UNIVERSITY AVIATION ASSOCIATION

COLLEGIATE AVIATION REVIEW

Thomas Q. Carney, Ph.D., Editor
Richard O. Fanjoy, Ph.D., Associate Editor

Sponsored by University Aviation Association and Purdue University

Cover design by Marc H. Luedtke

October 2004 **Volume 22: Number 1**

The Collegiate Aviation Review (*CAR*)
Fall 2004, Volume 22, Number 1
Thomas Q. Carney, Editor

All correspondence and inquiries should be directed to:

University Aviation Association
3410 Skyway Drive
Auburn, AL 36830
Telephone: (334) 844-2434
Email: uaa@mail.auburn.edu

ISSN Number: 1523-5955

Editorial Board

Of the

Collegiate Aviation Review

ACKNOWLEDGEMENTS

The University Aviation Association gratefully acknowledges the generosity of the sponsors for this edition of the *CAR*: the **University Aviation Association**; and **Purdue University**.

No juried publication can excel, unless experts in the field serve as anonymous reviewers. Indeed, the ultimate guarantors of quality and appropriateness of scholarly materials for a professional journal are the knowledge, integrity, and thoroughness of those who serve in this capacity. The thoughtful, careful, and timely work of the Editorial Board and each of the following professionals added substantively to the quality of the journal, and made the editor's task much easier. Thanks are extended to each reviewer for performing this critically important work.

In addition to the members of the UAA Publications Committee, the reviewers include:

Tony Adams	Eastern Kentucky University
Tim Brady	Embry-Riddle Aeronautical University
Paul A. Craig	Middle Tennessee State University
James E. Crehan	Baton Rouge, LA
Roland P. Desjardins	Alteon Training, LLC
Gerry R. Fairbairn	Daniel Webster College
Ronald J. Ferrara	Middle Tennessee State University
Robert S. Finkelstein	North Shore Community College
Jeffrey Forrest	Metropolitan State College of Denver
Carey L. Freeman	Hampton University Department of Aviation
Terry Gibbs	University of Nebraska at Kearney
Margaret F. Klemm	Purdue University
William A. Kohlruss	Embry-Riddle Aeronautical University
Kent W. Lovelace	University of North Dakota
Jacqueline R. Luedtke	Embry-Riddle Aeronautical University
Rebecca K. Lutte	University of Nebraska at Omaha
C. Elaine McCoy	University of Illinois
William K. McCurry	Arizona State University
Robert K. Mock	Metropolitan State College of Denver
Isaac R. Nettey	Kent State University
Donald A. Petrin	Purdue University
Stephen M. Quilty	Bowling Green State University
Jose R. Ruiz	Southern Illinois University Carbondale

List of Reviewers, continued:

Jacqueline B. Sanders	Mercer Co. Community College
Greg M. Smith	Embry-Riddle Aeronautical University
Alan J. Stolzer	Parks College of Engineering & Aviation
D. Scott Worrells	Southern Illinois University Carbondale
John P. Young	Purdue University

In addition, the editors express thanks to Ms. Sheron Griggs, Purdue University, for her tireless and very effective efforts in assembling and formatting the manuscript.

STATEMENT OF OBJECTIVES

The *Collegiate Aviation Review* is published annually by the University Aviation Association. Papers published in this volume were selected from submissions that were subjected to a blind peer review process, and were presented at the 2004 Fall Education Conference of the Association.

The University Aviation Association is the only professional organization representing all levels of the non-engineering/technology element in collegiate aviation education. Working through its officers, trustees, committees and professional staff, the University Aviation Association plays a vital role in collegiate aviation and in the aviation industry.

The University Aviation Association accomplishes its goals through a number of objectives:

To encourage and promote the attainment of the highest standards in aviation education at the college level.

To provide a means of developing a cadre of aviation experts who make themselves available for such activities as consultation, aviation program evaluation, speaking assignments, and other professional contributions that stimulate and develop aviation education.

To furnish a national vehicle for the dissemination of knowledge relative to aviation among institutions of higher education and governmental and industrial organizations in the aviation/aerospace field.

To foster the interchange of information among institutions that offer non-engineering oriented aviation programs including business technology, transportation, and education.

To actively support aviation/aerospace-oriented teacher education with particular emphasis on the presentation of educational workshops and the development of educational materials in the aviation and aerospace fields.

University Aviation Association
3410 Skyway Drive
Auburn, AL 36830
Telephone: (334) 844-2434
Email: uaa@mail.auburn.edu

Call for Papers

for the

2005 UAA Fall Education Conference

and the

Collegiate Aviation Review (CAR)

Both qualitative and quantitative research manuscripts are acceptable. All submissions must be accompanied by a statement that the manuscript has not been previously published and is not under consideration for publication elsewhere.

All authors will be required to sign a "Transfer of Copyright and Agreement to Present" statement in which (1) the copyright to any submitted paper which is subsequently published in the ***CAR*** will be assigned to the University Aviation Association (UAA) and in which (2) the authors agree to present any accepted paper at a UAA conference to be selected by the UAA, if requested.

Authors should submit **five** double-spaced copies of the manuscript, conforming to the guidelines contained in the *Publication Manual of the American Psychological Association*, 5th Ed. (APA). If the manuscript is accepted for publication, the author(s) will be required to submit the manuscript on 3½-inch computer disk, or via e-mail to the editor, in Microsoft Word format. Papers accepted for publication must be submitted in "camera-ready form" by the prescribed deadline. *Authors should use the previous year's CAR for guidance in format and page layout.*

The UAA review process incorporates editorial input and recommendations from "blind" peer reviewers. A list of all reviewers is available from the ***CAR*** editor and is published annually in the ***CAR***.

All manuscripts must be postmarked no later than May 1, 2005, and should be sent to:

> Dr. Thomas Q. Carney
> Purdue University, Department of Aviation Technology
> 1401 Aviation Drive
> West Lafayette, IN 47907-2015

Questions regarding the submission or publication process may be directed to the editor at (765) 494-9954, or may be sent by email to: tcarney@purdue.edu

Students are encouraged to submit manuscripts to the ***CAR***. A travel stipend up to $500 is available for successful student submissions. Please contact the editor or UAA for additional information.

TABLE OF CONTENTS

Improving Safety in a High Reliability/Low Commitment Work Environment

K.J. McNamara, J.M. Thom, and R.E. Thompson
Purdue University

ABSTRACT

Over the years several strategies were used to create safe and productive work environments. While all of these methods made an impact on the employees and the work environments, most results were short lived and in some instances created a reverse effect that actually made the employees less productive and less safe. To be successful, it was important for the employees to "buy-in" to these policies and procedures, and to "understand, accept and appreciate" them (Geller, 2001). When this occurred, behaviors would begin to change and in turn, the culture of the work group or organization began to change as well. The measurement of employees' perceptions regarding the acceptance level of a possible training classification program in previous studies at Purdue University was positive. Based on this historical data a new study was done at a major U.S. air carrier in an effort to gather information regarding employees' views and opinions on the possible implementation of a system of color coding to identify the job classification of the employees working in an environment requiring high reliability, and with a low commitment to the job, such as part time employees. Based on the findings of this study, it was concluded that a training classification system based on color coding could be accepted and supported by low commitment, high reliability organizations. The name of the company studied was withheld in this paper due to proprietary considerations, and was identified in this study as *Company X*.

INTRODUCTION

Companies struggle with the necessity of providing a safe and productive work environment for their employees. The complexity of daily work operations and the overwhelming number of safety issues may leave workers without the proper tools and resources to accomplish their jobs. Research into this problem has led to new programs to change the work environment's culture by changing individual's behavior patterns (McSween, 1995). An area of concentration in this research has focused specifically in workplace safety. Preliminary results are positive when the programs are implemented within stable, full-time work groups. It is the purpose of this study to apply the theories behind this new research and test whether these programs can also work for similar high reliability work environments utilizing as their primary work force part-time and temporary workers with high turnover rates. This study focuses on the implementation of a training classification system within such a work group at a major U.S. air carrier, which is referred to in this study as *Company X*.

BACKGROUND

Over the years strategies have been used to create safe and productive work environments. These included, but were not limited to: social pressure (Asch, 1995), obedience (Milgram, 1963), negative reinforcement (Endler & Hartley, 1973), and positive reinforcement (Koepnick, 1993). While all of these methods made an impact on the employees and the work environments, most results have been short lived and in some instances created a reverse effect that actually made the employees less productive and less safe.

Within the last decade, three prominent and respected researchers, James Reason, Scott Geller, and Terry McSween, have narrowed their research focus to perfecting behavioral approaches that help to create safe and productive workplace environments. Similarity is found in their work, based on focus of the interaction of people with themselves, other people, and with the work environment. Reason has focused on the "defenses" or safeguards organizations can put in place so that accidents may be prevented (Reason, 2000). Geller has concentrated on behavioral approaches to safety and productivity, and attempts to share the reasoning behind why these types of programs are so effective (Geller, 2001). Finally, McSween goes one step further by detailing how to integrate behavioral systems into the workplace (McSween, 1995). All of these authors have categorized training classification systems as an approach aimed at changing the behavior and/or culture of the work group, by changing the behavior of the individual employees and their interactions with each others and their work environment.

Reviewing Reason, Geller, and McSween, the theory behind why behavioral based programs are so effective becomes clear. Behavior based programs "develop a set of comprehensive principles on which to base safety procedures and policies" (Geller, 2001, 21). It is important for the employees to "buy-in" to these policies and procedures and "understand, accept, and appreciate" them (Geller, 2001). When this occurs, behaviors begin to change and in turn, the culture of the work group or organization begins to change as well. The method of the current study closely follows the ideas and information found in Thomas Krause's book, *The Behavior-Based Safety Process* (1997). Krause (1997) has proposed to use the following implementation sequence with behavior-based programs (p. 95):

1. Implementation Planning Meeting,
2. Assessment Visit and Report,
3. Behavioral Inventory Tools Development, Management Training, Ownership Meetings,
4. Observation Course Development,
5. Observer Course Review, Computer Software Training, Observer Training, Kickoff Meetings,
6. Ongoing Observations and Data collection, Process Checks,
7. Safety Improvement Process Training,
8. Action Planning, Users Conferences, Benchmarking.

Prior study and research (Hess, 2000) has covered steps one through five. The training classification study done here focuses on steps six and eight.

A review of literature on training classification systems reveals several programs already in place. The United States Navy has long used a classification system program on aircraft carrier flight decks. Working in such a hazardous environment, verbal communication is nearly impossible due to the high levels of noise and number of tasks being performed simultaneously. In light of these difficulties, a highly evolved set of hand signals and color-coded vests have been put into place. (Paige, 1998). Each person on the flight deck has a specific function. There are fireguards, fuelers, pilots, mechanics, flight deck officers, and deck edge officers, just to name a few. Each job classification is assigned a specific color vest, and everyone must know what each color means prior to being allowed onto the flight deck. Both the operations on the aircraft carrier flight decks and the operations on the aircraft ramp of *Company X* fit the description of a high-reliability organization (HRO). Reason states, "Organizational flexibility means possessing a culture capable of adapting effectively to changing demands. Flexibility is one of the defining properties of…high-reliability organizations (HROs)" (2000, 213). Basically, the amount of critical job responsibilities and the ever changing environment in which they must be performed classify *Company X* workers to be called a high-reliability organization. Within an HRO there are many operational challenges occurring during high demand and peak production periods (Reason, 2000). Utilizing a training classification system was expected to increase employees' awareness of their surroundings by providing additional means (color-coded clothing) for assessment.

Initial work between Purdue University and *Company X* began in the fall of 1998. Some of the data and information collected during this time was used throughout the course of this current study. The measurement of the employees' perceptions regarding the acceptance level of a possible training classification system program was positive (Hess, 2000). Based on this response, focus groups were held in an effort to gather information regarding employees' views and opinions on the possible implementation of a program of this kind. The focus group questions solicited information regarding; the benefits of a training classification program, the potential problems implementation may cause, and the anticipated employee support and acceptance levels. Once again results proved that a training classification program might have been a viable option *Company X* should explore (Hess, 2000).

There have been examples of other forms of employee classification programs that have been accepted by employees, and have proved to increase employee situational and safety awareness. For example, Southwest Airlines CEO, Herb Kelleher decided to "code" employees by their personality types. By identifying certain personality traits, employees had a better understanding of how to approach each other and how to interpret individual responses (Freiberg & Freiberg, 1996). Within a month after implementation, there was shown to be a drop in safety violations as observed by an independent consultant (Freiberg & Freiberg, 1996). In addition, Southwest Airlines prided itself on fostering a family and team culture. The employee classification system reinforced to the employees the airline's commitment to this value.

Personal injuries and equipment damage cost *Company X* millions of dollars each year[1]. Surprisingly, the dollar amounts only include the treatment of injuries and the cost of parts to make repairs to the equipment. The data has not included lost time from work, overtime wages to fix damaged equipment, or lost revenues because the company does not have a system to track these costs. This spending is not budgeted into a separate account, because the severity and number of accidents is not seen as predicable from year to year. However, now that *Company X* reports a drop in quarterly profits, efforts have been made to cut spending in several areas (Connor, 2001). The information regarding personal injuries and equipment damage obviously has the attention of high-level officers in the company and is seen as a target area to reduce spending. Efforts have been taken to find solutions to decrease the amount of personal injuries and equipment damage. This study, being one of those efforts, attempts to show that employees can accept new programs based on behavior changing strategies at this *Company X* station.

PROCEDURES

Performing research in an industrial setting posed certain challenges and had limitations not present in a laboratory or controlled setting. In this particular case, due to a limited number of observers, the observations were limited to only two of the thirteen aircraft offload teams. In addition, the study was conducted at only one *Company X* station. Although permission was granted to perform the study, *Company X* did reserve the right to monitor and/or control the release of the information generated by the study if deemed necessary.

The intent of this study was to determine in a high turnover environment, where high reliability was needed, whether the employees could successfully accept and utilize a simple visual classification system to provide awareness of the levels of skills and experience necessary for certain job activities.

Pre-test and post-test surveys were developed based on the information gathered during the initial focus groups. These surveys were pilot tested by a group of offload workers representing the various types of employees that would be involved in the observations. The workers who participated in the pilot test were not a part of the remainder of the study. Corrections were made to ensure the survey would accurately collect the desired information. Two offload teams under different managers were then classified by using three different color coded armband ID holders. This classification took place during a pre-work meeting held onsite in a pre-designated area. During this meeting, the pre-test survey was administered and the program explained to the employees. The workers then received the proper color armband for their predetermined skill and experience. Each color specified the types of specialized training the employee had completed. Red was used for newly hired employees, blue was given to employees qualified to operate equipment on the ramp, and

[1] *Company X has* deemed actual figures as proprietary and confidential, however they were made available to the researcher.

yellow was assigned to team heads[2]. All employees were required to wear an armband at work in order to show their FAA (Federal Aviation Administration) authorization to be on the flight ramp area. This made implementation very easy to accomplish. The researchers then, using an at-risk behavior checklist already developed for other university research[3] (Fought, 2000) observed the two "coded" work groups. After a period of four weeks, all employees in the observed work groups completed a post-test survey to gather information regarding the classification system trial. The post-test survey data was then compared to the pre-test survey data using a Statistica database. An ANOVA (analysis of variance) was performed on all questions in order to determine if there was a significant ($p>0.05$) relationship between the two sets of data (Sekaran, 2000). In addition, a t-test was performed because it was not known if the difference would be positive or negative (Sekaran, 2000). The open-ended questions were entered into the database exactly as written by the employees, and provided to the company for their review (preserving the employees' anonymity) on the training classification program trial. Evaluation, comparison, and statistical analysis of the observation data using an Access® based program (Lee, 2001) were also completed.

FINDINGS AND DISCUSSION

Upon completion of the training classification system and analysis of the data gathered, several findings were evident. With regard to the survey responses, the ANOVA test indicated there was no significant difference ($p>0.05$) between the answers given on the pre-test versus the answers given on the post-test. More specifically, the ANOVA compared five identical questions from the pre-test and post-test surveys and concluded the answers were the same. This indicated the employees accepted the training classification system. While the ANOVA test showed a slightly negative correlation among the tested questions, none of the correlations were significant, and therefore it may be concluded the surveys were not significantly different. In addition, two-tailed t-tests were performed on the five repeated questions; however a 5x5 factorial design induced an error rate, making this data unusable. The pre-test survey contained questions aimed at gaining the employees' perceptions and opinions on the use of a training classification system in their work environment. Most responses were positive and stated that a classification system would be accepted if implemented into policy. The written responses also provided valuable information about the system trial. Many employees reported the armbands made assignment of tasks easier and aided newer employees in the group. Several people also stated that if the armband system was incorporated across the station, it would make operation of a mixed work group (a temporary work group consisting of many employees from different areas) much easier because an employee's qualifications would be easily visible.

The observation data also supported the acceptance of the classification system.[4] A total of 36 individual observations were conducted throughout the course of the trial. Referring to Appendix A, a significant drop in the number of safety violations was noted. On the first night of observations, 37 safety violations were observed. Subsequent observations yielded violation numbers of 26, 21, 23, 10, 1, and 9 respectively. These numbers confirmed that a downward trend in respect to safety violations occurred during the observations. Another noted observation was the increase of safety topics brought up in pre-work meetings, as compared to the information gathered from the Safety Perception Survey.

As previously mentioned, several limitations occurred during the course of this study. The

[2] Colors were chosen based on availability from the armband vendor.

[3] Student observers had completed a standard training program for using the safety metrics package at Purdue University. This metric was successfully used at other major air carriers.

[4] Limitations such as safety audits, manager explanations of the program to employees, observer interactions with the work groups, and company memos may render this data unreliable.

practice of not using new hires on offload teams forced a change in the levels of training classifications in this study. Originally, red was to be used for new hires with no training, blue would be given to employees qualified to operate offload equipment, and yellow would be worn by team leads. In light of the changes, the following classification system was instead used: red was given to employees qualified to drive aircraft tugs, blue was given to fully qualified (tug and belt loader qualified) employees and yellow was worn by the team leads. Although the system was used differently from initially planned, the study was not affected by this change. The completion of an internal safety audit during the system trial period, which resulted in a memorandum instructing managers to "crack down" on safety violations, may have had an affect on the observation data. Extra emphasis given to the importance of "being safe" on the ramp was usually shown as a temporary increase in awareness from the employees. However, during the work operation, when the pressures of "getting the job done" were noticeable, the employees seemed to revert back to normal behaviors. Since the observations of this study focused only on the actual offloading of aircraft, a time when this reversion pressure was present, the effect of short term improvement was noted but believed to be minimal. Another factor that may have affected the study concerns the stability of the work groups. Several employees did not complete both the pre-test and post-test surveys. This fact may have lowered the reliability of the survey data. In order to minimize this effect, employees who entered the system trial after the kick off were briefed on the study, given the appropriate color armband, and had the opportunity to ask questions regarding the study. Finally, the interaction of the observers and the work groups may have affected the observation data. It was evident that some signs of the Hawthorne Effect existed during the study.

The Hawthorne Effect occurs when workers' job performance improves following the start of the researcher's intervention (Muchinsky, 1983). Muchinsky stated, "Performance continues to improve because of the novelty of the situation; e.g. the employees respond positively to the novel treatment they were getting from the researchers. Eventually, however, the novelty begins to wear off, and productivity levels return to their earlier level" (1983, 19). It is important to note, the drop in observed safety violations may be attributed to the attention given to the work groups.

However, perhaps because the observation trial in this study was only four weeks long, there were no signs of safety violations returning to the level noticed at the beginning of the trial. It was found that sometimes behavior changes were due just to a change in the environment. (Muchinsky, 1983). In this case, the observed employees were separated from the rest of the work environment by the different color armband colors and were made aware of the observers' presence. Throughout the course of the study, several employee participants involved in the study asked questions regarding what the observers were looking for. Giving this information to the employees may have altered the employees' behaviors.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this study, it is concluded that a training classification system can be accepted and supported by low commitment, high reliability organizations. For this station of *Company X*, it is recommended the training classification system be tested at the entire station level, and further research be conducted in an effort to validate the current study's findings, and to identify if the armbands could contribute to an increase in safety and/or productivity.

If the assumption is made that the acceptance of the training classification system could be validated station wide, the next logical recommendation would be to test the effects of the classification system on the entire work environment. Identifying the effects of the armbands may be tested by using additional work groups. Steps would have to be taken in order to reduce or eliminate the limitation of the current study. For example, implement the armband system and make no observations during the trial period, or make blind observations of the work groups, so the employees would have no knowledge they are being observed. Placing observers in the control tower, and scheduling the work groups only to gates where there would be an unobstructed view could accomplish these blind observations. It would, however, require cooperation from the scheduling center. This would reduce the possible problem with the Hawthorne Effect. It might also be helpful to try using the observations without the use of the armbands to see if the same results would occur. It would even be useful to try the classification system with a different part of the operations (i.e. arrivals or on loads) or at a different station at a different airport[5] to get a more representative opinion sample from the organization.

It is also recommended that questions be added to the survey to cover the topic of safety issues brought up in the pre-work meetings. It is unknown whether the information gathered regarding this subject during the Safety Perception Survey is accurate. The increase of safety issues in the pre-work meetings noted in the current study may have been caused by the presence of the observers. If this information is collected during a training classification system trial, this theory may be proved or disproved. Overall, the findings of the current study present a justifiable argument that the armband training classification program would be successfully accepted if implemented at *Company X*. It is speculated further that this system would work in any similar aerospace High Reliability/Low Commitment organization.

[5] *Company X* conducts operations worldwide and stations exist at numerous locations around the planet.

REFERENCES

Asch, S.E. (1995). Opinions and social pressure. *Scientific American*, 31, 193.

Connor, M. (2001, June 28). Corrected update 1- *Company X* quarterly profits drop 54 percent. Retrieved on July 2, 2001 from World Wide Web: Address not included to maintain *Company X*'s anonymity.

Endler, N.S. & Hartley, S. (1973). Relative competence, reinforcement and conformity. *European Journal of Social Psychology*, 3, 63.

Fought, C. (2000). [Safety metrics package]. Unpublished software.

Freiberg, K. & Freiburg, J. (1996). *Nuts! Southwest Airline's crazy recipe for business and personal success*. Austin, TX: Bard Press.

Geller, S.E. (2001). *The psychology of safety handbook* (2nd. Ed). Boca Raton, FL: Lewis Publishers.

Hess, T., Matteson, M., McNamara, K, & Thompson, R. (2000). [Safety perception survey at *Company X*]. Unpublished raw data.

Koepnick, W. (1993, October). Do safety incentive programs really work? Presented at the National Safety Council Congress and Exposition, Chicago, IL.

Krause, T.R. (1997). *The behavior-based safety processes: managing involvement for an injury-free culture* (2nd ed.). New York, NY; John Wiley & Sons.

Lee, K.G. (2001). [Safety observation metric]. Unpublished software.

McSween, T.E. (1995). *The values-based safety processes, improving your safety culture with a behavioral approach.* New York, NY; John Wiley & Sons.

Milgram, S. (1963). Behavioral studies of obedience. *Journal of Abnormal Psychology*, 67, 371.

Muchinsky, P.M. (1983). *Psychology applied to work: an introduction to industrial and organizational psychology*. Homewood, IL; The Dorsey Press.

Paige, C.W. (1998). Flight Deck Operations. Retrieved on June 19, 2001 from the World Wide Web: http://members.nbci.com/_XMCM/charlespage/17FLIGHTOPS.htm

Reason, J. (2000). *Managing the risks of organizational accidents.* Aldershot, England: Ashgate Publishing Limited.

Sekran, U. (2000). *Research methods for business* (3rd ed.). New York, NY: John Wiley & Sons.

APPENDIX A

Observation Raw Data

Safety Infraction	Date						
	16-May	22-May	24-May	29-May	31-May	4-Jun	12-Jun	**Totals**
Hearing protection	18	7	10	8	6	0	4	**53**
Improper lifting	10	6	5	6	3	0	0	**30**
Walking in between dollies when driver in tug	3	4	4	4	0	0	0	**15**
No honk before moving vehicle	5	5	2	0	0	0	0	**12**
Reckless behavior	0	2	0	0	1	0	5	**8**
No back belt used	0	2	0	2	0	0	0	**4**
Equipment not chocked properly	1	0	0	0	0	0	0	**1**
Cargo door not fully open before moving ladder	0	0	0	1	0	0	0	**1**
Dangerous goods mishandled	0	0	0	1	0	0	0	**1**
Cargo area not inspected	0	0	0	1	0	0	0	**1**
No safety net in place	0	0	0	0	0	1	0	**1**
Totals	**37**	**26**	**21**	**23**	**10**	**1**	**9**	**127**

Estimating Airline Employment: The Impact Of The 9-11 Terrorist Attacks

David A. NewMyer, Robert W. Kaps, and Nathan L. Yukna
Southern Illinois University Carbondale

ABSTRACT

In the calendar year prior to the terrorist attacks of September 11, 2001, U. S. Airlines employed 732,049 people according to the Bureau of Transportation Statistics [BTS] of the U. S. Department of Transportation (Bureau of Transportation Statistics, U. S. Department of Transportation [BTS], 2001). Since the 9-11 attacks there have been numerous press reports concerning airline layoffs, especially at the "traditional," long-time airlines such as American, Delta, Northwest, United and US Airways. BTS figures also show that there has been a drop in U. S. Airline employment when comparing the figures at the end of the calendar year 2000 (732,049 employees) to the figures at the end of calendar year 2002 (642,797 employees) the first full year following the terrorist attacks (BTS, 2003). This change from 2000 to 2002 represents a total reduction of 89,252 employees. However, prior research by NewMyer, Kaps and Owens (2003) indicates that BTS figures do not necessarily represent the complete airline industry employment picture. Therefore, one key purpose of this research was to examine the scope of the post 9-11 attack airline employment change in light of all available sources. This first portion of the research compared a number of different data sources for airline employment data. A second purpose of the study will be to provide airline industry employment totals for both 2000 and 2002, if different from the BTS figures, and report those. Finally, the third purpose of the study was to report any variations from the overall airline industry trend. A literature review was used to complete this study. Sources used in this study included government documents, government web resources, published articles, aviation industry publications and various non-government web resources such as airline websites. Among the key conclusions of the study were the following: (1) Paralleling earlier studies, it was found that the BTS data underreported the total U. S. airline employment total by at least 61,005 employees in 2000 and 61,359 employees in 2002; (2) Utilizing a combination of BTS and World Aviation Directory (Jackman, F., 2000 and 2002) airline employment data, it was found that U. S. airline employment totals dropped by 88,898 employees or 12.5% when comparing the 2000 data with the 2002 data; (3) Low cost carriers including AirTran, Frontier, JetBlue and Southwest combined to add 9,440 employees in the same 2000 to 2002 period, an addition of 25.4 percent.

INTRODUCTION

In the Fall of 2001 and into the Spring of 2002, the headlines carried by major news publications screamed "layoffs" throughout the airline industry. As of the beginning of 2004, airlines in general began to recover with some airlines beginning to hire again, albeit against the backdrop of conflict in the Middle East and rising fuel prices. It now seems timely to look back to examine the extent of the airline employment loss since the Fall of 2001. This paper will focus only on the airlines, leaving post-9/11 employment trends in other aviation segments such as aerospace manufacturing to be examined elsewhere.

The current research is an outgrowth of prior aviation employment research, particularly NewMyer, D. A., Kaps, R. W., and Owens, R. T. C. (2003, July) Airline Employment Trends in the USA Since 1978**.** *Proceedings of the Aviation Management Education and Research Conference* and NewMyer, D. A., and Owens, R. T. C. (2003, October) Aviation Employment in the U. S.: A Review of Data Sources in *Collegiate Aviation Review***.** Both of these documents identified the problem of the lack of a common, aviation industry-wide employment data source. Therefore, it is important for this paper to examine multiple sources of airline employment information to arrive at as accurate a depiction of airline employment data as possible.

This paper will present airline employment figures from the Air Transport Association (ATA), the United States Department of Labor and the Bureau of Transportation Statistics of the US Department of Transportation, both as a whole, and by category of airline (major, national, large regional and medium regional). Other sources will also be examined such as the World Aviation Directory and airline websites. A total airline employment estimate will then be created from the various sources for both 2000 and 2002. This will allow a pre-9/11 and post-9/11 comparison to be made. In examining the data, there will be comparisons drawn among known airline data sources and some general conclusions will be made related to the coverage of the various airline employment data sources and the impact of the 9/11 attacks on the estimated airline employment totals.

METHODOLOGY

This paper is based on a literature review with a focus on a range of data sources related to airline employment. World events affecting the aviation industry, the availability of new aviation employment data sources, and the advent of increased access to employment data from on-line sources prompted the current study. Included in the review of literature were articles published in such scholarly journals as *Collegiate Aviation Review* and *Journal of Aviation/Aerospace Education and Research*, as well as information obtained from aviation industry publications such as *Aviation Week and Space Technology* and the *World Aviation Directory*. Information was also obtained from various government agencies related to aviation such as the US Department of Labor and the Bureau of Transportation Statistics of the US Department of Transportation. In addition, information about airline employment was obtained from aviation industry associations such as the Air Transport Association of America.

It is also important to mention the timeliness and validity of the data reported in each of the sources to be used in this study. Various concerns about the available airline employment data were identified in the research conducted by NewMyer, Kaps and Owen (2003) and in the current research. These weaknesses include:

A. BTS data are reported only for those airlines who must report their employment data to the United States Department of Transportation. The non-reporting airlines are left out.

B. United States Department of Labor (USDOL) airline employment data is only available in an aggregate form and individual airline data are not available from USDOL.

C. Air Transport Association of America airline employment data are summaries of data provided for ATA member airlines only and are not inclusive of all airlines in the U. S. Also, ATA data are updated annually roughly parallel to the availability of data from the USDOT Form 41 reports that are also used by the BTS for their data. So, this source appears to duplicate the BTS data.

D. World Aviation Directory airline employment data are self-reported by each airline, are not mandated or regulated in any way, and are not necessarily updated by each airline in a timely fashion.

HISTORICAL TRENDS

Historical airline employment information from the years 1979 (deregulation took effect on October 24, 1978 and is assumed to not have an employment impact until 1979) to 2002 from the US Department of Transportation, Bureau of Transportation Statistics is presented in Table 1.

The key thing to note when reviewing the data in Table 1 is that, according to the US Department of Transportation, Bureau of Transportation Statistics, employment at major, national, and regional airlines has grown from 338,621 at the end of 1978 to 642,797 at the end of 2002. This is a near doubling (89.8%) of airline employees in the US in this period. It also represents an annual average airline employment growth rate of 4.05% per year.

When analyzing the data provided by the BTS, you can see a couple of interesting anomalies. There are definite dips in the overall airline employment information. For example, these declines occur in the years 1979 through 1983, 1990 to 1992 and, 2000 to 2002. Therefore, there has been at least one important economic or world event in the early part of each of these decades that has had a negative effect on airline employment.

Table 1. *Airline Employment by Year Since Deregulation, Included Is Major, National, Large And Medium Regional*

Year	**Employment**	**Year**	**Employment**
2002	642,797	1989	555,714
2001	653,488	1988	512,533
2000	732,049	1987	483,117
1999	725,660	1986	435,872
1998	696,202	1985	376,233
1997	656,243	1984	347,197
1996	634,866	1983	322.570
1995	600,315	1982	329,059
1994	585,427	1981	345,578
1993	577,761	1980	354,264
1992	569,005	1979	357,973
1991	566,973	1978	338,261
1990	588,926		

SOURCE: Bureau of Transportation Statistics, United States Department of Transportation, *Number of Employees-Certificated Carriers 1978-2002.* Retrieved April 4, 2004 from: http://www.bts.gov/oai/

One such possibility for negative impact would be an economic recession. According to Hall, Feldstein, Frankel, et. al (2003):

> *A recession is a significant decline in activity spread across the economy, lasting more than a few months, visible in industrial production, employment, real income, and wholesale-retail sales. A recession begins just after the economy reaches a peak of activity and ends as the economy reaches its trough. Between trough and peak, the economy is in an expansion. Expansion is the normal state of the economy; most recessions are brief and they have been rare in recent decades.*

This is particularly helpful when looking at some of the major events that have happened in the past twenty years. For example, when the recessions of the early 1980s and 1990 happened (Federal Aviation Administration, 2003, IV-4) it can be seen in Table 1 that airlines in general experienced a small contraction in employment during these same periods. It is interesting to note, however, that regional airlines experienced growth during the early 1990’s (BTS, 1992). The Gulf War is another example of a major event that affected airline employment.

According to Gulf War chronology (WGBH Boston, n.d.) the first attack against Iraq was on January 17, 1991. During 1991, the major and national air carriers were in a brief decline in regards to employment. As for large and medium regional carriers, this was a substantial growth year. For example, in 1991, medium regional carriers employed 612 and 8,162 for large regional air carriers (BTS, 1992). In 1992, the employees of these two carrier groups were 2,345 and 9,610, respectively (BTS, 1993). When analyzing this further you can see that the employment growth rate during the time of the Gulf War for the medium regional segment of the air carrier industry was 283.1%. For large regional air carriers the growth rate during the same period was 17.4%. (BTS, 1993). Therefore, the regional airline employment growth that many such airlines experienced during the early part of the current decade, in spite of the poor economy and negative world events, was paralleled in the early 1990's during similar difficult times.

US DEPARTMENT OF LABOR DATA

An authoritative source of information on employment in the U. S. is the United States Department of Labor (USDOL). The USDOL classifies industries using the Standard Industrial Classification (SIC). SIC Group 45 is "Transportation by Air." This group includes "establishments engaged in furnishing domestic and foreign transportation by air and also those operating airports and flying fields and furnishing terminal services." (Office of Management and Budget**,** 1987**,** p. 277) The Department of Labor has recently adopted a new classification system called the North American Industry Classification System or NAICS (United States Department of Labor [USDOL], 2004). The NAICS is described by USDOL as a "clean slate" revision of the system used to classify employment establishments by industry type. Unlike previous SIC revisions, the NAICS changes are fundamental changes in the categories. The notice making NAICS effective in the U. S. was issued in April 1997 and the first NAICS U. S. manual was published in mid-1998. (USDOL, 2004). While the NAICS is currently being implemented, the new classification system does not affect the statistics reported in this paper. The Department of Labor states that there were 1,251,430 people employed in the Transportation by Air group, SIC Code 45, as of March 1, 2003. (US Department of Labor, 2003). When collecting the data from the Department of Labor, either seasonal or non seasonal data can be used. The non seasonal adjustment numbers are reported here.

The SIC then narrows the "transportation by air" group further into sub-groups. For example, Major group 45 (Transportation by Air), Industry group Number 1, (451) is air transportation, scheduled, and air courier services. This group employs a total of 970,900 people. Another important subcategory of the 451 group is 4512 or 4513 (4512 is air transportation, scheduled). The 4512 industry group includes all companies that furnish air transportation over regular routes and on regular schedules. This industry classification includes air cargo carriers and air passenger carriers, (both must be scheduled). A total of 508,700 were employed in this group as of April 4, 2003 (USDOL, 2003).What is important to note about the USDOL data is that detailed information about categories of airlines (such as majors, nationals or regionals) is not available since the data are aggregated by industry and not company.

Table 2. *US Department Of Labor Employment Data for Industry Group 45: "Transportation By Air" (All Employees, Thousands)*

Year	Total	Air Transportation Scheduled and Air Courier Services	Air Transportation Scheduled*	2001 National Industry Specific Occupation & Wage Estimates (new)	
SIC (old)	45	451	4512	45	1,251,430
				451	1,062,490
2000	1,279.9	1,085.2	582.5	4512	Not Reported
2001	1,266.0	1,070.3	581.2	458	141,140
2002	1,161.4	970.9	508.7		

SOURCE: US Department of Labor, Bureau of Labor Statistics, 2003 * 4512 is a sub-category of 451.

ATA DATA

Air Transport Association of America (ATA), the association that represents larger airlines operating in North America (including Canada), made this statement in their 2002 Annual Report: "One of the unfortunate outcomes of the terrorist attacks is that most airlines had to reduce their workforces. Airlines initially announced layoffs and furloughs of roughly 100,000 employees." (Air Transport Association of American [ATA], 2003) Yet, these layoffs were not reflected in the ATA's own airline employment data. In 2000 this number was 625,739 and in 2002 this number was 601,356, reflecting a decline far less than 100,000 employees. (ATA, 2001 and 2003) It is important to note that ATA airline employment numbers only include employment for ATA member airlines and include no data for most cargo and regional airlines.

Table 3. *Air Transport Association Total Employees (Members)*

Year	Total
2002	601,356
2001	624,197
2000	625,739
1999	609,347
1998	575,536
1997	545,926

SOURCE: Air Transport Association Annual Reports (1998-2003).

BTS DATA

The airline employment data set consists of cargo carriers, and passenger carriers. There are four types of passenger carriers. These types are Major, National, Large Regional and Medium Regional. (See Table 4) The USDOT reporting requirements for airlines categorize them into the above categories based on annual gross revenues, with any airline at $1.0 billion or more in annual revenues being classified as a Major, with $100 million to $1.0 billion classified as a National while Large Regionals are at $10 million to $100 million and Medium Regionals are those below $10 million. (Wells, 1999)

Another difference in these types of air carriers is the type of airplane they operate (by aircraft seating capacity) and also if they report to the DOT on Form 41. Form 41 is a Department of Transportation form which air carriers that operate aircraft with over 60 seats must submit on a monthly basis.

Table 4. *Bureau of Transportation Statistics By Group*

Year	1998	1999	2000	2001	2002
Majors	623,389	650,267	672,294	607,857	585,890
Nationals	59,414	66,368	56,056	41,865	52,470
Large Regional	11,471	6,687	2,177	2,426	3,285
Medium Reg.	1,928	2,338	1,522	1,340	1,152
Total	696,202	725,660	732,049	653,488	642,797

SOURCE: US Department of Transportation, Bureau of Transportation Statistics, *Number of employees-Certificated carriers 1998-2002.* Retrieved April 4, 2004 from http://www.bts.gov/oai/

The data that is collected is both financial and operational and is reported to the Bureau of Transportation Statistics (BTS). Form 298 (c) is the same as Form 41 except it is for air carriers operating under Part 135 and that have aircraft with 10 seats or less and this data is reported to BTS on a quarterly basis. (Federal Aviation Administration, 2003, p. IV-1)

The recent trends the BTS data depicted in Table 4 show us that all of the airlines categories have declined in employment when comparing 2000 and 2002 figures. However, two categories of 2002 data, nationals and large regionals, had already started to rebound from 2001 figures while majors and medium regionals continued to drop in 2002. This is a bit misleading due to the fact that several airlines have been known to grow to the point where they have "jumped" from one category to another. What was particularly confusing, however, is that the number of regional airlines actually reporting employment data to BTS has dropped from a total of eighteen large regionals that reported to the DOT in 1997 to ten large regionals reporting in 2001. This segment has seen its employment total, as reported in Table 4, dropped from 11,471 to 3,285 (-71.4%). This shows that there is a problem with the employment reporting aspect of large regional air carriers. As for medium regionals, the past five year trend line in employment for this segment is -40.2%. This is partially due to the fact that there were sixteen carriers reporting in 1999 and now there are eleven. Once again, this shows the disparity of which carriers report and how they report their information to the BTS. Comparing the figures shown in Table 4, it can be seen that the majors and national groups have seen varying declines in employment in the past five years. The majors reached a peak of 672,294 in 2000 and dropped by 86,404 jobs by 2002, or a drop of 12.9 percent. The nationals reached their peak in 1999 at 66,368 and declined to 41,865 (-36.9%) but rebounded to 52,470 by 2002(-20.9%).

WORLD AVIATION DIRECTORY (WAD) DATA

The Summer 2004 Edition *World Aviation Directory* (Jackman, F. [Ed]) data show what a problem there is in collecting accurate employment data. When analyzing the BTS data, it was obvious that there were some key carriers that had not reported their data to BTS and that regional airlines fluctuated widely in reporting employment data. The procedure used to verify the BTS data was to simply collect airline employment data from the *World Aviation Directory* by cross checking the BTS data by airline with the employment information contained in the airline employment listings in the WAD. Any airline not reported in the BTS data was recorded along with their employment number. A key characteristic of the WAD is that it is a voluntary, (not regulated), secondary source data set. That is, the WAD airline employment data are not necessarily updated regularly by each airline. The *World Aviation Directory* is a commercially published document with no government regulatory authority supporting it (as is the case with BTS data). This collection of data (See Table 5) showed that there were approximately 65 companies that were not reporting their statistics to the BTS. These companies accounted for a total of 57,348 employees at companies classified as major, national, large regional and medium regional airlines. This is a total of 10.07% of the total airline employment represented in BTS figures. Also, some of the companies listed in the WAD figures are quite small, or, may be non-existent. But, the key thing is that the BTS figures are missing sizeable employment numbers from companies that are not listed as reporting these data to BTS. For example, if one adds the WAD figure from Table 5 (57,348) to the BTS figure for 2002 (642,797), the US airline employment total is 700,145.

ANALYSIS

The Airline Transport Association of America says that during the 50 day Gulf War there were 25,000 jobs eliminated and the industry lost $13 Billion. (ATA, 2003a). ATA has estimated that since 9/11 there has been $18 billion lost, and 100,000 job losses (ATA, 2003a and 2003b). There has been a loss of over 460,000 jobs since 9/11 in Tourism and Travel (ATA 2003a). In February 2003 airline fuel prices reached $1.20 per gallon, representing a 108% increase over the previous year. Bookings for domestic travel are down more than 20%, Atlantic down 40%, Latin more than 15% and Pacific more than 30%. (This was before SARS). (ATA, 2003a)

The composite airline employment data compiled in this paper show a slightly more optimistic picture of airline employment since the 9/11 attacks than what the ATA describes. For example, combining the BTS data for the end of calendar year 2000 with the World Aviation Directory data for the Spring of 2001 (Appendix 1) gives an immediate pre-9/11 attack airline employment figure of 793,054 employees. This number is composed of 756,150 employees at major and national airlines and 36,904 at regional airlines. Using the BTS/WAD combination to compile end of 2002 figures (Appendix 2), the total employment figure is 704,156, or a drop of 88,898 employees (somewhat less than the 100,000 mentioned by ATA and other sources) in two years. This represents an 11.2% drop in overall airline industry employment. What is interesting is that the majors and nationals together dropped by 94,379 employees to 661,771 employees (-12.5%) but the regional airlines figures INCREASED by 5,481 to a total of 42,385 (an increase of 14.9 %). Table 6 summarizes the 2000-2002 changes.

As can be seen in the table above, the four low cost airlines depicted added a total of 9,440 employees in the 2000 to 2002 period, or a total increase of 25.4% within these four carriers. Of course, these airlines are not global carriers and are not subject to many of the pressures that the major airlines face with regard to things like the SARS crisis. However, it is still key to point out that not all airline industry segments suffered a downturn in employment in the post-9/11 period. Another bright spot in the figures are the employment data for so-called “low cost airlines” as shown in Table 7

Table 5. *Major and National Airlines According To 2004 WAD*

Air Carrier	Employment	Sales Number	Type
ABX Air Inc.	7,400	3,074,252	Cargo
Atlas Air, Inc.	1,600	NO SALES #	Scheduled & Cargo
BAX Global	10,100	1,900,000,000	Cargo
Express One Intl.	300	100,000,000	Charter Cargo
Total	**19,400**		
Regional Airlines According to WAD			
Air Cargo Carriers, Inc.	140	17,000,000	Scheduled and Cargo
Air Midwest, Inc.	225	NO SALES #	Scheduled and Cargo
Air Sunshine, Inc.		NO #	Scheduled & Charter
Airline of the Virgin Islands	40	NO SALES #	Scheduled & Charter
Alaska Central Express	60	NO SALES #	Cargo
Alaska Juneau		NO #	
Aeronautics	70	NO SALES #	Scheduled & Cargo
Alaska Seaplane		NO #	
Services, LLC	7	NO SALES #	Scheduled
*Allegheny Airlines, Inc.	1,650	NO SALES #	Scheduled & Cargo
Aloha IslandAir, Inc.	260	NO SALES #	Scheduled & Charter
Ameriflight Inc.	650	65,000,000	Scheduled & Cargo
Arctic Circle Air Service, Inc.	40	8,000,000	Scheduled & Cargo
Arctic Transportation Services	65	NO SALES #	Domestic & Intl.
Aruba Intl. Airways	120	82,000,000	Scheduled
Astral Aviation Inc.	400	289,940,000	Scheduled & Charter
**Atlantic Coast Airlines	3,000	2,100,000	Scheduled & Cargo
Atlantic Airlines, Inc.	17	2,500,000	Cargo
Atlantis Airways	15	13,000,000	Scheduled & Charter
AVI Inc.	100	NO SALES #	Scheduled & Charter
Aviation Services Ltd.	90	NO SALES #	Scheduled & Cargo
Baker Aviation Inc.	34	NO SALES #	Scheduled & Cargo
Bellair, Inc.	15	NO SALES #	Scheduled & Cargo
Bemidji Aviation Services Inc		NO #	Scheduled & Charter
Bering Air, Inc.	85	9,000,000	Scheduled & Charter
Big Sky Airlines	245	26,800,000	Scheduled & Cargo
Cape Smyth Air Service, Inc.	105	12,000,000	Scheduled & Cargo
Casino Express, Inc.	128	22,000,000	Scheduled & Cargo
CCAir, Inc.	420	70,000,000	Scheduled & Cargo
Chalks Ocean Airways	45	NO SALES #	Scheduled & Charter
Challenge Air Cargo	800	131,500,000	Scheduled Seaplane
Chautauqua Airlines, Inc.	1,350	240,000,000	Cargo
Chicago Express Airlines, Inc.	680	35,000,000	Scheduled & Charter
Coastal Air Transport	7	500,000	Scheduled & Charter
Colgan Air, Inc.	200	19,000,000	Scheduled & Cargo
Comair Inc.		NO #	Scheduled
Commutair	340	85,000,000	Scheduled & Charter
Corporate Airlines, Inc.	287	NO SALES #	Scheduled & Cargo
East Coast Aviation Services	43	15,000,000	Scheduled

Empire Airlines, Inc.	185	18,000,000	Scheduled
Era Aviation	1,024	NO SALES #	Scheduled & Charter
Express Airlines I	2,300	NO SALES #	Cargo
Express Jet Airlines	5,500	980,500,000	Scheduled & Charter
Florida West Intl.Airways, Inc	90	125,000,000	Scheduled & Charter
40 Mile Air	25	NO SALES #	Scheduled & Charter
Frontier Flying Service, Inc.	95	7,000,000	Cargo
Grand Canyon Airlines, Inc.	50	5,000,000	Scheduled & Cargo
Great Lakes Airlines	900	132,000,000	Scheduled & Cargo
Gulf & Caribbean Cargo, Inc.	15	NO SALES #	Scheduled & Charter
Gulfstream Intl. Airlines, Inc.	550	100,000,000	Scheduled & Charter
Hooters Air		NO #	Scheduled & Cargo
Hyannis Air Service, Inc.	500	NO SALES #	Scheduled
Island Airlines, Inc	75	NO SALES #	Scheduled & Charter
Island Express Airlines	33	NO SALES #	Scheduled
Jim Air, Inc.	8	NO SALES #	Scheduled
Kenmore Air Harbor, Inc.	65	1,000,000	Scheduled & Cargo
Ketchikan Air Service, Inc.	3	10,000,000	Scheduled & Charter
LAB Flying Services, Inc.	75	NO SALES #	Scheduled & Charter
Laker Airways (Bahamas) Ltd.	86	NO SALES #	Scheduled & Charter
Larry’s Flying Service, Inc.	60	4,600,000	Scheduled & Charter
M&N Aviation, Inc.	30	NO SALES #	Scheduled & Charter
Mesa Airlines, Inc.	4,000	NO SALES #	Scheduled & Cargo
New England Airlines, Inc.	15	2,300,000	Scheduled
Olson Air Service, Inc.	19	7,000,000	Scheduled & Charter
Ozark Air Lines	70	5,000,000	Scheduled & Charter
Pacific Wings	55	NO SALES #	Scheduled
Peninsula Airways, Inc.	350	NO SALES #	Scheduled & Charter
Piedmont Airlines, Inc.	1,750	NO SALES #	Scheduled & Cargo
ProAir, Inc.	400	NO SALES #	Scheduled & Cargo
PSA Airlines, Inc.	1,670	NO SALES #	Scheduled
Salmon Air	12	1,700,000	Scheduled
Skagway Air Service, Inc.		NO #	Scheduled & Charter
SkyWest Airlines	5,772	774,218,000	Scheduled
Suburban Air Freight, Inc.		NO #	Scheduled
Sunshine Airlines, Inc.	30	5,200,000	Cargo
Tanana Air Service	18	1,500,000	Scheduled & Charter
Trans North Aviation, Ltd.	20	3,000,000	Scheduled
Vieques Air Link, Inc.	53	NO SALES #	Scheduled & Charter
Virgin Air	11	NO SALES #	Scheduled
Warbelow’s Air Ventures, Inc.	65	6,500,000	Scheduled & Charter
West Isle Air	26	1,200,000	Cargo
Wright Air Service Inc.	30	NO SALES #	Scheduled & Charter
Yute Air Alaska Inc.	180	22,000,000	Scheduled & Charter
2004 Regional Airline Total	**37,948**		
2004 Major and National Total	**19,400**		
Overall 2004 Total	**57,348**		

Source: Jackman, F (Ed.) (2004), World Aviation Directory, Summer, 2004 Edition

Table 6. *Airline Change From 2000 To 2002*

	Major& National	Regional	Total
2000	756,150	36,904	793,054
2002	661,771	42,385	704,156
Change	-94,379	+5,481	88,898

Source: Bureau of Transportation Statistics and World Aviation Directory

Table 7. *Employment at "Low Cost" Airlines, 2000-2002*

	AirTran	Frontier	JetBlue	Southwest	Total
2000	4,035	2,317	1,158	29,688	37,198
2002	4,919	3,620	4,011*	34,088	46,638
Change	+889	+1303	+2,853	+4,400	9,440

*From JetBlue Airways 2003 annual report (no BTS figure reported).
All other figures: Bureau of Transportation Statistics

CONCLUSION

This research further verifies that airline employment data sources vary widely in terms of their coverage and total reported numbers. For example, airline employment numbers from the Air Transport Association of America and the Bureau of Transportation Statistics do not cover the regional airline portion of the airline industry. In the case of ATA, the reason is obvious: The ATA membership is all that is included in their employment data. In the case of BTS, the numbers are shown only for those airlines required to report data to BTS via Forms 41 or 298. In the instance of US Department of Labor data, it is difficult to determine what is included and what is not since detailed, airline-by-airline data are not published. Turning to the World Aviation Directory, it is possible to obtain an estimate of airline employment data for any airline not reported in the BTS or ATA data, but which might be listed in the WAD. In fact, using the data from the World Aviation Directory, it is clear that the employment levels in all airline categories are currently underreported in the available industry sources. Most important is that the regional airline employment figure is grossly underreported in BTS data according to what was discovered in WAD literature review. Therefore, using the comprehensive, combined picture created by the BTS and the WAD data, one can reach a more complete and inclusive view of U. S. airline employment data. Any such combination of data sources must recognize the previously-stated limits of airline employment data sources, particularly the concerns about the reliability of the self-reported data contained in the *World Aviation Directory* airline employment figures. On the other hand, there is no comprehensive source of airline employment data that contains the figures of Form 41 and 298 reporting airlines and those of the airlines who do not report their employment data via these forms. Until that happens, such combinations of data sources will have to be used by researchers to reach an industry-wide view of airline employment numbers.

With regard to the impacts of the 9/11 attacks, the data revealed that the employment impacts fell heaviest on the major and national airlines. The 2000 to 2002 change in employment was a decline of -12.5% for this segment. On the other hand, large and medium regional airlines grew by 14.9% and low cost airlines grew by 25.4% in the same period. While there is some good news in these data, the good news only applies to approximately ten percent of the industry working in the regional airlines and low cost carriers. The rest of the industry, as depicted by these data, is still suffering from a large decline in employment that occurred in a short period of time. As implied earlier, there have been large downturns in the airline industry and its employment in the past. Some have been as large or larger than the post-9/11 reductions in terms of total percentage change. But, a drop of over 88,000 employees (-11.2%) in two years is still significant and will take a number of years to reverse.

RECOMMENDATIONS

As the researchers completed the work on this literature review, there were a number of recommendations for further research, analysis and industry practice that were uncovered:

1. With regard to airline employment data:

A. The Bureau of Transportation Statistics is encouraged to conduct a special study of airline employment data with these two goals in mind

(1) To arrive at a total airline industry employment number endorsed by the federal government that represents the entire industry; and,

(2) In the process of conducting this study, identify a "painless" method of airline employment data reporting for those cargo and regional airlines not now reporting their employment data to BTS.

B. Further research needs to be conducted into the number of people working in the air cargo and regional airline segments of the airline industry.

2. With regard to the uses of a comprehensive set of airline employment data:

A. A better understanding of the economic impact of the airline industry will be achieved if we all know just how big the industry is, how widespread it is, and how many employees there are in the industry; and,

B. Universities, colleges and aviation training companies that are in the business of preparing future aviators need to have a clear understanding of the breadth of the airline industry and its employment needs. A comprehensive set of airline employment data, particularly one that clearly depicts where regional airline jobs are located (since regionals can provide key entry-level airline employment) would be very useful in their efforts.

REFERENCE LIST

Airports Council International – North America (2002). *The economic impact of U.S. airports 2002.* Retrieved January 22, 2003, from http://www.aci-na.org.

Air Transport Association of America, Inc. (2001). *2000 Annual report.* Washington, DC: Air Transport Association

Air Transport Association of America, Inc. (2002). *2001 Annual report.* Washington, DC: Air Transport Association

Air Transport Association of America, Inc. (2003a). *Airlines in crisis: The perfect economic storm.* Washington, DC, Air Transport Association

Air Transport Association of America, Inc. (2003b). *Airlines seeing war impacts.* Retrieved on April 22, 2003 from http://www.airlines.org/

Air Transport Association of America, Inc. (2003c). *2002 Annual report.* Washington, DC: Air Transport Association

Air Transport Association of America, Inc. (2004). *2003 Annual report .Retrieved* April 24, 2004, from: http://www.airlines.org/econ/econ.aspx

Avjobs.com. (2003, May). The airline industry. *Avjobs.com. R*etrieved May 7, 2003, from: http://www.avjobs.com/careers/industry.asp

Bureau of Transportation Statistics, U. S. Department of Transportation (1979-2003). *Number of employees-Certificated carriers, 1978-2002* Retrieved April 4, 2004 from: http://www.bts.gov/oai/

Bureau of Transportation Statistics, U. S. Department of Transportation (1992). *Number of employees-Certificated carriers, 1991* Retrieved April 4, 2004 from: http://www.bts.gov/oai/employees/1991emp.html

Bureau of Transportation Statistics, U. S. Department of Transportation (1993). *Number of employees-Certificated carriers, 1992* Retrieved April 4, 2004 from: http://www.bts.gov/oai/employees/1992emp.html

Bureau of Transportation Statistics, U. S. Department of Transportation (1999). *Number of employees-Certificated carriers, 1998* Retrieved April 4, 2004 from: http://www.bts.gov/oai/employees/1998emp.html

Bureau of Transportation Statistics, U. S. Department of Transportation (2000). *Number of employees-Certificated carriers, 1999* Retrieved April 4, 2004 from: http://www.bts.gov/oai/employees/1999emp.html

Bureau of Transportation Statistics, U. S. Department of Transportation (2001). *Number of employees-Certificated carriers, 2000.* Retrieved April 4, 2004 from: http://www.bts.gov/oai/employees/2000emp.html

Bureau of Transportation Statistics, U. S. Department of Transportation (2002). *Number of employees-Certificated carriers 2001*. Retrieved February 5, 2003 from: http://www.bts.gov/oai/employees/2001emp.html

Bureau of Transportation Statistics, U. S. Department of Transportation (2003). *Number of employees-Certificated carriers, 2002* Retrieved April 4, 2004 from: http://www.bts.gov/oai/employees/2002emp.html

Federal Aviation Administration. (2003). *FAA aerospace forecasts 2003-2014.* Washington, DC: U.S. Government Printing Office.

Hall, R., Feldstein, M., Frankel, J., Gordon, R., Romer, C., Romer, D., et.al. (2003, April 10). *The NBER's recession dating procedure*. Retrieved May 7, 2003, from: http://www.nber.org/cycles/recessions.html

Hughes, D., Fiorino, & F., Dennis, W. (2003). Airlines feel winds of war as financial storm rages [Electronic Version]. *Aviation Week & Space Technology.* Retrieved May 7, 2003, from,: http://www.aviationnow.com/avnow/new/channel_awst_story

Jackman, F. (Ed). World aviation directory. (Spring / Summer2001). Major/national/regional air carrier data, Sec. A1. Washington DC, McGraw-Hill.

Jackman, F. (Ed). World aviation directory. (Fall 2002/ Winter2003). Major/national/regional air carrier data, Sec. A1. Washington DC, McGraw-Hill.

Jackman, F. (Ed). World aviation directory. (Summer2004). Major/national/regional air carrier data, Sec. A1. Washington DC, McGraw-Hill.

JetBlue Airways (2003). *Annual report.* Retrieved April 28, 2004 from: http://investor.jetblue.com/ireye/ir_site.zhtml?ticker=jblu&script=1700

National Air Transport Association. (2000). *Aviation businesses and the services they provide*. Alexandria, VA.

NewMyer, D. A., Kaps, R. W. & Owen, R. T. C (2003, July). Airline employment trends in the USA since 1978. *Proceedings of the Aviation Management Education and Research Conference,* Montreal: Concordia University, published on CDROM.

NewMyer, D. A., Kaps, R. W., & Sharp, S. E. (1997, Spring). Aviation industry employment data estimates revisited. *Journal of Aviation/Aerospace Education and Research* 7, 3, Daytona Beach: Embry Riddle Aeronautical University

NewMyer, D.A, Owen, R.T., (2003). Aviation employment in the US: A review of data sources *Collegiate Aviation Review* 21, 1.

Office of Management and Budget. (1987). *Standard industrial classification manual*. Office of Management and Budget. (NTIS No. PB 87-100012).

Southwest Airlines (2003). *Annual report.* Retrieved May 12, 2003 from: www.iflyswa.com/investor_relations/ar2002.html

United States Department of Labor. (2001). *2001 Bureau of labor statistics occupational employment statistics*. Retrieved March 17, 2004, from: http://www.bls.gov/oes/2001.oesi3_458.htm.

United States Department of Labor. (2002). *2002 Bureau of labor statistics occupational employment statistics*. Retrieved March 16, 2004, from: http://www.bls.gov/oes/2002/oes530000.htm

United States Department of Labor. (2003). *2003 Bureau of labor statistics for industry* Retrieved April 4, 2004, from: http://www.bls.gov/.

United States Department of Labor (2004). *North American industry classification system (NAICS)* Retrieved July 18, 2004 from http://www.bls.gov/bls/naics.htm

U.S. Department of Transportation. (1998). *How to become a certified carrier.* Washington, DC: Air Carrier Fitness Division.

Wells, A. T. (1999). *Air transportation: A management perspective (4th ed.).* Belmont, CA: Wadsworth Publishing Company.

WGBH Boston (n.d.). *Frontline: The gulf war: Chronology.* (n.d). Retrieved May 7, 2003, from: http://www.pbs.org/wgbh/pages/frontline/gulf/cron/

Yergin, D., Vietor, R.K., Evans, P.C., (2000, November). *Fettered flight: Globalization and the airline industry.* Washington DC: Air Transport Association.

APPENDIX A

Pre 9/11 Attacks
US Airline Employment Data

Major and National Airlines

Air Carrier	Full-time	Part-Time	Total
ABX AIR Inc			7900
Air Transport	622	28	650
Air Wisconsin	2,551	310	2,861
Airtran	3,622	413	4,035
Alaska	9,112	1,221	10,333
Aloha	1,762	1,050	2,812
America West	10,992	2,809	13,801
American	86,663	14,536	101,199
American Eagle	8,189	1,235	9,424
American Trans Air	7,018	953	7,971
Arrow	1,318	25	1,343
Atlantic Southeast			
Atlas Air			
BAX Global			9900
Challenge Air Cargo	33		33
Continental	36,156	9,788	45,944
Continental Express	4,205	492	4,697
Continental Micronesia	1,148	419	1,567
Delta	66,758	13,632	80,390
DHL Airways			10000
Emery	3,938	1,091	5,029
Evergreen	475	29	504
Executive	1,103	372	1,475
Express One	492	71	563
Federal Express	93,073	53,371	146,444
Frontier	1,847	470	2,317
Gemini	591		591
Hawaiian	2,874	561	3,435
Horizon	3,517	625	4,142
Jet Blue	833	325	1,158
Kitty Hawk Air Cargo	796		796
Legend			
Mesaba	2,615	760	3,375
Midway	1,524	688	2,212
Midwest Express	2,534	651	3,185
National	1,156	215	1,371
Northwest	50,341	3,548	53,889
Polar Air	765		765
Ryan	1,260	17	1,277
Southwest	28,860	828	29,688
Spirit	1,574	337	1,911
Sun Country			
Trans States	1,273	200	1,473

Trans World	18,835	1,301	20,136
United	90,398	11,416	101,814
United Parcel	5,231	197	5,428
USA Jet	530	14	544
USAIR	41,708	4,125	45,833
Vanguard	804	108	912
World Airways	950	73	1,023
Total Major & Nationals	**600,046**	**128,304**	**756,150**

Regional Airlines

Air Carrier	Full-time	Part-time	Total
40 Mile Air			25
Air Cargo Carriers Inc			140
Air Midwest Inc			225
Air Sunshine			
Airlines, Inc.			280
Airlines, Inc.			50
Airlines, Inc.			769
Airways, Inc.			90
Alaska Central Express			87
Alaska Juneau Aeronutics			70
Alaska Seaplane Sevices			7
Allegiany	42	6	48
Aloha IslandAir			260
Ameriflight			650
Amerijet			
Ameristar			
Arctic Circle Air Sevice			40
Arctic Transportation Service			65
Aruba Intl. Airways			120
Asia Pacific	22	12	34
Astral Aviation Inc.			400
Atlantic Airlines, Inc.			17
Atlantic Coast Airlines			3000
Atlantic Coast Jet			300
Atlantic World Airlines			17
Austin Express			130
AVI Inc.			100
Aviation Services Ltd.			90
Baker Aviation Inc.			34
Bellair, Inc.			15
Bemidji Aviation			
Bering Air, Inc.			85
Big Sky Airlines			240
Business Express			1200
California Coastal Airways			
Cape Smyth Air			
Capital Cargo	217		217
Cargo, Inc.			15
Casino Express	134		134
CCAir, Inc.			720

Chalks Ocean Airways			45
Challenge Air Cargo			800
Champion Air	466	40	506
Chautauqua Airlines, Inc.			700
Chicago Express			
Coastal Air Transport			7
Colgan Air, Inc.			200
Comair Inc.			4500
Commutair			340
Corporate Airlines, Inc.			287
Custom Air	61		61
East Coast Aviation			
Empire Airlines, Inc.			160
Era Aviation			1,446
Express Airlines I			1,400
Expressnet	183		183
Falcon	185	12	197
Florida West	66	2	68
Florida West Intl.			
Frontier Flying			
Grand Canyon			
Great Lakes Airlines			1250
Gulf & Caribbean			
Gulfstream Intl.			
Haines Airways			40
Hyannis Air Service, Inc.			350
Island Airlines, Inc			75
Island Express Airlines			33
Jim Air, Inc.			8
Kenmore Air Harbor, Inc.			65
Ketchikan Air Service, Inc.			3
LAB Flying Services, Inc.			75
Larry's Flying			
Lynden	127	11	138
M&N Aviation, Inc.			30
Mesa Airlines, Inc.			1,450
Miami Air			
National Air Express			50
National Airlines			1,100
New England Airlines, Inc.			15
North American	245	38	283
Northern Air Cargo	247	14	261
Olson Air Service, Inc.			19
Ozark Air Lines			70
Pace			
Pacific Island Aviation			108
Pacific Wings			55
Pan Am	550		550
Peninsula Airways, Inc.			350
Piedmont Airlines, Inc.			1,750

Planet	84		84
ProAir, Inc.			400
PSA Airlines, Inc.			1197
Redwing Airways			7
Reeve	79	10	89
Reliant	110	3	113
Salmon Air			12
Service, Inc.			105
Service, Inc.			95
Service, Inc.			60
Services Inc.			
Services Ltd.			
Sierra Pacific	30		30
Skagway Air Service, Inc.			
SkyWest Airlines			3600
Southcentreal Air			28
Southeast			
Southern Air			
Suburban Air Freight, Inc.			
Sun Country			1200
Sun Pacific	32	2	34
Sun World	69		69
Sunshine Airlines, Inc.			30
Tanana Air Service			18
Tatonduk	190	31	221
Tradewinds	177		177
Trans Air			61
Trans Air Link	16		16
Trans North Aviation, Ltd.			20
Ventures, Inc.			50
Vieques Air Link, Inc.			53
Virgin Air			11
Warbelow's Air			
West Isle Air			26
Wright Air Service Inc.			30
Yute Air Alaska Inc.			180
Zantop	129	57	186
Total Regionals	**3,461**	**238**	**36,904**
Total Majors and Nationals	**600,046**	**128,304**	**756,150**
Total Carriers	**603,507**	**128,542**	**793,054**

SOURCE: Jackman, F. (Ed.) *World Aviation Directory* (Spring/Summer 2001)

APPENDIX B

Post 9/11 Attacks
US Airline Employment Data

Major and National

Air Carrier	Full-time	Part-time	Total
ABX Air Inc.			7,900
Air Transport	560	26	586
Air Wisconsin	2,837	288	3,125
Airtran	4,500	419	4,919
AirTran Airways			4,000
Alaska	9,521	1,302	10,823
Aloha	1,755	996	2,751
America West	10,285	2,585	12,870
American	88,256	13,857	102,113
American Eagle	7,349	1,016	8,365
American Trans Air	6,477	354	6,831
Arrow	1,000	30	1,030
Atlantic Southeast	4,907	349	5,256
Atlas Air, Inc.			1,600
BAX Global			9,900
Centurion (Challenge Air)	59	1	60
Champion Air	602	179	781
Comair	4,765	614	5,379
Continental	32,095	8,149	40,244
Continental Micronesia	946	412	1,358
Delta	60,002	8,701	68,703
DHL Airways	920	16	936
Evergreen Intl.			550
Executive	1,801	545	2,346
Express One Intl.			300
Federal Express	92,003	47,339	139,342
Frontier	3,020	600	3,620
Gemini	471		471
Hawaiian	2,719	504	3,223
Horizon	3,131	556	3,687
Jet Blue			
Kitty Hawk Air Cargo	271		271
Mesaba	2,644	802	3,446
Midway (US Air Express)	41		41
Midwest Express	2,137	547	2,684
National			
Northwest	42,463	1,898	44,361
Polar Air	699	68	767
Ryan	833	7	840
Southwest	33,322	766	34,088
Spirit	2,199	380	2,579
Sun Country			
Trans States	1,083	128	1,211

United	73,495	6,917	80,412
United Parcel	5,782	251	6,033
USA Jet			
USAIR	28,612	3,093	31,705
Vanguard			
World Airways	1,000	103	1,103
Total Major and Nationals	**534,562**	**103,798**	**662,610**

Regional Airlines According to WAD and BTS

Atlantic Coast Airlines**			3,000
Allegheny Airlines, Inc*.			1,650
40 Mile Air			25
Aeronautics			70
Air Cargo Carriers, Inc.			140
Air Midwest, Inc.			225
Air Sunshine, Inc.			
Airline of the Virgin			
Alaska Central Express			87
Alaska Juneau			
Alaska Seaplane			
Allegiant	133		133
Aloha IslandAir, Inc.			260
Ameriflight Inc.			650
Amerijet	392	11	403
Ameristar	22		22
Arctic Circle Air Services			40
Arctic Transportation Services			65
Aruba Intl. Airways			120
Asia Pacific	35	6	41
Astral Aviation Inc.			400
Atlantic World Airways			17
Atlantis Airways			15
Austin Express			130
AVI Inc.			100
Aviation Services Ltd.			90
Baker Aviation Inc.			34
Bellair, Inc.			15
Bemidji Aviation Services Inc.			
Bering Air, Inc.			85
Big Sky Airlines			240
Business Express, Inc.			1,200
California Coastal Airways			27
Cape Smyth Air			
Cape Smyth Air Service, Inc.			105
Capital Cargo	181		181
Casino Express	115	8	123
Casino Express, Inc.			102
CCAIr, Inc.			420
Chalks Ocean Airways			45

Challenge Air Cargo			800
Chautauqua Airlines, Inc.			1,350
Chicago Express Airlines, Inc.			450
Coastal Air Transport			7
Colgan Air, Inc.			200
Comair Inc.			4,500
Commutair			340
Continental Express			5,100
Corporate Airlines, Inc.			287
Custom Air	96	1	97
East Coast Aviation			
East Coast Aviation Services Ltd.			43
Empire Airlines, Inc.			176
Era Aviation			1,024
Express Airlines I			2,300
Expressnet	244	47	291
Falcon	320	3	323
Florida West	63		63
Florida West Intl. Airways, Inc.			90
Frontier Flying Service, Inc.			95
Grand Canyon			
Grand Canyon Airlines, Inc.			50
Great Lakes Airlines			1,250
Gulf & Caribbean Cargo, Inc.			15
Gulfstream Intl.			
Gulfstream Intl. Airlines, Inc.			769
Hyannis Air Service, Inc.			500
Island Express Airlines			33
Islands, Ltd.			40
Jim Air, Inc.			8
Kalitta Air	246	12	258
Kenmore Air Harbor, Inc.			65
Ketchikan Air Service, Inc.			3
LAB Flying Services, Inc.			75
Laker Airways			
Laker Airways (Bahamas) Ltd.			
Larry’s Flying			
Larry’s Flying Service, Inc.			60
Legend Airlines, Inc.			430
Lynden	128	7	135
M&N Aviation, Inc.			30
Mesa Airlines, Inc.			1,450
Miami Air			0
Midway Airlines Corp.			1,000
New England Airlines, Inc.			15
North American			0
Northern Air Cargo	250	11	261
Olson Air Service, Inc.			19
Omni	438	5	443
Ozark Air Lines			70

Pace	284	38	322
Pacific Island Aviation, Inc.			108
Pacific Wings			55
Pan Am	250		250
Peninsula Airways, Inc.			350
Piedmont Airlines, Inc.			1,750
Planet	149		149
Prestige Airways			150
ProAir, Inc.			400
PSA Airlines, Inc.			1,249
Redwing Airways, Inc.			7
Salmon Air			12
Services, LLC			7
Sierra Pacific	23		23
Skagway Air Service, Inc.			
Sky King	89		89
SkyWest Airlines			5,000
Southeast			0
Southern Air			0
Suburban Air Freight, Inc.			
Sun World	16	2	18
Sunshine Airlines, Inc.			30
Tanana Air Service			18
Tatonduk	199	38	237
Tradewinds	152	3	155
Trans Air Link			0
Trans North Aviation, Ltd.			20
USA 3000	342	25	367
Ventures, Inc.			65
Vieques Air Link, Inc.			53
Virgin Air			11
Warbelow's Air			
West Isle Air			26
Wright Air Service Inc.			30
Yute Air Alaska Inc.			180
Zantop	32	21	53
Total Regionals	**4,199**	**238**	**44,609**
Total Majors and Nationals	**534,562**	**103,798**	**662,610**
TOTAL	**538,761**	**104,036**	**707,219**

* Indicates that they are a part of US Airways / US Airways Express

** Indicates that they are a part of United Express / Delta Connection

Source: Jackman, F. (Ed.) *World Aviation Directory* Fall 2002/Winter 2003 and BTS 2002

A Critique of Aviation Management Programs

Edwin D. Phillips
Southern Illinois University Carbondale

ABSTRACT

Periodic critique is a characteristic of successful organizations. This article uses the concepts of critical management research to describe and critique all University Aviation (UAA) Association aviation management bachelor degree programs. Narrative and tabular description is provided of the location, title, department administrative location in the university, mission and courses offered by UAA member schools. A brief history of the introduction and purpose of aviation management is offered. Critique is made regarding the lack of a clear definition of "aviation management," and that the technological attraction of aviation flight education may overshadow the role of aviation management education. Specific recommendations are made to improve the current state of aviation management programs.

INTRODUCTION

This article reviews and critiques aviation management bachelor degree programs at University Aviation Association (UAA) member colleges and universities in the United States. UAA is the preeminent professional organization for non-engineering aviation education at the college level. There is no evidence to suggest programs offered at non-UAA institutions have characteristics that differ from those of UAA member schools. Periodic critique is a key component of any successful organization (Blake and Mouton, 1985). My recent entry into the world of aviation management education following twenty-nine years of challenging and varied management experiences with a major airline is the motivating force for this critique.

This work is divided into four sections. The introduction provides a perspective for the research. The second part of the article is a narrative picture (taken in the year 2003) of aviation management programs identified by department title, name of degree(s) offered, where departments are administratively placed within a university, department mission and titles of courses offered. The third section is a critique that discusses these programs and the existence and interaction of various values within society in general and the aviation educational community in specific. The article ends with specific recommendations to improve the aviation management educational product.

Audience

The audience for this article is students, administrators, faculty, advisory board members and alumni involved in the process of providing aviation degree programs in the United States. No experience or expertise is claimed for programs located outside the United States and any such programs are excluded from the study. Some of the concepts discussed may have application to non-USA programs, but no such claim is made.

Research Method

People, humans, are the engine of aviation education. The individuals involved in producing aviation programs are practicing management, the principles of planning, organizing, leading and control (Daft & Marcic, 2001). Study of aviation education practices is therefore the study of people, or social science. This requires qualitative research, the "understanding of subjective experience, meaning and intersubjective interaction" (Fossey, Harvey, McDermott, & Davidson, 2002, p. 718) that occurs among the people who create, offer and modify aviation management degrees. The positivism of a statistical approach is inappropriate. Research practices of collecting and analyzing data for this project are specifically guided by the concepts of "naturalistic inquiry" as described by Lincoln and Guba (1985) and "critical management research" formed by Alvesson and Deetz (2000).

Defining "Critique"

The reader may (and probably should) reflect on the meaning of "critique." Does this article intend to be "critical," and if so, in what manner? Research must be viewed on a continuum. Alvesson and Deetz (2000) indicate there are two aspects to critical management research. One is to view "critical" as a postmodern questioning of social order and dominating practices. The second is a focus on qualitative or interpretive research. This paper leans heavily toward the second perspective but does not ignore the first. Where appropriate an effort is made to "…counteract the dominance of taken-for-granted goals, ideas, ideologies and discourses which put their imprints on management and organization phenomena" (Alvesson and Deetz, 2000, p. 18.).

Data Collection

Today's electronic world makes data for this project accessible on UAA, the Council on Aviation Accreditation, and individual college and university web sites. Email inquiry and phone calls were used as necessary to clarify or expand web site information. Key aviation journals and published meeting proceedings were reviewed for related material.

OVERVIEW OF AVIATION MANAGEMENT PROGRAMS

The Reason for Aviation Management Programs

Consistent oral history and expressed belief among experienced members of the aviation academic community suggests that aviation management bachelor degree programs were created to meet pilot hiring requirements. At some point in history the major airlines began to prefer or demand pilot job applicants have a bachelor's degree in addition to the required pilot licenses and desired flight hours. Some colleges and universities which offered only flight training determined it was necessary to create a four-year degree to allow students to become highly desirable job applicants. "Aviation management" programs were the solution. Today these programs also serve the needs of non-pilot students who wish to learn about aviation business skills and the challenges faced by managers in consulting firms, airports, airlines, government agencies, etc.

Number of Aviation Management Programs

Mandis (1984) published the first listing of accredited colleges, universities and technical schools that offer aviation related programs. He listed 377 programs. Kaps (1995) indicated there were 351 associate, bachelor and certificate related non-engineering aviation programs. These numbers have historical value but include many programs beyond aviation management bachelor degrees.

The NewMyer, Kaps, and Sigler's (2001) review of Aviation Management programs includes 43 schools. Oderman (2003) states there are 60 aviation management or aviation administration programs in the United States. Neither report provides criteria for inclusion of programs reviewed in the research and may include other than UAA programs.

All 117 UAA member institutions were analyzed for this project. Those programs selected for inclusion offer a bachelors degree with emphasis on the conceptual and technical skills of managing and/or that are designed to prepare students for possible management positions. This encompasses programs in "corporate aviation," "airport," "air traffic control," "aviation administration" and or "aviation management." At the conclusion of the review a possible description suggested itself. "Aviation management" tends to encompass all aviation bachelor degree programs other than those with a primary emphasis on flight or maintenance. There are 56 UAA programs that meet these criteria. Based on Oderman's work and this research it is reasonable to conclude there are about 55 to 60 aviation management bachelor degree programs in the United States. Table 1 lists the names and key characteristics of the 56 UAA programs.

Number of Degree Titles

The 56 schools in this study offer degrees with 40 different titles. "Aviation management," the most common, is found at 18 schools. "Aviation administration," "airway science" and "airport management" degrees are each found at three schools. The other 36 titles are a variant on the four primarily used titles and include single use titles that vary from "Aeronautical Management Technology" to "Urban Policy Studies (specialization in aviation management)." A detailed list is included in Table 2.

Aviation Management Department Administrative Positioning

An understanding of the aviation management academic discipline is guided by how aviation departments are administratively placed within a university. A pattern of placing departments in any one or a particular combination of colleges may shed light on how academia views the discipline. Forty-five of the 56 departments are positioned within a "college" or "school" that most frequently includes other non-aviation departments.

Subtle name variations may indicate locally significant variance not clear from an outsider's perspective. Recognizing that possibility it appears that aviation management departments are placed in colleges or schools with 34 different titles. Six (18%) are in business or management colleges. Table 3 lists the administrative locations.

Department Mission

The Council on Aviation Accreditation (CAA) requires accredited programs "MUST have a mission statement that reflects an educational philosophy, goals, purposes, and general intent…" (Council on Aviation Accreditation, 2003, p. 15). Reviewing departmental mission statements should provide the key direction or philosophy of a program. Six of the 56 UAA aviation management programs include a mission statement on the department's web site. They are:

- Delaware State University – Dover, Delaware
- Delta State University – Cleveland, Mississippi
- Elizabeth City State University – North Carolina
- Lynn University – Boca Raton, Florida
- Texas Southern University – Houston, Texas
- University of Maryland Eastern Shore – Princess Anne, Maryland

The mission statement of these six departments emphasizes a mission of preparing students for jobs or careers in aviation. Elizabeth City State adds in a separate area that the educational objectives of the program include providing graduates "…with the ability to develop clear and careful scientific reasoning; and to comprehend the sub-disciplines that influence the nation's aviation industry and systems" (Elizabeth State University, 2004, Aviation Science).

None of the six match the more universal theme of The Transportation Center at Northwestern University which is, "Since its inception in 1954, the Center's mission has been to make substantive and enduring contributions to the movement of materials, people, energy, and information" (Northwestern University, 2004, Northwestern University Transportation Center).

Course Content

What we do as individuals – or departments – are perhaps the true measure of what we think or feel. Reviewing courses offered in aviation management programs is therefore a meaningful indication of what is believed to be important. Judgments about specific course content based on title and catalog description is an inexact science. Recognizing that limitation, the diversity of course offerings is shown in Table 4. A total of 39 titles are offered. Of these, 18 are offered in only one or two of the 56 UAA programs. Some key courses that should be on the list are missing and identified later in this article.

Defining "Aviation Management"

The first aviation school in the United States is St. Louis University's Parks College of Engineering and Aviation which was founded in 1927 (St. Louis University, 2004). Flouris (2001) states that Auburn University's aviation management program was founded in 1941 and is the second-oldest in the country. Although aviation management has existed for over sixty years as a field of study there is mystery associated with a definition of the term. Efforts to identify the first aviation management program have been unsuccessful.

The U.S. Department of Transportation (DOT) lists and explains common transportation "expressions." "Air Traffic Management (ATM)" is on the list and is defined as "The process used to ensure the safe, efficient, and expeditious movement of aircraft during all phases of operations. Air traffic management consists of air traffic control and traffic flow management" (Bureau of Transportation Statistics, 2004). "Aviation management" is not on the list. Articles that address some aspect of aviation management (Flouris, 2001; Worrels, 2002) often don't define what is meant by the term. A more critical issue is students say something like, "I'm an aviation management major, but I don't really know what that means." There is no central or common definition that resolves that question.

An early and highly popular Bill Cosby comedy routine includes dialog in which the teacher says, "Two and two is four." The child's response is, "What's a 'two'"? Don't those of us who are in field of aviation management education already know what "aviation management" is? Some may believe attempting to formalize a definition is akin to asking for a description of "two." It is an uncommon question or challenge. To build and use mathematical formulas knowing the construct of "two" is mandatory. To successfully educate students in aviation management it seems a logical conclusion that educators must have a clear understanding of what is described by that term.

Determining the philosophical construct of aviation management seems a mandatory step in a critique of aviation management bachelor degree programs. Without a clear understanding it is a messy, if not impossible, journey to the next logical step of identifying the pedagogy of aviation management. A meaningful pedagogy for the discipline of aviation management rests on a clear understanding (i.e. definition) of the term.

Efforts to clarify the term are not new. "…The problem with Aviation Management is that it does not have a clearly defined curricular content or structure" (Fairbairn, 1987, p.81). No specific definition of "aviation management" is found in the literature. To complicate matters, alternate terms "aviation administration" and "aviation science" are commonly used. An award winning ethics article uses the terms "aviation management" and "aviation administration" interchangeably in the same paragraph (Oderman, 2002, p. 6). A follow-up article uses the same dual reference on a single page (Oderman, 2003, p. 17.) "Aviation science" is a term used in eight difference degree titles.

NewMyer, Kaps, and Sigler (2001) completed a review of aviation management programs. The first section of their report presents "Aviation Management Definitions." The "definitions" are a list of eight statements from aviation department web pages that describe the program offered at that individual university. Most address the intent to prepare students for careers in aviation jobs. This suggests that "aviation management" is the process of preparing individuals for jobs in industry. Such a definition or description seems incomplete.

A definition of "aviation sciences" is found on the web pages of The University of Maryland Eastern Shore (UMES) Aviation Sciences Program. It states, "Aviation Sciences are the theory and practices of the technical skills required to perform professional services in the field of aviation" (UMES, 2004). This definition is noteworthy because its existence is unique.

Reviewing the Council on Aviation Accreditation's (CAA) standards manual provides solid data for consideration. The CAA (2003) lists aviation management as one of six degree specializations. A "Narrative Description" of "Option Criteria" indicates that (for accreditation) both associate and bachelor degree aviation management programs include a "coherent sequence of business and aviation courses designed to prepare the student to function effectively as a manager in a selected segment of the aviation industry" and that the program "MUST provide focus on a potential career field…such as airlines and airport, or flight operations management or aircraft maintenance management" (Council on Aviation Accreditation, 2003, p. 28).

"Topical Content" for the aviation management specialization includes the type of courses to be included. "Basic Business

Management" courses recommended include accounting, economics, finance, management, business law, and human resource management. "Management Focused Aviation Course work" describes the type of courses to be offered and provides examples for an air transportation focus. "Providing preparation for a career…" (Council on Aviation Accreditation, 2003, p. 41) is part of the description. This suggests that the discipline of aviation management involves a range of business and management challenges found in the aviation industry.

If there is a common understanding of what aviation management is, and if aviation administration and aviation science (or other terms) are the same thing, that understanding is highly illusive.

Validation

One of the concepts of natural inquiry (Lincoln & Guba, 1985) is that sampling need only continue until the results are repetitive. Collecting the above data brought repetitive results. Another basic aspect of research is validation. The data discussed above were reviewed in an education training session on this subject at the 2003 Fall UAA Education Conference. Present during the session were individuals with lengthy and diverse backgrounds in aviation management. The UAA program data was accepted as presented and support was expressed for the process of investigating a definition of aviation management and or defining the pedagogy of aviation management.

Summary

Here is a recap of what we know about "aviation management" degree programs:

- They started about sixty years ago; probably to provide a four year degree to make pilot students competitive for airline positions.
- At the close of 2003 there were 55 to 60 programs in the United States.
- Departments offering aviation management degrees are assigned to 34 different university "colleges" and "schools" from engineering to business to education to many others.
- These programs offer bachelor degrees with 40 different titles.
- There are about 39 different courses offered by aviation management departments. Half that number are unique courses taught at only one or two schools.
- The primary advertised mission of aviation management programs is to prepare students for jobs in aviation.
- Any written definition of "aviation management" is difficult, if not impossible to find.

A CRITIQUE

The purpose of these thoughts is to critique, not to criticize. The purpose is to provide perspective for well informed discussions about the future of aviation management programs.

The External Environment

The President of the United States participated in the Kitty Hawk celebration of the Wright brothers' first flight. *Aviation Week & Space Technology*, *National Geographic*, and *The Smithsonian* are just a few of the national magazines that had cover stories featuring the anniversary of flight. This symbolizes the strong emotional impact the concept of flight has on the public in general and on many individuals involved in aviation education. This positive emotional attitude toward airplanes and flying is a key cultural norm to be considered when reflecting on the environment in which aviation management education occurs.

A meaningful description of attitudes is found in the conflicting ethnographic portrayal of flight and management. Simultaneous with the first flight celebration television channels were filled with romantic and emotional airplane movies such as *The Spirit of St. Louis*. If selecting a movie for classroom use to depict human accomplishments in the history and challenge of flight the only difficulty is deciding which one.

Compare this with the challenge of attempting to find a film that accurately portrays the challenge of management in any industry, let alone aviation. (Any suggestions?) As the TV stations broadcast great airplane movies the news portrays the foibles of management errors such as the ethics problems at Boeing resulting in a new CEO, and criminal charges placed against several senior officers of major companies. Our cultural environment honors flying and airplanes and does little or nothing to support and frequently criticizes management.

The Educational Environment

Flight programs were created because of the need to meet the technological advances in aircraft design, manufacture and operation that started in the early 1900s. About the time of World War II a mingling of increased employment standards for pilots and a new series of management related organizational challenges in a growing commercial aviation industry combined to give birth to aviation management degree programs. Aviation management was initially, and perhaps still is, positioned as an off-shoot of flight. It was a logical decision to put aviation management organizationally alongside the program that caused its birth. Flight students continue to be the primary recruits for aviation management bachelor degrees.

Flight education and aviation management are like cojoined twins. The two major fields of study are linked. The degree of connection varies by sets of "twins." At one end of the spectrum are five programs with strongly linked twins. Aviation management students are required to take flight training. (These programs are identified in Table 1.)

Most programs do not require flight training of aviation management students. The other end of the spectrum is Elizabeth City State University. Three Aviation Science degrees are offered with minors in Business Administration, Computer Science or Electronics but the school offers no flight training.

Flying an airplane is seemingly explicitly made more important than managing by two schools. The views are copied from the web pages of departments that offer flight and aviation management majors. The source of the comments is purposefully omitted.

- "Why do some students switch their major to aviation management after being in the flight program? Some (name of school) students switch their majors to Aviation Management because of the cost of the flight program. ______'s flight program is very challenging and dedication is required for success in the program. ____'s aviation management degree is an excellent alternative."

A logical conclusion is that being a pilot requires greater dedication and is more challenging than being a manager.

- "Just as all our pilots study aviation management to gain deep insights into their career, those in the management concentration benefit from gaining an understanding the pilot's perspective. We find that managers in the aviation industry are best-equipped and command greater credibility by becoming an aviator."

This seems to say with some assurance that pilots are the best managers in an aviation company. Successful airline chief executive officers Bob Crandall, Herb Kelleher and Stephen Wolf, among others, might disagree.

Based on personal observations made during the UAA Fall 2003 Educational Conference it appears flight related issues have the major emphasis in UAA processes. "Simulators" seems to refer to flight simulators only and cabin, ticket counter, podium, galley or business game simulators are apparently omitted from discussion. Committees exist for flight training and ATC education. The list of all UAA committees includes (University Aviation Association, 2004):

ATC Education
Aviation Education
Awards
Center of Excellence
Curriculum
Distance Learning
Flight Education
Meeting Planning
Membership
National Advisory Council
Publications
Test Advisory
Scholarship
Simulation
Technical Education
Legislative Affairs

Future Funding Strategies
Safety
NBAA/UAA Professional Development Program**.**

There is no committee for aviation management. (On April 15, 2004 the UAA Board agreed to form an Aviation Management Committee [Chubb, 2004].)

It would be interesting to learn the last time the safety committee considered the challenge of educating students about the problems and techniques of educating students on how to reduce occupational injuries among airline office employees, ticket counter and ramp service personnel or flight attendants.

More than half the departments teaching aviation management are located in colleges with some combination of science and technology in the title. Flight training logically fits. But, consider the management challenges facing today's airlines, airports and major aviation equipment suppliers. The success or failure of these companies does not rest on pilot skills or technical and engineering expertise, but on business strategy. If placing aviation management education on a continuum with technical knowledge and skills on one end and business and organizational conceptual skills and knowledge on the other, it belongs well along toward the business end. A respected financial journal states the problem clearly, "…the basic business model of the network carriers is broken, and … they will have to reinvent themselves or go out of business" (Economist.com, 2004, March25, Airlines under siege, 12). This is clearly a management challenge.

Course Offerings

The emphasis on flight training and airplanes may breed some misunderstanding of what it is that aviation managers do. For example, what is the product of an airline? Flight and maintenance departments have established a commendable history of providing dependable, risk free operation of the airplane. Senior managers of airlines don't ignore the challenge of maintaining this fine record, but this section of the industry tends not to be the major factor in strategic planning. Marketing issues of price, schedule and frequent flyer programs are what identifies an airline to most customers. Wells and Wensveen state "Why is marketing so important? Without marketing and sales, there would be no airlines" (2004, p. 304).

Michele Burns, speaking as Delta's CFO, views an airline as a big information technology company (Airfinance Journal, 2001). This view makes the key management challenge how communication is mediated. These various perspectives require heavy course emphasis in marketing, business planning, finance, and information technology. No such courses are included in the top ten most frequently offered by aviation management programs.

The largest single employee group at major airlines is the "onboard service" division (alternatively called "inflight service"). Onboard includes hiring, training and managing flight attendants, cabin design including seating configuration, galley design, entertainment systems, supplies (pillows, blankets, headsets, magazines, etc.), food and beverage service and equipment for accidents and incidents such as defibrillators and "first aid" kits, oxygen systems, "safety cards," etc. In 2002 American Airlines employed 102,000 workers (Bureau of Transportation Statistics, 2002), of which 26,000 (Dallas Business Journal, 2003, April 15) or 25% were flight attendants. Other onboard operational employees and planning and management staff must be added to that number. In spite of this predominant position in the industry, not a single aviation management course is offered that features this aspect of the aviation business.

Anyone who reads the above paragraph and concludes this is a recommendation to train students to become flight attendants is mistaken. There are diverse and complex management challenges in developing, costing, training, monitoring and changing onboard service equipment, procedures and policies. Consider this example from the daily airline operational routine. The next time you are on a commercial flight on which cocktails are sold ask one of the flight attendants to explain how the cash is collected and reported for the liquor and any headset, food, or "duty-free" sales. Look at the accounting process on that one flight and mentally place it as part of a system-wide cash accounting procedure. Then consider how those for sale products are chosen, purchased, loaded and stored on the aircraft, what systems exist to prevent loss due to theft, etc? Understanding the need and challenge of managing these types of issues are the type of material to be included in an onboard curriculum.

For a larger challenge, consider changing behavior of the flight attendant employee group. This type of managerial problem is seen in a recent example at American. On March 30, 2004, John Tiliacos, an American Airline regional manager wrote a letter to thousands of flight attendants telling them the negative things customers are saying about their performance (Torbenson, 2004). How does the airline improve customer ratings of flight attendant "friendliness" and or "helpfulness" as measured by passenger surveys and comments? This remains an unanswered management challenge. Aviation management students need to be aware of the problem, and the many causes for the problem, and encouraged to help seek effective solutions.

Summary

There is no claim made or intended that anything in aviation education is broken and requires an emergency fix! No suggestion is made that aviation management programs abandon their roots and start a mass exodus to business schools. Aviation management being cojoined and working cooperatively with flight (and perhaps aviation maintenance) in a single university administrative organization should provide strength to the entire aviation program. However, this relationship must be treated with caution. There is a tendency for the technology of the physical airplane and piloting "…to create the ways in which people perceive reality" (Postman, 1992, p. 21). The reality of aviation management requires administrators, faculty, alumni and students recognize that management is a process and challenge much different and arguably more complex than flying airplanes.

RECOMMENDATIONS

These comments are intended as realistic and definitive suggestions to improve the overall performance or effectiveness of UAA aviation management programs. Five recommendations follow. The first four are actions for individuals acting within and as part of an institutional system, especially the UAA. The fifth recommendation is more personal and is addressed to educators, advisory board members and to others not directly involved in the educational process but who consider aviation management important. It is followed by a lengthy explanation.

1. The UAA is encouraged to form an Aviation Management Committee.
2. One of the new committee's first tasks should be an effort to define "aviation management" and create an appropriate pedagogy. This is best accomplished by working closely with the Council on Aviation Accreditation. After creating these concepts the committee can initiate the appropriate academic dialog within the community in an attempt to reach a broad consensus view.
3. Each academic oriented UAA committee is encouraged to determine if aviation management is appropriately balanced within the committee's activities. Should the management aspect of air traffic control (for example) receive additional emphasis?
4. A critical aspect of an academic discipline is both doing research and sharing it. The local campus library or electronic joint library retrieval system available to you and your students has a plethora of management or business journals readily available such as the Harvard Business Review. Determine if your campus library (or library system) has the research journals of aviation management. Examples are Collegiate Aviation Review, Journal of Air Transport Management, Journal of Air Transportation, etc. If not, work to make them available. Aviation management will not and should not be considered a meaningful discipline unless undergraduate and graduate students and faculty – especially new faculty – has ready access to the discipline's historical research efforts.

5. As an individual educator support the value of student personal achievement in aviation management.

The last recommendation requires explanation. The nature of pilot or maintenance education allows for specific student personal achievement by successfully completing a "check-ride" or trouble-shooting a maintenance challenge. This provides for immediate personal and sometimes, such as participation on an intercollegiate flight team, public satisfaction and recognition. At the end of the day the student can describe to others the success he or she has obtained. Where is the parallel for the aviation management student? Piloting and solving maintenance challenges include tangible technological processes. It's possible to video-tape the process. Management is a difficult process to "see" and the results of the process may not be adequately measured except over long periods of time. Successful learning about management processes may be even more difficult to observe and therefore to recognize individual achievement.

Adding to the complexity of this issue is the anti-management perspective which can be viewed in widely available public forums such as Scott Adam's "Dilbert" comics. The challenge to educators to support student success and achievement in aviation management is difficult! But, it was difficult for the Wright brothers to achieve the first successful flight. And, David Neeleman indicates it wasn't easy when he started Jet Blue (Neeleman, 2003).

Some steps for individuals to consider are:

- Aviation history has pilot "heroes" like Lindberg. The same emphasis can be placed on managerial heroes like W. A. Patterson.
- Ensure the local student internship program has a significant management oriented component as well as flight and maintenance.
- Evaluate the balance of guest lecturers invited to campus. Is there an appropriate mix of speakers who are primarily managers along with those clearly in more technical positions?
- Review the department's advisory board. What is the percentage of members who primarily represent the management function?
- Create opportunities for aviation management students to perform related tasks such as a Junior Achievement club (Junior Achievement, 2004). Investigate whether the local airport manager desires some conceptual work accomplished such as reviewing and recommending new or revised polices and regulations.
- Include in aviation management syllabi the critical role and potential value of management. Perhaps in the urgency to (for example) lecture on "decision making processes" we miss explaining the larger view to our students. The first sentence in the book that many credit with starting today's view of management states, "The manager is the dynamic, life-giving element in every business" (Drucker, 1954, p. 3).This perspective must be shared with our students.

As a community of scholars we can and should add to and as necessary modify this list.

CONCLUSION

This article concentrates on aviation management bachelor degree programs. The data presented provide a current snap-shot of the 55 to 60 programs offered in the United States. Flight and aviation management programs are linked much like cojoined-twins. The degree to which the programs are linked may put too much emphasis on the technical aspects of aviation at the expense of the management aspects. Five recommendations are made to improve the relationship.

The general public, governmental agencies and other businesses all require an effective aviation industry served by healthy airlines, airports and other aviation related organizations. These organizations, and ultimately the public, are dependent on a trinity of successful and healthy flight, maintenance and management educational programs. If any of those three entities is a weak link, the system dies. The aviation academic community must work consciously to make or retain aviation management as a strong link.

REFERENCES

Airfinance Journal. (2001). Profits@deltaair. *Airfinance Journal Business Yearbook 2001*, 39-41.

Alvesson, M., & Deetz, S. (2000). *Doing critical management research*. Thousand Oaks, CA: Sage.

Blake, R., & Moulton, J. (1985). *The managerial grid III: The key to leadership excellence*. Houston: Gulf.

Bureau of Transportation Statistics. (2002). 2002 Number of Employees for Certificated Carriers Year End Data 2002. Retrieved March 29, 2004, from http://www.bts.gov/oai/employees/2002emp.html

Bureau of Transportation Statistics. (2004). Transportation Expressions 1996. Retrieved March 29, 2004, from http://www.bts.gov/cgi-bin/btsprod/expr/expr.pl?letter=a

Chubb, G. P. (2004, Summer). Board of Trustees: Reports of midyear meeting. *Collegiate Aviation News, 28(3),* 3.

Council on Aviation Accreditation. (2003). *Accreditation standards manual Form 101*. Auburn, AL: CAA.

Dallas Business Journal. (2003, April 15). American's flight attendants get voting extension. Retrieved March 29, 2004, from http://www.bizjournals.com/dallas/stories/2003/04/14/daily14.html?page=2

Daft, R. L., & Marcic, D. (2001). *Understanding management* (3rd. ed.). Orlando, FL: Harcourt.

Drucker, P. F. (1954). *The practice of management*. New York: Harper.

Economist.com. (2004, March 25). Airlines under siege: Silver linings, darkening clouds. Retrieved March 30, 2004 from http://www.economist.com/business/PrinterFriendly.cfm?Story_ID=2535961

Elizabeth City State University (2004). Aviation Science. Retrieved April 12, 2004, from http://www.ecsu.edu/ecsu/acaddept/technology/bs_aviation_science.htm

Fairbairn, G.R. (1987). Development of aviation management coursework. In W.D. Geibel (Ed.), *1987 Proceedings University Aviation Association Fall Education Conference* (pp. 76 – 98). University Aviation Association

Flouris, T.G. (2001). *Collegiate aviation programs in a college of business: The challenge of dual accreditation.* Paper presented at the Aviation Management Education and Research Conference, Concordia University, Montreal, Canada.

Fossey, E., Harvey, C., McDermott, & Davidson, L. (2002). Understanding and evaluating qualitative research. *Australian and New Zealand Journal of Psychiatry,* 36, 717 – 732.

Junior Achievement. (2004). Let their success be your inspiration. Retrieved April 12, 2004 from http://www.ja.org/

Kaps, R. W. (1995). *Perceptions of aviation professionals and aviation educators concerning industry suggested curriculum content for a non-engineering aviation doctoral degree*. Unpublished doctoral dissertation, Southern Illinois University at Carbondale.

Lincoln, Y.S., & Guba, E.G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.

Mandis, M.G. (1984). *The aero aviation college directory*. Fallbrook, CA: Aero.

Neeleman, D. (2003). Welcome from our CEO. Retrieved March 29, 2004, from http://www.jetblue.com/learnmore/index.html

NewMyer, D.A., Kaps, R.W. & Sigler, J.W. (2001). *A review of the scope and status of aviation management degree programs and curricula: What is aviation management?* Paper presented at the Aviation Management Education and Research Conference, Concordia University, Montreal, Canada.

Northwestern University. (2003). Northwestern University Transportation Center. Retrieved April 12, 2004, from http://www.nutc.northwestern.edu/public/aboutus/who.html

Oderman, D.B. (2002). Ethics education in university aviation management programs in the US: Part one – the need. *Journal of Air Transportation*, 7(3), 3-32.

Oderman, D.B. (2003). Ethics education in university aviation management programs in the U.S.: Part two– the current status. *Journal of Air Transportation*, 8(1), 15-36.

Postman, N. (1992). *Technopoly: The surrender of culture to technology*. New York: Random House.

St. Louis University. (2004). Parks College of Engineering & Aviation History. Retrieved March 29, 2004, from http://parks.slu.edu/history.html

Torbenson, E. (2004, April 14). American shares service complaints. *DallasNews.com*. Retrieved April 14, 2004, from http://www.dallasnews.com/cgi-bi/bi/gold_print.cgi

University Aviation Association. (2004). Committee Chairs. Retrieved April 16, 2004 from http://uaa.auburn.edu/chairs.htm

University of Maryland Eastern Shore. (2004). What are Aviation Sciences? Retrieved April 12, 2004 from http://www.umes.edu/engavi/Sciences.htm

Wells, A.T. & Wensveen, J.G. (2004). *Air transportation: a management perspective*. (5th ed.). Belmont, CA. Thomson.

Worrels, D.S. (2002). The case method: An enhancement to curriculum in aviation management coursework. *The Journal of Aviation/Aerospace Education & Research*, 11(3), 25-32.

Table 1. *University Aviation Association (UAA) Member Schools Offering "Aviation Management" Bachelor Degree Programs*

Note: AC – The program is accredited by the Counsel on Aviation Accreditation (CAA).
M – The aviation department's web site includes a mission statement.

	Institution and Location	College/School for University Programs	Major(s) Offered	Miscellaneous Comments
1 AC	Arizona State University Mesa, AZ	College of Technology and Applied Science	Aeronautical Management Technology	
2 AC	Auburn University Auburn AL	College of Business	Aviation Management	
3	Averett University Danville, VA	New to university status, no "colleges."	Aerospace Management Aerospace Management and Criminal Justice	One of two programs that offer a tie with security
4	Bowling Green State University Bowling Green, OH	College of Technology	Aviation Management and Operations	
5	Bridgewater State College Bridgewater, MA	School of Business and Aviation Science	Aviation Management	
6	California State University Los Angeles, CA	Department of Technology College of Engineering	Industrial Technology (option in Aviation Administration)	
7 AC	Central Missouri State University Warrensburg, MO	College of Applied Sciences and Technology	Flight Operations Management	
8	Central Washington University Ellensburg, WA	College of Education and Professional Studies	Flight Technology (Aviation and Airport Management	
9	College of Aeronautics La Guardia Airport, NY Flushing, NY		Airline Management Airport Management	
10 AC	Daniel Webster College Nashua, NH		Aviation Management	
11 M	Delaware State University Dover, DE	School of Professional Studies	Airway Science Management	
12 M	Delta State University Cleveland, MS	College of Business	Aviation Management	
13	Dowling College Oakdale, NY		Aviation Management	
14 M	Elizabeth City State University Elizabeth City, NC	A department of the university not assigned to a college/school.	Aviation Science (concentration in business administration)	Does not offer flight training. Offers unique Social Responsibility and Ethics course.

15 AC	Embry-Riddle Aeronautical University Daytona Beach, FL	College of Business	Aviation Business Administration Aviation Management	
16	Fairmont State College Bridgeport, WV	School of Technology	Aviation Administration	
17 AC	Florida Institute of Technology Melbourne, FL	School of Aeronautics	Aviation Management	
18	Florida Memorial College Miami, FL		Airway Science Management	Offers unique Passenger Management course.
19	Georgia State University Atlanta, GA	Andrew Young School of Policy Studies	Urban Policy Studies (specialization in aviation management)	
20 AC	Hampton University Hampton, VA	School of Engineering and Technology	Aviation Management	
21	Henderson State University Arkadelphia, AR	School of Business	Airway Science	Requires pilot training.
22	Indiana State University Terre Haute, IN	School of Technology	Aerospace Administration	
23	Jacksonville University Jacksonville, FL	Davis College of Business	Aviation Management Aviation Management and Flight Operations	Offers unique Executive Communication Techniques course.
24	Kent State University Kent, OH	School of Technology	Aviation Management	
25	Lewis University Romeoville, IL	College of Arts and Sciences	Aviation Administration	
26 AC	Louisiana Tech University Ruston, LA	College of Liberal Arts	Aviation Management	
27 M	Lynn University Boca Raton, FL	Morgan School of Aeronautics	Business Administration (specialization in Aviation Management)	
28	Marywood University Scranton, PA	College of Creative Arts and Management	Business Administration (Airport/Airline Management track)	Requires pilot training.
29	Metropolitan State College of Denver Denver, CO	School of Professional Studies	Aviation Management	Appears to require a Flight Dispatch and Load Planning course.
30 AC	Middle Tennessee State University Murfreesboro, TN	College of Basic and Applied Science	Aerospace (concentration in Administration)	

31	Minnesota State University Mankato, MN	College of Education	Aviation (concentration in Aviation Management)	Requires pilot training.
32	The Ohio State University Columbus, OH	College of Arts and Science, and College of Engineering	BA Aviation (Aviation Management)	
33	Ohio University Albany, OH	College of Education and Technology	Aviation Sciences (Aviation Management option)	
34	Oklahoma State University Stillwater, OK Tulsa, OK	College of Education	BS in Aviation Sciences (Aviation Management)	
35 AC	Purdue University W. Lafayette, IN	School of Technology	Aviation Administration Technology	Only program that has reference to airport service industries.
36	Rocky Mountain College Billings, MT		Aviation Management	
37	San Jose State University San Jose, CA	College of Engineering	Aviation Operations (concentration in Administration)	
38	Southeastern Oklahoma State University Durant, OK	Aviation Science Institute	Aviation Management (options in (1) business, (2) safety, or (3) security)	One of two schools that offer a tie with security issues.
39	Southern Illinois University Carbondale, IL	College of Applied Science and Arts	Aviation Management	
40 AC	St. Cloud State University St. Cloud, MN	College of Science and Engineering	Aviation (emphasis in management or operations)	Unique Women in Aviation course.
41	St. Francis College Brooklyn Heights, NY		Aviation Administration Aviation Business Studies	Only program to offer a series of courses on travel and tourism.
42 AC	St. Louis University St. Louis, MO	Parks College of Engineering & Aviation	Aeronautics Aviation Science/Aviation Management	
43	State University of New York Farmingdale, NY	School of Engineering Technologies	Aviation Administration (cargo specialization)	Only program that specializes in cargo management.
44	Tarleton State University Killeen, TX	College of Science and Technology	Aviation Science (Aviation Management option)	Program designed to only accept those with two prior years of study typically in a flight program.
45	Tennessee State University Nashville, TN	College of Engineering, Technology and Computer Science	Aeronautical and Industrial Technology (concentration in Aviation Management)	

46	Texas Southern University Houston, TX	Department of Transportation, College of Science and Technologies	Airway Science Management	Offers a course that combines FBO and aviation service operations.
47	University of Alaska Anchorage, AK	Aviation Technology Division	Aviation Administration – Aviation Management	
48	University of Dubuque Dubuque, IA	School of Professional Programs	Aviation Management	Offers a Safety and Ethics in Aviation course, and a scheduling course.
49	University of Louisiana Monroe, LA	College of Arts and Sciences	Aviation Administration	
50 M	University of Maryland Eastern Shore Princess Anne, MD	School of Business and Technology	Aviation Science (concentration in Aviation Management)	
51	University of Nebraska Kearney, NE	College of Business and Technology	Aviation Science Management (options from either the Business School	
52 AC	University of Nebraska Omaha, NE	College of Public Affairs and Community Service	Public Administration (specialization in Aviation Administration)	Offers Diversity in Aviation course.
53 AC	University of North Dakota Grand Forks, ND	School of Aerospace Sciences	Aviation Management Airport Management	Offers unique Methods and Materials in Teaching Aviation course. Requires pilot training.
54	University of Oklahoma Department of Aviation Norman, OK	College of Continuing Education	Aviation Management	Requires pilot training.
55 AC	Western Michigan University Battle Creek, MI	College of Aviation	Aviation Science and Administration	
56	Westminster College Salt Lake City, UT		Aviation Management	

Table 2. *Aviation Management Degree Titles Offered at UAA Member Schools*

	Degree Title	Number of duplicate titles
1	Aeronautical and Industrial Technology (concentration in Aviation Management)	
2	Aeronautical Management Technology	
3	Aeronautics	
4	Aerospace (concentration in Administration)	
5	Aerospace Administration	
6	Aerospace Management	
7	Aerospace Management and Criminal Justice	
8	Aerospace Studies	
9	Airline Management	
10	Airport Management	2
11	Airway Science	
12	Airway Science Management	2
13	Aviation (Aviation Management)	
14	Aviation (emphasis in management or operations)	
15	Aviation Administration	3
16	Aviation Administration – Aviation Management	
17	Aviation Administration (cargo specialization)	
18	Aviation Administration Technology	
19	Aviation Business Administration	
20	Aviation Business Studies	
21	Aviation Management	18
22	Aviation Management (options in (1) business, (2) safety, or (3) security)	
23	Aviation Management and Flight Operations	
24	Aviation Management and Operations	
25	Aviation Operations (concentration in Administration)	
26	Aviation Science (Aviation Management option)	
27	Aviation Science (concentration in Aviation Management)	
28	Aviation Science (concentration in business administration)	
29	Aviation Science and Administration	
30	Aviation Science Management	
31	Aviation Science/Aviation Management	
32	Aviation Sciences (Aviation Management option)	
33	Aviation Sciences (Aviation Management)	
34	Business Administration (Airport/Airline Management track)	
35	Business Administration (specialization in Aviation Management)	
36	Flight Operations Management	
37	Flight Technology (Aviation and Airport Management Specialization)	
38	Industrial Technology (option in Aviation Administration)	
39	Public Administration (specialization in Aviation Administration)	
40	Urban Policy Studies (specialization in aviation management)	

Table 3. *Administrative Placement of Departments Offering Aviation Management Degrees in University "Colleges" and "Schools"*

	Name of College or School	Repetitive Placements
1	Aviation Science Institute	
2	Aviation Technology Division	
3	College of Applied Sciences and Arts	
4	College of Arts and Science	3
5	College of Aviation	
6	College of Basic and Applied Science	
7	College of Business	4
8	College of Business and Technology	
9	College of Continuing Education	
10	College of Creative Arts and Management	
11	College of Education	2
12	College of Education and Technology	
13	College of Engineering	3
14	College of Engineering & Aviation	
15	College of Engineering, Technology and Computer Science	
16	College of Liberal Arts	
17	College of Public Affairs and Community Service	
18	College of Science and Engineering	
19	College of Science and Technologies	
20	College of Science and Technology	
21	College of Technology	
22	College of Technology and Applied Science	
23	None - university program not in a college/school	
24	School of Aeronautics	2
25	School of Aerospace Sciences	
26	School of Business	
27	School of Business and Aviation Science	
28	School of Business and Technology	
29	School of Engineering and Technology	
30	School of Engineering Technologies	
31	School of Policy Studies	
32	School of Professional Programs	
33	School of Professional Studies	2
34	School of Technology	3

Table 4. *Courses Included in Aviation Management Curricula*

A. Top-ten courses taught in aviation management programs (NewMyer, Kaps & Sigler, 2001).

1	Aviation Law
2	Aviation Safety
3	Airline Management
4	Airport Management
5	Basic Air Traffic Control
6	Air Transportation
7	Current Aviation Management Practices
8	Airport Planning and Design
9	Human Factors/Crew Resource Management
10	Aviation Management Writing and Communication

B. Other courses taught in three or more programs.

11	Aviation History
12	Air transport research
13	Aviation Regulations
14	Cargo operations
15	Corporate/business Aviation Operations
16	Fixed Base/Airport Services/Fueling Operations
17	General Aviation Operations
18	International Airline Operations
19	Marketing
20	National Aviation Policy
21	Regional Jet/Commuter Operations

C. Unique courses taught in one or two programs.

22	Air Transportation Logistics
23	Aviation Insurance/Risk Management
24	Diversity in Aviation
25	Executive Communication Techniques
26	Impact of Aviation and Space Exploration on Society
27	Intermodal Transportation
28	Management Decision Making
29	Methods and Materials in Teaching Aviation
30	Passenger Traffic Management
31	Safety and Ethics in Aviation
32	Scheduling (aircraft, crew and services)
33	Social Responsibility and Ethics
34	Taxes
35	Telecommunications
36	The Travel Industry
37	Tourism Development
38	Travel and Economic Geography
39	Women in Aviation

Airport Management Program and Curriculum Issues at 2- and 4-year Aviation Colleges and Universities

Stephen M. Quilty
Bowling Green State University

ABSTRACT

The majority of aviation related education programs at U.S. colleges and universities focus on flight education and training. These flight education programs and curricula have been developed over time and within the regulatory constructs of Title 14 Code of Federal Regulations Parts 61, 141, 145 and others. Not as well developed are curricula and goals for student outcomes related to airport management and operations, or aviation management programs in general. This paper presents and outlines issues as they relate to the development of an airport/aviation management curriculum for 2- and 4- year post secondary education institutions and promotes discussion on these issues in light of practical and accreditation constraints.

INTRODUCTION

Previous journal articles have stated that the skills and knowledge required of individuals for entry into the field of airport operations and management have changed from a decade ago (Prather, 1998; Quilty, 2003). The requirements are becoming more diverse, challenging and technical. Individuals are expected to be knowledgeable of real estate principles, noise issues, wildlife mitigation, emergency response, hazardous materials handling, environmental mitigation, construction management, and security to name a few specific topics.

Not only have the knowledge requirements increased, but the skill and personal ability requirements have become more demanding and specialized as well. Airport management and operations employees must not only have effective team, interpersonal, communication, and decision-making skills, but they must also be able to assess risks and hazards properly, handle emergency crisis situations, have a tolerance for ambiguity, plow snow, enforce security regulations, be drug and criminal activity free, and respond at all hours of the day, as needed, in changing weather conditions.

The increased knowledge and skill requirements pose a problem for academic institutions attempting to prepare students for these new requirements. For 4-year institutions, the goal is to provide a graduate who has a broad educational background coupled with a major field of generalized study. For 2-year institutions, the focus can be more specialized but at the expense of the broader capabilities of a four year institution. For the industry, neither approach may meet the needs of airports for well trained and qualified individuals.

Speaking at the 1995 UAA Fall Education Conference, Kurt Herwald, CEO and President of Stevens Aviation, a general aviation service organization, closed his guest speaker remarks with the following:

> "The long term outlook for the service end of the aviation industry will call for a higher level of education, increased technical complexity, more emphasis on training and retraining and a focus on a team environment. From this we need from you the educator's usable skills, recognition that the employee in his job will undergo constant change and that those who succeed will progress from technical positions to managers and as a result must adapt, be flexible, and work well with others." (UAA Newsletter, 1995, pg. 12-13).

Herwald recommended that educators focus on both theoretical and functional knowledge, and that students be provided a broad versus narrow education base. The use of the word "broad" in this context refers to individuals with flight education backgrounds. At issue is the specialized nature of flight education curricula that leaves little room for business, management or other airport operations courses.

Since the majority of graduates from university or college programs are from flight education programs, it is reasonable to expect that the majority of applications to an FBO, general aviation or airport facility are those with primarily a flight background. Based on a preliminary review of typical aviation programs, the students would not have the broad business or operations-related courses that would be of value to the organization. This was emphasized when Herwald went on to say that graduates need to have excellent written and verbal communication skills, an understanding of the business--both the economics and marketing aspects--strong leadership and interpersonal skills. Conclusions made by Fuller and Truitt (1977) in a study on essential course requirements for the aviation consulting business also targeted the strong need for oral and written communication skills.

This paper addresses some of the issues facing 2- and 4-year institutions in developing a curriculum that meets the needs of the industry, the requirements for accreditation, and a generally recognized goal of cooperative articulation between different levels of educational institutions. It also presents a basic overview of skills and knowledge requirements for entry level airport operations personnel and opens the debate for further study and clarification of the student learning outcomes in the area of airport operations. The target of this discussion is focused toward entry level airport operations positions at general aviation and air carrier airports to which many of aviation students gravitate to upon graduation.

BACKGROUND

In 1976, the University Aviation Association (UAA) developed through its members recommended standards for aviation curricula by establishing the College Aviation Accreditation Guidelines. In essence, the Guidelines outlined the first curricula standards for associate, baccalaureate, and graduate programs in aviation. With the assistance of the UAA in 1983, the Federal Aviation Administration developed and implemented the FAA Airway Science Program. The Airway Science Program was developed as a means to better prepare individuals for occupational specialty careers with the FAA. Five major specialties were identified: (1) Airway Science Management; (2) Airway Computer Science; (3) Aircraft Systems Management; (4) Airway Electronic Systems; and (5) Aviation Maintenance Management (FAA Brochure, 1989)

The UAA, through its Airway Science Curriculum Committee, helped to review and evaluate various aviation curricula across the country. In response to the identified need by institutional members of UAA for accreditation of non-engineering aviation programs (aviation programs housed in engineering programs were generally accredited under the engineering disciplines), the original UAA guidelines were considered for revision and adoption by a separate accrediting body, the Council on Aviation Accreditation (CAA, 2003, page 1).

The CAA was established in October of 1988 to act as an accrediting body for non-engineering aviation programs in the United States. "Accreditation is a status granted to an educational institution or a program that has been found to meet or exceed stated criteria of educational quality." (CAA, 2003). The purpose of accreditation, according to the CAA Standards Manual, is to ensure the quality of the institution or program, and to assist in the improvement of the institution or program. Accreditation, which applies to institutions or programs, is to be distinguished from certification and licensure, which apply to individuals." (CAA, 2003, page 8).

The lack of program standards for individuals seeking specifically designed certificate or licensure programs under CAA guidelines are generally addressed through FAA licensure or industry driven programs such as the National Business Aviation Association's Certified Aviation Manager (CAM); the American Association of Airport Executives' Accredited Airport Executive (A.A.E.), Certified Member (C.M.), or Airfield Certified Employee (A.C.E.) programs; or the National Air Transportation Associations Safety 1st® program.

Under Section 2.5 Scope of the CAA Accreditation Standards Manual, the CAA

"...acknowledges the need for broadly educated individuals who are specifically qualified in aviation, requiring the preparation afforded by associate degree programs with a significant general education component or baccalaureate programs." (CAA, 2003).

It is the phrase "broadly educated" and the phrase "specifically qualified" that is perceived to create a problem in aviation management curriculum development. CAA guidelines would consider an institution for accreditation under the context of a broader general education and aviation breadth that may not actually meet the needs of the industry. From an investigation of position descriptions and general industry information, the industry appears to require university or college graduates to have more specialized skills and knowledge, at least at the entry level position. General education is a very important and necessary aspect of the overall development of a student. The problem from an accreditation standpoint is how does one strike the proper balance between "specifically qualified" and "broadly educated" and remain within the acceptable number of course offerings to meet an institution's normal graduation requirements?

Dating back as far as 1995, industry feedback to academia and the FAA has been to place more focus on airport operations. In a summer workshop addressing the FAA's Airway Science program, James Dunlap, director of operations for Denver International Airport, pointed out the need for less administration and more operations focus for those in airport management. "Airport operations could be a class by itself with topics such as weather forecasting, snow removal, FAR's including Part 139, security, planning/construction, commercial vehicles/ parking, and airport emergencies. These are the topics that airport operations specialists deal with on a daily basis (Newsletter, 1995, pg. 11).

At the same symposium, it was brought out that operation individuals need education on how construction activity will affect airport operations and on topics such as runway resurfacing, security system upgrades, facility additions, and contractor administration, rather than just the big picture of a major construction project or new airport construction. It was suggested that other areas to be included in a graduate's repertoire of knowledge would be those related to environmental issues, tenant concessions, airport government and political factors, communications, public relations, computer skills, crisis management, and conflict resolution. (UAA Newsletter, 1995, pg. 11).

But the industry requirements continue to change and CAA or individual institutions may have to address this issue sooner than later. In February of 2004, the FAA issued a revised <u>14 Code of Federal Regulations (CFR) Part 139</u>. Embodied in revised 14CFR Part 139 regulation is the requirement for specialized instruction of individuals responsible for the safe operation of airports. Specifically, Part 139 requires those individuals at certificated airports having responsibility for carrying out the duties of ensuring airport compliance are to be qualified and trained in areas such as airport self-inspection, airport condition reporting, airport accident and incident reporting, airport fueling and inspection, emergency response, and operation on airport movement and safety areas (FAA, 2004).

The American Association of Airport Executives (AAAE) has been offering a number of educational seminars, conferences, and workshops to airport and other aviation professionals. The major aviation fuel and oil suppliers, such as BP Oil and AvFuel, have requirements for line service and fire hazard training. A review of these training activities would indicate that the products of university aviation management and flight training programs are not adequate to meet the needs of the market and therefore additional transition training is necessary.

ISSUES

The issues outlined in this paper warrant aviation faculty and industry debate and accreditation deliberation. There are five issues addressed:

1. What courses should make up the core of an airport management or operations program?

2. What should be the content or learning outcomes of airport management or operations courses?
3. How will 2-year and 4-year institutions integrate their airport management or operations curriculums or otherwise meet the marketplace demand for graduates?
4. How will transfer courses from 2-year institutions be incorporated into 4-year institutions when the airport management or operations course content or text is the same?
5. Who will teach the airport management or operations courses.

Issue 1: What courses should make up the core of an aviation management program?

The Council on Aviation Accreditation (CAA) Standards Manual identifies the object of an aviation core is to ensure that all students in a collegiate aviation program have a foundation of essential and specialized knowledge of national and international aviation and aerospace systems appropriate to the degree being sought. The students' foundation of knowledge of these systems should include a broad understanding of the components of the systems, insight into how these components function together, and an understanding of how these relate to the physical, economic, political and social environments within which these systems operate (CAA, 2003, pg. 12).

Appendix F of the CAA Standards Manual Form 101 (CAA, 2003) provides a list of subject matter for all program possibilities which could fall under an Aviation Studies option. The topic list is broad in its scope. For instance, airport management, aviation law, aviation business administration, aviation economics, and aviation safety are several of the topics cited. These topics reflect the origins of the UAA Accreditation Guidelines and the subsequent Airway Science program. It also reflects the subject matter topics that previous studies have ascertained. What is missing is the more specific outcomes that the courses should address and the industry actually needs. An analysis or study of specific outcomes may determine that additional courses may be required to adequately cover the knowledge and skills required by the industry.

Issue 2: What should be the content or learning outcomes of airport management or operations courses?

Individuals seeking entry level positions in airport operations will encounter a variety of different position titles. A review of entry level positions in airport operations culled from the American Association of Airport Executives job listings for the period January 1999 to December 2003 identifies the positions listed in Table 1.

A review of the brief position descriptions provided later in this paper along with sample position description in Appendix A, shows several factors are prevalent. Shown in Table 2 are frequently mentioned core requirements determined from all of the position descriptions reviewed. While the knowledge areas may well be covered in today's courses and curriculums, it is unknown what depth of knowledge is necessary. The specialist nature of the entry level position and the depth to which an understanding of the subject matter is required, especially since safety and the lives of others are at stake, makes a study of the learning outcomes of each of the requirements important for determining the structure of a course.

Table 1. *List of entry level airport operations positions titles for the period January 1999 through December 2003.*

Airport operations trainee	Airport operations duty officer
Airport operations aide	Airport operations specialist
Airport operations technician	Airport operations specialist I
Airport operations representative	Airport compliance coordinator
Airport operations coordinator	Airport certification specialist
Airport operations assistant	Airport safety specialist
Airport operations officer	Administrative/operations coordinator
Airport operations agent	Airport manager specialist I
Airport operations/facilities coordinator	Airport duty manager

Table 2. *Knowledge requirements listed in airport operations position descriptions.*

- FAA rules and regulations to include 14 CFR Parts 77, 139, and 150
- TSA rules and regulations to include 49 CFR Part 1542 and 1544
- Advisory Circulars
- Federal, state and local laws applicable to airports
- Airport organization
- Knowledge of airport certification and security
- General airport operations practices
- Airline operations
- Airport security
- Emergency practices and rescue techniques
- Emergency and disaster preparedness
- Groundskeeping repair and maintenance
- CPR/First Aid
- Navigational aids
- Air traffic control
- Airport traffic communications systems
- Basic airport terminology
- Computer based programs and applications including word processing, database management, spreadsheets and other related computer software
- Public relations procedures

Relative to the knowledge requirements of the Federal Aviation Regulations (FAR), several of the job listings used clarifying words such as “demonstrated knowledge”, “working knowledge”, “thorough knowledge” and even “considerable knowledge” of the FAA requirements, policies and procedures, and regulations. One advertisement required applicants to pass a test pertaining to FAA Regulation Part 139. Recently, AAAE has made available the opportunity for individuals to achieve Certified Member (C.M.) status by successful completion of the AAAE’s accreditation exam. However, anecdotal information received by this author from persons interviewing graduates with the C.M stated they were “book smart” but had difficulty applying it to airport situations because of a lack of experience.

From a skill and ability perspective, the position announcements addressed common themes as well. Table 3 lists several of the skills often identified in the announcements. These skills point to the learning outcomes that are necessary for the overall curriculum and help to define the type of activities that should occur within courses.

In contrast to the Table 3 listings, the Standards for CAA accreditation list criteria that are similar but in some respect less specific. It is assumed that an aviation program would have to identify specific learning skills as part of any accreditation standard. The question is to what degree do they develop those skills? At the associate degree level, institutions that can best focus on specific training do so but at the expense of the more general and broad-based education requirement expected by CAA and other accrediting bodies. Baccalaureate degree granting institutions may have to refine their management programs to better address the needs and requirements of the industry by providing additional specific skill based education.

A few of the abstracted job positions identified the requirement for working rotating or any shift, working in various weather conditions, performing physical work activities, having the ability to lift heavy objects, and meeting the criminal history background check (CHBC) required by the Transportation Security Administration (TSA). These types of requirements, while not considered knowledge or skill requirements, reflect capabilities and behaviors that should be part of a student's development, either as informational course material or as part of a cooperative education or internship program. Appendix A list several job descriptions that best illustrate the type of positions and performance outcomes expected by the industry of a university undergraduate curriculum on airport management.

Table 3. *Knowledge requirements listed in airport operations position descriptions.*

Strong oral, written and interpersonal communication skills
Good radio communication skills
Crisis management skills
Use effective management skills and maintain a team atmosphere
Maintaining safe operations based on sound judgment and experience
Prepares and presents oral and written reports
Generates data and analysis reports and forms
Ability to analyze situations quickly and objectively
Ability to determine a proper course of action during emergencies
Ability to plan and coordinate multiple activities occurring simultaneously
Demonstrate a strong customer service inclination
Computer literacy in Microsoft Word, Excel and Internet
Commercial drivers license
Lighting/safety systems

Table 4. *Fundamental skills and values of aviation graduates (2004 CAA, pg. 55).*

Critical Thinking Skills
Problem analysis; problem solving
Judgment and decision making (including resource identification and management)
Interpersonal Skills
Oral and written communications
Conflict management/conflict resolution
Team building; team maintenance; individual accountability
Values and Attitudes
Ethical standards; integrity
Flexibility; versatility; openness to change
Curiosity, imagination, creativity
Motivation
Passion
Dedication

Table 5. *Education and experience requirements listed in airport operations job announcements.*

"Four year degree in aeronautics, management, engineering or related field, or a two-year degree and at least three years of directly related full-time employment in airport, airline or military operations, or similar type experience."
"Bachelor's in business administration, engineering, public administration, aviation management or aerospace engineering plus six months of work experience related to airport operations."
"Two years of college, four years airport experience."
"High school education or the equivalent work experience."
"Two years' college course work (60-semester/90-quarter hours) in aviation, public/business administration or related field; two years' experience in airport operations at an air carrier airport facility OR related bachelor's degree and six months' experience."
"Bachelor's degree in aviation management, airport administration, or related field, and one year of relevant airport operations experience at a U.S. certificated airport."

Issue 3: How will 2-year and 4-year institutions integrate their airport management or operations curriculums or otherwise meet the marketplace demand for graduates?

Though the basic educational requirements varied for the positions listed in Table 1, the majority of the positions sought a four year degree with some level of previous airport experience, typically one year. Two year degrees generally required additional previous work experience. There were a few listings having a high school graduation as a minimum requirement, though those may reflect local government requirements rather than what the airport would like. The requirements generally varied with the size of airport, with larger airports requiring the four year degree and experience, and smaller airports having less stringent requirements. Table 5 lists a sampling of various education and experience requirements taken from the position announcements.

The experience factor places emphasis on the requirement for an internship or cooperative education work experience as being part of an institution's aviation program. Cooperative education and internship experiences are defined as optional or academic program opportunities that enable a student to obtain work experience in one or more career fields (CAA, 2003, pg. 34). That many entry level positions require previous airport experience supports Prather's statement that "Individuals no longer may be able to enter the field with sufficient education alone" (Prather, 1999, pg. 54). CAA standards support internship and co-op programs, but the programs are required to have documented academic requirements and evaluative controls.

The primary point of this issue is that, just as airports have become more complicated and challenging due to the demands of the industry and market, the demands on higher education to meet the challenges have increased as well. The cost of attendance at a 4-year institution is rising nationally. As a result, enrollment trends at two year institutions have been increasing (Smith, 2004). In trying to meet the demands for workplace skill training, 2-year institutions have been more flexible in that regard and are able to develop courses and instruction that address the industry's specialization needs. But how would that specialized study be accepted into a 4-year curriculum which has a more generalized scope and restricted transfer evaluation? While one can argue it is in the best interest of an individual to have both a educational specialization and a broad perspective, financial and political pressures at the State education levels for a.

Two year programs:	Student needs direction
Four year programs:	Student is self-directed
Graduate programs:	Student gives direction

Figure 1. A model for discussion of student performance outcomes at different aviation educational levels.

seamless articulation policy that graduates a student in four years makes both difficult to achieve. This is an issue for the UAA and CAA to take up in more earnest.

It is suggested and proposed that perhaps the discussion begin with a performance outcome model shown in Figure 1. The model provides a simple analogy for what skill ability the courses taught at the different institutional levels should strive toward as a learning outcome for their aviation graduates. A graduate of an associate program would obtain positions that require supervision and direction, while an undergraduate would be able to function more autonomously, and a graduate program would allow students to move into supervisory positions.

While not a focus of this paper, it is noted that there are master degree programs that exist for individuals with some or no prior aviation education and which, in essence, cover material similar to the lower educational levels. At what level and to what degree should airport operations material be appropriately addressed?

<u>Issue 4</u>: How will transfer courses from 2-year institutions be incorporated into 4-year institutions when the airport management or operations course content or text is the same?

In addressing the specialization needs of the industry, 2-year institutions often offer the same content as at 4-year institutions. In aviation, this has been seen mostly in the area of flight training. It is surmised that with the financial and political pressures identified in Issue 3, more 2-year schools may seek to expand their aviation and airport management curriculums in the future. Also of concern are advance placement courses at the high school level that are appearing to becoming more popular. Is it reasonable to grant university credit to a high school student in a subject matter using the same text as that used at a university and which is taught at 300 or 400 levels? How will academic professionals address these issues, if at all? It would be easier to answer these questions if we can better identify the learning outcomes required of the students and then assess them on those outcomes.

As stated previously, it can be expected that more associate degree programs may seek to offer airport, general aviation or FBO related courses. Currently, of the 46 two-year institutions listed in the *Collegiate Aviation Guide*, fourteen list an aviation management or operations related course on their websites. In offering related courses at either the baccalaureate or associate level, the question of what text to use presents itself. The texts normally available for courses in airport operations or management are listed in Table 6. The text *General Aviation Marketing and Management* and *Essentials of Aviation Management* are generally considered for courses geared toward FBO and small airport operations. The remaining texts are geared for airport operations and management at larger air carrier airports. Yet, one can find any in use at either at 2-year, 4-year or even in a high school because those are the available choices.

A drawback to each textbook is the attempt to be all encompassing and focus more on aspects of overall management rather than the more detailed developmental or operational aspects of entry level positions. Each text may have chapters or sections that do address the some of the specifics requirements of entry level positions, but they generally would not be covered to any great depth. It can be argued that those chapters or courses would better serve students if the topics received focus attention as separate courses. It is rare for an individual to graduate from a university and obtain an immediate position as an airport manager. The career path normally begins with a lower level administrative or operations position where specific skills are necessary. In support of the need for study of the necessary performance

Table 6. *Airport operations and management course texts.*

Text	Author	Publisher
1. General Aviation Marketing and Management	Wells, A.	McGraw-Hill
2. Essentials of Aviation Management	Rodwell, J.	Kendall-Hunt
3. Airport Planning and Management	Wells, A.	McGraw-Hill
4. The Administration of Public Airports	Gesell, L.	Coast Aire Publications
5. Airport Operations	Ashford, N.	McGraw-Hill
6. Planning and Design of Airports	Horonjeff, R.	McGraw-Hill
7. AAAE Accreditation Modules	Quilty, S.	AAAE
8. Airport Engineering	Ashford, N.	John Wiley & Sons

outcomes for airport operation personnel, the development or assembly of a proper text would be a welcome result. The closest material to date may be AAAE's A.C.E.-Operations modules (Quilty, 2004), which are designed specifically for individuals having duties and responsibilities to carry out safety oversight and federal requirements on airports.

<u>Issue 5</u>: Who will teach the airport management or operations courses?

.

The last issue, related to the two previous ones, is who will teach the courses? Clearly, someone with operational knowledge of how airports function and comply with federal regulations would be the ideal. Currently, many 2- and 4-year institutions seek out the local airport manager to instruct airport management related courses. But as with any adjunct instructor, they may have the working knowledge but not necessarily the capability to effectively instruct. It is important that these individuals be provided proper support and materials with which to accomplish their tasks. At the collegiate level, there are few permanent faculty (three that this author can identify) who have achieved previous recognition as an Accredited Airport Executive (A.A.E.) through AAAE. This combination of experience and education would appear to be ideal to the type of individual sought by universities. Sometimes, individuals having responsibility for teaching a course in airport management or operations comes from the existing flight faculty who have limited exposure or experience with required learning outcomes for airport operations personnel. The academic institutions need to better prepare future faculty in the area of airport operations.

SUMMARY

The original *College Aviation Accreditation Guidelines* and Airway Science Management program identified core courses for those pursuing a variety of administrative and management positions such as airport management, operations, or general aviation operations. While specifying an additional nine to 12 business or management courses at the upper level, only one course in airport management was necessary as a specialty and that could be taught at the associate degree level (FAA Brochure, 1989).

The Council on Aviation Accreditation was later established to ensure the quality of an aviation institution or program, and to assist in improving aviation institutions or programs. However, a review of the additional training accomplished at airports would indicate that the products of university aviation management and flight training programs are not adequate to meet the needs of the market and therefore additional training has been necessary.

The CAA identifies an aviation professional as "one who employs a common body of knowledge gained by study, experience, and practice, and applies it with imagination, intuition, judgment, competence, reason, ethics, integrity, and responsibility, to the design, management and operation of safe, efficient and comprehensive national and international aviation and aerospace systems." (CAA, 2003, page 10). For such a comprehensive description, the question remains as to whether today's associate, university, and even master level programs are presenting courses with sufficient detail and with appropriate faculty and texts to prepare such individuals.

This paper presented a look at various position announcements for entry level airport operations employees, along with corresponding experience and education desired and skill requirements. From a knowledge standpoint, an analysis of the position announcements identifies common requirements that illustrate the need for more specialized content within the core subject matter of Airport Operations or Airport Management. A revision to flight education curriculum should be considered as well since flight education graduates often seek and obtain entry level operations positions at airports and fixed base operators.

Five issues are raised in this paper for consideration by the academic community. The issues center on what should be the necessary course content and level at which airport operations or management courses should be offered. Both associate, baccalaureate and graduate degree granting institutions may need to refine their aviation management programs to better address the needs and requirements of the industry. One course in airport management may not be enough for students. Additional specific skill-based education is suggested. A study to better identify the specific skills and learning outcomes necessary for graduates of aviation management and operations programs is suggested.

REFERENCES

Council on Aviation Accreditation, (2003, July). *Accreditation standards manual, Form 101*. Auburn, AL: Council on Aviation Accreditation.

Federal Aviation Administration (1989). *FAA Airway Science Program* [Brochure].Washington, D.C.: U.S. Federal Aviation Administration.

Fuller, M. and Truitt, L. (1997). Aviation education: Perceptions of airport consultants. *Journal of Air Transportation* 2(1), 64-80.

Prather, C.D. (1998). Post-secondary aviation education: Preparing students to manage airports of the 21st century. *Collegiate Aviation Review*, 16(1), 46-51.

Prather, C.D. (1999). Airport internships: Effectively structuring a departmental rotation internship. *Collegiate Aviation Review*, 17(1), 53-73.

Quilty, Stephen M. (1996). Educational course and curriculum needs for corporate aviation managers. *Journal of Aviation/Aerospace Education and Research*, 7(1).

Quilty, Stephen M. (2003). Achieving recognition as a world class airport through education and training. *Journal of Air Transportation* 8(1), 3-14.

Quilty, Stephen M. (2004). *Airfield certified employee: operations, Modules 1-5.*Alexandria, VA.: American Association of Airport Executives.

University Aviation Association., (1995, July/August). *Airway science summer workshop focuses on aviation industry* [Newsletter]. Auburn, AL: University Aviation Association.

APPENDIX

Below are sample position announcements taken from the American Association of Airport Executives' job listings between January 1999 and December 2003. They have been modified to delete airport identification and nonessential information such as pay grade and contact information.

AIRPORT OPERATIONS OFFICER
Under the supervision of the operations manager, monitors airfield and other facilities and personnel to ensure compliance with FAA and Commission regulations; researches and writes manuals and bid specifications; performs snow removal duties; other operations related duties as assigned. Qualifications: Bachelor's degree in aviation management, business administration, public administration or related field; prior work experience in airport operations, maintenance, or as an airport intern, a plus; must be able to meet and maintain FAA security requirements; valid driver's license required, CDL required.

OPERATIONS OFFICER
Under the direction of the operations and facilities manager, assists in planning, organizing and supervising the air and landside activities of the airport. Duties: noise abatement program and procedures, voluntary curfew incidents, violations of rules and regulations by pilots. Liaison between District and FAA and commercial carriers, maintains airport certification manual, issues NOTAMS, responsible for risk management and industrial safety program. Maintains tenant relations in connection with the property management and planning departments. College degree or equivalent plus a minimum of one year experience in airport administration and/or operations. Ability to write reports, correspondence, and written instructions, effectively present information and respond to management, administrations, engineers, media and the general public. Excellent telephone, computer skills including MS Word, Excel, Access, PowerPoint. Valid driver's license.

OPERATIONS OFFICER
Reports to operations supervisor. Basic functions: Respond to all ARFF alerts; Maintain pertinent records including landing fees; Operate snow removal equipment as needed; Monitor and maintain compliance with airport security TSA Part 1542. Skills and qualifications: Must posses a working knowledge of FAR Part 139; All applicants must successfully complete the following training: Operation of crash/fire rescue vehicle and snow removal equipment; Must possess or be able to possess a valid driver's license.

AIRPORT OPERATIONS ASSISTANT
Requirements: One year full-time experience in general airport operations including airport management, airport operational maintenance, or air traffic control; -OR- Possession of a Commercial Pilot's Certificate with an Instrument Rating or Military Aviator Rating; -OR- An Associate of Arts degree in Airport Flight Operations or Aviation Management. A valid Class C Driver's License is required at time of hire.
Duties: Duties include shift work 365 days per year. Airport Operations Assistants maintain airport facilities and equipment; provide information to the public regarding airport operations and FAA and airport regulations; enforce airport rules and regulations; operate radio communications equipment; assist in the administration of a Storm Water Pollution Prevention Program; coordinate resolutions to user concerns; assist in the enforcement of airport noise abatement programs; collect fees and generate invoices; operate airport rescue and firefighting equipment; conduct airport inspections; coordinate special events; assist in the supervision of airport contractors; respond to airport safety hazards and discrepancies; disseminate Notices to Airmen (NOTAMs); prepare written correspondence; perform minor maintenance; and perform other tasks as assigned.

OPERATIONS OFFICER
Duties include, but are not limited to, performing daily operations activities at either of two county-operated airports (a general aviation airport and a non-hub commercial service airport); conducting

airfield inspections; ensuring compliance with requirements of FAR Parts 139 and 107 and airport regulations; responding to aircraft incidents/accidents; operating ARFF truck for aircraft emergencies; coordinating and monitoring various activities of commuter airlines; monitoring airfield security; administering vehicle paid parking lot and parking regulations; promoting good public relations, and performing related duties as assigned. Six months of experience working at a general aviation, military or commercial service airport or an on-airport aviation business, or private pilot license, completion of an airport internship, or one year of college-level coursework (30 units) in airport/aviation administration (or equivalent). Knowledge of FAR required. Possession of state driver license.

AIRPORT OPERATIONS COORDINATOR
Entry level positions available immediately at busy general aviation reliever airport. Responsible for day-to-day airfield operations, security, airport safety and FAR Part 139 requirements, including inspections, wildlife, hazmat and noise abatement programs, snow removal operations, crash, fire and rescue services. Duties also include landing fee collection and customer service. Rotating shift assignments required. A.S or B.S degree preferred. Candidates should have aviation or firefighting experience and hold a valid driver's license.

AIRPORT OPERATIONS OFFICER
Under general supervision of the Operations Supervisor the position has delegated responsibility for daily operation and condition of the airport (small non-hub commercial service airport) and and general aviation airport. Possible assignments include, airside/landside operations, airport security, customer service, use of the airport systems such as FIDS/BID, CCTV, ID Badging and Access Control, etc. Successful candidates must have a working knowledge to enforce and ensure compliance with FAR 77, 139 & TSAR 1542, 1544, as well as other federal, state and local laws and regulations. Requires B.S. degree in aviation or related field, current valid driver’s license, ability to pass FBI criminal background check, good written and verbal communications, and knowledge on computer OS and office applications.

OPERATIONS SPECIALIST
Job Purpose: Under general supervision, performs various functions associated with the day-to-day operation and services of the airport.
Essential Job Functions: Routinely inspects and monitors terminal facilities, airside activities, public and employee parking lots and fixed base operations; reports deficiencies to the appropriate agencies. When necessary implements procedures to ensure airside safety during construction and other abnormal conditions. Implements airport recall list relative to airside, landside, and other facility emergencies. Assists customers and tenants with facilities' and services' needs, such as gate information, service vendors, baggage, and distressed passenger needs. Assists with ground transportation network to include public and employee shuttle buses, taxicabs, limousines, and courtesy vehicles, to include correcting deficiencies. Assists in providing supervisory direction to the Welcome Center, Operations Center, and other customer service functions of the airport. Prepares reports and collects data related to customer services, airside and landside activities. Assists in enforcing operating rules and regulations, provisions of contracts and lease agreements. Performs related work as required.
Education and Knowledge: Any combination of education and experience equivalent to graduation from a four (4) year college curriculum in aviation/airport management. Familiarity with the operation of a modern metropolitan airport, including knowledge of the applicable laws, rules and regulations. Knowledge of the principles and practices of general office management. Must possess a valid Driver's License; must possess and maintain a clear driving record; must maintain SIDA (Security Identification Display Area) and AOA (Airport Operations Area) clearance.
Work Experience: Demonstrated competency in the materials, methods, and equipment used in the operation and improvement of civil airports typically acquired through at least six months experience in airport operations.

Mental Skills: Ability to prepare reports and correspondence; ability to follow written and oral instructions; ability to accurately read maps. Demonstrated ability to direct and coordinate diversified operational activities.
Manual Skills: Ability to operate radio, telephonic and computer equipment; ability to type accurately.
Physical Effort: Requires movement throughout the terminal area and outlying facilities which includes the ability to traverse various airport terrains; ability to operate automobile.
Working Conditions: Good. Conditions could occasionally include working in inclement weather. Must be available to work assigned shifts, holidays, and weekends.
Safety of Others: High level of responsibility.
Public Relations: Ability to establish and maintain effective internal and external relationships. Must demonstrate strong interpersonal skills and high level professionalism.
Supervisory Skills: Ability to oversee the work of others.

The Perceived Value of Airline Flight Operations Internship Activities and/or Benefits in the Pursuit of Career Goals

Jose' R. Ruiz
Southern Illinois University

ABSTRACT

Collegiate aviation institutions throughout the United States have been involved in airline flight operations internship programs for over 20 years. Collegiate aviation and industry partnerships serve a variety of purposes, including: (a) allowing a student the opportunity to observe and experience the many facets of a commercial air carrier operation, (b) developing a greater awareness of the airline industry for the student, allowing for better-informed career choices and, (c) providing the airline with access to a low-cost, highly qualified, temporary workforce and a potential employee pool. This graduate follow-up study involved students who participated in the Southern Illinois University Carbondale (SIUC) Aviation Management and Flight (AVMAF) airline flight operations internship program. The study examined data gathered from students who served as interns at one of six different U.S. major air carriers and one U.S. regional air carrier. Former interns were asked to rate the value 14 specific internship activities/benefits had in the pursuit of their career goals. Former interns were also allowed the opportunity to identify other valuable internship activities and/or benefits not originally mentioned in the survey via open-ended response. Respondent employment demographic data are reported. The most valuable and least valuable internship activities and/or benefits identified by the collective group are reported. The most valuable and least valuable internship activities and/or benefits identified for each airline are reported. Recommendations for improving airline flight operations internship programs are also provided.

INTRODUCTION

Collegiate aviation institutions throughout the United States have been involved in airline flight operations internship programs for over 20 years (NewMyer, Ruiz & Rogers, 2000).

Collegiate aviation and industry partnerships serve a variety of purposes, including: (a) allowing an intern the opportunity to observe and experience the many facets of a commercial air carrier operation, (b) developing a greater awareness of the airline industry for the intern, allowing for better-informed career choices, and (c) providing access to a low-cost, highly qualified, temporary workforce and a potential employee pool.

> Employers gain access to committed, knowledgeable, temporary, and low-cost help, plus an opportunity to groom potential full-time employees. The participating students get a unique opportunity to experience the real world in their chosen profession. Co-op programs usually provide pay and/or academic credit, and the participants gain a "foot in the door" with a familiar post-graduate employment prospect. (Kiteley, 1997, p. 1)

Recognizing the potential benefits associated with these industry partnerships, many collegiate aviation programs throughout the country maintain internship agreements with at least one U.S. domestic air carrier. "According to the University Aviation Association, students can choose [an airline flight operations internship] from among more than 270 two- or four-year accredited aviation colleges or universities" (Phillips, 1996, p. 43).

At the time of this research study, the Aviation Management and Flight (AVMAF) Department at Southern Illinois University Carbondale (SIUC) offered airline flight operations internships with six major air carriers and one regional carrier. During the course of an airline flight operations internship, a variety of activities and/or benefits are made available to interns by the participating airline. This study identified 14 internship activities and/or benefits offered by at least one of the seven participating airline partners. How valuable are these activities and/or benefits in the pursuit of career goals? The "most valuable" and "least valuable" internship activities and/or benefits, as perceived by former interns, are identified and categorized by airline. A collective analysis was also conducted. Recommendations designed to improve airline flight operations internship programs and promote future study are also provided.

AIRLINE FLIGHT OPERATIONS INTERNSHIPS

Airline flight operations internship programs provide students the opportunity to experience the airline environment for a pre-determined period of time (typically one academic semester) at an off-campus location for academic credit. Qualifications vary, but many airline flight operations internship programs require students to possess at least a private pilot certificate. While on the internship, students are expected to perform a variety of administrative support functions. However, interns are also exposed to the varied operational and support functions associated with an airline.

Phillips (1996) discussed airline internship programs at United, Delta, TWA, USAir, and FEDEX. The article mentioned numerous benefits associated with these internships, including: (a) full-time employment at United and FEDEX, (b) potential for being hired at Delta, (c) aircraft simulator time, (d) travel benefits, and (e) jump seat flights or Additional Crewmember (ACM) privileges.

> Simply stated, an internship or cooperative education program (co-op) is an opportunity for a college student to combine traditional on-campus academic learning with professional work experience in a chosen field. These programs allow students in a large number of collegiate aviation programs to bridge the gap between the classroom and the real world. (p. 44)

D. Parker (personal communications, March 8, 2002), United Parcel Service (UPS) 727 Ground School Supervisor felt that the internship program was valuable for both the student and the airline.

> We have the opportunity to work with the brightest students in [collegiate] aviation. Our interns are trained and qualified to develop sophisticated training aids. We invest quite a bit of money in our interns, but we receive a great return on our investment. We may not guarantee our interns an interview like other airline do, but if an intern does a good job for me – when he's ready, I will personally go to Human Resources and tell them that we need to interview this guy! Now that's an advantage toward achieving your career goals!

B. Davis (personal communications, March 8, 2002), Pilot Recruiter for TWA was enthusiastic in her opinion related to the value of the internship program at TWA.

> An internship allows a student the opportunity to observe and participate in activities involved in running an airline - getting an airplane off the ground is only one facet of the operation. Classroom instruction is great, but an internship allows a student to apply his knowledge. An internship can pay off big dividends as a student applies for employment in the future. We consider an internship to be a four-month interview. If an intern applies for a job at TWA, we know what we're getting and they [the intern] know what they're getting into. An internship can really increase your chances of getting a job with an airline.

NewMyer (1991), reported that three airlines: United, Northwest and Eastern had a total of six university or community college "partners" including three airline-university intern agreements. It was noted that these partnerships were a response to "…the airline industry's search for an answer to the need for qualified, quality pilots…" (p. 16).

In a presentation that addressed airline flight operations internship benefits conducted at Concordia University, Ruiz (2001) quoted a statement made by the United Airlines flight operations internship program director at that time: "Internships are a phenomenal opportunity for a job interview. Interns are not competing with the other 9000 applicants - they can move into the flight deck five years earlier than non-interns, resulting in an additional $7 - $7.5 million in career earnings." (p.22)

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

The Aviation Management and Flight Department of Southern Illinois University Carbondale has administered an airline flight operations internship program since 1987. At the time of this study, the SIUC AVMAF department maintained formal airline flight operations internship agreements with six U.S. major domestic air carriers, including: American Airlines, Delta Air Lines, Northwest Airlines, Trans World Airlines LLC, United Airlines and United Parcel Service. A formal airline flight operations internship agreement also existed between the SIUC AVMAF department and Chicago Express Airlines, a U.S. regional carrier serving the Midwest. Each of these air carriers expose interns to a variety of activities and/or benefits for participating in the internship.

PURPOSE OF THE STUDY

The purpose of this study was to identify what value former interns assigned to multiple airlines placed on individual airline flight operations internship activities and/or benefits in the pursuit of career goals. This report is intended to assist airline flight operations internship program managers develop an internship program that will emphasize learning experiences former interns perceived as valuable in the pursuit of career goals.

Methodology

The population for this study included SIUC AVMAF students who completed airline flight operations internships with U.S. air carriers that maintained a formal airline flight operations internship agreement with SIUC. The SIUC AVMAF department and airline internship partners performed a records review and identified 224 students who met the population criteria from July 1987 through May 2002. Twenty-three airline flight operations interns had served with American Airlines, 9 with Chicago Express Airlines, 20 with Delta Air Lines, 8 with Northwest Airlines, 23 with Trans World Airlines, 136 with United Airlines, and 13 with United Parcel Service. Eight interns served on multiple (two) internships.

A total of 218 intern addresses were obtained from the SIUC Alumni Association and SIUC AVMAF internship records. Addresses for six former interns who served at United Airlines were not available. A total of 226 survey questionnaires were mailed to 218 former interns. Eight of the former interns attended multiple (two) internships and, therefore, received two questionnaires, accounting for a total of 226. Two mailings of the survey questionnaire were conducted over a three month period. The first and second mailings of the survey questionnaire resulted in the receipt of 150 survey questionnaire responses, a response rate of 66.4 percent.

SURVEY QUESTIONNAIRE

The survey questionnaire made use of a linear, numeric scale-based opinionnaire to elicit the perceived value of 14 airline flight operations internship activities and/or benefits in the pursuit of career goals (see Table 1). SIUC AVMAF internship program records indicated that each internship activity and/or benefit listed in the survey questionnaire was offered by at least one of SIUC's seven airline partners. Scale values ranged from "Extremely Valuable" = 5 to "No Value" = 1. The survey questionnaire also contained an open-ended section that allowed respondents to identify additional internship activities and/or benefits they considered valuable.

Table 1. *Airline Flight Operations Internship Activities and/or Benefits*

Jumpseat/Observing Member of the Crew Privileges
Opportunity to View Airline Operations First Hand
Opportunity to Work within an Airline
Guaranteed Job Interview
Opportunity to Interact and Network with Airline Personnel
Access to Aircraft Simulators
Access to Aircraft Ground Schools
Job Shadowing
Access to Airline Training Classes
Tours of Airline Facilities
Travel Opportunities
Work Assignments/Projects
Preferential Hiring with a Regional Airline
Opportunity to Observe Executive Meetings

Analysis

Data collected from the survey questionnaire was described using Statistical Product and Service Solutions (SPSS) generated means, standard deviations, frequencies and percentages. When comparing airlines, Chi-square tests were conducted and cross-tabulation tables were examined to identify statistically significant differences in responses at the $p<.05$ level. "In psychological and educational circles, the 5 percent (.05) level of significance is often used as the standard for rejection" (Best, J.W. & Kahn, J.V., 1993). A Kruskal-Wallis test was conducted on activities and/or benefits identified as statistically significant by the Chi-square test to confirm findings.

RESPONDENT EMPLOYMENT DATA

One hundred forty-four respondents (96%) indicated that they were employed in aviation professions. Six respondents (4%) indicated that they were employed in non-aviation professions.

One hundred thirty-seven respondents (91%) reported that they were employed as pilots by a major airline, a regional airline, a corporate entity, the military, or a flight school (see Table 2). In several cases, respondents indicated that they were employed by two organizations, e.g., full-time employment with a major airline and part-time employment with the Air National Guard, thus explaining why 137 pilots reported occupying 147 positions. Regional airlines employed the majority of respondents (36.7%). Respondents who interned with Chicago Express Airlines, the only regional airline in this study, were all employed by Chicago Express (100%). The military employed the fewest number of respondents (2.8%).

Table 2. *Pilot Positions Presently Occupied by Respondents*

Employer	Frequency	Percentage
Regional Airline	54	36.7
Major Airline	49	33.3
Flight Instruction	26	17.7
Corporate	14	9.5
Military	4	2.8
Total	147	100

United Airlines employed 37 of the 49 respondents (75.5%) flying for a major airline (see Table 3). Collectively, other participating major air carriers employed 12 respondents (24.4%). Of the 37 respondents hired as pilots by United, 36 of the respondents (97.2%) interned with United. Of the remaining 12 respondents hired as pilots by various other major airlines, 1 interned with UPS, 2 interned with TWA, 3 interned with Delta, and 6 interned with United.

Table 3. *.Major Airlines that Employ Respondents*

Employer	Frequency	Percentage
United	37	75.5
American	4	8.1
Delta	3	6.2
UPS	3	6.2
US Airways	1	2.0
FEDEX	1	2.0
Total	49	100

FINDINGS

Collective Ranking of Activities and/or Benefits

Respondents identified "Jumpseat/ Observing Member of the Crew Privileges" as the most valuable internship activity and/or benefit in the pursuit of career goals (*M* = 4.55). This activity and/or benefit also had one of the smallest standard deviations in this section of the survey questionnaire (*SD* = .76). This standard deviation indicates that responses related to the perceived value of this activity and/or benefit was similar (see Table 4). Notably, 137 respondents (91.3%) rated the "Jumpseat/Observing Member of the Crew Privileges" activity and/or benefit to be "Valuable" or "Extremely Valuable" in the pursuit of career goals.

Respondents also indicated that several other activities and/or benefits were highly valued. "Opportunity to View Airline Operations First Hand" (*M* = 4.50), "Opportunity to Work within an Airline" (*M* = 4.48), "Opportunity to Interact and Network with Airline Personnel" (*M* = 4.37), "Access to Airline Simulators" (*M* = 4.09), and "Access to Aircraft Ground Schools (*M* = 4.04) were internship activities and/or benefits that ranged between "Valuable" and "Extremely Valuable" in the pursuit of career goals (see Table 4). The standard deviation associated with these five activities and/or benefits were among the lowest in this section of the survey questionnaire (*SD* = .69, .74, .73, 1.08 and 1.07, respectively), suggesting that responses related to the perceived value of these activities and/or benefits were not widely dispersed. The internship activity and/or benefit "Guaranteed Job Interview" received a high rating (*M* = 4.41), but it also received the second highest standard deviation in this section (*SD* = 1.14). This indicates that responses related to the perceived value of this activity and/or benefit varied more than responses to other activities and/or benefits (see Table 4).

Respondents identified "Opportunity to Observe Executive Meetings" as the least valuable internship activity and/or benefit in the pursuit of career goals (*M* = 3.52). This activity and/or benefit also had the fourth highest standard deviation in this section of the survey questionnaire (*SD* = 1.11).

The "Preferential Hiring with a Regional Airline" internship activity and/or benefit received the second lowest rating in this section (*M* = 3.65). It also had the highest standard deviation in this section of the survey questionnaire (*SD* = 1.50). However, almost half of the respondents (40.7%) reported that the "Preferential Hiring with a Regional Airline" internship activity and/or benefit were not available to them at the time of their internship. Of the 89 respondents that did have access to the "Preferential Hiring with a Regional Airline" internship activity and/or benefit, 51 respondents (57.3%) rated it as "Valuable" or "Extremely Valuable" in the pursuit of career goals. Respondents perceived the remaining internship activities and/or benefits as less valuable in the pursuit of career goals (see Table 4). Means for these activities and/or benefits ranged from 3.65 to 3.95 on a five point scale.

Respondents identified six additional internship activities and/or benefits they considered valuable in an open-ended section of the survey questionnaire. Narrative responses were organized according to key terms, phrases and prevailing themes (see Table 5).

Table 4. *Ranking of Airline Flight Operations Internship Activities and/or Benefits*

Activity and/or Benefit Ranking	Mean	Standard Deviation
Jumpseat/Observing Member of the Crew Privileges	4.55	.76
Opportunity to View Airline Operations First Hand	4.50	.69
Opportunity to Work within an Airline	4.48	.74
Guaranteed Job Interview	4.41	1.14
Opportunity to Interact and Network with Airline Personnel	4.37	.73
Access to Aircraft Simulators	4.09	1.08
Access to Aircraft Ground Schools	4.04	1.07
Job Shadowing	3.95	.95
Access to Airline Training Classes	3.95	1.09
Tours of Airline Facilities	3.83	.97
Travel Opportunities	3.81	1.11
Work Assignments/Projects	3.67	.96
Preferential Hiring with a Regional Airline	3.65	1.50
Opportunity to Observe Executive Meetings	3.52	1.11

Note. Rankings were based on responses to a 5-point scale (1 = *No Value*, 5 = *Extremely Valuable*)

N = 150

Table 5. *Additional Internship Activities and/or Benefits Identified by Respondents*

Activities and/or Benefits	Frequency	Percentage
Interview Preparation/Access to the Hiring Process	11	29.0
Friendships with Other Interns	8	21.0
Access to Training Materials	7	18.5
Boeing Manufacturing Plant Tour	5	13.0
Flight Engineer Rating	4	10.5
Maintenance Facility Tours	3	8.0
Total	38	100

Note. Responses were to an open-ended section of the survey questionnaire.

MOST VALUABLE AND LEAST VALUABLE ACTIVITIES AND/OR BENEFITS BY AIRLINE

This section identifies the airline flight operations internship activities and/or benefits considered most valuable and least valuable in the pursuit of career goals by respondents from individual airlines. Means and standard deviations are used to describe data gathered for each item in the survey questionnaire by airline.

American Airlines.

A total of 18 survey questionnaire responses were received from 23 former American Airlines flight operations interns (78%). Respondents identified the “Jumpseat/Observing Member of the Crew Privileges” internship activity and/or benefit as the most valuable in the pursuit of career goals (*M* = 4.56). The standard deviation associated with the activity and/or benefit was .86, indicating that responses related to this activity and/or benefit were not widely dispersed.

Respondents identified the “Opportunity to Observe Executive Meetings” internship activity and/or benefit as the least valuable in the pursuit of career goals (*M* = 3.38). The standard deviation associated with this activity and/or benefit was the fourth highest among those provided by respondents from American Airlines (*SD* = 1.12), indicating that responses related to this internship activity and/or benefit varied more than responses for other activities and/or benefits.

Chicago Express Airlines/ATA Connection.

A total of seven survey questionnaire responses were received from nine former Chicago Express Airlines flight operations interns (78%). Respondents identified the "Guaranteed Job Interview" and “Preferential Hiring with a Regional Airline” internship activities and/or benefits as the most valuable in the pursuit of career goals. Both internship activities and/or benefits had a mean of 5.00. The standard deviation associated with both activities and/or benefits was .00, indicating that responses related to these activities and/or benefits were exactly alike.

Respondents identified two internship activities and/or benefits as the least valuable in the pursuit of career goals. These activities and/or benefits were “Tours of Airline Facilities” and “Travel Opportunities”, both activities and/or benefits had a mean of 3.43. The standard deviation associated with the “Tours of Airline Facilities” activity and/or benefit was .79, indicating that responses related to this internship activity and/or benefit were not widely dispersed. The standard deviation associated with the "Travel Opportunities" activity and/or benefit was 1.27, the second highest reported by respondents from Chicago Express Airlines, indicating that responses related to this internship activity and/or benefit varied more than responses for other activities and/or benefits.

Delta Air Lines

A total of 18 survey questionnaire responses were received from 20 former Delta Air Lines flight operations interns (90%). Respondents identified the "Opportunity to Work within an Airline" internship activity and/or benefit as the most valuable in the pursuit of career goals (*M* = 4.78). The standard deviation associated with the activity and/or benefit was .43, indicating that responses related to this activity and/or benefit were not widely dispersed.

Respondents identified the "Preferential Hiring with a Regional Airline" internship activity and/or benefit as the least valuable in the pursuit of career goals (*M* = 3.38). The standard deviation associated with this activity and/or benefit was the highest among those provided by respondents from Delta Air Lines (*SD* = 1.67), indicating that responses related to this internship activity and/or benefit varied more than responses for other activities and/or benefits.

Northwest Airlines.

A total of four survey questionnaire responses were received from eight former Northwest Airlines flight operations interns (50%). Respondents identified two internship activities and/or benefits as the most valuable in the pursuit of career goals, "Access to Airline Training Classes" (*M* = 5.00) and "Access to Aircraft Ground Schools" (*M* = 5.00). The standard deviation associated with each of these activities and/or benefits was .00, indicating that responses related to these activities and/or benefits were exactly alike.

Respondents identified the "Travel Opportunities" internship activity and/or benefit as the least valuable in the pursuit of career goals (*M* = 3.25). The standard deviation associated with this activity and/or benefit was the highest among those provided by respondents from Northwest Airlines (*SD* = 1.50), indicating that responses related to these internship activities and/or benefits varied more than responses for other activities and/or benefits.

Trans World Airlines

A total of 18 survey questionnaire responses were received from 23 former TWA flight operations interns (78%). Respondents identified the "Jumpseat/Observing Member of the Crew Privileges" internship activity and/or benefit as the most valuable in the pursuit of career goals (*M* = 4.78). The standard deviation associated with the activity and/or benefit was .65, indicating that responses related to this activity and/or benefit were not widely dispersed.

Respondents identified the "Preferential Hiring with a Regional Airline" internship activity and/or benefit as the least valuable in the pursuit of career goals (*M* = 3.33). The standard deviation associated with this activity and/or benefit was the highest among those provided by respondents from TWA (*SD* = 1.63), indicating that responses related to this internship activity and/or benefit varied more than responses for other activities and/or benefits.

United Airlines.

A total of 80 survey questionnaire responses were received from 130 former United Airlines flight operations interns (62%). Respondents identified the "Guaranteed Job Interview" internship activity and/or benefit as the most valuable in the pursuit of career goals (*M* = 4.75). The standard deviation associated with the activity and/or benefit was .75, indicating that responses related to this activity and/or benefit were not widely dispersed.

Respondents identified the "Opportunity to Observe Executive Meetings" internship activity and/or benefit as the least valuable in the pursuit of career goals (*M* = 3.33). The standard deviation associated with this activity and/or benefit was among the highest among those provided by respondents from United Airlines (*SD* = 1.09), indicating that responses related to this internship activity and/or benefit varied more than responses for other activities and/or benefits.

United Parcel Service

A total of five survey questionnaire responses were received from 13 former UPS flight operations interns (38.5%). Respondents identified the "Access to Aircraft Simulators" internship activity and/or benefit as the most valuable in the pursuit of career goals (*M* = 4.80). The standard deviation associated with the activity and/or benefit was .45, indicating that responses related to this activity and/or benefit were not widely dispersed.

Respondents identified the "Preferential Hiring with a Regional Airline" internship activity and/or benefit as the least valuable in the pursuit of career goals (*M* = 2.50). The standard deviation associated with this activity and/or benefit was the third highest among those provided by respondents from UPS (*SD* = .71), indicating that responses related to this internship activity and/or benefit were not widely dispersed.

Notably, respondents from Delta, TWA, and UPS identified "Preferential Hiring with a Regional Airline" as the least valuable internship activity and/or benefit in the pursuit of career goals.

STATISTICALLY SIGNIFICANT DIFFERENCES AMONG AIRLINES

Chi-square tests were conducted and cross-tabulation tables were examined to identify statistically significant differences in the manner respondents from different airlines viewed individual airline flight operations internship activities and/or benefits. The "Guaranteed Job Interview" internship activity and/or benefit was the only activity and/or benefit found to be statistically significant at the $p<.05$ level, [X^2 (24, N = 128) = 46.12, p = .00]. However, one of the limitations associated with the Chi-square test is as follows:

If there is an unusually small expected frequency in a cell, chi-square (if applied) might result in an erroneous conclusion. For more than two cells, chi- square should *not* be used if more than 20 percent of the f_e cells have expected frequencies less than 5. (Lind, Marchal & Mason, 2002, p. 559)

According to this rule, it would not be appropriate to use the goodness-of-fit test on this specific internship activity and/or benefit, as 28 cells (80%) have expected cell counts of less than five (see Table 6).

The Kruskal-Wallis is a non-parametric test requiring only ordinal-level (ranked) data. No assumptions related to the shape of populations are required. For the Kuskall-Wallis to be applied, the samples selected from the group must be independent (Lind, Marchal & Mason, 2002).

After applying a Kruskal-Wallis test of significance the relationship was no longer found to be significant at the $p<.05$ level, [X^2 (4, N = 128) = 6.55, p = .16].

Table 6. *Chi-square Test of Association between Airlines and Responses to the Internship Activity "Guaranteed Job Interview"*

Level	Count	American	Chicago Express	Delta	Northwest	TWA	United	UPS	Total
	Observed	2	0	2	0	3	2	0	9
No Value	Expected	.9	.4	1.0	.1	1.0	5.5	.1	9.0
	% within Airline	15.4%	.0%	14.3%	.0%	21.4%	2.6%	.0%	7.0%
	Observed	1	0	0	0	0	0	0	1
Little Value	Expected	.1	.0	.1	.0	.1	.6	.0	1.0
	% within Airline	7.7%	.0%	.0%	.0%	.0%	.0%	.0%	.8%
	Observed	2	0	2	0	4	2	0	10
Neutral	Expected	1.0	.5	1.1	.1	1.1	6.1	.2	10.0
	% within Airline	15.4%	.0%	14.3%	.0%	28.6%	2.6%	.0%	7.8%
	Observed	1	0	2	1	2	10	1	17
Valuable	Expected	1.7	.8	1.9	.1	1.9	10.4	.3	17.0
	% within Airline	7.7%	.0%	14.3%	100.0%	14.3%	12.8%	50.0%	13.3%
	Observed	7	6	8	0	5	64	1	91
Extremely Valuable	Expected	9.2	4.3	10.0	.7	10.0	55.5	1.4	91.0
	% within Airline	53.8%	100.0%	57.1%	.0%	35.7%	82.1%	50.0%	71.1%
Total	Count	13	6	14	1	14	78	2	128

CONCLUSIONS

Respondents assigned to multiple airlines perceived individual airline flight operations internship activities and/or benefits to be of value in the pursuit of career goals.

Discussion of Collective Findings

Mean values for internship activities and/or benefits ranged from 4.55 to 3.52. Seven internship activities and/or benefits possessed means of 4.04 or higher. The aggregate mean for the 14 internship activities and/or benefits was 4.06. All internship activities and/or benefits were viewed as possessing some value; however, internship activities and/or benefits that allowed respondents to network with airline personnel, assisted in acquiring future employment, provided access to training facilities and allowed exposure to the operational environment of the airline industry were considered most valuable. "Preferential Hiring with a Regional Airline" did not rank as highly as anticipated by the researcher; however, 61 respondents (40.7%) indicated that preferential hiring opportunities with regional airlines were not available during their internship. Of the 89 respondents who did have access to the activity and/or benefit, 51 respondents (57.3%) considered it valuable or extremely valuable in the pursuit of their career goals.

"Jumpseat/Observing Member of the Crew Privileges" was identified as the most valuable internship activity and/or benefit (M = 4.55) in the pursuit of career goals. During my tenure as department airline flight operations internship coordinator, interns have often remarked on the value they placed on the jumpseat activity. Interns often described the opportunity to view airline flight operations "first hand" as "invaluable". "Opportunity to Observe Executive Meetings" was identified as the least valuable internship activity and/or benefit (M = 3.52) in the pursuit of career goals. I speculate that the reason for this lack of perceived value was the role interns were most likely allowed to play in these meetings. They may have been allowed to observe the meetings, but not participate in their proceedings.

Most Valuable and Least Valuable Activities and/or Benefits by Airline

Data that was categorized and analyzed by individual airline indicated that respondents perceived internship activities and/or benefits that allowed them access to training classes/facilities, exposure to the airline operational environment, and assisted in acquiring future employment were considered the most valuable in the pursuit of career goals. Respondents perceived travel opportunities, tours of airline facilities, and the opportunity of observe executive meetings as the least valuable internship activities and/or benefits in the pursuit of career goals.

Statistically Significant Differences Among Airlines

There were no statistically significant differences ($p<.05$) in the manner respondents from different airlines perceived the value of airline flight operations internship activities and/or benefits in the pursuit of career goals.

RECOMMENDATIONS

1. Internship activities and/or benefits whose collective mean equaled or exceeded 4.00 were considered valuable or extremely valuable in the pursuit of career goals. As such, airlines that offer airline flight operations internships should consider providing the following internship activities and/or benefits:

    a. Jumpseat/observing member of the crew
    b. Opportunities to view airline operations first hand
    c. Opportunities to work within the airline
    d. Guaranteed job interviews
    e. Opportunities to interact and network with airline personnel
    f. Access to aircraft simulators
    g. Access to aircraft ground schools
    h. Interview Preparation/Access to the
    i. Hiring Process

2. Conduct a research study that updates the list of activities and/or benefits offered by major air carriers hosting internships.
3. Conduct a research study that updates the list of activities and/or benefits offered by regional air carriers hosting internships.

Airline flight operations internships expose students to learning experiences that cannot be duplicated in the classroom. As such, it is the responsibility of the collegiate aviation institution and the participating air carrier to ensure that these experiences are meaningful and rewarding. Identifying activities and/or benefits that interns perceive as valuable in the pursuit of their career goals is a start in this direction.

REFERENCES

Best, J.W., & Kahn, J.V. (1993). *Research in education* (7th ed.). Needham Heights, MA: Allyn-Bacon.

Bradley, P. (1997, September). Is the pilot shortage coming? *Business and Commercial Aviation*. 78-80.

Department of Aviation Management and Flight (AVMAF). (1999). *Airline internships offered at Southern Illinois University Carbondale*. Carbondale, IL: Author.

Kiteley, G.W. (1997, November). *Aviation industry and college partnerships in the United States.* Auburn, AL: University Aviation Association.

Lind, D.A., Marchal, W.G., & Mason, R.D. (2002). *Statistical techniques in business and economics* (11th ed.). New York, NY: McGraw-Hill Irwin.

NewMyer, D. A. (1991)..Status report: An airline-university cooperative pilot career program. *Collegiate Aviation Review*, 15-22

NewMyer, D.A., Ruiz, J.R., & Rogers (2000). University flight operations internships with major airlines: Airline perspectives. *The Journal of Air Transportation World Wide, 5*(2), 111-129 .

Phillips, W. (1996, November). Internships and coops: Collegiate programs that can make your career take off. *Flight Training*, 43-47.

Ruiz, J.R. (2001). Collegiate aviation internships with U.S. major airlines: A changing climate. Paper presented to the Aviation Management Education and Research Conference. Abstract retrieved August 15, 2001 from http://www.johnmolson.concordia.ca/amerc

Identifying Synergistic Relationships of National Aviation (Blue Ribbon) Commission Reports: A Qualitative Data Analysis Application

Nanette Scarpellini-Metz and Brent D. Bowen
University of Nebraska at Omaha

ABSTRACT

By examining the three Blue Ribbon Commission reports focused on the aerospace industry from 1993-2002, the purpose of this paper was to identify significant synergies emerging in the aerospace industry as identified by the commissions' shared aims. A content analysis of the commission reports' recommendations revealed fundamental issues that continue to persist even though they have been recognized as problems. The analysis used a combination of concepts and phrases to link the reports together. The research revealed how the aerospace industry has changed during the time periods examined by these commissions as it resonated in the types of recommendations and associated language used in the reports. The analysis revealed three common areas of concern: modernizing the Federal Aviation Administration, forming partnerships between business and government, and investing in long-term research and development. A fourth area emerged in the 1997 and 2002 reports—developing core infrastructure for the safety and security of the entire nation, not just the passengers. Based on the dynamic trends identified in the analysis of the three reports, this study advocates a selective pattern of future policy action based on the Blue Ribbon Commissions' recommendations.

The aerospace industry has undergone a metamorphosis since its inception a hundred years ago. With the Wright Brothers first successful flight in 1903, few could imagine the widespread use of airplanes for transportation and the movement of freight as seen today. The United States (US) is struggling to maintain the most successful aerospace industry in the world. In 1993 the first of three Blue Ribbon Commissions was formed by presidential decree to study the industry. These commissions scrutinized the aerospace industry and offered workable recommendations to maintain the nation's dominance. The focusing events that led to the formation of the three distinct Blue Ribbon Commissions were such that they would have the ability to impact future policy action. Propelled by the commission findings and these events, the aerospace industry and the nation are on the verge of significant policy action. The purpose of this study to understand the connections between these commissions in order to form effective and useful policy action to lead the US in the unpredictable global market.

The three Blue Ribbon Commissions span nearly ten years: 1993-2002. This paper examines the recommendations and searches for recurring themes throughout the reports that would reflect evidence of their successful implementation. A content analysis was conducted based on the executive summary or its equivalent for each of the three commissions' final reports. Through content analysis, synergies developing within the aerospace industry became apparent. By comparing the reports, this paper demonstrates the influence of the commissions on the aerospace industry and the need for their continuing support.

The three Blue Ribbon Commissions were:

- Commission on the Future of the United States Aerospace Industry of 2002
- White House Commission on Aviation Safety and Security of 1997
- National Commission to Ensure a Strong and Competitive Airline Industry of 1993

While there are other Blue Ribbon Commissions and related reports, these three Commissions were selected for various reasons to include the major focusing events precipitating their formation. Focusing events have had the potential to significantly impact policy action (Cobb & Primo, 2003). Resulting public reaction further spurred industry and/or government action. Moreover, between 1993 and 2002, the aerospace industry experienced considerable change. At the start of the 21st century, policy changes have occurred that influenced the financial strength of the aerospace industry and the nation as a whole in an emerging global market. Recommendations from these reports continued to influence policy action. The 2002 report was the primary document in the analysis while the other two reports served as secondary documents to which the first document was compared.

To provide contextual background, the next section offers a description of the formation and a summary of the recommendations suggested by each of the three commissions. This analysis will be followed by an explanation of the respective content. The paper concludes with a discussion of the influence of the Blue Ribbon Commissions on the aerospace industry.

Blue Ribbon Commissions Development and Recommendations

The formation of each commission resulted from a critical and potentially pivotal event in either the aerospace industry or the nation as a whole. The commissions addressed current and pressing problems within the industry which could possibly affect the nation's economic or overall well-being. Both presidents involved in the creation of these blue ribbon commissions used them to gain insight into the aerospace industry from an insider's perspective to better manage the industry and address public concerns. A limitation of the study is that each of the commissions had a different purpose since they resulted from unique circumstances. This could have had an effect on the reports' content. However, all three commissions addressed common problems and provided related recommendations for dealing with the current issues.

The Blue Ribbon commission process has become an increasingly prominent tool in the policymaking process (Kitts, 1995). This has been due, in part, to legislative issues related to executive power in areas such as foreign and defense policy. Overall, Blue Ribbon commissions have had varying success in promoting change through their recommendations. Factors related to success include articulating attainable objectives, allowing sufficient time for commissioners to complete the study, the quality of background research, response to testimony from public hearings, use of outside experts, and also commissioners' involvement in implementing the process (Johnson, 1982). Additional factors that have had a significant impact after the report was completed include the media response to the commission report and the current political environment in terms of those involved in the implementation process (Johnson, 1982; Luck, 2000). Research suggests that commission recommendations must include viable strategies that demand serious consideration from policymakers and shape political will and initiative (Johnson, 1982; Kitt, 1995; Luck, 2000).

Luck (2000) found that the aggregate impact of the Blue Ribbon commissions was more significant than the influence of an individual commission. The studies conducted within the Blue Ribbon commission process provided important contributions to various policy areas, such as guiding the international agenda of the United Nations (UN) (Luck, 2000). Typically, commission findings build on foundations established by prior studies. Consequently, they influence future Blue Ribbon commissions. Luck found considerable sharing of ideas between the Blue Ribbon commissions involving the UN and suggests similarities between other commissions. Previous aviation commissions, such as the Aviation Safety Commission that filed its report in April 1988, laid the groundwork for subsequent commissions. This commission concluded that while the national air transportation system was safe, the safety came at the expense of its passengers through delays and various inconveniences (Aviation Safety, 1988). These findings foreshadowed the current status of the air transportation system. The true success of the Blue Ribbon Commission process must be evaluated over the long term to fully appreciate the influence it has on the issues as well as those involved (Johnson, 1982; Luck, 2000).

Commission on the Future of the United States Aerospace Industry of 2002

Following the terrorists attacks on the World Trade Center and the Pentagon on September 11, 2001, President George W. Bush formed the

Commission on the Future of the United States Aerospace Industry. With Robert S. Walker as Chairman, the Commission was established by Section 1092 of the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, Public Law 106-398. The Walker Commission was created to investigate the potential role the US aerospace industry played in the global economy and any correlation there may be to US national security (Commission on the Future, 2002). Accordingly, the Walker Commission evaluated the relationship between the domestic aerospace industry and the nation's economic and national security. “The Commission’s urgent purpose is to call attention to how the critical underpinnings of this nation’s aerospace industry are showing signs of faltering—and to raise the alarm” (p. v). During its investigation, the Commission issued three interim reports detailing project status. The final report was issued on November 18, 2002.

To thoroughly investigate the aerospace industry, the Walker Commission engaged in various fact-finding activities that included six public meetings occurring between November 2001 and November 2002. The Commissioners listened to 61 witnesses in public sessions and contacted more than 100 organizations to collect information (Commission on the Future, 2002). Additionally, the membership visited both Asia and Europe to explore the US aerospace role in these regions. A website was developed to communicate with individuals on a national and global level. The site had over 150, 000 visitors.

The Walker Commission emphasized the importance of the aerospace industry staying strong to maintain the stability of US leadership in the global aerospace sector. The final report was meant to be a call to action. Nine chapters of the report offered nine recommendations to the nation’s leaders to foster the future of the US aerospace industry. The report and the work of the Walker Commission was based on what it hoped to create—a national vision to cultivate the imagination and innovation characterizing the first hundred years of the aerospace industry. This vision is “Anyone, Anything, Anywhere, Anytime” (Commission on the Future, 2002, p. VI.).

While the previous commissions offered three or four recommendations, the Walker Commission developed nine recommendations to ensure the strength of the aerospace industry. These recommendations corresponded with the nine chapters of the final report.

1. Vision: Anyone, Anything, Anywhere, Anytime

    The federal government must provide increased and continued investment in the aerospace industry as well as support private investment in the industry. The US should “boldly pioneer new frontiers in aerospace technology, commerce and exploration” (p. VI).

2. Air Transportation: Exploit Aviation’s Mobility Advantage

    Adapt to growing and changing styles of aerospace vehicles both in civil and military functions. Move more quickly to establish new aerospace systems with an emphasis on process certification as opposed to product. Support the implementation processes and simplify airport and runway expansion.

3. Space: Its Special Significance

    Stress the importance of space to national security and economic well-being by supporting the partnership between government and industry to develop technologies. Provide future opportunity for public and commercial space ventures.

4. National Security: Defend America and Project Power

    Promote the continuous development of design and manufacturing proficiencies. Make use of the private sector to develop advances in communication, navigation and surveillance. For critical technologies and core capabilities that are not commercially viable, support their continued development. Eliminate unnecessary barriers to defense obtaining products and services from the private sector as well as make defense products available for international sale.

5. Government: Prioritize and Promote Aerospace

    Advance aerospace by forming a management configuration that spans the government and includes a national aerospace policy. Establish an aerospace sectoral budget to "launch presidential aerospace initiatives, assure coordinated funding for such initiatives and replace vertical decision-making with horizontally determined decisions in both authorizations and appropriations" (p. xii). Under this recommendation, the Commission also calls for a "White House policy coordinating council, an aerospace management office in the OMB and a joint committee in Congress" (p. xii).

6. Global Markets: Open and Fair

    Reform US and multilateral regulations and policies to provide for a fully-competitive transfer of products and resources across international borders. Reevaluate export control regulations—especially the limits on technologies. Reduce the effect of market interference by foreign government by fortifying multilateral controls or by increasing in-kind backing for US industry.

7. Business: A New Model for the Aerospace Sector

    Boost the level of government investment. Accelerate the implementation of resourceful policies in government and industry that fuel increased investment in the public and private sectors.

8. Workforce: Launch the Future

    Stop the loss of technologically-skilled workers by addressing the early education of potential workers. Promote the intellectual and industrial potential of Americans by restructuring the educational system. Form an interagency task force to work out a national strategy that will encourage interest in the aerospace industry and promote opportunities. Reform the educational system and advance lifelong learning principles. Secure long-term endowment to education especially in the areas of math and science.

9. Research: Enable Breakthrough Aerospace Capabilities

    Raise the level of federal government monetary support in basic aerospace research to allow the US to take a principal position in relating research to product advances. This position will augment national security as it cultivates a more efficient and safer air transportation system.

These nine recommendations are described in detail in the Walker Commission's final report. Some of the recommendations are broken into several parts with various action areas described.

There was no suggestion of the funding resources for most of these various actions and the prioritization of these recommendations remains unclear. Perhaps it is the order in which they appear, but there is little to support this.

White House Commission on Aviation Safety and Security of 1997

The crash of Trans World Airlines Flight 800 prompted President Clinton to form the White House Commission on Aviation Safety and Security with its initial emphasis on security (White House, 1997, p. 4). On July 25, 1996, Vice President Al Gore was named Commission Chairman. In August, Executive Order 13015, detailed the functions and purposes of the new commission. Due to his role as Chairman, it became known as the Gore Commission. It was designed to determine what aerospace industry changes were needed to help the industry operate better and cost less while the government seeking similar changes. Additionally, the Gore Commission was tasked with three mandates: 1. examine the shifting security issues and determine how to manage them; 2. modify government regulations to address changes in aviation industry; and 3. discover how to make optimum use of technological advances for the air traffic control system (ATC) (White House, 1997, p. 4).

By September 9, 1996, the Gore Commission offered a preliminary aviation security action plan detailing 20 recommendations. These recommendations were met with immediate action. In October 1996, over $400 million was appropriated by Congress to purchase new security improvements, such as the most recent explosives detection technology. By 1997, all the recommendations were at least in the initial stages of implementation. During a period of seven months, the Gore Commission went to airports and other aviation facilities around the US and abroad. In addition, the members engaged in six public meetings which included representatives from the aviation industry, the general public and individuals victimized by air tragedies. Input was sought globally through a Gore Commission website and at the International Conference on Aviation Safety and Security sponsored with George Washington University. On February 12, 1997, Gore presented the Commission's final report. Based on these experiences, the final report reflected a vision that assured "leadership in communications, satellite, aerospace and other technologies that increasingly are defining the global economy…to ensure greater safety and security for passengers; to restructure the relationships between government and industry into partnerships for progress; and to maintain global leadership in the aviation industry" (p. 5).

The Gore Commission offered the following key recommendations:

1. Safety
   Modify the Federal Aviation Administration's (FAA) regulatory and certification programs in order to decrease the accident rate "by a factor of five within a decade" (p. 5).
2. Air Traffic Control
   Modernize the National Airspace System using the latest safety and efficiency developments by 2005. In order to finance the process, a new financial plan is needed.
3. Security
   Assign more federal resources to advance civil aviation security. Greater cooperation is needed between local authorities and the private sector.
4. Aviation Disasters
   Designate the National Transportation Safety Board as the single entity managing the response to the disasters.

Throughout the recommendations, the Gore Commission emphasized the importance of government-industry partnerships in achieving these objectives. "The premise behind these partnerships is that government can set goals and then work with industry in the most effective way to achieve them. Partnership does not mean that government gives up its authorities or responsibilities" (p. 6). In areas where partnership was not feasible, the government exerted its position to implement the law. As opposed to using regulation, the government would also be able to use incentives to achieve goals.

Particular attention was given to the modification of the FAA. The Challenge 2000 report studied how to develop new methods for regulating operators and manufacturers. The Gore Commission calls for the FAA to reengineer itself for the 21st century. The new Management Advisory Council was tasked with contributing alternatives. The Clinton-approved reforms "give the FAA almost unlimited latitude to design new systems to meet the agency's unique and particular needs" (p. 7). An example of success in this area was the reduction in procurement documents from 233 documents to less than 50. The rest of the reform movements are less straightforward.

The Gore Commission advocated three steps for government to follow to maintain its dedication to the goals put forth:

(1) That the Secretary of Transportation report publicly each year on the implementation status of these recommendations;
(2) That the President assign the incoming leadership at the Department of Transportation and the FAA the clear mission of leading their agencies through the

> necessary transition to re-engineered safety and security programs; and
> (3) That the performance agreements for these positions, which the documents that senior managers sign with the President outlining their goals and specific means of measuring progress, include implementation of these recommendations. (White House, 1997, p. 7).

The combination of official recommendations and prescribed steps form the framework of the Gore Commission's findings. The Gore Report suggested specific actions to be accomplished by specific organizations representing a much more detailed and comprehensive plan than the previous Blue Ribbon Commission report described in the next section.

National Commission to Ensure a Strong and Competitive Airline Industry of 1993

With Public Law 103-13 approved on April 7, 1993, President Clinton established the National Commission to Ensure a Strong and Competitive Airline Industry with Gerald L. Baliles as its Chairman (National Commission, 1993). Hereafter, referred to as the Baliles Commission. The creation of this commission followed reported losses of approximately $10 billion in the industry since 1990 (Kahn, 1993). Analyzing this loss was coupled with evaluating the repercussions of deregulation in the 1970s and determining the government's role in regulating and subsidizing civil aviation due to its position in the larger national infrastructure. The Baliles Commission's mandate was "to investigate study and make policy recommendations about the financial health and future competitiveness of the US airline and aerospace industries" (p.ii). Both the President and Transportation Secretary Pena called for the Baliles Commission to evaluate every facet of these industries and to generate recommendations that would secure their power and competitive position nationally and globally.

According to Baliles, "The air transportation system has become essential to economic progress for the citizens and businesses of this nation" (National Commission, 1993, p. 1). Between May and August 1993, the 26 members of the Baliles Commission studied, analyzed and developed recommendations that were detailed in its report, *Change, Challenge and Competition*. It is based on "three principles—efficiency and technological superiority, financial strength and access to global markets" (National Commission, 1993, p. 3). While the subsequent Blue Ribbon Commission would offer specific actions and recommendations, the Baliles Commission identified three general areas where change was needed.

1. Efficient and Technological Superiority
   In order for the US air transportation system to be efficient and technologically superior, the Baliles Commission recommended redesigning the FAA. For the FAA to operate efficiently, it must be structured to generate a secure and reliable funding supply. This funding supply should be used to support strategic capital investments as well as a sound regulatory system. The system needs to not only improve safety and efficiency, but also to be cost-effective and not hinder the management of the industry.
2. Financial Strength
   For the US air transportation system to operate in an environment of rapid change, it relied on financial backing. While the 1980s were a period of growth, it was not enough to establish financial independence. Additionally, regulations and laws required additional spending to abide by such restrictions as noise abatement standards in addition to the regular turnover of aging equipment. To enhance their role in global markets, airlines need to invest significant resources. The entire system depended on highly skilled people staying in the workforce. Consequently, layoffs and industry instability led to a decrease in the pool of the select workers needed to augment the air transportation system.

3. Global Mobility
   In order to employ air transportation competitively, the outdated regulations and safeguards of the international system needed to be modified for the modern market. The Baliles Commission found that global economy demands were beyond the limits of the bilateral system of acquiring flying privileges in new areas for US airlines. The system stymied rather than promoted growth and development. The recommendation described an "open and comprehensive multi-national regime having as broad a geographic base as possible that allowed people and products to move freely and efficiently" (National Commission, 1993, p. 4).

The Baliles Commission found the advancement of the US air transportation system was restricted by policies built on a limited outlook that reduced its ability to use available resources (National Commission, 1993). Using the three principles, the report offered recommendations on how to strengthen the air transportation system and the aerospace industry.

Interpretation of Impact from Commissions' Recommendations

Since the early 1990s, the aviation industry has experienced a wide range of conflicts created by internal and external forces. The Blue Ribbon Commissions, formed between 1993 and 2002, dealt with some issues scarcely imagined in previous decades. They also were faced with recurrent issues that had failed to be adequately resolved. By determining the related enduring themes linking these three commissions, this report illustrates the influence of the Blue Ribbon Commissions on the aviation industry through the resulting policy action or inaction. An understanding of these decisive synergies should enable policymakers and future commissions to better define the needs of the industry and the nation. The collective impact of all three Blue Ribbon Commissions' synergies provides a more credible message than an individual commission could project. By analyzing these reports, both individually and collectively, an accurate and logical depiction of the common synergistic bonds can be presented.

Methodological Approach

This study applied a reliable methodological approach where content analysis was conducted by examining electronic versions of the executive summary for the Walker and Baliles Commissions and the introduction section of the Gore Commission findings since an executive summary was not included in this report. Documents were imported into the NVivo qualitative analysis software to aid in coding and analysis. The three commission reports were used to provide a representative summary of the aerospace industry at the start of 21st century. Each Commission was comprised of a range of individuals associated with the aerospace industry and government; they each presented an accurate and relatively unbiased depiction of the problems and needs of the industry.

Content analysis was a useful method for exploring threads of commonality running throughout the three reports. Frankfort-Nachmias and Nachmias (1996) defined content analysis as "any technique for making inferences by systematically and objectively identifying specified characteristics of messages." (p. 324). Similarly, Borg said content analysis is "a research technique for the objective, systematic and quantitative description of the manifest content of communication" (1963, p. 256). The purpose of content analysis was to compare communication styles in order to uncover any trends in communication content. This method was chosen because it studied the "processes occurring over long periods of time" (Babbie, 1999, p. 296). Systematic analyses of the three Blue Ribbon Commission reports uncover common themes and fundamental issues characteristic of the aerospace industry.

Even though the report summaries were analyzed, this analysis was broken down into a combination of concepts and phrases as units of analysis. According to Babbie (1999), the unit of analysis is critical in determining subsamples and subsequent coding and categorization. Since "content analysis is essentially a coding operation," the researcher must establish the conceptual framework for determining the results (p. 290).

Coding the Blue Ribbon Commission Reports

The coding and analysis of the reports formed the basis for how the results were determined and framed. Since the reports were of varying lengths, the analysis examined only the executive summary of the Walker and Baliles Commissions' reports and the introduction of the Gore Commission report. These documents were of similar length and content.

Using the NVivo qualitative software to manage and record the coding process, each document was separately coded on a line-by-line basis. The Walker Commission was the primary document in the analysis so it was coded first. The other two reports were subsequently coded based in part on the categories that emerged during the coding of the Walker summary. When appropriate, new nodes and categories were added to ensure the best coverage of linkages between the documents. Coding of all three reports was reviewed and changed several times to better facilitate an in-depth analysis of the emerging trends and issues of the aerospace industry.

The recommendations of each of the commissions provided a basis for determining the variables which were then coded as nodes for the analysis. These nodes were then categorized according to joint issues that linked them within a more encompassing tree node. The tree nodes reflected the primary synergies of the aerospace industry discussed later in this report. For instance, *Modernizing the FAA* emerged as a tree node. Branches of this tree node included such nodes as *financial issues* and *transportation system action*.

In addition to the line-by-line coding, simple word count searches were also conducted. This allowed for content analysis of specific areas, such as the FAA as well as financial issues. By determining how often a word or concept was mentioned throughout the documents, the study found the prominence of certain areas within each commission and over the course of the three reports. The coding and word count searches were instrumental in identifying linkages between the three Blue Ribbon Commissions' findings.

These two methods of coding provided a way to identify both manifest and latent content. Manifest content represents the obvious, superficial content; whereas, latent content reveals underlying meaning (Babbie, 1999). Simple word count searches provided some interesting insight into recurring issues. However, the use of line-by-line coding provided a more thorough understanding of the issues and their treatment over the span of the three Blue Ribbon Commissions. The combination of the two forms of coding provided a more meaningful analysis with enhanced reliability and validity (Babbie, 1999).

Resultant Linkages between the Commission Reports

The results of the content analysis provide suggested connections between the three Blue Ribbon Commissions. In addition to the line-by-line analysis, a basic word count was also used to determine the amount of attention certain subjects were given. Even in areas considered important by all three commissions, the word count provided interesting data (Table 1)

Table 1. *High Frequency of Synergistic Terminology Usage for Blue Ribbon Commissions*

Commission	Research/Technology	International/Global	FAA	Partnership	Security
Walker	53	58	7	15	22
Gore	4	6	15	16	23
Baliles	6	13	6	1	0

Based on the initial coding, 17 terms were applied to the content analysis for the three documents. Of the 17 terms, four were merged into two terms, such as *research* and *technology*. Of the remaining 15 term categories, five showed a high incidence of use. These five categories were research/technology, international/global focus, FAA, partnership, and security. The relationships appeared to varying degrees throughout the line-by-line analysis and coding process. By examining the figure, it was apparent that linkages were much stronger between two of the commissions than with the third. For instance, the area of research and technology was strong between the Walker and Baliles Commission, while the Gore Commission exhibited minor attention to this issue. The concept of partnerships was greatest within the Gore Commission report, but the Walker and Baliles Commission gave it limited attention. This graphical representation visually illustrates the areas of commonality found between the Blue Ribbon Commissions (Figure 1).

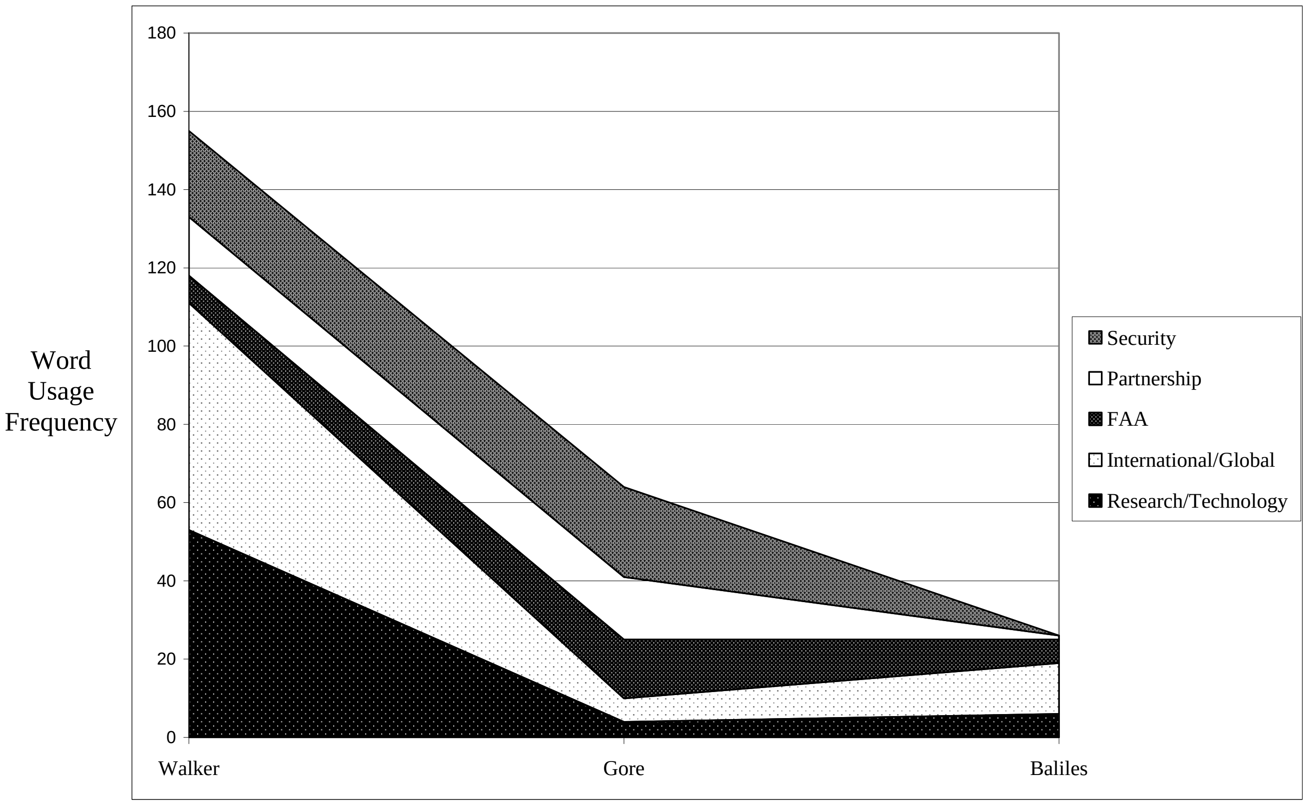

Figure 1. Synergistic Connections between Blue Ribbon Commissions, 1993-2002.

Some areas were not included in this figure because only one or two of the commissions indicated strong interest or the overall frequency was low. For instance, all three reports mention *air traffic control* (ATC), *resources* and *competitive*. However, the incidence was so low the significance was uncertain (Table 2).

Table 2. *Low Frequency of Synergistic Terminology Usage for Blue Ribbon Commissions*

Commission	Competitive	Air Traffic Control	Resources
Baliles	6	2	1
Gore	1	2	2
Walker	11	1	1

In other areas, such as *financial resources*, the incidence may be higher but there is scant correlation. The Baliles and Walker Commission had limited mention of the issue, but the Gore Commission had no mention of it (Table 3). Similarly, the Gore Commission was the only commission to specify aviation disasters. While the Walker Commission was also formed in the wake of a similar disaster, it did not include this type of language. Likewise, both the Gore and Walker Commissions had discussion related to *leadership* and the *federal government*. These terms were absent from the Baliles Report.

Table 3. *Varied Frequency of Synergistic Terminology Usage for Blue Ribbon Commissions*

Commission	Leader	Federal Government	Financial	Disaster
Baliles	0	0	7	
Gore	5	2	0	2
Walker	18	9	4	

All three reports contained considerable references to the *aerospace industry*. Since this was the focus of the reports, reference to this issue was omitted from the figure to focus on more specific connections. However, the mention of *safety* and *future* were just as frequently mentioned in different reports. The Gore Report emphasized safety, whereas the Walker report stressed the future (Table 4).

Table 4. *Mixed Frequency of Synergistic Terminology Usage for Blue Ribbon Commissions*

Commission	Industry	Safety	Future
Baliles	22	1	3
Gore	17	21	2
Walker	68	3	31

Both steps of the content analysis offered unique yet corresponding information. By using the line-by-line analysis to establish a context for the specific content analysis, interesting parallels were identified, as well as the actual level of support. Having a context for the words provided a fuller understanding of the latent content and set the groundwork for establishing a framework for future policy action discussed in the next section. This step focused the findings and provided a clear example of the relationship between the three Blue Ribbon Commissions.

Framework for Future Policy Action

Through the content analysis and the use of coding, the text was divided into various categories reflecting synergies that evolved in the aerospace industry. These synergies represent commonality expressed by Blue Ribbon Commission reports between 1993 and 2002. By linking the reports together, it became apparent how the aerospace industry changed during this time period.

Content analysis suggested some significant gaps between the recommendations and their influence over time. In some cases, the same issues were repeated in each of the commission reports indicating little resolution in that area. The analysis also revealed three common areas of concern by the three commissions based on the recommendations for action on these issues. The three areas consisted of the FAA, partnerships between business and government, and investment in long-term research and development. A fourth common area was shared by the Gore and Walker Commissions due to an unrelated series of events that prompted their formation. This commonality focused on a joint civil and military initiative to develop core infrastructure for the safety and security of the entire nation, not just the passengers. The content analysis merely identified recurring issues over time, not how they may or may not have been addressed.

Modernizing the Federal Aviation Administration

All three of the Blue Ribbon Commissions included recommendations that highlighted concerns about the organization and function of the FAA. Collectively they called for a major reorganization of the administration, with the Baliles Commission recommending privatizing the operations. According to Alfred Kahn, former chairperson of the Civil Aeronautics Board, "positioning the FAA as an independent government corporation is the single most constructive feature of the entire [Baliles Commission] report" (1993, p. 8). The Commissions found that the underlying problem was the lack of stable funding within the federal budget process. Without committed funding, the FAA was severely limited in its ability to manage its many responsibilities including its core responsibility for aviation safety. This inconsistent funding hampered the FAA's effectiveness especially as it attempted to meet the need for modernizing ATC equipment. These FAA-generated inefficiencies were costly both to the airlines and its passengers (Gore and Walker Commissions).

In other less glamorous areas, the FAA also needed to make changes. All three commissions suggested that changes should include revising the regulatory and certification process. For instance, the language of the federal aviation regulations (FAR) should be simplified. The FARs should allow for performance-based regulations. By permitting FAA's funding stream to be leveraged to finance strategic capital investments, as well as a regulatory system, may enhance its cost-effectiveness without impeding the ability of the industry to manage its affairs.

The Gore and Walker Commissions discussed the need to support Free Flight as part of the national airspace system. The operations would transition from the current ground-based system to a more collaborative air traffic management system. Free Flight would combine digital communication, satellite navigation, and computer-aided decision support tools to create an adaptable, more efficient airspace system. With the technology already in existence, transitioning to the newer system presents the problem. The Commissions cited poor oversight as the primary limitation for the transition which in turn contributed to inadequate user input, poor decisions and unsatisfactory contractor performance.

After ten years of commission reports, the Walker Commission recommended the FAA design, own and operate an air traffic control system in cooperation with the Department of Defense (DOD). In addition to producing the necessary technology in use by European and Asian countries, the Walker Commission found the private sector already had a proven ability to provide critical services such as increasing quality and decreasing costs. By collaborating with the private sector, the Walker Commission recommended the FAA transition to a new national airspace system (NAS) that integrated operations and airport capacity needs.

Previous research portrays the FAA as a reactionary agency with action occurring primarily after a crisis. These procedures are consistent with the FAA's "blood-on-the runway" reputation (Lutte, 1999). Lutte's study on crises and agency action found that increased FAA action followed major accidents if they occurred in the US. However, the actions taken were typically described as the least likely to enhance safety, such as issuing an airline a fine below $10,000 (Lutte, 1999, p. 111). This type of ineffective action supports the continued problems found with the FAA in the analysis of the Blue Ribbon Commissions' recommendations.

Forming and Managing Partnerships between Business and Government

Throughout the three commission reports, increasing attention has been given to establishing partnerships between the public and private sectors. These partnerships were recommended as a method to remove prohibitive legislation and regulatory barriers that impeded the growth of the US aerospace industry in the global market. The partnerships can be used to form an infrastructure that supports an open and comprehensive multi-national regime with a broad geographic base. Such an integrated structure would allow people and products to move freely and efficiently. By working together the public and private sectors could integrate research as well as establish industry standards. The Gore Commission recommended that this standardization extend to regulations and procedures as well as the industry infrastructure. The Walker Commission continued the focus on public-private partnerships as an area of untapped potential. By fostering such relationships, both entities could benefit along with those using air cargo and transportation.

Investing in Research and Development Infrastructure

The importance of research and development varied throughout the three reports. The Baliles Commission scarcely mentioned the issue, focusing more on restructuring and reengineering to foster innovation. The Gore Commission shared the focus on reengineering and simplifying the infrastructure in aviation and all government-related endeavors. The primary emphasis on research and development was found in the Walker Commission.

The issue of research and development remained minor until the Walker Commission. Its Final Report emphasized the need to create an environment that fostered innovation and supported current infrastructures that promoted these efforts, such as the National Aeronautics and Space Administration (NASA). The Commission recommended various incentives to encourage risk-taking and the rapid introduction of products and services. By prioritizing FAA and NASA research and development efforts, the nation would have the critical building blocks for the future. To support this endeavor, the Walker Commission suggested creating an Office of Aerospace Development in every federal department and most federal agencies. Additionally, NASA should turn over day-to-day management responsibilities for field centers to respective state governments, universities, or businesses. The Walker Commission also recommended privatizing some NASA utilities at the Kennedy Space Center and Cape Canaveral Air Force Station.

Developing Core Infrastructure for Joint Civil and Military Initiative

This final area that emerged as a developing trend links the Gore Commission and the Walker Commission. The Baliles Commission focused on developing a strong aerospace industry with virtually no mention of safety or security measures needed to protect the aerospace industry or the nation as a whole. The Gore Commission recognized the possible security threats posed by the airline industry. Many of the measures it recommended, if implemented, could have helped to prevent the terrorist attacks that followed. Following the events of September 11, 2001, the Walker Commission added another layer to the Gore Commission's recommendations by recommending a joint civil and military initiative to develop core infrastructure. This is the first of the Blue Ribbon Commissions to unite the military and civil authorities. The airway system needs to combine civil aviation, national defense and homeland security to neutralize possible threats. The Walker Commission recommends the use of common advanced communication, navigation, surveillance infrastructure and modern operational procedures.

These four issues form the basis for the Blue Ribbon Commissions' recommendations. While each commission dealt with a unique period in time, they share common goals of furthering the aerospace industry. How they go about this process separates them, but still signifies a commonality when they are all linked through analysis. Each commission became more complex in its recommendations and course of action. This is evident through a simple review of the reports. The number of recommendations grew from 1992 to 2003, as did the length of the reports. For instance, the executive summary of the Walker Commission was longer than the entire Baliles Commission report. There are many possible explanations for this change. Quite simply, the expectations of the Walker Commission could be considered much higher than those of the Baliles Commission since the 2002 report was dictated by the terrorist attacks of 1996 and 2001.

Future Policy Action: Where do we go from here?

The Blue Ribbon Commissions highlighted key issues affecting the aerospace industry over the long term. These issues are modernizing the Federal Aviation Administration, forming partnerships between business and government, investing in long-term research and development, and cultivating the core infrastructure for national safety and security (Table 5).

Table 5. *Key Issues Affecting the Aerospace Industry Per the Blue Ribbon Commissions*

Commission	FAA	Partnership	Research/Technology	Security
Walker	7	15	53	22
Gore	15	16	4	23
Baliles	6	1	6	0

While each of the commissions may have addressed these issues using a different approach, it is the commonality of focus that illustrates the Blue Ribbon Commission process's strength. The importance of these issues remains as relevant today as when the Baliles Commission first emphasized their value and impact.

Many of the recommendations have been addressed; however, critical problems continued throughout the time period evaluated. Clearly these problems will continue if policy changes are not made and implemented. The Walker Commission echoed the earlier commission reports when it identified these key issues and offered a range of actions to address them. Granted, many suggested actions may not be feasible. However, based on the synergies that emerged from a combination of the three reports, a more selective pattern of action might be advocated.

The strength of the Blue Ribbon Commissions is gained through these common areas of significance. This is echoed by Secretary of Transportation Norman Y. Mineta in a recent hearing on The Future of Air Transportation in America. Mineta said, "Our national plan must be connected to the Walker Report….We will coordinate a direct connection to the future of aviation as guided by the Walker Report in the long term" (Future of Air, 2004). The short term impetus comes from the previous commission reports' recommendations. Mineta indicated that the Joint Planning Development Office (JPO) process is going to implement the White House policies/mandates that are consistent with Walker Commission Report. Similarly, FAA Administrator, Marion Blakely, stated the "JPO is the key to our future. Maintaining leadership is absolutely critical to maintaining our position in global aviation" (Future of Air, 2004).

This action should center on the key issues categorized in this study. The FAA must be modernized based on the most up-to-date technology available. In order to make this happen, the FAA requires a stable funding base to operate from until air transportation is replaced by a new form of transportation. With increased air transportation forecast, the FAA needs to move beyond Cold War technology to embrace and lead the way for the National Airspace System (NAS). By forming mutually beneficial public-private partnerships, the FAA and the nation will also benefit economically (Commission on the Future, 2002). These partnerships should reduce the cost of the government doing a job that can be accomplished more efficiently in the private sector. Involvement in partnerships may move the FAA toward a more proactive reputation than previously revealed. Clearly, resources can be pooled and focused on developing a research and development infrastructure that can address the long and short-term goals of the aerospace industry and its partners. By making optimum use of technology produced in the public and private sectors, the FAA and the aerospace industry will be better able to prepare for the future demands of the global market and the rising importance of air transportation. Even as the terrorist attacks begin to fade in the public's memory, the elements of safety and security remain intense.

REFERENCES

Aviation Safety Commission. (1998). *Final Report of the Aviation Safety Commission.* April 1988. Washington, DC: US Government Printing Office

Babbie, E.R. (1999). *The basics of social research* (8th ed.). Belmont, CA: Wadsworth Publishing Company.

Borg, W. (1963). *Educational research: An introduction*. New York: David McKay Co., Inc.

Cobb, R.W. and Primo, D.M. (2003). *The plane truth: Airline crashes, the media, and transportation policy*. Washington, D.C.: Brookings Institution Press.

Commission on the Future of the United States Aerospace Industry. (2002). *Final report of the Commission on the Future of the United States Aerospace Industry.* Washington, DC: US Government Printing Office.

Executive Order 13015, FR Doc. 96-21996 (1996).

Frankfort-Nachmias, C. & Nachmias, D. (1996). *Research methods in the social sciences* (5th ed.). New York: St. Martin's Press.

Future of air transportation in America: Hearing before the Committee on Science, House of Representatives and the Aerospace States Association. Washington, DC. (2004).

Kahn, A.E. (1993). Change, challenge, and competition: A review of the airline commission report. *CATO Regulation: The Review of Business & Government*. Retrieved September 16, 2003 from http://www.cato.org/pubs/regulation/reg16n3d.html.

Kitts, K.D. (1995). Presidential commissions and national security issues (Doctoral dissertation, University of South Carolina, 1995). *Dissertation Abstracts International, 56*, 4929.

Johnson, J.R.C. (1982). Perceptions of factors affecting the relative effectiveness of temporary blue ribbon state commissions (Doctoral dissertation, University of Denver). *Dissertation Abstracts International, 43*, 2251.

Luck, E.C. (2000). Blue ribbon power: Independent commissions and UN reform. *International Studies Perspectives 1*, 89-104.

Lutte, R.K. (1999). *Crises and agency action: Airline Accidents and airline safety policy.* Unpublished doctoral dissertation. University of Nebraska at Omaha.

National Commission to Ensure a Strong and Competitive Airline Industry. (1993).*Change, challenge and competition.* Washington, DC: US Government Printing Office.

White House Commission on Aviation Safety and Security. (1997). *Final report*. Retrieved September 10, 2003 from http://avsp.larc.nasa.gov/WHC_Aviation_Safety.pdf

A Structured Methodology for Adjusting Perceived Risk

J. M. Thom and D. R. Clariett
Purdue University

ABSTRACT

This papers details the background and the use of a structured analysis for risk assessment based on the Risk Homeostasis Theory. The general global theory of perceived risky behavior is examined and is shown to be applicable to a specific task, as opposed to theoretical constructs only. The Risk Homeostasis Theory is used here as a basis, for conducting a detailed risk analysis of aviation activities.

INTRODUCTION

A 1999 OSHA (Occupational Safety and Health Administration) census shows 21,283 reported cases of job related injuries while using handheld power tools, despite training and warnings located on machines and within procedures. (OSHA website, statistics). For a person to perform a task effectively, both education and training are needed, because training targets the actions. The purpose of a lecture class (education) is to grasp the conceptual theory, and the lab (training) is an opportunity to convert the theory into practical application or training. To perform a job task safely, the same approach utilizing both education and training should be taken. Training may only consist of how to do the act, and focus less on the conceptual theory of "why" certain acts are done, but without the "why" the determination of the adverse outcomes can not be internalized. An increase in the perception of the cost of risky behavior acts as a motivator to behave safely. Motivation to avoid risky behavior is driven by an individual's target level of risk (TLR). TLR is the perception level that describes, intuitively, the amount of risk accepted by an individual (Wilde, 1994). It is established based on perceived costs and benefits of both risky and safe behavior. In a given situation, the TLR is compared to its counterpart, the perceived level of risk (PLR). The PLR is the amount of risk perceived while performing an activity. When there is a disparity between the TLR and the PLR, individuals adjust their actions to bring both perceptions into balance.

This process of continuously balancing the perceptions of risk is called Risk Homeostasis Theory (Wilde, 1982). Performing a job safety analysis can be a key for adjusting the target level of risk. The job safety analysis can systematically identify task hazards, and the information from the analysis can be used to provide information to enable people to make adjustments in their perceptions of what is risky and what is not, based on knowledge of potential outcomes.

BACKGROUND

Risk Homeostasis Theory (RHT) was developed to explain behaviors of individuals and the propensity to experience a traffic accident. The model stated that road users perceived a certain level of accident risk in a given situation, (PLR), which was compared with the level of accident risk they were willing to accept, (TLR). Whenever there was a discrepancy between the two perception levels, the individual would make behavioral adjustments to re-establish the balance (Wilde, 1986). An individual would not have continued to experience more risk than they wanted intuitively.

Traditionally, countermeasures implemented to reduce accidents, such as speed restrictions or seatbelt use, were believed to be fully effective based on engineering calculations. The generally accepted belief was that the driving environment could have been made safer by manipulating external controls and adding restrictions that limit the opportunity to take risks. With the traditional view, the responsibility for controlling the accident rate resided with the traffic legislators, rather than the drivers. 4-way stops at dangerous intersections, safety bags in cars, child safety seats, and anti-lock brakes, were all designed to be barriers between the person and the negative outcome. Within an industrial setting, these external countermeasures were represented by personal protective equipment such as, fall harnesses, hearing protection, machine guards, pull-out devices, and new processes that inherently prevented the possibility of injury. These measures were designed to be a barrier between the person and the negative consequence.

Implementing countermeasures has a lesser effect than calculated because drivers transfer the risk associated with the newly regulated behavior to other unregulated behaviors. In the instance of driving, a person driving a car with anti-lock brakes may decide to drive faster and begin stopping later during the rain because of the car's highly advanced braking system. The same could be said on a worksite when implementing a pull out device on a press. A pull out is a safety device physically connecting the operator to the moving part of the press by means of a lightweight cable (Brauer, 1994, 159). On the downward stroke, the motion of the press acts on the straps causing the operator's hands to be pulled out of the path of the press. Implementing this safety device may cause the operator's behavior to change, since the operator may try and quickly adjust die pieces while the press is on its downward stroke. The operator may logically believe that because there is no resistance on the straps, there is still time to make a quick adjustment. This change of behavior is readjustment of the risk experienced. A more radical view of the compensation theory is represented by the RHT model of driver behavior developed by Dr. Gerald Wilde, shown in Figure 1.

With the comparison action depicted in Figure 1, "…apart from temporary fluctuations, time-averaged accident risk is independent of factors such as the physical features of the environment and operator skills, and ultimately depends upon the level of accident risk accepted by the road user population in return for the benefits received from mobility in general and from specific risky acts in mobility in particular (Wilde, 1984)." The accident rate in the jurisdiction is the output of the PLR closed-loop process, which is determined by the person's pre-established TLR. The levels of risk described in the RHT model are intuitive and cannot be depicted by actual numbers (Wilde, 1994).

To clarify the PLR closed-loop process, consider the following scenario where numbers are used to illustrate how the comparison process would work. An individual has a pre-established TLR rated as a five, which means the person is willing to accept a risk level that they rate as a five. If the person is in a situation in which he/she perceives a risk level rate of eight, then he/she adjusts the actions so as only to perceive a risk level rate of five. In the event of disparity, the PLR adjusts to match the TLR. A person analyses their actions, predicts an outcome, and compares the assessment to their personal idea of what should be done. For example, Daimon, an accomplished welder, is given the assignment to weld two steel pieces. Daimon analyses the task, then, proceeds to retrieve a welding helmet, a pair of gloves, an apron, and a fire extinguisher, and remove his contacts. Based on his knowledge of the task, his understanding of the hazards, and various experiences, Daimon performs the safety actions because he does not want to accept the amount of risk if the actions are not performed. Not performing the safety acts exposes Daimon to possible accidents: blindness from melting contacts, hot metal burns from not wearing gloves and apron, or a major fire because the fire extinguisher is not located nearby causing a slower response. Each possibility of an accident raises the perceived level of risk. Adequate education, training, and experiences lead Daimon to understand the task and the hazards. He does not want to risk loosing his eyesight, or getting burned, or loosing his job because the shop burned down. Daimon performs the safe actions to balance his perceived level of risk with his pre-established level of risk.

Figure 1 also depicts the risk level of the TLR as not determined by skill or the environment; rather, the TLR is determined by the **perceived** costs and benefits of risky and safe behavior. For instance, Bob is driving down the highway behind Ted. Both are driving at a speed of 70 miles per hour (mph). If it starts to rain and Bob slows to a speed of 65 mph while Ted maintains his speed of 70 mph.

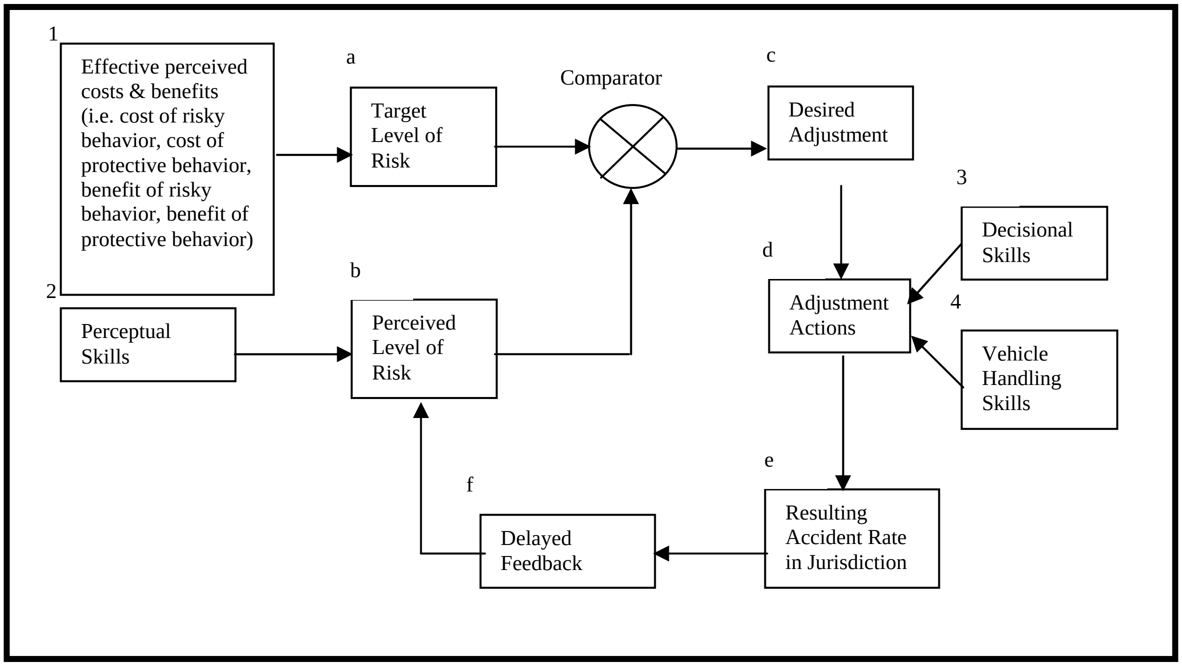

Figure 1. RHT Model of Driver Behavior.

The rain means nothing here except in the context of each driver's mind and their resultant PLR. The consequences are predicted based on the current situation, meaning both individuals observe their actions and assess a risk level. Bob feels that if he maintains his speed, he runs the risk of crashing. This consequence is a result of Bob recalling when he skidded and crashed in the past, recalling one of his friends crashing in such weather, or not feeling his tires are adequate for the road. When Bob assess the risk level based on his current actions, he compares it to his target level of risk. Bob decides to slow down in order receive an acceptable risk level. Ted slowly pulls away from Bob because he maintains his speed of 70 mph. Ted assesses his risk level and determines that the risk received is not greater than the risk willingly accepted. Ted's prediction of the consequence does not include crashing because he has never experienced, either directly or indirectly, that action.

Perception is a cognitive function, meaning to apprehend with the mind, or to understand (Oxford, 1997). To directly affect perception, a method must be used that targets the cognitive and thinking processes. A common approach to teaching tasks in industry, is training. People either watch someone perform a future task, or perform the task themselves while being observed by an "expert." "Behavior is learned and can be changed by providing people with new learning experiences" (Geller, 2001, 115). During training, learning occurs when the behavior has changed as a result of the direct and indirect experiences. The training approach requires the employee to practice the desired behavior and receive pertinent feedback to support what is correct and incorrect (165). The findings of two feedback studies (Jagdeep, Chhokar & Wallin, 1984; Komaki, Heinzmann & Lawson, 1980) conclude that performance improves with the introduction of feedback, declines when withdrawn, and improves again when reintroduced.

Safe behavior, like any other behavior, is learned through the repetitive interaction of action and consequence. Training "acts a person into thinking a certain way" (Geller, 2001, 115). Therefore, safety training is a way to act a person into thinking safely. A more direct path to having people think "safe" would be to control the end result. For a person to understand, to know "why", activities of repetition should be supported by education. In college, the lecture is designed to teach the conceptual theory, the "why", and the lab is designed to teach the practical "how" application actions.

"Education targets thought processes directly and might indirectly influence what people do" (Geller, 2001, 165). The cognitive processes pertain to a person's attitudes, beliefs, values, intentions, and perceptions (165). Rather than "acting into a certain way of thinking", a person "thinks into a certain way of acting" (165), thus requiring analytical skills, and not just the surplus of repetitive action. A person's behavior adjusts because they perceive an understanding of why certain actions are performed. In a safety situation, a person's behavior adjusts because their target level of risk is altered. A person now has the cognitive ability to understand the ramifications of performing certain actions. "If we do not educate people about the principles or rationale behind a particular safety policy, program or process, they might participate only minimally" (163) in following the safety policy, program, or process. To motivate individuals to performing safe actions, training should involve informing about the negative consequences and personal physical ramifications when performing activities unsafely (Re Velle, 1980). Safety instructions should be more in tune with the educational approach. They should assist in the development of the conceptual "why" as well as add pertinent information to the knowledge base.

A Job Safety Analysis, JSA, is a technique that can be used to develop safety instructions more in tune with RHT. A JSA is a systematic technique used to identify inherent hazards associated with a task (Re Velle, 1980; Job Safety Analysis, 1999). The technique consists of analyzing the task by breaking it down into successive steps, investigating the hazards associated with each step, and developing solutions that can either eliminate or guard against the hazards.

In industry, the JSA can be performed proactively or retroactively (Feyen, 2002). The goal of the JSA is to accomplish the first level of accident prevention: learning the basic causes of each accident (1997, Accident Prevention). Once a cause has been identified, proper countermeasures can be implemented. The most common result of the JSA is the creation of a Job Safety Procedure, JSP.

The combination of information in the JSP affects the information stored in the knowledge-based level. It notifies of the hazards associated with the task, rather than trusting that the technician knows the risks, based on prior experiences. The JSP also informs how to decrease the probability of having an accident, which is information for the knowledge base when making decisions. However, the JSP does not strongly affect the mental model because it does not target the conceptual "why" associated with the safety act. To target the "why", possible accidents, and their probabilities should be included along with notification of the hazard. In the JSP, under the heading, Required/Recommended Personal Protective Equipment, it prohibits wearing rings. The JSP should also state that wearing a ring while operating an air tool might lead to amputation of the finger. The mental model is described as an individual's internal representation of two aspects: its procedural and conceptual attributes (Riding and Rayner, 2000, 202). Notification of the "why", the conceptual attribute, affects the mental model. The combination of the stored information and the mental model results in a perception of costs and benefits associated with compliance or deviance from the recommended practice. In accordance with RHT, the target level of risk is established.

A JSA is a **systematic** approach used to control large amounts of subjective information. Completion of the following steps is required for the JSA: 1) select the job to be analyzed 2) breakdown the job into successive steps 3) identify the hazards and potential accidents 4) develop ways to eliminate hazards and potential accidents (Re Velle, 1980; Job Safety Analysis, 1999).

Selection of the job is the first task. The selection JSA can be performed proactively or retroactively (Feyen, 2001), and can be selected based on the number of historical accidents or incidents at the company. Another method of selecting the job is to analyze where workers are exposed to excessive hazards or hazardous materials. New procedures are also considered good candidates for a JSA for two reasons. It is cheaper, to implement something correctly the first time, and secondly, a proactive approach can be taken because employees start out with the proper safety procedures and behaviors.

Next, separate the task into successive steps. Too much detail causes the analysis to become unnecessarily long and trivial. Too little detail leaves holes in the procedure and counteracts the effectiveness of the JSA. A general rule of thumb is that most jobs separate into 10 – 15 basic steps (Accident Prevention, 1997). The instructional list should have enough steps to accurately describe the work, but no more than are actually needed. After the instructional steps are created, identify the hazards, determine the potential accidents for each step, and analyze the causes of those accidents. Accidents are categorized into 13 basic types (Accident Prevention; 1997, Job Safety Analysis, 1999):

1. Fall to same level
2. Fall to lower level
3. Caught in
4. Caught on
5. Caught between
6. Contact with electricity
7. Contact with heat
8. Contact with cold
9. Contact with radiation
    a. Contact with toxic or noxious substances
10. Overexertion
11. Struck by
12. Strike against

Finally, effort is put forth to develop a way to eliminate the hazard. The first hazard control method to be considered should be elimination (Brauer, 1994). If there is no hazard present, then there is no chance of an accident. If elimination is impractical, choices of reducing the hazard and implementing safety devices, warnings devices, and procedures are considered. The U.S. Department of Labor, Mine Safety and Health Administration (1999) concludes that solutions are normally from one of the following categories: Environmental change, Job frequency, Protective apparel, and Job procedures. For every hazard identified, a solution is needed to offset its potential.

PERFORMING THE JSA

The JSA requires the completion of four major steps; scope development, task analysis, amalgamation, and countermeasures. The researcher had previously taken the training course analyzed in this study, completed the complete aviation technology program, received an FAA Airframe and Powerplant mechanic's certificate, and had been involved with safety research projects with industry in the past. The researcher had experience in observing people in an aviation setting and gathering data used to assess safe behavior. The job safety analysis procedure was performed in accordance with the Job Safety Analysis procedurals (Feyen, 2002).

Scope development

A job safety analysis was performed on riveting a patch repair in a sheet metal fabrication training laboratory in a technology based aviation program at a major U.S. university. The general function of the laboratory studied was to develop a basic knowledge in undergraduate students of the different tools used for aircraft manufacture and repair. The subjects were freshmen students in the aviation technology program.

Scope development consisted of: formulating the analysis limitations by identifying general information, sketching the major tools used in the task, and identifying all tools needed along with a brief description of their operation. The following general information was documented prior to the analysis to avoid irrelevant information: Analysis Limit, Job Identification, Work Objective Job Location, Operator ID, and Shift Length. The general information for the task was summarized in Table1.

A hazard was defined as a "…potential or inherent characteristic of an activity, condition, or circumstance which can produce adverse or harmful consequences (Brauer, 1994, 80)." The analysis was limited to including hazards associated with physical injury and avoided identifying hazards associated with aircraft damage, environmental damage, or failure of the equipment.

Three computer sketches were created, giving a general depiction of the environment and primary tools used. These included the shop floor layout, the work stand, and the rivet gun (Figure 2) and an illustration of the work stand (Figure 3).

The work stand was 73 inches tall x 48 inches long x 36 inches wide, and held two sections of aircraft skin. The aircraft skin was connected to the work stand by four tabs located along the base bar of the work stand and at the top of the center bar. The task required the students to work in pairs; two students per work stand.

The rivet gun was a Taylor T-4x aircraft pneumatic riveting hammer (Figure 4). For operation, the student squeezed the trigger of the rivet gun allowing pressurized air into the handle of the gun. The rivet gun was also designed so that the pressurized air pushed the piston forward, toward the barrel, when in the back position (near the handle), repeatedly. This design created the reciprocating motion for the piston and the vibration of the rivet gun. The regulator knob was used to control the amount of air used within the rivet gun. Adjustment of the knob controlled in the speed of the piston and thus the force of the piston's impact. A pneumatic air hose, rivets, a bucking bar, and a wood block were also used in the riveting task. The air hose used in lab was 10 feet long, had a female quick connect adapter located on each end, and was reinforced with aluminum coils on the ends to prevent damage to the adaptor/hose connection area. A bucking bar, a piece of steel, was used as a hard surface to press against the rivet shaft when riveting. Wooden blocks were also observed in the lab to be used for testing and setting the rivet gun regulator setting prior to using the rivet gun on the actual aluminum structure under construction. The regulator setting was tested by: placing the rivet gun header on the wood, squeezing the trigger, and noting the piston speed both audibly and tactily. The safety equipment items were: gloves, hearing protection, and safety glasses.

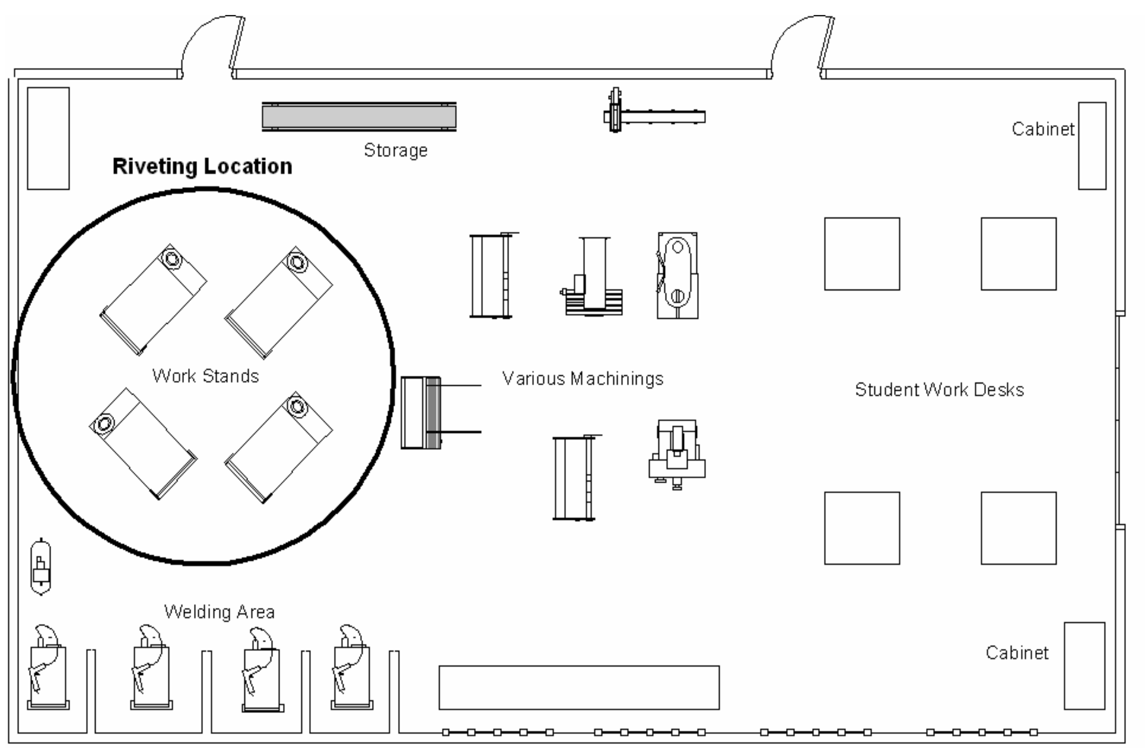

Figure 2. Work area layout

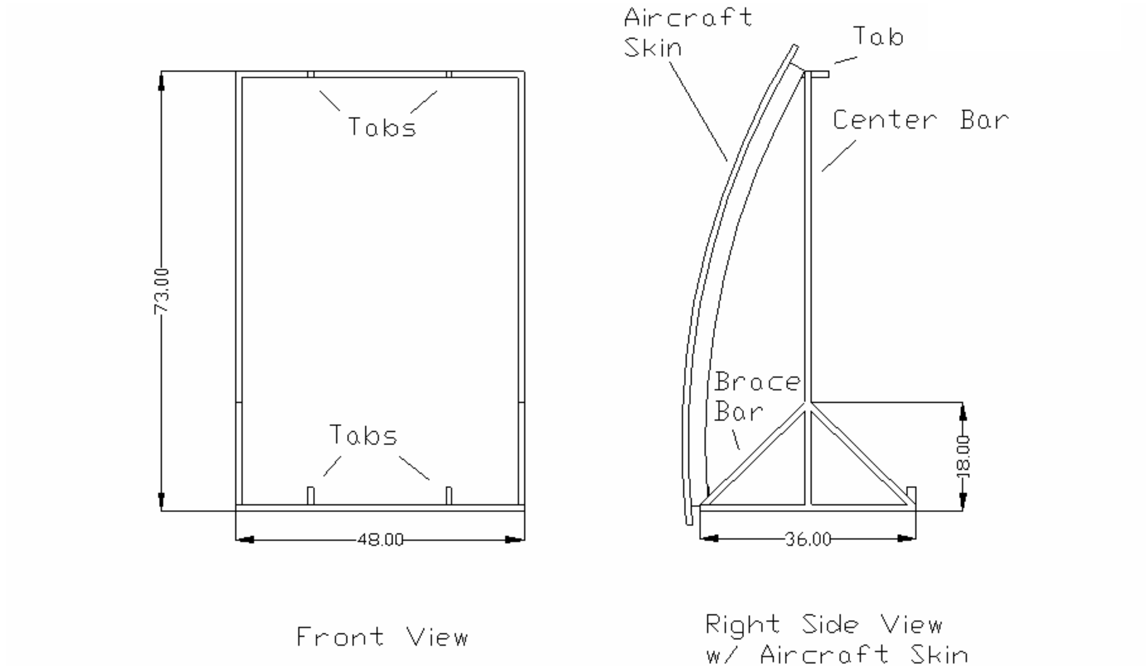

Figure 3. Work Stand.

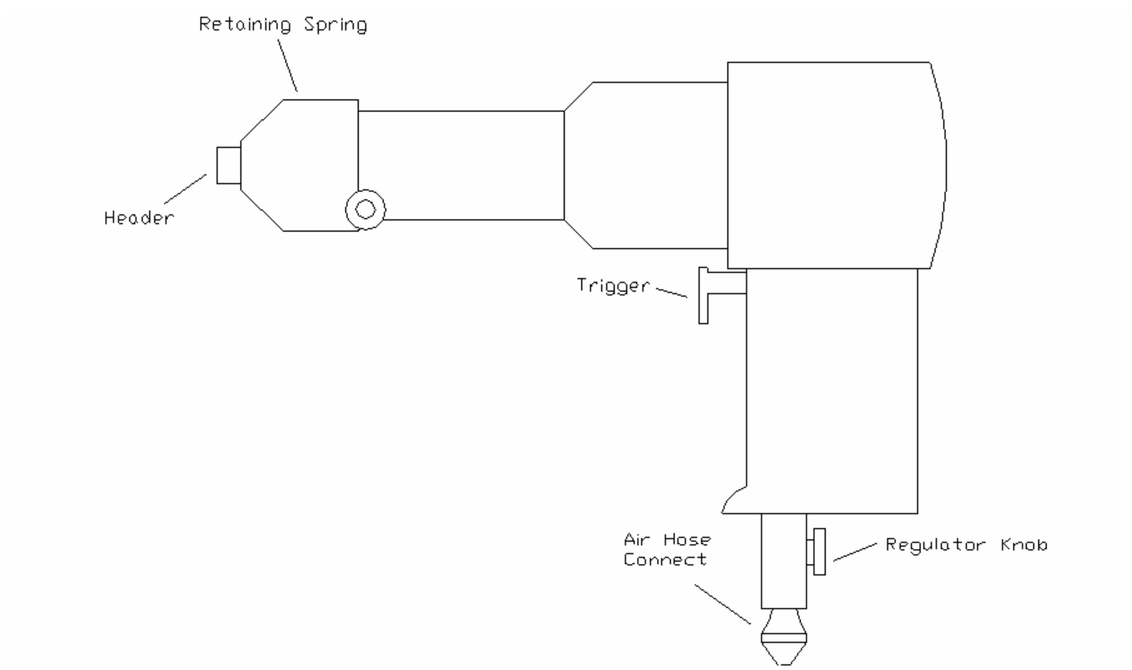

Figure 4. Rivet Gun.

Task Analysis

The question when observing the students was: “What are the hazards associated with this task?” The question was not, “Did the student perform any unsafe activities while performing this task?”

Two people were needed to rivet a patch repair and a method of tapping on the aircraft skin was used to communicate intention, and success or failure. One student (technician one) operated the rivet gun and the other student (technician two) held the bucking bar. The aircraft skin was positioned on the work stand (Figure 3). The student holding the bucking bar positioned himself or herself, between the skin and the work stand center bar. Task analysis consisted of: itemizing the task into successive steps and identifying the hazards associated with the task. The students had been taught the procedure previously by demonstration of the laboratory instructor. A total of 12 hours were used for this investigation. The task was observed 15 times: 10 student observations, 2 instructor observations, and 3 researcher performances.

Observation of the task revealed 19 primary sequential steps:

1. Remove spring from end of rivet gun
2. Install header into rivet gun
3. Screw spring to end of rivet gun
4. Connect air hose to rivet gun
5. Test rivet gun regulator setting on wood block
6. If needed, adjust regulator setting on rivet gun
7. Insert rivet into hole
8. Technician one places rivet gun header on rivet head
9. Technician two stand on backside of aircraft skin
10. Technician two places bucking bar on rivet shaft
11. Technician one, communicate intention to squeeze trigger
12. Technician one squeeze rivet gun trigger
13. Technician two removes bucking bar
14. Technician two checks height of bucked rivet shaft
15. Disconnect air hose
16. Hand hose above head height
17. Unscrew spring from end of rivet gun
18. Remove header
19. Screw spring to end of rivet gun

After development of the sequential steps, hazards and accidents were identified for the task utilizing nomenclature and categories from the accident types and the general hazards checklist located in Appendix A.

- Contact with cold
- Contact with radiation
- Contact with toxic or noxious substances
- Overexertion
- Struck by
- Identified hazards: Fall to same level
- Fall to lower level
- Caught in
- Caught on
- Caught between
- Contact with electricity
- Contact with heat
- Strike against

The general hazard categories, located in Appendix A, were kinetic/mechanical energy, pressure, acceleration/deceleration/gravity, physiological, and human factors. The basic operation of the tools used for the task was studied in order to effectively identify the hazard categories. For the task, the items used were: a rivet gun, a work stand, pressurized air hose, rivets, and rivet gun accessories. The rivet gun piston moved in a reciprocating fashion, therefore, the general hazards associated with Kinetic/Mechanical Energy hazards were used. Pressure hazards category was used because the task involved utilizing pressurized air. The task also involved handling of small parts and vibrating parts, which could have resulted in a student dropping tools and items. The Acceleration/ Deceleration/Gravity hazards were reviewed. The task involved moving in and out of a confined area: therefore, Physiological hazards were used and were summarized in Table 2. Human Factors is a subset of Physiological hazards.

The following hazards were determined to occur during the riveting process:

1. Falling Object
2. Noise Exposure
3. Prolonged exposure to vibration

4. Struck by
5. Fall to lower level
6. Awkward Position
7. Pinching
8. Slipping/Tripping

Amalgamation

Amalgamation required: identifying when the hazard occurred and generating ideas of possible consequences related to the hazard or accident. The steps were observed being performed, and from the list of hazards and accidents created from the task analysis step, labeled with the hazard. It was possible for there to be more than one hazard associated with a step, it was possible for there to be no hazards associated to a step, it was possible that the same hazard was associated to several steps, and it was possible that the existence of one hazard to generate the existence of another. The results were listed in Table 3.

Consequences of hazard/accident occurrence were also generated based on the researcher's expertise at this technical task. The researcher used information from several company job safety analyses, previous safety courses, cumulative trauma injury research, military aviation experience from the course instructor, and personal experience. Ideally, a group of safety observers would have been used to allow for a wider breadth of consequence possibilities. "What if" scenarios were assessed. The researcher asked the following questions in the development of the consequences: "What are the possible consequences of this hazard?" and "What type of injury will be sustained if this hazard occurs?"

The purpose of identifying the consequences is to give the future student an idea of the possible ramifications associated with performing a risky act. According to RHT, perception of the cost of risky behavior affects the target level of risk. Notification of the physical cost associated with performing a risky act, meaning the possible outcomes from the hazard condition, affected perception and thus, the target level of risk. The information is displayed in Table 4. The table lists the hazard/accident and the physical result of such an accident occurring. The method displayed in this procedure for generating ideas is not the best way; however, due to the characteristics of the study, the method is best for completion within the allotted time frame.

Excessive noise is a cumulative trauma disorder. The result of constant exposure to excessive noise may result in a reduced hearing capability. This injury is non-recoverable. Cumulative trauma disorders are also associated with prolonged vibration exposure. Three main injuries are Hand-Arm Vibration syndrome, carpel tunnel syndrome, and trigger finger. Hand-Arm Vibration syndrome (HAVS), also known as white hand, is when feeling is lost in the hand. The hand takes on a pale whitish color in this condition. White hand is a result of prolonged exposure to holding a vibrating object. Carpel Tunnel syndrome is inflammation of a tendon located in the wrist. Inflammation occurs after prolonged exposure to working with the hands, with the wrist bent or deviated in the ulnar position. Trigger Finger is when the tendon located above the middle joint of the finger squeezing the rivet gun wears and as a result the finger has no angular deflection. It can only move to the straight position or the bent position. The results of the tripping/slipping hazard are stumbles, sprains, fractures, bone breaks, and concussions. Awkward position, primarily occurring for Technician two and occasionally for Technician one, can result in stiffness, muscle aches and strains from maintaining a static position for prolonged periods of time. Falling to a lower level is a hazard only relevant when utilizing a ladder or other elevation device. The consequences are similar to tripping/slipping. Falling objects is listed as a hazard because its occurrence generates another hazard. The consequence of a falling object hazard is the generation of a tripping/slipping hazard. Pinching occurs when the skin on the hand gets caught between the coils on the retaining spring. Possible consequences were welts and broken skin. Finally, consequences of being struck by flying objects result in minor bruises and, if contacting the eyes, eye irritation.

Countermeasures

The safety procedures were the result of both the hazard identification and the amalgamation steps in the JSA process. The recommended countermeasures were the actions necessary for the student to avoid the negative consequence. The actions involved using existing safety equipment or performing certain steps prior to the activity (Table 5).

Ordering of the consequence column and the recommended countermeasure column are in accordance with the ordering of the hazards in the hazard/accident column. Step 12 exposes the student to the following hazards: prolonged vibration, noise exposure, awkward posture when kneeling, struck by objects, pinching, and fall to lower level. Prolonged vibration exposure can cause HAVS, trigger finger, and carpel tunnel syndrome. The recommended countermeasure is wearing gloves. The gloves in the lab are not vibration resistant gloves; however do provide a degree of protection from the vibration effects. Extended periods of noise exposure can cause a reduction in audible capability. The recommended countermeasure for avoiding the negative consequence is wearing hearing protection. When kneeling for extended periods of time stiffness develops in the knee joint. The recommended countermeasure for awkward position hazards, as well as prolonged vibration exposure, is to take frequent breaks. The breaks should consist of walking around or simply both students changing positions. Getting struck by flying objects can leave a bruise or contact the student's eye. To avoid contact with the eyes, recommended countermeasure is wearing eye protection. Pinching, occurring on the hand can cause welts and broken skin. It is recommended that gloves be worn when performing the riveting task. Finally, falling to a lower level can cause broken bones, fractures, sprains, and concussions. During conditions when a ladder is needed to gain height, check the ladder for stability and operation prior to use. The purpose of the job safety procedures is to assist with the development accurate and complete reasons "why" certain safety actions are performed. Instead of a student simply wearing gloves, or hearing protection because it was read on a warning label or list of instructional steps, a student can now understand why the safety equipment is used, and have a better understanding of the costs when not using the recommended countermeasures.

A priority system was established to suggest safety improvement. A probabilistic risk assessment technique, MIL-STD-882D, was used to identify the hazard's probability of occurrence. MIL-STD-882D was a qualitative assessment tool that involved ranking the severity of the hazard/accident consequence, and ranking the hazard/accident frequency, taking into account the exposure time interval. Although some guidelines were defined, the technique was subjective and ranking had a degree of reliance on the analyst's experience and skill. The two rankings, probability and severity, were then combined in a matrix, shown in Table 6, and the urgency of elimination or reduction to exposure was determined.

The chart compares the probability of mishap ranking to the severity of consequence ranking and results in a recommended action. The recommended action is divided into three risk code actions. Code 1, requires immediate suppression of the risk. Code 2, allows the activity to occur only if regulated by management. Code 3, allows the activity to occur and is not considered needing immediate attention. As a general rule, do not expose employees to risks resulting in a code 1 or code 2. Identification of risks resulting in those areas is considered first when recommending a countermeasure.

Severity of consequence was divided into four categories: catastrophic, critical, marginal, and negligible. The definition of each category was listed in Table 7.

Probability of mishap was divided into six levels: frequent, probably, occasional, remote, improbable, and impossible. The definition for each level was itemized below.

- Frequent = Likely to occur repeatedly in lab life cycle (multiple events every week).
- Probable = Likely to occur several times in lab life cycle (one event every week).
- Occasional = Likely to occur sometime in lab life cycle (one event every semester).
- Remote = Not likely to occur in lab life cycle, but possible (one event every two semesters).

- Improbable = It can be assumed occurrence may not be experienced (less than one event for every four semesters).
- Impossible = Physically impossible to occur (no accident events).

The scope of the study was also to identify hazards that caused physical injury and avoid hazards that caused damage to the equipment and the environment. The definitions of the severity categories were a combination of personnel illness/injury and down time. The down time column signified the recuperation time for the type of injury sustained. A catastrophic injury or illness was one that caused permanent loss or required a recuperation time greater than 4 months, such as amputation, severe head trauma, and burns. Critical injuries resulted in a recuperation time of 2 weeks to 4 months, as with bone fractures and sprains. A marginal injury was an occupational injury or illness that resulted in a recuperation time of 1 day to 2 weeks, such as cuts, abrasions, bruises, and minor crushing injuries. Finally, negligible injuries were those that required a recuperation time of less than a day. Such conditions resulted in no injury or illness. The modified severity categories were illustrated in Table 8.

The severity of consequence was identified, and the frequency, based on the reduced probability scale, was estimated. The ranking was put into the MIL-STD-882D, Table 6, and the resulting risk code and recommended action was noted. A similar analysis was conducted for all hazards identified. Table 9 listed the results of the individual rankings. The priority column coincided with MIL-STD-882D risk action levels. Level 1 was high, Level 2 was medium, and Level 3 was low.

Excessive exposure to noise and vibration were the major hazards to be avoided while riveting a patch repair in the lab. The probability for exposure was listed as frequent because the hazard of vibration and loud noises was repeated when performing the task. The severity was ranked as critical because, unlike most other outcomes listed, the cumulative trauma disorders were unrecoverable. Some symptoms eventually would subside after sufficient rest; however, there was a permanent disabling effect due to susceptibility of recurring injuries and regenerative capabilities of the body. Prevention was considered the better approach for controlling such hazards. The resulting priority rating was identified as high. This meant that some form of countermeasure should be implemented soon that would reduce the affects of the hazard.

A list of recommended safety controls was created. The safety controls, Table 10, were: generation of job safety procedures, spare ear muffs, impact absorbing (IMPACTO) gloves with elastic support, mobile work tables, additional training, kneel pads, and interval inspections. The recommendations were listed in the order of hazard importance as concluded with the probabilistic assessment technique.

FINDINGS AND DISCUSSION

Given the existence of differing cognitive styles, introducing instructions by textual information, targets only a select group of individuals. The individuals targeted have a cognitive style applicable to learning the information within the mode of transmission. The implementation of instruction suggests an educational approach. In order to educate about hazards using instruction, the information presented should have an affect on an individual's awareness, mental model, perception of cost, and rules and assumptions governing behavior. In education, a person is informed on how to perform a task, why a task is performed, the end result, and "what if" scenarios. The mental model is affected by explaining how, and why the task is performed. Informing of the end result establishes goals and expectations. Finally, "what if" scenarios formulate the rules and assumptions that govern behavior.

The information required for education of the hazards can be obtained through a job safety analysis presented in the Table 11.

CONCLUSIONS AND RECOMMENDATIONS

This study argued that education of the costs and benefits associated with performing risky actions would adjust the target level of risk. Essentially, education about the cost would increase their perception of the cost, and reduce the amount of risk willingly accepted. If students were informed of the consequences of risky behaviors, then they would have been educated on the cost of performing risky behaviors. The hazard/accident-consequence table developed during the JSA amalgamation step determined the information needed to be included in educational approach.

The educational safety awareness instruction should be similar to Table 11 and include: the hazard, the cause of the hazard, possible results of the hazard, and the action needed to avoid the hazard. Presentation of instruction in this manner affects the student educationally by adjusting their hazard awareness, safety mental model, perception of cost associated with the hazard, and their rules and assumptions that govern their behavior. To encourage education, both the procedural steps and the safety steps should be presented together. In industry, procedures list their warnings, cautions, and notes prior to listing the procedural steps. It is recommended that the industry format be used. The hazard information should be located prior to the procedural steps in order for the student to perceive and understand the hazard prior to performing the task.

Notification of the hazard frequency can also affect safety awareness. Without notification of frequency, the awareness is governed by previous experiences of perceiving the accident. As a result the student is trained to believe the hazard never occurs because it has not been perceived in the past.

A group should perform a JSA. A large percentage of a JSA is subjective assessment: hazard identification, consequences, probability assessment, and recommendations. Each of the subjective categories, however, can have an increase in validity by increasing the number of individuals assessing the task.

Table 1. *General Task Information.*

General Information	***Definition***
Analysis Limit	Analysis will be limited to including hazards associated to physical injury and avoid hazards associated with failure of the task.
Job Location	Sheet metal training laboratory
Job Identification	Riveting Lab
Work Objective	Rivet a patch repair on aircraft skin
Operator Identification	Students
Shift Length	4 hours /week

Table 2. *Physiological work hazards.*

Hazard Category	**Definition**
Kinetic/Mechanical Energy hazards	Hazards present as result of one or more objects in m colliding with another object under a degree of magnitude.
Pressure hazards	Hazards present as a result of a fluid (air or gas) maintained under a constant force.
Acceleration/Deceleration/Gravity hazards	Hazards present as a result of an object rapidly changing its state of motion.
Physiological hazards	Hazards present as a result of lack of compatibility between personnel capabilities and task requirements.
Human Factors	A subset of the Physiological hazards category.

Table 3. *Task steps and hazards.*

Task Step	**Hazard/Accidents**
1. Remove spring from end of rivet gun	Falling object Noise Exposure Tripping/Slipping
2. Install header into rivet gun	Falling object Noise Exposure Tripping/Slipping
3. Screw spring to end of rivet gun	Falling object Noise Exposure Tripping/Slipping
4. Connect air hose to rivet gun	Struck by Noise Exposure
5. Test rivet gun regulator setting on wood block	Struck by Noise Exposure
6. If needed, adjust regulator setting on rivet gun	Struck by Noise Exposure

7. Insert rivet into hole	Fall to lower level Falling object Noise Exposure Tripping/Slipping Awkward Posture
8. Technician one places rivet gun header on rivet head	Fall to lower level Noise Exposure Tripping/Slipping Awkward Posture
9. Technician two stand on backside of aircraft skin	Tripping/Slipping Awkward Posture
10. Technician two places bucking bar on rivet shaft	Awkward Posture Noise Exposure
11. Technician one, communicate intention to squeeze trigger	Noise Exposure Awkward Posture
12. Technician one squeeze rivet gun trigger	Fall to lower level Struck by Noise Exposure Pinching Awkward Posture Prolonged vibration exposure
13. Technician two removes bucking bar	Awkward Posture Noise Exposure
14. Technician two checks height of bucked rivet shaft	Awkward Posture Noise Exposure
15. Disconnect air hose	Struck by Noise Exposure
16. Hang hose above head height	Noise Exposure
17. Unscrew spring from end of rivet gun	Falling object Noise Exposure Tripping/Slipping
18. Remove header	Falling object Noise Exposure Tripping/Slipping
19. Screw spring to end of rivet gun	Falling object Noise Exposure Tripping/Slipping

Table 4. *Hazard Consequences*
.

Hazard	Consequences
Excessive noise	Reduced audible capability (non-recoverable)
Prolonged vibration exposure	Hand-Arm Vibration Syndrome (HAVS), Trigger Finger, Carpel Tunnel Syndrome (non-recoverable)
Tripping/Slipping	Concussions, broken bones, fractures, sprains, stumbling
Awkward position	Muscle strain, muscle aches, stiffness (recoverable)
Falling to lower level	Concussions, broken bones, fractures, sprains,
Falling objects	Generation of tripping and slipping hazard
Pinching	Pinching
Struck by flying objects	Eye irritation, bruise

Table 5. *Hazard Countermeasures.*

Sequential Step	***Hazardous/Accident***	***Consequence***	***Recommended Countermeasures***
1. Remove spring from end of rivet gun	• Tripping/Slipping • Noise Exposure • Falling object	Broken bones, fractures, sprains, stumbling, concussions, reduced audible capability (non-recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection
2. Install header into rivet gun	• Tripping/Slipping • Noise Exposure • Falling object	Broken bones, fractures, sprains, stumbling, concussions, reduced audible capability (non-recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection
3. Screw spring to end of rivet gun	• Tripping/Slipping • Noise Exposure • Falling object	Broken bones, fractures, sprains, stumbling, concussions, reduced audible capability (non-recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection
4. Connect air hose to rivet gun	• Noise Exposure • Struck by	Reduced audible capability (non-recoverable), bruise, eye irritation	• Wear hearing protection • Wear eye protection
5. Test rivet gun regulator setting on wood block	• Noise Exposure • Struck by	Reduced audible capability (non-recoverable), bruise, eye irritation	• Wear hearing protection • Wear eye protection
6. If needed, adjust regulator setting on rivet gun	• Noise Exposure • Struck by	Reduced audible capability (non-recoverable), bruise, eye irritation	• Wear hearing protection • Wear eye protection
7. Insert rivet into hole	• Tripping/Slipping • Noise Exposure • Awkward Posture (kneeling) • Fall to lower level • Falling object	Broken bones, fractures, sprains, concussions, stumbling, Reduced audible capability (non-recoverable), stiffness (recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection • Take frequent breaks to stretch legs • Check ladder stability and operation

8. Technician one places rivet gun header on rivet head	• Tripping/Slipping • Noise Exposure • Awkward Posture (kneeling) • Fall to lower level	Broken bones, fractures, sprains, concussions, stumbling, Reduced audible capability (non-recoverable), stiffness (recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection • Take frequent breaks to stretch legs • Check ladder stability and operation
9. Technician two stand on backside of aircraft skin	• Tripping/Slipping • Noise Exposure • Awkward Posture (arched back)	Broken bones, fractures, sprains, concussions, stumbling, reduced audible capability (non-recoverable), stiffness (recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection • Take frequent breaks to relax back
10. Technician two places bucking bar on rivet shaft	• Noise Exposure • Awkward Posture (arched back)	Reduced audible capability (non-recoverable), muscle strain, muscle aches, stiffness (recoverable)	• Wear hearing protection • Take frequent breaks to relax back
11. Technician one, communicate intention to squeeze trigger	• Noise Exposure • Awkward Posture (kneeling)	Reduced audible capability (non-recoverable), muscle strain, muscle aches, stiffness (recoverable)	• Wear hearing protection • Take frequent breaks to relax back
12. Technician one squeeze rivet gun trigger	• Prolonged vibration exposure • Noise Exposure • Awkward Posture (kneeling) • Struck by • Pinching • Fall to lower level	Hand-Arm Vibration Syndrome (HAVS), Trigger Finger, Carpel Tunnel Syndrome (non-recoverable), reduced audible capability (non-recoverable), stiffness (recoverable), bruise, eye irritation, welts, broken skin, broken bones, fractures, sprains, concussions,	• Wear gloves • Wear hearing protection • Take frequent breaks to stretch legs • Wear eye protection • Check ladder stability and operation
13. Technician two removes bucking bar	• Noise Exposure • Awkward Posture (arched back)	Reduced audible capability (non-recoverable), muscle strain, muscle aches, stiffness (recoverable)	• Wear hearing protection • Take frequent breaks to relax back
14. Technician two checks height of bucked rivet shaft	• Noise Exposure • Awkward Posture (arched back)	Reduced audible capability (non-recoverable), muscle strain, muscle aches, stiffness (recoverable)	• Wear hearing protection • Take frequent breaks to relax back

15. Disconnect air hose	• Noise Exposure • Struck by	Reduced audible capability (non-recoverable), bruise, eye irritation	• Wear hearing protection • Wear eye protection
16. Hand hose above head height	• Noise Exposure	Reduced audible capability (non-recoverable)	• Wear hearing protection
17. Unscrew spring from end of rivet gun	• Tripping/Slipping • Noise Exposure • Falling object	Broken bones, fractures, sprains, stumbling, concussions, reduced audible capability (non-recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection
18. Remove header	• Tripping/Slipping • Noise Exposure • Falling object	Broken bones, fractures, sprains, stumbling, concussions, reduced audible capability (non-recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection
19. Screw spring to end of rivet gun	• Tripping/Slipping • Noise Exposure • Falling object	Broken bones, fractures, sprains, stumbling, concussions, reduced audible capability (non-recoverable)	• Housekeeping/Keep floor clear of obstruction • Wear hearing protection

Table 6. *Severity and Probabilities.*

Severity of Consequence	**Probability of Mishap**					
	Impossible	Improbable	Remote	Occasional	Probable	Frequent
Catastrophic					1	
Critical				2		
Marginal			3			
Negligible						
Risk Code/ Actions	1	Imperative to suppress risk to lower level.	2	Operation requires written, time limited waiver endorsed by management.	3	Operation permissible.
Note: Personnel must not be exposed to hazards in Risk Zones 1 and 2						

Table 7. *Consequence categories.*

Severity of Consequences					
Category/ Descriptive Word	**Personnel Illness/ Injury**	**Equipment Loss ($)**	**Down Time**	**Product Loss**	**Environmental Effect**
Catastrophic	Death	>1Million	>4 mo	>1Million	Long-term (5 yrs or greater) environmental damage or requiring >$1M to correct and/or in penalties
Critical	Severe injury or sever occupational illness	250K – 1M	2 wks – 4 mo	250K – 1M	Medium –term (1-5 yrs) environmental damage or requiring $250K – 1M to correct and/or in penalties
Marginal	Minor injury or minor occupational illness	1K – 250K	1 day – 2 wks	1K – 250K	Short-term (<1yr) environmental damage or requiring $1K - $250K to correct and/or in penalties
Negligible	No injury or illness	>1k	<1 day	>1k	Minor environmental damage, readily repaired and/or requiring <$1K to correct and/or in penalties

Table 8. *Modified severity categories.*

Category/ Descriptive Word	Personnel Illness/ Injury	Down Time
Catastrophic	Death/Sever injury or sever occupational illness	>4 mo
Critical	Severe injury or sever occupational illness	2 wks – 4 mo
Marginal	Minor injury or minor occupational illness	1 day – 2 wks
Negligible	No injury or illness	<1 day

Table 9. *Individual safety rankings.*

Accident	**Causes**	**Probability**	**Severity**	**Priority**
Exposure to excessive noise	Actuating mechanism of the rivet gun (prolonged exposure)	Frequent	Critical	High
Exposure to excessive vibration	Actuating mechanism of the rivet gun, holding vibrating object, working with the wrist bent or deviated in the ulnar position (prolonged exposure)	Frequent	Critical	High
Tripping and Slipping	Work-stand is too small, Housekeeping	Probable	Critical	High
Awkward positioning	Prolonged exposure to kneeling or arching of the back when standing behind the aircraft skin	Frequent	Marginal	Medium
Falling to lower level	Improper use of stool/ladder	Occasional	Critical	Medium
Falling objects	Oily or damp hands, clumsiness, irregular surfaces	Frequent	Negligibl e	Low
Caught in retaining spring	Hand located to far down on rivet gun shaft	Occasional	Marginal	Low
Struck by flying objects	Elasticity on air hose, nearby hazardous activity, contacting loose metal chips while riveting	Remote	Marginal	Low

Table 10. *Recommended safety controls.*

Recommended Countermeasure	Hazards Addressed
Generation of Job Safety Procedures	All hazards addressed by informing the technician
Spare Ear Muffs	Decrease the risk of Cumulative Trauma Disorders (Hearing loss)
IMPACTO Gloves w/ elastic wrist support	Decrease the risk of Cumulative Trauma Disorders (HAVS, Carpel Tunnel Syndrome, and Trigger Finger)
Mobile Work Tables	Assist in keeping the environment clear of debris and reduce the hazard of tripping and slipping
Additional Training	Include the proper use of a ladder and proper positioning for leverage Include a philosophy of housekeeping and informing of the ramifications of slipping and tripping Include methods to reduce Cumulative Trauma Disorders (awkward positioning, vibration, noise) and encouraging the technicians to take frequent breaks, switch off between hands (i.e. using the left hand instead of the right) and task rotate
Kneel Pads	Encourage better posture for the technician driving the rivet by providing a comfortable area for the knee to contact the floor
Interval Inspections	Irregularities in the pneumatic line, including quick disconnects

Table 11. *Job safety analysis.*

Hazard	Causes	Consequences	Countermeasure
Excessive noise	Riveting	Reduced audible capability (non-recoverable)	Use hearing protection.
Prolonged vibration exposure	Riveting, Bucking	Hand-Arm Vibration Syndrome (HAVS), Trigger Finger, Carpel Tunnel Syndrome (non-recoverable)	Take frequent breaks. Rotate job with lab partner.
Tripping/Slipping	Moving around the work stand. Placing tools and other objects on the floor. Keeping a messy work area.	Concussions, broken bones, fractures, sprains, stumbling	Maintain good housekeeping. Keep floor clear of obstruction. Avoid placing tools on the floor. Be aware of objects rising from the floor. Walk instead of running.
Awkward position	Standing behind the aircraft skin. Riveting below the waist.	Muscle strain, muscle aches, stiffness (recoverable)	Take frequent breaks to stretch. Rotate jobs with lab partner.

			If kneeling, place knee on a soft surface.
Falling to lower level	Using the wrong equipment. Using broken equipment Using the ladder improperly.	Concussions, broken bones, fractures, sprains,	Check elevating devices prior use for basic operation and stability.
Falling objects	Dropping tools or items	Generation of tripping and slipping hazard	Be patient. Work with dry hands or gloves.
Pinching	Hand getting caught in the retaining spring.	Pinching	Wear gloves.
Struck by flying objects	Dislodging wood or metal from the wood block. Misalignment with the rivet gun header and the rivet.	Eye irritation, bruise	Wear eye protection. Use both hands when riveting.

REFERENCES

Accident Prevention. (1997). Washington D.C.: U.S. Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy.

Brauer, R., L. (1994). Safety and Health for Engineers. New York, John Wiley and Sons, Inc.

Feyen R. (2002). Job Safety Analysis. Lecture notes

Geller, E., S. (2001). The Psychology of Safety Handbook. New York, Lewis Publishers.

Jagdeep, Chokkar, J., S., & Wallin, J., A. (1984). A field study of the effect of feedback frequency on performance. *Journal of Applied Psychology 69*, 3, 524-530.

Job Safety Analysis (1999). Washington D.C.: U.S. Department of Labor, Mine Safety and Health Administration.

Komaki, J., Heinzmann A., T., & Lawson, L. (1980). Effects of training and feedback: Component analysis of a behavioral safety program. *Journal of Applied Psychology 65, 3*, 261-270.

The Oxford Desk Dictionary and Thesaurus (1997). New York: Berkley Publishing Group.

ReVelle, J., B. (1980). Safety Training Methods. New York: John Wiley and Sons, Inc.

Riding, R., J., & Rayner, S., G. (2000). International perspectives on individual differences: Cognitive styles. Stamford, Connecticut: Ablex Publishing Corporation.

Wilde, G. J. S. (1982). The theory of risk homeostasis: Implication for safety and health. *Risk Analysis* 2, 209-225.

Wilde, G. J. S. (1986). Beyond the concept of risk homeostasis: suggestions for research and application towards the prevention of accidents and lifestyle-related disease. *Accident Analysis and Prevention 18,* 377-401.

Wilde, G. J. S. (1994). Target Risk. Toronto, PDE Publications. (viewed on the World Wide Web January, 2002).

http://www.OSHA.gov (viewed on the World Wide Web April 1, April 2, and April 3, 2002).

APPENDIX

A General Hazard Checklist

(Disclaimer: this list is incomplete and has been adapted from several sources.)

Electrical Energy

The inadvertent release or interruption of electrical energy may lead to:

– Shock	– Power outage	– Disruption of communications
– Burns	– Distribution back feed	– Failure of control systems
– Overheating	– Unsafe failure to operate	– Grounding failures
– Ignition of combustibles	– Inadvertent activation	– Explosion/electrical (electrostatic)
– Explosion/electrical (arc)	– Destruction of electronic components	

Kinetic/Mechanical Energy

Objects and/or persons in motion can cause severe injury and/or property damage upon collision with other objects or persons. In general, the risk of injury is determined by the magnitude of the kinetic energy, the duration of the collision, the contours of the surfaces that collide, and the body part(s) involved in the collision. Effects on both humans AND equipment should be considered, particularly if damage to equipment is likely to create other hazards (e.g., disruption of control systems, grounding failures, etc.).

– Sharp edges/points	– Lifting weights	– Pinch points
– Rotating equipment	– Stability/toppling potential	– Crushing surfaces
– Reciprocating equipment	– Ejected parts/fragments	

Pressure

High pressures can cause explosion and fragmentation of containers and vessels or the whipping of lines and hoses. Low pressures can cause containers to implode or collapse; rapid pressure changes can cause disorders such as embolisms or the bends (see also “Physiological”).

– Over pressurization	– Backflow	– Blown objects
– Pipe/vessel/duct rupture	– Cross flow	– Pipe/hose whip
– Implosion	– Hydraulic ram	– Blast
– Mislocated relief device	– Inadvertent release	– Dynamic pressure loading
– Relief pressure improperly set	– Miscalibrated relief device	

Acceleration/Deceleration/Gravity

Problems are similar to those listed for kinetic/mechanical energy. In addition, rapid acceleration/deceleration of fluids can cause severe structural damage to piping and containers while certain explosive materials may detonate under shock or rapid changes in direction.

– Inadvertent Motion	– Fragments/Missiles	– Falling Objects
– Loose Object Translation	– Sloshing Liquids	– Elevated surfaces
– Impacts	– Slips, trips, and falls	

Temperature Extremes

High or low thermal extremes can cause severe skin "burns", systemic disorders (e.g., heat stroke, hypothermia), and damage to equipment or materials. Rapid temperature changes can cause material damage due to expansion/contraction. High temperatures can ignite combustible materials and cause fire. Low temperatures may cause systems to fail, such as freezing of water sprinkler systems with subsequent loss of fire protection and water damage due to flooding.

– Heat source/sink	– Elevated reactivity	– Humidity/moisture
– Hot/cold surface burns	– Freezing	– Elevated volatility

– Confined gas/liquid
– Pressure elevation
– Altered structural properties (e. g., embrittlement)
– Reduced reliability
– Elevated flammability

Fire/Flammability

– Fuel
– Oxidizer
– Ignition source
– Propellant

Radiation

Ionizing radiation can cause severe damage (sometimes with delayed effects) to human tissues, chemical changes, and disruption of communications. Non-ionizing radiation can cause a variety of disorders, including cataracts, heating/charring/burning of organic tissues, disruption of electrical equipment, and chemical decomposition of materials.

Ionizing
– Alpha
– Beta
– Neutron
– Gamma
– X-ray

Non-Ionizing
– Laser
– Infrared
– Microwave
– Ultraviolet

Explosives

Initiators:
– Heat
– Friction
– Impact/shock
– Vibration
– Electrostatic discharge
– Lightning
– Welding (stray current/sparks)
– Radio frequency energy
– Induced voltage (capacitive coupling)

Sensitizers:
– Heat/cold
– Vibration
– Impact/shock
– Low humidity
– Chemical contamination

Presence of explosive:
– Propellant
– Gas
– Liquid
– Vapor
– Dust

Effects:
– Mass fire
– Blast overpressure
– Thrown fragments
– Seismic ground wave
– Meteorological reinforcement

Leaks/Spills

Materials:
– Liquids/cryogens
– Gases/vapors
– Dusts
– Radiation sources

Conditions:
– Flammable
– Toxic
– Irritating
– Corrosive
– Slippery
– Odorous
– Reactive
– Asphyxiating
– Flooding
– Run off
– Pathogenic
– Vapor

Chemical Reactivity

Slow destructive processes include corrosion, oxidation and material degradation.
Rapid chemical processes can produce high pressures (sometimes causing explosions), high temperatures (sometimes causing fire), and/or the release of toxic materials.

Contamination

This is a general problem caused by the introduction of foreign matter to equipment and or processes. Possible problems include: clogged filters, damaged bearings, and ruining of raw materials or finished products. Failure of safety systems such as fixed piping water sprinklers for fire protection may occur.

– System cross-connection
– Leaks/spills
– Vessel/pipe/conduit rupture
– Backflow/siphon effect

Physiological

Lack of compatibility between work requirements and human capabilities can lead to errors, accidents, and overstressing of human tissues. Toxic substances can produce a wide spectrum of localized and systemic disorders, with immediate or delayed effects. Virtually all of the body's systems can be adversely affected.

– Excessive force requirements
– Awkward postures
– Localized mechanical pressure
– Prolonged vibration exposure
– Cold exposure
– Heat exposure
– Fatigue
– Prolonged static muscular exertion
– Nuisance dusts/odors
– Asphyxiants
– Allergens
– Pathogens
– Radiation
– Repetitive tasks
– Lifted weights
– Baropressure extremes
– Mutagens
– Teratogens
– Toxins
– Irritants
– Cryogens
– Carcinogens
– Noise exposure

Human Factors (see also **Controls and Displays)**

– Failure of vigilance
– Operator error
– Inadvertent operation
– Failure to operate
– Temporal stressors
– Operation out of sequence
– Right operation/wrong control
– Early/late initiation
– Operate too long
– Operate too briefly

Controls and Displays (also see **Human Factors)**

– Nonexisting/inadequate warning systems
– Excessive information presentation and/or processing requirements
– Glare
– Inadequate/improper illumination
– Vibration (may impair ability to read display or actuate control)
– Inadequate control and/or display differentiation
– Inaccessibility of controls and/or displays
– Inappropriate control and/or display location
– Faulty/inadequate control and/or display labeling
– Nonexisting/inadequate "kill" switches

Automated Control Systems

– Power outage
– Interference (EMI/ESI)
– Grounding failure
– Moisture
– Short circuit
– Inadvertent activation
– Sneak software
– Lightning strike

Unexpected Utility Outages

– Electricity
– Steam
– Heating/cooling
– Ventilation
– Air conditioning
– Fuel
– Compressed air/gas
– Lubrication
– Exhaust
– Drains/sumps

Common Causes

– Utility outages
– Single-operator coupling
– Seismic disturbance/impact
– Faulty calibration
– Vibration
– Flooding
– Dust/dirt
– Fire
– Location
– Radiation
– Wear-out
– Maintenance error
– Animals/insects

Environmental

Temperature extremes can cause hyperthermia and hypothermia in humans while exposure to extreme weather can cause severe injuries and extensive property damage. Material degradation can result from long-term exposure ("weathering").

– Moisture/humidity
– Air flow/circulation
– Sustained high winds
– Freezing/thawing cycle
– Flooding
– Lightning
– Sunlight exposure (UV)
– Dust, sand, and dirt
– Temperature extremes
– Wind gusts
– Hail

Contingencies

(i.e., emergency responses to abnormal events)

- "Hard" shutdowns/failures
- Freezing
- Fire
- Windstorm
- Hailstorm
- Utility outages
- Flooding
- Earthquake
- Snow/ice load

Operative phases

- Transport
- Delivery
- Installation
- Calibration
- Checkout
- Shakedown
- Activation
- Standard start
- Emergency start
- Normal operation
- Load change
- Coupling/uncoupling
- Stressed operation
- Standard shutdown
- Emergency shutdown
- Troubleshooting
- Maintenance

Collegiate Aviation Review
SUBSCRIPTION ORDER

The *Collegiate Aviation Review* is a refereed professional journal that publishes articles of interest in all areas of aviation research, aviation operations (both domestic and international), and the pedagogy of collegiate aviation. ISSN 1523-5955.

Please Print or Type

Name ______________________________

Address ______________________________

City, State, Zip ______________________________

Country ______________________________

Signature ______________________________

Subscription Options

______UAA Member subscription - $20/year
______Non-member subscription - $30/year (U.S. – add $5 shipping & handling; Non-U.S., add $10)
______Previous Issues available for Years 1985 – 2003 (Specify Year) - $15/year/issue

Payment Options
(Payable in U.S. funds only)
______Check Enclosed (Payable to University Aviation Association)
______Purchase Order Enclosed
______Credit Card

VISA________ MasterCard_______ AMEX_______

Card Number _______ ________ ________ ________

Mail subscription order to: University Aviation Association
3410 Skyway Drive
Auburn, AL 36830

Phone: (334) 844-2434 Fax: (334) 844-2432