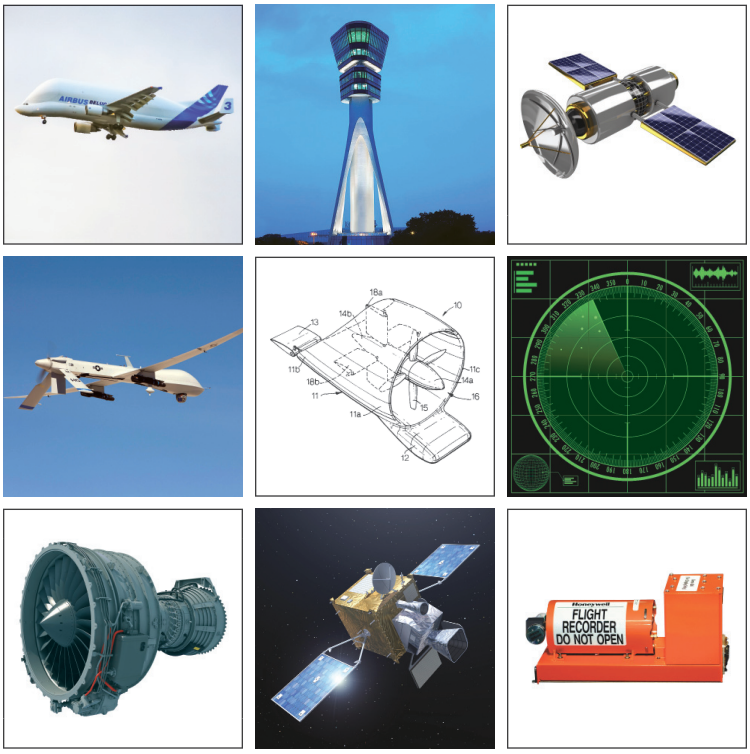
SREB | High Schools That Work

Advanced Career

# Aerospace Engineering Curriculum




## College or Career?...Why Not Both?

# *Advanced Career combines college-ready academics with authentic, hands-on projects.*


Schools are challenged to better prepare students for a wide array of postsecondary options. The workforce of today and tomorrow demands a higher level of skill — people who grasp complex problems, understand technology and troubleshoot problems.

Advanced Career (AC) answers both of these needs. By fusing a rigorous academic core with challenging project work and advanced technology in a career pathway program of study, AC courses give students a greater depth of knowledge and skills and prepare them for more options after high school.

## Advanced Career provides:

- ready-to-implement AC course work for students
- comprehensive training for teachers
- access to tools and technology for project-based learning
- end-of-course assessments
- opportunity for industry certification and/or dual credit

# Aerospace Engineering

How can planes become faster, more economically feasible and environmentally friendly? How can we adapt the technology we use in outer space to explore unknown territory on the ocean floor? The aerospace engineering field is poised to answer such questions. Current top trends include a focus on systems software that can increase communication with ground control, resulting in slightly shorter flight times and 100 gallons less fuel per flight; using centrally located communication systems in space that allow communications between passenger planes; better data-handling systems that result in meaningful data to inform decisions; a flying commuter system and vehicles resulting in a new traffic system; and aerospace engineering programs that evolve from a hardware-based science to systems-based science.[1]

Private and public sectors have partnered to leverage their technologies in new ways to solve problems in areas of need. For example, they are testing a new aircraft body design that will result in engine noise reduction and fuel efficiency.[2]

This program will equip students with the knowledge and skills to be successful in both college and the global workforce. Careers include systems, design, structural analysis, software and aerospace engineers; lab, avionics and radar technicians; materials planners; technical writers; air traffic controllers; pilots; drone designers; inspectors; and aircraft and airframe mechanics.

In this four-course AC curriculum, students will explore the designing, building, testing and analyzing science behind the forces and physical properties of planes, rockets and unmanned vehicles. They will utilize tools such as Excel, LabVIEW and sensing systems to collect and analyze data. In addition, students will work collaboratively, manage projects, be creative and innovative, think critically, and solve problems as well as propose solutions to design problems. Further, they will learn to apply literacy, mathematics and science concepts and use technology to effectively solve real-world, challenging problems with business and industry partners. Through project-based learning, students will explore the future of the aerospace industry and learn to apply those habits of behavior and mind unique to the field.

Students completing the program may become a Certified LabVIEW Associate Developer and may be prepared for earning other relevant industry certifications.

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*Aerospace Engineering was developed by SREB and Alabama as a part of a multi-state consortium to improve career and technical education in this country.*

For more information about other Advanced Career curricula, visit sreb.org/AC.

# Advanced Career
# Aerospace Engineering Curriculum

Aerospace Engineering will appeal to students who are curious about the design and flight of aircraft and spacecraft vehicles.

## Course 1:
### Fundamentals of Aerospace Technology

This project-based learning course engages students who are curious about aviation and aerospace careers. This course will introduce students to an engineering design process, tools to collect and analyze data, the science of aviation, materials and structures, and safety. Students will participate in real-world experiences such as designing, building and testing a pilot seat, kite, straw rocket and launcher, motor-powered rocket and a model glider.

## Course 2:
### Advanced Aerospace Technology

This course builds on the foundation of Course 1 and engages students in applying the design process, using tools to collect and analyze data, exploring a deeper level of the science of aviation and discovering how quality control systems work in the aviation field. Students will work collaboratively in teams to design, build and test a wing; plot a course for a plane to take off and land; design, build and test a wing attachment system; test materials under stress; and design, build and test an electric-powered plane. Students will demonstrate their newly acquired knowledge and skills by presenting their innovative ideas, techniques and solutions to business and industry partners.

## Course 3:
### Aeronautics Engineering Applications

This project-based learning course is for students who have successfully completed Courses 1 and 2. Students will learn about systems such as flight control, remote-control vehicles and the virtual world. Students will learn to fly using flight simulators. They will work collaboratively to propose a shift from a VOR navigation system to a GPS system and determine the cost savings. In addition, students will develop rotor blades for helicopters and design and program an unmanned flying vehicle.

## Course 4:
### Astronautics Engineering Applications

Students in this capstone course will focus on outer space and underwater applications. During the six projects, they will work collaboratively to design, build and test a laser communication system; develop a plan for space survivability in hostile environments; and utilize software to create a three-dimensional model of a satellite orbit and a team remote vehicle for underwater exploration. Depending on articulation agreements or state policy, students who successfully complete the course may be able to earn dual credit.

1 https://www.asme.org/engineering-topics/articles/aerospace-defense/top-5-aerospace-trends-now-future. American Society of Mechanical Engineers. Retrieved November 22, 2013.

2 http://www.dailymail.co.uk/sciencetech/article-2185304/NASA-Boeing-successfully-test-triangle-airplane.html. Daily Mail Online. Retrieved November 22, 2013.

# Key Features of Advanced Career

## Fully Developed Pathway Programs

Advanced Career (AC) encompasses a coherent sequence of four ready-to-implement courses; comprehensive training for teachers; access to tools and technology for project-based learning; and end-of-course assessments. To ensure fidelity from site to site, each course has a syllabus that includes instructional philosophy, instructional delivery and support systems, assessment and a recommended grading system.

## Advanced Career Programs of Study

Each AC program of study (POS) is a progression of non-duplicative courses joined with a college-ready academic core and aligned from high school to postsecondary studies. The integration of academic and technical content in each POS prepares students for more options after high school graduation, offers opportunity for dual credit and leads to an industry-recognized credential, advanced training, or an associate's or bachelor's degree. The high-skill, high-wage career fields represented among the AC programs of study are important to the economy.

## Project-Based Learning

Each course is designed around project-based units — featuring essential questions, project descriptions, authentic roles and tasks that require students to utilize an industry-recognized decision-making process. Assignments in AC courses encompass essential elements of good project-based learning to engage students in an extended process of asking questions, using resources and developing answers. Students collaborate and work in teams and develop important 21st-century skills.

## Blended Learning Experiences

AC course work creates rigorous blended learning experiences for all students. Students apply their academic and technical skills to real-world projects in ways that advance their literacy, math, science and technical knowledge and skills, and strengthen their habits of behavior and mind for success.

## Technology and Software

Students employ industry-standard data acquisition hardware and software systems to complete authentic tasks simulating the work of professionals in the field.

## Assessments

Each project unit includes formative and summative assessments. Each course has an end-of-course assessment that measures both academic and technical achievement with the performance level needed for jobs, advanced training and postsecondary credit-bearing courses. In addition, students and teachers complete surveys about what works or does not work in the AC course. This serves to inform continuous improvement of the AC program.

## Counseling for Careers

Student and parent orientation to each AC program of study highlights the career field, including requirements for jobs and postsecondary study in the career field. Each AC course has a career and education exploratory component. Counselors trained to support the AC program will assist students in developing a career and education plan aligned with students' goals and aspirations.

## Teacher Selection, Professional Development and Support

Teachers are selected who have strong math skills and experience in the pathway career field. Staff development is essential and includes an intensive two-week summer institute for teachers to prepare them to teach each course and to use a project-based approach. They will perform students' assignments and use the tools developed by national industry partners. A support team including the principal, counselor and academic teachers in literacy, math and science learn how to support AC teachers and students in course implementation.

## Dual Credit and Industry Certification

Courses three and four in the AC program offer the potential for dual credit when a state or district has an established process for approving such courses. Each AC program of study also offers opportunities for industry certification for students who complete the program.

## Collaboration and Partnerships

Ongoing relationships among education, business and other stakeholders are central to AC pathway programs. Representatives from industry and postsecondary institutions have helped shape the curriculum design and technical content. Serving as an expert panel, they have collaborated with secondary educators and state education agency staff to identify authentic learning experiences for students that can lead to additional opportunities after high school. Organizations represented in the development of the Aerospace Engineering Pathway Program include:

Alabama Department of Education
Airbus
ASRC Federal Analytical Services, Inc.
Auburn University
Autauga County Technology Center
Bevill State Community College
Civil Air Patrol
Georgia Institute of Technology
GKN Aerospace Alabama Fuel Systems
Lockheed Martin
Missile Defense Agency
NASA Marshall Space Flight Center
National Instruments
Paris Educational Consulting
Southern Regional Education Board
Trenholm State Technical College
Tuskegee University
University of Montevallo