University partnerships strengthen sustainability at Boeing

Why it matters: Strong university partnerships are one way Boeing demonstrates that it is looking outside the aerospace industry to give and receive support for research and development and to attract top talent.

Here are some universities partnering with Boeing on sustainability:

- **Yale Center for Natural Carbon Capture:** In April 2022, Boeing pledged $10 million to research efforts in natural carbon sequestration to scale natural solutions to mitigate GHG. The Center's focus is on near-term solutions that can capture approximately one gigaton of CO_2 per year, the equivalent to current annual airline emissions. This approach offers potential co-benefits such as improved soil health and biodiversity conservation.
- **University of Sheffield:** Boeing is the founding member of the Energy Innovation Center (EIC), which is focused on driving SAF development. In early 2023, the EIC was announced as the UK's SAF Clearing House, in partnership with the University of Dayton, reinforcing the critical role this first-of-its-kind facility in the UK will play in the global ecosystem. The EIC builds on Boeing's long-standing relationship with Sheffield, which started with the co-founding of an advanced research center for manufacturing and led to the opening of Boeing's first European manufacturing facility, demonstrating a successful model for university and industry collaboration.
- **University of Cambridge:** In 2023, Boeing is celebrating 20 years of collaboration with the University of Cambridge. Among other research projects, Boeing is partnering with the university's Whittle Lab on its Aviation Impact Accelerator (AIA) to draw from a multidisciplinary range of expertise. AIA develops interactive, evidence-based models, simulations and visualization tools for decision-makers and others to understand low-emissions flight pathways, complementing our own Cascade tool. The AIA tool will help Boeing and interested parties understand how policies, scenarios and technology transitions support the industry's net-zero carbon emissions from commercial aviation by 2050.
- **Cranfield University's Digital Aviation Research and Technology Centre:** This partnership focuses on technologies that are relevant to the operational efficiency pillar of our sustainable aerospace strategy.
- **Villanova University:** The Resilient Innovation through Sustainable Engineering (RISE) Forum advances corporate sustainability by identifying and applying data-driven sustainability solutions. Boeing has access to faculty and graduate students who possess the technical expertise to examine real-world problems by evaluating various technologies or operational innovations through a systems perspective.

What's next: We will continue to partner with academic institutions at the forefront of sustainable aerospace research.

Fossil-Free Future for Aerospace: His Majesty King Charles III visits Cambridge University, when he was Prince of Wales, to see plans for a new Whittle Laboratory building that would act as a hub for the university-led Aviation Impact Accelerator (AIA), of which Boeing is an official industry adviser, focused on accelerating the move toward the commercial aviation industry's climate goals. (University of Cambridge photo)

Alicia Piscitelli. (Boeing photo)

Studying sustainable materials in forestry waste: University partnerships nurture the sustainability talent pipeline, which benefits graduates and the company. Alicia Piscitelli secured a position on Boeing's Research & Technology team after completing three company internships and earning both master's and doctorate degrees from Villanova's sustainable engineering program.

Boeing's circular economy expert and Associate Technical Fellow (see Page 30), Christin Datz, was Piscitelli's master's thesis adviser as she researched ways to advance the sustainable product life cycle. Piscitelli's doctoral research focused on renewable feedstock material for thermoset polymers used in interior aircraft composites. She studied ways to synthesize phenolics with renewable feedstocks derived from pine root oil and forestry waste.

Most recently, she's helping Boeing to find sustainable ways to manage polymers at the end-of-life phase of the sustainable product life cycle.

Boeing partners with decision-makers for sustainable aerospace

Boeing is working with decision-makers and policy institutions globally to create tailor-made paths forward to decarbonize commercial aviation.

Why it matters: The commercial aviation industry's ambition of net-zero carbon emissions by 2050 has multiple levers to work toward meeting this target. SAF is seen as the best solution to accelerate toward this goal as it is a drop-in solution to the aviation ecosystem.

Around the globe: Here's a snapshot of Boeing's global policy partnerships.

- **Americas:** Partnering with International Air Transport Association (IATA), Boeing hosted a SAF Roundtable at the IX Summit of the Americas and asked heads of state to develop sound policies to incentivize the production of SAF across the western hemisphere, highlighting the potential of the region. Boeing also partnered with seven airlines from across the Americas, using nearly 400,000 liters (106,000 gallons) of SAF for commercial flights during the week of the summit, avoiding the release of over 214 tonnes of CO_2.
- **Australia:** SAF will unlock its share of an extra $10 billion each year in GDP, generating 26,000 jobs, while reducing emissions by around 9%. Boeing and Bioenergy Australia hosted a panel at the Prime Minister's Sydney Energy Forum to accelerate the production of SAF, where the Australia Transport Minister announced plans for a Jet Council. Boeing also chaired the SAF Alliance of Australia and New Zealand to make key policy recommendations on scaling SAF.
- **China:** Boeing and Peking University Institute of Energy released a report that compiles results of a yearlong research effort into SAF, the basis of a plan to decarbonize air travel in the world's second-largest commercial aviation market.

Boeing Global Sustainability Policy & Partnerships Vice President Brian Moran (right) is joined by Mohamed Al Ghailani, Boeing's sustainability lead for Middle East, Türkiye and Africa, at COP27, where they engaged with government, industry and civil society partners. (Boeing photo)

- **Europe:** Boeing became a member of the European Commission's Renewable and Low-Carbon Fuels Value Chain Industrial Alliance. As part of the Aviation Working Group, Boeing is partnering with the European policymakers to inform how to scale production and uptake of SAF. In 2022, Boeing also took the lead as Sector Champion for Aviation in the World Economic Forum's First Movers Coalition (FMC), which has assembled 24 of the world's leading companies. All airlines and air transport companies in this sector have set a target to procure 5% of their fuel demand as advanced SAF. The group works to overcome technology barriers and bring forward supply with the intent of striking binding commitments between buyers and sellers.
- **Middle East:** Boeing discussed real-world climate actions at the 2022 COP27 via panels and keynotes with partners and stakeholders, amplifying that the only way to keep 1.5 degrees C alive is through cross-sector partnerships, strategies, regulation and data to keep all parties on track.
- **Singapore:** Boeing joined the International Advisory Panel (IAP) set up by the Civil Aviation Authority of Singapore to develop Singapore Sustainable Air Hub Blueprint by 2023. Boeing provided insight into IAP's report on scaling SAF and improving air traffic management to create a conducive policy framework for the region's busiest aviation hub. Boeing also briefed the Association of Southeast Asian Nations Air Transport Ministers on key strategies for sustainable aviation, encouraging further discussion amongst the member states on accelerating regional cooperation.
- **UK:** Boeing hosted the seventh Jet Zero Council meeting in its offices, presenting its Cascade tool to the Secretary of State for Transport and Secretary of State for Energy and Net Zero. The work of the council is crucial for the UK Jet Zero Strategy. Boeing was appointed co-chair of the Defence Supplier Forum Climate Change and Sustainability Aviation Group with the Royal Air Force. Boeing also leads a NATO group on behalf of the UK focused on accelerating military adoption of SAF to support defence sustainability and energy security.

- **U.S.:** The SAF Grand Challenge engages federal government agencies to develop a comprehensive strategy for scaling up new technologies to produce SAF on a commercial scale from renewable or waste resources. Objectives include: expanding SAF supply and end use; reducing its cost; enhancing its sustainability; supplying at least 3 billion gallons of SAF annually by 2030; and sufficient SAF to meet 100% of aviation fuel demand by 2050, which is projected to be around 35 billion gallons per year.

What's next: Boeing will continue to work closely with governments, customers and decision-makers globally to achieve our shared goal in 2023 and beyond, including:

- Partnering on SAF road maps across the APAC region, including Australia, New Zealand, Southeast Asia and Japan.
- Helping to develop Australian Jet Zero Council.
- Advocating to policymakers, the finance community and suppliers through regional workshops with FMC around the world to build local capacity for SAF supply, enhance demand commitments and unlock commercial challenges.
- Supporting the release of global SAF guidance on future supply and demand issues for buyers and sellers.
- Working closely with the UAE government on shaping sustainable transport agenda at COP28.

Gonzaga University Senior Design students receive the Adient Aerospace Ovation seating; left to right in photo: Hannah Dunn, Micah Donald, Brady Jurgens, Emily Andresen. (Zack Berlat, Gonzaga photo)

Lighter seats lift efficiency

Boeing's Cabin and Interiors and Payloads Engineering teams are finding innovative ways to reduce waste, emissions and weight during the product life cycle for complete customer solutions that promote sustainability. One of those ways involves a group of college students in Spokane, Washington. Boeing and joint venture aircraft seating partner, Adient Aerospace, joined with Gonzaga University's School of Engineering and Applied Science students to support a sustainability-focused research initiative. The students are using Adient Aerospace's Ovation seat prototype to study cabin product design, manufacturing and maintenance to find new approaches to increase sustainability measures.

Gonzaga University senior design students Brady Jurgens, Hannah Dunn, Emily Andresen and Micah Donald study Ovation seat design and structure. (Zack Berlat, Gonzaga photo)

Habitat restoration along the Lower Duwamish Waterway in Seattle. (Boeing photo)

OPERATIONS

Responsible and Resilient

Quality

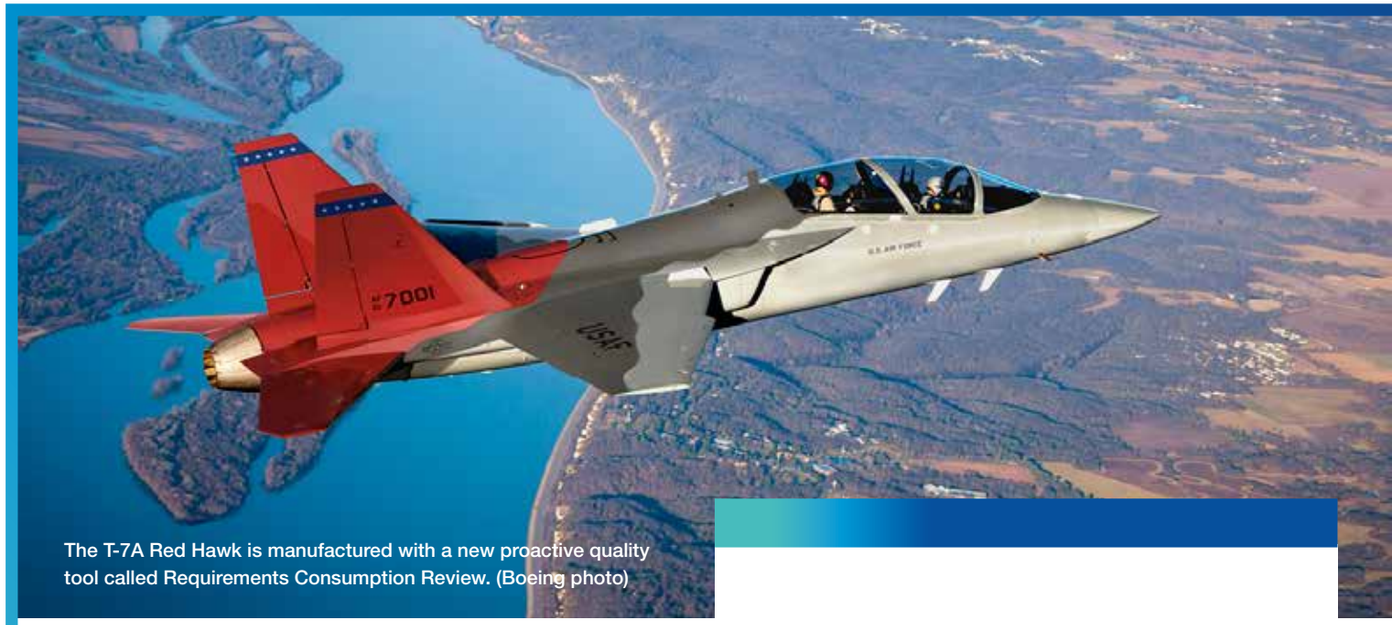
We design quality into every aspect of our business and drive personal accountability to ensure quality in everything we do and in every product we deliver. We promote quality with our people, our culture, metrics and oversight.

The Boeing Quality Management System (QMS) has a foundation in AS9100, which is the internationally recognized and premier aerospace QMS standard. Boeing aims to flow down AS9100 certification and compliance to its suppliers in order to enable effective and efficient processes that meet multiple customer, statutory and business requirements.

QMS and the company's Safety Management System (SMS) work together and are built into the company's organizational structure, policies, processes, procedures and resources. Our customers and our regulators have extremely high expectations of Boeing, and these systems help to operationalize safety and quality in order to meet those expectations.

We incorporate safety and quality metrics into our primary annual incentive structures, further driving our focus across the enterprise at every level of the organization. We operate with four enterprisewide operations councils focused on strengthening quality, manufacturing, supply chain and program management in every program. We deliver quality through a relentless commitment to integrity, safety and sustainability, which is fundamental to our mission.

Learn more about our approach to quality.



The T-7A Red Hawk is manufactured with a new proactive quality tool called Requirements Consumption Review. (Boeing photo)

A sustainable approach to supplier quality success

Boeing is expanding a new proactive quality tool called Requirements Consumption Review (RCR) to ensure suppliers fully understand all requirements prior to building a product — and it's significantly reducing waste and rework down the line to enable first-time quality.

Why it matters: The program is having a positive impact on quality.

- Boeing conducts the review for newly designed products or products that have moved to a new supplier and that may generate a defect, for example, given the part's complexity.
- RCRs have resulted in a 95% first-time quality yield, compared to 60% for similar parts that did not involve the tool.
- First deployed across Boeing's Defense, Space & Security business, RCRs are now being implemented across Commercial Airplanes and Global Services as well.

"When we send a purchase order to a supplier, it can be a detailed process to ensure we receive high-quality products that meet our exacting requirements. This early involvement approach involves a cross-functional team that works proactively with the supplier to go through the purchase order together, including all the critical technical requirements, and establish confidence and clarity from the start. It also demonstrates that we are invested in their success."

Doug Ackerman, vice president of Supplier Quality