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Developing Innovative Strategies for Aviation Education and Participation

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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP RESEARCH REPORT 202

Developing Innovative Strategies for Aviation Education and Participation

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AIRPORT COOPERATIVE RESEARCH PROGRAM

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ACRP RESEARCH REPORT 202

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FOREWORD

By Joseph D. Navarrete
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ACRP Research Report 202: Developing Innovative Strategies for Aviation Education and Participation provides the aviation industry with resources to help promote interest in aviation among younger populations ranging from 10 years old to 25 years old. The report helps educators and aviation enthusiasts understand the need for encouraging interest in aviation, offers guidance on developing a program of activities to fit particular needs, and provides activities for developing a program that can be scaled and tailored for various age groups and resource availability.

The aviation industry is a vital sector of the U.S. economy, yet participation in aviation as a career, for business, as an extracurricular activity, as a sport, and as 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. 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, other states lack the resources necessary to promote this important transportation asset. Industry groups also engage in educational and promotional programs. Yet there has not been a single-source report summarizing those efforts, nor has there been guidance to help state and local agencies develop and implement such efforts. Research was needed to provide guidance and supporting material for state agencies and local airports to promote interest and participation in the aviation industry.

The ACRP Project 01-34 research team, led by Mead & Hunt, featured outreach to more than 100 groups and organizations engaged in some type of aviation education activity, including state and federal agencies, schools and universities, STEM-related groups, aviation industry associations, and museums. Through this engagement, the team collected numerous innovative activities and focused on a series of case studies that showcased a diversity of approaches and programs. Based on this research, the team prepared a report and an interactive collection of "landing pages" of activities targeted by type, age group, and general cost. The collection of the landing pages is a valuable resource to those wishing to engage young people in aviation. The collection includes more than 100 activities that can be adapted to any particular situation.

The report is designed to help develop intentional pathways for promoting interest in aviation. These pathways are seen as the process for engaging students at an early age to pursue aviation at some level and then have them, in turn, continue the cycle by promoting aviation to others. The report addresses the challenges to establishing and maintaining these pathways—such as resource limitations, lack of programming or curriculum, competing interests for kids, and administrative or organizational issues—and identifies opportunities

to overcome them. The report also provides support for developing and executing single events and activities when they are the most practical means for exposing young people to the aviation industry. Finally, the report includes three summary listings of the landing pages, sorted by activity type, target age group, and cost per person. A searchable list, by keyword, of these landing pages can be found in the Presorted Tables PDF.

There is also an individual activity landing pages PDF, which is an alphabetical listing of organizations and the types of activities they offer. The PDF User Guide explains how to use and search the PDFs. A microsite with supporting materials may be found on TRB's website at http://www.trb.org/acrp/acrpreport202.aspx.

CONTENTS

1 Summary

3 **Chapter 1** Introduction
3 1.1 Purpose of the Research and Report
4 1.2 Reason for Development
5 1.3 Intended Audience for This Resource
5 1.4 Contents of This Resource
6 1.5 How This Resource Was Developed
7 1.6 Summary

8 **Chapter 2** Importance of Aviation Education and Activities
8 2.1 Overview of Education Practices
11 2.2 Overview of Aviation Activities
18 2.3 Summary

19 **Chapter 3** Careers in the Aviation Industry
19 3.1 Flight
23 3.2 Control
23 3.3 Manage
25 3.4 Maintain
27 3.5 Design
28 3.6 Operate
30 3.7 Other Aviation Careers
30 3.8 Workforce Development
31 3.9 Summary

32 **Chapter 4** Pathway to Establishing an Aviation Career Program
33 4.1 Importance of an Intentional Pathway
36 4.2 Summary

37 **Chapter 5** Sample of Organizations Involved in Aviation Education
37 5.1 Federal Agencies
38 5.2 National Industry and Trade Organizations
48 5.3 National Youth Organizations
50 5.4 Summary

51 **Chapter 6** Selected Case Studies of Entities Involved in Aviation Education
51 6.1 Purpose of the Case Studies
52 6.2 How the Case Studies Were Chosen
52 6.3 Summary of Challenges and Opportunities from Review of the Case Studies

53 6.4 Case Studies
54 Case Study 1: Richland County School District One Challenger Learning Center
57 Case Study 2: Pima Air & Space Museum
60 Case Study 3: Insitu RoboFlight Academy
62 Case Study 4: West Michigan Aviation Academy
64 Case Study 5: Gaetz Aerospace Institute and Embry-Riddle Aeronautical University
66 Case Study 6: Basic and Advanced Aerospace Educator Courses, Middle Tennessee State University
68 Case Study 7: Wings Over the Rockies Air & Space Museum

71 **Chapter 7** Summary of Landing Pages
72 7.1 How to Use the PDFs
73 7.2 Explanation of Categories and Keywords
77 7.3 Presorted Tables

78 References and Bibliography

79 **Appendix A** Landing Pages Sorted by Activity, Target Age Group, and Cost per Person

Note: Photographs, figures, and tables in this report may have been converted from color to grayscale for printing. The electronic version of the report (posted on the web at www.trb.org) retains the color versions.

SUMMARY

Developing Innovative Strategies for Aviation Education and Participation

Where Will the Aviation Industry Be Tomorrow?

Global reliance on aviation for recreation, business travel, and commerce continues climbing. Over the past 10 years, however, interest in aviation for recreation or as a profession has experienced a notable decline. The decline is putting the health of the aviation industry at risk, especially in terms of a greater demand for qualified professionals to staff employment opportunities than there is number of qualified people to fill the positions. The national trends showing this decline are highlighted in this report.

Why Is a Resource Needed?

The existing pilot shortage is expected to continue. This shortage and the looming shortage of other aviation professionals formed the basis for the problem statement and research that led to the creation of this aviation education resource. This report highlights available careers in the aviation industry, including a sample of possibilities. The report describes the steps many organizations are taking from the federal level to grassroots groups to try to alleviate the barriers to become an aviation professional. Compiling this information in one document provides a single reference for those responsible for actively seeking to develop interest in aviation. Existing aviation enthusiasts and professionals bear the responsibility to inspire the youth of today to become the aviation professionals and enthusiasts of tomorrow. This education resource helps individuals volunteer, mentor, and network, especially with professional educators, to inspire youth to become future aviators or professionals.

How Do Professional Educators and Organizations Fit?

Aviation enthusiasts, aviation professionals, and educators can work together to promote aviation as a passion or a career. This collaboration creates opportunities for students to gain the hands-on experience that develops interest and passion in aviation. Schools that focus on science, technology, engineering, and math (STEM) as connected disciplines may find activities related to aviation to be a good fit with their core curriculum. Information about STEM is included relating to potential education activities, incorporating arts (STEAM) into aviation education, and in this document the significance of tying STEM/STEAM activities to aviation operations (STEAM and O). This education resource discusses various activities that an organization or individual may participate in or host.

A key finding of the research is that programs achieve measurable success through overlap between classroom and recreational support and engaging youth from childhood through adulthood in a continual cycle, referred to in this report as a *pathway*. This report provides

a sample of the various federal, national, and youth organizations involved with designing and providing educational activities, opportunities, and curriculum for the industry.

What Exactly Is a *Pathway*?

A *pathway* consists of the spectrum of activities that can lead from the first exposure to the more detailed interactions, all the way to choosing aviation jobs as a career and then contributing to a continual cycle that begins again at the initial level. The success of a pathway will depend on tailoring or adapting the pathway to the specific needs, resources, and situation at hand. The starting point is to plan and implement the six-step aviation education management system described in Chapter 4.

Can I See How These Programs Work in Real Life?

A key impact of the report is the tool developed expressly as a starting point for individuals and teams interested in being champions, who drive development of educational programming. Compiled interview results were used to create a PDF to be used as a tool to search activities by keyword. Chapter 7 explains and illustrates the tool. Nearly 100 different entities from around the country engaging in aviation participated in the research interviews. The collected responses formed the basis of landing pages, which are 1- or 2-page summaries of aviation education programming and curriculum. The landing pages and more detail about how they work are included at the end of this report.

Through identifying and ranking the many challenges and opportunities discovered during the interviews, seven case study examples emerged to exemplify different successes in aviation education. These case studies appear in Chapter 6 and share advice, lessons learned, and issues to avoid.

CHAPTER 1

Introduction

Most of the U.S. population relies on aviation in some form, whether for the delivery of goods, the transportation of people, or their career. In addition, aviation holds the same importance worldwide for the same economic reasons. For more than 10 years, interest in aviation for pleasure and careers has experienced a notable decline. The decline may be due to many factors such as economic downturn, lack of industry promotion, associated costs, reduction in military pilot training, and so forth, but it is multiplying and must be addressed.

This trend has been unsettling to the aviation industry, which has initiated various programs to inform students of all ages about the industry and potential career opportunities. Some programs are informal such as clubs, after school activities, summer camps, and workshops. Some programs are formal through the K–12 school system and undergraduate education institutions. Aviation employers have sought to increase the number of skilled employees by offering internships and scholarships and by partnering with universities to develop aviation curriculum career opportunities. Many airports, state aeronautics offices, aviation industry organizations, and volunteers are also busy creating a wide variety of hands-on programs designed to spark an interest in aviation through personal experience at an early age.

These aviation education programs vary in terms of the targeted age group, activities, venue, curriculum, and frequency. Challenges to creating aviation education programs include available funding, curriculum development, organizational skills, and recruiting people to help establish and continue successful programs. One of the biggest hurdles is the lack of connectivity among pockets of wonderful things happening across the country. This lack of connectivity is a barrier to sharing these creative, established aviation education programs and making them accessible to all who would like to participate.

The intent of this education resource is to support the efforts of those who want to start aviation education programs. This effort can range from those who are educational professionals to local community members with a passion for aviation. The report is designed to be a resource for users to develop and implement aviation education programs for many different educational levels. The report presents an overview of the aviation and aerospace industries and career opportunities, emphasizes the importance of aviation education activities, and lists organizations that have developed sustainable aviation education programs. To see aviation education in action, this resource highlights seven specific organizations selected as case example representatives of successful programs worthy of additional study and emulation.

1.1 Purpose of the Research and Report

The purpose of this research was to produce an aviation education resource used by those interested in creating and offering aviation education programs for children and young adults from 10 to 25 years old. The intent is that state agencies, local airports, community groups,

and education professionals use this resource to develop, deliver, and sustain strategies that promote aviation as a career or hobby.

1.2 Reason for Development

As aviation professionals continue to retire at the same time industry demand grows, the industry finds itself in a precarious position of not having enough qualified professionals to staff the employment opportunities available.

For many years, the aviation industry has experienced a modest decline in qualified personnel through the retirement of a dramatic number of Vietnam-era pilots, aircraft mechanics, air traffic controllers, and airport professionals, alongside a general decline in young people exposed to and interested in aviation careers. At the same time, the aviation industry has bounced back from the sharp decline that followed the terrorist attacks of September 11, 2001, and the ensuing financial downturn. As aviation professionals continue to retire at the same time industry demand grows, the industry finds itself in a precarious position of not having enough qualified professionals to staff the employment opportunities available. Consequently, there was a need to provide the industry with guidance to help aviation enthusiasts and educators with basic information to develop programs and activities that engage youth in the aviation industry.

1.2.1 Aviation Workforce Shortage

ACRP Web-Only Document 28: Identifying and Evaluating Workforce Requirements stated that "The Department of Employment and Economic Development projects that the aviation industry will have more than 1 million job openings in the next 10 years, while government and industry forecasts anticipate critical shortages in the next two decades as 10,000 baby boomers become eligible to retire each week" (Cronin et al. 2016).

Aviation is a unique industry, as it has a myriad of regulations that see to the safety of the industry and the traveling public, but this regulatory framework also presents a high barrier for most people attempting to enter the industry. Since the start of aviation in the early 1900s and the creation of the Federal Aviation Administration (FAA) in 1958, safety has always been the number one focus. The certifications, substantial job requirements, cost of training, and Transportation Security Administration (TSA) background check requirements created to sustain the safety first mission often deter people from entering the aviation industry.

The U.S. aviation industry is losing more than 6,000 pilots annually . . . the United States faces a decline and shortage in the number of aviation professionals necessary to keep the aviation industry viable such as pilots, engineers, and mechanics (AOPA 2018).

FAA data show that the number of each type of pilot has been on a gradual decline from a high in 1980. From 2000 to 2016, the total pilot numbers have decreased 6.6% with the private pilot group taking the biggest hit, a decrease of 39.6%, closely followed by commercial pilots at a 21.2% decline. Airline transport pilots increased 11.5%, but industry experts suspect this is in response to the restricted airline transport rule created in the aftermath of the Colgan Air crash in 2009, in which many commercial pilots rushed to obtain additional certification to meet the newly created law (RAA 2017).

1.2.2 Decline in General Aviation Activity

In reviewing the 2017 U.S. Civil Airmen Statistics from the FAA over the past 10 years, the U.S. aviation industry experienced a continued fluctuation of active airmen certifications. A high was reported in 2010 with a total pilot community of 627,588, and a low was reported in 2016 with a total pilot community of 584,362. The year 2017 saw a slight increase going to 609,306. The largest group in 2017 was the private pilot segment with 162,455 certificates held. The second largest group was Airline Transport with 159,825, and student pilots in the third largest group accounted for 149,121 certificates. Commercial pilots rounded out the large categories with 98,161 certificates. The smallest group was the recently created recreational class with only 153 certificates reported.

As of June 1, 2018, according to the Aircraft Owners and Pilots Association (AOPA) *Annual Report,* the U.S. aviation industry is losing more than 6,000 pilots annually, which has been a trend for more than three decades. The annual report also noted that the United States faces a decline and shortage in the number of aviation professionals necessary to keep the aviation industry viable such as pilots, engineers, and mechanics. The hope is that a recent change to medical licensing, known as BasicMed, will encourage additional people to begin their entrance into aviation or allow existing pilots to continue to fly under this alternative to the third-class medical certification that general aviation pilots have traditionally been required to maintain.

The *FAA Aerospace Forecasts for Fiscal Years 2018–2038* (the Forecast) provides projections of aviation activity in the United States for several different metrics. The Forecast projects a modest growth in commercial service passengers, with an average of 1.9% per year over the next 20 years, which is slightly slower than the 2017 forecast. U.S. airlines continue to experience profitable operations through their ability to become nimbler in adjusting seat capacity and charging for services used such as meals and premium boarding. Collectively, the network carriers and the low-cost carriers combined to report a total profit of $21.6 billion in 2017, with network carriers accounting for $15.3 billion and low-cost carriers contributing $5.7 billion.

General aviation (GA) activity is expected to continue to report increases in activity as well. According to the Forecast, in 2017 the GA industry reported an increase of 4.2% for aircraft deliveries, with most of those purchases in the lower-priced piston GA aircraft segment. The long-term outlook suggests that the GA fleet will remain relatively stable over the forecast period even though it is expected that the number of GA hours flown will increase slightly by 0.8% per year through 2038. This expectation is based on growth in turbine, rotorcraft, and experimental hours that offset the decline in more traditional fixed wing piston aircraft being retired from the fleet as the aging pilot population reduce their flight hours.

1.3 Intended Audience for This Resource

This report assists audiences to develop, deliver, and sustain aviation educational activities. The first audience is aviation enthusiasts, including people generally interested in aviation as a hobby or career who want to share that enthusiasm with the next generation. An aviation enthusiast usually has a background or interest in aviation and wants to take that knowledge and develop, volunteer for, or lead an aviation educational activity in the local community.

The second audience is professional educators who may lack an aviation background but desire to become involved in aviation or simply add aviation activities to a curriculum for their students. A related audience would be the aviation educator who has developed one or two successful classes or camps and would like to take programming to the next level. The intention of the report is to help each audience in different ways while producing more robust aviation education programs across the country, by connecting them to shared resources and ideas for better programming.

1.4 Contents of This Resource

The report investigates pockets of aviation education taking place all over the country. This chapter provides the context of the research question; how the research was conducted; and the purpose of, contents of, and use of the report.

Chapter 2 contains educational guidance for both aviation enthusiasts and professional educators. Those guidelines may include state standards, Next Generation Science Standards, and the STEM principles. The chapter discusses education techniques addressing online education

6 Developing Innovative Strategies for Aviation Education and Participation

and the importance of planting the seed of aviation interest in students through opportunities while they are young. One significant advantage the report offers is that the report highlights existing programs that either can be accessed directly for materials and activities or that can be used as a model for developing tailored curriculum.

Chapter 3 focuses on the different careers tied to the aviation and aerospace industries and presents a list, although not an exhaustive one, of careers in these fields. Occupations range from pilots flying commercially to federal air traffic controllers and managers of the nation's airports. Occupations include those who maintain aircrafts, airline flight dispatchers and ramp workers, and aircraft and airport designers. The careers are grouped by primary job functions.

Chapter 4 discusses a pathway to establishing an aviation career program. The focus is on what is necessary to develop, implement, and sustain successful aviation education programs. As a starting point, more than 100 "landing pages" gleaned from interviews nationwide accompany this resource in a single, electronic, searchable document. The landing pages are 1- or 2-page summaries of aviation education programming and curriculum. The goal is that a reader can use each part of the document to build his or her own specialized aviation education programming to fit their needs.

Chapter 5 provides information on aviation education and programming at the federal level of government, as well as information on many national and regional organizations and trade associations that offer aviation educational opportunities. The information covers how those national programs support aviation educational activities with examples or membership opportunities.

Chapter 6 presents case studies of established programs that can serve as those types of model. Successful programs can serve as an effective model for an organization or educator developing new educational programs. Each case study is independent of the others and can be analyzed to find items that will work in any setting. The case studies show the dedication of each organization and the time it has taken each organization to become successful and sustainable. Presenting this variety allows the reader to see that one size does not fit all. Looking at locally available resources and desired learning outcomes is important to designing activities that meet those needs to establish sustainable programs.

Chapter 7 explains how to use the searchable PDF tool and landing pages. The text also provides a listing and description of all the keywords to use in a search. Three tables, sorted by the three primary categories, are included in the chapter as well.

1.5 How This Resource Was Developed

Over the course of the development of the report, interviews were conducted of nearly 100 different entities from around the country engaging in aviation activities. The interview participants ranged from small local museums putting on 3-hour camp experiences for elementary school students to large museums having a week-long program or year-long programs for students. The information from each interview participant and from the respective organization was collected and cataloged. Review of the data indicated robust, educationally beneficial programs were already in place throughout the country and building a singular template would not be the best use of the research gathered.

Instead, the information collected formed the basis to build individual activity summaries, referred to as *landing pages,* for use through the report's online searchable PDF document. A recurring theme of the interviews was that educators spent many hours searching the Internet (googling) to find activities that match their available resources. Based on this consistent

response and experience of participants, the decision was made that each activity/landing page should be searchable by resources required. Organizations using this resource will need to adapt the activities to fit the needs of students and to match activities with the availability of local resources.

The landing pages include the categories listed below, which can be searched by keyword for quick retrieval of similar activities. These keywords are discussed further in Chapter 7 and can be used in the searchable PDF.

Landing page categories and keywords are

- *Activity:* camp, class, internship, flight, club, scholarship, contest
- *Target Age Group:* elementary, middle, high school, postsecondary
- *Title:* title of the event
- *Duration:* <3 hours, 3–8 hours, 1–3 days, >3 days
- *Emphasis:* science, technology, engineering, art, math, operations
- *Staff:* full time, part time, volunteers, parents
- *Venue:* classroom, hangar, airport, laboratory, online, auditorium, museum
- *Provider:* state, museum, university, school, organization
- *Specialized Equipment:* aircraft, simulators, unmanned aircraft systems (UAS), computers
- *Cost/Person:* free, under $25, $26–100, over $100
- *Funding Source:* self, admission, tuition, grant, state, donations, membership
- *Participants:* small (0–20), medium (21–50), large (51–100), x-large (101+)
- *Region:* activities divided by the FAA regions

The reader can search the PDF by keyword to find an activity to view. As an example, to find a type of activity, the user can use Ctrl + F to type the word *camps* into the search function, and all the landing pages identified as camps will appear in the search. If the user wants to find activities that would be free to the participants, the keyword to search would be *free*.

1.6 Summary

This chapter has provided context, described the intended audience, described what the report contains, and described how to use it. A snapshot of the PDF tool rounded out the chapter to give a quick overview of how the report will be immediately practical for all audiences. The next chapter describes the significance of aviation education in keeping the industry alive and thriving for the future.