

FAMILY PROGRAMMING GUIDE

ABOVE AND BEYONDSM

THE ULTIMATE INTERACTIVE FLIGHT EXHIBITION

PRESENTED BY





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Education resources and programming for ABOVE AND BEYOND are made possible by Boeing in celebration of its centennial and its ongoing commitment to prepare and inspire the next generation to dream, design, and build something better for the next century. Boeing Centennial education collaborative partners include The Documentary Group, WGBH, PBS LearningMedia, Iridescent, and Teaching Channel. The Museum of Flight is an education collaborator.

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I. WELCOME TO ABOVE AND BEYOND!

ABOVE AND BEYOND is a 5,000-square-foot, multisensory, flight and aerospace exhibition that invites visitors to experience what it takes to make the “impossible” possible, in and above the sky. This unique learning opportunity is brought to you by The Boeing Company and developed in collaboration with a host of renowned aviation specialists, aerospace experts, historians, archivists, teachers, and educational programming professionals.



WELCOME TO ABOVE AND BEYOND!

ABOVE AND BEYOND offers direct access to immersive simulations, interactive design challenges, iconic historical touchstones, visionary concepts for the future, and inspiring stories from game-changing innovators past and present.

Looking back at the history of flight, one thing is abundantly clear: The sky was never the limit. From the time humans first got off the ground, the race was on to go above and beyond. Faster . . . farther . . . higher . . . smarter! ABOVE AND BEYOND creates an uplifting and memorable experience that encourages all visitors to aim high and push past the limits in their lives. This exhibition is designed to ignite a passion for humankind's greatest adventure: our journey of flight in the air and space. In doing so, it honors past world-changing innovations in flight while looking ahead to what's next and demonstrating the impact of aerospace in our everyday lives. The exhibition also serves to inspire children and young adults to imagine future careers in aerospace, and support educators in building STEAM awareness and skills among K-12 students.

This Programming Guide summarizes special programs that align with themes and content in the exhibition. These programs are developed as part

of a larger educational initiative made possible by Boeing to commemorate their centennial anniversary. Boeing teamed up with several leading educational partners to cocreate K-12 resources that celebrate the science and engineering behind aerospace innovation and prepare students, families, mentors, and educators with skills for the next century. These resources are readily available to you in support of the learning initiatives in ABOVE AND BEYOND.

Go above and beyond in this communitywide celebration of flight!

II. GO BEYOND: BOEING CENTENNIAL PARTNERS

Boeing teamed up with several leading educational partners to cocreate K-12 resources that celebrate the science and engineering behind aerospace innovation and prepare students, families, mentors, and educators with skills for the next century. These resources are readily available to you in support of the learning initiatives in ABOVE AND BEYOND.

*Learn more about ABOVE AND BEYOND at
www.AboveAndBeyondExhibition.com*

*Please note these complementary resources are included for awareness and consideration. Additional funding may be required to apply these resources and tailor programs to museums and their particular needs.

**CURIOSITY MACHINE:
ENGINEERING DESIGN
CHALLENGES FOR STUDENTS
AND FAMILIES**

**WGBH / PBS LEARNINGMEDIA:
AEROSPACE ENGINEERING
COLLECTION**

**NASA:
"MUSEUM IN A BOX"**



ENGINEERING DESIGN CHALLENGES FOR STUDENTS AND FAMILIES

www.curiositymachine.org

Select a Design Challenge for you and your family, and work together to create fun inventions - using the same process used in the real world - and with live guidance and assistance from real scientists and engineers.

Curiosity Machine is a community of scientists, engineers, children and their families who create, invent, and engineer together. The website is an initiative of the science education nonprofit Iridescent, and hosts design challenges that are open-ended and appropriate for children in grades K-12. With the support of a parent or mentor, even your youngest family members can navigate the Curiosity Machine website. There, they can watch inspirational videos that showcase the work and strategies of Boeing aerospace engineers. The videos are accompanied by a related design challenge for children to build. Children will follow the Engineering Design Process with the support of a trained online mentor who guides and encourages them to persist through failure and bring their ideas to reality. The website guides children through the engineering design process, encouraging them to document their building steps using videos and pictures.

The activities on Curiosity Machine are appropriate for on-site programs and events for children and families. Families work together using simple, low-cost materials to complete design challenges and master key concepts based on current engineering research and work. These challenges are ideal for family fun days, summer STEM camps, after-school engineering clubs, and Scout sleepovers.

Using this online resource:

- *Students and families watch an inspiring video featuring a scientist or engineer explaining a concept they apply in their real work every day.*
- *Students and families explore an open-ended aerospace design challenge related to the scientific topics covered in the video presented.*
- *Students follow the engineering design process—Inspiration, Planning, Build-Test-Redesign, and Reflection—while working through each challenge.*
- *Students plan, build, test, and redesign their solution to the*

challenge, uploading videos, pictures and/or text demonstrating their inventions.

- *Mentors provide one-on-one feedback to students and their families throughout their process of designing, building, and inventing solutions.*

In collaboration with Iridescent, Boeing engineers and scientists have helped to create hands-on design challenges based on the work they do every day as aerospace innovators. Try them all!

**TO GET STARTED, GO TO
WWW.CURIOSITYMACHINE.ORG.**



NOTE: Check the site often, as projects are updated and new challenges are added.

AEROSPACE

- **Deploy a Satellite:** Build a satellite with a 6-inch-square body that can deploy its own solar wings and antennae, and can fit inside a 9-inch-diameter tube.
- **Build a Plane Powered by Stored Energy:** Build a plane that is powered by stored energy from a rubber band, balloon, or spring. The plane should be able to fly straight for 5 feet.
- **Make a Wave Machine:** Make a device that will carry a wave and record the wave's movement.
- **Engineer an Air-Powered Spinning Machine:** Build an air-powered spinning machine inspired by the Boeing CST-100.

Visit the Curiosity Machine often to find more than 20 new Boeing-inspired challenges that will be added during the next year.

Check out these additional aerospace-related challenges you can also find on the Curiosity Machine (you'll need to register if new user):

- **Engineer a Balloon Helicopter:** Build a balloon helicopter that can fly at least 3 feet from the ground. <https://www.curiositymachine.org/challenges/45/>
- **Design a Powerful Bird Wing:** Design and build a powerful bird wing that can spin you around in an office chair when you flap it. <https://www.curiositymachine.org/challenges/22/>
- **Control a Microraptor's Flight:** Make a microraptor and then control its flight with attached strings. <https://www.curiositymachine.org/challenges/64/>
- **Engineer a Landing Device:** Build a device that will slow down your payload as it falls so it lands gently when dropped from 8 feet high. <https://www.curiositymachine.org/challenges/13/>

WGBH/PBS LEARNINGMEDIA: AEROSPACE ENGINEERING COLLECTION

DOCUMENTARY FILM SERIES

THE AGE OF AEROSPACE

[Coming Soon]

Driven by the galloping pace of technological innovation, the last 100 years have seen more changes in the way we live than any previous century in human history. There has been no greater driver of this transformation than the cascade of invention inspired by the Wright Brothers that brought us air travel, the Jet Age, space exploration, and satellites—man-made celestial bodies orbiting the earth—

that literally affect almost every moment of our lives.

The Age of Aerospace is a multipart documentary series that tells the story of how this happened through the lens of an aerospace giant, The Boeing Company, which today is the largest aerospace company in the world, having acquired or merged with many of the most important

aerospace companies of the last century: McDonnell, Douglas, North American Aviation, Rockwell, Piasecki/Vertol, and Hughes Satellite Systems. The story of these companies is the story of men and women whose intelligence and imagination were focused on engineering the future and thereby transforming our lives.

DOCUMENTARY SERIES EDUCATIONAL CONTENT

AEROSPACE ENGINEERING

Collection on PBS LearningMedia™

www.pbslearningmedia.org/collection/aeroeng/

In addition to the documentary series, the producers of *The Age of Aerospace*, The Documentary Group, have partnered with WGBH Boston to create a suite of educational resources that will be distributed on PBS's educational service, PBS LearningMedia. Using video and interactive media, these resources will give students a window into what it takes to make something fly, the scientific concepts that make flight possible, and the history of aviation, while introducing them to some of the people who build the machines

that take us into the sky. These resources support the middle and high school Engineering Design ideas and practices of the Next Generation Science Standards and state standards.

Mini-documentary: A 3- to 5-minute excerpt from an episode of the documentary series that exhibits a major milestone or theme of aerospace engineering. Mini-documentaries are surrounded by essays, relevant primary sources, additional media, and links to related resources on PBS LearningMedia, all of which allow students to further explore concepts and themes

discussed in the videos.

Interactive: A student-guided interactive examination of major ideas of aerospace. These resources allow students to explore a subject at their own pace and through their own path. In one interactive, experience the engineering design process as an aerospace engineer assigned



to design and test an airplane. In the other, immerse yourself in five illustrated scenes, each depicting an era of passenger flight, and explore the changes that have occurred in passenger air travel since the dawn of commercial aviation, in an interactive graphic timeline.

Exploration: A multimedia presentation of specific concepts of aerospace and relevant physics. These resources use short videos, images, graphics, and text to guide students through concepts from various perspectives.

The screenshot shows the PBS LearningMedia interface. At the top, there's a search bar and a 'BROWSE BY OPTIONS' dropdown. Below that, a navigation menu includes 'DASHBOARD', 'Favorites, Profile, Tools', and '100 mi'. The main content area features a 'Challenge of Flight' resource with a 5-star rating and a description: 'Examine the physical forces that act on a plane in flight, the motions a pilot controls, and the design process engineers follow to develop planes that meet a business mission and manage these flight conditions. In this interactive produced by WGBH and The Documentary Group, the first part of the interactive uses videos, still images, and diagrams to explain the four forces of flight (lift, thrust, drag, and weight) and the three motions a plane experiences in flight (roll, pitch, and yaw). The second part explores the four primary steps of the design process and the tasks today's aerospace engineers use in their work.' Below the description is a grid of interactive elements: 'Introduction', 'LAUNCH', 'Controls', 'Design', 'History', and '21st Century Skills'. There are also sections for 'Support Materials' and 'You might also like', which includes a 'Background Essay' and several video thumbnails.

Profiles: Videos that show students how aerospace engineers work and think by hearing from



engineers themselves. Each profile features an engineer from across the aerospace industry, from satellites to commercial airplanes to the next rocket to Mars, talking about his or her experience as an engineer. By meeting working aerospace engineers, students will learn what it takes to build something that flies, from the people who actually make it happen.

About PBS LearningMedia:

PBS LearningMedia (www.pbslearningmedia.org), a partnership of PBS and WGBH, provides Pre-K–12 educators with access to free digital content for their classrooms, designed to improve teacher effectiveness and student achievement. The service offers more than 100,000 standards-aligned digital resources from 205 trusted media partners. Currently, 1.7 million educators have registered access to PBS LearningMedia content. PBS LearningMedia is offered locally by 155 PBS licensees, representing 356 stations in 55 U.S. states and territories.

Partners:



The Documentary Group produces work based on a very simple principle: have faith in the intelligence, taste, curiosity and integrity of the audience. The Documentary Group was founded in 2006 by the core members of PJ Productions following the death of legendary

broadcaster Peter Jennings. The producers and directors, who were for many years the team behind Jennings' documentaries at ABC News, are dedicated to continuing the tradition of smart and innovative filmmaking while enthusiastically embracing the modern and expanding media landscape. An independent production company, with offices in New York and Los Angeles, The DocGroup produces long-form and short-form films for the major commercial networks, public television, and cable, as well as for the educational market, digital distribution and theatrical release. <http://thedocumentarygroup.com/>



WGBH Boston is America's preeminent public broadcaster and a major contributor to PBS LearningMedia, which was built using WGBH's digital resource website Teachers' Domain as a foundation. WGBH is the largest producer of PBS content for TV and the Web, including *Frontline*, *Nova*, *American Experience*, *Arthur*, and *Curious George*. WGBH also is a major source of programs for public radio (producing PRI's *The World*®) and a pioneer in technologies and services that make media accessible to hearing and visually impaired audiences. Find more information at wgbh.org

NASA: "MUSEUM IN A BOX"

www.aeronautics.nasa.gov/mib.htm

The "Museum in a Box" program brings the physical sciences of flight to kids of all ages. These self-contained activities provide hands-on/minds-on lessons with an aeronautics theme to inspire future scientists, mathematicians, and engineers.

This group of exercises provided by NASA offer a variety of ways your family can explore the themes in ABOVE AND BEYOND together.

NOTE: Please check the supply list for each activity. All materials must be provided by the user.

The following activities, listed with their recommended age levels, are available to download from www.aeronautics.nasa.gov/mib.htm

DRESSING FOR ALTITUDE

Why Do We Really Need Pressure Suits? (5-12)

HISTORY OF FLIGHT

Designing an Aeronautics Museum Gallery (5-12), First Flyers (PK-4), If These Airplanes Could Talk (5-12)

PARTS OF AN AIRPLANE

Getting on an Airplane (K-2), Parts of an Airplane (K-4, 5-8, & 9-12)

PRINCIPLES OF FLIGHT

Axes/Control Surfaces (K-4 & 5-12), Bernoulli's Principle (K-4 & 5-12), Foam Wing (K-12), Four Forces (K-4 & 5-12), Kites (K-4 & 5-12), Principles of Flight in Action (9-12)

STRUCTURES AND MATERIALS

Composites (K-12), Space Shuttle Tiles (2-4, 5-8, & 9-12), Space Shuttle Tires (K-4 & 5-12), Space Shuttle Tires Supplemental Lessons (K-12)

PROPULSION

Ball Launcher (5-12), Rockets Away (K-12), Wind Power (9-12)

FUTURE FLIGHT

Aerolab (5-12), Fuel Cell Activity (5-12), Solar Power (5-12)

CAREERS IN AERONAUTICS

Careers in Aeronautics (5-12)

AIRSPACE

Contrails (K-12), Noise: Good Vibrations (K-8 & 9-12), Noise: Quieting the Popper (5-12), Noise: Seeing Sound (K-8), Noise: Speed of Sound (9-12), Pollution: Making Oxygen and Carbon Dioxide (K-12), Weather to Fly By (K-8)

III. AEROSPACE CAREERS

The Above and Beyond exhibition is intended to spark curiosity about the topics explored during a visit and ignite interest in pursuing studies and careers that bring the wonders of flight and space exploration to fruition. As students consider a future in aerospace, examples of exciting jobs and career areas abound across the industry, in academia, and with government partners. Boeing, which contributed to the development of Above and Beyond, is a leading example of the variety of careers available for students interested in seeing the many applications of studies in science, technology, engineering, and math.

EXPLORING CAREERS IN AEROSPACE

There are people out there who do amazing things. How amazing you ask? They build passenger airplanes, military fighter jets and helicopters, satellites, and space transportation systems. For more than 100 years, they've defined and redefined aerospace. They work in Aerospace. And they work at Boeing.

WHAT'S AN AEROSPACE CAREER?

At Boeing, it could mean just about anything. But you can count on it to be exciting. Yes, they have rocket scientists. But they also have chemists. And engineers. And accountants. And mechanics. And mathematicians. And cyber security experts. And just about any other job you can think of.

Every day, they all put their heads together to design and build technologies and products we use every day. The next time you're outside, look up. If you see an airplane, odds are it's made by Boeing. And the company continues to expand beyond aerospace into other advanced technology fields.

RECOMMENDED VIDEOS

Who We Are: In The Words of Boeing Employees (Runtime 03:46)

<https://www.youtube.com/watch?v=gdu05M3LnPY>

Inside look: Boeing engineers are making an impact on the future of space (Runtime 00:42)

<https://www.youtube.com/watch?v=iwinwk3ZhWg>

Inside look: Learn how Boeing is building the world's biggest rocket (Runtime 01:04)

<https://www.youtube.com/watch?v=sI-tjy2ePs>

So, what do you think? Pretty impressive, right? If you want to do something incredible, something that no one else has ever done, something that can, and will, change the world – think about a career with Boeing. We do more than dream about the future. We're building it right now.

To learn how Boeing is preparing and inspiring the next generation of innovators, visit: www.boeing.com/principles/education.page

Other links:

For information on Internships and careers at Boeing, visit: www.boeing.com/careers/college/index.page

To see what type of jobs are being offered, visit: <http://jobs-boeing.com/>

Boeing global locations can be viewed here: <http://www.boeing.com/global/>