

Spring 2009

Have We Made Progress? Trends in Minority Participation in Postsecondary Aviation Education

David C. Ison

Embry-Riddle Aeronautical University, isond46@erau.edu

Follow this and additional works at: <https://commons.erau.edu/ww-graduate-studies>



Part of the [Higher Education Commons](#)

Scholarly Commons Citation

Ison, D. C. (2009). Have We Made Progress? Trends in Minority Participation in Postsecondary Aviation Education. *Collegiate Aviation Review*, 27(1). Retrieved from <https://commons.erau.edu/ww-graduate-studies/5>

This Article is brought to you for free and open access by the College of Aeronautics at Scholarly Commons. It has been accepted for inclusion in Aeronautics, Graduate Studies - Worldwide by an authorized administrator of Scholarly Commons. For more information, please contact commons@erau.edu.

Have We Made Progress? Trends in Minority Participation in Postsecondary Aviation Education

David C. Ison
Rocky Mountain College

ABSTRACT

The purpose of this research was to evaluate the trends in participation by minorities who completed professional pilot education programs in the United States. Data concerning the number of students who completed degrees at the associate's, bachelor's, and master's levels was collected via the Integrated Postsecondary Education Data System (IPEDS). It was found that minorities, including women, now make up 30.0 percent of the professional pilot program student body. These participation rates were found to be higher than those found among the pilot population and in the aviation industry in general. The level of involvement of minorities in aviation higher education has shown consistent improvement over the past decade.

INTRODUCTION

The face of the United States is changing. Once a predominately white country, the U.S. has progressively been migrating towards a diverse mix of races and ethnicities (Hobbs and Stoops, 2000). In May of 2007, the U.S. Census Bureau reported that the number of minorities topped 100 million, equating to approximately one third of the total U.S. population. The U.S. Department of Labor (1999) forecasts that by 2050, minorities will make up 50 percent of the U.S. population.

These demographic changes have also trickled into the composition of the American postsecondary student cohort. Between 1994 and 2004, the growth in minority students far outpaced that of white students (Cook & Cordova, 2007). These statistics, of course, are averages across the spectrum of areas of study. There have been a few particular subjects in which minorities have historically lagged such as in science, technology, engineering and mathematics (STEM) fields (Babco, 2003). In particular, minorities have consistently been underrepresented in aviation, especially in the role of aircraft pilot (Hedge, 2007).

The importance of diversity in both higher education and in the workplace has been highlighted by a variety of research (Fassinger, 2008; Umbach, 2006; Lockwood, 2005; Turney, et al, 2002; Willdorf, 2000; Brinson & Kottler, 1993; Luedtke, 1993). Thus an assortment of programs and initiatives has been undertaken over the years to improve minority

representation in general and in specific fields (American Council on Education, 2008; The Sallie Mae Fund, 2008; American Asian Institute, 2005; The White House, 2003; W.K. Kellogg Foundation, n.d). Significant effort has been put forth to augment the number of minorities in STEM fields (Committee on Equal Opportunity in Science and Engineering, 2004; Babco, 2003). The Federal government and several private organizations have made concerted efforts to improve participation rates by minorities in aviation, many with emphasis on recruiting more pilots (Federal Aviation Administration, 2008; The Wolf Aviation Fund, 2008; Federal Aviation Administration, 2007; Women in Aviation, 2007; The Organization of Black Airline Pilots, 2007; Minority Aviation Education Association, 2004; Sterkenburg & Stanley, 2002; Corporate Social Responsibility Newswire, 2001, U. S. Department of Transportation, n.d.).

Unfortunately, little research exists that investigates whether there has been any improvement in minority participation in aviation. Exacerbating this quandary is the minimal amount of data that is available on minorities in the aviation field. Existing data does not address the critical nature of minorities being fed into the industry. Simply, existing data does not give a complete picture of the progress, or lack thereof, being made by minorities pursuing careers as pilots. This information is critical to the future of the aviation industry because in order to avert a shortage of

professional aviators, the industry will have to increasingly rely on minority college graduates as new and replacement employees (Turney & Maxtant, 2004; Hanson & Oster, 1997; Villazon, 1992). This dearth of data beckons the question: have we seen an improvement in minority participation in aviation higher education in recent years?

REVIEW OF LITERATURE

The Changing Face of America

Over the past 100 years, the demographic composition of the U.S. population has been in flux, with the most dramatic changes taking place in recent years. Yet at the beginning of the 20th century, the U.S. was far from what could be considered a diverse nation. “In 1900, only two non-Southern states [...] had populations with at least 10 percent races other than white” (Hobbs, & Stoops, 2000, p. 73). In fact, the most diversified states, those in the South, were essentially only divided between Blacks and Whites as an artifact of the regional dominance of slavery only forty years prior. Even just 30 years ago, the U.S. was still a nation divided between these two primary racial groups: “As recently as 1970, the U.S. population was primarily classified as either White or Black, and the population of races other than White or Black was only 2.9 million, or 1.4 percent of the population” (Hobbs & Stoops, 2000, p. 74).

Within recent years there have been more rapid and dynamic changes in racial and ethnic makeups within the U.S. “By 2000, the number of people in the United States who were of races other than White or Black had grown to 35 million” equating to 12.5 percent of the population (Hobbs & Stoops, 2000, p. 76). From 1980 to 2000, sizeable changes had taken place to the minority population in the U.S. While the White population grew 12.3 percent, the Black population increased by 30.8 percent. During the same period, the Asian and Hispanic populations grew by 204 percent and 141.7 percent, respectively. The American Indian and Alaska Native population expanded by 74.3 percent.

These diversification trends are expected to accelerate within the next half-century:

Over the next fifty years, the population of the United States is

expected to grow by nearly 50 percent, [...] to an estimated 394 million people in 2050. [...] Immigration trends, coupled with varied birth rates will bring more diversity. [...] By 2050, minorities are projected to rise [...] to almost one in every two [Americans]” (U.S. Department of Labor, 1999, p. 3).

The construct of the population in 2050 is projected to be 52.8 percent White, 24.5 percent Hispanic, 13.6 percent Black, 8.2 percent Asian or Pacific Islander, and 0.9 percent Native American. This estimation shows impressive change from the values observed in 1995, when the population was 73.6 percent White, 12.0 percent Black, 10.2 percent Hispanic, 3.3 percent Asian, and 0.7 percent Native American (U.S. Department of Labor, 1999, p. 3). In fact, it is projected that soon after the middle of the 21st century, “[p]eople of color (e.g. Blacks, Hispanic/Latino Americans, Asian Americans, and American Indians) [...] are projected to become the numerical majority” (Fassinger, 2008, p. 254).

A Diverse Workforce

Changes in the demographic landscape have permeated into other aspects of American society. One such arena in which minorities have made inroads is the American workforce. In 1997, Blacks comprised 10.8 percent of the workforce while Hispanics participation was 9.8 percent. By 2007, Blacks and Hispanics held 11.0 percent and 14.0 percent respectively. Women also saw gains, though modest, in workforce participation rising from 46.2 percent in 1997, to 46.4 percent in 2007 (U.S. Department of Labor, 2008). The Bureau of Labor Statistics did not collect data on Asian Americans until 2003. From 2003 to 2007, Asian participation in the workforce increased from 4.2 percent to 4.7 percent (U.S. Department of Labor, 2008). Unfortunately, no comparable data on the Native American workforce is available.

Diversity in the Classroom: Minorities in Higher Education

Minorities have also made gains within higher education. Between 1994 and 2004,

minority enrollments in higher education rose 49 percent to 4.8 million. During the same period, enrollments of White students increased 6 percent to 10.6 million. Concurrently, minorities experienced remarkably higher numbers of degree completions at both the associate and baccalaureate levels (Cook & Cordova, 2007, p. 3). Since 1970, women have gone from being a minority in undergraduate programs to a majority today. According to the National Center for Education Statistics (2004) presently “more than half of all bachelor's and master's degrees are awarded to females” (p. 78). The Integrated Postsecondary Education Data System (IPEDS) indicated that in 1996, 24.1 percent of all bachelor's degree recipients were non-White. When considering all women and minorities, it was noted that these individuals made up 65.7 percent of bachelor's recipients. In 2007, the percentage of non-White students rose to 32.2 and for students that were women and/or of minority status the participation rate increased to 70.4 percent (National Center for Education Statistics, 2008a).

Yet while changes in the U.S. population certainly have made their way into higher education, the distribution of this diversification has been far from even among areas of study. “[G]ender differences in majors still exist, with female bachelor's degree recipients much less likely than their male peers to major in computer science, engineering, and physical sciences” (National Center for Education Statistics, 2004, p. 9). Minorities of all types have historically been underrepresented in the sciences, technology, engineering, and mathematics (STEM) fields. In these fields, 77.1 percent of participants are White, 7.6 percent Black, 3.8 percent Hispanic, 11.2 percent Asian, and 0.4 percent Native American (Fassinger, 2008; Babco, 2003).

The relationship between minority involvement in individual subjects of study and the workforce utilizing such knowledge areas is critical – if a low number of minorities complete programs of education in certain fields year after year, there is little hope of near-term improvement in participation rates. Fassinger (2008) notes that while women now outnumber men in the number of bachelor's degrees

awarded in the STEM fields, the STEM workforce is still dominated by men.

However, such changes do give signs of hope. In time, it can be surmised that the participation rates of women in the STEM workforce will improve. Evidence of this type of progress can be seen in recent strides made by Black and Native American students. “Blacks and Native Americans are going into higher education in greater numbers and have made progress in participating in science, engineering, and mathematics fields” (Babco, 2003, p. 1). The percentage of degrees awarded in these areas of study among Blacks jumped from 5 percent in 1987, to 8 percent in 2000. For Native Americans the participation rates rose from 0.4 percent in 1987 to 0.7 percent in 2000. These improvements have translated to gains in the workforce as well (Babco, 2003).

Diversity in the Skies: Minority Participation in Aviation

Similar to STEM fields, the participation rates of minorities in aviation have historically been low. In particular, minorities have historically been few and far between among the professional pilot population. “For much of their existence, U.S. airlines have employed mostly White males, and it is still the case that White males dominate the management and piloting ranks of the industry” (Hanson & Oster, 1997, p. 115). The same has been true among pilots in the U.S. military: “there have been relatively smaller percentages of African-American and Hispanic officers among Air Force pilots than might be expected from other demographic and educational data” (Barucky & Stone, 1999, p. 20-1).

Karl Minter, President of the Organization of Black Airline Pilots, states that “[a]ccording to the current statistics less than five percent of pilots in the commercial aviation industry are women or Black” (Ace Camp Public Relations, 2008). According to the Bureau of Labor Statistics 2007 data, 4.2 percent of aircraft pilots and flight engineers were women, 0.5 percent were Black, 3.0 percent were Asian, and 2.0 percent were Hispanic or Latino. However, this data is an extrapolated estimate based on a complex sampling arrangement used by the agency.

Unfortunately, “little good information is available on the penetration of women and minorities into the U.S. air transportation industry” which is exacerbated by the fact that “no statistics are gathered on minority pilots” by the Federal Aviation Administration (FAA) (Henderson, 1995, p. 34). There is no research on the trends of minority participation among civilian pilots in the United States. However, current and historical participation rates can be examined by recognizing the link between those individuals in the pipeline for a particular industry (i.e. the degree completions in professional pilot programs). The reason why the use of this type of analysis is so compelling is that college education has, in essence, become a job requirement for those seeking employment as a professional pilot (Echaore-McDavid, 2005).

Only one study by Hedge (2007) has been published on minority enrollments and recruitment programs in collegiate professional pilot programs. Regrettably, this data was collected indirectly through program chairs and provides broad ranges of enrollments rather than specific numbers. The data provides only a snapshot of students enrolled in a limited sample of schools during one particular academic year (Hedge, 2007).

Both the lack of participation of minorities among pilots as well as the inadequate data that is available is troubling. “Given the need for a highly technically skilled workforce, the aviation industry seeks to attract and retain the best and brightest talent for its future and growth. And that of necessity means drawing from a diverse talent pool” (Turney & Maxtant, 2004, p. 5). Moreover, “to ensure that aviation has the future workforce it needs to ensure that aviation jobs are open to all members of society. There is clearly untapped potential in groups that have been historically underrepresented in the industry” (Hanson & Oster, 1997, p. 114). Perhaps best summarizing the need of a diverse workforce, Fassinger (2008) states that:

A strong workforce [...] is critical to the continued economic leadership of the United States in an increasingly competitive global marketplace. [...] The strength of the workforce

depends on the full utilization of the talents, abilities, and perspective of diverse workers. [...] Research indicates that diversity can be highly effective in workplace tasks requiring innovation and exploration of new opportunities and ideas (p. 253).

Because of the obvious importance diversity in aviation, a variety of Federal, industry, and private organizations have developed initiatives to promote minority participation in aviation. In 1992,

Congress directed the Department of Education to enter into appropriate arrangements with the National Academy of Sciences (NAS) for a study of civilian aviation training programs [...] Specifically, Congress was interested in ways to increase the access of women and minorities to civilian aviation jobs, particularly highly skilled jobs as pilots (U.S. Department of Education, 2005).

The Federal Aviation Administration has written regulations that govern its affirmative action standards and requirements (U.S. Department of Transportation, 2008). Both the FAA and numerous private groups have expended a tremendous amount of energy to recruit minorities into aviation. “A number of aviation education programs undertake such efforts, including the FAA’s Aviation Career Education Academies as well as more targeted programs sponsored by groups such as the Organization of Black Airline Pilots, the Ninety-Nines, and Women in Aviation International” (Hanson & Oster, Jr., 1997, p. 121). The Minority Aviation Education Association, Inc. has been helping minorities gain exposure to aviation on a variety of levels for over 10 years. This organization claims to have reached over one million individuals through their education programs (Baynes, 2003).

In 2004, five historically black colleges teamed up with Western Michigan University (WMU) College of Aviation to create the Diversity in Aviation Consortium. The goal of this organization is to try and improve participation of minorities in collegiate flight

programs (Black Issues in Higher Education, 2004). Private companies have also joined in to promote minority pursuit of flight education. Delta Airlines and Western Michigan University began a program that

with \$1.65 million in support from Delta over a four year period, WMU's College of Aviation will begin training a minimum of 24, and as many as 40, women and minority pilots who, once training is completed, will be given priority employment consideration (Corporate Social Responsibility Newswire, 2001).

Several airlines have made clear their intentions to assist in helping minorities into their ranks as pilots, especially in light of past discrimination in the industry: "United [...] says it 'is committed to providing opportunity for career advancement to women and minorities'" (Henderson, 1995, p. 43). UPS has also made public statements touting their affirmative action programs and their excellent minority representation among their employees (Henderson, 1995).

With the rapid changes that have taken place in the demographics of the U.S. population, the workforce, and in higher education, there have been improvements in the numbers of minorities that are entering fields in which they have historically been underrepresented. In particular, there have been strides made in the STEM fields. With gains such as these, there is clearly hope for improvements in other fields as well. Yet change can only be detected by evaluating previous data and comparing to current data (Holbeche, 2006).

Current research does not adequately support the ability to detect changes in the number of minorities who are aircraft pilots. Considering all of the initiatives and efforts being put forth to attract minorities to aircraft cockpits, there is even more evidence for the need of a more thorough and detailed study on the status of professional pilot minorities. While the available data on minority pilots in the workforce is certainly informative, such data paints an incomplete picture of what is occurring in the occupation. Since future generations of pilots are cultivated in collegiate aviation

programs, it is necessary to investigate the completions of such programs by minorities to bring to light whether or not minorities are making progress in aviation. But even more importantly, this data sheds light on what is to come in the future for minorities in aviation.

METHODOLOGY

Purpose

The purpose of this study was to quantify the historical number of minority students who have completed a collegiate professional pilot education associate's, bachelor's, or master's degree program in the United States to ascertain if minorities have made gains in participation rates in postsecondary aviation in recent years. In addition, this study provides baseline data for future studies in this area.

Participants

The population for this study was all students who have completed an associate's, bachelor's, or master's degree in a professional pilot education program at degree-granting institutions in the U.S. that reports student statistics via the Integrated Postsecondary Education Data System (IPEDS). The IPEDS parameters that were set to determine the schools eligible for inclusion in the study are as follows:

- Data viewed by collection year
- Any state or jurisdiction
- Any geographic region
- Any sector
- Degree-granting
- Any highest degree offered
- Any institutional category
- Any Carnegie classification
- Any degree of urbanization
- Any institution size category
- U.S. schools only

Once the universe of schools was determined, additional parameters were set to extract the desired information. Since detailed major data is not available for enrollments, only data on degree completions was collected. This data is a better indication of the numbers of individuals who are eligible for entering the workforce with the requisite education levels to

be competitive in the job market. Within the completion stratus, the “Awards/degrees conferred by program (6-digit CIP code), award level and gender” (National Center for Education Statistics, 2008a) subset was selected. Next, the following selections were made to extract the necessary data:

- Award level: total degrees, associate’s degrees, bachelor’s degrees, master’s degrees
- First major (in years selectable)
- Grand total of students, total; male; female
- White, non-Hispanic students, total; male; female
- Black non-Hispanic students, total; male; female
- Hispanic students, total; male; female
- Asian or Pacific Islander students, total; male; female
- American Indian/Native Alaskan students, total; male; female
- 49-Transportation and Material Moving Workers
 - 49.01-Air Transportation Workers
 - 49.0101-Aviation and Airway Science
 - 49.0102-Aircraft Pilot and Navigator (Professional)
 - 49.0107-Aircraft Pilot (Private)

From the year 2003 to 2007, an additional area of study code, 49.0108-Flight Instructor, was made available and was included in the analysis. There were no significant differences noted in the numbers of participants based on the inclusion of this category. There was also slight variance in the total number of institutions that were made available for data analysis by IPEDS over the period investigated. However, these additional numbers of schools were not significant contributors to the participation rates of minorities.

From 2002 to 2003, an atypical jump in the number of students reported in professional pilot education programs was noted. This appears to be due to improved reporting of aviation student majors by schools in the IPEDS universe, increases in numbers of degree programs, and a general increase in students at all levels. Even in light of this rise in numbers of students, the

participation rates of all cohort types remained stable. The change in participation rates of every type of student from 2002 to 2003 was found to be statistically insignificant through the use of a *z*-test for proportions of samples of unequal size.

Procedure

Through the use of the IPEDS dataset cutting tool, the necessary data was pulled from the database under the parameters outlined previously. Data was collected for each year from 1996 to 2007. Per annum, the total number of professional pilot education program students completing degrees (including associate, bachelor and master levels), those who completed associate’s degrees, those who completed a bachelor’s degree, and those who completed a master’s degree were collected (National Center for Education Statistics, 2008a). Each year was stored as a separate Microsoft Excel (2007) file. Excel was then used to sum all students who completed the apposite degree program. Participation rates were calculated by dividing the number of students in a particular membership group (e.g. black non-Hispanic female) by the total number of students reported.

Upon the completion of these calculations, the data for each year was placed into a separate Excel spreadsheet for comparison and analysis. From this data, the participation rates were broken down into analytical categories. The first was the percentage of students who were non-White. The second was the percentage of students who were women and/or an individual of a racial/ethnic minority.

The participation rates of all reported groups were analyzed using the Dimensions Research (2005) *z*-test for two proportions of unequal sample size calculator. This method of analysis was selected after analyzing available statistical tools (Gravetter & Wallnau, 2007; Stephens, 2006) and upon consultation with senior faculty in the Educational Psychology Department at the University of Nebraska – Lincoln and in the Mathematics department at Rocky Mountain College (C. Ansonge, personal communication, October 22, 2008; U. Hoensch, personal communication, October 25, 2008). Because the goal of this research was to identify a statistically significant change in participation

rates, a two-tailed test method was utilized. Each individual analysis was conducted at a minimum of a 95% confidence level (Clark-Carter, 1997).

RESULTS

Because the interest of this study concerns the participation rates by minorities in aviation higher education, it was determined that the most appropriate presentation of data would be in percentage format. From 1996 to 2007, there has been a steady increase in the percentage of all types of minority students (see Figure 1). In 1996, there were 14.4 percent of students that were non-white and 22.9 percent that were women and/or of a minority group. In 2007, these numbers had increased to 21.4 percent and 30.0 percent respectively. These changes were found to be statistically significant (non-white: $z = 9.67, p < .01$; women and/or minority: $z = 8.45, p < .01$).

At each degree level, notable increases in minority participation were found. Among students completing an associate's degree, 17.7 percent were non-white and 27.8 percent were women and/or of a minority group in 1996. In

2007, these percentages had moved upwards to 26.9 percent and 37.0 percent respectively. These increases were also found to be statistically significant (non-white: $z = 5.08, p < .01$; women and/or minority: $z = 4.54, p < .01$). For recipients of bachelor's degrees, the participation rate of non-whites was 15.1 percent in 1996 and 19.6 percent in 2007. Women and/or minorities had participation rates at the bachelor's level of 24.3 percent in 1996, and 27.4 percent in 2007. Again, these were found to be statistically significant for changes among non-white students ($z = 5.07, p < .01$) and for those who were women and/or members of a minority group ($z = 3.04, p < .01$). Among students completing master's programs, 10.0 percent were non-white in 1996, and 22.4 percent in 2007. This change was found to be statistically significant ($z = 6.64, p < .01$). Master's completion rates by women and/or minority status individuals were 14.4 percent in 1996, and 30.1 percent in 2007. Respectively, the difference between 1996 and 2007 was statistically significant as well ($z = 8.74; p < .01$).

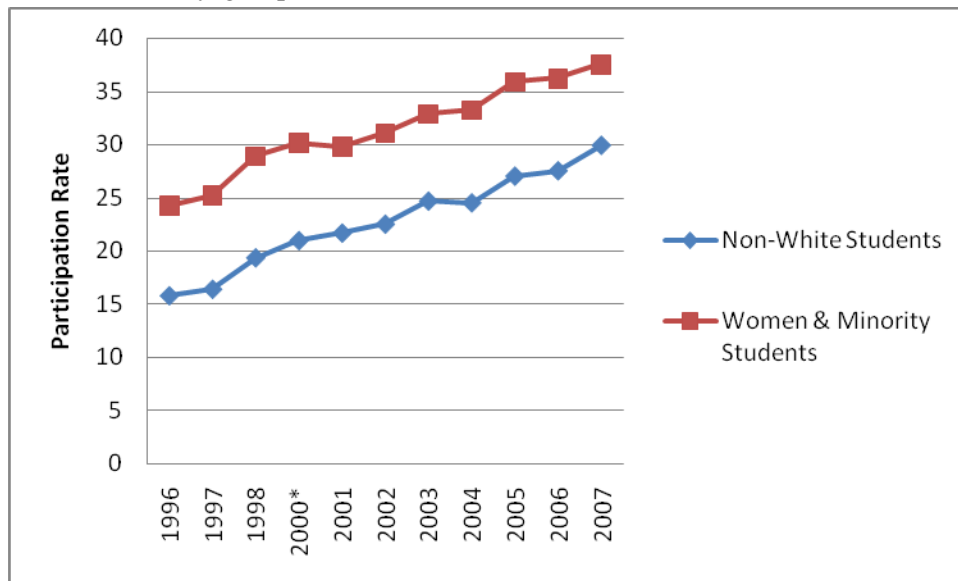


Figure 1. Participation rates of minority students in aviation higher education, 1996 to 2007.

*Note: IPEDS changed the way data was assigned to report years in 1999.

No data specifically for 1999 is reported here.

Because of the complexity of the data for changes in participation rates for individual classes of students, data is presented in tabular format for ease of evaluation (see Table 1). For

each type of student, the difference in total participation rates between 1996 and 2007 (at the associate, bachelor and master levels), the

statistical significance, the z score and the p value are presented.

DISCUSSION

Within the aviation industry, the percentage of participants and employees that are women and/or considered to be a minority has historically been low (Hanson & Oster, 1997). With women accounting for only 6.0 percent of all pilots (Federal Aviation Administration, 2006) and non-whites making up approximately 5.5 percent of the pilot population (The Organization of Black Airline Pilots, 2008), it would naturally be surmised that the percentage of these individuals with aviation higher education would be similarly low. However, the data shows that the participation rate by non-whites (21.4 percent) as well as that by women and minorities (30.0 percent) far surpasses than

what takes place within the industry in general (Federal Aviation Administration, 2006; The Organization of Black Airline Pilots, 2008). It is encouraging to see that there has been a consistent rise in the percentages of women and minorities participating at all degree levels over the past 10 years.

The highest participation rates among non-whites were found at the associate's level (27.8 percent). This finding is consistent with previous research on increases in minority inclusion in higher education. The degree level with the next highest participation rate by non-whites was the master's (22.4 percent). Lastly, non-whites had a 19.6 percent participation rate at the bachelor's level. This ranking (associate's, master's, bachelor's) of participation rates remains the same when including women in the minority category.

Table 1. *Statistical Significance of Changes in Participation Rates at Associate's, Bachelor's and Master's Degree Levels 1996 to 2007*

Classification	Increase in % 1996 to 2007	Statistically Significant @ 95%	z Score	p Value Two-tailed
Women – All	1.60	Yes	2.73	< 0.01
Black – All	1.14	Yes	2.65	< 0.01
Black – Men	0.89	Yes	2.28	0.023
Black – Women	0.24	No	1.20	0.230
Hispanic – All	2.72	Yes	6.60	< 0.01
Hispanic – Men	2.30	Yes	5.90	< 0.01
Hispanic – Women	0.42	Yes	2.85	< 0.01
Asian – All	1.14	Yes	3.79	< 0.01
Asian – Men	0.87	Yes	3.04	< 0.01
Asian – Women	0.28	Yes	2.45	0.014
A. I.* – All	0.58	Yes	3.47	< 0.01
A. I.* – Men	0.43	Yes	2.73	< 0.01
A. I.* – Women	0.16	Yes	2.15	0.031

* Note: A. I. = American Indian

These findings are simultaneously concerning and encouraging. It is concerning that the primary density of minorities is found at the associate's level. As the aviation industry moves to favor baccalaureate and even graduate education, these individuals will continue to be disadvantaged within this employment sector. At the same time, there is hope that more minorities are pursuing graduate education. Perhaps this will help balance overall participation rates.

When examining the actual percentage increases that took place between 1996 and 2007, the rankings of the rates of change were somewhat different than those previously mentioned. For women and minorities, the rise in participation rate at the associate's level between 1996 and 2007 was around 10 percent. For bachelor's degrees this augmentation was 3.3 percent and at the master's level there was a 15.7 percent increase. These findings only

reiterate the concerns about minority concentrations at the associate's level but the dramatic increase in minority participation in graduate education is extremely promising. Upon viewing changes among individual categories of minorities only one group, black women, did not enjoy significant increases in participation rates during the last decade.

Even in light of these significant improvements, the participation rates by women and minorities in aviation higher education still lags when compared to the entire spectrum of higher education. In 2007, 32.2 percent of all students were non-white and 70.0 percent were women and/or minority members (National Center for Education Statistics, 2008b, p. 318). In comparison, 21.4 percent of professional pilot program students were non-white and 30.0 percent were women and/or minorities. Clearly, there still is an unsettling disconnect. From these statistics, it should be clear that the participation rate of women in professional pilot education is still extremely low.

Yet even in the light of low representation in aviation, women and minorities have continued to increase in numbers throughout the industry, albeit slowly. The climbing numbers of these individuals who are pilots and aviation college students all point to a growing trend of increasing participation by women and minorities. With this said, there is clearly a need for improvement. However, the fact that the proportion of women and minority postsecondary students exceeds participation rates found in other parts of the industry points to a future of continued improvements in participation rates by members of these groups. All in all, this beckons kudos for the efforts put forth by the multitude of groups who have championed the inclusion of women and minorities in aviation.

SUMMARY

The purpose of this study was to investigate the trends of participation rates by minorities in aviation higher education. Minorities, including women, now make up 30.0 percent of the professional pilot program student body. These rates exceed the participation rates in industry with 4.2 percent of pilots being women and 5.5

percent of pilots being minorities. The participation rates by minorities have seen steady improvements over recent years pointing to a high likelihood of continued advancement. It is hopeful that such improvements will permeate throughout the aviation industry.

Caution is in order when interpreting the historical and current levels of participation of minorities in aviation. While the trends in the participation rates by minorities within aviation higher education are positive, overall participation rates of minorities in aviation are still unimpressive. It is therefore more critical than ever that efforts are put forth to encourage and support minorities entering and completing aviation higher education programs to help boost levels of these individuals among the aviation profession.

RECOMMENDATIONS

The findings of this study shed light onto the current status of minorities in aviation higher education and on their future participation prospects within the industry. Although minorities are certainly making interminable strides in involvement in aviation higher education, it is critical that the factors that have made this possible are retained and amplified. Based upon these observations, the following recommendations are made:

1. Continue efforts to recruit, mentor, and retain women and minority aviation students.
2. Promote the continued efforts by private, industry, and government groups to encourage and support women and minorities to pursue postsecondary aviation education.
3. Monitor the status of women and minority participation in aviation higher education through follow up studies.
4. Encourage the government or another entity to collect more detailed data on the participation of minorities in aviation, specifically among professional pilots.
5. Investigate how to improve participation rates of those groups that did not have as strong of increases such as black women, black men, Asian women, and American Indian women.

REFERENCES

- Ace Camp Public Relations. (2008). *Media Events for the Organization of Black Airline Pilots, Atlanta Flight Line, Ace Camp and Dream Flight sponsored by Delta Air Lines*. Retrieved September 1, 2008 from <http://www.acecamps.org/pressRoom.shtml>
- American Council on Education. (2008). *Supporting the retention of women in higher education*. Retrieved August 1, 2008 from http://www.acenet.edu/Content/NavigationMenu/ProgramsServices/OWHE/RetentionSupport/Supporting_the_Rete1.htm
- American Asian Institute. (2005). *Current programs*. Retrieved August 2, 2008 from <http://www.aaichicago.org/aaiprograms-current.htm>
- Babco, E. L. (2003). *Trends in Black and Native American participation in STEM higher education*. Washington, DC: Commission on Professionals in Science and Technology.
- Barucky, J. D., & Stone, B. M. (1999). Paper presented at the RTO HFM Workshop: *Difficulties in accessing a representative pilot force: challenge and views of minority pilot focus groups*. Monterrey, CA: RTO MP-55.
- Baynes, D. (2003). *The Minority Aviation Education Association, Inc.* Retrieved August 6, 2008 from http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2003_08_01/noDOI.10333964590473251043
- Black Issues in Higher Education. (2004). *HBCUs work to diversify aviation field*. Retrieved August 6, 2008 from http://findarticles.com/p/articles/mi_m0DXK/is_7_21/ai_n6143487
- Brinson, J., & Kottler, J. (1993, June). Cross-cultural mentoring in counselor education: A strategy for retaining minority faculty. *Counselor Education & Supervision*, 32(4). 241.
- Clark-Carter, D. (1997). *Doing quantitative psychological research: From design to report*. New York: Psychology Press.
- Committee on Equal Opportunity in Science and Engineering (CEOSE) (2004). *Broadening Participation in America's Science and Engineering Workforce. The 1994-2003 Decennial & 2004 Biennial Reports to Congress*. Arlington, VA: National Science Foundation.
- Cook, B. J., & Cordova, D. I. (2007). *Minorities in higher education. Twenty second annual statusreport: 2007*. Washington, DC: American Council on Education.
- Corporate Social Responsibility Newswire. (2001). *Delta, Western Michigan University Announce Program To Boost Number Of Women, Minority Pilots*. Retrieved August 28, 2008 from <http://www.csrwire.com/PressRelease.php?id=547>
- Dimension Research. (2005). *z-test for two proportions calculator [computer software]*. Lombard, IL: Author.
- Echaore-McDavid, S. (2005). *Career opportunities in aviation and the aerospace industry*. New York: Checkmark Books.
- Fassinger, R. E. (2008). Workplace diversity and public policy: Challenges and opportunities for psychology. *American Psychologist*, 63(4). 252-268.
- Federal Aviation Administration. (2008). *Minority scholarships*. Retrieved August 28, 2008 from http://www.faa.gov/education_research/education/student_resources/scholarships_grant/minority_scholarships/

- Federal Aviation Administration. (2007). *Aviation Career Education (ACE) Academy Program*. Retrieved August 28, 2008 from http://www.faa.gov/education_research/education/student_resources/ace_camps/
- FAA. (2006). *Table 2. Estimated active women airman certificates held: December 31, 1997-2006*. Retrieved October 1, 2008 from http://www.faa.gov/data_statistics/aviation_data_statistics/civil_airmen_statistics2006/
- Gravetter, F. J., & Wallnau, L. B. (2007). *Statistics for the behavioral sciences* (7th ed.). Belmont, CA: Thomson Higher Education.
- Hansen, J. S., & Oster, Jr., C. V. (Eds.). (1997). *Taking flight: Education and training for aviation careers*. Washington, DC: National Academy Press.
- Hedge, Rosa L. (2007) *A review of minority recruitment programs in aviation education programs*. Ed.D. dissertation, Oklahoma State University, United States - Oklahoma. Retrieved October 23, 2008, from Dissertations & Theses: A&I database. (Publication No. AAT 3291351).
- Henderson, D. (1995). The drive for diversity. *Air Transport World* (September). 33-43.
- Hobbs, F., & Stoops, N. (2000). *Demographics in the 20th Century* (U.S. Census Bureau, Census 2000 special reports, Series CENSR-4.) Washington, DC: U.S. Government Printing Office.
- Holbeche, L. (2006). *Understanding change*. Burlington, MA: Butterworth-Heinemann.
- Lockwood, N. R. (2005). *Workplace diversity: Leveraging the power of difference for competitive advantage*. Alexandria, VA: Society for Human Resource Development.
- Luedtke, J. R. (1993). *Maximizing Participation of Women in Collegiate Aviation Education* (National Institute for Aviation Research Report 93-14). Wichita, KS: National Institute for Aviation Research.
- Minority Aviation Education Association. (2004). *Program activity*. Retrieved August 3, 2008 from <http://www.maeonline.org/activity.htm>
- National Center for Education Statistics. (2008a). *IPEDS data set cutting tool*. Retrieved on multiple dates from <http://nces.ed.gov/ipeds/pas/dct/index.asp>
- National Center for Education Statistics. (2008b). *Digest of Education Statistics, 2008*. Retrieved on October 1, 2008 from <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2009020>
- National Center for Education Statistics. (2004). *Trends in educational equity of girls & women: 2004*. (NCES document 2005-016). Washington, DC: Author.
- The Organization of Black Airline Pilots. (2008). *OBAP goals, highlights, and vision*. Retrieved August 28, 2008 from <http://www.obap.org/aboutus/aboutus-vision-goals.asp>
- The Sallie Mae Fund. (2008). *Fund initiatives: African-American initiative*. Retrieved August 1, 2008 from <http://www.thesalliemae.org/smfnew/initiatives/aa.html>
- Stephens, L. J. (2006). *Beginning statistics* (2nd ed.). New York: McGraw-Hill.
- Sterkenburg, R., & Stanley, D. (2002). Session from the International Conference on Engineering Education: *Introducing underrepresented minority high school students to an aeronautical technology program at Purdue University*. Manchester, UK.
- Turney, M. A., & Maxtant, R. F. (2004). Tapping diverse talent: A must for the next century. In Turney, M. A. (Ed.) *Tapping diverse talent in aviation: Culture, gender, diversity* (310). Aldershot, UK: Ashgate.

- Turney, M. A., Bishop, J. C., Karp, M. R., Niemczyk, M., Sitler, R. L., & Green, M. F. (2002). National survey results: Retention of women in collegiate aviation. *Journal of Air Transportation*, 7(1). 69-92.
- Umbach, P. D. (2006). The contribution of faculty of color to undergraduate education. *Research in Higher Education*, 47(3). 317-345.
- U.S. Census Bureau. (2007). *Minority population tops 100 million*. Retrieved August 1, 2008 from <http://www.census.gov/Pressrelease/www/releases/archives/population/010048.html>
- U.S. Department of Education. (2005). *Aviation careers*. Retrieved August 14, 2008 from http://www.ed.gov/offices/OUS/PES/higher.html#aviation_careers
- U.S. Department of Labor. (2008). *Labor force characteristics by race and ethnicity, 2007*. Washington, DC: Author.
- U.S. Department of Labor. (1999). *Futurework: Trends and challenges for work in the 21st century*. Washington, DC: Author.
- U.S. Department of Transportation. (2008). *CFR 152.409, 152.411*. Retrieved August 15, 2008 from http://edocket.access.gpo.gov/cfr_2005/janqtr/pdf/14cfr152.407.pdf
- W.K. Kellogg Foundations. (n.d.). *Profiles in programming: Native American Higher Education Initiative*. Retrieved August 2, 2008 from <http://www.wkkf.org/pubs/YouthEd/Pub582.pdf>
- The White House. (2003). *From Risk to Opportunity Fulfilling the Educational Needs of Hispanic Americans in the 21st Century*. Washington, DC: Author.
- Willdorf, N. (2000, January 21). Minority law professors said to need mentors. *Chronicle of Higher Education*, 46(20), A18.
- The Wolf Aviation Fund. (2008). *Aviation and space education: Unlocking the future*. Retrieved August 28, 2008 from <http://www.wolf-aviation.org/education.htm>
- Women in Aviation International. (2007). *About WAI*. Retrieved August 28, 2008 from <http://www.wai.org/about.cfm>
- Villazon, L. E. (1992) *Career paths of male and female natural science professors in twelve four year colleges in Pennsylvania*. Ed.D. dissertation, Temple University, United States Pennsylvania. Retrieved October 22, 2008, from Dissertations & Theses: A&I database. (Publication No. AAT 9302158).