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# Proceedings of the First Annual Nebraska Aviation Education Association Conference

James E. Crehan
*University of Nebraska at Omaha*

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# Proceedings of the First Annual Nebraska Aviation Education Association Conference

James E. Crehan
Editor

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## PREFACE

One of the goals of the Nebraska Aviation Education Association (NAEA) is to provide a forum for educators in the state of Nebraska to present professionally the results of research conducted in the pursuit of aviation education. These Proceedings allow a medium for this research to be published for the use of all members of the Association and other interested parties. It is the intent of the NAEA to publish proceedings of future conferences as well.

You will find the articles in these proceedings to be varied, befitting the very nature of aviation education as an emerging discipline in higher education. You will see some of the many issues with which the discipline must deal, particularly in the challenging aviation industry of today. The topics included herein only scratch the surface of potential topics for future conferences. It is hoped that this publication will inspire readers to prepare and submit papers which will enhance the level of knowledge concerning aviation education.

The NAEA acknowledges the outstanding support of the University of Nebraska at Omaha Aviation Institute and its Director, Dr. Brent Bowen. Without the support for printing and distribution, it is unlikely these proceedings would have been available. Thanks and sincere appreciation to Dr. Bowen and the Aviation Institute for this level of support.

Thanks also to Ms. Gail Scott for her tireless efforts in the preparation of these proceedings. The amount of work and effort to produce such a publication is unknown until the process actually is underway. Gail eased the level of stress for me, probably while simultaneously increasing her level of stress. Thank you, Gail.

I hope you enjoy reading these papers presented at the First Annual Conference of the NAEA. If you are interested in participating in the NAEA as a member and/or future presenter, please contact me at (402) 493-7013.

James E. Crehan
Editor

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# USING THE DAT FOR SELECTION OF PILOT TRAINEES IN HIGHER EDUCATION INSTITUTIONS

by

Professor James E. Crehan
Aviation Institute
University of Nebraska at Omaha

for

Nebraska Aviation Education Association

January 1994

# USING THE DAT FOR SELECTION OF PILOT TRAINEES IN HIGHER EDUCATION INSTITUTIONS

James E. Crehan, Associate Professor
Aviation Institute
University of Nebraska at Omaha
Omaha, Nebraska 68182-0508
(402) 554-3424
EMAIL: jcrehan@cwis.unomaha.edu

## ABOUT THE AUTHOR

James E. Crehan is Associate Professor of Aviation with the University of Nebraska at Omaha Aviation Institute. He received a BS from Louisiana State University, MA from Central Michigan University, MA from the Naval Postgraduate School, and is completing a Ph.D. in Education from Southern Illinois University at Carbondale. He concentrates his teaching efforts in the areas of aviation systems approaches and in airport management and development. He has held previous positions as Professor of Aerospace Studies and Assistant Director Air Institute at Southern Illinois University at Carbondale; and as Chairman, Department of Aerospace Technology at Indiana State University.

## ABSTRACT

There has occurred over the past ten years, a tremendous growth in the scope of aviation flight training programs at the baccalaureate level in institutions of higher education in the United States. This growth is due in part to the increasing potential for careers due to the changing demand within the airline industry as pilots. As the Federal Aviation Administration continues to force airline pilots operating under Federal Aviation Regulation Part 121 to retire at the age of sixty, there is increased need for new replacements for these pilots in the industry. The United States military services, who have long provided highly experienced pilots for the major air carriers in the United States, no longer produce pilots at levels sufficient to maintain the pipeline supply of pilots on which the major airlines have so long depended. One source of pilots which is increasingly available today is from universities which provide flight training at the baccalaureate level.

This paper reviews some of the literature pertaining to selection of pilots. This literature indicates that the majority of research has been conducted using military and commercial pilots as subjects, but that very little research has been conducted using the general aviation pilot as a subject. It will also review some preliminary results of research into the possibility of enhancing the ability to predict success of students in flight training at the collegiate level. The traditional data used to predict success in college may not be sufficient to predict success in curricula which rely upon both theoretical and practical approaches to the development of specific skills necessary to operate in todays highly technical aviation environment.

## INTRODUCTION

There have been numerous attempts to determine the effectiveness of inventories and tests to predict success of pilot candidates in training for flight of aircraft. Study began seriously in Germany during World War I aimed toward the use of psychological criteria for selecting candidates for training to become heavy transport vehicle drivers. The focus for this selection centered around the individual operator and was not equipment specific. As equipment became more technical in nature, the emphasis changed to consider the interaction between the individual and the machine. With the advent of the airplane as a critical part of the war machine, research was directed toward selection of pilot candidates as a result of physical and written tests (Buch and Diehl, 1984). During this process, research indicated that there was a need for development of inventories which would predict with a higher degree of certainty the ability of a pilot candidate to be successful in pilot training.

Initial research in the United States centered around three aspects thought to be indicative of ability to persist in pilot training. These were emotional stability, the perception of tilt, and mental alertness. Subsequent attrition rates of 50% to 60% during the screening process using these aspects of training indicated the need for more sophisticated testing techniques for selecting pilot trainees (Buch and Diehl, 1984).

Evaluations of a multitude of factors ensued, factors such as motor performance, memory, attention to detail, muscular sensation and equilibrium (Jones, 1986). It became obvious from the research presented that it was more effective to evaluate an individual on several tests or inventories and to develop an overall profile for success, rather than depending upon one test or inventory in isolation.

Following World War II, the University of Illinois and the Ohio State University developed laboratories to research specific issues inherent to aviation. These studies used general aviation pilots as subjects to a much larger degree than formerly accomplished. Much of the research concentrated on individual tasks in the cockpit of aircraft, rather than on tasks which required action on the part of more than one crew member. The field of aviation psychology as we know it today was born from roots such as the research accomplished by these universities.

As aircraft became increasingly sophisticated due to technological enhancements, research moved from individual to crew tasks with emphasis on cognitive skills versus psychomotor skills. Of more concern now was the management of all facets of flight, and the capability to make decisions (Gopher, 1984). The need was for a pilot to be capable of estimating probable outcomes of specific actions, to rapidly reorder priorities, and to be capable of decisive action when confronted by indecision in others (Roscoe and North, 1980). The need for evaluating pilot judgement was rapidly becoming evident. Literature had indicated that judgement was an intrinsic factor or a by-product of past experience, but later studies indicated that judgement training resulted in fewer judgmental errors (Buch and Diehl, 1984).

The majority of research has been conducted with military and professional pilots as subjects. Research using general aviation pilots as subjects began as a result of Federal Aviation Administration desires to investigate the degree to which faulty pilot judgement was responsible for general aviation aircraft accidents. In the early 1970s, Jensen and Benel of the University of Illinois were pioneers in this research effort by testing for irrational pilot judgement decision tendencies.

Military studies used Cattell's Sixteen Personality Factor Questionnaire (Cattell, Eber and Tatsouka, 1970) to provide general dimensions for description and predictability of pilot success. This still left a void in the ability to predict success prior to the beginning of pilot training.

The Royal Air Force in England used the Eysenck Personality Inventory in the selection of pilot cadets. It was found in a study of 205 cadets that pilot cadets tend to be more extroverted and less neurotic than the average for the general population (Jessup and Jessup, 1971). It was felt the highly stressful environment of flight resulted in an increase of neuroticism for people tending to be introverted. This adversely impacted the learning curve for those tending more to introversion.

Major airlines in the United States depend heavily upon the Minnesota Multiphasic Personality Inventory (MMPI) for selection of pilots who already have experience in the flight environment. This does not, however, predict for the existing need today, that of an inventory which will predict success in the pilot training ab initio (from the beginning) training environment.

## RESEARCH AT INDIANA STATE UNIVERSITY

In an effort to develop a capability to enhance the ability to predict success in pilot training, the author has been conducting research using the normal quantitative factors, such as the SAT results, high school grade point average, and high school class ranking as predictors for success in aviation programs at the university level. These factors are used in conjunction with three sub-tests of the Differential Aptitude Tests (DAT) battery to evaluate incoming freshman students in aerospace technology at Indiana State University. The three sub-tests are those for abstract reasoning, mechanical reasoning, and space relations. This study has been ongoing for the past four years.

The purpose of the study is to determine the possibility of predicting several factors: the cumulative GPA at specific intervals; the cumulative GPA in all aerospace coursework; and the GPA in specific aerospace courses which are pilot specific, such as pilot theory and flight courses. The ability to predict success in college coursework considered both the traditional factors in isolation and these same factors used in concert with the DAT sub-tests for abstract reasoning, mechanical reasoning, and space relations. It is felt there will be a positive correlation between the scores obtained on the DAT sub-tests and the ability to persist in this flight-specific coursework.

The methodology used was to administer the above three sub-tests of the DAT to all incoming freshman students entering the Professional Pilot Technology degree program at Indiana State University. The tests were administered in group settings by university testing office personnel. Tests were timed and tightly controlled. The tests were then professionally scored and the results entered into the student information system at Indiana State University for later use in the research project.

The primary criterion measure was the grade point average at the completion of the freshman year of study. The grade point average at the end of each of the second, third, and fourth years was also used to further determine the long-term effect of the study. Predictor variables used were the SAT composite score, high school rank, and high school grade point average.

Initial results indicate a slightly positive correlation between the scores on all factors combined when compared to the traditional group of factors without the DAT scores. The SAT composite scores proved to be highly significant in predicting college grade point average, as expected based upon the literature review. The initial indication is, however, that the DAT sub-tests will enhance the ability to predict success defined in terms of grades in specific coursework related to flight training.

## CONCLUSIONS

Future comparisons will be made of grades obtained in pilot specific courses based upon the DAT scores in each of the three sub-test areas. It is felt by the author that this information will assist in the development of a methodology based upon combining inventories in a manner which will enhance the ability to predict success in flight education. Continuing research will be conducted on specific course grades to determine if there is a direct correlation between the DAT results and specific grades in flight courses.

## REFERENCES

Buch, G. & Diehl, S. (1984) An investigation of the effectiveness of pilot judgement training. Human Factors 26(5), pp. 557-564.

Cattell, R., Eber, H. & Tatsouka, M. (1970) Handbook for the sixteen personality factor questionnaire (16PF). Champaign, IL: Institute for Personality and Testing.

Gopher, D. (1984). On the psychophysics of workload: Why bother with subjective measures? Human Factors, 26(5), pp. 519-532.

Jessup, G. & Jessup, H. (1971). Validity of the Eysenck personality inventory. Occupational Psychology, 45, pp. 111-123.

Jones, D. (1986). Flying and danger, joy and fear. Aviation, Space and Environmental Medicine, 57, pp. 131-136.

Roscoe, S. & North, R. (1980). Prediction of pilot performance. In Roscoe, S. (Ed.), Aviation Psychology, (pp. 127-133). Ames, IA: The Iowa State University Press.

# CYCLIC STUDENT EVALUATION PROCEDURES IN HIGHER EDUCATION FOR AVIATION

by

Dr. Terence Foster
Aviation Institute
University of Nebraska at Omaha

for

Nebraska Aviation Education Association

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## About the Author

Dr. Foster earned his Engineering Ph.D. from the University of California at Berkeley after receiving his S.B. and S.M. degrees from M.I.T. He was a Fulbright-Hays visiting postdoctoral professor in the Earthquake Engineering Institute of Skopje, Macedonia (formerly in Yugoslavia). Dr. Foster is a Registered Professional Engineer in ten states with a National Certificate and is a Certified Computing Professional. He holds the F.A.A. Commercial-Instrument Pilot and Ground Instructor Certificates.

He is an Associate Professor at the University of Nebraska College of Engineering and Technology and the Aviation Institute. In the preceding twenty years he held positions with Union Pacific, MultiTec, and H.D.R. as Assistant Vice President, President, and Vice President, respectively. During his military service, he was an Army Captain stationed at the Pentagon and the Jet Propulsion Laboratory. Dr. Foster has led over ten technical, professional, business, and civic organizations including the Nebraska State Board of Examiners for Professional Engineers and Architects and the Nebraska Society of Professional Engineers.

Dr. Foster's research interests cover structural mechanics and information systems in construction, aerospace, and biosystems. His publications discuss cold regions engineering, random vibrations, finite element analysis, systems analysis and optimization, and computer assisted design.

## Abstract

Aviation education has a rich heritage of evaluation procedures which go beyond the traditional classroom methods prevalent in higher education. The classroom procedure of students submitting examinations or projects and receiving one grade comes under scrutiny in light of the aviation competency based practical test standards.

Practical test standards suggest cyclic evaluations as an alternative to the single evaluation. The student works in evaluation cycles until an acceptable level of performance occurs for each task component of a curriculum unit. Cyclic evaluations approximate many actual situations more accurately than single evaluations.

This paper reports techniques for and experiences with using cyclic evaluations since 1992 in aviation and engineering classes at the university level. Results show positive student, employer, and educator responses. The research also enumerates the challenges and responsibilities associated with cyclic evaluations.

## Cyclic Student Evaluation Procedures in Higher Education for Aviation

Employers prefer higher education program graduates who can perform a series of asks relevant to the employers' needs. Moreover, this task performance should demonstrate an acceptably high level of competence. This situation confronting traditional classroom education is similar to the aviation community requiring pilots trained to a specified level of competence beyond the achievement of an average based on a single test of a body of knowledge. If pilots were licensed based upon their total performance without regard to individual task competence, the results could be fatal. Consider a pilot who received a "passing" composite test score by doing well on everything except landings, and the tragic predictable outcome in practice is obvious.

The U.S. Federal Aviation Administration was keenly aware of this shortcoming years ago when they instituted task-oriented "Practical Test Standards." (FAA, 1977) The practical test philosophy in aviation has evolved over time to reflect FAA and aviation industry skill requirements (Englehardt, 1993). Use of outcome-based or competency-based instructional processes suggests their potential adaptability to classroom settings in higher education. This connection has prompted the classroom experimentation leading to this paper.

After looking at the competency-based education (CBE) techniques developed in the last 15 years, the paper presents a comparison of traditional and nontraditional educational models, the latter which are founded upon CBE principles. The specific CBE procedures relevant to higher education in aviation and engineering are discussed along with their implications for the instructional environment. Conclusions are drawn to present CBE in the perspective of its results from this author's uses of it.

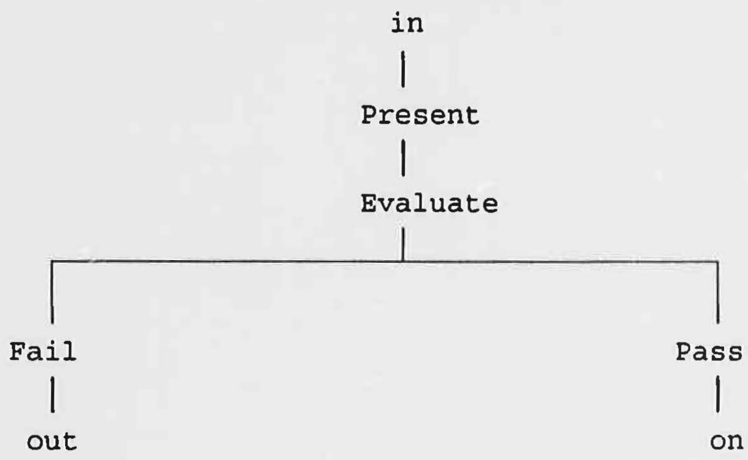
### Background

CBE has been used with increasing frequency in the last decade. Work at the Dallas Community College District (Hirsch, Dallas Community College District, 1992) has had a great deal of success in quantitative fields such as engineering. They have used the DACUM (Developing a Curriculum) method in which an employer works with the educational staff to resolve a body of knowledge into a finite series of tasks which can facilitate successful completion and progress on a task by task basis. The breadth of CBE applicability is referred to (Monjan and Gassner, 1979), with extensions to library sciences (Jay and Jay, 1991). These authors agree that students are encouraged by the opportunity to bypass the stigma of failure by redoing a task quickly (and privately) within a course framework.

### The Traditional Model

In typical classroom situations, the prevalent evaluation technique is one in which the student makes one pass through a task or an entire course as Figure 1 shows.

Figure 1
Single evaluation model




f Fail
1 - f Pass
(0 < f < 1)

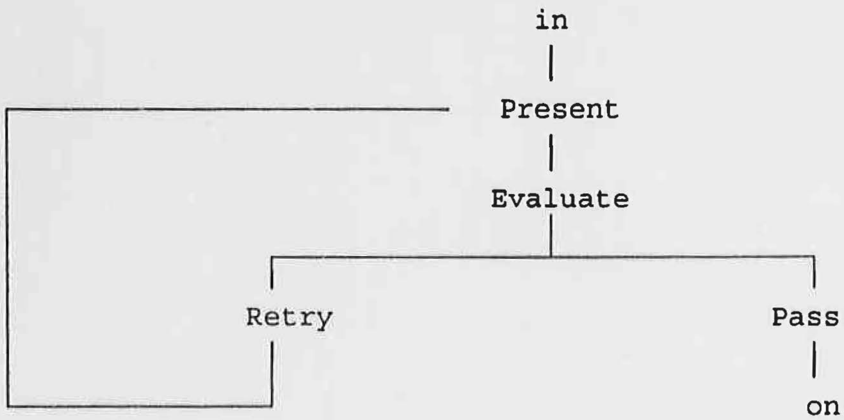
Total Evaluations = N

If N students enter such a system, then a failure rate $0<f<1$ assures that fN fail with all negative connotations associated with failure; and (1-f)N pass. For each evaluation, N tests are given. The most debilitating impact of the failure is the loss of time and financial resources in repeating a whole body of instruction when perhaps repetition of 1 or 2 portions of a course would assure sufficient success if they are repeated until mastery occurs.

## The Alternative Model

An alternative evaluation model changes the traditional model in such a manner as to give the immediate option of relearning and retrying the material cyclically in an event driven environment which encourages mastery of small modules of course material as task building blocks of the entire course. Figure 2 shows the cyclic flow of this model.

Figure 2
Cyclic evaluation model




1st try: $f$ Fail Total
$1 - f$ Pass Total

2nd try: $f(1 - f)$ Pass $= f - f^2$ this try
$f^2$ Fail Total
$1 - f + f - f^2 = 1 - f^2$ Pass Total

•

•

nth try: $f^n$ Fail Total
$1 - f^n$ Pass Total

Total Evaluations $= N(1-f^{(n+1)})/(1-f)$

For N students in such a system with f failing each time through, there are fN retakes after the 1st cycle and (1-f)N passes. After the 2nd cycle the cumulative retakes (still in the system) and passes are $f^2N$ and $(1-f^2)N$, respectively. Likewise after n cycles, the cumulative retakes and passes on are $f^nN$ and $(1-f^n)N$, respectively. So it can be seen that, as N students retake the material, a sufficiently large number then will pass as $f^n$ approaches 0. The cumulative number of evaluations given to N students is $N(1-f^{(n+1)})/(1-f)$ after n cycles. Thus, for large n, the total evaluations approach $N/(1-f)$. Reasonably speaking, of course, n is limited to a finite but potentially large number or is allowed to occur a large number of times in a given time period.

## Implications

In making the transition to a cyclic teaching model using the procedures just discussed, the educator assumes a new set of responsibilities and relationships with regard to the students. In the traditional model the students move through the instructional material in unison, so that the educator can make one presentation to all of the students. However, in the cyclic teaching model, each of the students might be working on a different task depending upon whether they have completed it successfully or not.

In the cyclic case, then, the instruction becomes highly individualized with each educator and student having a 1:1 relationship defined by the student's position in the network of tasks constituting a course. Thus the cyclic methods for teaching used by this author put the educator into a role similar to other individualized educators such as flight instructors and music teachers. Any significant number of students, say over 10, can make this role difficult if some forms of assistance are not available.

The use of computerized instructional media has led to the use of the computer as the automated assistant in the 1:1 cyclic instructional environment. To date, these methods have been used effectively by the author in procedural courses such as computer assisted design and drafting (CADD) and computer introduction classes (Foster, 1993). In these courses student materials are submitted on disk and paper with comments being returned on paper. The transition is underway to submit all of these materials over computer networks with computer annotated files being returned. In this way, handling of disparate materials is eliminated in favor of electronic materials being transmitted over a network. Also, computer assisted evaluations can supplant the manual evaluations that now occur.

Can the nontraditional cyclic teaching model discussed here apply to more conceptual subject matter such as aerodynamics or mechanics of materials? Available software packages such as Interactive Physics (Knowledge Revolution, 1992) facilitate the decomposition of a course into tasks. The course content does not seem to be a constraining factor as long as its divisibility into tasks is feasible.

## Conclusions

It has been seen that an alternative cyclic evaluation procedure based on CBE leads to a 1:1 student:teacher ratio which can be handled for large classes by use of computerized task oriented materials. The most common comment in support of the techniques presented in this paper is, "This is like real life." This comment is especially relevant where people work in a project environment where a product is not released until a high standard of quality exists. In an operational environment such as that of many aviation disciplines, the cyclic task repetition assures a high standard of performance aimed at "getting it right the first time" where a "first time" might be all that is available.

Because of the student confidence and employer satisfaction which the procedures engender, it is possible to say tentatively that the educational experience can be improved for students and employers by the proper use of nontraditional cyclic CBE methods presented in this paper. However, the complexity of the instructional environment increases with the cyclic methods so that higher levels of instructional technology become necessary.

## References

Englehardt, E. A., "The Practical Test Philosophy," *FAA Aviation News*, November - December, 1993

Foster, E. T., "Alternative Student Evaluation Procedures in Engineering," *ASEE Midwest Section Conference Proceedings*, March 31 - April 3, 1993.

Hirsch, M., "Competency-based Education," A2YSC Newsletter, Vol. 14, Summer, 1992, pp. 1, 2.

Hirsch, M., "Developing a Curriculum," Dallas Community College District Internal Documents.

Jay, M. E., Jay, H. L., *Designing Instruction for Diverse Abilities and the Library Media Teacher's Role*, Library Professional Publications, 1991.

Knowledge Revolution, "Interactive Physics II," Software, San Francisco, 1992.

Monjan, S. V., Gassner, S. M., *Critical Issues in Competency Based Education*, Pergamon, 1979.

United States Department of Transportation, Federal Aviation Administration Circular AC 60-14 "Aviation Instructor's Handbook," 1977.

# MAXIMIZING PARTICIPATION OF YOUNG WOMEN IN AVIATION AND HOW TO INTEGRATE AVIATION CONTENT INTO CLASSROOM SETTING

by

Dr. Jacqueline R. Luedtke
Aviation Institute
University of Nebraska at Omaha

for

Nebraska Aviation Education Association

January 1994

## MAXIMIZING PARTICIPATION OF YOUNG WOMEN IN AVIATION AND HOW TO INTEGRATE AVIATION CONTENT INTO CLASSROOM SETTING

### ABOUT THE AUTHOR

Jacqueline R. Luedtke is Assistant Professor of Aviation at the University of Nebraska at Omaha. She holds a Doctorate in Higher Education with an emphasis in Aviation/Aerospace Education from Oklahoma State University and a Master of Business Administration degree from Wichita State University. Her FAA certifications include Private Pilot, Airplane Single Engine Land and Instrument Rating. She is also an Airplane Advanced-Instrument Ground Instructor. Her research interests include women's contributions to aviation, aviation management, service quality in aviation, effects of marketing in aviation, and research administration. Her professional affiliations include Alpha Eta Rho; Civil Air Patrol, Aerospace Education Member; Ninety-Nines, Inc.; Optimist Club, Omaha's Aviation Branch; University Aviation Association; Wichita Aeronautical Historical Association.
Women's contributions to aviation and aviation education have been long overlooked. Since the early days of aviation, women have been active participants in aviation and aviation education. Opportunities for women in aviation did not come easily; they were based on decades of struggle, determination, and perseverance.

### ABSTRACT

While the last ten years have seen advances in opportunities available to women, progress is not evident in piloting careers, including aviation education. This presentation offers a demographic analysis of aviation education and women participants in this field of study. Data collected were analyzed to determine whether or not the participation of women in aviation education is representative of the participation of women in higher education overall. The study analyzed the U.S. Department of Education data and other statistics on women in higher education. This information was compared to data collected on aviation faculty through a structured interview process applied to all UAA-member institutions offering a baccalaureate degree and above in aviation education.

This paper focuses on how educators at all levels can enhance their aviation classes by incorporating the subject of women in aviation and their contributions to this discipline in the classroom.

## Introduction

While the last ten years have seen advances in opportunities available to women, progress is not evident in piloting careers, including aviation education. This paper will include a review of women in aviation in order to establish the interest and participation of women in aviation. This analysis will also focus on how educators at all levels can enhance their aviation classes by incorporating the subject of women in aviation and women's contributions to aviation in the classroom.

## Background Literature

Since the early days of aviation, women have been active participants in aviation and aviation education. Opportunities for women in aviation did not come easily. They were based 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 was not trying for a speed record and she did not have as good a publicist as Earhart, 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 and people believed a woman's place was "in the home" (Gyr, 1990).

Women have been active in aviation and aviation education since the beginning of flight. Katharine Wright, sister of Orville and Wilbur, helped finance "man's" first flight. Katharine contributed to their 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 infamous 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 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). Orville Wright rejected all female applicants on grounds they were notoriety seekers. 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 education in a variety ways--and today, women are making inroads into the higher education of aviation in our colleges and universities. However, much work needs to be done to assist younger women--especially secondary school age students--to advance in aviation.

## Nature of the Problem

Since the first "manned" flight on December 17, 1903, the arena of flight has almost exclusively consisted of men pilots and, consequently, men aviation educators. Even today, women constitute a very small percentage of the flying realm, including the educational field of aviation. There has been little written on contemporary American women in aviation. Likewise, documentation of the pioneering efforts of male pilots is much easier to find than female contributions. As Holden discovered, the reasons why consist of attitude and economics. These factors still operate to a certain extent today (Holden, 1992).

The opportunity to become a professional aviator has never been more accessible than now. The General Aviation Task Force reports that flight instruction increased 12.5 percent in 1989. Student pilot starts in September, 1989 were 10,153 compared to 7,624 the preceding year (More Student Pilots, 1990). The influx may be attributed to the widespread news that more than one-half of all airline captains will reach mandatory retirement age before the year 2000. Combine this with the fact that military pilot attrition rates have slowed to record lows and, thus, the career potential becomes obvious. The aviation industry today needs highly-educated personnel in order to remain competitive in today's world. If the United States is to modernize and expand its air transport system, then it is essential that we recruit and hire more trained and talented women in the years ahead (Busey, 1991).

Our society has made some progress in accepting women in the work place. Strides of women are visible in many careers. However, encouragement for women to participate in aviation and aerospace education has not paralleled these successes. Although women are making strides in all aspects of aviation, women in collegiate aviation education are still underrepresented at present. The small number of women in collegiate aviation education needs to be addressed. Women have been involved in "aviation education" since the inception of flight; however, higher education in aviation is a relative newcomer and it has been basically man's domain. In order for the United States to succeed in this ever-increasing technical field, higher education must continuously increase its function in producing highly-educated personnel for the aviation/aerospace industry. These highly-educated workers must include the best of the best--whether female or male.

This is an important issue for the academic department, the university as a whole, as well as K-12 schools. The pool of talent for new scientists and engineers is predominantly female, minority, or disabled; these are the very segments of our population we have not attracted to science and engineering careers in the past (Changing America, 1989). The role of women, along with minorities and people with disabilities, in science and engineering has been seen only as an equity issue rather than as the key to future national strength in science and technology. By the year 2010, there may be a shortage of as many as 560,000 science and engineering professionals. This threatens America's economic strength, security, and quality of life. (Changing America, 1988).

Because of this predicted shortage of aviation educators and engineers, some schools are beginning to recruit more female and minorities in their aviation, aerospace, and engineering departments. For example, Purdue's Engineering School's support program for women has helped raise the proportion of female engineering students from two to 21 percent. Purdue retains women engineering students at the same rate as men (Changing America, 1988). In addition, Purdue, along with Michigan Technological University and the University of Dayton, started a career-awareness program for women in the early 70s and it continues to do well today. This has increased their enrollment of women in engineering above the national rate of 16%. This program is a one-week, concentrated career awareness program which utilizes university, industry, and governmental resources to broaden and accelerate the career awareness of tenth, eleventh, and twelfth grade high school female students and provides first-hand exposure to the academic and work environment of the engineer and engineering technologist (Shaw, et. al, 1991).

## Current Aviation-Oriented Organizations

As demonstrated above, these support and career awareness programs have been very successful in increasing enrollment of women in engineering at these schools. Other schools with aviation, aerospace, and engineering departments need to follow these schools' examples if they are to remain competitive in the future. Nebraska aviation communities are following suit in conjunction with FAA-sponsored day workshops which include subjects in math and science. In 1993, at an Aviation Career Awareness Program, 125 female high school students attended. This will be divided into two programs in 1994 to be held at Lincoln and Blair. Iowa has a similar program for seventh-grade girls.

Listed below is a partial list of programs and various ways in which to enhance aviation awareness to young women.

1. Concentrated career awareness programs/workshops: utilizes university, industry, and government resources; broadens and accelerates career awareness of 10th-12th grade female students; provides first-hand exposure to academic and work environment of engineering and engineering technologists. These programs help to make female students aware of the opportunities in aviation and aviation education.

2. Mentoring programs/role models for girls and women of all ages and in all aspects of the aviation industry. Because there is a lack of female role models, women faculty

need to be encouraged to act as role models for young women in aviation. Mentoring and networking are especially critical aspects in supporting young female students in aviation.

3. Involvement of the aviation industry in aviation youth organizations. The Omaha Aviation Optimist Club is a good example of community involvement with young people involved in aviation; this organization sponsors the "Explorer Scouts," a youth organization dedicated to aviation. Other area organizations involved in aviation include the ACE (Aviation Career Education) Academy and the Girl Scouts.

4. Other organizations have a deep-seated interest in advancing young women in aviation. The Ninety-Nines is one such organization; it has become an impressive organization in furthering women's commercial interests in aviation. It serves as a network and inspiration for women to write articles on aviation and fosters a sense of air-mindedness. The Ninety-Nines address civic clubs, schools, and governmental institutions, taking their knowledge and love of aviation to the community-at-large.

5. The University Aviation Association (UAA) is an organization composed of colleges and universities that offer aviation educational programs. This organization, active since 1950, provides information exchange and fellowship among those involved in higher education aviation curriculum. In 1993, UAA member institutions with 4-year aviation education degree programs numbered 67 ("UAA membership List," 1993).

6. Sensitize the public to aviation industry and what is needed to maintain a viable industry; punch holes in the good ole boy network and attitudes in order to encourage instead of discouraging young female students. This is vital for the United States to sustain this industry.

7. Increase the number of aviation graduate programs; actual masters programs or programs with an emphasis in aviation are needed in more colleges and universities.

8. It is essential that counselors in secondary schools be made aware of the opportunities for young women in aviation, locally and nationally, and that they convey this information to their students.

9. It is crucial that a certain number of scholarships be made available strictly for girls for studies in university aviation programs.

10. In secondary schools, it is important to explore aviation careers in classes and demonstrate the contributions of women in aviation (an example is provided below).

Short Teaching Unit (Lesson Plan)
Audience: Secondary School Students

Since it is important to teach issues of diversity in all schools, a unit could be included in secondary-school curriculums as an Introduction to Aviation. This would expose students to issues regarding history, research statistics, etc. Little, if anything, is taught in schools regarding contributions women have made in aviation, the aviation-related jobs they took over when men went to war, and the education advances women have championed. If attitudes are to be changed, these contributions must be advanced in school curriculums. Students would be introduced to the contributions that women have made in the field of aviation and aviation education in the U.S. (as well as throughout rest of world). Students would be introduced to the history of women in aviation and the current status of women in aviation and aviation education. Some key contributions of women aviators that could be included are listed below.

A Representative Group of Women in Aviation:

Katharine Wright: (sister of Orville & Wilbur) - Helped financed man's first flight by teaching Latin and Greek.

Blanche Stuart Scott: First American woman to solo an airplane.

Katherine Stinson: (1912) The fourth & youngest (age 16) woman in U.S. to earn a pilot's license.

Marjorie Stinson: In 1915, the first woman authorized to fly the experimental airmail service. The Stinson sisters started a flying school and taught brothers, Eddie & Jack, to fly. Eddie founded the Stinson Aircraft Co.

Bessie Coleman: First black licensed pilot (in France around 1930).

Amelia Earhart: Most famous aviatrix; educational activities/promoted aviation and acted as role model: facilitated charter of the Ninety-Nines; flew solo across Atlantic; soloed from Hawaii to U.S. mainland January, 1935. One of many women of the era who promoted aviation education. Advisor in aeronautics at Purdue University. Assumed lost in 1937 while attempting around-the-world flight.

Helen Richey: First woman hired as co-pilot on Pennsylvania Air Lines (1935). Male pilots protested; she was fired.

Jackie Cochran: Numerous altitude and speed records and her total career record in aviation has never been equalled by any other pilot. Instrumental in starting the WASP program in WWII. Broke sound barrier in 1953 (Yeager first person to break sound barrier in 1947).

Olive Ann Beech: President of Beech Aircraft Company. She demonstrated the importance of women non-pilots involved in aircraft manufacturing, etc.

Ensign Gale Ann Gordon: In 1966, first woman to solo in a Navy training plane.

Emily Warner: In 1973, copilot with Frontier Airlines; first American woman in modern times to fly for a scheduled airline.

Dr. Sally Ride: Physics research assistant (mission specialist) - America's first woman astronaut to make it into space.

Military: First female combat pilots: three F-16 women pilots; approximately six women combat pilots in Navy.

This history and contributions of aviatrixes provide students an occasion to analyze contributions that women, as well as men, have made to aviation. Questions to be asked could include the following: why were women excluded from history of aviation; what is the role of women in aviation today; are women making headway in field of aviation today. These questions should expand students' views and perceptions regarding women and their role in aviation since the time of Orville, Wilbur, and Katharine Wright to present day.

There are increasingly open avenues for women seeking careers in aviation today. These include careers as cargo pilots, aviation inspectors, corporate pilots, air traffic controllers, aeronautical engineers, boom operators, flight engineers, and astronauts (Smith, 1981). Nowadays, Navy women routinely fly the mail to aircraft carriers and deliver food and weapons to ships all over the world. They dogfight, test new missile systems, and serve as flight instructors. Women flight students are now a common sight in Pensacola. In 1990, there were 12,477 Navy pilots, 225 of whom were women (Holden, 1992).

## Current status of students in 4-year degree aviation education programs

Student enrollments in aviation education majors at 42 surveyed UAA aviation institutions ranged from 12 to 1060 with a mean of 263.7. Table 1 indicates the total number of aviation education students of the responding 42 institutions enrolled in each degree area (AS, BS/BA, Masters, Doctorate) during the Spring, 1993, semester. Only eight of the 42 responding UAA-member institutions plan to offer a higher level aviation degree within the next two years in addition to what is presently being offered; seven will be offering a masters degree and one will be offering a doctorate in aviation education. The percentage of female students in these aviation-degree programs ranged from five to 50%, with the average being around 14% of the total students in aviation. Twenty-one institutions incorporated a minor in aviation in their curriculum, while 21 universities did not include an aviation minor in their program.

TABLE 1

NUMBER OF STUDENTS IN 4-YEAR DEGREE
AVIATION EDUCATION PROGRAMS

| | |
|---|---|
| AS | 705 |
| BS/BA | 10,149 |
| MS/MBA | 195 |
| Doctorate | 5 |
| Total | 11,054 |

Thirty-two institutions characterized their aviation programs as growing, three indicated their programs as declining, and seven believed their programs would stay fairly constant in the near future. Growth projections ranged from slow (2%) to explosive (200%). Only one responding institution reported that an administrative cap had been placed on enrollment so that their program was not allowed to grow at the present time. Table 2 on page 9 indicates the projected growth of the 32 institutions that are forecasting increased enrollments in their aviation programs in the near future. Of the 25 colleges and universities that offered aviation scholarships, 112 were available for men or women, with five scholarships being available for women only.

TABLE 2
PROJECTED INCREASE IN ENROLLMENTS
IN NEAR FUTURE

| Expected Growth Reported | Frequency |
|---|---|
| 200% | 1 |
| 100 | 2 |
| 75 | 2 |
| 50 | 1 |
| 40 | 1 |

| | |
|---|---|
| 30 | 1 |
| 25 | 2 |
| 20 | 4 |
| 15 | 3 |
| 10 | 5 |
| 5 | 7 |
| Rapid | 2 |
| Slow | 1 |

Perhaps the most significant finding is the fact that the majority of the colleges and universities projected notable growth for their aviation programs in the future. This is especially surprising in today's troubled economic times. However, it has been demonstrated that slow or difficult economic periods are an opportune time for students to stay in or return to school to complete their degrees.

## Summary

Even though women have been involved in aviation since its beginning, the majority of the United States' population knows very little of women's history in this area. Little, if anything, is taught in schools regarding the contributions women have made in aviation, the aviation-related jobs they took over when men went to war, and the educational advances women have championed. If attitudes are to change, girls as well as boys in the lower grades must be taught the history of women in aviation and that females can and should be involved in aviation and aviation education.

Studies have shown that our teaching methodologies, facilities, and programs still contain barriers and bias against women which inhibit women from achieving an equal education and career opportunities. It has been demonstrated that a discrepancy exits between the educational treatment of male versus female students. These issues must be addressed at all levels of our educational system.

Along these same lines, many of our programs are conducted in facilities which project bias. Constructed to meet the needs for training decades ago, many schools possess marked differences in bathroom, locker, and other facilities for women; these marked differences in facilities send a subtle message to women students that they were not intended to be there (Eiff, 1993).

Mentoring is important in a woman's career, as well as networking with women and men, joining organizations such as the Ninety-Nines, participating in Women in Aviation conferences, acquiring higher degrees in education and as many flight ratings as possible, becoming more aggressive, seeking leadership from women, and being a role model for other women.

## Call for Action

Colleges, universities, and secondary schools, as well as the UAA and FAA, must work toward encouraging and facilitating more young women to become pilots and to demonstrate the possibilities for females in aviation. Possible means of accomplishing this is through sponsorship of women's aviation organizations and by marketing to younger female students in order to inform these potential students of the opportunities available in aviation. As demonstrated, it is important to solicit assistance from women's aviation organizations; these organizations are a wealth of information and assistance. They also provide scholarships for worthy women pilots or want-to-be pilots.

Previously addressed were reasons why women have not achieved proportional representation in aviation. One reason cited was that young women do not have an adequate number of role models. This is especially true for those women who choose to become pilots or aviation educators. Colleges and universities should recruit more women aviation faculty to foster role models. It has been proven that when universities, businesses, or NASA employ women on their staff, these women provide good role models for both students and for up-and-coming women executives and faculty alike. Institutions must increase the number of female students in their aviation programs. Likewise, they must develop more coordinated graduate programs in aviation, whether as an actual masters program in aviation education or as an emphasis in this field of study. By enlarging female student enrollments, a certain percentage will eventually infiltrate the academic ranks. Perhaps as more women enter male-dominated careers, their presence as role models for girls and women will further serve to demonstrate the appropriateness of nontraditional career choices.

The WASPS, among their repertoire of songs, had one entitled "Zoot Suits and Parachutes." One line of the song advised, "If you have a daughter, teach her how to fly." One of the members of this organization asserted that "...we have taught our daughters how to fly, both in the literal and in the figurative sense, and they are flying higher than we ever could. Our granddaughters and our great-granddaughters, I can only assume, will fly ever higher - perhaps they will even reach the stars!" (Cole, 1992, p. 155). It is time for women to "fly ever higher" in all areas of aviation and aviation education and our colleges and universities are in the perfect position to do this.

## References

Busey, James B. (1991, March). The future for women in aviation. Proceedings from the Second Annual National Conference on Women in Aviation, (pp. 1-5). St. Louis, MO.

Changing America: The new face of science and engineering final report. (1989, December). The Task Force on Women, Minorities and the Handicapped in Science and Technology.

Changing America: The new face of science and engineering interim report. (1988, September). The Task Force on Women, Minorities and the Handicapped in Science and Technology.

Cole, Jean Hascall. (1992). Women pilots of World War II. Salt Lake City: University of Utah Press.

Eiff, Gary. (1993, August). Women in Aviation Education: Are We Prepared? (pp. 5-6). University Aviation Association July/August 1993 Newsletter.

Gyr, Marian. (1990, May-June). Book review of pioneer airwomen. Women in Aviation: The Publication, p. 9.

Holden, Henry M., & Griffith, Captain L. (1992, March). Ladybirds: The untold story of women pilots in america. (Revised, 2nd Printing). Mt. Freedom, N.J.: Black Hawk Publishing Co.

More student pilots. (1990, January 8). Aviation Week and Space Technology, p. 13.

Shaw, C. M., Fogel, N., Gonzalez, M. B. (1991, September). Women in engineering: Planning and persistence pay off. Frontiers in Education. American Society for Engineering Education. Purdue University.

Smith, Elizabeth Simpson. (1981). Breakthrough: Women in aviation. New York: Walker and Company.

University Aviation Association. (1993). UAA membership list - February 1993. Opelika, AL: Author.

# GENDER ISSUES IN AVIATION EDUCATION

by

Professor Rebecca Lutte
Aviation Institute
University of Nebraska at Omaha

for

Nebraska Aviation Education Association

January 1994

# GENDER ISSUES IN AVIATION EDUCATION

## ABOUT THE AUTHOR

Rebecca Lutte is an instructor at the University of Nebraska at Omaha Aviation Institute. Ms. Lutte received her Bachelor of Science degree in Professional Aeronautics from Embry-Riddle Aeronautical University. She is currently pursuing a Master of Public Administration from the University of Nebraska at Omaha. Her FAA certifications include Commercial Pilot, Certified Flight Instructor - Instrument, and Advanced - Instrument Ground Instructor. She has authored articles and made professional presentations on aviation topics and the case writing method. Her professional affiliations include the University Aviation Association and Society for Case Research.

## ABSTRACT

The paper will present a study of the gender issues affecting women employed in aviation higher education. The study focused on women faculty members and administrators. Although the number of women in higher education has increased, the growth has been slow. Women in academe are faced with many issues. According to the literature, barriers for women include the organizational structure of the institutions. Women tend to be concentrated in low positions within the hierarchy. They are not well represented in positions of leadership, such as deans, department chairs, or tenured faculty members. According to surveys, many women who do hold leadership positions have experienced frustration due to limited power. These barriers for women; organizational structure, leadership, and power will be the focus of this paper.

## INTRODUCTION

The purpose of this paper is to examine the status of women employed in higher education and to acknowledge some of the issues affecting women in this field. Issues discussed will address organizational structure, leadership, and power. The scope of the study included women faculty members and administrators and focused on the aviation field of higher education.

## LOW REPRESENTATION

Although the number of women in higher education has slowly increased, the numbers are still considerably less than men. In the 20s women comprised twenty-eight percent of faculty members. That number dropped to nineteen percent in the 50s. (Cullivan, 1990) In the 90s, the number of women faculty has risen back to twenty-eight percent of full time faculty members.

Those statistics represent overall faculty distribution. Women are even less represented in aviation departments in higher education. As can be seen in Table 1, only 5.2% of aviation faculty positions are held by women.

Table 1: Faculty Distribution by Gender

| | OVERALL FACULTY DISTRIBUTION | AVIATION FACULTY DISTRIBUTION |
|---|---|---|
| MALE | 72% | 94.8% |
| FEMALE | 28% | 5.2% |

Source: University of Aviation Association Proceedings (October, 1990).

## ORGANIZATIONAL STRUCTURE AND LEADERSHIP

Women are also not highly represented in positions of leadership. They rarely are in the top positions within the organizational hierarchy. In fact, research shows that only 1.1 women senior officers may be found at the level of dean or above at each college and university in the country (Kaplan and Tinsley). In order to further evaluate the issue of women in leadership positions, the Project on the Status and Education of Women conducted a survey and made the following observations:

* The higher the rank, the fewer the women.

* The more prestigious the school or department, the fewer the women.

* Women have been less likely to receive tenure than men. (In fact, only twenty-four percent of full time women faculty members have achieved tenure)

*It is uncommon for women to be department chairs, and rarer still for them to be academic deans.

* The majority of women administrators remain concentrated in low-status areas that are traditionally viewed as women's fields (such as nursing and home economics) or in care taking and academic support roles (such as student affairs or admissions).

## POWER

According to several studies, women who are in positions of leadership often express frustration due to a feeling of limited power in that position. One study revealed that women administrators were dissatisfied with having responsibility but no authority (Cullivan, 1990). In an additional study, seventy-nine percent of women administrators surveyed believed they had less influence than their male counterparts.

Lack of power can be attributed in part to a lack of resources for women. According to the Project on the Status and Education of Women, women receive fewer budgetary resources than men of the same rank and women are given lower priority access to office support. In addition, eighty-seven percent of female administrators surveyed felt that they were excluded from informal networks (Cullivan, 1990).

## CALL FOR ACTION

There are many actions that could assist in changing the role of women in higher education. First, women should be aggressive in breaking down barriers for entry into leadership positions. For example, women are earning far fewer doctoral degrees than men, especially in fields that have been traditionally viewed as men's work. Table 2 on page 3 shows the breakdown, by gender, of doctoral recipients as reported by the Chronicle in 1993.

Table 2: Characteristics of recipients of doctorates.

| | All Fields | Business/ Management | Education | Engineering | Physical Science |
|---|---|---|---|---|---|
| MEN | 63.2% | 74.9% | 41.9% | 91.3% | 81.6% |
| WOMEN | 36.8% | 25.1% | 58.1% | 8.7% | 18.4% |

Source: Chronicle of Higher Education: Almanac Issue XL (25 August 1993).

Another action that women can take involves publishing. It was noted that only twenty-four percent of women faculty have achieved tenure. Professional publications are an accepted requirement for tenure. However, a recent study revealed that over half (56%) of women faculty members had no publications for the last two years. These two barriers, lack of publications and low enrollment in doctoral programs, are barriers that women can often successfully break down.

Further research is necessary. There are many programs that various institutions are using to increase awareness and address gender issues. Mentoring programs and workshops are just two of these areas that could be analyzed in terms of effectiveness. In addition, further research is required to evaluate the relationship between women employed in higher education overall and women employed specifically in the aviation sector of higher education.

In order to change the role of women in higher education, both women and the organization as a whole must be prepared to make and accept changes. Colleges and universities are viewed as a source of new ideas, a place where people are challenged and provided opportunities for growth. As one author stated, "The difficulties that women face in the academic community are not different from those faced by other professional women in the world at large. If we do not solve them in academe, we will have little hope in solving them elsewhere" (Women Status Report, 1986).

## REFERENCES


Almanac Issue. (1993, August). Chronicle of Higher Education.

Bowen, B. (1990). Measurement of participation levels of women and minorities as collegiate aviation educators. University Aviation Association Proceedings, 1-11.

Cullivan, K. (1990, Winter). Women in higher education: Part of the power or part of the problem? CUPA, 41, 9-15.

Kaplan, S., & Tinsley, A. The unfinished agenda: Women in higher education administration. Academe, 75, 18-22.

Women Status Report. (1986) Project on the Status and Education of Women,Washington, DC: Association of American Colleges.

"DO THE AIRLINES CARE ABOUT OUR CHILDREN?"

by

Dr. Larry Carstenson
Assistant Professor of Business and
Director of Airway Sciences Programs at
the University of Nebraska at Kearney

for

Nebraska Aviation Education Association

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DO THE AIRLINES CARE ABOUT OUR CHILDREN?

## ABOUT THE AUTHOR

Larry Carstenson is an Associate Professor of Business at the University of Nebraska at Kearney where he has been the Director of Airway Science programs since January, 1991. Dr. Carstenson holds a Juris Doctor degree from the University of Nebraska at Lincoln and was engaged in the practice of law at Aurora, Nebraska, for over twenty-six years prior to his assumption of his teaching duties at UNK.

Dr. Carstenson holds a commercial helicopter license and an air transport pilot license with several thousand hours of flying experience. He is part-time line captain for GP Express Airlines, a commuter airline with headquarters in Grand Island, Nebraska. Dr. Carstenson also serves as general legal counsel and as a member of the Board of Directors of GP Express Airlines. He is currently serving as Vice-President of the Nebraska Aviation Education Association.

DO THE AIRLINES CARE ABOUT OUR CHILDREN?

Although this presentation is entitled "Do the Airlines Care About Our Children?", perhaps it really should be: "Does the FAA Care About Our Children?" because of the attitude which seems to have pervaded recent Congressional Hearings on the proposed legislation to mandate seat restraints for infants under the age of twenty-four months. According to one frequent flyer:

"The fact is, the FAA has actively fought the notion of special seats for children, denigrating the research done by the National Highway Traffic Safety Administration and going so far as to prohibit the use of NHTSA approved car seats in airplanes." [1] Only the terrible tragedy in Sioux City Iowa with United Flight 232 in 1989 precipitated any action at all by the FAA.

"I can still remember the look in the flight attendant's eyes as we both knew this baby had a slim chance of surviving the crash landing. Picture me - a person only 5 feet 3 inches tall - trying to bend over to reach the floor to hold onto my baby, a task that was almost physically impossible. Imagine the sickening feeling of realizing our baby was being sucked out of my grasp as the plane flipped over. There has never been such a feeling of helplessness and terror in my life." [2]

Did you know that infants are the only things in an airplane which are not required to be tied down during a take off, a landing or in turbulence? It is no surprise to anyone that adults must always be restrained during such operations. How many times have we heard "Please fasten your seat belts for landing, place your seat backs in an upright position and stow all carry on luggage underneath your seat"? We know that all carry on baggage must be secured for take off, landing and turbulence. Your pet must be secured in its cage in the baggage area. Even cadavers must be properly stowed during flight. It is absolutely ludicrous, however, that none of these rules applies to your child. That twenty pound object (your child) becomes a one thousand pound weight in a crash, hurtling through the cabin and doing who knows what kind of damage to not only the child but to anyone who happens to be in the way. Why do you think the airlines make you put your twenty pound briefcase in a secure place during certain flight and ground operations?

The National Transportation Safety Board was appalled at the results of the United Flight 232 accident. The occupants of that airplane had over forty-four minutes from the incident to the impact to prepare for the crash. There were even five vacant seats on the aircraft but without child restraint seats available for their use, there was nothing the parents of small children could do except place the children on the floor, between the legs of the parents.[3] In retrospect, knowing that the aircraft cartwheeled upon impact, that was not a satisfactory solution. [4]

In another incident which occurred prior to the fateful crash of Flight 232 an infant was held on his mother's lap during a takeoff from Stapleton International Airport in Denver, Colorado, on a snowy winter night in 1987. The infant died of multiple blunt trauma injuries. His mother survived with serious injuries. Another infant passenger in the plane also survived the crash. [5]

So, what is the problem? Federal Aviation Regulation (FAR) 121.311, which governs the conduct of major air carriers, specifies that everyone on board a commercial aircraft must have a "...safety belt properly secured about him or her during movement on the surface, takeoff, and landing." The regulation continues: "Notwithstanding the preceding requirements, a child may: (1) Be held by an adult who is occupying an approved seat or berth if that child has not reached his or her second birthday...." The FAA does understand the importance of child restraint systems. In the Child Passenger Safety Resource Manual the FAA is quoted as saying:

"The Federal Aviation Administration (FAA) recommends that young children ride in child safety seats during air travel. Child seats will not only enhance the child's safety in the event of a crash but will also protect the child from injury during in flight turbulence and rough landings." [6] FAR 135.128 establishes the same procedure in commuter airline flights and FAR 91.107 regulates non commercial flights in a similar manner. After extensive Congressional Hearings, Congress gave lip service to the efforts of many aviation related organizations (including the United States Association of Flight Attendants, Air Transport Association and the Aviation Consumer Action Project, and even the National Transportation Safety Board) and amended Section 601 of the Federal Aviation Act of 1958 by adding language which authorizes a child under twenty-four months to occupy an approved child restraint system provided that the restraint system complies with certain requirements.[7] (See, for example, FAR 121.311(b)(2), amended on September 15, 1992, and prescribing procedures for major air carrier operation.) In announcing that rule change by Congress the FAA said that mandating use of child restraint seats would have made air travel too costly for some families, forcing many to drive instead. [8] FAR 121.311 further provides (at 121.311(c)):

"No certificate holder may prohibit a child, if requested by the child's parent, guardian, or designated attendant, from occupying a child restraint system furnished by the child's parent, guardian, or designated attendant, **provided the child holds a ticket** for an approved seat or berth, or such seat or berth is otherwise made available by the certificate holder for the child's use, and the requirements contained in paragraphs (b)(2)(i) through (b)(2)(iii) of this section are met...." (Emphasis supplied.)

The United States could have better protected its infant citizens by following the lead of Great Britain which mandated the use of child restraint systems for passengers less than two years old, irrespective of size or weight, during take off, landing and flight in turbulence. [9]

So, again, what is the problem? Anyone who has attempted to travel recently with small children will tell you that absolutely no consistency exists among the major airlines (or even among the commuter air carriers, for that matter) regarding how to handle a family who travels on a commercial air carrier with a small child who does not have a paid ticket. The family hopes to become lucky and find an empty seat near their assigned seats in which they may place the child on his or her approved restraint system. It is true that the federal aviation regulations cited above absolutely require an air carrier to allow the use of a child restraint system provided that the system meets all the requirements of the regulation and **"provided the child holds ticket for an approved seat".**

The problem arises with the family who cannot afford another full adult fare for their infant and must, because of the cost, carry the child on the parent's lap which, of course, is authorized by the Federal Aviation Regulations. When the parents check in at the gate they are often told either (a) that they can not bring their infant seat aboard the aircraft without a ticket or (b) that only one carry on is allowed. Now, anyone with an infant and an infant seat knows that one other essential item is necessary on that airplane - the diaper bag. Unfortunately, when added to the infant seat, the diaper bag makes one too many carryons. The bottom line: some consistency needs to be established among the airlines so traveling parents will know in advance what requirements to expect. By the way, calling the airlines in advance does no good in most cases, either. The person with whom the parent visits on the phone is not the same person who tells the parent differently at the gate.

Some of the advocates of mandatory child restraint systems argue about the rights of our infant children. They point out that our nation is currently struggling with the rights of unborn children so what about the rights of our born children? Congressman Jim Lightfoot of Iowa pleaded the cause of our infants on the floor of the House on October 7, 1993 when he asked the House to mandate the use of child restraint systems:

"...it is a violation of an infant's basic rights when we give them one level of protection and adults another much higher level. After all, a child cannot be taken to or from the airport without a safety seat, why should they fly without one? This House has had a long and honorable history of demanding from the FAA a higher level of protection for the flying public. This House has taken the lead in issues the flying public now takes for granted like floor level lighting, protective breathing devices, and smoke detectors. Today we can close one of the final loopholes in aviation safety by giving our children the protection they deserve." (The House failed to enact Congressman Lightfoot's proposal.) [10]

Since 1985 all fifty states in this country require the use of child restraint systems in automobiles. Is it time to mandate the use of child restraining systems on airplanes? This has been attempted both by Congressman Lightfoot and by Senator Christopher Bond of Missouri.[11] The argument against the mandating of the use of child restraint systems (which would, presumably, result in mandating the purchase of an additional ticket by the parents for the infant) is that the requirement of the purchase of additional tickets for children would cause more families to abandon air travel and go by car to save money.

That would result in exposure of the infants to a more dangerous mode of transportation.[12] So, what should we do? The solution to this issue involves both education and competition. We need to devote some time to educating the airlines on the safety needs of our children who travel on airliners and informing the airlines on how they can satisfy those safety needs. Then we need to stimulate competition among the airlines to fight for those child passengers because if the airlines get the child, they will get one, or possibly both, of the parents as well. The airlines could initiate competition among themselves with each striving to become "The Official Airline for Kids", or "The Family Airline." Airlines could promote travel of families who are traveling with infant children without a ticket for that child by promoting travel at off times or during non peak periods. If it is determined that a charge must be made for the child's ticket, make that charge a nominal one because the flight will be at a time when the seat is not sold anyhow. Perhaps the airlines could follow the lead of one of our domestic auto makers and build infant seats into a selected number of their airline seats? After all, if they can go to the expense of installing air phones in all the airplanes for the benefit of those people who use them, it would seem that the airlines would be willing to incur some expense in installing infant restraint systems which would certainly provide more protection for our children than they have now, sitting on their parent's laps.

Even a cursory examination of the reports, information and hearings on the subject of child safety should motivate everyone to action on this very important subject. Imagine yourself in the position of one of the United Flight 232 flight attendants on that fateful day in July in Iowa in 1989:

"Once the passenger preparation was completed, I harnessed myself in my jump seat and waited for the brace signal. I mentally reviewed all that had been done. I recalled an incident a month earlier when, in heavy turbulence, two infants were torn from their parents' arms and thrown through the air. One infant was sent to the hospital for its injuries.

Within minutes we impacted, an impact that no words will ever adequately describe. I evacuated the passengers and exited the plane. Making my way through the corn field, the first passenger I met was Sylvia Tsao, who was headed back towards the burning plane. She told me that she had to return to the plane to find her infant son. I restrained her from proceeding and told her someone would find her son. She turned to me and blurted out that I had told her to place her son on the floor and hold him. She had done that and now he was missing. I was overcome with the knowledge that I would live with those words for the rest of my life. Evan Tsao died in the crash." [13]

## REFERENCES


1. "The Fears of a Frequent Flyer", Journal of Commerce and Commercial Bulletin, August 3, 1989, page 8A.

2. Testimony of Lori Michaelson, a passenger on United Flight 232 (an airline which crashed in Sioux City, Iowa on July 19, 1989), before the House Aviation Subcommittee, on July 12, 1990, as quoted in the Congressional Record on October 7, 1993, page H7593.

3. (National Transportation Safety Board Aircraft Accident Report. United Airlines Flight 232, Sioux Gateway Airport, Sioux City, Iowa, July 19, 1989. PB 90-910406 NTSB/AAR-90/06.)

4. NTSB/AAR-90/06, supra, page 36.

5. National Transportation Safety Board Aircraft Accident Report. Continental Airlines Flight 1713 at Stapleton International Airport, Denver, Colorado, on November 15, 1987. PB88-910411. NTSB/AAR-88-09.

6. Page 115, Child Passenger Safety Resource Manual, U.S. Department of Transportation, National Highway Traffic Safety Administration, 1993.

7. Hearing before the Subcommittee on Aviation of the Committee on Public Works and Transportation of the House of Representatives, One Hundred First Congress, Second Session, on H. R. 4025, conducted on July 12, 1990.

8. Wall Street Journal, September 15, 1992, page A18.

9. Flight International Magazine, "Lessons To Be Learned", October 31, 1990, page 24.

10. Congressional Record, October 7, 1993, H7593.

11. See page 11 of the House Hearing on the Aviation Subcommittee on H. R. 4025 on July 12, 1990.

12. McKenzie and Warner, "The Impact of Airline Deregulation on Highway Safety" submitted to FAA Docket No. 26142 by the Competitive Enterprise Institute.

13. Statement of Jan Brown in her testimony before the House Aviation Subcommittee, on H.R. 4025, on July 12, 1990, page 79

# ENHANCEMENTS TO AEROSPACE EDUCATION PROVIDED THROUGH THE NEBRASKA (NASA) SPACE GRANT CONSORTIUM

by

Professor Densel K. Acheson
Ms. Gail L. Scott
Aviation Institute
University of Nebraska at Omaha

for

Nebraska Aviation Education Association

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## About the Authors

Densel K. Acheson is an Assistant Professor of Aviation at the University of Nebraska at Omaha's Aviation Institute. Since August, 1990, he has been conducting classes in Aviation Meteorology, Aviation Safety, Aviation History, Advanced Aircraft Systems, and Advanced Weather Services. In addition, he serves as the Flight Training Coordinator for the Institute's student flight training program and as the Executive Secretary of the Nebraska Space Grant Consortium. A native of Lafayette, Indiana, he graduated from Purdue University in 1961 with a Bachelor of Science degree in History and Political Science. Later, in 1973, he earned a Master of Political Science degree from Auburn University. With over 5,500 flying hours, he currently holds a private pilot certificate with an instrument rating.

Gail L. Scott is a graduate teaching assistant at the University of Nebraska at Omaha's Aviation Institute. She received her Bachelor of Business Administration with a minor in Economics from Wichita State University in 1991, and her Master of Business Administration with an emphasis in Aviation Management from Wichita State University in 1993. She is currently working on her Ph.D in Administration, Curriculum, and Instruction specializing in Educational Leadership at the University of Nebraska at Lincoln. Her professional affiliations include Alpha Eta Rho; Civil Air Patrol, Aerospace Education Member; and the Optimist Club, Omaha's Aviation Branch.

## Abstract

The National Space Grant College and Fellowship Program was authorized by Congress to help maintain, through the nation's universities, United States capabilities in aerospace and technology. In the Spring of 1991, the University of Nebraska at Omaha's (UNO) Aviation Institute submitted its initial planning grant proposal to participate in this program and develop the Nebraska Space Grant Consortium.

The University of Nebraska at Omaha is the administrative home for the Nebraska Space Grant Consortium. Since the Consortium's creation, faculty and students from the following five universities currently participate in the program: Creighton University, University of Nebraska at Lincoln, University of Nebraska at Omaha, University of Nebraska Medical Center, and University of Nebraska at Kearney.

Since its establishment in 1992, the Consortium has distributed approximately $560,000 in NASA funds and matching monies from the state of Nebraska. A total of approximately $156,500 has been awarded to 33 deserving graduate and undergraduate students. These fellowships have allowed them to participate in a wide range of aerospace education and research activities

Through the program, new opportunities have been provided to open new lines of communications and strengthen others plus to formalize linkages among the current five participating universities. The enhanced communication and research infrastructure that has evolved has enabled the state to compete more effectively at a national level for other substantive aerospace research opportunities with government and industry. This grant has enhanced Nebraska's opportunity to compete nationally in aerospace research and education by creating an enhanced research infrastructure through the cooperation and communication among participating universities and collaborative efforts among faculty.

## Introduction

The National Space Grant College and Fellowship Program was authorized by Congress to help maintain, through the nation's universities, United States capabilities in aerospace and technology. The program's objectives are (1) to establish a national network of universities with interests and capabilities in aeronautics, space and related fields; (2) to encourage cooperative programs among universities, aerospace industry and Federal, State, and local governments; (3) to encourage interdisciplinary training, research, and public service programs related to aerospace; (4) to recruit and train professionals, especially women, under-represented minorities and persons with disabilities, for careers in aerospace science and technology; and (5) to promote a strong science, mathematics and technology education base from elementary through university levels.

Phase I began in 1989 with the selection of 21 designated institutions to begin implementing programs which supported the objectives listed above. Phase II of the program was instituted in 1990 to broaden the base of the program by providing an opportunity for all states not currently involved in the program to submit proposals to participate as members of the Space Grant Consortia. In the Spring of 1991, the University of Nebraska at Omaha's (UNO) Aviation Institute submitted its initial planning grant proposal to develop the Nebraska Space Grant Consortium under Phase II. In this phase, states were allowed to compete in one of two categories: Program Grants or Capability Enhancement Grants.

## Capability Enhancement Grant

Using the planning grant, UNO developed and submitted its successful proposal to compete for a Capability Enhancement Grant which totals $150,000 annually for a four year period. Of this amount, a minimum of $75,000 is allocated for research enhancement. Non-federal matching funds are used to increase this amount to a total of $150,000. A minimum of $50,000 would be used for fellowships with the remaining $25,000 available for augmenting the fellowship program or providing additional research enhancement monies. This capability enhancement grant led to the creation of the Nebraska Space Grant Consortium with the following goals:

(1) To clearly establish statewide goals concerning development of interdisciplinary education, research infrastructure, and public service programs related to aeronautics, space science and technology.

(2) To recruit and train professionals especially women, under-represented minorities, and persons with disabilities for careers in aeronautics, space-related science, and engineering.

3) To develop a strong science, mathematics, and technology education base from elementary through university levels.

By striving to meet these goals, the Nebraska Space Grant Consortia, with its member institutions of higher learning, will become more competitive for needed funds to improve the quality of aerospace research and education within the state.

The Nebraska Space Grant Consortium

The University of Nebraska at Omaha is the administrative home for the Nebraska Space Grant Consortium. The Aviation Institute Director, Dr. Brent D. Bowen, also serves as the Consortium Director. Since the Consortium's creation, faculty and students from the following five universities currently participate in the program:

* Creighton University
* University of Nebraska at Lincoln
* University of Nebraska at Omaha
* University of Nebraska Medical Center
* University of Nebraska at Kearney.

Since its establishment in 1992, the Consortium has distributed approximately $560,000 in NASA funds and matching monies from the state of Nebraska. A total of approximately $156,500 has been awarded to 33 deserving graduate and undergraduate students. These fellowships have allowed them to participate in a wide range of aerospace education and research activities which include, but are not limited to:

* Focal plane processing for space-borne imaging systems
* Airline Quality measurement and analysis
* Remote sensing of wetlands
* Airlines in Distress: A Predictive Model
* Effects of space-flight, acceleration and vibration on vestibular function
* Distributed problem-solving in air carrier operations
* Adaptive restoration in imaging systems
* Sponsorship of the ACE Academy, providing high school students information about aviation career opportunities
* Research of the policies and practices of air carriers with regard to the safety of infants
* Additive effects of mixtures of phytoplankton blooms and different types of suspended sediments on composite, and hyperspectral reflectance curves
* Study of circadian rhythms and adaptation to timing changes
* Sponsorship of UNO's Aviation Institute Aviation 2000 conference
* Support of the UNO Mallory Kountze Planetarium
* Investigation of the ability of the general aviation pilot to transition from a single pilot environment to a multi-crew environment requiring an understanding of crew resource management techniques and procedures
* Economic Impact of Nebraska Airports on Local Municipalities
* Women in Aviation

The fellowship recipients are selected by a competitive process that begins with students submitting an application to the Space Grant Consortium representative on their respective campus. Each participating institution uses a committee of selected faculty and administrators to choose among the applicants for a fellowship. The number of fellowships awarded by each institution is based on the number of aerospace research opportunities and projects that are available in which students may participate. Participating faculty mentor each student's research and study activities. Those faculty who submit competitive research proposals, receive project support and/or research enhancement funds to further develop Nebraska's aerospace research infrastructure. During the first two years of the Consortium's existence, approximately $207,000 has been distributed among participating faculty for research enhancement.

The remaining funds are used to develop or revise engineering and science curricula; provide for guest speakers in college, secondary, and elementary classrooms; and to offer educational outreach activities designed to stimulate interest in science, mathematics and technology in grades K through 12 and/or increase awareness of aerospace advances among the general public. A variety of programs have been stimulated by the support of the Nebraska Space Grant Consortium. The Mallory Kountze Planetarium staff has been most active in developing several new educational outreach programs for elementary and secondary students using the facilities of the planetarium to increase interest in science and math at an earlier age. Among these programs are: a science workshop for area Girl Scouts; developing a day camp centered on the theme of "Young Astronauts" or "Space Camp"; a workshop to assist elementary and secondary educators in developing science lesson plans and creating science modules at their own schools; and expand the offerings of the planetarium to include added demonstrations of how physics affects our world. Additional outreach efforts include co-sponsoring this conference which promotes aviation awareness among educators at all levels besides friends of Nebraska aviation.

The consortium was instrumental in having Astronaut Wally Schirra as the keynote speaker at the 1993 UNO Aviation Institute's annual Aviation 2000 conference. The conference promotes aviation trends and opportunities among secondary and post-secondary students as well as the Institute's students and the general public. Captain Schirra also made appearances at local schools in addition to assisting in the dedication of the NASA Educational Center at the Mallory Kountze Planetarium. Another facet of consortium support is guest lecturers' that provide seminars for faculty development at the post-secondary level. This portion of the program allows classroom instructors the opportunity to learn about new developments designed to improve the quality of instruction and consequently, the quality of education for the students. Other seminar speakers have focused on improving educators' research methods and writing skills.

## Benefits of Space Grant Program Participation in Achieving State Goals

To date, the Nebraska Space Grant Consortium is making substantive progress in achieving its stated goals. Through the program, new opportunities have been provided to open new lines of communications and strengthen others plus to formalize linkages among the current five participating universities. The enhanced communication and research infrastructure that has evolved has enabled the state to compete more effectively at a national level for other substantive aerospace research opportunities with government and industry. This grant has enhanced Nebraska's opportunity to compete nationally in aerospace research and education by creating an enhanced research infrastructure through the cooperation and communication among participating universities and collaborative efforts among faculty.

The opportunities to broaden state educational offerings in aerospace studies have been strengthened by new outreach programs. Teaching faculty have had opportunities to increase their classroom capabilities which in turn enhances the education process. The sixteen female and seventeen male graduate and undergraduate fellowship recipients have benefitted through increased faculty involvement in the field and the increased research activities. While the state is beginning to see tangible benefits of the program, the work is not yet done. Future goals are to involve aerospace related industry with the Consortium and to seek a regional Space Grant alliance that will further benefit Nebraska and its people.

References

Acheson, D., Scott, G. (1994). 1992-1993 Nebraska Space Grant Consortium Annual Report. Submitted to the National Aeronautics and Space Administration Higher Education Branch.

Acheson, D. (1993). 1991-1992 Nebraska Space Grant Consortium Annual Report. Submitted to the National Aeronautics and Space Administration Higher Education Branch.

McCoy, E., Acheson, D. (1991). Nebraska Space Grant Consortium Proposal. Submitted to the National Aeronautics and Space Administration Higher Education Branch.

National Aeronautics and Space Administration. (1993, September). NASA's Education Program. Office of Human Resources and Education. Education Division.

National Space Grant College and Fellowship Program. (1990, May). Phase II--Space Grant State Consortia. Office of External Relations. Educational Affairs Division, University Programs Branch.