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Aviation Outreach Model and Gap Analysis: Examining Solutions to Address Workforce Shortages

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Abstract

The purpose of this research is to examine aviation outreach programs to identify best practices and areas for improvement in the endeavor to recruit youth to the aviation industry. The research includes creation of a model of aviation outreach and development and application of an aviation outreach gap analysis design. Three programs are analyzed, Women in Aviation Girls in Aviation Day, Experimental Aviation Association Young Eagles, and Aircraft Owners and Pilots Association High School Aviation Initiative. Each program takes a unique approach to recruiting youth and the strengths and weaknesses, based on the aviation outreach model, are discussed. Results of the research reveal that each of the three outreach programs should be considered a best practice. Recommendations for aviation outreach are provided with emphasis on increased attention to outcome measures. This research contributes a new method to assess outreach programs, a critical task in the effort to create solutions to the global aviation workforce challenges.

One of the most pressing issues facing the aviation community is the need to address the growing shortage of qualified personnel throughout the industry. The industry is facing shortages in many areas and it is a global concern. Outreach programs will play a vital role in the ability to fill the workforce pipeline with qualified professionals in the industry. Many aviation organizations, including large nonprofit organizations, have developed programs to try to introduce youth to opportunities in the aviation industry. The purpose of this research is to develop a model of aviation outreach program delivery and to analyze programs to identify best practices and determine areas for improvement.

Aviation Global Workforce Shortages

Aviation is facing global shortages of qualified personnel in many key areas of the industry. According to the Boeing Pilot and Technician Outlook, global demand is high for technicians, cabin crew, and pilots. Between 2017 and 2016, the global aviation industry will require 648,000 new airline technicians, 839,000 new cabin crew members, and 637,000 new commercial airline pilots (Boeing, 2017). The regions with greatest demand are Asia, followed by North America and Europe (Boeing, 2017). In 2011, the International Civil Aviation Organization (ICAO) published a 20-year forecast to examine the global needs for pilots, technicians, and air traffic controllers. The ICAO forecast a shortage in all three areas of aviation and again noted North America, Asia, and Europe as the most effected regions (ICAO, 2011). Shortages are expected as demand for air transport continues to rise. The International Air Transport Association (IATA) in their most recent forecast, predicted a near doubling of passengers in the next twenty years, leading to 7.8 billion passengers traveling in 2036 compared to 4 billion in 2017 (IATA, 2017). The forecast also supports the growth in the Asia market

predicting that the China domestic air transport market will surpass the US to become the largest such market in the world by 2022 (IATA, 2017).

The global shortage of pilots has captured the attention of the industry. Given the Boeing estimate for 41,000 new aircraft entering service globally in the next 20 years, the industry will need 87 new pilots each day to meet that need, one every 15 minutes (Ostrower, 2017). The shortage is impacted by a variety of factors including cost of training, airline pilot retirement rates, demand for air travel, and reduced number of pilots coming from the military to supply the airlines (Higgins et al., 2014). The US Air Force was recently authorized to recall as many as 1,000 retired pilots back to active duty service to address the severe military pilot shortage (Winsor, 2017). In the US, the pilot supply challenges have primarily impacted the regional airline industry. The recent FAA forecast notes “the regional airlines are facing pilot shortages and tighter regulations regarding pilot training” (Administration, 2017, p. 11). In 2015 the Regional Airline Association (RAA) estimated that regional airlines were only able to meet 62.7% of their hiring goals (RAA, 2016). At the most recent RAA annual conference, the RAA President and Chairman stated, “our industry faces a critical shortage of qualified pilots that, unless addressed, will continue to have a dramatic effect on our nation. The shortage will translate into fewer jobs, less economic activity, reduced aircraft orders, less service to some communities and no service at all to others” (RAA, 2017, p. 4).

Research on the pilot shortage has primarily focused on causes such as the impact of regulatory change on the pilot supply (Bjerke & Malott, 2011; Lutte & Lovelace, 2016), impact of pilot pay on pilot supply (Byrnes, 2015; Lutte, 2017), and analysis of supply and demand (Higgins et al., 2014). In a recent study which explored the hiring challenges at regional airlines, aviation outreach was identified as an essential tool to address the pilot shortage (Lutte, 2017).

Understanding Outreach

Outreach research is often focused within the area of social work. Within that literature, outreach has been defined as the “process of locating, contacting, and recruiting groups that are invisible, hidden, or otherwise difficult to engage in a program” (Ford, Miller, Smurzynski, & Leone, 2007, p. 174). Outreach is viewed as serving one of three purposes, 1) to reach and engage customers who do not readily use services, 2) to deliver services, or 3) to raise awareness of opportunities (Dewson, Davis, & Casebourne, 2006). Dewson, et al. (2006) also describes the use of outreach as a tool for recruitment.

Outreach definitions are often framed in terms of taking services to people or making target groups aware of what organizations can offer. The definition generally includes the elements of making contact and providing services or resources to a targeted group (Andersson, 2013). Outreach applies to a variety of fields and generally involves action taken out of the “mainstream institutional setting” (p. 1) to “raise the profile” (p. 2) of available services (Dewson et al., 2006). The overall goal is to initiate change in the target group (Andersson, 2013).

Andersson (2013) notes three components to outreach, making initial contact, initiating change, and providing support to keep the process going. The process has been described as influenced by three factors: person factors, process factors, and environment factors (Ford et al., 2007). Person factors focus on outreach staff and include elements such as training and personality (Ford et al., 2007). Cheney and Merwin (1996) note that training should include attention to having the appropriate attitude, safety and conflict resolution, and the ability to provide accurate information. Additionally, Dewson et al. (2006) noted that it is important that volunteers for outreach be recruited from the communities that outreach serves. Those who participate in this activity should possess the following characteristics:

- Enthusiastic, friendly, outgoing
- Passion for the job
- Empathy towards targeted group
- Shared characteristics with targeted group
- Good communication and organizational skills
- Flexible and prepared to work out of hours (Dewson et al., 2006, pp. 28-29)

Process factors are defined as “how populations are selected for outreach and the activities used to facilitate interactions” (Ford et al., 2007, p. 174). An important element to outreach is defining the target group and making initial contact. The key to making contact is “there has to be a purposeful attempt at getting in touch with members of a target group” (Andersson, 2013, p. 177). While that may seem obvious on the surface, one could argue that a purposeful attempt to get in touch with a specific target group would involve more than a general internet or social media posting. By contrast, this definition implies a specific action targeted to a specific group. Another key element is to come to agreement on defining the problem that needs to be addressed (Andersson, 2013). A greater challenge is the ability to contact those considered underrepresented or “hard to reach” (Andersson, 2013; Dewson et al., 2006). This group may have little knowledge of the information provided. In the case of aviation, there are certain underrepresented groups in the profession, such as women and minorities, who may constitute a hard to reach group. In the STEM recruitment world, one author notes the key to success to recruiting young women. “It is no secret at all. Women and girls need to see female role models in the workplace that look like them – over and over and over again” (Milgram, 2011, p. 5).

Environment factors address the place and overall environment where the contact or interaction occurs. This may occur in public, private, or in an environment where safety may be a concern. Safety concerns related to the specific environment should be included in training (Cheney & Merwin, 1996). Additional considerations for location of outreach activity include 1) location close to where the target groups live, 2) location close to where the target group spends time, and 3) location where the target group is comfortable (familiar & non-threatening) (Dewson et al., 2006).

Engaging the target group through interaction requires a strategy for activity implementation. Outreach may involve a variety of activities. Generally, there are two options, either acting as a link to connect target groups with resources, a process referred to as “linkage”, or providing a direct interaction to initiate change (Andersson, 2013, p. 176). Linkage activities may range from advertising and marketing to having a presence at employment fairs or other key venues (Dewson et al., 2006). Providing a direct interaction can include in school outreach, public events, establishing clubs, providing a camp or workshop experience, or establishing mentoring programs (Castner & Stowell, 2012). It should also be noted that there is often a limited opportunity to engage during a direct interaction event due to interactions in outreach activities generally characterized by brief encounters in busy and often noisy environments (Cheney & Merwin, 1996). The ability to interact with target groups may also be impacted by gatekeepers. Gatekeepers are “influential individuals who can either facilitate or impede access to a community” (Ford et al., 2007, p. 176).

Some argue that it is not enough to provide an event or opportunity for direct interaction. There must also be continued, sustained involvement and support to keep the process for change moving forward (Andersson, 2013; Ford et al., 2007). Given the limitations noted for direct interactions, providing a means for sustained support prove to be beneficial. The purpose of sustained involvement is to avoid being a “random act of outreach” that lacks connections to additional steps (Castner & Stowell, 2012, p. 18). According to Castner and Stowell (2012), “outreach is most effective when viewed as a continuous process” (p. 18).

Providing activities to facilitate interactions may also result in opportunities to collaborate with other organizations. This collaboration, when it works, can be useful for building relationships with

other organizations and may enhance outreach (Dewson et al., 2006; Klemm, Rempusheski, & Teixeira, 2013). Scull and Cuthill (2010) recommend the following steps for collaborative response in outreach 1) “identification of stakeholder groups, 2) action planning, 3) establishment of working groups to progress strategy implementation, and 4) implementation monitoring, and potential revisions of identified strategies” (p. 71). The authors provide a model of engaged research that incorporates the idea that all stakeholders who influence the decision to participate should be involved in the outreach efforts (Scull & Cuthill, 2010). A word of caution must be included as collaboration may also result in conflict amongst organizations.

Creating a way to measure outcomes is an ongoing challenge for outreach programs (Dewson et al., 2006; Dickey, 2000; Whitney, Dutcher, & Keselman, 2013). Challenges include defining outcome measures and the fact that outcomes from the outreach activity often take an extended amount of time to materialize (Dewson et al., 2006). It is more common in nonprofits to measure outputs vs outcomes. Outputs can be measured by examining areas such as number of events provided or number of people attending, whereas outcomes are designed to measure change such as change in behavior or skills based on the outreach experience (Lee & Clerkin, 2017). Short term options for evaluation may include observations of outreach personnel/volunteers and audience interaction or debriefings with outreach personnel/volunteers (Cheney & Merwin, 1996). With either method, documentation is an important element. Surveys of participants are also a common measure (Cheney & Merwin, 1996). Additional barriers to creating a successful outreach program addressed in the literature include lack of clear goals, lack of support from mainstream organizations, and lack of funding (Dewson et al., 2006; Ford et al., 2007).

Purpose of the Research

The purpose of this research is to analyze aviation youth outreach programs through development of a model of aviation outreach programs and development and application of an aviation outreach gap analysis.

Research Questions:

1. What are the key elements to an aviation outreach program?
2. What types of aviation youth outreach programs are currently being offered by large aviation nonprofit organizations?
3. What are large aviation nonprofit organizations doing well regarding youth outreach and what areas can be improved upon?

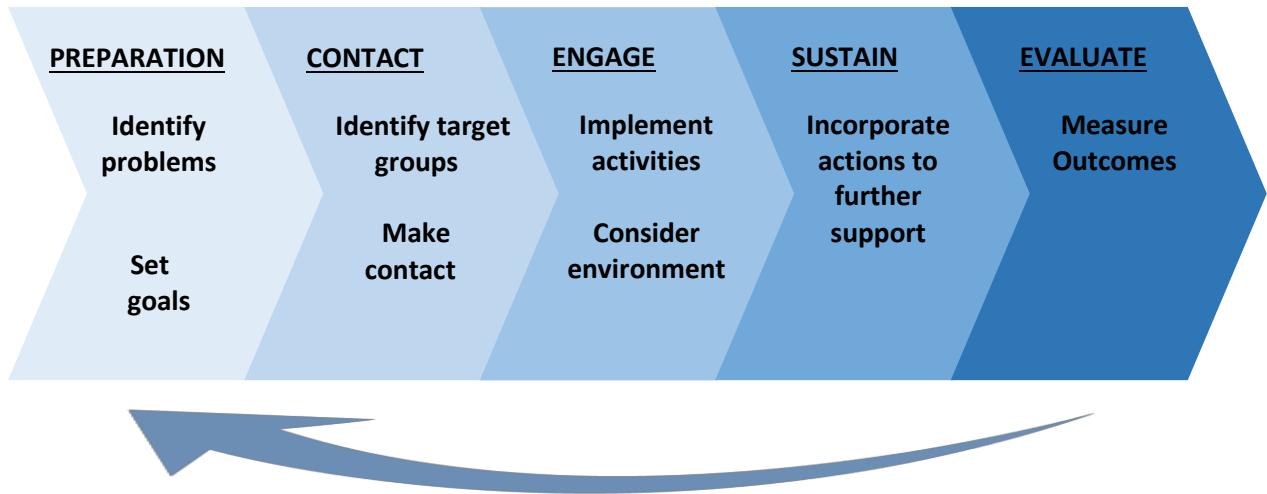
Model of Aviation Outreach

Dewson et al. (2006) note that the “definition of outreach is often shaped by the type of activity that is being undertaken” (p. 11). The following definition of aviation outreach is presented for the purpose of this research:

Outreach in aviation involves contacting and engaging targeted groups to bring awareness of the career opportunities in the field to recruit the next generation of aviation professionals.

The review of the literature on outreach resulted in development of the aviation outreach model (Figure 1).

Figure 1. Model of Aviation Outreach



The first step in the model is preparation and pre-outreach planning. These actions include identifying goals. To identify goals, stakeholders should first agree on the problem(s) to be addressed. For example, when targeting youth for raising awareness of careers as airline pilots, problems to address may be declining allure of the career due to negative perceptions of lifestyle and pay, cost of training, and overall lack of awareness of career opportunities (Lutte & Lovelace, 2016). Once the problem(s) to address is agreed upon, goals should be established that relate to those specified problems. Additional areas to consider in the preparation stage include timeline, budget, and identification of additional stakeholders and gatekeepers.

The next step, initiating contact, consists of actions such as identifying the specific target groups and a means to establish initial contact. Organizations may choose to target a specific age group or level of education (Grades 9 – 12 for example). Making initial contact can include direct contact options, use of social media, or a combination of methods. Large organizations may also use the organization’s chapter network for reaching out to local communities. A strategy for contacting hard to reach or underrepresented groups should also be considered. Knowledge of the identified gatekeepers, those who can facilitate or impede outreach such as school counselors or corporate sponsors, will result in an ability to develop a strategy for utilizing gatekeepers to enhance outreach.

Engagement steps include implementing the activities for interaction with the target group. Activities that are tied to the identified goals are developed and implemented. Factors to consider include the environment in which the activity will take place and identification of potential threats to safety. For example, if flight operations are a part of the activity, additional environmental concerns are to identify any threats to safety that will need to be considered. When working with youth, additional threats to be managed may include the need for background checks or other oversight measures for volunteers. Another consideration is to address the training needs for those who are directly involved in providing the outreach activity.

Once the outreach has taken place, the next step in the model is to sustain the momentum that has started. In this phase, organizations should consider additional actions such as providing materials for “next steps” for participants to continue a path for an aviation career. This may include providing additional information and activities. Having the ability to capture contact information for participants will enhance the ability to reach out and assist in sustaining the momentum of participants.

In the final step, evaluation, organizations should develop a means to measure the results of the outreach initiative. Identifying outcome measures is a primary, yet challenging, means to evaluate a

program. Collecting data on outcome measures and then comparing those results to the organizational goals will allow for evaluation of the program. As establishing outcome measures can be difficult, alternative evaluation techniques such as direct observations of activities and/or event debriefs may also prove useful. Regardless of what technique is utilized, the results should be compared back to the original goals, making this process a cyclical process that then feeds back to preparation for future outreach events.

Aviation Outreach Gap Analysis

This study is qualitative in nature and incorporates development and implementation of a gap analysis design. Gap analysis has been defined as a method for comparing desired outcomes or performance to actual outcomes or levels of performance (FAA, 2010; Stolzer, Halford, & Goglia, 2011). The analysis allows for identification of possible deficiencies in programs so that strategies can be developed to correct those deficiencies. Gap analysis has been described as a self-audit against industry best practices (Pro, 2017). This methodology is widely used in aviation (Hudy & Woolford, 2007; Lutte, 2015; Malm, Fredriksson, & Johansen, 2016; Plioutsias, Karanikas, & Chatzimihailidou, 2017), particularly in the area of Safety Management Systems (FAA, 2010; ICAO, 2013; Leib & Lu, 2013; Ostrowski, Valha, & Ostrowski, 2014; TRB, 2009).

An aviation outreach program gap analysis was designed to incorporate the five elements of the model to analyze outreach programs based on those elements. When developing a gap analysis, several options exist. The researcher can adopt a previously developed gap analysis design, revise an existing gap analysis, or develop a new gap analysis. As this is a new line of research not previously explored, the researcher developed a new gap analysis for this study. The development was influenced by a review of many types of gap designs developed for aviation. The final gap analysis developed for this research (Appendix) is modeled after the ICAO SMS gap analysis (ICAO, 2013) and the ASBU training gap analysis (Lutte, 2015).

The gap analysis was applied to a purposive sample of nonprofit organizations with youth aviation outreach programs. The nonprofit organizations were selected based on size and reputation. Organizations with large membership and those that are well known within the aviation community were targeted. The gap analysis was applied using a review of documents and publicly available information regarding the targeted programs. When able, interviews were conducted with members of the organization involved in management of the programs to fill in missing information. A limitation to this approach is that not all components of the gap analysis (example: budget) had information publicly available to an external party. The three programs selected are described below.

Experimental Aircraft Association Young Eagles

The Experimental Aircraft Association (EAA), a nonprofit organization with over 200,000 members, focuses on promoting and supporting recreational flying (EAA, 2017a). The mission of EAA is “to grow participation in aviation by promoting the spirit of aviation” (EAA, 2017b). EAA has multiple programs to promote aviation. The program selected for this research is the Young Eagles program. According to EAA, “inspiring young people to experience the freedom of flight is one of EAA’s greatest obligations to assure a strong future for aviation” (EAA, 2017d). The Young Eagles program, started in 1992, provides a first free ride on an airplane to youth between ages 8 and 17. Through a network of 43,000 EAA member volunteer pilots, the EAA has provided flights for over 2,000,000 kids (EAA, 2017c). At the EAA annual Air Venture in Oshkosh, Wisconsin in 2016, Harrison Ford flew the 2 millionth Young Eagle flight (Pope, 2016). Multiple requirements must be met to volunteer as a Young Eagles pilot including training requirements, background check, and insurance requirements. Workshops for Young Eagles volunteers and leaders are provided at Air Venture each year. The youth participant also completes a registration form with parental approval

and waiver which also allows EAA to capture participant information. The Young Eagles is the first step in a five-step program for young people. With the capture of participant information, the EAA can follow up with the offer of an EAA student membership, access to a learn to fly course, an opportunity for a free first flight lesson, and potential for flight training scholarships (EAA, 2017c). In 2011, the EAA conducted a study to identify the participants in the program who continued on and earned a pilot certificate. The results indicated that Young Eagles participants are 5.4% more likely to earn a pilot's certificate than youth of the same age who did not participate in the program. The study also revealed that 9% of the Young Eagles who earned pilot certificates were female, higher than the 6% female representation for the total pilot population (Tallman, 2011).

Women in Aviation Girls in Aviation Day

The nonprofit organization, Women in Aviation, International (WAI), has a membership of over 12,000 (WAI, 2017a). The organization is “dedicated to the encouragement and advancement of women in all aviation career fields and interests” (WAI, 2017a). A primary outreach program of WAI is the annual Girls in Aviation Day (GIAD), targeted at girls ages 8 to 17. WAI delivers this program through implementing events throughout many of the 114 chapters and some corporate members of the organization. The goals of the program, as listed on the organization's web site are to “*connect* with other girls and women who are excited about aviation, *explore* the opportunities for working in the aviation and aerospace industry, and *experience* the high flying fun aviation offers” (WAI, 2017b). A variety of events are implemented by the various chapters and sponsors. Chapters are provided with a chapter kit from WAI that includes information such as potential activities, how to schedule volunteers, volunteer training, fundraising suggestions, liability release form, guidance on obtaining insurance, and general guidelines for events (Bosco, C, personal communication, October 19, 2017). The guidelines include activities that are not allowed (flights) and the need for parent participation. To participate as a volunteer, one must be a member of a WAI chapter. Background checks for volunteers are not required (Bosco, C, personal communication, October 19, 2017). Some examples of chapter events include the University of Nebraska at Omaha Maverick chapter with support from the NASA Nebraska Space Grant conducted an event that included activities such as flight planning and career presentations and the participants were provided information on future EAA Young Eagles flights in the area. The Houston Texas WAI chapter hosted an event for 100 girls at the Lone Star Flight Museum with hands on activities to learn about aviation concepts. United Airlines hosted events at five different airport locations with activities that ranged from tours of flight operations to panel presentations on career opportunities for women in aviation. The GIAD has grown at a rapid pace since the first GIAD in 2015. The first year there were approximately 3,200 participants. In 2016, the numbers grew to approximately 7,000 participants (M. Martin, personal communication, October 19, 2017). On September 23, 2017, there were 74 events held in 12 different countries by chapters and corporate members with approximately 9,700 attendees (WAI, 2017b). While WAI does not capture participant information, they do conduct follow up surveys with chapters for evaluation and review and use those results to make potential changes to the program and to share best practices (M. Martin, personal communication, October 19, 2017).

Aircraft Owners and Pilots Association High School Aviation Initiative

The largest nonprofit aviation organization in the US, the Aircraft Owners and Pilots Association (AOPA), has a membership of over 400,000 (AOPA, 2017d). The mission of the AOPA is “to protect your freedom to fly by advocating on behalf of our members; educating pilots, nonpilots, and policymakers alike; supporting activities that ensure the long-term health of General Aviation; fighting to keep General Aviation accessible to all; and securing sufficient resources to ensure our success” (AOPA, 2017b). To assist in meeting their mission, AOPA has created an umbrella program called You Can Fly to build the pilot community. The program includes several initiatives such as a program to build and support flying clubs and programs to provide flight training resources for both new pilots and pilots who have been inactive for an extended period. As a part of the You Can Fly programs, the organization has launched the AOPA High School Aviation Initiative to address the identified problem of “a gap in aviation youth education” (AOPA, 2017e). The mission of this initiative “is to help build and sustain aviation STEM programs in high schools in order to provide a quality workforce to the aviation industry” (AOPA, 2017a). Through the High School Aviation Initiative, AOPA works with high schools and other education programs to share resources and best practices for implementing aviation related programs and aviation STEM curriculum. The program primarily targets principals, guidance counselors, and teachers. There are also provisions for scholarships and grant support. As a part of these efforts, AOPA hosts an annual AOPA High School Aviation STEM Symposium to bring educators together for further collaboration. The Symposium is in its third year. Previous years were a one day event with participation levels of 160 in 2015 and 200 in 2016 (Tulis, 2017). The Symposium for 2017 was a two-day event with 258 attendees from 40 states (Hasselbring, C, personal communication, November 9, 2017). The 2017 event presented the curriculum and information related to implementing a 9th grade aviation course which has been field tested by 29 teachers and will be available for high schools starting in the Fall of 2018 (Tulis, 2017). Additional courses for grades 10, 11, and 12 will be added culminating in a four-year aviation high school program in three available tracks, pilot, unmanned aircraft systems, and aerospace engineering. The curriculum includes units on industry workforce needs; career options such as military, airlines, maintenance, and air traffic control; professional development such as resume writing, interview skills, and professionalism; and guidance on pathways including universities, technical colleges, and the military (Hasselbring, C, personal communication, November 9, 2017). To participate in the high school initiative, high schools must apply to AOPA and are selected based on factors such as administrative support and qualifications and dedication of the proposed teachers who will implement the curriculum (Hasselbring, C, personal communication, November 9, 2017). The program is funded by donations to the AOPA foundation and all courses will be offered at no charge to high schools (AOPA, 2017c). To evaluate the program and gain feedback, AOPA conducts surveys and on-site visits. Teachers in the program complete 12 surveys a year and students complete two. The surveys and site visit results are analyzed by external evaluators and results are submitted to AOPA to explore potential program improvements (Hasselbring, C, personal communication, November 9, 2017).

Gap Analysis Results

The aviation outreach gap analysis was applied to all three outreach programs. The results of the gap analysis application are described by summarizing the information related to the five areas of the aviation outreach model. For each area, a summary table is provided to present the gap analysis results for the three cases. Each question in the gap analysis is designed for a “yes” or “no” response. A “no” indicates a gap exists. A response of “NA” indicates that there is not enough evidence available to determine whether the outreach component has been met. It should not be assumed that gap elements are not met simply because information for the gap element was not publicly available.

Outreach Preparation

All three organizations have a positive response to all items under the outreach preparation segment of the gap analysis (Table 1). The problems related to the shortage of qualified personnel are well understood and goals to address the problem are described on the program websites. The timelines for each of the programs vary. While two events are offered at specific times, such as Girls in Aviation Day and the AOPA High School STEM Symposium, the EAA Young Eagles program is ongoing and occurs year-round. Budget information and financial statements are available for all three organizations. Two of the three (AOPA and EAA) make some financial statements publically available on their web sites that indicate expenses for programs in general. WAI provides a financial statement within the WAI State of the Organization document available through member login to the web site. The financial statement includes specific expenses for Girls in Aviation Day. That exact amount is not presented here as it is membership protected. All three organizations appear to have a solid understanding of the use of gatekeepers. The AOPA program makes use of school counselors and principals as access points and use teachers in K-12 schools for implementation of the high school curriculum. EAA and WAI use their chapters as gatekeepers as the chapter volunteers provide the actual engagement activity on behalf of the organization. This allows for excellent coverage and an ability to reach a much wider audience. Using chapters also allows for greater flexibility. For example, Young Eagles chapters can schedule flight days based on regional weather, availability of volunteers, etc. In the case of WAI, allowing chapters to determine the specific type of activity provided for Girls in Aviation Day, with guidance from WAI, allows for greater creativity and the ability to respond to the size and needs of the specific target market.

Table 1. Aviation outreach gap analysis results: Outreach preparation

	WAI GIAD	EAA Young Eagles	AOPA High School Initiative
Has the problem statement been clearly identified?	Yes	Yes	Yes
Have clear goals for the outreach effort been identified?	Yes	Yes	Yes
Has a timeline been established?	Yes	Yes	Yes
Has a budget been agreed upon?	Yes	Yes	Yes
Have *gatekeepers been identified?	Yes	Yes	Yes
Has a strategy been developed for working with gatekeepers?	Yes	Yes	Yes

*Gatekeepers are defined as stakeholders who can facilitate or impede outreach (example, school counselors, corporate sponsors).

Initiate Contact

There are mixed results for the second component of the gap analysis, initiate contact (Table 2). All three groups have identified their respective target groups and use a variety of means including social media and direct contact for initiating contact. In the chapter kit, WAI provides specific suggestions for contacting key groups such as other local aviation groups and schools to enhance participation. The kit also provides guidance on contacting media and the use of social media. While WAI clearly has set a strategy for targeting underrepresented groups in aviation through their focus on women, it is not as clear whether EAA has established a specific strategy for contacting underrepresented groups. Although there is no evidence of a specific strategy to contact underrepresented groups, it appears that the EAA Young Eagles program has had some success in outreach to young women as indicated in the results of the EAA study. AOPA does note that a diverse group of students can be reached (AOPA, 2017e) through the High School Aviation Initiative. Diversity of the student population is a factor when reviewing high school applications (Hasselbring, C, personal communication, November 9, 2017). A focus on diversity is also included in the curriculum to highlight the accomplishments of people in aviation in underrepresented groups such as Katherine Johnson, the WASPs, and the Mercury 13 group (Hasselbring, C, personal communication, November 9, 2017).

Table 2. Aviation outreach gap analysis results: Initiate contact

	WAI GIAD	EAA Young Eagles	AOPA High School Initiative
Has the target group(s) been identified?	Yes	Yes	Yes
Have potential hard to reach or underrepresented groups been identified?	Yes	NA	Yes
Has a plan for initial contact been developed?	Yes	Yes	Yes
Has contact using social media been considered?	Yes	Yes	Yes
Has contact using direct communication been considered?	Yes	Yes	Yes
Has a plan for contacting gatekeepers been established?	Yes	Yes	Yes
Does the contact plan include a strategy to reach out to underrepresented or hard to reach groups?	Yes	NA	Yes

Engage

In the area of engagement, all three organizations implement activities to meet identified goals (Table 3). As previously noted, two of the three organizations, the EAA and WAI, use their vast chapter networks for implementation of activities. In the case of EAA, chapter volunteers schedule and organize Young Eagles events and members volunteer to fly. The program is centrally administered with specific training and event requirements such as background checks for volunteers and required insurance for participating pilots. All Young Eagles events must comply with the EAA program guidelines. Given the nature of the events, a free flight experience, this approach is an excellent means for EAA to identify potential safety threats and the organization shows evidence of strategies to address those safety concerns. For Women in Aviation, the chapters participating in Girls in Aviation Day develop their own programs which allows them to tailor the programs to their specific target audience. While this approach provides for creativity and flexibility, it also results in less control by the central organization over the events conducted. Using the program chapter kit with specific guidelines for activities assists in addressing that concern. All three programs show evidence of identifying and addressing safety threats. This is clearly an essential task for the EAA, considering that flight activities are the focus. Efforts of the EAA in this area include parental consent on a liability release form, background checks for volunteers, and requirements related to flight currency, aircraft condition, and insurance. While the other organizations are not directly involved in flight activities, a review of any safety concerns, particularly for programs that work with youth, is warranted. WAI has identified and addressed safety concerns to include having a parent or other responsible adult with the participant throughout the activity, requiring a parent to sign a liability release and use of photo release. In addition, the organization provides guidance for the chapters to obtain insurance for the event. AOPA has identified safety threats related to curriculum activities and strategies to address those concerns are included in the curriculum design (Hasselbring, C, personal communication, November 9, 2017). Since the AOPA program targets educators in K-12 schools, it is suggested that those teachers who are implementing the program have been vetted by the schools and appropriate safety strategies for the school environment have been addressed by the school. Training is provided in all three programs for those involved in implementing the programs. All organizations provide training resources. Excellent examples of training resources include the WAI GIAD chapter kit and the AOPA High School Symposium.

Table 3. Aviation outreach gap analysis results: Engage

	WAI GIAD	EAA Young Eagles	AOPA High School Initiative
Have activities been implemented to meet the goals identified?	Yes	Yes	Yes
Have threats to safety related to the specific activity environment been identified?	Yes	Yes	Yes
Have strategies to address specific safety threats been implemented?	Yes	Yes	Yes
Has appropriate training been developed and provided to those engaged in the outreach activity?	Yes	Yes	Yes

Sustain

All three programs provide information to targeted groups to sustain momentum and continue forward progress towards next steps (Table 4). As previously noted, the EAA has laid out a five-step process allowing for the participant to progress from that first flight experience to a certificated pilot. The WAI organization offers a 6-month free digital membership to all who participate in GIAD. Attendees who fill out a form which captures name, age, address, and email will receive the membership. Additional information for next steps may be provided at the various events. For example, the University of Nebraska at Omaha Maverick chapter provided EAA Young Eagles information to their participants. The AOPA High School Initiative provides valuable next step information for educators and others who attend the Symposium. Participants learn about the state of hiring in the industry and postsecondary opportunities for their students through panel presenters. Information on career progression is also targeted directly to students through the curriculum design. Students in the High School Initiative program build a career portfolio based on the professional development activities and receive information on career options and pathways to achieve those goals.

Table 4. Aviation outreach gap analysis results: Sustain

	WAI GIAD	EAA Young Eagles	AOPA High School Initiative
Is information provided to the target group to provide “next step” actions to sustain the momentum?	Yes	Yes	Yes

Evaluate

As noted in the literature, evaluation is a common challenge for outreach programs. The gap analysis explores the use of output measures, outcome measures, and alternative options such as direct observation of the program or some type of debrief following the event to gain feedback (Table 5). All three organizations track output measures such as numbers of participants and events. These measures allow programs to compare year to year data to track trends and growth. Outcome measures have been collected and analyzed by one organization, the EAA. The outcome measure identified was pilot certification. This allowed the organization to examine which participants in the Young Eagles program went on to earn a private pilot certification. This is not an ongoing process but was a one-time review in 2011 using FAA and EAA data. The WAI organization does not measure outcomes due to the challenge that outcomes are not immediate but are years in the making (Martin, M, personal communication, October 19, 2017). WAI does use other measures for evaluation. A survey is distributed to all participant chapters to gather feedback to continuously improve the program and share best practices. There is evidence of capturing output measures and alternative techniques (site visits, surveys) for the AOPA program but no evidence was located showing identification or analysis of outcome measures, not surprising given the long lead time for outcome measures to materialize and the relative newness of the program.

Table 5. Aviation outreach gap analysis results: Evaluate

	WAI GIAD	EAA Young Eagles	AOPA High School Initiative
Has *output data been collected?	Yes	Yes	Yes
Have outcome measures been identified?	No	Yes	No
Has data on the outcome measures been collected?	No	Yes	No
Has data been analyzed and compared to original goals?	Yes	Yes	Yes
Have alternative evaluation techniques other than outcome measures been implemented (exp: event debrief, observations, etc)?	Yes	NA	Yes
Has assessment data been collected for alternative evaluation techniques?	Yes	NA	Yes
Has assessment data been analyzed and compared to original goals?	Yes	NA	Yes

* Output measures represent what is produced such as the number of participants or outreach events. Outcomes are measures of impact of the outreach such as changes in behavior. Examples of outcome measures may include participants who become pilots, enroll in aviation university programs, become employed in the aviation industry, or change their views about aviation career options.

Analysis of Results

The research provided a means to examine and ultimately assess outreach activities by large aviation nonprofit organizations. Given the importance of the task, the resources required, and the significant amount of time associated with engaging in outreach activities, it is important that we get it right. The application of the gap analysis shows the aviation outreach programs examined are doing just that. The strengths of the three programs examined include the following. The programs reflect a broad range of creative solutions to address the aviation workforce shortage. The programs make excellent use of extensive networks of chapters, volunteers, and identified gatekeepers to broaden the reach. Additionally, Women in Aviation serves as a primary example of a nonprofit organization implementing outreach that is aimed at underrepresented groups. The weaknesses are those that routinely plague outreach activities. While the three organizations are effective in measuring outputs of the programs, most do not measure outcomes. This is not uncommon in outreach programs and is particularly challenging in youth outreach programs due to the long gap in time between activity and desired outcome. A leader in measuring outcomes is the EAA Young Eagles program. An additional

area that could be improved is a thorough and comprehensive review of potential safety threats. While some of the organizations do take measures to address some concerns, evidence of a comprehensive review of safety concerns would enhance the programs. Again, the EAA Young Eagles program is the stand out program example of identifying and addressing safety threats, an essential task given the flight activities of the program. A final recommendation is to develop a strategy for identifying, *targeting*, and including underrepresented groups in outreach efforts. WAI is a stand out example of successfully meeting this goal.

Based on the review, the following specific recommendations are provided for each of the three programs. It is recommended that the EAA update the 2011 study. Given the amount of data to review, it would be challenging to conduct the review on an ongoing basis but having a set time, such as every five years, would allow for trends to be established. To explore the best of use of resources, it may also be beneficial to track whether the participants utilized the five-step approach EAA offers. The AOPA program is just launching the first high school courses with more on the way. Capturing participant data may be stifled due to the environment in which the program operates and restrictions on sharing of information of high school students. If the organization can capture participant information through an alternate means, such as participant sign up for a specifically designed High School Initiative student membership with AOPA, that would allow for the opportunity to capture participant information. AOPA could then identify and analyze outcome measures such as enrollment in an aviation university program or pilot certification through follow up surveys or additional research. It is recommended that AOPA work with universities to explore the option of delivering the AOPA curriculum as dual credit coursework, allowing the high school students to also gain college credits at a local university aviation program. For the Women in Aviation GIAD program, capturing contact information for participants is recommended. This could be done by adding parameters to the event registration or sign in sheet. Alternatively, WAI can create a database using the existing sign-up data for the 6-month free digital membership which currently captures contact information. A database of participants would allow WAI to conduct a variety of follow up assessment actions such as track the number of participants who become full members or conduct a survey at set intervals to assess whether the girls who participated in GIAD continued on a path to an aviation career. By conducting a periodic assessment, the organization could establish trends and gather information to update the database of participants. After all, today's Girls in Aviation Day participants, will be tomorrow's Women in Aviation mentors. One of the many strengths of WAI is the scholarship program. For 2018, the WAI available scholarships are estimated at \$634,000 (WAI, 2017c). It is also suggested that WAI consider a scholarship earmarked specifically for former GIAD participants to further sustain the momentum of the program. While recommendations related to outcomes and evaluations were provided, it is understood that organizations must balance their resources against the perceived value of such efforts.

Conclusions

Aviation outreach programs play an important role in addressing the needs of the aviation workforce. Recruiting the next generation of aviation professionals is a high priority for the industry. This task should remain a constant focus. As one director observed, when times are lean in the industry, less of these programs exist and it is vital to keep a consistent focus on recruitment (Bosco, C, personal communication, October 19, 2017). The research shows the three programs provided by EAA, AOPA, and WAI are exemplary examples of aviation outreach and should be considered best practices for aviation organizations. Further research should be conducted to expand the number of programs examined and to further identify and explore outcome measures to determine the impact of the programs on the workforce pipeline.

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