Section 601 Youth in Aviation Student Outreach Report

U.S. Department of Transportation (DOT)

Federal Aviation Administration (FAA)

Response to U.S. Congress

FAA Reauthorization Bill of 2018

Public Law 115-254

Section 601

Youth in Aviation Student Outreach Report

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1. Section 601 of FAA Reauthorization Act of 2018

Below is the language of Section 601 of FAA Reauthorization Act of 2018, Public Law (P.L.) 115-254, which directs the FAA to develop the attached Youth in Aviation Student Outreach Report:

FAA Reauthorization Act of 2018

Public Law 115-254

TITLE VI – Aviation Workforce

Subtitle A – Youth in Aviation

Sec. 601. STUDENT OUTREACH REPORT

Not later than 180 days after the date of enactment of this Act, the Administrator of the Federal Aviation Administration shall submit to the appropriate committees of Congress a report that describes the Administration's existing outreach efforts, such as the STEM Aviation and Space Education Outreach Program, to elementary and secondary students who are interested in careers in science, technology, engineering, art, and mathematics –

(1) to prepare and inspire such students for aviation and aeronautical careers; and
(2) to mitigate an anticipated shortage of pilots and other aviation professionals.

2. Executive Summary

The U.S. has the largest, most complex, and safest aviation system in the world. Civil aviation is a major contributor to the U.S. economy, representing a significant portion of U.S. Gross Domestic Product (GDP).[1] New technologies fuel the growth of the aviation industry and help keep America's skies safe. As the civil aviation industry expands, the demand for qualified aviation professionals increases. However, fewer students are choosing to enter the workforce pipeline.

The aviation industry anticipates a significant shortage of pilots, maintenance technicians, and aviation professionals over the next twenty years. The industry recognizes the need to address these shortages through a comprehensive approach and dedicated effort to build the pipeline of young professionals with the right skills, abilities, and interest in the aviation careers.[2]

The U.S. Congress, the White House, and the Government Accountability Office (GAO) emphasize the need to address the skills gap and workforce shortages through science, technology, engineering, and mathematics (STEM)-related sections and reports, including:

- The FAA Reauthorization Act of 2018, P.L. 115-254;
- The White House 2018 STEM Strategy and Goals for America; and
- The GAO Reports on STEM Education and Aviation Workforce.

The FAA is committed to partnering with industry, non-profits, and educational institutions to enhance education pathways and build the pipeline of qualified aviation professionals. The FAA's recently-established Aviation Workforce Steering Committee will study the current challenges from the perspective of pipelines, pathways, and partnerships to identify concrete actions that can be taken to have an impact on the aviation workforce challenge.[3]

The FAA supports multiple initiatives that help educators build STEM competencies and technical knowledge among today's youth and propel the interest in aviation. Many efforts focus on underrepresented populations to encourage minorities, women, and people with disabilities and increase their representation in the industry. The FAA provides training to employees interested in acting as STEM Aviation and Space Education (AVSED) Outreach Representatives to inform, educate, and engage elementary through high school students across the country. The FAA expanded its reach by targeting a 20 percent increase in the number of Outreach Representatives in FY 2019 and a 50 percent increase in the number of outreach events to drive youth participation in national, regional, and local STEM AVSED events. Additionally, the FAA partners with the Department of Education on several STEM activities, as well as other government agencies and organizations, including NASA, the Department of Labor, and the Department of Defense.

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[1] *The Economic Impact of Civil Aviation on the U.S. Economy, FAA, September 2017.*
[2] *The Aviation Workforce of Tomorrow: Where Are They Needed and Where Will They Come From, Transportation Research Board, August 2016.*
[3] *Aviation Workforce Steering Committee Charter, 2019.*

3. Background

Civil aviation is a major contributor to the U.S. economy, representing 5.1 percent of U.S. Gross Domestic Product, supporting approximately 10.6 million jobs, and contributing $1.6 trillion to the economy.[4] As the U.S. civil aviation industry expands, the need for qualified aviation professionals increases. The anticipated growth in aviation careers has an inverse projection among high school and college aged demographics. The total number of 16 to 24-year olds is projected to decline by 1.3 percent by 2024.[5]

Requirements for pilot licenses, certifications, training, and experience necessary for aviation occupations have compounded the challenge of attracting, hiring, and retaining a robust aviation workforce. According to the GAO, fewer students have been entering and completing pilot training since 2001.[6] The number of completions of undergraduate professional pilot-degree programs – those most likely to pursue a career as an airline pilot – has decreased by 23 percent from academic years 2000-2001 through 2011-2012[7]. The need for cybersecurity experts, systems engineers, aerospace engineers, and other engineering professionals critical to the future of the aviation system continue to grow. The U.S. Bureau of Labor Statistics estimates at least an 8 percent growth in demand for engineering professionals over the next 10 years,[8] further underlining the need for STEM education.

Addressing this aviation workforce challenge is a high priority for the FAA, aviation stakeholders, and the nation. The White House, the U.S. Congress, and the GAO recognize the severity of the challenge and the need to enhance and improve STEM education:

- In July 2018, the White House established the National Council for American Workforce to build strong foundations for STEM literacy, increasing diversity, equity, and inclusion, and preparing youth and adults for the jobs of today and of the future.[9]
- In December 2018, the White House published a five-year strategic plan which included strategic goals for enhancing STEM, such as:[10]
    - Building strong foundations for STEM literacy;
    - Increasing diversity, equity, and inclusion in STEM; and
    - Preparing the STEM workforce for the future.

[4] *The Economic Impact of Civil Aviation on the U.S. Economy, Federal Aviation Administration (FAA), September 2017.*
[5] *The Aviation Workforce of Tomorrow: Where Are They Needed and Where Will They Come From, Transportation Research Board, August 2016.*
[6] *GAO Report: Aviation Workforce: Current and Future Availability of Airline Pilots, February 2014.*
[7] *GAO Report: Aviation Workforce: Current and Future Availability of Airline Pilots, February 2014.*
[8] *Bureau of Labor Statistics: Engineers: Employment, Pay, and Outlook.*
[9] *Executive Order Establishing President's National Council for the American Worker, White House, July 19, 2018.*
[10] *Charting a Course for Success: America's Strategy for STEM Education, White House, December 2018.*

- In October 2018, the U.S. Congress included several STEM-related sections in the FAA Reauthorization Act of 2018 to spotlight the aviation workforce challenges and create strategies for promoting youth and women access to aviation.[11]
- The GAO developed a report on STEM education and published results of an aviation workforce study, highlighting the need for between 1,900 and 4,500 more pilots per year, on average, to meet demand over the next decade.[12]

In addition, the GAO found that while the federal investment in STEM education programs remained relatively stable from FY 2010 to FY 2016, the number of programs declined from 209 to 163. The GAO reported that the federal government officials from 13 agencies were spending approximately $2.9 billion on 163 STEM education programs in FY 2016.[13] Agency budgets ranged from $14,000 to hundreds of millions of dollars per year in support to various STEM efforts.

a. Projected Aviation and Aerospace Workforce Shortages

Economic projections show that the need for qualified aviation and aeronautical professionals will continue to grow over the next twenty years.[14] Fewer employees enter the industry pipeline, exacerbating the shortage of airline pilots, maintenance technicians, and UAS professionals.

Figure 1: Projected Aviation Workforce Shortages over the Next 20 Years

Industry	Job Function	Employee Shortage[15]
Aviation and Aeronautics	Commercial Airline Pilots	637,000
Aviation and Aeronautics	Maintenance Technicians	648,000
Aviation and Government	Unmanned Aircraft Systems (UAS)	300,000

Forecasts drawn from Boeing reports and FAA reports, conducted by McKinsey & Company

b. STEM Readiness Challenges

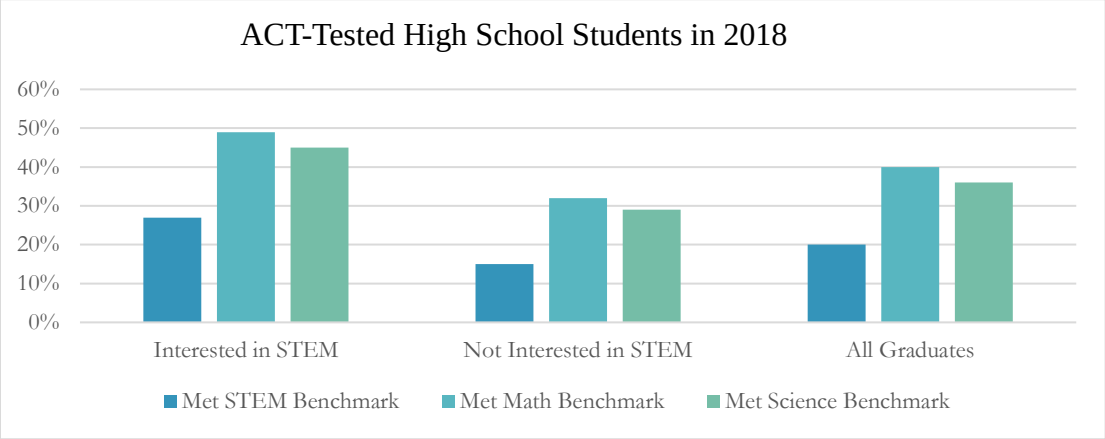
Inadequate preparation in K-12 math and science education results in fewer American students advancing into STEM careers.[16] Moreover, there is a large gap in achievement, interest, and participation among certain groups: women, minorities, and people with disabilities are underrepresented in many STEM fields, including aviation. This limits their ability to pursue many

[11] *Public Law (P.L) 115-254, House of Representatives (H.R.) Bill 302, 115th U.S. Congress, October 5, 2018.*
[12] *Aviation Workforce: Current and Future Availability of Airline Pilots, GAO, February 2014.*
[13] *STEM Education: Actions Needed to Better Assess the Federal Investment, GAO, March 2018.*
[14] *FAA Aerospace Forecast Fiscal Years 2018-2038, March 2018.*
[15] *Boeing 2018 Pilot & Technician Outlook Report, July 2018; McKinsey & Company FAA reports on Commercial Airline Workforce Study, Aviation Maintenance Technician Workforce Study, & Aviation Maintenance Workforce Study, 2018.*
[16] *Charting a Course for Success: America's Strategy for Stem Education, White House, December 2018.*

well-paid, high-growth jobs and deprives the aviation industry of the full benefit of diverse talents and perspectives.[17]

In 2018, less than 20 percent of high school students met American College Readiness Test (ACT) benchmarks for science and math, indicating STEM aptitude – an important building block of success in aviation industry. Less than 50 percent of ACT-tested students indicated interest in STEM careers. Combined, these factors point to a complex challenge that needs to be addressed.

Figure 2: Student Interest in STEM and Readiness Benchmarks[18]



c. Addressing Aviation Industry Workforce Challenges

With the aviation industry poised for growth, and the aviation and aerospace sectors playing key roles in the U.S. economy, preparing students for careers and ensuring a strong aviation workforce pipeline is of high importance to the FAA.

The FAA established its STEM Aviation and Space Education Program in 1961 to address the industry needs and prepare the next generation of skilled professionals for careers in aviation and aerospace. The FAA has assigned a National STEM AVSED Program Lead to oversee the efforts focused on coordinating with industry partners, preparing students, training educators, and supporting institutions with an established infrastructure to reach children and young adults.

Today, several parts of the FAA are engaged in STEM outreach, including the Air Traffic Organization, the Office of Aviation Safety, NextGen, the Office of Commercial Space, the Office of Airports, the Office of Civil Rights, the Office of Human Resource Management, and the Office of National Engagement and Regional Administration, among others. The FAA trains its employees to represent the agency and drive aviation and STEM-focused education in their

[17] *Prepare and Inspire: K-12 Education in STEM for American's Future, National Science Foundation (NSF), September 2010.*
[18] *STEM Cohort ACT: National 2018 Report: The Condition of College and Career Readiness.*

communities. Hundreds of FAA-trained Outreach Representatives dedicate their time and energy to encourage American youth to consider careers in aviation and aerospace industries.

The FAA collaborates with partners across the country to spur interest in aviation industry careers for thousands of elementary, middle, and high school students at local, regional, and national levels. It also drives STEM initiatives for technical, community, and undergraduate college programs. The focus of this report is on elementary, middle, and high school student outreach, per the legislative requirement outlined in Section 601 of the FAA Reauthorization Act of 2018.[19]

4. The FAA's STEM AVSED Program

Addressing this aviation workforce challenge is a high priority for the FAA. The agency's STEM AVSED Program ensures ongoing awareness and alignment with FAA strategic goals and priorities as well as industry stakeholder needs.

a. Mission

The FAA's STEM AVSED Program mission is to inspire youth to pursue careers in aviation, using STEM programs to fill the pipeline of skilled aviation professionals. The FAA works with industry partners, non-profit organizations, associations, other government agencies and organizations, and educational institutions to accomplish this mission.

b. Guiding Principles and Resources

The following principles guide the FAA's STEM AVSED Program: prioritization, communication, and collaboration. The FAA leverages existing programs and efforts to accomplish this, maximizing the impact of limited resources. The FAA prioritizes efforts that cater to a diverse range of students, with special focus on reaching disadvantaged and minority communities, and historically underrepresented populations. The FAA proactively communicates with key stakeholders, including aviation industry, academia, and federal agencies.

Collaboration with external organizations, including educational institutions, non-profits, associations, and industry partners, is an important aspect of the FAA's STEM AVSED Program. Industry partnerships help expand program reach, increase public awareness, and enhance student access to the various programs offered throughout the country. Using an established infrastructure to reach elementary through high school students allows the FAA to:

- Reduce implementation time by using existing proven programs;
- Lower cost of development and support of specific programs; and
- Minimize risk of investing time and resources into programs with limited reach.

[19] *Section 601 of FAA Reauthorization Act of 2018, Public Law (P.L) 115-254, House of Representatives (H.R.) Bill 302, 115th U.S. Congress, October 5, 2018.*

The FAA focuses on partnering with industry and educational institutions to inspire youth and encourage them to pursue aviation careers and help the aviation and aerospace industries build a pipeline of professionals to meet workforce needs.

c. Ongoing Partnerships and Outreach Efforts

The reach of the FAA's STEM AVSED Program has steadily expanded over time. With increased demand for air travel, economic growth, and expansion of the aviation workforce, the focus on fostering educational pathways, workforce pipelines, and key partnerships has become increasingly important. As a key driver of success, the FAA's STEM AVSED Program works with a range of external organizations, including educational institutions, non-profits, associations, other government agencies and organizations, and industry partners. Collaboration with aviation and aerospace industry partners helps expand program reach, increase public awareness, and enhance student access to the various events throughout the country.

Many of the FAA's STEM AVSED activities are carried out by Outreach Representatives who dedicate time and energy to engage, educate, and inspire today's youth. The FAA trains its employees to act as the representatives of the agency in their communities, and support aviation-focused activities in the field. FAA Outreach Representatives support numerous STEM AVSED events, both through direct engagement and partnerships with a variety of organizations and non-profits, reaching over approximately 24,000 youth in FY 2018. Expanding its efforts, the FAA has increased the number of Outreach Representatives from 244 in FY 2017 to 375 in FY 2018, with a goal of over 500 active representatives in FY 2019.

The STEM AVSED Outreach Representative Program supports FAA employees in their efforts to reach youth and promote the interest in aviation and aerospace. The FAA has a streamlined approach for training Outreach Representatives, providing employees with online materials, developing and distributing educational toolkits, and assisting with supply ordering and implementation.

The FAA National STEM AVSED Program Lead and nine regional points of contact in the Office of National Engagement and Regional Administration facilitate the program and ensure that Outreach Representatives have the training and materials they need to successfully execute their efforts. Supporting employees in over 100 facilities, service centers, and regional offices across the country, the FAA National STEM AVSED Program Lead provides:

- Standardized STEM AVSED training for Outreach Representative through the FAA's electronic Learning Management System (eLMS);
- Online repository of internal STEM AVSED outreach information, standard operating procedures, and STEM AVSED materials for distribution to schools;
- Age-appropriate briefings with targeted information for students;
- Talking points for speaking to various audiences;

- Guidelines for follow up and metrics reporting;
- Centralized supply ordering; and
- Assistance in developing memoranda of understanding with partners.

Through the dedication of Outreach Representatives, the FAA conducts numerous national, regional, and local programs and events throughout the country. Some efforts span the age spectrum, reaching elementary through high school students, while others target specific age groups. The table below provides an overview of key initiatives and partners supported by the FAA's STEM AVSED Program:

Figure 3: FAA STEM AVSED Partners and Outreach Efforts

Partner / Program	Description	Students Reached		
		Elem.	Mid.	High
Academy of Model Aeronautics (AMA)	The world's largest model aviation association, representing a membership of more than 150,000 from every occupation, income level, and age group. The programming includes ongoing educational outreach through a variety of events, including Forest Fury, in which 17 teams of students compete to solve real-world problems using drones to sense trouble areas and deliver aid in emergency situations. Some of the events are hosted by the Central New York (CNY) Drones, an organization that promotes drone-focused STEM-based education, and highlights career opportunities in the region. CNY Drones is affiliated with and works with AMA to provide students with the chance to learn what it takes to build and operate drones.		✓	✓
Airshows and Expos	The FAA supports airshows and aviation-related expos, especially events that draw students, as venues for STEM outreach activities, and participates in 8 to 12 events annually. The FAA promotes the agency's mission, increases attendees' awareness of aviation career opportunities, and highlights the importance of aviation and aerospace industries to our communities and the economy.	✓	✓	✓
American Institute of Aeronautics and Astronautics (AIAA)	The FAA partners with AIAA on a variety of educational outreach efforts, such as Student Conferences in each AIAA Region, as a means to encourage students in aerospace-related fields to discuss research, exchange knowledge, and generate interest in the field of aerospace engineering.		✓	
Aviation Career Education	Students in this 1- to 5-day long aviation career exploration program receive instruction in aviation		✓	✓

Partner / Program	Description	Students Reached		
		Elem.	Mid.	High
(ACE) Academy	history and the physics of flight. Activities include field trips to aviation sites and aviation-related hands-on STEM programs. The FAA supports ACE Academies by providing director guides and materials. This program reaches approximately 1,500-2,000 middle and high school students annually.			
Build a Plane	The FAA works with Build A Plane nonprofit, dedicated to promoting aviation and aerospace careers by giving young people the opportunity to build real airplanes. Aircraft restoration and construction provides real-world applications for learning science, technology, engineering, and math. Build A Plane nonprofit has recently started Build A Rocket program to provide schools across the U.S. an opportunity to build a high performance, high powered rocket. The rocket comes in an easy-to-assemble, premanufactured kit and delivers a STEM project that inspires students to pursue careers in aviation and aerospace, and motivate them to achieve higher education.			✓
Career Days	The FAA supports career days and career fairs at local schools, and other local and regional authorities. The FAA participates in events to highlight the benefits and applicability of STEM knowledge to the aviation industry. STEM AVSED Outreach Representatives reached over 2,300 students in FY 2018 through 28 career days, in addition to other career day outreach by FAA Employee Associations reaching over 20,000 students, and these efforts focus on increasing the students' and teachers' awareness of the role that the FAA plays in aviation safety and the importance of aviation and aerospace industries to our communities.	✓	✓	✓
Civil Air Patrol (CAP)	The FAA partners with CAP to promote and support aviation and aerospace careers and STEM education. CAP educational programs help prepare American citizens to meet the challenges of a sophisticated, global aerospace industry and understand related issues.		✓	✓
Dreams Soar	Dreams Soar partners with female role models to share and promote the importance of STEM education. Dreams Soar has participated in over 57 outreach events worldwide to date, reaching over 11,000 young girls and boys. The FAA worked to define the role for the first female STEM AVSED outreach Dreams Soar ambassador.	✓	✓	✓

Partner / Program	Description	Students Reached		
		Elem.	Mid.	High
Educator Workshops	The FAA provides teachers with tools for using aviation as a classroom theme to introduce STEM concepts, and aims to inspire students to pursue careers in aviation and encourage them to continue their STEM studies. Workshops include lectures, presentations, hands-on activities, tours of FAA facilities, and other activities. The FAA organizes and runs workshops, and provides instruction, support, and materials to the educators.	✓	✓	✓
Experimental Aircraft Association (EAA) AirVenture and KidVenture	The EAA conducts local and national outreach efforts, bringing together individuals interested in learning more about aviation and willing to share their own knowledge. The FAA supports EAA's annual Air Venture and KidVenture events, dedicated to inspiring the dream of personal flight in youth. EAA manages the events attended by ~20,000 students. The FAA develops and implements aviation-focused programs and FAA employees attend and manage the stations dedicated to various phases of flight.	✓	✓	✓
International Black Aerospace Council (IBAC)	IBAC provides an interface between corporations, educational institutions, organizations, government, and the military and serves as a clearing house for the exchange of information, ideas, and prospects for scholastic and employment opportunities for people of color in aerospace careers.	✓	✓	✓
Jamail Larkins Outreach	Jamail Larkins serves as an independent ambassador for aviation and space education. Jamail is one of the country's youngest air show participants, reaching up to 20,000 students annually through public schools and youth groups. The FAA partners with Jamail Larkins to spur interest in STEM subjects and highlight the numerous opportunities within the aviation and aerospace community.	✓	✓	✓
National Coalition for Aviation and Space Education (NCASE)	The FAA works with the National Coalition for Aviation and Space Education (NCASE) to promote aviation and space education through school initiatives. NCASE collaborates with educators, government officials, and industry representatives to provide educational resources and train the nation's youth in STEM and aviation. The FAA coordinates with NCASE on *The Crown Circle for Aerospace Education Leadership Award* and *The Dr. Mervin K Strickler Award for Aerospace Education Leadership*, and supports the efforts by writing the solicitation,	✓	✓	✓

Partner / Program	Description	Students Reached		
		Elem.	Mid.	High
	reviewing the submissions, selecting winning educators, and coordinating the award ceremonies.			
The National Coalition of Certification Centers (NC3)	NC3 is a network of educational institutions and industry partners that embody passion for a highly skilled workforce and promote strong technical education. NC3 conducts train-the-trainer events to provide high school instructors with professional development opportunities and enable them to bring their technical knowledge back to their classrooms. The FAA partners with NC3 to develop highly-skilled, job-ready professionals through a network of educational partners and global industry leaders.			✓
National Summer Transportation Institute (NSTI) Program	The FAA partners with the U.S. Department of Transportation's (DOT's) Federal Highways Administration (FHWA) to support a two-week transportation-focused camp program through NSTI. The program promotes STEM subjects and transportation education, and focuses on disadvantaged and at-risk middle and high school students.		✓	✓
Ninety-Nines, Inc.	Ninety-Nines, Inc. is a nonprofit organization of licensed women pilots. The FAA partners with this organization to work with local communities to promote the advancement of aviation industry through education, scholarships, and mutual support, and emphasizes opportunities for women.	✓	✓	✓
NASA Challenger Center for Space Science Education	NASA offers dynamic, hands-on exploration and discovery opportunities to students around the world. The FAA supports the program to equip students with the knowledge, confidence, and skills that will improve the nation's social and economic well-being.		✓	
Real World Design Challenge (RWDC)	The Real World Design Challenge (RWDC) is an annual competition providing middle and high school students an opportunity to work on real world engineering challenges in a virtual team environment. The FAA supports competition through event planning and execution, helps advertise and promote the program to schools, and recruits judges and provides speakers for the national challenge and awards ceremony in Washington, DC.		✓	✓
Recognizing Aviation and Aerospace	The FAA supports the annual competition sponsored by DOT that prompts students to develop innovative solutions to real-world aviation and aerospace			✓

Partner / Program	Description	Students Reached		
		Elem.	Mid.	High
Innovation and Science Engineering (RAISE) Award by the U.S. DOT Secretary	challenges. The event encourages students to share those innovations with the broader community and promotes student-led research projects. The FAA's Center of Excellence in New Jersey coordinates this effort by writing the solicitation, reviewing the submissions, selecting the winning team, and coordinating the recognition event.			
Smart Skies	The FAA co-developed this program with NASA to promote air traffic control and aviation careers. The program involves an online tool designed to engage middle school students and teach them about the challenges that air traffic controllers experience every day, reaching up to 10,000 students visiting the site annually. The FAA employees promote the program in schools and cross-promote the program with NASA.		✓	
Team America Rocketry Challenge (TARC)	TARC is the world's largest rocket contest, sponsored by the Aerospace Industries Association (AIA) and the National Association of Rocketry (NAR). The national competition is held annually in the Plains, VA. The FAA's Office of Commercial Space supports the effort by providing judges for the program and coordinating logistics for the participating teams.		✓	✓
Walk in My Boots (WiMB)	The FAA's Flight Standards (AFS) offices and STEM AVSED Program collaborate on the WiMB Job Shadow to connect high schools with aviation maintenance facilities. The job shadow experience spurs interest in aviation careers and helps address the shortage of skilled workers in the aviation maintenance field. The FAA provides information and materials for WiMB program.			✓
Women in Aviation International (WAI)	The FAA works with Women in Aviation (WAI) by organizing the annual Girls in Aviation Day at the WAI Convention. The FAA runs the workshops at the event, reaching over 3,600 students annually. WAI encourages the advancement of women in all aviation career fields and interests. WAI encourages young women to consider aviation as a career and provides assistance in pursuing aviation careers.	✓	✓	✓
The Young Artists Contest	The FAA partners the Fédération Aéronautique Internationale (FAI) and the National Association of State Aviation Officials (NASAO) for the Young Artists Contest international contest, which encourages youth to demonstrate the importance of	✓	✓	✓

Partner / Program	Description	Students Reached		
		Elem.	Mid.	High
	aviation through art. Reaching approximately 300 elementary through high school students, this national event motivates students to become more familiar with aviation, aeronautics, engineering, and science.			
Youth Aviation Adventure (YAA)	YAA creates and provides opportunities to learn about different facets of aviation careers and industry at regional and international airports. The FAA supports this program that targets students ages 12 to 18.		✓	✓

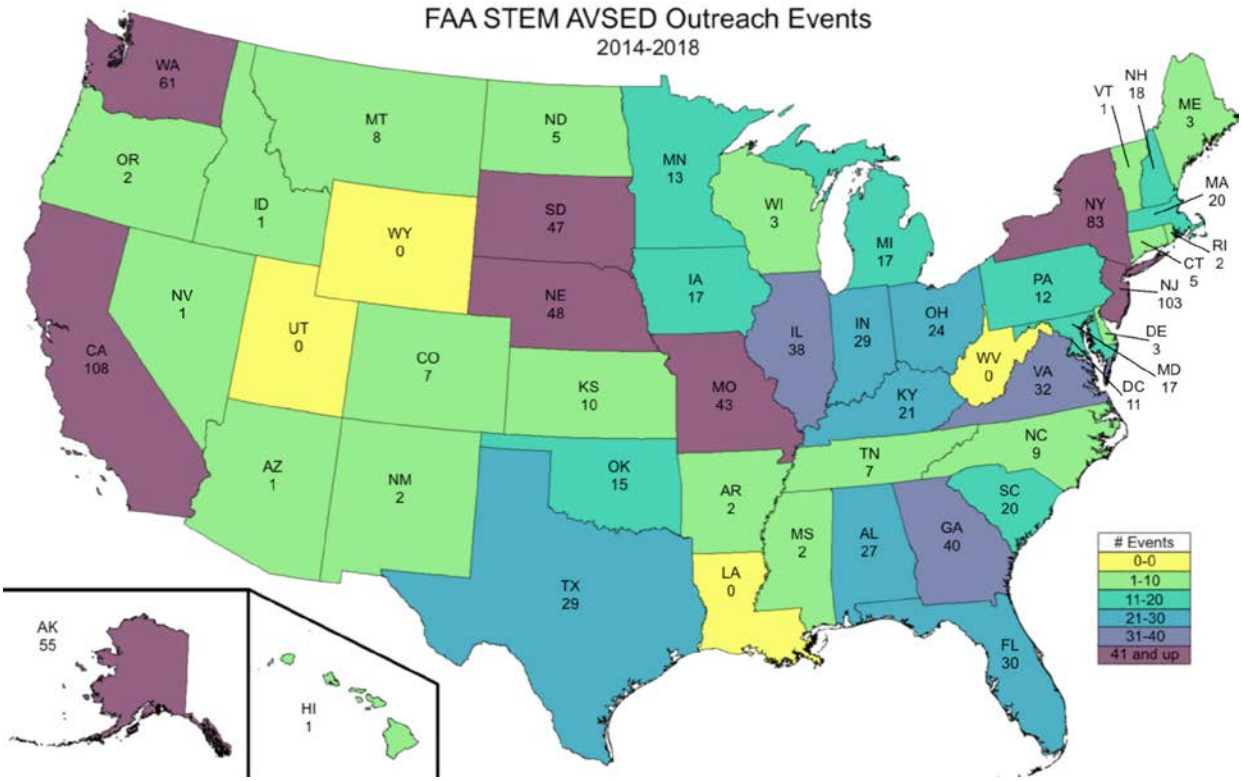
d. Program Accomplishments

The FAA's STEM AVSED Program creates and fosters opportunities for students to become interested in aviation industry careers. The focused effort with elementary, middle, and high school students has several benefits:

1. It creates a passion for aviation;
2. It builds skills and abilities; and
3. It forms the foundation for the pipeline for future careers in aviation.

The FAA's STEM AVSED Program works to maximize its reach, leveraging the dedication of Outreach Representatives. Over the past five years, FAA Outreach Representatives have conducted over 1,000 events across the country to promote STEM education and inspire youth to pursue aviation careers, as shown in the map below:

Figure 4: FAA STEM AVSED Events for Elementary, Middle, and High School Students in 2014-2018



5. Looking Ahead

To encourage and build the aviation workforce of the future, the FAA's STEM AVSED Program must continue to grow with support from the agency, employees, other federal entities, and aviation industry partners. The funding and collaboration are critical to the agency's ability to implement programs focused on elementary, middle, and high school student in aviation and address the growing workforce needs.

The FAA will continue leveraging its workforce in a cost-efficient manner while maximizing impact for reaching and inspiring students to explore aviation and aeronautical careers. The FAA will partner with industry, associations, and non-profits to create new pathways and build the pipeline of qualified aviation professionals.

a. The FAA Aviation Workforce Steering Committee

As a part of its approach, the FAA has established the Aviation Workforce Steering Committee. This committee determines agency goals for addressing aviation workforce challenges, explores options, and facilitates cross-agency strategic coordination.

The FAA's Aviation Workforce Steering Committee focuses on:

1) **Priming the Pipeline**: What can be done to attract new people to critical aviation professions?
2) **Pathways to Proficiency**: How can we maximize efficiency in training?
3) **Productive Partnerships**: How can we promote productive partnerships with government, academia, and industry stakeholders?

An effective aviation industry relies on individuals with unique skill sets. The committee helps identify methods to increase the pipeline of individuals interested in serving the aviation and aerospace workforce of the future. While the most immediate workforce challenges are the shortage of pilots and technicians, the committee considers all aviation professions. A special focus on diversity and inclusion and attracting women, minorities and persons with disabilities to the aviation and aerospace professions helps ensure the government and the industry can recruit from a broader and more inclusive talent pool in the future.

The FAA's Aviation Workforce Steering Committee provides leadership, guidance, and oversight to the STEM AVSED Program and its partners. It does so by identifying and implementing short and long-term solutions and innovative approaches to address identified aviation workforce challenges. With this leadership and consistent support, the FAA will continue expanding its efforts and partnerships across the federal government, educational institutions, and the aviation industry.

b. Planned Activities

In FY 2019, the FAA's STEM AVSED Program will continue to support its partners, programs, and outreach events, while expanding its capabilities. To further prepare and equip Outreach Representatives to work with schools, engage youth, gather metrics, and ensure follow-up, the FAA will evolve a field toolkit with age-appropriate presentations, videos, and hands-on activities for promoting STEM education and aviation career paths among students.

The FAA will continue to support the following ongoing and planned activities:

- Career fairs;
- Career days;
- Facility tours;
- Job shadowing;
- Science fairs; and
- Ongoing engagement with schools.

FY 2019 STEM AVSED Priorities

- Increase the number of outreach events by 50 percent from FY 2018, including a focus on underrepresented communities.
- Increase the number of fully-trained Outreach Representatives by 20 percent.
- Develop MOUs with two new partners.
- Continue to update Outreach Representative toolkit.
- Refine data gathering tools.

The FAA will support specific partnerships and events, including:

- Team America Rocketry Challenge.
- Boston Logan Aviation and Maritime STEM Expo.
- Women in Aviation and Girls in Aviation Events.
- ACE Academies expansion to 36 events.
- KidVenture.
- Real World Design Challenge.
- Strickler and Crown Circle Awards.
- Sun 'n Fun International Fly-In and Expo.
- Unmanned Safety Institute (USI) Drone Initiative.

c. FY 2019 – FY 2024 Strategic Goals and Objectives

In alignment with the Congressional mandate and federal STEM plans, the FAA plans to help address aviation industry needs through proactive communication, talent inspiration, cultivation, and diversity by using evidence-based approaches.

The FAA defined the following strategic goals and objectives for STEM AVSED in FY 2019 – FY 2024:

Goal 1: Promote increased participation of underrepresented groups in STEM activities and educational programs.

Obj. 1.1 – Improve engagement of underserved populations in STEM events through innovative approaches to existing and new programs.

Obj. 1.2 – Increase the exposure of FAA STEM opportunities to underserved groups by supporting increased involvement of FAA Outreach Representatives in inner-cities and specific geographic areas.

Obj. 1.3 – Expand the exposure of FAA-supported STEM programs by engaging in opportunities that reach all populations, tailoring messages to the needs of underserved populations.

Goal 2: Inspire youth and community engagement in STEM education and outreach in elementary, middle, and high schools by enhancing student and educator participation in FAA-supported STEM events.

Obj. 2.1 – Increase public awareness of education and outreach opportunities as measured by promotional metrics.

Obj. 2.2 – Improve the quality and availability of agency-provided STEM AVSED resources.

Obj. 2.3 – Encourage educators by increasing and supporting FAA Outreach Representatives participating in STEM activities and aviation outreach events in schools and labs.

Obj. 2-4 - Partner with FAA employee associations to conduct STEM AVSED events to target underrepresented communities.

Goal 3: Cultivate the pipeline of future aviation professionals by enhancing curriculums in elementary, middle, and high schools, and technical and community colleges.

Obj. 3.1 – Support a broader portfolio of STEM AVSED programs targeted toward students pursuing higher education in STEM fields.

Obj. 3.2 – Enhance internship opportunities in the FAA and across aviation industry, with an emphasis on STEM.

Obj. 3.3 – Enhance the STEM curriculum through the available means.

Obj. 3.4 – Establish an outreach mechanism to increase understanding of pathways to aviation careers and higher-education opportunities.

Obj. 3.5 – Promote aviation-based mentorship programs.

Goal 4: Communicate the value and purpose of the STEM AVSED strategy and the need for engagement.

Obj. 4.1 – Educate FAA senior leaders and stakeholders on the value of STEM programs as critical enablers of aviation industry and support these programs through strategic communications resources.

Obj. 4.2 – Develop FAA outreach messages to attract STEM talent and relay the agency's involvement in developing innovative solutions that address workforce challenges.

Obj. 4.3 – Promote partnerships within other federal, state, and local agencies and industry to support STEM initiatives and activities.

Obj. 4.4 – Identify current programs and best practices that engage youth in STEM AVSED activities and share them across the agency.

GOAL 5: Enhance the efficiency and effectiveness of STEM initiatives by gathering evidence and metrics using a systematic approach.

Obj. 5.1 – Implement a systematic approach to identify and share best practices across FAA lines of businesses and staff offices.

Obj. 5.2 – Evaluate the efficiency and effectiveness of FAA-supported STEM AVSED programs annually.

Obj. 5.3 – Analyze metrics and data to generate program updates that inform future decisions.

6. Appendix

a. Terminology

For the purpose of this report, the term “aviation and aeronautical careers” encompasses all aerospace, aeronautical, aviation, and aerospace/defense-related careers related to the statutory and legislative Youth in Aviation report mandated by Congress in Section 601 of the FAA Reauthorization Act of 2018, Public Law (P.L.) 115-254.

These terms are used throughout the document, and are defined as follows:

- Aerospace: relating to the industry concerned with aviation and space flight.
- Aeronautics: relating to the science or practice of building or flying aircraft.
- Aviation: relating to the flying or operating of aircraft.
- STEM: relating to the subjects of Science, Technology, Engineering, and Math.

b. Data Sources

- Aviation Workforce: Current and Future Availability of Airline Pilots, GAO, February 2014 (https://www.gao.gov/assets/670/661243.pdf)
- STEM Education: Actions Needed to Better Assess the Federal Investment, GAO, March 2018 (https://www.gao.gov/assets/700/690840.pdf)
- Diversifying the Pipeline of STEM Talent, GAO, June 2018 (https://blog.gao.gov/2018/06/19/diversifying-the-pipeline-of-stem-talent/)
- The Aviation Workforce of Tomorrow: Where Are They Needed and Where Will They Come From, Transportation Research Board, August 2016 (http://onlinepubs.trb.org/Onlinepubs/trnews/trnews304feature.pdf)
- Charting a Course for Success: America's Strategy for STEM Education, White House, December 2018 (https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf)
- FAA Report: Commercial Airline Pilot Study Literature Review, McKinsey & Company, 2018
- FAA Report: Commercial Airline Pilot Supply and Demand, McKinsey & Company, 2018
- FAA Report: Commercial Airline Pilot Workforce Study, McKinsey & Company, 2018
- FAA Report: Aviation Maintenance Workforce Study, McKinsey & Company, 2018
- FAA Report: Aviation Maintenance Technician Workforce Study, McKinsey & Company, 2018
- Delphi Study of Aviation Maintenance Experts' Recommendations for a Model School Curriculum (https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1007&context=teachinglearning_etds)
- The Economic Impact of Civil Aviation on the U.S. Economy, Federal Aviation Administration (FAA), September 2017 (https://www.faa.gov/about/plans_reports/media/2017-economic-impact-report.pdf)
- Executive Order Establishing President's National Council for the American Worker, White House, July 19, 2018 (https://www.whitehouse.gov/presidential-actions/executive-order-establishing-presidents-national-council-american-worker/)
- FAA Aerospace Forecast Fiscal Years 2018-2038, FAA, March 2018 (https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2018-38_FAA_Aerospace_Forecast.pdf)
- FAA Aviation Workforce Steering Committee Charter, Draft, February 2019
- The FAA Aviation Workforce Symposium Opening Remarks, Daniel K. Elwell, September 13, 2018 (https://www.faa.gov/news/speeches/news_story.cfm?newsId=23134&omniRss=speechesAoc&cid=104_Speeches)

- FAA Commercial STEM AVSED Education Public Website (https://www.faa.gov/education/programs/)
- FAA Reauthorization Act of 2018, Public Law (P.L) 115-254, House of Representatives (H.R.) Bill 302, 115th U.S. Congress, October 5, 2018 (https://www.congress.gov/115/bills/hr302/BILLS-115hr302enr.pdf)
- The FAA STEM AVSED Outreach Representatives Internal Website (https://my.faa.gov/tools_resources/training_learning/stem-avsed/get-involved-in-stem-avsed/STEM-AVSED-Outreach-representative-Toolkit.html)
- Federal STEM Education 5-year Strategic Plan, 2013 (https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf)
- NASA STEM Engagement Website (https://www.nasa.gov/stem/about)
- Pilot & Technician Outlook 2018-2037, Boeing, July 2018 (https://www.boeing.com/commercial/market/pilot-technician-outlook/)
- Prepare and Inspire: K-12 Education in STEM for America's Future, National Science Foundation (NSF), September 2010 (https://nsf.gov/attachments/117803/public/2a--Prepare_and_Inspire--PCAST.pdf)
- Programme for International Student Assessment (PISA) Report, 2015 (https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf)
- The Results Are In! Students Are Going into the Aerospace and Defense Workforce!, Real World Design Challenge, 2018 (http://rkcinternational.com/wp-content/uploads/2018/10/The-Real-World-Design-Challenge-The-Results-are-in-V10.0.pdf)
- STEM Cohort ACT: National 2018 Report: The Condition of College and Career Readiness (https://www.act.org/content/dam/act/unsecured/documents/cccr2018/National-CCCR-2018.pdf)

c. Aviation Workforce Statutes in FAA Reauthorization Act of 2018

The FAA Reauthorization Act of 2018 includes multiple sections focusing on the topics of building the aviation workforce of the future to meet current and future demands. Under Title VI – Aviation Workforce, Subtitle A – Youth in Aviation, the Act includes multiple sections establishing and mandating a variety of governmental mechanisms, from developing and submitting reports to Congress, to establishing Task Forces, to standing up Advisory Boards, to initiating studies, all in service of encouraging, building, and supporting the aviation workforce of the future.

The table below outlines key sections related to the aviation workforce needs:

Figure 6: FAA Reauthorization Act of 2018 Aviation Workforce Statutes

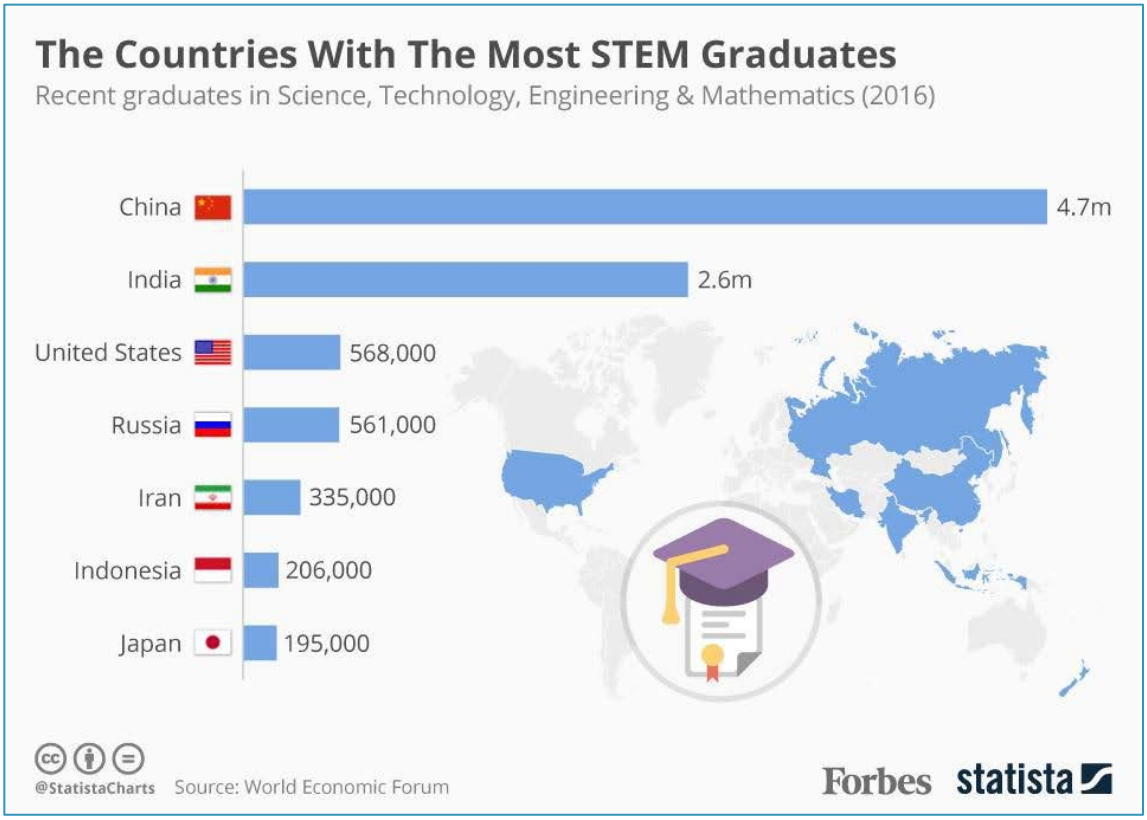
Section #	Topic
601	Student Outreach Report
602	Youth Access to American Jobs in Aviation Task Force
611	Sense of Congress Regarding Women in Aviation
612	Supporting Women's Involvement in the Aviation Field
621	Aviation and Aerospace Workforce of the Future
622	Aviation and Aerospace Workforce of the Future Study
623	Sense of Congress on Hiring Veterans
624	Aviation Maintenance Industry Technical Workforce
625	Aviation Workforce Development Programs
631	Community and Tech College COEs in Small UAS Technical Training
632	Collegiate training initiative program for Unmanned Aircraft Systems

d. Worldwide STEM Graduate Data

The United States lags behind other first world nations with respect to graduates focused on potential STEM careers. The infographic below shows the data on STEM graduates across several countries[20], and indicates that the United States numbers fall behind China and India. Adjusting for populations, the United States continues to lag behind China and India in overall percent of STEM graduates versus population, with 0.173 percent for the United States versus 0.339 percent for China and 0.20 percent for India.

A critical goal for the FAA's STEM AVSED Program is to increase the number of high school graduates in the United States pursuing STEM careers in aviation.

Figure 8: Countries with the Most STEM Graduates[21]



[20] *CIA World Factbook*.
[21] *Source: World Economic Forum, Forbes.com and Statista.*

e. History of the FAA's STEM AVSED Program

Below is a brief history of the FAA's STEM AVSED Program and related student outreach efforts:

- **1950s:** FAA and NASA established, STEM AVSED Program begins to take shape.
- **1960s:** Strong visibility of aviation and aeronautical industries boosts student outreach programs.
- **1970s:** President Ford signs Public Law 94-353, the Airport and Airway Development Act Amendment, mandating aviation education programs and establishing FAA regional programs.
- **1980s:** Established the first FAA Education Resource Center and Aviation Career Education (ACE) academy; ACE expands to reach more students.
- **1990s:** The FAA aviation education task force recommends establishing further educational opportunities for students. Task force proposes 50+ initiatives to advance America's aviation education resources.
- **2000s:** The FAA formalizes the program, supports Real World Design Challenge (RWDC) – an annual engineering competition for high school students. NASA develops Smart Skies online simulator geared towards students, currently downloaded approximately 5,000 times per month.
- **2010s:** The FAA furthers partnerships with educational institutions, school systems, non-profit organizations, and industry to fuel development of new student outreach programs.