

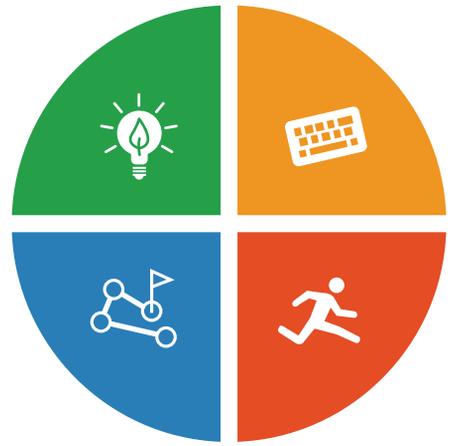


Youth Access to American Jobs in Aviation (YIATF) Report



Presented By YIATF Task Force

Summary of Recommendations



Early Awareness and Engagement

1. Fund libraries to provide aviation and aerospace books and media
2. Provide in-person engagement whenever possible and develop written materials on aviation and aerospace for school staff and teachers
3. Develop turnkey afterschool aviation and aerospace activities
4. Launch early outreach to future teachers and guidance counselors
5. Empower teachers to ignite student interest
6. Meet the students where they are with gaming and social media
7. Industry stakeholders can sponsor student competitions



Information Access

8. Create a one-stop aviation/aerospace information portal
9. Create a "virtual counselor" component on the site



Collaboration

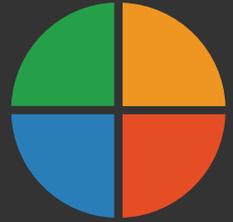
10. Create industry advisory councils
11. Tap the power of college and career readiness platforms
12. Significantly increase the mentoring, pre-apprenticeships and apprenticeships available to grow future employees
13. Build educational outreach to underrepresented groups at Minority-Serving Institutions, community colleges and technical institutions
14. Dual enrollment programs between high schools and colleges/universities as well as workforce development grant programs create well-aligned pathways.



Address Financial Hurdle

15. Decrease the cost of flight training by increasing the allowable simulator time for pilot certification
16. Increase the maximum Pell Grant for students
17. Develop a national aviation scholarship program
18. Implement a multi-faceted aerospace workforce development program
19. Increase donations to aerospace education programs by increasing the corporate tax benefit
20. Aviation and aerospace companies could consider several different financial options to assist in bringing underrepresented groups to the sector
21. The FAA should review its regulations and guidance related to technical proficiency of industry personnel and certification standards as well as update its own practices for managing and developing government human resources

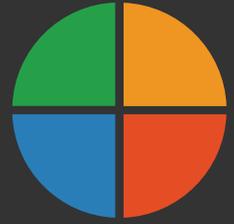
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EXECUTIVE SUMMARY



What an exciting time to be part of aviation and aerospace! Since the early days of flight, innovation, persistence and resilience have been some of the hallmarks of what makes a career in these industries so fulfilling. Right now, there is incredible demand for talent that has created a tremendous enthusiasm for the opportunities. For too long, however, those opportunities have existed for a limited group of individuals who had the information and financial means to access aviation and aerospace. The result is an industry that does not reflect the diversity of America.

In order to continue to be at the forefront of innovation, we must harness the intellectual contributions of people from a wide variety of backgrounds so that they can share in the transformative power that these careers offer. We are facing an unprecedented need for a growing pipeline of young people who either do not know of what we have to offer or perceive that the costs of pursuing a career are simply out of reach. The Youth Access to Aviation Jobs in America Task Force has developed an actionable plan for how we deliver the growth that we need—and at the same time—provides a roadmap for underrepresented groups to join us.

As the Task Force realized early on, there are important and successful projects going on throughout the country, and we highlight many of them in this report. What makes this report important is our discovery that the four areas we suggest—Early Engagement, Information Access, Collaboration, Funding—must all work together if we are going to make substantial, long-term impacts to sustaining, growing and retaining our workforce.



FOUR AREAS OF FOCUS



Early Engagement: Our research found that we need to start when students are at least 10 years old to expose them to all of the possibilities available to them, while also working to connect with teachers, parents/caregivers and guidance counselors.

Industry Information Centralized on the Internet: We need one place where all of the constituents we need to reach—students, parents/caregivers, educators and guidance counselors—can retrieve information, learn about resources in their region from curriculum to scholarships and discover options that they may not have known existed. The Internet is the answer.

Creating a Connected Pathway: When we work together to create a pathway from 10 years-of-age to adulthood, we are sharing our networks and resources with students to ensure that they take the next step that gets them to a career in aviation or aerospace.

Support for Individuals and Organizations: We know that a career in aviation and aerospace requires financial resources to earn licensing, certification or a degree. The safety record of our industry is built upon standards, and those standards require investments by those individuals who wish to join. Those investments are, however, also a barrier to entry and persistence. We need a consistent funding stream for individuals, aviation and aerospace educators and organizations that allows them to focus on growing the pipeline instead of competing for scarce resources.

The thread that ties each of these efforts together is—**Communication**. In this report, we suggest a model for how educators, industry professionals and the federal government can work together and support each other to drive success at both the regional and national level, and thus gain a better understanding of our common purpose and share in each other's success. For some, our industry is mysterious, and little is understood beyond one or two well-known careers. We need the opportunity to remove that veil of mystery and enlighten young people about all of the possibilities available. We also have to stop hoping that a "golden spike moment" (i.e., one moment in time when we get a young person's attention) will crystallize into an aviation or aerospace career. Instead, we must purposefully collaborate to create multiple opportunities throughout a young person's life to raise awareness and possibly begin their path of education and training earlier, which will result in a transformative career in an exciting industry.



TASK FORCE MEMBERS

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INTRODUCTION



The overall goal of the Task Force was to provide recommendations and strategies that facilitate and encourage students to pursue studies and careers in aviation and aerospace. We face an unparalleled need for talent in the aviation and aerospace industry, and there is a ready solution to that talent shortfall in a largely untapped resource: young people from currently underrepresented groups who are unaware of this opportunity-rich sector. These are groups that need support to pursue these opportunities, and an industry that is eager to provide a welcoming and equitable atmosphere.

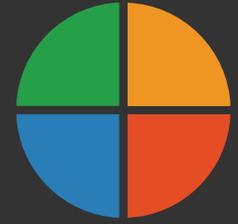
Defining the Workforce Shortage

Before the COVID-19 pandemic even began, the aviation industry—both in the United States and around the globe—was facing a 20-year stretch of unprecedented need for qualified employees, according to the Boeing and Airbus forecasts. Those reports identified the surging demand for talent to serve the industry, and many were already working to expand that pipeline to include opportunities for underserved populations who traditionally have not been exposed to these fields—specifically minorities and women. Caregivers, students, educators, guidance counselors and youth leaders are eager to know that aviation and aerospace are high-tech, in-demand fields with well-paying jobs and a solid career outlook.

As the Boeing workforce outlook from 2022 to 2041 report states:

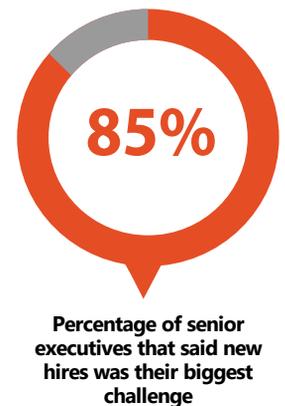
Passenger demand has recovered to near pre-pandemic levels in many areas of the world and will accelerate as travelers regain a sense of safety and security... This outlook assumes continued investment in an uninterrupted pipeline of qualified personnel to replace those who either reached retirement age or opted for voluntary early retirement during the pandemic. The return of personnel furloughed during the pandemic will provide only limited relief, as many have already left the industry. As a result, competition to recruit and retain top-tier talent will be strong as more flights and routes are added. At the same time, the industry is experiencing a juniority across the workforce, further reinforcing the importance of relevant, affordable, and accessible training (Commercial Pilot, Civil Pilot, Aviation Technician & Cabin Crew Demand Outlook, 2022).

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Furthermore, an Oliver Wyman Economic Analysis in June 2022 that examined trends which impacted the aviation industry over the past year notes:

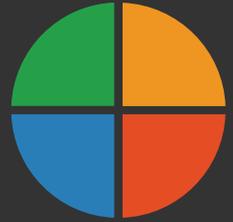
Demand recovery is steady and solid across both leisure and corporate travel, and US airlines are looking at one of their best quarters in recent history. Leisure demand is close to pre-pandemic levels. Corporate bookings, while still lagging leisure travel, are rising, and international demand continues to improve as travel restrictions ease. Tight labor market conditions go beyond having enough crews for flights; it also reflects staffing problems in the ranks of ground staff, baggage handlers, air traffic controllers, TSA agents, and vendors that help supply airlines and airports. A stunning 85% of senior executives in Oliver Wyman's annual maintenance, repair, and overhaul survey said that finding new hires was their biggest challenge (Oliver Wyman, 2022).



In addition to the shortages faced in aviation and aerospace, a report issued by McKinsey and Company in 2022 identified the urgent need to take a new approach to attracting and retaining the workforce. Specifically, “an industry with 50,000 unfilled positions is losing staff at a rate of six percent higher than other sectors and at the same time is losing out in recruiting new talent due to factors including a failure to compete with tech companies’ pay rates that, for example, typically run twice as high for software engineers” (Alcock, 2022). McKinsey further outlines the pressures that will be brought by the burgeoning electric vertical lift and takeoff (eVTOL) industry, as well as advanced air mobility (AAM) to attract workers and the talent it will take to move the industry to more sustainable technology.

This Task Force of 21 members represented a variety of different viewpoints and included organizations that serve youth, educators, industry organizations and aviation and aerospace corporations. All are working to raise awareness to inspire the next generation to pursue a career in aviation and aerospace. We had tremendous support from the Federal Aviation Administration (FAA), which greatly strengthened this effort by providing subject matter experts. The FAA also continually demonstrated implementation of new strategies that will make a real difference in addressing the workforce demands.

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Members of this Task Force, and countless others, are already working to provide incredible opportunities to tomorrow's aviation and aerospace workers and leaders. This report suggests scalable opportunities that harness the best of what is happening across the country.

Every member of this Task Force understands the power of aviation and aerospace to change lives and provide an incredible lifetime of opportunity, and we want to harness that power through a set of recommendations that meets the future needs of a growing—and what will once again be—a thriving industry.

The Diversity Challenge and Opportunity

Unfortunately, this industry has been slower to understand and act upon creating a more equitable and inclusive workforce. For too long, the vast majority of aviation and aerospace workers and leaders has been overwhelmingly male and white. The number of women who hold job titles such as "pilot" and "aviation maintenance technician," among others, are less than 10 percent and there are even smaller percentages for those from ethnically diverse backgrounds (Ison et al., 2016, 27).



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Central to the work of this Task Force has been a shared understanding of the powerful opportunities for social mobility offered by aviation and aerospace and a commitment to bringing those opportunities to underrepresented and underserved communities including rural communities. To achieve that will require ongoing education, commitment and action by those in positions of power to expand opportunities and create pipelines of success.

Aviation and aerospace are not the only industries to be grappling with how to diversify their workforce and excite young people about the opportunities it possesses. The Center for an Urban Future in New York City in their May 2022 report: *In Good Company: What NYC Employers Should Do to Expand Access to Good Jobs* point out the disparity in well-paying jobs for those from a minority background. In the report, they outline actions that public and private sector employers can take to provide equitable solutions across the most diverse city in the nation. They conclude:

New Yorkers of color are alarmingly underrepresented in most of the city's well-paying industries: For instance, Black New Yorkers make up 22 percent of the city's workforce but hold just 7 percent of the jobs in the securities industries, 7 percent of the positions in advertising, 8 percent in publishing and 9 percent in the tech sector. In nearly 100 industries, white New Yorkers out-earn Black New Yorkers by at least \$10,000. Similar disparities persist in many industries and occupations for Hispanic New Yorkers, Asian New Yorkers, and women.

The factors that produce these disparities are complex and pervasive, likely including persistent gaps in educational attainment by race and income—magnified by the effects of systemic racism, gender bias, and ableism. ...there are many areas where employers can and should do more to help address these inequities, close opportunity gaps, and enable far more New Yorkers from lower-income households and neighborhoods to obtain and succeed in well-paying jobs (Dvorkin & Geringer, 2022).

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Likewise, the engineering sector has experienced long-term challenges in recruiting women, despite efforts to the contrary. Only about one-in-five bachelor's degrees in engineering are awarded to women and, of all engineers, women continue to make up only about 14 percent, which is the lowest proportion (Ireland, 2022). Research notes that adding women and other underrepresented groups to our workforces:

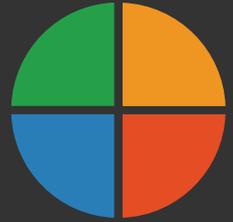
...is key for boosting your company's joint intellectual potential. Creating a more diverse workplace will help to keep your team members' biases in check and make them question their assumptions. At the same time, we need to make sure the organization has inclusive practices so that everyone feels they can be heard. All of this can make your teams smarter and, ultimately, make your organization more successful, whatever your goals (Rock & Grant, 2016).



The recently released report conducted by the Women in Aviation Advisory Board underscored the need to create more inclusive work environments in order to attract and retain women across aviation and aerospace:

The biggest barrier that discourages women from entering and staying in aviation careers is culture—and it is the hardest to change. Changing culture requires consistent leadership commitment over time in thousands of large and small actions across government and industry (Women in Aviation Advisory Board, 2022).

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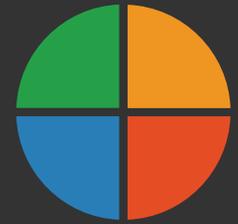
Outreach to Underrepresented Groups is Paramount

Creating a diverse, equitable and inclusive industry is critical to achieving our long-term workforce goals. As Secretary of Defense Lloyd Austin (the first Black person to hold that position) said at a White House Diversity Roundtable in February 2022: "I equate diversity with being invited to the dance. Inclusion is actually being asked to dance." To take this one step further, Dr. Menah Pratt-Clarke, Vice President for Strategic Affairs and Diversity and Diversity Professor of Education at Virginia Tech added:

...and belonging is being able to dance to the music that is representative of your background heritage. What those who are on the outside of the dance decision-making team really want is equity. They want to be part of the planning committee, co-selecting the music, co-selecting decorations, not having to wait to be asked to dance... It's about changing the system and the way in which the dance decision-making process operates. It's about restructuring practices, procedures, policies, and politics, to create a system that is more wonderful for everyone (Barone, 2022).



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As an industry, we should no longer be debating the merits of making investments in minority communities where the resources have not been equitably distributed as a result of systemic racism. We will all need to do more to support underrepresented populations in their pursuit of a career that provides for them and their families in a fast-paced and exciting industry.

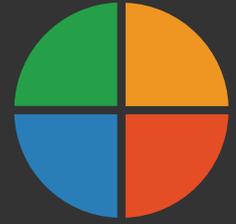
To meet the need for a qualified and well-trained workforce, we must create awareness in communities whose members can be the greatest contributors to the industry's success. To expand the pipeline, we must create greater awareness at the middle and elementary school levels, which will lead to greater engagement at the high school level—including for girls, who are less likely to engage in science, engineering, technology or math courses (STEM) as they progress into high school (Kesar, 2018). With minority populations, research has found that they do not feel a sense of belonging or see fellow students who look like them in STEM classes (Kricorian et al., 2020). Increasing that engagement level, creating a sense of belonging and seeing more students who look like them can lead young people to enroll in collegiate and technical training programs and, hopefully, pursue a career in aviation and aerospace.

Once we create awareness—and students decide that these are fields that they want to pursue—we must find a way to make this pathway affordable. Students from low socioeconomic backgrounds need the financial support to pursue the credentials to join this industry—whether it is training in aviation maintenance, flight or an engineering degree. By lowering the overall debt load for the neediest students, we can provide a lifetime career path with incredible opportunities, as well as another way to drive diversity in the workforce, thus creating more awareness in underrepresented groups. This could result in a “snowball effect” with a long-term solution for solving the personnel shortage and the lack of diversity in our industry.

Approach to the Recommendations

Our recommendations therefore fall into four major categories that will be covered in greater detail in this report. The first category is focused on the fact that engagement with young people needs to start early. Waiting until high school is simply too late, given that awareness and financial support are two of the significant barriers that this Task Force has identified. The second category is the need for easy-to-access resources where anyone—caregiver, teacher, guidance counselor or young person—can find out more information and connect to local resources.

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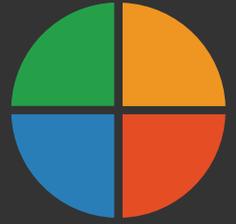


The third area of recommendations speaks to the importance of collaboration among all of the amazing programs across the United States to create a connected career pathway that draws students into aviation and aerospace. The fourth and final category of recommendations—and possibly the biggest hurdle for the students we are trying to reach—is funding, and this entails both providing individual financial support to pursue training and education, as well as creating a sustainable funding model for organizations. This report also provides a roadmap for implementation for specific constituents, including industry, education (at all levels), states, youth-serving organizations and the federal government.

For each category of recommendations, this report will provide a set of actionable items accompanied by the data and survey results that led to that particular recommendation. Some of these recommendations can be tackled more easily, while some will be more difficult—but to do nothing will severely impede this industry’s ability to grow and prosper. In addition, we will suggest the use of documented best practices. This term will be defined as “...a procedure that has been shown by research and experience to produce optimal results and that is established or proposed as a standard suitable for widespread adoption” (Merriam-Webster, 2021). Woven through all of our recommendations are initiatives that are designed to open pathways for underserved and underrepresented groups who have so much to gain and so much to give to an industry that very much needs to capitalize on their potential.

Throughout the report we refer to *Regional Advisory Councils* that would assist in this effort and should be comprised of the major stakeholders in the region (e.g., airports, airlines, repair stations, business aviation, museums, non-profit organizations engaged in activities, scouting, education/training providers that include high schools, colleges and universities—especially minority-serving institutions, etc.). Furthermore, the chairs of the Regional Advisory Councils would report to a *National Advisory Council* that would monitor the efforts, provide information about best practices across the country, design metrics of success and a model for continuous improvement.

There is no one solution that we suggest which will solve our workforce challenges, particularly where the lack of representation from women and minorities is concerned. It must be—and will be—a multi-solution approach where some opportunities will happen more quickly with some having greater impact. What will ultimately make a difference will be our ability to collaborate, communicate our wins and challenges, and our commitment to attracting young people to this exciting, impactful and horizon-expanding industry.



Recommendations



URGENTLY NEEDED: EARLY ENGAGEMENT



Most people do not understand the vast array of available opportunities in the exciting and multi-faceted aviation and aerospace fields. As cited in a 2019 National Academies of Sciences, Engineering and Medicine report on Developing Innovative Strategies for Aviation Education and Participation: *"...participation in aviation as a career for business, as an extracurricular activity, as a sport, and as a recreation has declined over the last decade. There are many causes for the decline, including a reduced interest in aviation among younger populations and other demographics and a lack of industry promotion"* (National Academies, 2019, Foreword).

Consider this information about the declining interest in aviation in light of a 2021 Naviance Student Survey Report that listed the top request—by graduating high school students and students in grades 6 to 11—as: *"...discovering their interests and strengths, exploring career options and finding internship and work opportunities"* (PowerSchool, 2021).

For far too long, aviation and aerospace—as a career—has been a mystery to those outside of the community (or beyond the security fence) with little understanding about the vast array of professions needed to support a thriving industry. Students and families are eager to understand career opportunities and pathways that provide consistent and long-term options for growth. Furthermore: *"They [students] need support systems—in school and at home—that can help them to understand how to plan and work toward future success"* (PowerSchool, 2021).

The findings of the Naviance Survey were corroborated by this Task Force's own research the YIATF Trends Subcommittee Survey, which found that youth are highly influenced toward their potential career paths at the ages of 10 and 18. Clearly, there is a convergence of the industry's need to promote itself to younger generations that's coupled with the need and desire of students and caregivers for information and support systems for just these kinds of exciting career opportunities. Based on our research, there are several recommended initiatives that we can offer to interest youth in aviation and aerospace careers, and we present these initiatives in terms of educational venues, new platforms and industry support.

“Don't have the tools or knowledge for it. But this year, **5 out of my 50 students** expressed interest in **a career in aviation.**”

-HIGH SCHOOL EDUCATOR

Early Awareness and Engagement



1. Fund libraries to provide aviation and aerospace books and media

Build Awareness through Education

Ensure that elementary, middle and high school—as well as public libraries—have the means to create sections with age-appropriate books and media on all-things aviation and aerospace.

As children grow and learn, their need for information and/or inspiration changes—with older students more likely to focus on career development opportunities while younger ones need more general introduction and content interest. In each case, the availability of high-quality information plays a critical role.

Libraries are an essential information hub in rural and in urban communities, especially for those from under-resourced families. According to a 2021 report issued by the American Library Association, libraries serve a crucial role in having ready access to information. For low-income communities—especially rural areas—this access was impeded because of the pandemic. For example:

Estill County (KY) exemplifies the challenges many underserved communities face. ‘Grandkids are being raised by their grandparents by the hundreds . . . Seven out of ten kids qualify for free lunch at school. Only 7.3 percent of homes have broadband access,’ said Lesa Ledford of the Estill County Public Library. Getting more people online in her community means more opportunities for residents to access education, entrepreneurship, and employment—all essential to achieving social mobility. When informed her library would receive a grant that includes internet enabled hotspots, funding for financial literacy programming, and more she said, ‘This grant will change lives.’ (American Library Association, 2021, 13).

In urban areas, the critical role of libraries as a hub for career services is just as strong with the New York Public Library’s having reported that they are the only public hub for career services in 64% of their neighborhoods, while only receiving 0.44% of New York City’s annual budget (Surico et al., 2021). Research has indicated that the best approach to exposing students to the aviation and aerospace industry is to meet the students “where they are”—which means where they are currently being influenced and educated—while targeting age, demographics and geographic locations to create the largest impact.

Early Awareness and Engagement



1. Fund libraries to provide aviation and aerospace books and media

Proposed implementation:

- *Allocate city/state/federal funding for libraries to select books and media with aviation and aerospace themes.* To accomplish this, support is needed from voters, industry and government to provide additional funding to libraries. Libraries are popular with voters as a funding source, "In more than 100 library-related referendums across 27 states, more than 90 percent of voters supported the library. In Ohio, 31 of 32 referenda passed, while in Michigan, 18 of 20 met with approval" (American Library Association, 2021, 14).
- *Form Regional Advisory Councils* composed of the Federal Aviation Administration's Aviation Education Regional Representative, industry, academia, aviation-focused organizations, and others who could strategize on increasing support for aviation and aerospace materials in libraries in their region.

"If kids can **dream it**, they can **do it**. It's up to us to **light the path** for them."

- FAA DEPUTY ADMINISTRATOR BRADLEY MIMS

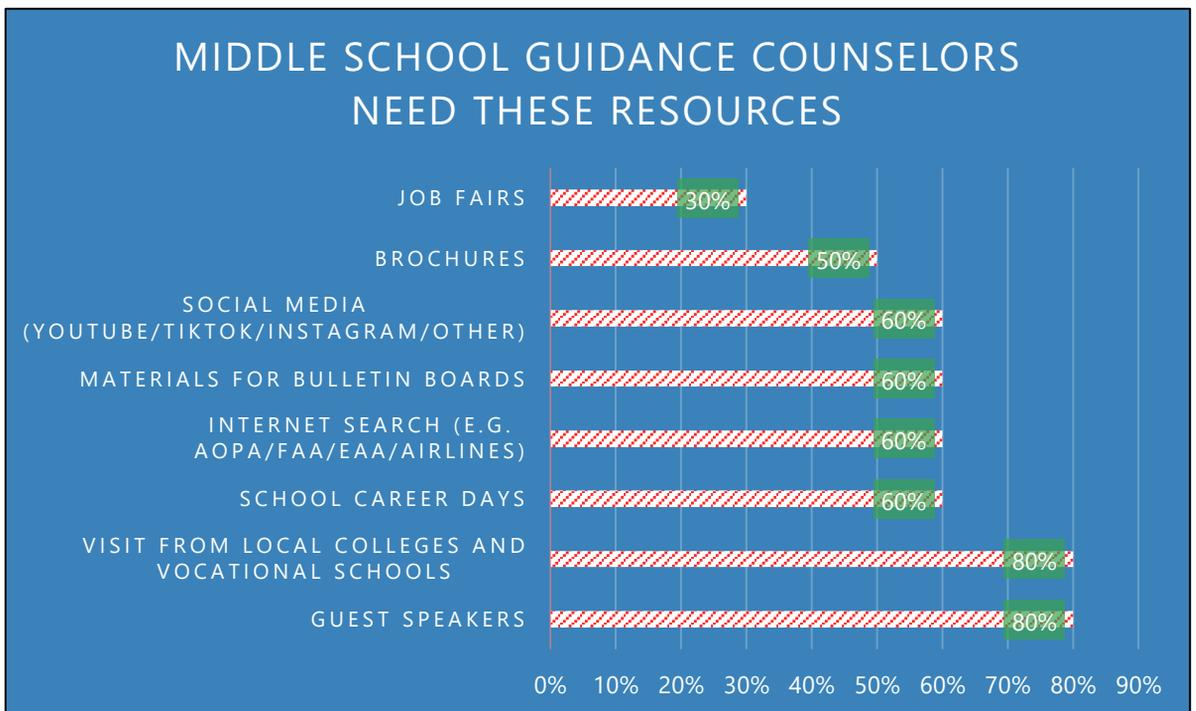
Early Awareness and Engagement



2. Provide in-person engagement whenever possible and develop written materials on aviation and aerospace for school staff and teachers

Survey data indicated the strong desire for in-person presentations and written materials. Materials on aviation and aerospace careers are not widely developed or distributed for aviation and aerospace careers. School counselors, career counselors and teachers believe these would be beneficial.

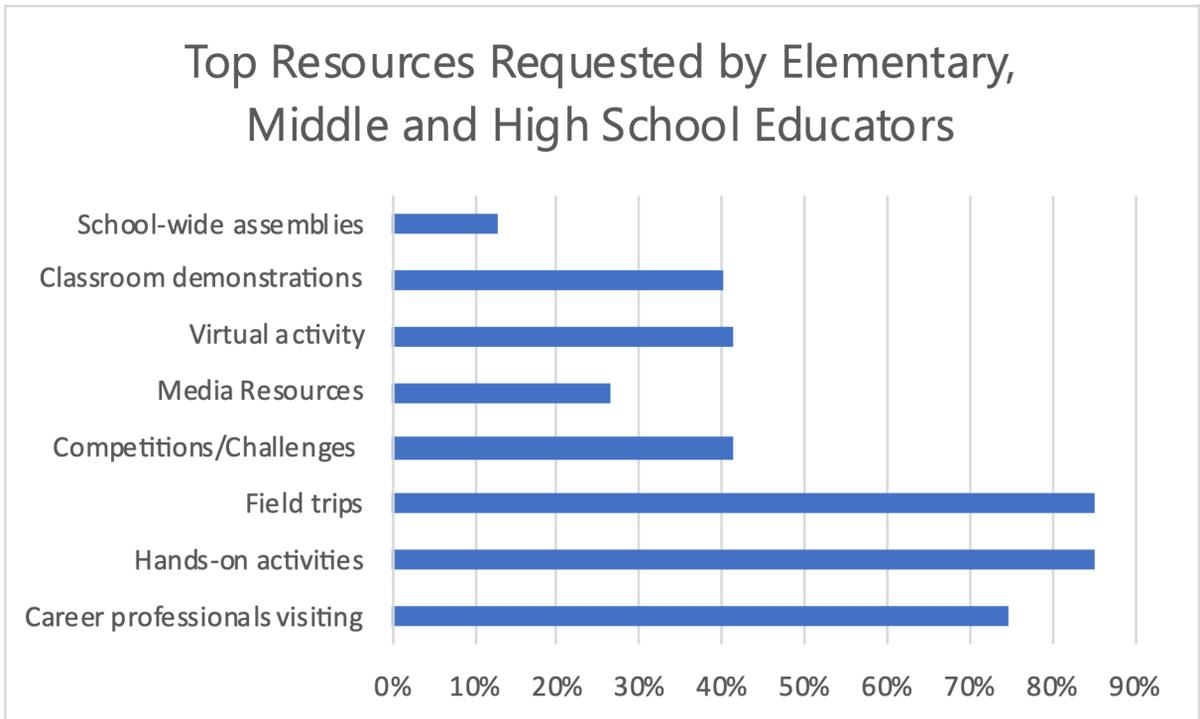
The Task Force’s survey of teachers and guidance counselors indicated that it would be valuable to have more information about aviation/aerospace careers to discuss with students. Middle school guidance counselors, specifically, revealed that 50% believe that brochures/reading material are beneficial to introduce students to aviation and aerospace. Survey results also indicate that digital and written information should supplement in-person resources and respondents further indicated the following resources would be the most helpful in introducing students to aviation/aerospace careers:



Early Awareness and Engagement



2. Provide in-person engagement whenever possible and develop written materials on aviation and aerospace for school staff and teachers



Proposed implementation:

- *Bring Aviation Professionals to the Classroom: Aviation and aerospace organizations develop “Adopt a Classroom” or “Adopt a School” programs.*

Professionals who interact with youth every day report that their students want to interact with—and be supported by—various aviation and aerospace professionals in a classroom environment where career paths seem accessible and possible. Young people are also more likely to choose fields in which they feel represented, so it is critical that these classroom visits be conducted by those from underrepresented groups with a semi-regular, recurring interaction. To emphasize this point, a 2019 PBS NewsHour report looked at the need for young minorities to see themselves in the media and how it affects how they see themselves: *“We need to see people that look like ourselves and can say ‘Oh, that looks like me!’ or ‘I identify with that,’”* said *Sonali Chhotalal, a junior at Cape May Technical High School in New Jersey* (PBS NewsHour, 2019).

Our own research supports this approach to students, underscoring the importance of being intentional in reaching out to them.

Early Awareness and Engagement



2. Provide in-person engagement whenever possible and develop written materials on aviation and aerospace for school staff and teachers

For example, in our research, middle school counselors expressed that the following resources would be the most helpful (in order of importance):

- Guest speakers
- Visits from local colleges and vocational schools
- School career days

In addition, high school counselors said the following resources would be most helpful in introducing students to aviation/aerospace careers:

- Visits from local colleges and vocational schools
 - School career days
 - Job fairs
 - Guest speakers
- *Create a list of speakers and mentors—by region—to develop a plan for outreach to industry and secondary schools (beginning at the elementary school level) as well as a list of elementary, middle and high schools that would welcome visits, approve site visits to industry and ongoing support from industry.*
 - *Encourage the FAA’s Aviation and Space Education (AVSED) office to develop a standardized curriculum that could be used by aviation and aerospace professionals to incentivize young people to consider aviation and aerospace as a potential career.* These interactions could be in-person, virtual, and at the company’s/airport/aviation museum location. The FAA would need to have sufficient marketing (which could possibly be supported by an industry partner in the region) to all of the schools in a particular region to elicit interest. Every attempt should be made to help students understand the breadth and depth of possibility—from aviation maintenance technician and pilot to engineer and airport manager.
 - *Form public-private partnerships between businesses, associations, schools, and government agencies to create new and update existing materials as well as a distribution process so that written resources (and electronic materials) can be easily obtained by school and career counselors, teachers, and others to provide to students.* Governments typically use public-private partnerships to collaborate with private sector companies in order to finance infrastructure projects. However, these partnerships can be used for other types of projects as well. Congress has tasked the FAA with taking on numerous workforce development issues, and public-private partnerships could be effective.

Early Awareness and Engagement



2. Provide in-person engagement whenever possible and develop written materials on aviation and aerospace for school staff and teachers

Benefits of creating public-private partnerships to develop written materials:

- Most informative and effective materials are developed by employing companies in partnership with schools and regulatory agencies.
 - Employer leadership is key in defining direct career pathways and attracting future employees.
 - Partnerships will naturally extend beyond development of written resources to additional resources, direct employment opportunities, increased investment, optimal use of resources and overall workforce development that results in increasing supply capacity. The Task Force recommends that materials be designed in an electronic format (such as a PDF) so that they can either be viewed electronically or printed.
 - Costs will be shared by multiple stakeholders.
- *Develop a list of best practices (i.e., a toolkit) for organizations on how to engage with youth.* Based on age, these toolkits would support current organizations in their efforts and exponentially increase impact.
 - *Invite youth organizations to industry conferences.* Organizations with a large audience of young people (e.g., Boy Scouts/Girl Scouts, Boys and Girls Clubs of America, etc.) would be invited to attend industry conferences. Here, they would give their advice about the best methods for influencing young people and collaborate to develop opportunities and materials that would influence them to pursue a career in aviation and aerospace.
 - *Encourage professional industry organizations to expand youth outreach.* For example, the middle and high school curriculum created by Aircraft Owners and Pilots Association (AOPA) as well as the high school curriculum by Choose Aerospace could be expanded to reach younger students by other associations and organizations engaged in outreach efforts.

Early Awareness and Engagement



2. Provide in-person engagement whenever possible and develop written materials on aviation and aerospace for school staff and teachers

- *Consider using the 4-H or the National Future Farmers of America (FFA) model and apply it to aviation by sponsoring local outreach clubs in an afterschool enrichment environment.* 4-H clubs are delivered by Cooperative Extension—a community of more than 100 public universities across the nation. Starting at age eight, 4-H provides experiences where young people learn by doing (<https://4-h.org/>). The FFA, for example, was set up as a high school program where students must follow an accredited agriculture curriculum implemented by the school. Accreditation for core aviation curriculum could be designed similar to the FFA model.
- *Partner with Professional Organizations for Women and Minorities.* Chapters of National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), Society of Women Engineers (SWE) and Women in Aviation-International (WAI) at higher education institutions across the country are already engaged in youth outreach. Partner with these chapters, especially at Minority-Serving Institutions, to conduct outreach campaigns to secondary students within their region.



Early Awareness and Engagement



3. Develop turnkey afterschool aviation and aerospace activities

Respond to the strong demand for afterschool programs by developing easy-to-implement aviation and aerospace activities that can be used within current afterschool programming.

Afterschool programs have been identified as not only effective at reducing the numbers of at-risk youth, but also credited as key programs in workforce development pipelines. More than 10 million children and youth participate in afterschool programs annually, and the demand for additional programs remains strong—with 25 million children waiting for an available program (Afterschool Alliance, 2022).

A 2019 survey of employers found that more than 80 percent encountered challenges recruiting qualified job candidates and among that group, three out of four reported a skills gap among applicants. Afterschool and summer learning programs are uniquely positioned to help address this major challenge and prepare young people for the jobs of tomorrow (Building Workforce Skills and Inspiring Future Careers: This Is Afterschool, 2020).

Afterschool activities can vary widely, depending on many factors, and common programs include academics, specialized skills development, mentoring and sports. Funding and access are the biggest barriers to establishing additional afterschool programs.

Funding mechanisms for afterschool programs could include:

- There is one dedicated federal fund available for specific programs: 21st Century Community Learning Centers.
- Some states allocate funds specifically dedicated to afterschool programs.
- Some states fund initiatives that include afterschool programs as an allowable use of funds.
- Some states use other funds to support afterschool programs (e.g., portion of lottery profits or unclaimed lottery winnings).
- Some states use funds from state-level departments of education and other grants.

Early Awareness and Engagement



3. Develop turnkey afterschool aviation and aerospace activities

Proposed implementation:

- *Expand the FAA Aviation Career Education (ACE) Academy through industry partnerships.* ACE Academy is a summer aviation education program for K-12 students that provides a wide range of aviation career exploration experiences as well as a STEM focus. This turnkey program is cosponsored by the FAA and various host organizations. The implementation and the cost is largely borne by the host organization. We recommend that the FAA form partnerships with industry to create similar programs and initiatives for after school programming. Public-private partnerships could also be effective resources for developing aviation and aerospace turnkey activities and initiatives to be implemented by after school programs. Similar to how the FAA publishes grant opportunities in the Federal Register to receive applications, the FAA could publish partnership opportunities for creating turnkey after school programs similar to the FAA’s ACE model.



Early Awareness and Engagement

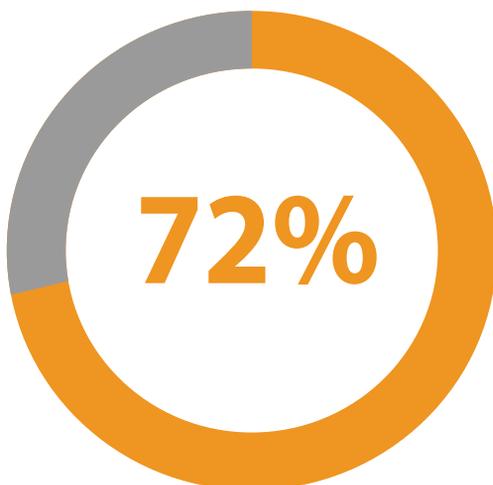


4. Launch early outreach to future teachers and guidance counselors

Outreach to degree-seeking students at post-secondary educational institutions who are pursuing careers as teachers/guidance counselors in order to inform them of aviation/aerospace careers and pathways so that they have base knowledge when they enter the teaching profession.

Working with educational programs that provide teacher training and teaching certifications to all educators will enable new teachers to have an awareness of aviation and aerospace and how this can be integrated into lessons and will build overall awareness within the educational community. Similar to the Albert Einstein Distinguished Educator Fellowship (AEF) Program (<https://science.osti.gov/wdts/einstein>) and other fellowship programs, teacher exposure to aviation and aerospace provides a foundation that he or she can then carry forward into the classroom and use when explaining science, history or social science concepts.

A key trend in our data identified that teachers are influencers who ignite student interest and promote career awareness. Teachers are working with our target group every single day, and they are crucial in helping to build a pipeline of future talent. Yet, our data also showed that 65% of our respondents had basic-to-no knowledge of the various aviation careers. And 72% of our respondents had basic-to-no knowledge of available aviation and aerospace career resources.



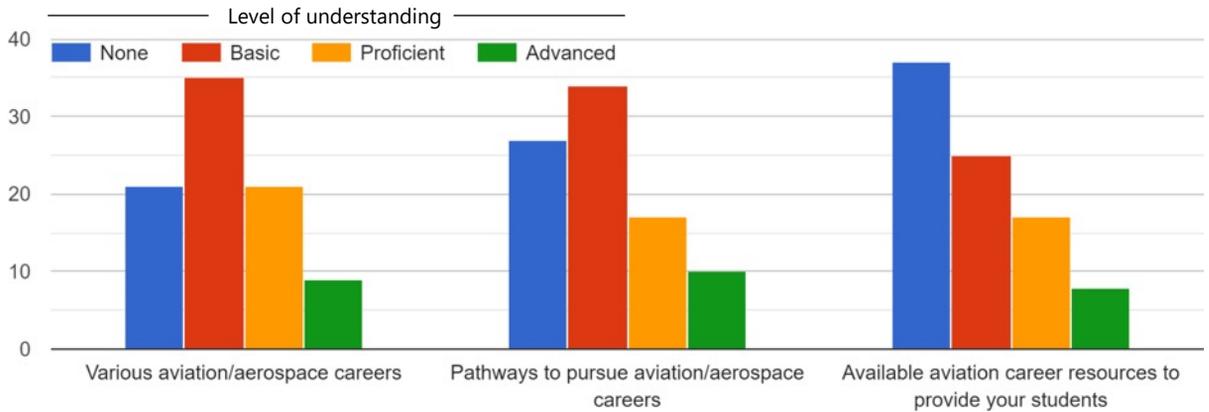
Percentage of teachers with basic-to-no knowledge of available aviation and aerospace career resources

Early Awareness and Engagement



4. Launch early outreach to future teachers and guidance counselors

Teachers Need a Better Understanding of Careers, Pathways and Resources to Educate Students



Proposed implementation:

- *Distribute information targeting degree-seeking teachers, regardless of their specialty, before they get to the classroom.*
- *Work with educational institutions to help provide information through their own curriculum.*
- *Collaborate with universities that have a Teaching Fellows Program.*



“Our goal is to **remove the barriers** for underrepresented students to enter the field of aviation and aerospace. A key barrier in this mission lies in **lack of knowledge**. Approximately **95%** of our student body does not have **a meaningful connection to aviation** within their families. Understanding the needed certifications, cost, and opportunities can be a challenge. By discussing these opportunities in class, visiting local businesses, developing mentorships, and learning about financial options we can **better prepare students** to enter the field.”

-AVIATION HIGH SCHOOL EDUCATOR

Early Awareness and Engagement



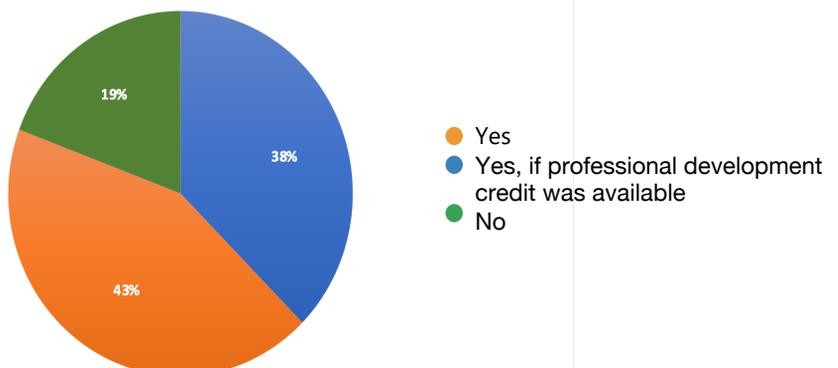
5. Empower teachers to ignite student interest

Establish professional development opportunities and aviation/aerospace teaching “academies” for educators in K-12 with the goal of enhancing a teacher’s knowledge of aviation/aerospace careers and pathway;; a “train-the-teacher” concept. Prepare and equip teachers to implement aviation-based projects and curriculum into the classroom by leveraging a network of aviation museums: Civil Air Patrol (with its numerous hands-on kits), AOPA’s high school curriculum, and others with expertise throughout the nine geographical regions of the FAA. AVSED would identify standards as well as the learning outcomes that programs can work toward.



Early engagement would be significantly strengthened by coupling interactions of aviation and aerospace professionals with teachers who are trained in understanding the available opportunities. Our research confirmed the importance of the role that teachers play in the development of career exploration and their exposure to different career options and pipelines. Teachers are key influencers who ignite student interest and promote career awareness. One teacher impacts countless young people; parents trust teachers and teachers trust other teachers; educators are the key linchpin to inspire and influence students. When teachers are more knowledgeable about opportunities within the aviation industry, they can help eliminate misconceptions and reduce barriers to entry.

Teacher Interest in Learning More About Aviation and Aerospace Opportunities



Early Awareness and Engagement



5. Empower teachers to ignite student interest

That said, teachers lack consistency in materials, curricula and learning outcomes to make them optimally effective. Specifically, our educator survey showed that 55.3% of respondents would like more professional development in order to support aviation and aerospace education for their students. Additionally, our data showed that 80.4% of teachers surveyed were interested in attending a teacher development program. It should be noted that 37.9% of those teachers, however, would only be willing to attend if continuing education units or equivalent were available. Clearly, rewarding teachers for learning is critical to the success of such programs.

Proposed implementation:

- *Use established curriculum, teaching academies/camps and hands-on kits to inspire and equip teachers.* Below, please find connections directly to these best practice opportunities:
 - National Air and Space Museum's Teacher Innovator Institute:
 - <https://airandspace.si.edu/learn/educator-resources/teacher-innovator-institute>
 - Teachers Air Camp Experience: <https://aircampusa.org/educator/>
 - Civil Air Patrol's Teacher Orientation Program Flights:
<https://www.gocivilairpatrol.com/programs/aerospace-education/programs/top-flights>
 - AOPA High School Curriculum:
<https://youcanfly.aopa.org/high-school/high-school-curriculum>
 - Choose Aerospace Teacher Aviation Maintenance Curriculum:
<https://www.chooseaerospace.org/curriculum.html>
 - Civil Air Patrol's Aerospace Education STEM Kit Programs (These are free, and many are aligned to state education standards):
<https://www.gocivilairpatrol.com/programs/aerospace-education/programs/stem-kits>

Early Awareness and Engagement



5. Empower teachers to ignite student interest

- *Identify and coordinate with aviation museums within the nine geographic areas of the FAA's Regional Headquarters.* Using Regional Advisory Councils for a geographic area, implement a standardized program that could possibly be modeled after the National Air and Space Museum's Teacher Innovator Institute. The Advisory Council can also work to identify resources, expertise and funding to implement this effort. To assist with funding and outreach, the FAA could work with the Department of Labor, Department of Education, Department of Defense, National Science Foundation and NASA to leverage grant opportunities to fund aviation program development at the regional and national level—again using the Regional Advisory and National Advisory Council.
- *Provide Continuing Education Units (CEUs) and funding for any model developed for a particular state.* When adopting one of the model programs listed above, each state's Department of Education should seek to provide CEU credit and funding. Additionally, any model being developed for teachers in a particular state should include connections to opportunities for hands-on experiences, such as higher education aviation programs, aviation museums, airports, aerospace manufacturing facilities (including components), and flight training schools, among other places.
- *Use the Regional Advisory Council specifically for that area to coordinate and collaborate for maximum impact.* This Council would have the available knowledge and expertise to develop camps, airport visit days, overnights at aviation museums and teacher externships at a variety of aviation and aerospace locations, among other events.
- *The FAA's AVSED office should host a booth at the annual conference of the American School Counselor Association (ASCA).* As a result of building a portfolio of best practices, materials and opportunities in aviation and aerospace, the FAA could offer their resources to raise awareness about the aviation and aerospace industry.



Early Awareness and Engagement



6. Meet the students where they are with gaming and social media

Build Awareness Through New Platforms

Target and tailor aviation and aerospace outreach programs based on age, demographics, and geographic location to ensure young people are engaged and inspired through the most effective means. This also includes messaging to parents and caregivers who hold significant influence over the career choices of their students.

Our research indicated the best approach to exposing students to the richness of the aviation and aerospace industry is to meet the students “where they are.” It is imperative to be in the same places where they are being influenced and educated based on their age, demographics and geographic location in order to create the greatest impact. **Specifically, we suggest that social media, gaming and other new technologies (e.g., virtual and augmented reality) as well as platforms (e.g., Metaverse) can open pathways to engaging and inspiring young people like never before. We need to take advantage of these platforms to reach the next generation.**



Early Awareness and Engagement



6. Meet the students where they are with gaming and social media

As previously stated, our data indicated the ages 10 and 18 were important pivotal moments when students became interested in aviation and aerospace, and those are the times to specifically target young people. At each of these ages, an individual's need for information and/or inspiration is different—with an older student being more likely to focus on career development opportunities, while a younger one needs more general introduction and content interest. The most important aspect of this awareness-building campaign is to create a drive to take an action-oriented next step. *"Outreach is not just about awareness; it is also about empowerment. This is an essential component"* (Aviation Professor and Member of Women in Aviation Advisory Board, 2022).

Additionally, our data indicated that we also need parent/caregiver buy-in. Caregivers are an impactful force with students, and, as a result, we need to target messaging and education to these influencers about the richness of the opportunity. We therefore suggest programs that engage the entire family with hands-on aviation experiences which will increase excitement and the possibilities in the industry. Parents and caregivers want to support their students in their career choices, and they need resources to do so. Peer support through specific social media groups—such as the Facebook group "Raising Aviation Teens"—has had success with parents and caregivers by creating and sharing their own resources for teens to pursue careers in aviation. The benefit of a "mentor" from a group like this can help the path seem clearer to an individual who has more questions than answers. For those parents and caregivers who do not use social media, the suggestions offered in the centralized website recommendation (later in the report) has information for parents and caregivers to find real-time resources needed to support their student's career interest.

Young people, ages 8-to-18 spend, on average, well over six hours per day consuming digital media, gaming and in-front screen time. Children younger than the age of eight spend just under five hours (CDC, AACAP, 2022). **Social media is another area where a positive influence may be created. Social networks can provide peer motivation, inspire young people to develop healthy habits, try something new, follow their dreams, and speak up about things that matter to them.** Teens also find positive role models online (*Teens Using Social Media for Good, SmartSocial.com, 2022*).

Early Awareness and Engagement



6. Meet the students where they are with gaming and social media

When we surveyed educators, 80% of middle school educators and counselors and 17% of high school counselors said that social media and other digital collateral would be a helpful resource to further student interest in aviation and aerospace careers. We therefore propose leveraging the marketing outreach of the FAA as well as the aviation and aerospace industry to collaborate with arts and entertainment to expand the awareness about the industry and the opportunities available.

Proposed implementation:

- *Create an outreach advisory committee composed of young people.* As part of the success of this initiative, the Task Force recommends that an outreach committee be created with young people who are well-versed in gaming platforms to advise the FAA and the industry on the best new platforms and content creators to partner with on this initiative. This outreach committee could also suggest game developers who could fund and develop games with the skills set that the aviation and aerospace industry desires from the next generation of talent. We encourage this initiative to include more than just flying aircraft and to focus on desired skill sets so as to provide greater exposure to the breadth and depth of the sector.
- *Explore YouTube as a delivery method.* Content creators—like the popular toddler YouTube celebrity, Blippy—spur interest in a variety of STEM topics. Blippy’s aviation-themed videos have view counts in the tens of millions. Leveraging partnerships with existing creators like Blippy, Stevie Triesenberg and SciShow—in addition to creating unique targeted content and linking them to the ‘one-stop shop’ website (which has greater explanation later in this report)—can help increase visibility into aviation and aerospace.
- *Reach out to celebrity or prominent influencers* (brand ambassadors) and enlist them, particularly Black, Indigenous and People of Color (BIPOC) and women—and their social media platforms—to expand awareness about the excitement of aviation and aerospace and the possibilities for careers.
- *Enlist the help of the Ad Council* (a non-profit organization to offer pro bono campaigns to raise awareness and inspire action, (*Ad Council*, n.d.) to spread the word about aviation and aerospace. (This might be similar to their recent campaign encouraging “Girls in STEM”:
<https://www.adcouncil.org/campaign/empowering-girls-in-stem>).

Early Awareness and Engagement



6. Meet the students where they are with gaming and social media

- *Create a short video for seatback entertainment systems in commercial aircraft to be used during flights where you have a captured audience of caregivers, teachers and students. This would be a great place to share information about the exciting fields in aviation and aerospace and provide a modern version of positions—like aviation maintenance—where technology plays a critical role or explaining the job options at airports.*
- *Develop partnerships with the gaming industry to create digital collateral with an aviation focus. According to a 2022 video game industry report, 71% of those under the age of 18 play video games and, in general, “video gamers are about as likely to be female as male” (Entertainment Software Association, 2022). The aviation and aerospace industry, the FAA and others could sponsor gaming content that has already been created rather than creating the content. This would be a first step and could mean sponsoring individuals on Twitch, who will then lead other viewers/players in flight simulation, airport management and air traffic control, among other positions. The FAA currently partners with social media influencers who have an impact in bringing the message of safety and excitement to the industry, and the next step could be to partner with gamers who are already enthusiastic about aviation and aerospace. Also, we should consider other video games that use problem-solving, analytical and communication skills that we want for the aviation and aerospace sectors.*



Early Awareness and Engagement



7. Industry stakeholders can sponsor student competitions

Build Awareness Through Industry Support

Establish partnerships with industry stakeholders to support and create exciting, awareness-building aviation and aerospace competitions for middle and high school students.

Student competitions can create excitement and build awareness, regardless of the discipline. There are examples across the country where the spirit of competition has been leveraged to create enthusiasm in students for education and new skills. Everything from FIRST Robotics (<https://youtu.be/WIK7S7-Kx70>) and spelling bees, to athletic competitions and “hack-a-thons” (where students spend a weekend or limited amount of time solving a proposed problem) have allowed students them to participate at a high level of engagement. Many competitions are the spark for a student to step into a new area of study. This then would introduce caregivers to future opportunities for their student. **Furthermore, research has shown a positive effect of competition on individual students, naming it as the number one indicator of student success (Inc., 2016), and it would simultaneously provide awareness about the aviation and aerospace industry as a viable career path.**



“...both parents and students describe the experience as **‘life changing’**. In the past three years, a total of six team members have graduated from [our] high school, all have **selected engineering related fields of study** at their respective universities. RWDC has extended their education outside of the classroom and given them the **confidence to tackle challenging engineering** fields of study and helped them develop a passion for learning.”

PARENT OF A REAL-WORLD DESIGN CHALLENGE (A HIGH SCHOOL AVIATION COMPETITION) STUDENT ON THE HIGH SCHOOL TEAM IN KANSAS

Early Awareness and Engagement



7. Industry stakeholders can sponsor student competitions

Proposed implementation:

- *The National and Regional Advisory Councils could develop a new area of competition for middle and high school students.* These industry stakeholder groups could develop public/private partnerships to begin the effort with a non-profit potentially furthering the effort. An excellent example of this is the General Aircraft Manufacturers Association’s (GAMA) Aviation Design Challenge (<https://gama.aero/opportunities-in-ga/aviation-challenge/>). This six-week teacher-led program produces an aircraft design where students compete virtually for an all-expense paid trip to an aircraft manufacturer. Another example—currently only available for collegiate teams—is the Vertical Flight Society’s Annual Student Design Competition (<https://vtol.org/awards-and-contests/student-design-competition>), which uses emerging technologies as inspiration. Also at the collegiate level, the National Intercollegiate Flying Association (NIFA) hosts regional and national competitions that focus on pilot skill events, such as accuracy landing competitions and knowledge-based testing. Emulating events that are hosted by the NIFA, or encouraging secondary school students to observe a competition near them, could additionally encourage entry into the field.

Efforts like the ones referenced above need the support of social media and outreach on YouTube, among other examples, to raise awareness and interest. Companies are also encouraged to strongly consider the skills that students acquire through these competitions (e.g., STEM, teamwork, troubleshooting, communication, etc.) as “real world experience” when considering new graduates for engineering positions, where “years of working experience” can be an impediment.



INFORMATION ACCESS IS ESSENTIAL: THE INTERNET IS THE ANSWER



Early in our work, it became evident that one of the greatest barriers to attracting new talent to the aviation and aerospace industry is a lack of awareness among young people, their families, their teachers and advisors. We have attempted to address this issue in our recommendations listed in Early Engagement. But once that interest has been piqued, where do students, families and educators go to learn more? How do they learn about opportunities to turn an interest or passion into a career path?

The same data that drives recommendations for increasing teacher and student engagement indicates the practical need for centralized information. A common resulting theme from all our surveys (Program, Youth and Educator) was a lack of information on aviation careers and career pathways. In fact, **our survey of high school guidance counselors revealed that 65% believed the number one resource that would be useful to introduce students to aviation and aerospace careers would be the Internet.**

Unfortunately, there is a deficit of easily accessible aviation and aerospace career development resources in one place currently on the Internet. Moreover, there is little-to-no national tracking data/mechanism for those who show an early interest in the career through participation in aviation-focused youth activities. As a result, there is no current national strategy to engage those students and guide them on a pathway to an aviation career. Aviation and aerospace education—as well as career pathway information—is fragmented and confusing and, for underrepresented groups, may be nonexistent in their particular regions. Secondary school counselors and teachers also do not have the knowledge or resources to offer adequate support and guidance to students who are interested in pursuing careers in aviation and aerospace. Students interested in these careers ultimately do not pursue them because of a lack of information, career guidance and mentorship.

65%



Percentage of school guidance counselors that believe the best resource for introducing students to aviation and aerospace careers would be the Internet.

INFORMATION ACCESS IS ESSENTIAL: THE INTERNET IS THE ANSWER



We suggest that the most effective way to provide accurate, helpful information would be to develop a website that meets the needs of a variety of constituents and provides connections to local resources. Our website would include a “virtual counselor” interactive component that provides general career information to all visitors. This “virtual counselor” would also allow for an opt-in mechanism to provide youth with individually tailored information and engagement. A national website would change the most cited reason in our survey work—from a family member or friend who connected me to the industry—to the answer of: “I went to a website based on awareness” (built from the recommendations in the first section of the report). The Regional Advisory Councils will be integral to providing content oversight, particularly as it pertains to their region, and to keep the site up to date.



Information Access. Internet is Essential



8. Create a one-stop aviation/aerospace information portal

Host a comprehensive industry platform to house information about aviation/aerospace careers and pathways on a centralized website.

A web-based platform that consolidates information into one easily accessible location would include the following:

Overall:

- At point-of-entry, differentiate between student, parent/caregiver, or educator and develop introductory content written specifically for that group.
- At point of custom search, request registration and/or account creation that asks for certain demographic data points.
- Utilize the current FAA AVSED group and their expertise as the subject matter experts for the site and its contents—calling upon other expertise as needed.
- Include robust Frequently Asked Questions (FAQs) for a variety of careers and next steps
- Information request options which could be fed back to the Regional Advisory Councils/regional AVSED representatives as needed.
- Provide a targeted set of careers to highlight (to start)—pilot, aviation maintenance technician, flight dispatcher, drone pilot—and develop content that clearly illustrates each pathway. Then, create or use existing content to spotlight a “day in the life” of a particular profession. (These assets already exist but could be aggregated on this site for greater impact.)
- Provide a list of aviation education programs that include non-profit organizations, high schools, higher education and technical training.
- Provide connections to funding sources (by state) that also includes scholarships, such as Women in Aviation-International, National Gay Pilots Association, Aircraft Owners and Pilots Association, Organization of Black Aerospace Professionals, Experimental Aircraft Association, National Business Aviation Association, Alpha Eta Rho (which is an aviation honor society), University Aviation Association, ISTAT and Regional Airline Association, among others.
- Provide connections (by state) to regional resources, such as camps, flight training, scholarships, clubs, upcoming events, and the FAA’s AVSED connection.

Information Access. Internet is Essential



8. Create a one-stop aviation/aerospace information portal

- Provide connections to organizations that serve underrepresented groups that include Organization of Black Aerospace Professionals, National Gay Pilots Association, Women in Aviation-International, Latino Pilots Association, Professional Asian Pilots Association, The Ninety-Nines (the international organization of women pilots), Dreams Soar, Experience Aviation and Aviation Community Foundation, among others.
- Seek a partnership with Google and/or other similar platforms to direct aviation Internet searches with information on aviation/aerospace careers, pathways, funding sources, etc.
- Explanation of—and connection to—the resources available through the military to aviation careers.
- Provide a local and national calendar of events (Creedy, 2022).

For Students:

- Mentoring opportunities: Create one-on-one mentoring opportunities through a specific 'mentoring' section of the website, connecting those interested with volunteers and industry professionals.
- Outreach programs (by geographic location)
- Photo galleries
- Internship opportunities
- Powerful imagery through short videos to showcase careers that feature those from underrepresented groups to tell their story.
- Careers, pathways, requirements, salaries and information on financial planning.
- Opportunities to engage in aviation field trips and visits to aviation-focused museums.
- Create a longer-form 'Storyteller's Guide' that showcases true stories about career paths, work life and more from people who work in a number of different career fields inside the industry. Emphasize diversity within these fields, as this will put a human face to these career options.
- Games/simulations of career paths

Information Access. Internet is Essential



8. Create a one-stop aviation/aerospace information portal

For Educators:

- Ready-to-print resources
- Information on grants for aviation resources (educators)
- Infographics and poster kits for schools
- Interviews and podcasts that feature pilots-turned-teachers, such as: https://www.mankatofreepress.com/news/local_news/east-coach-wins-robotics-teacher-of-the-yearaward/article_335da8b0-ce97-11e5-8beb-3b83dc121dfc.html
- Links to existing curriculum and lesson plans for educators (e.g., Aircraft Owners and Pilots Association, Choose Aerospace, VEX Robotics, Civil Air Patrol, NASA Smart Skies, etc.)

For Parents/Caregivers:

- Careers, pathways, requirements, salaries and information on financial planning
- Listing of aviation education organizations by region (e.g., Civil Air Patrol, opportunity for demo flights with the Experimental Aircraft Association, upcoming “kids day” at local airports, etc.)
- Links (by state) to resources by age group (e.g., 8-12; 13-17; early adult)
- Financial resources (e.g., links to the Free Application for Federal Student Aid [FAFSA] and state-by-state links to grants for residents, scholarships and more)



Information Access. Internet is Essential



9. Create a “virtual counselor” component on the site

This interactive component of the website would use artificial intelligence (AI) to provide general career information to all visitors and could also allow for an opt-in mechanism to provide youth individually-tailored information and engagement on securing an aviation and aerospace career in the United States.

- The purpose of the virtual counselor is to provide site users an interface to ask questions and get information in a real-time and interactive way.
- The virtual counselor will be able to provide easy-to-find information on the website and resources based upon the specific query from the user.
- Ultimately, the virtual counselor would ideally also provide a “live chat” option where users can communicate with an actual person (possibly during set hours Monday-Saturday if the automated system is not able to match their question with existing information on the website. The other option is to provide an inquiry form, and someone could reach out to the student/parent/caregiver/educator within 72 hours, and the outreach would come from that inquiry’s region.).

By creating a virtual world that is helpful in all aspects of aviation and aerospace; connecting industry, schools/training/higher education, organizations, social media influencers, gamers and others we will provide families and educators with the information needed to learn more, find more and intentionally become members of the aviation and aerospace workforce.

The Task Force recommends that one entity create and maintain the website. While governmental agencies and their existing Internet platforms provide established web infrastructures and name recognition, other options could include a private or not-for-profit entity, or a partnership with a platform that has already developed resources and assets which could be used to develop a truly valuable resource. Another option, in 2020 there was proposed legislation for a National Center for the Advancement of Aviation (H.R. 8532) which would create a federally chartered entity to serve as a national independent forum to facilitate collaboration and cooperation between aviation and aerospace stakeholders among other priorities to build the workforce pipeline (Carson, n.d.). Were that legislation to pass and be adequately resourced, this National Center could develop and maintain the site.

Information Access. Internet is Essential



9. Create a “virtual counselor” component on the site

There are several websites that seek to grow the workforce for a particular industry, and these could be used as a model including:

- Institute for Electrical and Electronic Engineers (IEEE) offers pre-university resources for volunteers and teachers: <https://tryengineering.org> around the globe.
- Choose Aerospace is a partnership of aerospace stakeholders working to address the need for diverse, qualified technical workforce: <https://www.chooseaerospace.org/>
- Alliance for Aviation Across America is an organization raising awareness about the value of general aviation and local airports particularly in rural communities: <https://www.aviationacrossamerica.org/>
- Utah Rotor Pathways brings together industry, high schools and universities to provide helicopter pilot and maintenance training in high school: <https://utahrotor.org/>



COLLABORATION IS KEY: CREATE A CONNECTED CAREER PATHWAY



This Task Force had several public meetings with guest speakers from outstanding youth-serving programs across the country, some holding annual one-time events, six-week summer programs, year-long engagements and some supporting students over several years. These events and programs create excitement and passion for the students they serve, but they are often not part of a directed pathway that helps students to find that all important next step to training and/or collegiate aviation programs resulting in a career. Building on our recommendations to first create early awareness and then drive students, parents/caregivers and educators with interest to a comprehensive aviation and aerospace website, our Task Force recommends that we also work together to create a connected career pathway that leads to a position in aviation and aerospace. This pathway would be built by creating collaborative councils by region, using existing platforms and education programs to reach young people, and exploring additional ways to reach young adults.

As noted in a 2013 Oliver Wyman study on how to attract more young people to the aviation and aerospace workforce: ***“To develop the ...talent that aerospace companies will need, the industry must inspire and train the next generation of students. That’s going to take some unusual and creative partnerships”*** (Murray, 2013).





10. Create regional advisory councils

Representatives from industry, government and education should form advisory councils at the regional level—based on the nine regions of the Federal Aviation Administration—for better coordination, communication and partnership opportunities. Ideally, these Councils would be managed and coordinated by the FAA’s AVSED representative(s) in that region.

If aviation and aerospace organizations are not communicating with each other regularly, how can we possibly create awareness and drive students to a career path? We need the FAA’s AVSED offices to be “conveners” of like-minded individuals and organizations across the nine regions of the United States to share information about best practices, solicit data from students, caregivers and educators about what they need, as well as create responsive systems (e.g., adding information to the national website, creating greater opportunities to visit aircraft manufacturers or fly a drone, etc.).

In addition, state and local aviation agencies are in a unique position to support the industry. And while some states have established robust outreach and educational programs, others lack the necessary resources to promote this important transportation asset. Research is needed to provide guidance and supporting material for state agencies, local airports and manufacturers, among others, to promote interest and participation in the aviation and aerospace industry (National Academies, 2019).





10. Create regional advisory councils

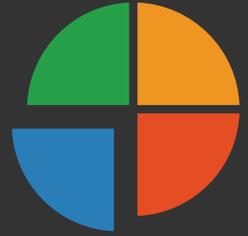
Proposed implementation:

- *Use the Regional Advisory Council to bring parties together to coordinate outreach and programs locally.* By having a “master list” of all of the activities and resources in a particular region (e.g., camps, airport visit days, aviation museums, Women in Aviation-International or The Ninety-Nines chapters, Civil Air Patrol units, aviation training facilities, collegiate aviation programs, etc.), these entities could collaborate to exponentially reach more students. These Regional Councils could also provide guidance and supporting materials for groups across the region (and also housed on the one-stop shop website) to promote interest and participation in the aviation industry, while also connecting students to existing programs in their geographic locations. An example of this collaboration—outside of aviation—can be found at: www.stemecosystems.org, which provides members with best practice opportunities and collaboration within in a region.
- *Champion these regional efforts with a National Council.* The FAA has a long history of using advisory committees—like the Aviation Rulemaking Advisory Committee—to foster change and enhance safety around a variety of topics, such as training and testing standards. Another example of the importance of advisory groups is the Congressional establishment of this Task Force, as well as the Women in Aviation Advisory Board, where passionate volunteers collaborated to provide their best thinking on a forward pathway to diversify the industry. Finally, the recent use of federal funding administered by the FAA to address the pilot and aviation maintenance technician shortage prioritizes local community partnership and the importance of regional focus, and it is administered at the national level.
- *Establish standing committees or councils with structure and management that are similar to other bodies* (using those established under FACA as an example), based on the participatory model of this Task Force and the Women In Aviation Advisory Board. Prioritize underrepresented individuals as members of any advisory councils/committee, as well as the inclusion of high school and college-age students.

“We use a Career software program so students can **research specific careers on their own**, but I don't "teach" about any specific careers as the counselor as **there is not enough time** to do so.”

-GUIDANCE COUNSELOR

Collaboration to a Connected Career Path



11. Tap the power of college and career readiness platforms

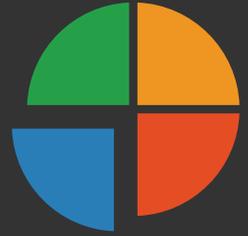
Bring the Excitement of Aviation and Aerospace to Existing Platforms

Work with college and career readiness platforms to provide and enrich information on aviation/aerospace careers; targets are school counselors, caregivers and students.

Career and college readiness platforms are powerful tools for students to explore their strengths, interests, and talents and what could be possible for their future. These platforms reach a wide audience as school districts nationwide require counselors, caregivers and students to utilize these platforms from middle school through high school. **Through partnerships with Naviance, CareerZone, CareerConnect, Xello and other career readiness platforms, we recommend expanding the aviation and aerospace information in these platforms to better delineate the various careers and pathways available in aviation and aerospace. This includes a direct link to the one-stop shop aviation/aerospace website once it is developed.**

Our student survey indicated that it is important for teachers and counselors to be more knowledgeable about aviation and aerospace and the various career pathways. Students repeatedly indicated they would like to be made aware of opportunities. A significant barrier to entry was a lack of knowledge and exposure. At the same time, educators are turning to digital tools more and more for personalized career searches and “aviation” or “aerospace” are not unique career clusters (meaning there are a myriad of positions you can be part of in the industry making it more difficult to search on one term). **When searching in general terms, aviation careers are hard to find within the most commonly used career readiness platforms. As a result, there needs to be more information within these platforms.** For example, in Naviance, an attempt to search specific aviation careers/terms (e.g., “aviation mechanic”) was challenging, while aviation and aerospace career pathway information is disjointed and confusing.

Collaboration to a Connected Career Path



11. Tap the power of college and career readiness platforms

Proposed implementation:

- *The leadership of the FAA's AVSED office could reach out to careers platforms, including Naviance, CareerZone, CareerConnect, and Xello to determine how they collect and determine the information that is shared with students and families. Once that data is mined and understood, a data-sharing arrangement might be possible and could be driven by the information developed on the one-stop shop website.*
- *Create a collaboration between the FAA/Department of Transportation and the Department of Education—along with these career readiness platforms—to work together in a public-private partnership with a free-flowing exchange of economic data to help families and students make choices about their futures.*



Collaboration to a Connected Career Path



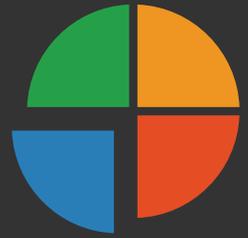
12. Significantly increase the mentoring, pre-apprenticeships and apprenticeships that are available to grow future employees

Stimulate career development programs that utilize aviation and aerospace employers to engage with prospective applicants. Utilize stackable credentialing programs that lead to credit toward the airframe, powerplant or general certificates (for aviation maintenance technicians), uncrewed aerial systems (UAS), flight, dispatch and other industry recognized credentials. Whenever possible, programs should begin in high school to close the gap between exposure to a career and full training, thus leading to certification and opportunities. This should be explored to recognize these credentials as part of the core curriculum (such as math and science requirements).

Through exposure and hands-on opportunities, high school and college students can learn about careers and opportunities that cannot be taught in the classroom. On-the-job experience is the next step after a solid academic foundation is in place.



Collaboration to a Connected Career Path

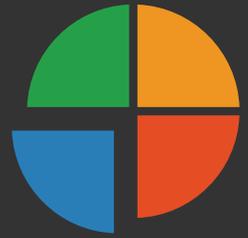


12. Significantly increase the mentoring, pre-apprenticeships and apprenticeships that are available to grow future employees

Our data suggested that student barriers to aviation careers included a lack of industry awareness or exposure. Couple this with the fact that the majority of teachers surveyed were also unaware of these career fields and do not include aviation-focused topics in their lessons. During our Task Force deliberations, we reviewed existing efforts to create career pipelines or interest and identified the need to increase direct engagement between employers, students, educators and caregivers. This recommendation allows the people and the equipment already working in aviation and aerospace to be used to deepen understanding of real job opportunities.

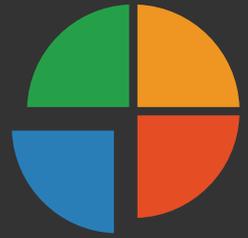
Proposed implementation:

- *Offer Job Corps training through a partnership between the FAA and the Department of Labor (DOL).* Job Corps is a federally funded comprehensive program that provides essential academic and career skills training and prepares students for success in every aspect of their lives. More than 40,000 students benefit from Job Corps training each year and many go on to apprenticeships. Right now, they do not offer or appear to partner with any aviation training/higher education institution for fields such as aviation maintenance. (See: www.jobcorps.gov)
- *Increase aviation industry apprenticeship opportunities.* Although aviation industry apprenticeships have been slow to gain traction, the Department of Labor's website shows that more than 600,000 students are currently engaged in apprenticeships—with a 92% retention rate. This is another area where aviation and aerospace can work with technical high schools, colleges and training institutions to create a visible pathway for students. (See: www.dol.gov/agencies/eta/apprenticeship). Federal student aid will also support the use of apprenticeships while students are enrolled in higher education and training programs (See: <https://fsapartners.ed.gov/knowledge-center/library/dear-colleague-letters/2014-12-18/gen-14-22-subject-apprenticeships-and-federal-student-aid-programs#:~:text=If%20all%20or%20part%20of,includin%20for%20the%20apprenticeship%20portion>). The Regional Advisory Councils could be key to this effort by identifying a company and a training partner to pilot an apprenticeship effort.



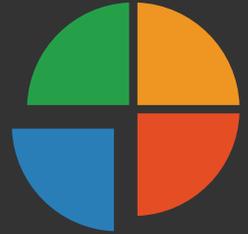
12. Significantly increase the mentoring, pre-apprenticeships and apprenticeships that are available to grow future employees

- *Encourage the FAA to explore recognition of other industry credentialing bodies.* There are several other national organizations that provide high-quality, skill-certification programs. With the recent changes to the FAA's requirements for aviation maintenance training programs, this could be an opportunity to consider how other types of skill credentialing could be used to support the training of technicians. For example, the National Coalition of Certification Centers (NC3), a non-profit corporation, builds industry-educational partnerships and develops, implements and sustains industry-recognized portable certification built on national standards. NC3 is funded through high school, community and technical college memberships and industry contributions. NC3 also works with industries and states to create viable programs. (See: www.nc3.net)
- *Bring underrepresented groups to aviation through FAA partnerships with non-profit workforce organizations.* The FAA and a National Advisory Council could partner with Jobs for the Future (JFF), a non-profit, to assist in driving transformation of the American workforce and education systems to achieve equitable economic advancement for all. The JFF collaborates with national leaders in education, workforce development, business, technology, government and philanthropy. Specifically, they develop powerful partnerships and networks that help scale for nationwide impact. In addition, JFF's Center for Apprenticeship & Work-Based Learning provides expert guidance and resources on effective approaches to work-based learning that benefit businesses, students and workers. (See: www.jff.org).
- *Aviation and aerospace companies can contribute to building a connected pathway by promoting internships, externships (job shadowing) as well as consider offering those opportunities to regional high schools.* By working with high schools, colleges and universities (particularly Title I high schools and minority-serving colleges and universities) that offer aviation and aerospace programs—as well as those institutions closely aligned with industry—companies can develop relationships with those educational institutions' guidance counselors and career services offices to build a pipeline of students.



12. Significantly increase the mentoring, pre-apprenticeships and apprenticeships that are available to grow future employees

- *Consider best practices in developing a mentoring program with middle and high schools, as well as college students from underrepresented groups. Recruit young professionals from these underrepresented groups to be the mentors. (As Astronaut Sally Ride said: "You can't be what you can't see.").* Based on research into best practices when developing these programs, the essential elements include: 1. Set clear expectations. 2. Establish program structures and processes. 3. Provide training and support. 4. Build relationships and engage mentors. (MacFarlane et al., 2018, II). Furthermore, in MENTOR's Fourth Edition of "Elements of Effective Practice for Mentoring" (and its review of the documented mentoring practices) it was encouraged to design programs that produce change, stay connected to local needs, contexts and circumstances, and demonstrate impactful and measurable results (MENTOR, 2015, 8).
- *Develop career coaching for prospective aviation industry employees. Coaching, as defined by the International Coach Federation (ICF), is: "...partnering with clients in a thought-provoking and creative process that inspires them to maximize their personal and professional potential" (International Coaching Federation, n.d.). Career coaching is a specific type of coaching that works with individuals to identify inter- and intra-personal skills that will help them find success within the industry. Leadership and executive coaching can also help prospective and current employees and students engage more meaningfully in their skills development, which will in turn increase the likelihood of retention in the aviation and aerospace field. "For underrepresented students, who may require supplementary guidance on navigating the college environment, particularly if they are the first in their families to attend college, access to both a coach and advisor may be particularly beneficial" (Farrugia et al., 2020, 1908).*

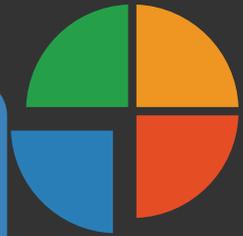


12. Significantly increase the mentoring, pre-apprenticeships and apprenticeships that are available to grow future employees

- *Create stackable credentials, as the Part 147 Airframe and Powerplant Certification Program evolves with the new flexibility in regulations.* Airframe and Powerplant training programs have within them several core competencies that could be segmented into stackable credentials, such as composites, sheet metal and circuitry, among others. These credentials could provide quicker access to aviation and aerospace employment, where students can either continue building practical experience toward certification under 14 CFR Part 65's experience requirements for mechanics or potentially qualify for employer endorsement for a repairman certificate. Such shorter-term programs would allow training providers to attract students with quicker, lower-cost pathways to initial employment, allow employers to receive technicians with fundamental skills, and demonstrate to the FAA the viability of such programs for agency recognition of incremental training or experience. The FAA could further support such efforts and increase the value of a repairman certificate by recognizing these short-term training programs.



Collaboration to a Connected Career Path



13. Build educational outreach to underrepresented groups, particularly at Minority-Serving Institutions, community colleges, technical institutions and non-aviation minority organizations

Improve and increase outreach to education institutions specifically serving underrepresented groups, especially Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Asian and Pacific Islander Institutions (AAPIs) and Tribal Colleges and Universities (TCUs).

It is essential for the future of the aviation industry that we have broad representation within our workforce to better reflect the US population and the customer base. We need to communicate and better collaborate with organizations or activities already present and strong in minority-serving institutions. These include community colleges and technical institutions as well as programs that are outside of aviation—such as fraternal organizations, clubs, community-based afterschool programs, housing authorities, places of worship and faith-based organizations, among others. Companies have a much greater opportunity to increase the diversity of their workforce if they seek out institutions and organizations that largely serve underrepresented students.

Proposed implementation:

- *Engage with Minority-Serving Institutions and two-year colleges to provide information about the market-driven job opportunities that most impact them.* Industry should reach out to higher education institutions and encourage dual enrollment programs in aviation. There are also opportunities for the FAA to partner with these institutions—much as they did with the Air Traffic Control-Collegiate Training (ATC-CTI) Initiative and the new Uncrewed Aerial Systems-Collegiate Training Initiative (UAS-CTI). Both of these programs serve as models to be developed for other in-demand fields, such as flight dispatch.
- *Drive recruitment with underrepresented groups by allowing already-completed aviation or aerospace organizational/educational activities to count as industry experience.* Consider working with the Office of Personnel Management to review job descriptions and qualifications for FAA, Department of Transportation, NASA and other aviation/aerospace jobs to determine if the published requirements could also include applicants who may not have any on-the-job experience but have demonstrated education/skills from youth organizations/activities. These credentials may also stand in replacement for a specific degree.

Collaboration to a Connected Career Path

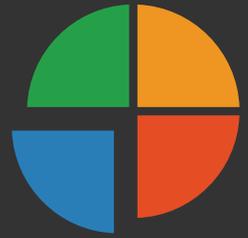


13. Build educational outreach to underrepresented groups, particularly at Minority-Serving Institutions, community colleges, technical institutions and non-aviation minority organizations

- *Partner with university minority sororities and fraternities.* For example, nine of the historically Black Greek letter organizations have “youth auxiliary groups” that range in age from kindergarten to high school. Partnering with these groups to provide curricula, speakers and simulator experiences, among others, could raise increased awareness in exactly the populations we are attempting to reach. (See Zeta Phi Beta as an example: <https://zphib1920.org/programs-initiatives/youth-auxiliaries/>)
- *Leverage opportunities that are outside of aviation and which include non-traditional inroads into underrepresented communities by adding them to Regional Advisory Councils or partnering to increase representation.* By partnering with organizations such as the Urban League (at the local and national level), military Junior Reserve Officer Training Corps programs in Title I high schools, among other places, we can further create engagement with the students we hope to recruit who are already active in activities and organizations. Aviation education organizations might also consider Housing and Urban Development (HUD) grants to fund workforce development in communities with groups that are underrepresented in aviation and aerospace.



Collaboration to a Connected Career Path



14. Establish dual enrollment programs between high schools and colleges/universities as well as workforce development grant programs to create well-aligned pathways.

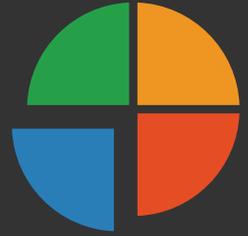
Dual enrollment programs are another opportunity to reach underrepresented populations with high school students simultaneously receiving credit for a high school course and a college-level course. An example of this is in New York where there is a partnership between a local Hispanic-Serving College and a minority-serving high school that allows students to be enrolled in college courses while in high school (that also count toward their high school degree requirements). Upon graduation and with one additional year of college, that student will receive an associate's degree in avionics (aircraft electronics) and have the skills required to work at a local avionics repair company (also part of the partnership). These credit-based programs are a tangible career pathway that will provide a pipeline of young people who may want a quicker pathway to a career.

Dual enrollment programs make economic sense for many students, greatly reducing college debt, and can provide the institutions that serve them with a steady flow of interested students. Dual enrollment is also a powerful lever for closing equity gaps, particularly for low-income students and students of color. Students from low-income backgrounds and/or school districts were 10% more likely to enter college after high school when they participated in dual enrollment programs. And students in majority-minority school districts who participated in dual enrollment were 32-56% more likely to go to college than their non-participating peers (Quottly, 2022).



At this critical time of need in the industry, high schools, training providers, colleges and universities, especially Minority-Serving Institutions, need a better understanding of the breadth of various types of in-demand careers in aviation and aerospace. Ideally, the FAA and the industry would seek out higher education institutions region-by-region to partner with them and the local high schools they serve to offer aviation-related dual enrollment programs.

Collaboration to a Connected Career Path



14. Establish dual enrollment programs between high schools and colleges/universities as well as workforce development grant programs to create well-aligned pathways.

The FAA's recent pilot and aviation maintenance workforce development grant programs are another excellent opportunity to prioritize collaboration and partnerships that serve a diverse population. These funds were specifically used to build partnerships and broaden awareness, such as dual enrollment programs. We strongly encourage Congress to significantly increase the amount of annual funding which right now is only \$5 million for two tracks (aviation maintenance technicians and pilots). The FAA also needs to share what is learned as a result of the first two rounds of funding and make that information available nationwide to assist in the development of successful, reliable and scalable projects.

Proposed implementation:

- *Employers should seek out higher education/technical institutions with aviation and aerospace programs especially those that serve underrepresented populations.* Targeting existing programs in the regions that aviation and aerospace companies serve, provide those institutions and organizations with financial support (e.g., scholarships in particular), internships and mentoring opportunities and support them in building dual enrollment programs.
- *Significantly expand the grant funding available to the FAA to drive innovation and outreach across the nation.* Congress should also consider providing the FAA with the operational funding to effectively staff this new programmatic area for the agency as well as the operational funds needed to share the results. In the first round of funding, more than 300 applications were received for only \$10 million of funding. We suggest an allocation of \$50 million by Congress in the next FAA reauthorization to have a more significant and lasting impact.

OVERCOMING THE FINANCIAL HURDLE: SUPPORT FOR INDIVIDUALS AND ORGANIZATIONS



This report has already proposed: (1) creating awareness about the vast opportunities in aviation and aerospace at a much earlier age; (2) creating a one-stop shop website; and (3) collaboration to create a connected education and career pathway. Our final recommendation is: (4) the financial support to assist those from low socioeconomic backgrounds with the financial resources needed to pursue a transformational career pathway. Below, we provide suggestions that can assist individual students who pursue the required education and specific training to become an aviation or aerospace professional, as well as a sustainable funding stream for organizations to support the workforce pipeline.

Education and training costs present a significant barrier to entry in aviation and aerospace for most individuals and particularly those from low-income backgrounds and underrepresented groups (Flyby, 2020). Just the cost of training to become an airline pilot is about \$87,000 for the training and certification. When FAA exam fees, housing, food and pilot gear are included the cost rises to \$100,000 and for those who pursue training as part of an academic degree that does not include the cost of tuition, fees, books and other costs associated with attending college (*How Much Does It Cost to Become a Commercial Pilot?*, 2020).

The cost for preparing technicians varies. The tuition and fees for an associate's degree aircraft maintenance program ranges from \$8,000 to \$45,000. When looking at the costs for a bachelor's program the costs range from \$20,000 to \$80,000. Non-university programs range from \$20,000 to \$50,000 (Crookston, 2021).

Students can fund their education in several different ways. Grants are typically funding that does not need to be paid back. Loans must be paid back. The financial structures currently in place include:

- Federal Pell Grants—For federally approved institutions and generally for students with the greatest need.
- State grants—Varies by state as to the amount and the criteria.
- Federal loans—Criteria varies by income level, parents' financial situation, number of credits achieved by a student in a degree program, and satisfactory academic progress both in credits achieved and the grade point average. Interest rate is set by the federal government and currently ranges from 4.99% to 7.54% for individuals and parents.
- Alternative loans—These are loans generally from banks and can be fixed or variable (and if the student or family can qualify based on their credit score) the rate in July 2022 could be from 0.94% to 13.95% (Calonia, n.d.).
- Institutional Aid—this is typically a scholarship either based on the merit or need (or both) of the student and is funded by the training entity/college/university the student is attending. Amounts vary by institution and the total cost of attendance.

OVERCOMING THE FINANCIAL HURDLE: SUPPORT FOR INDIVIDUALS AND ORGANIZATIONS



If students are pursuing a program at an institution that is not approved for federal grants or loans (which generally means that state aid will also not be available)—or the cost of the program is beyond the student’s financial capacity, or a student or family’s credit score is low either because they have no credit history, or the credit history contains negative information—the ability to pursue a program becomes incredibly difficult. We do not want to stop passionate, committed students from pursuing a career in aviation because of finances, and we suggest some possible new ways of thinking about affordability. Even when loans are available, many students see loans negatively. This is particularly true for low-income students, who are reluctant to take on significant debt to further their careers.

President Biden’s Student Loan Relief Program has brought a critical focus on the cost burden of higher education and the long-term negative impact it can have on students who attend training and/or higher education. The Task Force wants to prepare students for positions in aviation and aerospace and decrease the financial barrier that it presents.



“Funding is the number one obstacle. It is important to let students know that these education opportunities lead to access to careers. **Existing funding is not enough** to cover all of the costs for a student. There is a **significant gap** between what is funded and what is needed for both pilots and maintenance technicians. With additional funding they could **close the gap** in funding and help more students make it into aviation careers.”

-PRESIDENT, AVIATION COLLEGE AND A CHIEF FINANCIAL OFFICER, AVIATION COLLEGE

Overcoming the Financial Hurdle



15. Decrease the cost of flight training by increasing the allowable simulator time for pilot certification

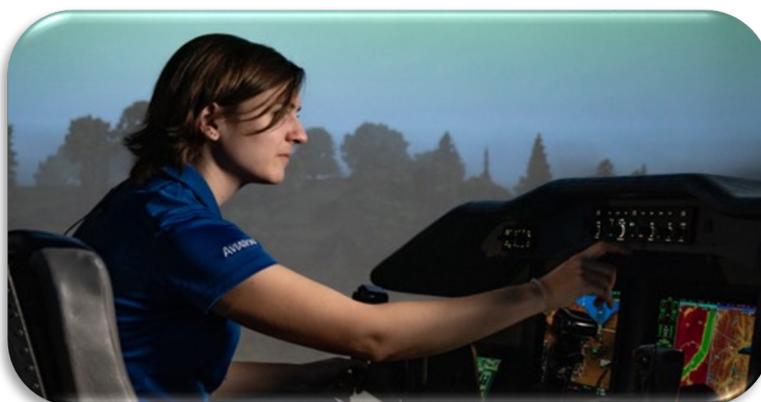
To assist individual students we recommend the following:

With the advancement in simulator technology, more allowable time in the simulator could reduce the minimum number of flight hours it takes for a student to achieve a license or certification and could decrease flight training costs.

The current student averages 60-to-80 hours (FAQs, n.d.) of dual (with a Certified Flight Instructor) training time in an aircraft for the Private Pilot License. The average cost for that time is \$155-to-\$170 per hour nationwide (Houston, 2019) It should be noted that cost has risen due to the impacts of the pandemic on fuel costs. The cost of the instructor is generally about \$45 per hour, with the remaining costs covering fuel, the maintenance of the aircraft and operating expenses for the flight training provider. Students must have a minimum of 40 hours (under Part 61) before they can test with a Designated Pilot Examiner to achieve their license. A recent Google search for the cost of time in a flight simulator at a flight school was \$80—roughly half the cost of time in an airplane. By increasing simulator time, it might be possible to reduce the average number of hours it takes to achieve the PPL and increase competency without sacrificing safety.

Proposed implementation:

- *FAA to work with several of the existing approved Flight Training Device manufacturers to determine the optimal mix of simulator and in-air flight training time with the goal of reducing the number of in-flight hours while maintaining safety.*



Overcoming the Financial Hurdle



16. Increase the maximum Pell Grant for students

President Biden has proposed doubling Pell by 2030 and included an increase in next year's proposed budget.

It has been widely reported that President Biden would like to see Pell Grants doubled for individual students by 2030. While this date occurs after his term (even if he were elected for a second term) has ended, he has already increased the Pell Grant by \$400 and has proposed a further \$2,175 increase for the 2023-2024 award year, which would bring the maximum grant to \$8,670, if approved by Congress. This would be a significant increase and provide much-needed funding for students to pursue any career in aviation and aerospace.

According to a study by the W.E. Upjohn Institute for Employment Research (Denning et al., 2017) as reported by Forbes showed:

...students qualifying for the maximum Pell Grant [the neediest students] see significant increases in college graduation and earnings compared with low-income students who didn't qualify for such aid. Those receiving targeted aid are 13 percent more likely to graduate from college and have 5 to 8 percent more in earnings. What's more, the government regains the entirety of its investment through increased tax receipts after just 10 years. In other words, the government recoups its whole investment just six years after students graduate – with decades of increased earnings and tax payments left to come (McPherson, 2022).



**New Potential Maximum for
Pell Grant**

Overcoming the Financial Hurdle



16. Increase the maximum Pell Grant for students

Concurrently, and especially for those students who are pursuing degrees with additional training costs, increasing Pell Grants reduces the need for additional loans, especially alternative loans with higher interest rates while providing an attainable career pathway.

Proposed implementation:

- *Congress should support increasing Pell Grants as soon as possible to make education and training possible for more low-income individuals.* Legislation already introduced to Congress—*Jumpstart Our Businesses By Supporting Students (JOBS) Act, Bill S.864*—would make high-quality, shorter-term training certifications eligible for Pell funding. There are many technical skills that can transfer into aviation and aerospace careers after brief training experiences, but the hourly requirements (150 minimum and 600 maximum, along with the requirement that it leads to a job within those limits) are too high for flight training and too low for an aviation maintenance program. We suggest that the FAA meet with the sponsors of the bill to see if modifications could be made to the hourly requirements, including consideration of removing minimum and maximum numbers of hours and instead focus exclusively on training outcomes like industry-recognized credentials and employment need, so as to include aviation and aerospace careers.
- *Create a memorandum of understanding (MOU) between the FAA/Department of Transportation and the Department of Education to provide the structure to explore options of expanding Pell eligibility, especially for students who are pursuing careers in high-demand fields such as aviation and aerospace.*

“With more money we could **impact more students**. With additional money we could provide more exposure and outreach; provide more hands-on experiences; and increase the numbers of students we impact. We would **expand our program across the US**. Lack of scholarships are a barrier to higher education. There is also a need to **develop partnerships** with community colleges to develop dual enrollment programs.”—

- PRESIDENT AND CHIEF EXECUTIVE OFFICER, AVIATION
EDUCATION ORGANIZATION

Overcoming the Financial Hurdle



17. Develop a national aviation scholarship program

These would be funds made to qualified students and would not need to be repaid.

National Aviation Scholarships would go to an individual student enrolled in an approved program and be paid out to the institutions providing the education and training (similar to how Pell Grants work now). Scholarships will be awarded based on financial need and could use the current awarding scheme used for Pell Grants. It is estimated that approximately \$100 million per year would be needed for the scholarship program which represents about .004% percent of the 2021 Pell grant Grant budget total of \$22.5 billion (*Student Financial Assistance - FY2021, n.d.*).

The US Department of Education Office of Federal Student Aid would administer the program. The scholarship program would be paid in three phases as students successfully complete the program (1) initial payment when the student begins training; (2) mid-point payment in the training program; and (3) final payment at the end of the training program. As a first step, the Department of Transportation (DOT) could work with the Department of Education (DOE) to determine the criteria for the program using a memorandum of understanding. We offer several funding suggestions below which would require action by Congress as well as collaboration between DOT and DOE.



Overcoming the Financial Hurdle



17. Develop a national aviation scholarship program

Proposed implementation:

All the funding suggestions below require Congressional action and are proposed with the understanding that any of the ideas must benefit all aviation partners (e.g., airlines, airports, manufacturers, repair stations). The Task Force makes these suggestions with the full knowledge that these are difficult and potentially complicated options and consideration could be given to a combination of two or more of the options.

- *Add funding to the US Department of Education budget to support the recommendation.*
- *Establish a separate fund or redirect funds within the Airport and Airway Trust Fund using 0.75% to pay for scholarships for aviation and aerospace education and flight training specifically.*
- *Establish a \$0.10 user fee on all commercial airline tickets sold in the United States that would be used to benefit all of aviation and aerospace with funding to support building the talent pipeline with scholarships.*
- *Consider increasing landing fees and use the funds to support scholarships for education and training programs.*
- *Congress should significantly increase the grant funding available to the FAA (as previously suggested) from the current level of \$10 million to \$50 million for innovative programs that lead to documented best practices in raising awareness and bringing more young people to careers in aviation and aerospace. Congress might also choose to increase that amount to \$100 million providing \$50 million to begin a National Scholarship Fund.*

Overcoming the Financial Hurdle



18. Implement a multi-faceted aerospace workforce development program

To assist aviation and aerospace education providers:

Develop an incentive to fund aviation and aerospace education programs through Departments of Defense and Transportation contracts.

One of the concerns we heard many times from our aviation and aerospace providers, particularly those serving underrepresented populations, was the lack of sustainable funding to implement programs and produce trackable outcomes. These non-profit organizations and institutions devote considerable time to finding funding—time that could be spent on serving greater numbers of students and building scalable programs. **The Task Force suggests an innovative solution utilizing the government contracting process that will incentivize industry partners to work with the organizations and institutions providing aerospace education in their region or the country as well as allow those programs to have an ongoing funding stream.**

It will be necessary to build a long-term partnership between aviation and aerospace companies—as well as aerospace education programs—to facilitate getting more students into the workforce. A funding incentive that uses the government contracting process will address the workforce issue by building partnerships between companies and education programs. The partnerships will be sustained by aligning the organizational goals of both groups using a financial incentive to collaborate.

This program will encourage companies to reach out to programs to enhance their competitiveness on contracts. At the same time, programs will be encouraged to develop activities that lead to students entering the aerospace workforce to achieve funding. Programs will also be required to develop metrics based on the criteria in the contract's Request for Proposals (RFPs) demonstrating that their students are pursuing employment in aviation and aerospace. The metrics will be used to measure the programs' performance during the contract period.

Overcoming the Financial Hurdle



18. Implement a multi-faceted aerospace workforce development program

Proposed implementation (with greater details in the Appendix):

- *The program will be paid for by using 0.25% of all Department of Defense (DOD) and Department of Transportation (DOT) aviation and aerospace contracts. The estimated funding available using this approach would be \$512.5 million per year based on contracts awarded in 2019.*
- *DOD and DOT contracts will require companies to address the workforce need by including aerospace education programs that build the aerospace workforce as subcontractors. Companies will choose educational programs to be subcontractors from the Aerospace Education Program List.*
- *The aerospace education program subcontracts will focus on building the workforce by demonstrating how programs are getting students into jobs such as pilot, aircraft maintenance technician and engineer.*
- *The Aerospace Education Program List will be located on a federal agency website. The website will be paid for by using a portion of funds allocated for the aerospace education subcontracts. This will cover the cost of design, development, maintenance and administration of the website.*
- *Congress would need to take the next step in developing legislation to implement the program and the DOD and DOT would need to modify the existing contracting process to accommodate the proposed changes.*



Overcoming the Financial Hurdle



19. Increase donations to aerospace education programs by increasing the corporate tax benefit

Companies currently receive a tax incentive of 25% for donating to not-for-profit organizations (Internal Revenue Service, 2021) and we propose increasing that incentive.

Annual corporate donations are \$20,770,000,000. The amount of annual donations to education is \$2,900,000,000 with most of this funding not going to aviation and aerospace institutions and organizations (Curtis, 2018). The Task Force proposes increasing that tax incentive by 10% for those companies providing funding directly to non-profit aviation and aerospace education 501(c)(3) institutions and organizations bringing the total tax incentive for corporations to 35%. This would include financial contributions, donations of equipment and volunteer time by employees.

Proposed implementation:

- *Congressional Action.* The House of Representatives Ways and Means Committee handles all changes to the tax law, and we suggest that the Department of Transportation consider working with the committee to begin a process of review of this recommendation to determine next steps.
- *Incentives would increase corporate engagement.* This incentive could also create greater interest by companies to offer their employees as volunteers with aviation organizations and institutions to speak, mentor, provide job shadowing, site visits and more.
- *Enhance the effectiveness of corporate support.* Industry partners should also create easy-to-find resources, such as a point of contact on their websites so that aerospace education programs and organizations can find and request volunteers to serve as mentors, judges and speakers, etc. as well as request financial support.



Overcoming the Financial Hurdle



20. Aviation and aerospace companies could consider several different financial options to assist in bringing underrepresented groups to the sector

The Task Force looked at several options not widely used to assist those from low socioeconomic backgrounds to make a career in the industry possible.

The aviation and aerospace industry has in recent years undertaken several initiatives to assist those who desire a position with sign-on bonuses. The Task Force suggests that there are some additional options that could provide a financial incentive to a more diverse group of students.

Proposed implementation:

- *Assist with repayment of student and training loans.* As the pause of repayment of student loans comes to an end on December 31, 2022, many students will be faced with the repayment of debt, which for aviation and aerospace students could include college tuition, fees and training costs. Some students, especially those from low socioeconomic backgrounds will look at the debt-level required to pursue a career and simply choose a different field. Aviation and aerospace are not the only industry facing this economic barrier—healthcare is facing the same issue and has used assistance with debt repayment as a tool to attract and retain their workforce.
- *Follow a similar model to healthcare.* At one hospital in Michigan, “The benefit is available to all employees after they have worked at the hospital for six months and pays \$200 a month in the first year, \$300 monthly in the second year and \$400 monthly in the third year, with a maximum benefit of \$12,000. Benefits are prorated for part-time employees” (Carrns, 2022). This is just one example of how a student loan repayment program could be structured.



Overcoming the Financial Hurdle



20. Aviation and aerospace companies could consider several different financial options to assist in bringing underrepresented groups to the sector

- *Increase the amount of pathway support offered to underrepresented populations (particularly to cover the gap between federal and state aid and the actual cost of education/training) including a stipend for expenses that will allow the student to focus on training and not on finding the funding for training.* Several regional and major airlines currently offer financial incentives as part of their pathway programs for flight training and airlines could consider expanding this to include future aviation maintenance students. Aerospace manufacturers might consider the same incentive for engineering students.
- *Industry should work with Minority-Serving Institutions to identify students at targeted high schools (particularly Title I schools) and provide financial/pathway incentives.* Scholarships along with guaranteed internships/externships and a hiring pathway, as they begin their training programs and/or college education, create an ideal situation where a student would understand that they could graduate with less debt, a resume of experience and the opportunity of a first position in aviation and aerospace.



Overcoming the Financial Hurdle



21. The FAA should review its regulations and guidance related to technical proficiency of industry personnel and certification standards as well as update its own practices for managing and developing government human resource

Leveraging Regulatory Oversight to Lower Costs

We encourage the government to review its own standards with regard to skill development and seek ways to enhance opportunities for growth and provide for new technology to drive down the cost of training.

Technology, industry and academia are evolving faster than standards, policy and regulation. Agile systems need to be in place that will evaluate the skills needed for the rapidly changing jobs and workforce. When certification standards are not performance-based and flexible, they no longer serve the safety purpose of confirming industry professionals can perform their assigned tasks. Recently, the FAA published its first meaningful update of mechanic certification requirements in 50 years. For decades, the agency was certifying students having completed training programs that built proficiency in skills that sometimes were largely obsolete. The government must also consider its own recruitment, training and personnel development standards in order to support critical thinking by inspectors and managers. Without such responsiveness in the FAA's own personnel management, regulations stifle innovation—which can be a key driver in attracting talent—and prevent successful installation of the “just culture” to which the agency aspires.

Our recommendation is to regularly review and adapt the rules and guidance related to personnel management, certification, and training in a more routine manner to allow for skill development and adaptability to new resources and technologies. This process should consider both industry and government needs and practices.

Our data suggested that the second most common age for developing interest in aviation was 18 (10 years-of-age being the first), an age where individuals are transitioning out of high school and either pursuing education, entering the workforce, joining the military/uniformed service or otherwise beginning career development. The inability of regulators to adapt to emerging market opportunities makes industry “slow” to engage with young people and has the impact of dampening new careers. We are encouraged with the recent changes and further understand that the FAA's training and workforce development standards are under careful review by the Department of Transportation's Safety Oversight & Certification Advisory Committee (SOCAC). (See: [https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/committee/browse/com\)itteelD/717/](https://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/committee/browse/com)itteelD/717/))

Overcoming the Financial Hurdle



21. The FAA should review its regulations and guidance related to technical proficiency of industry personnel and certification standards as well as update its own practices for managing and developing government human resource

Proposed implementation:

- *Execute the final recommendations that will be made by the SOCAC.*
- *Execute recommendations in the May 2021 report by the US Government Accountability Office assessing the FAA's strategic planning to prepare its workforce for the future (Government Accountability Office, 2021). This will allow the FAA to identify skills gaps across the agency and respond to technological changes.*
- *Institute industry recommendations (and pursue further opportunities to implement) revising FAA procedures for training acceptability. For example, as flight simulation (including virtual reality) continues to improve, consider how simulated training time could lead to greater proficiency/competency for the various licenses and ratings needed to become a commercial pilot. For maintenance personnel and other technical support, easing administrative burdens related to continuing professional development will help bolster existing knowledge, grow individual careers and prepare the industry at large for technical advancements. This could lower an existing barrier to access for new professionals and give existing personnel opportunities to grow (itself a recruitment incentive).*
- *Update agency guidance and other resources describing aviation career opportunities.*

CONCLUSION



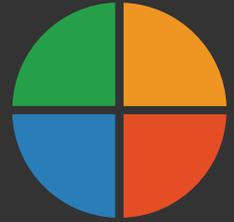
Now is the time to change how we attract the talent pipeline to the aviation and aerospace industry. The current workforce crisis gives us the perfect opportunity to make fundamental changes in order to attract young people to this vast industry of opportunity. Equally important, we must build an industry that reflects the nation and the customers that we serve by hiring underrepresented individuals who will strengthen an industry that is at the forefront of innovation and technological change. We are at a pivotal moment with the chance to be the world leader, demonstrating how one of the least diverse industries can transform itself to become the most diverse. This is a win-win opportunity that solves the workforce issue holding the industry back from optimal growth.

Our data suggested that issues of diversity, equity, and inclusion continue to persist across aviation and aerospace and were central to the Task Force's work and discussion. We heard testimony from a variety of youth-facing organizations, students and junior-level employees, museums, employers and a leading aviation journalist about the ongoing challenge of attracting and retaining a diverse workforce when the present workforce is largely white, male and has changed slowly.

This Task Force has created a strategic plan that should yield results: imbuing an early awareness of the industry, providing information resources for a variety of constituents, creating a connected pathway that allows us all to work together and learn from each other, and finally proposing new ways of providing sustainable funding for individual students and education programs. We believe that if we take this multi-pronged approach, we will increase the number of students pursuing careers in aviation and aerospace, particularly those from underrepresented backgrounds.



CONCLUSION

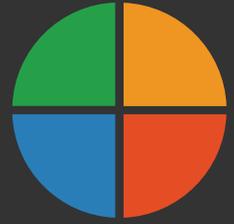


The single most important recommendation we can make after more than two years of work is that we must continue the conversation at the regional and national level. Throughout the report, we recommended Regional Advisory Councils that bring together all of the stakeholders on a regular basis to connect resources, collaborate on projects and imbue a passion for aviation and aerospace across that region. These Regional Advisory Councils would then send a representative from their group to a National Advisory Council that would monitor these efforts, assist in further collaboration, share best practices across the country and lead a national effort to make a difference.

This report has drawn a road map to progress. However, if we want to retain individuals from underrepresented backgrounds, the industry must not only be committed to outreach and hiring, but also to creating equitable environments so that these same individuals feel psychologically safe and valued as members of the team. This is not a problem that can be solved overnight, and companies need courageous conversations, examinations of policies with a new educated lens, and an ongoing training and education program that allow everyone to learn, make mistakes and move forward. Most importantly, we all need to be accountable and responsible for making change happen by setting measurable goals, publishing our data, sharing our learnings and never stopping the work.



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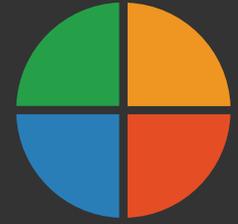
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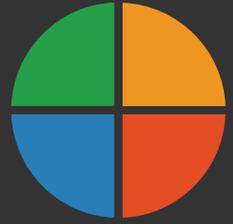
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APPENDIX:

Aerospace Workforce Development Program Implementation



Operationalizing the Funding Plan Requirements for DoD and DoT RFPs and Creation of an Aerospace Education Program List

It will be necessary to develop criteria to determine programs impacting the aerospace workforce. The criteria will be used in DoD and DoT RFPs to measure aerospace education programs performance. Programs meeting those criteria will be placed on an Aerospace Education Program List so companies can easily find the programs that contribute to the aerospace workforce to include as subcontractors in response to RFPs.

Eligibility for education programs and organizations include the following:

Type of programs: Aerospace education programs both curricular and extra-curricular.

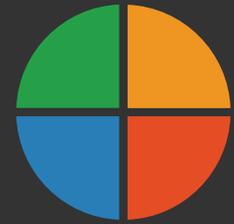
Types of organizations: Both not-for-profit and for-profit organizations with aerospace education and training programs including local education agencies, institutions of higher education, private agencies and other related organizations.

Additional considerations:

- All programs must be U.S. based. U.S. based programs may be international, however no international data may be used when providing data for program ranking and no international program activities may be supported with any of the funds.
- Under the Code of Federal Regulations Title 5 agencies should prevent the appearance of showing favoritism to any individual or organization or endorsing any non-government product, service or enterprise. (Federal Code of Regulations, n.d.) The Aerospace Program List allows all aerospace education programs, that are eligible, to be on the List, therefore favoritisms for any program does not apply. The List does rank programs based on workforce contribution criteria. The companies choose programs based on those criteria. There is a need for a Congressional waiver that states that the ranking of aerospace education programs on the Aerospace Education Program List is exempt from any interpretation that the government is appearing to or favoring any program under the Code of Federal Regulations.

APPENDIX:

Aerospace Workforce Development Program Implementation



- Companies will not be allowed to provide subcontracts to any of their own internal training or educational programs. All subcontracts and funds must be used to support training and education programs that are not part of the company's enterprise.
- Data Collection Authorization: If the Aerospace Education Program List is hosted by a federal agency it will be subject to the Paper Reduction Act (PRA). People will be asked to provide data on their education programs (United States Congress, 1995).
- Congress should provide a waiver to allow education program data to be collected outside the limitations of the PRA.

The DoD and DoT aerospace contract RFPs will have a requirement that companies include aerospace education programs in their contracts to build the workforce. An Aerospace Education Program List will be established so the companies will be able to identify education programs that are impacting the aerospace workforce.

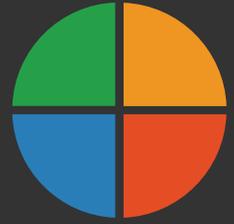
The primary purpose of the Aerospace Education Program List is to provide companies with an easy way to find aerospace education programs to include in their contract proposals. The amount of funds each program gets, through a subcontract, will be determined by the size of the company contracts in which they are included. If the contract is awarded the programs get 0.25 percent of the total budget for each contract in which they participate.

All programs on the List must be aerospace education programs. The List will have three Tiers based on aerospace education program workforce outcomes. Programs will be ranked on the List in the three Tiers based on the criteria listed below. Program ranking is based on the impact of the program on getting students in the aerospace workforce. This includes working in any area of aerospace such as companies with DoD or DoT contracts as well as those who do not have contracts with these agencies. It also includes government, education or other organizations in the aerospace sector.

The Tiers are organized from 3 to 1 with 3 being the highest and 1 being the lowest. Programs with the highest-ranking criteria will be in Tier 3. Those in Tiers 1 and 2 may move up to higher Tiers by improving their impact on getting students in the aerospace workforce. There will be criteria for programs to be in each Tier of the Aerospace Education Program List.

APPENDIX:

Aerospace Workforce Development Program Implementation



Criteria for Being on the Aerospace Education Program List:

- Total number of students the program impacts.
- Total number of minority students the program impacts. These include: African Americans, Hispanics, Native Americans and Pacific Islanders.
- Total number of female students the program impacts.
- Percentage of students who moved into an aerospace related program after finishing K-12 education. This can be a college, university, trade school, apprenticeship program, etc. as long as it is a program that is training people for post secondary aerospace careers.
- Percentage of students from a sample that go into the aerospace workforce.
- Percentage of the students from the overall program going into the aerospace workforce (Large enough sample to be able to generalize to the whole population).
- Percentage of the students holding an aerospace job for 2 or more years.

Additional Program Information:

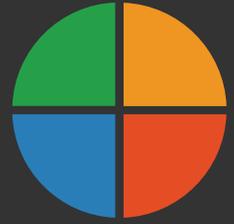
Additional program information will be provided to enable companies to identify other variables they may want to consider that are not specifically linked to the impact on the workforce. These will include a Program Description, Program Characteristics, Contact Information and Education Program Financial Accountability.

Program Description:

There will be a one paragraph Executive Summary including a brief narrative describing the program. This Executive Summary should be written to provide a short comprehensive description of the program and topic addressed. A person reading this Executive Summary should be able to understand the program without needing specific technical expertise or knowing the specifics of the program. An Executive Summary should not contain any citations.

APPENDIX:

Aerospace Workforce Development Program Implementation



Program Characteristics:

- Grade level: elementary, middle school, high school, college, university or trade school
- Subject area: pilot, aircraft maintenance technician and engineer or other aerospace career
- List STEM subjects taught: Science, Technology, Engineering, Mathematics
- List other subjects taught
- Geographic reach: city, state, regional, national
- Curricular or extracurricular (may be both)
- Demographic information on populations impacted: females/males, underserved groups, rural, suburban, urban

Program Contact Information

- Name
- Title
- Organization
- Phone
- Email
- Website

Education Program Financial Accountability

Education programs need to demonstrate that they are fiscally sound and are able to carry out the tasks required for the company contracts. Formal education organizations including K-12 schools and colleges and universities have regular accounting practices that will enable them to meet the fiscal requirements of the contracts. Informal not-for-profit education programs that have 501(c)3 status are also required to have formal accounting practices by the U.S. Internal Revenue Service (IRS) and will also meet the accounting practices required by company contracts. For-profit education and training programs that have sound accounting practices will also be eligible. All of these types of education programs will need to be able to meet the government programmatic and fiscal reporting requirements.

APPENDIX:

Aerospace Workforce Development Program Implementation



Scoring and Rating Education Programs

Programs will be rated to determine their impact on the aerospace workforce. They will provide data on their programs using the criteria for being on the Aerospace Education Program List. This information will be used to rate the program's impact on the workforce. The data from the programs and how the programs are rated will be included on the List.

The Programs higher on the List will be those making the greatest contribution to the aerospace workforce. This approach will provide a comparative analysis based on the programs listed and their contribution to the aerospace workforce.

Each program will provide data used to measure the criteria listed above. They will be given ratings which show how the programs compare with other programs for a given criterion or measurement. The distribution of ratings will be approximately 20% of programs in each criterion category between 5 and 0.

The programs will then be listed based on their contribution to the workforce. For details see Appendix: Operationalizing the Aerospace Education Program Rating System for the website.

Program Tiers

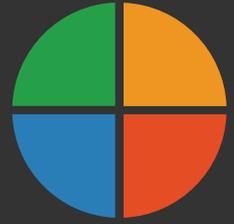
There will be three program tiers based on the programs' contribution to the workforce. Tier 3 has programs with the highest contribution to the workforce and Tier 1 has the lowest contribution to the workforce.

To qualify for being in each tier the programs need to provide data to address the minimum requirements of the criteria in the tier. Programs may move up in the tiers when they meet the criteria for the next higher tier.

Programs will be motivated to address the criteria in the higher tiers since it will enhance their eligibility for funding. When programs address the criteria needed to move to a higher tier, they will also be improving their contribution to addressing the aerospace workforce. The measurements or criteria for Tiers 3-1 are shown below Highest tier to Lowest tier.

APPENDIX:

Aerospace Workforce Development Program Implementation



Tier 3: Ranking Criteria: Impact on the Aerospace Workforce (Highest Tier)

Program Name:		
Criteria	Raw Score	Rating 1-5
*Total number of students the program impacts.		
*Total number of minority students the program impacts. These include: African Americans, Hispanics, Native Americans and Pacific Islanders.		
*Total number of female students the program impacts.		
* Percentage of students who moved into an aerospace related program after finishing K-12. This can be a college, university, trade school, apprenticeship program, etc. as long as it is a program that is preparing people for post secondary aerospace careers.		
*Percentage of students from a sample that go into the aerospace workforce.		
**Percentage of the students from the overall program going into the aerospace workforce (Large enough sample to be able to generalize to the whole population).		
**Percentage of the students holding an aerospace job for 2 or more years.		
Total Rating Score		
Program Rank:		

* Information in these criteria categories is the minimum required to be in Tier 3.

** The information, in these criteria categories, is not required to be in Tier 3 but is a plus in considering the rating.

APPENDIX:

Aerospace Workforce Development Program Implementation



Tier 2: Ranking Criteria: Impact on the Aerospace Workforce (Middle Tier)

Program Name:		
Criteria	Raw Score	Rating 1-5
*Total number of students the program impacts.		
*Total number of minority students the program Impacts. These include: African Americans, Hispanics, Native Americans and Pacific Islanders.ns and Pacific Islanders.		
*Total number of female students the program impacts.		
*Percentage of students who moved into an aerospace related program after finishing K-12. This can be a college, university, trade school, apprenticeship program, etc. as long as it is a program that is preparing people for post secondary aerospace careers.		
Total Rating Score		
Program Rank:		

* All these criteria categories are required to be in Tier 2.

APPENDIX:

Aerospace Workforce Development Program Implementation



Tier 1: Ranking Criteria: Impact on the Aerospace Workforce (Lowest Tier)

Program Name:		
Criteria	Raw Score	Rating 1-5
*Total number of students the program impacts.		
**Total number of minority students the program impacts. These include: African Americans, Hispanics, Native Americans and Pacific Islanders.		
**Total number of female students. The program impacts.		
Total Rating Score		
Program Rank:		

* This criterion category is required to be in Tier 1.

** The information, in these criteria categories, is not required to be in Tier 1 but is a plus in considering the rating.

APPENDIX:

Aerospace Workforce Development Program Implementation



Data Validation

Programs will be required to verify that the data they provide are accurate and correct. Validation of the data will be done through the regular agency contracting review process. Agencies review contracts to validate programmatic and financial aspects of the proposals before they are awarded. There are also quarterly, annual and final reviews of the work done by the prime and all of the subcontractors. Companies also keep lists of vendors they use as subcontractors and rate them based on quality. Any aerospace education program providing false information will be banned from being on the Aerospace Education Program List for five years.

Government and Company Review of Education Programs

The DoD and DoT establish program priorities by which each contract is reviewed (Department of Defense, 2022). The Aerospace Education Program List criteria will be used by the government to establish RFP requirements based on measures of the education programs' contribution to the aerospace workforce. Similarly, companies responding to government RFPs will use the Aerospace Education Program List to identify education programs that contribute to the aerospace workforce. They will then be able to choose education programs that will help them in addressing the RFP requirements.

Identifying a Hosting Location for the Aerospace Education Program List

It will be necessary to identify an organization to maintain and host the Aerospace Education Program List. Aerospace education programs will need to be able to access the List to add data and information about the programs and companies will need to be able to access the List to identify programs to be subcontractors. Having a central repository of aerospace education programs will help facilitate collaboration among government, industry and education leading to aerospace workforce development.

Three potential organizations that could host this List have been identified. They are: (1) FAA Aviation and Space Education (AVSED) Program; (2) National Aeronautics and Space Administration (NASA); and (3) The U.S. Department of Defense (DoD) Office of the Undersecretary for Research and Engineering.

The description and advantages of each potential organizational option for hosting the Aerospace Education Program List on their websites are provided below. These are listed in priority order based on their advantages.

APPENDIX:

Aerospace Workforce Development Program Implementation



FAA Aviation and Space Education (AVSED) Program

FAA's STEM AVSED Program aims to prepare and inspire the next generation of skilled professionals for the aviation and aerospace industries using science, technology, engineering, and math (STEM), and to educate the public about the FAA's mission to maintain the safest, most efficient aerospace system in the world. The FAA's STEM AVSED Program has been an integral part of FAA outreach and the national education system for decades. The program was established to expose students to aviation and aerospace careers and to promote STEM education. With the support of numerous partners in the public and private sectors, AVSED reaches out to students so they can learn more about civil and commercial aviation as well as the critical role that science, technology, engineering, and math plays in a young aviator's future. AVSED currently lists STEM aerospace programs at elementary, middle school, and high school levels. (Federal Aviation Administration, 2022)

AVSED is the best choice for hosting a list of programs because it is neutral, having no vested interest in any program. Additionally, the FAA does not have any vested interest in any of the companies that might use this service, but they also already have a relationship with companies involved in aerospace. One of the FAA's goals is to address the aerospace workforce issue. AVSED also has relations with aerospace education programs that would qualify to be on the list and is already planning on developing relationships with other aerospace educational programs nationwide. The FAA is the ideal location for the list of aerospace education programs because it already has a list of aerospace education programs, and it has a history of working with both the companies and the aerospace programs.

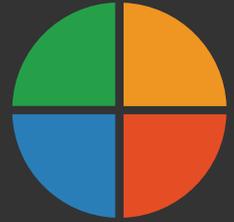
National Aeronautics and Space Administration (NASA)

NASA would also be an excellent location for the Aerospace Education Program List. NASA is a global leader in aeronautical and space research as well as exploration. NASA has 20 centers across the U.S with specific focuses on space and aeronautics. NASA's research, exploration and technological advancement emanate from education in science, technology, engineering, and math.

NASA also supports STEM education under "STEM Engagement at NASA." (NASA Website, n.d.) NASA supplies many resources for students and educators K-12 through university levels to support STEM education with a connection to NASA's work in aeronautics and space research and exploration (NASA, 2022).

APPENDIX:

Aerospace Workforce Development Program Implementation



“NASA makes vital investments toward building a future diverse STEM workforce. The scope of STEM Engagement comprises all endeavors to attract, engage, and educate students and to support educators and educational institutions. The STEM engagement portfolio consists of a diverse set of opportunities, activities and products, encompassing internships; fellowships; student learning opportunities (challenges, competitions and other experiences); informal education and out-of-school learning activities; educational products, tools and platforms; educator support; competitive awards to educational institutions for research and development and institutional support. Given the nation’s need for a skilled STEM workforce and projected demands in order to meet future needs, NASA clearly has a vested interest in attracting, engaging and preparing its future STEM professionals” (NASA, 2022).

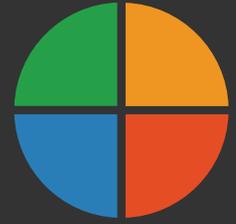
US Department of Defense Office of the Undersecretary for Research and Engineering

The Office of the Undersecretary for Research and Engineering is composed of several agencies crucial to national research and development these include: Missile Defense Agency, Defense Advanced Research Projects Agency, and the new Space Development Agency. The Defense Department serves as an innovative leader in developing technology to protect Americans and troops. (DoD Office of the Undersecretary for Research and Engineering Website, n.d.) Most of the contracts provided to companies to develop these technologies are issued by this office.

The advantage of having the DoD host the list of aerospace programs is that they are the largest contracting agency to companies in which the proposed aerospace programs would be included. The DoD would be able to direct companies who apply for DoD contracts to the listing of programs with which they can work in the contract application process. Another advantage is that the DoD has no vested interest in any of the companies or the programs and it would rank and display program data without any bias. The major downside for the DoD as the hosting organization for the list of aerospace programs is that they have limited relationships with these programs and would have a harder time communicating with the programs (Office of the Undersecretary of Defense for Research and Engineering, n.d.).

APPENDIX:

Aerospace Workforce Development Program Implementation



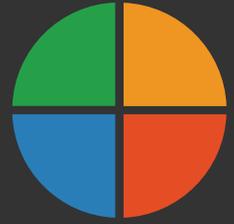
Federal Agency Collaboration

The federal agency hosting the Aerospace Education Program List will need to collaborate with other key federal agencies. There will need to be links to the agencies that are providing contracts to companies.

The White House Office of Science Technology Policy Council on STEM Education (CoSTEM) already coordinates the activities of sixteen federal agencies including DoT, DoD and NASA. CoSTEM could coordinate the activities relating to the implementation of the Aerospace Workforce Development Program and the Aerospace Education Program List.

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Road Map for the Hosting Organization

This is designed to be a “road map” for the organization hosting the Aerospace Education Program List. It provides operational details and explanation of issues that need to be considered when implementing the hosting of the Aerospace Education Program List.

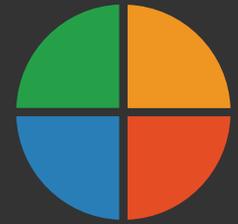
Details on how to design and develop program ratings for the Aerospace Education Program List are provided here. First definitions of key terms are provided. Then details on how to rate the programs are specified. This information is provided to help the hosting agency develop the website.

List of Key Terms

Item	Definition
Program List	The Aerospace Education Program List is designed to provide companies with an easy way to find aerospace education programs to include in their contract proposals. All programs on the List must be aerospace education programs that contribute to the aerospace workforce. The List will have three Tiers based on aerospace education program workforce outcomes.
Programs	Programs are aerospace education programs represented on the Aerospace Education Program List.

APPENDIX:

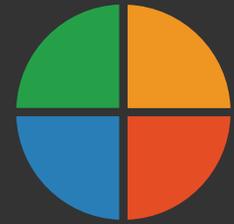
Operationalizing the Aerospace Education Program List Rating System for the Website



Item	Definition
<p>Criteria</p>	<p>Criteria are measures by which the programs’ contributions to the aerospace workforce are assessed. The criteria include the following:</p> <ul style="list-style-type: none"> • Total number of students the program impacts. • Total number of minority students the program impacts. These include: African Americans, Hispanics, Native Americans and Pacific Islanders. • Total number of female students the program impacts. • Percentage of students who moved into an aerospace related program after finishing K-12. This can be a college, university, trade school, apprenticeship program, etc. as long as it is a program that is preparing people for post secondary aerospace careers. • Percentage of students from a sample that go into the aerospace workforce. • Percentage of the students from the overall program going into the aerospace workforce (Large enough sample to be able to generalize to the whole population). • Percentage of the students holding an aerospace job for two or more years.
<p>Tier</p>	<p>The Tiers are a means by which programs’ contribution to the workforce is assessed. Programs are ranked on the Aerospace Education Program List in the three tiers based on the criteria. Program ranking is based on the impact of the program in getting students into the aerospace workforce. The Tier ranking is 3 to 1 with 3 being the highest and 1 being the lowest. Programs with criteria contributing most to the aerospace workforce will be in Tier 3. Those in Tiers 1 and 2 may move up to higher Tiers by improving their impact on getting students in the aerospace workforce.</p>

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Item	Definition
Raw Score	The raw score is a measurement of a program's contribution to the workforce. The raw score is either a number or percentage provided by the programs addressing the criteria.
Rating	The rating shows how strong a program's raw score is for a given criterion compared with other programs in the same Tier. The rating is calculated based on the raw scores using a formula to rank the programs for a criterion in a Tier. The ratings range from 5 to 0 with 5 being the highest score for a criterion and 0 being the lowest score for a criterion. Ratings are used to rank programs' contribution to the workforce.
Rank Order	Rank order is the order in which programs are listed, based on their contribution to the aerospace workforce. Ratings for all criteria in a Tier are added together and programs are ranked by the sum of their ratings.

Scoring and Rating Education Programs

Programs will be rated to determine their impact on the aerospace workforce. Raw scores provided by programs are used to rate the programs impact on the aerospace workforce. The criteria or measurement categories represented in the raw scores are either numbers or percentages of students impacted by the program.

Ratings will be given to programs based on the raw score provided for each measurement category or criterion. Program ratings will be determined by comparing their raw scores in each criterion. Each criterion will have its own rating that compares how every program scored in a tier. The rating will have a score of 5 for the highest quality and 0 for the lowest quality programs in each area measured. The rating for each measurement category will be calculated in the following ways.

The programs higher on the List will be making the greatest contribution to the aerospace workforce. This approach will provide a comparative analysis based on the programs listed and their contribution to the aerospace workforce. The raw scores, provided by the programs, are used to calculate the rating for each criterion. The sum of the ratings for each criterion will represent the sum of ratings for the program. Programs will be ranked on the List based on a sum of ratings. Then each program will be given a numerical rank that will determine the program location on the List in each Tier.

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Rating Programs

Each program will provide raw scores used to measure the criteria listed above. The distribution of ratings will be approximately 20% of programs in each criterion category between 5 and 0. For example approximately 20% of programs will be rated between 4 and 5, 20% will between 3 and 4, etc. The specific distribution of the programs in these categories will be determined using a formula to calculate the rating. Programs will be ranked based on the ratings they receive. The rating will represent the overall program quality based on the programs' contribution to the aerospace workforce.

The programs will then be listed based on the rating. The following examples show how the total number of programs on the List impacts the comparative rating of programs. The first example shows the rating distribution with ten programs. The second example shows the rating distribution with the addition of five programs.

Example 1: Initial Rating Distribution With Ten Programs

Rank	Program Name	Total Number of Students in a Program	Rating
1	Program A	100	5
2	Program B	90	4.5
3	Program C	80	4
4	Program D	70	3.5
5	Program E	60	3
6	Program F	50	2.5
7	Program G	40	2
8	Program H	30	1.5
9	Program I	20	1
10	Program J	10	0.5

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



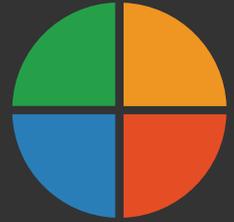
Example 2: Rating Distribution With The Addition of Five Programs

Rank	Program Name	Total Number of Students in a Program	Rating
1	Program A	100	5
2	Program K	95	4.666666667
3	Program B	90	4.333333333
3	Program L	90	4.333333333
5	Program C	80	3.666666667
6	Program M	75	3.333333333
7	Program D	70	3
8	Program N	65	2.666666667
9	Program E	60	2.333333333
10	Program O	55	2
11	Program F	50	1.666666667
12	Program G	40	1.333333333
13	Program H	30	1
14	Program I	20	0.666666667
15	Program J	10	0.333333333

The program rating for the criteria will be able to be set up on a spreadsheet to automatically update the ratings when the raw scores are added each year.

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Software

Excel was used in the design and testing of the concepts. The hosting organization will determine the software used to implement the Aerospace Education Program List.

Ranking of Education Programs

The programs are ranked based on each of the criteria. Programs provide raw scores for each criterion. The raw score data determines where a program is listed in the Tiers. There are three Tiers with 3 being the highest and 1 being the lowest. Each Tier requires different minimum required data. Being able to enter all the minimum required data for a Tier determines the Tier in which the program is listed.

The raw score data is then used to calculate the programs' rating for each criterion within each Tier. The programs then are located on the Aerospace Education Program List within each Tier based on the rating from 5 to 0.

The rating is derived, using a formula that provides rating gradations using decimal places, to differentiate ratings by fractions of a number. The rating is used to compare programs to determine their contribution to the aerospace workforce in each criterion category. The sum of the ratings for all criteria for a program in a Tier determines the program's rank order. The formula-based stratification is used to place the program on the Aerospace Education Program List based on overall quality. The programs are then listed in descending order by the rating.

The program rating, based on the criteria, will be updated when the programs add raw scores. This will also modify the rating of the programs with the addition of new data. This will be able to be set up on a web-based spreadsheet to automate the calculations when the raw scores are updated.

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Formula for the Rating of Education Programs in a Tier

The following is a formula used for determining the rating that each program receives in each Tier. The rating will stratify the programs differentiating them using detailed comparative scores facilitating accurate ranking of programs within a Tier.

The formula will have the top program assigned a rating of 5 and the program with the least contribution to the workforce assigned a rating approaching 0. All other programs will have a rating in between 5 and 0. As additional programs are added to the Program List in a Tier the formula will automatically update the ratings based on the comparison of the programs.

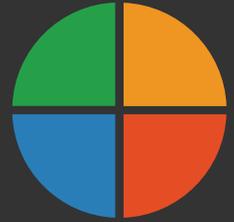
The following is the formula used to differentiate the programs on the Aerospace Education Program List and determine the numerical ranking of programs.

$$\frac{(\text{Number of Programs} + 1) - \text{Rank}}{\text{Number of Programs}} \times 5 = \text{Program Rating}$$

Examples 3 and 4 show the results of the use of the formula in a spreadsheet to rate programs for one criterion. Example 3 shows ten programs ranked and rated. Example 4 shows how the expansion to fifteen programs has an impact on the rating and rank order.

APPENDIX:

Operationalizing the Aerospace Education Program List
Rating System for the Website

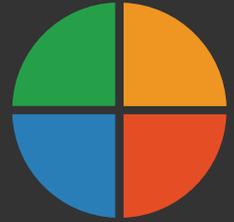


Example 3: Ten Education Programs in a Tier Program Rating Based on the Formula

Rank	Program Name	Raw Score Total Number of Students the Program Impacts	Rating
1	Program A	100	5
2	Program B	90	4.5
3	Program C	80	4
4	Program D	70	3.5
5	Program E	60	3
6	Program F	50	2.5
7	Program G	40	2
8	Program H	30	1.5
9	Program I	20	1
10	Program J	10	0.5

APPENDIX:

Operationalizing the Aerospace Education Program List
Rating System for the Website



**Example 4: Fifteen Education Programs in a Tier Program
Rating Based on the Formula**

Rank	Program Name	Raw Score Total Number of Students the Program Impacts	Rating
1	Program A	100	5
2	Program K	95	4.666666667
3	Program B	90	4.333333333
4	Program L	85	4
5	Program C	80	3.666666667
6	Program M	75	3.333333333
7	Program D	70	3
8	Program N	65	2.666666667
9	Program E	60	2.333333333
10	Program O	55	2
11	Program F	50	1.666666667
12	Program G	40	1.333333333
13	Program H	30	1
14	Program I	20	0.666666667
15	Program J	10	0.333333333

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



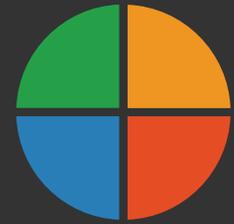
Tie Breakers in Each Tier

In the event of a tied raw score both programs would be listed at the same rank and the rating would be the same. Since both programs would be tied in their ranking the tied programs would be listed as the same number in the rank order. See the highlighted area of Example 5 below. The two tied programs would be listed alphabetically. The next Program on the list would go to the next number in the ranking skipping any numbers that would have been used as if there was no tie.

In this example, two programs B & L were tied for rank "3". Rank "4" was skipped. The next program C is assigned a rank of "5". In Example 5 the two tied programs are listed as "3". The next program is listed as "5", skipping the number "4". If the "4" or the number after the tied number is not skipped, it will also skew all of the ranking and result in a distorted comparative relationship among the programs, making it difficult to differentiate among the quality of the programs. It is also important to have an accurate Total number of programs to do the calculations with the formula. Numbering the next program after the tied programs as "4" can lead to the incorrect total number of programs in the List.

APPENDIX:

Operationalizing the Aerospace Education Program List
Rating System for the Website



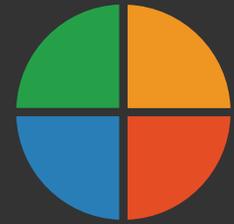
Example 5: How Ties in the Raw Scores for a Program Affect the Rating and Rank

Rank	Program Name	Raw Score Total Number of Students the Program Impacts	Rating
1	Program A	100	5
2	Program K	95	4.666666667
3*	Program B	90	4.333333333
3*	Program L	90	4.333333333
5	Program C	80	3.666666667
6	Program M	75	3.333333333
7	Program D	70	3
8	Program N	65	2.666666667
9	Program E	60	2.333333333
10	Program O	55	2
11	Program F	50	1.666666667
12	Program G	40	1.333333333
13	Program H	30	1
14	Program I	20	0.666666667
15	Program J	10	0.333333333

*These programs have the same rank since they have the same raw score.

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Ties for Missing Information in a Non-Required Field

In some of the Tiers there are criteria that do not require programs to have data. When a program does not have data in for a particular criterion, they will also have a tied ranking. The difference between the ties listed in Example 5 and Example 6 is that the ties in example 5 will be sharing a rank equal to the highest ranked program in the tie. In example 6 any program that does not have any data listed will automatically be tied for last place in the ranking. Example 6 shows how programs are ranked when information for a criterion is not included. The raw scores for programs that are missing data in the example are listed as NA (Not Applicable).

Example 6: Addressing Ties When Data Are Not Included

Rank	Program Name	Raw Score Total Number of Minority Students the Program Impacts	Rating
1	Program C	85	5
2	Program A	80	4.5
3	Program D	70	4
4	Program B	65	3.5
5	Program E	60	3
6	Program I	55	2.5
7	Program F	50	2
10	Program G	*NA	0.5
10	Program H	*NA	0.5
10	Program J	*NA	0.5

*Data are missing

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Sum of the Ratings Leading to the Ranking within a Tier

In each Tier, the ratings for each criterion are added to provide a final rating for each program. The final rating will be a sum of all of the ratings for each criterion for that program. The programs' rank order will be determined by the sum of all the ratings of the criteria in a Tier. Example 7 shows how programs will be rank ordered using Tier 1 as an illustration. Tier 1 programs are ranked using the ratings each program has received for each criterion. Then the ratings for each criterion are added to calculate the rating sum. The sum of the ratings of the criteria determines the programs' rank order.

In Example 7, using Tier 1 as an illustration, there are three criteria measuring impact on the workforce: "Total Number of Students the Program Impacts", "Total Number of Minority Students the Program Impacts" and "Total Number of Female Students the Program Impacts" The ratings for each criterion are calculated using the rating formula. The ratings for each criterion are added to determine the rank order. Programs will be listed within a Tier in descending order with the highest total rating sum at the top. The same process will be used to determine the rank order for programs in Tiers 3 & 2.

Example 7 shows how programs will be ranked based on the sum of their ratings in each of the criteria in a Tier. The rank order of the programs will be based on the order programs are ranked using decimal places. If two Programs have the exact same rating sum, then they will be listed alphabetically as represented in Example 7.

APPENDIX:

Operationalizing the Aerospace Education Program List
Rating System for the Website

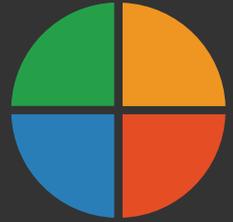


**Example 7: How Programs Will be Rank Ordered
Using Tier 1 as an Illustration**

Rank Order	Program Name	Rating Sum	Rating Total Number of Students the Program Impacts	Rating Total Number of Minority Students the Program Impacts	Rating Total Number of Female Students the Program Impacts
1	Program C	13.5	4.5	5	4
2	Program A	12.5	5	4.5	3
3	Program B	12	4	3.5	4.5
4	Program E	11	3	3	5
5	Program D	9.5	3.5	4	2
6	Program F	8	2.5	2	3.5
7	Program I	5	2	0.5	2.5
8	Program G	4.5	1.5	2.5	0.5
9	Program H	2	1	0.5	0.5
10	Program J	1.5	0.5	0.5	0.5

APPENDIX:

Operationalizing the Aerospace Education Program List Rating System for the Website



Final Program List Layout

The final Aerospace Education Program List will show the ranking order, the program names, and the sum of the ratings for all of the programs listed in each Tier. Programs will be initially viewed as they are in Example 8. However, users will be able to expand the data to get additional information on the criteria and view the list as it appears in the examples.

Example 8: The Layout Users Will See

Rank Order	Program Name	Rating Sum
1	Program C	13.5
2	Program A	12.5
3	Program B	12
4	Program E	11
5	Program D	9.5
6	Program F	8
7	Program I	5
8	Program G	4.5
9	Program H	2
10	Program J	1.5



