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DETERMINANTS OF UNDERREPRESENTATION OF WOMEN IN AVIATION EDUCATION

Jacqueline R. Luedtke and Brent D. Bowen

This analysis will study demographics regarding women aviation pilots/educators to ascertain the past, present, and future participation of women in all aspects of the aviation field. This review of women in aviation in general is necessary to establish the interest and participation of women in aviation. Other areas of literature that will be used include data on women entering male dominated fields such as engineering, business, education, etc. Comparisons of how women enter these male dominated fields versus aviation will be made.

BACKGROUND LITERATURE

Since the early days women have been active participants in aviation and aviation education. Opportunities for women in aviation did not come easily, but were founded on decades of struggle, determination, and perseverance. One of the most famous figures in aviation history is Amelia Earhart. She won early acclaim by becoming the first woman to fly across the Atlantic in 1928; however, her success was marred by the fact that two male pilots had actually been at the controls throughout the flight, even though she was a qualified pilot. Earhart compensated for this by achieving many record-breaking flights, and she eventually flew solo across the Atlantic in May 1932. She was lost at sea while attempting to fly around the world in 1937 (Gyr, 1990).

A year later another woman pilot, Lores Bonney, flew solo from Brisbane, Australia, to London—about five times as far as Earhart's trip across the Atlantic. Because she wasn't trying for a speed record and didn't have as good a publicist as Earhart had, her flight was unacclaimed and forgotten over time. There was little notice taken of her remarkable feat; this may have been because of the culture of the day when people believed a woman's place was "in the home" (Gyr, 1990).

Women like Amelia Earhart were highly visible and continually earned kudos and criticism, but most women in early aviation posed an economic threat to the men. Any failure was used to prove they were physically and emotionally unfit for flying. Ironically, if they survived an accident, their survival was used to show that air travel

was safe (Holden, 1992).

The fact that women comprise only 5.91 percent of all Federal Aviation Administration (FAA) certificated pilots demonstrates that they are as a group underrepresented in aviation in relation to their proportion in society (*U.S. Civil Airmen Statistics*, 1991). Consequently, the concern accorded regarding the underrepresentation of women in the aviation faculty of higher education is overshadowed by concern for the underrepresentation of women in all aspects of aviation. Because the existing statistics provide evidence that the ratio of women in the collegiate aviation faculty is comparable to the number of women FAA certificate holders, the resulting solution must be to increase the number of overall women FAA certificate holders (Bowen, 1990).

Katharine Wright, sister of Orville and Wilbur, helped finance "man's" first flight. Katharine contributed to her brothers' scientific pool of knowledge and to their bank account through their struggle to conquer flight. Almost every historian credits her with using the money she earned teaching Latin and Greek to purchase the materials for their fragile airplanes (Holden, 1992).

Ever since that day, women have also been caught up in the "spirit" of flight; unfortunately, few women had the economic means or society's approval of furthering their interest in this area. Influential persons in aviation were aware of women's efforts and accomplishments and could have helped to expand the roles of women in aviation, but they were surprisingly restrictive in their views. For example, Eddie Rickenbacker took the executives of

Determinants of Underrepresentation of Women in Aviation Education

Table 1
FAA Certificated Pilots

1981			1991		
	Certificates Held	Percent		Certificates Held	Percent
Female	47,721	6.24	Female	40,931	5.91
Male	716,461	93.76	Male	651,164	94.09
Total	764,182	100.00	Total	692,095	100.00

Source: U.S. Department of Transportation, *U.S. Civil Airmen Statistics*, 1991 and 1981

Boeing to task in 1930 for hiring the first female flight attendants. He argued that flying was a man's occupation and should stay that way (Holden, 1992). However, the women that persevered thought it important to educate the non-flying public about aviation. From that date to present time, women have been involved in aviation in a variety of ways--and today, women are making inroads into the higher education of aviation in our colleges and universities.

ANALYSIS OF THE BASIS FOR UNDERREPRESENTATION

The primary objective of this report is to analyze the potential similarity between the number of women pilots and the number of women faculty in University Aviation Association (UAA) colleges and universities which offer a baccalaureate degree in aviation. Second, data obtained on the number of women faculty in aviation will be analyzed against data on the number of women receiving earned doctorates.

Secondary data was obtained from two sources. Data on the number of women who are pilots was obtained from the FAA which publishes an annual summary of pilot demographics titled *U.S. Civil Airmen Statistics*. The data on women receiving doctoral degrees is periodically collected by the U.S. Department of Education. This information is reported annually in *The Chronicle of Higher Education Almanac*.

These sources can be regularly reviewed to monitor the progress toward achieving proportional representation for women in both of these areas.

Analysis of the change in the percentage of women pilots from 1981 to 1991 may offer a brief historical perspective. Data from the *U.S. Civil Airmen Statistics* (Table 1) compares the ratios of female to male FAA pilot certificate holders from 1981 to 1991.

While the last ten years have seen advances in opportunities available to women, progress has not been evidenced in piloting careers. Data from the *U.S. Civil Airmen Statistics* in Table 2 provides a detailed distribution of each FAA certificate category by gender. Both non-flight and flight categories are presented. A comparison between the current data and that from ten years previous is displayed.

Although percentages of certificated women pilots are

Table 2
Female FAA Certificate Holders

Category	1981	1991
Student	22,591	14,501
Private	19,602	17,514
Commercial	4,101	5,652
Certificated Flight Instructor	2,165	3,629
Airframe & Powerplant Mechanic	1,051	3,901
Airline Transport Pilot	584	2,308
Flight Engineer	189	1,256

Source: U.S. Department of Transportation, *U.S. Civil Airmen Statistics*, 1991 and 1981

widely disproportionate, higher education is one area which is experiencing gains toward achieving a proportionate role to men. Table 3 reveals the current gender distribution in the higher education faculty according to the 1992 *Chronicle of Higher Education Almanac*.

Most fields in higher education are experiencing gains

Table 3
Faculty Distribution by Gender

Gender	Number	Percent
Female (100%)	133,497	27.3
Male (100%)	355,503	72.7
Total (100%)	489,000	100.0

Source: *The Chronicle of Higher Education Almanac*, 1992

in the number of women who are receiving doctoral degrees. In the discipline of education, this figure has surpassed 50 percent; however, in engineering, the percentage is only 8.8 percent (*Chronicle of Higher Education*, 1992). Inasmuch as there are no doctoral degrees solely devoted to aviation aside from aerospace engineering, Table 4 utilizes data from the *Chronicle of Higher Education Almanac* to illustrate the number of women receiving doctoral degrees in business, education, and engineering. Business and engineering degrees are important because they reflect the closest degrees to aviation-related fields in most institutions. As can be seen from Table 4, women in aviation-related degree areas (business and especially engineering) are not making as much progress as much as women with education degrees.

DISCUSSION OF SECONDARY SOURCE DATA

A review of the information obtained in Table 2 suggests a view of limited success in the professional categories. The limitation is that as the proportion of women who have become Airline Transport Pilots (ATP) has increased from 584 in 1981 to 2,308 in 1991, the number of women student pilots has decreased from 22,591 to 14,501 during the same time. These figures indicate that the years of 1981 to 1991 have seen a period of attrition within the ranks along with a significant decrease in new

entrants. This trend could further indicate a decrease in the total number of women pilots in forthcoming years.

Although regression is evident in several areas, advances and achievements which have occurred are also noted. The progress exhibited in the notable increases made at the professional pilot level of ATP and Commercial held ratings demonstrates that new inroads are being achieved by women in aviation. Table 2 further illustrates other accomplishments made during the last ten years.

The demographic data viewed in Table 3 discloses that 27.3 percent of all higher education faculty are women. Currently, the median figure of women receiving doctoral degrees is 36.3 percent (Table 4). Since the doctoral degree represents the primary credential for higher education faculty, the increasing number of women receiving this degree throughout the remainder of this decade suggests that women will obtain a more proportionate role in the higher education faculty. This figure should provide further encouragement to women to pursue faculty positions in higher education as well as to continue the pursuit of the doctoral degree.

An examination of graduate engineering enrollments offers some insights into the problem of increasing the numbers of women in aerospace engineering faculty positions. Women comprised seven percent of the graduate enrollment in aerospace engineering in 1988, compared to 12 percent for engineering overall. Of advanced degrees granted in aerospace engineering, 6.9 percent were to women versus 11.6 percent granted to women in all engineering disciplines. At the Ph.D. level, six percent of aerospace Ph.D. degrees went to women versus 6.8 percent of Ph.D. degrees in all engineering fields (*Changing America*, 1988).

These statistics do not offer promise of any immediate increases in the representation of women in aerospace engineering faculties. Even if one-half of all women obtaining Ph.D.s in aerospace engineering choose to pursue academic positions, the available numbers will not permit any great percentage

Table 4
Percentage of Women
Receiving Doctorates in 1990

Field	Percent
Business	24.4
Education	57.7
Engineering	8.8
Median all fields	36.3

Source: *The Chronicle of Higher Education Almanac*, 1992

increases of women in faculty positions.

What this means is academic departments and universities as a whole need to actively cultivate their disciplines of aviation management/aerospace education. Administrators must understand that women, along with minorities and the disabled, do not constitute a high percentage in these areas of study and need to be recruited. Historically, aviation management has been an interdisciplinary discipline and, thus, has had a hard time finding a home in any particular department. For example, at one institution, aviation management might be housed in the business department, while elsewhere it is located in engineering or education. No one really knows where it should be situated and the matter depends on which chairperson is a champion of aviation education. In order to maintain the growth of this field of study, it is important that aviation education/management find a home in a department that will nourish it so that it can find its true niche. In time, with sustained growth, aviation might emerge as an academic department itself in more and more universities.

RELATED RESEARCH

In 1988, women comprised 51 percent of the population and 45 percent of the nation's workforce, yet they constituted only 11 percent of all employed scientists and engineers. Although the number of women and minorities in science and engineering increased through the early 1980s, the absolute numbers were small and are now declining. Federal employment has not kept pace with the increase in women scientists and engineers emerging from our education system. In 1987, only 10 percent of the Ph.D.s employed were women, although women earned 17 percent of the Ph.D.s awarded in science and engineering. The declining enrollment of U.S. graduate students is masked by recent high enrollments of foreign students in these fields, especially engineering. As of 1988, 75 percent of graduate students receiving financial support from university engineering departments were foreign nationals. The cultural attitudes of foreign students, particularly if they are instructors, may discourage some Americans, especially women, from taking science and engineering courses (Changing America, 1988).

A task force was established in 1988 to examine the current status of women, minorities, and the handi-

capped in science and engineering positions and to develop long range plans to advance opportunities for these people in our society. The task force's recommendations are important for universities to understand and to implement. Interest in science and aviation increased during the high points of the United States' space program. We need to be aware of this increased interest and to act upon it.

The Task Force on Women, Minorities, and the Handicapped found that, although women enter graduate school at about the same rate as men, they are considerably less likely than men to obtain a Ph.D. (Changing America, 1988). These trends among the traditionally underrepresented groups cannot continue. Strong leadership from presidents, deans, and department heads with a vision to the future is needed. The departments in these areas must increase their underrepresented faculty members in order to change with the times and attract the traditionally underrepresented students. The Task Force stated that we must produce enough professionals, including more from underrepresented groups, to meet the demand for faculty, industry, and Federal personnel by the year 2000. Specifically, universities should (a) lead in creating a climate of action and accountability that accelerates the participation of underrepresented groups in all aspects of their institutions; (b) set quantitative goals for recruiting, retaining, and graduating more U.S. students in aviation and sciences, especially from underrepresented groups. Departments should set similar goals and take responsibility to ensure that more students from these groups attain doctorates and obtain faculty positions; (c) provide child care for families of students and faculty; and (d) establish transfer centers with qualified counselors in 2-year colleges to ensure maximum flow talent from these to 4-year institutions (Changing America, 1988).

CONTINUING RESEARCH

Searches through the literature of all popular sources have resulted in little summary information about the representation of women in collegiate aviation education. Inadequacies in popular literature may be attributed to the few professional educational journals in the field of aviation and/or to the lack of a publishing expectation of aviation education faculty. The insights and conclusions of this study may add useful information to the body of

understanding not only on the future of women in collegiate aviation education but also how this translates into the future of collegiate-trained professional aviation managers and practitioners.

This effort has merely touched upon the issue of underrepresentation of women in the collegiate aviation faculty. Not included in a work this brief are the numerous specific examples of the contributions that

women have made to aviation, and more specifically, aviation education in the nation's colleges and universities. This information alone may result in several articles. Data from a national study on this issue is currently in process by the authors. Upon final analysis, a manuscript will be submitted to *The Journal of Aviation/Aerospace Education & Research* (JAAER) for review. □

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