems and services; technical and maintenance documents; and data analytics and digital services.



- \$23B Defense, Space & Security
- \$26B Commercial Airplanes
- \$18B Global Services
- \$0.2B Boeing Capital

- 10-Year Served Market**
- \$2.8T Defense, Space & Security
  - \$3.5T Commercial Airplanes
  - \$3.3T Global Services

- 13% Outside the U.S.**
- 16,961 Defense, Space & Security
  - 41,256 Commercial Airplanes
  - 20,523 Global Services
  - 77,614 Enterprise