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TABLE OF CONTENTS

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ACKNOWLEDGEMENTS

With the publication of the University Aviation Association's 1987 "Proceedings," a five-year milestone was achieved in the professional growth and maturation of the association's membership and publication program. Such a significant evolvement not only sets pace and direction but challenges the leaders, the educators, the mentors to address future directions and issues and to develop tomorrow's industry professionals.

The organization and operation of a professional refereed publication program requires inspiration, dedication, hard work, and involvement. The 1987 "Proceedings" is such an example.

The publication committee heartily congratulates the authors whose papers were reviewed and published. The committee also commends all the authors who submitted papers for review, and encourages them to continue their writing endeavors for future publication.

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William D. Geibel
Publications Committee Chairperson

A SIMULATOR-BASED APPROACH TO TRAINING IN AERONAUTICAL DECISION MAKING

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Submitted to the AFHRL
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fulfillment of the terms of the
"Research Initiation Grant Program"

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EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
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FOREWORD

This report is submitted in fulfillment of the terms of the "Research Initiation Grant Program". This represents a full report on a study to optimize and validate an approach to pilot judgment training produced at the AFHRL, Williams AFB during the 1985 USAF-UES "Summer Faculty Research Project".

A SIMULATOR-BASED APPROACH TO TRAINING IN AERONAUTICAL DECISION MAKING

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Abstract

The effectiveness of a simulator-based approach to training pilot skills in risk assessment and decision making was evaluated in a sample of pilots enrolled in a university aviation science program. The 16 experimental group subjects received four hours of classroom instruction designed to enhance pilot judgment skills, followed by four simulated cross-country flights during which several critical in-flight events occurred. Subjects in the control group received classroom instruction in basic instrument flying, followed by simulator sessions emphasizing instrument flight. Measures of pilot judgment were obtained on all subjects before and after the training, and subjects in the experimental judgment-trained group performed significantly better on the post-training simulation than did control group subjects. The findings suggest that significant gains in pilot decision-making skill can be obtained through the use of the judgment training materials along with simulator practice. The implications of Air Force undergraduate pilot training are discussed.

Introduction

In the many critical work roles assigned to the modern Air Force pilot, there is often insufficient time or opportunity to acquire and perfect decision-making skills through experience alone. Although limited fuel supplies, equipment availability, and the high cost of missons have placed increasing constraints on flight time for training purposes, the military pilot of today must none-the-less be ready to perform with flawless precision on his very first operational assignment. In effect, he must develop good risk assessment and decision-making skills during a short period of training rather than over months or years of experience. Moreover, the high attrition rate among military personnel in recent years has further reduced the experience level of pilots throughout the Air Force (Allen, 1979): "Five years ago, 70 percent of U.S. Air Force fighter pilots had flown in actual combat; today, that same percentage has never seen combat (Knickerbocker, 1979, p. 2)".

The Air Force responded to this need by providing flight personnel with realistic experience in exercises such as Operation Red Flag, in which pilots fly in a hostile environment against other pilots who have been specially trained in aggressor tactics. But a unified methodology for fostering the acquisition of good judgment and decision-making skills has never been developed, and little research has been done to identify the most efficient environments for gaining such experience.

Statistics on both military and civilian aviation accidents clearly demonstrate that the majority of aircraft accidents are attributable to "pilot error". In most cases, this error is one of risk assessment and/or decision making -- pilot judgment. Although pilot judgment is a factor in every flight situation, it is of the greatest concern in those situations in which complex tasks are carried out under conditions of uncertainly, time pressure and stress (Brecke, 1982; Jensen, 1982). Pilot judgement has been defined as:

> ...the mental process by which the pilot recognizes analyzes, and evaluates information regarding himself, the aircraft, and the outside environment. The final step in the process is to make a decision pertaining to the safe operation of the aircraft and to implement the decision in a timely manner (Berlin, Gruber, Holmes, Jensen, Lau, Mills and O'Kane, 1982. p. 4.)

The need for a more flexible approach to pilot judgment training was recognized in the U.S. Air Force more than a decade ago with the implementation of the Situational Emergency Training (SET) program (Thorpe, Martin, Edwards, and Eddowes, 1976). Later, high-fidelity full-mission flight simulation, known as Line-Oriented Flight Training (LOFT), was employed for training pilots who serve in multi-crew environments (Lauber and Foushee, 1981). Cockpit Resource Management (CRM) is another model for aircrew training which was built upon the basic LOFT paradigm. CRM focuses on decision-making and crew coordination (Cooper, White, and Lauber, 1979), and has now become a major component in the training programs for air-carrier and military transport personnel.

During this period too, the utility of special training programs to improve civil pilot judgment was demonstrated in a series of carefully planned investigations. Following an FAA-supported study which concluded that faulty pilot decisional activities were involved in 35% of all fatal general aviation accidents and in 52% of all non-fatal accidents, researchers at Embry-Riddle Aeronautical University (ERAU) produced prototype judgment-training materials for student and instructor pilots. Using an observation flight protocol to measure pilot judgment, the ERAU group demonstrated that these materials could be effective in improving pilot decision making (Berlin et. al., 1982).

An independent evaluation of these training materials was subsequently carried out in Canada using a sample of civilian Air Cadets. In this study too, subjects who received judgment training did significantly better on the observation flight than did control subjects (Buch and Diehl, 1984). While these studies employed classroom instruction in the judgment-training concepts along with coordinated in-flight activities, a second Canadian study demonstrated that the use of self-paced student manuals alone could also result in a significant improvement in observation flight performance (Buch and Diehl, 1983).

A recent field study conducted at FBO flight schools used subjects more representative of the general population of student pilots (Diehl and Lester, 1986). In this experiment too, these subjects who received the judgment training did significantly better on the observation flight than did control group subjects.

However, with the sole exception of the one Canadian study which used only the self-paced student manual, all of these investigations have used a coordinated series of in-flight exercises to complement the classroom teaching of risk assessment and decision making. Given the high cost of actual flight time, particularly in high-performance military aircraft, it was felt that an alternative approach was needed. The present study was therefore concerned with the use of a flight simulator in the training of pilot decision-making skills. The intent was to model, as faithfully as possible, the simulator-training environment provided within the Air Force's Undergraduate Pilot Training (UPT) program.

METHOD

Subjects

The subjects were randomly selected from among Aeronautical Science students enrolled in a Principles of Flight Instruction course at Embry-Riddle Aeronautical University. At the outset of the experiment, all subjects held a Private Pilot certificate with an Airplane Single Engine Land rating. Three control group subjects and six subjects in the experimental group also held multi-engine ratings. Subjects were randomly assigned to either the experimental or control group. There was no significant different between the experimental and control group either in age (t = 0.93, df = 27) or flight experience (t = 1.06, df = 27). The number of subjects in each group, their mean age, and mean flight experience is shown in Table 1.

Procedure

The experimental design compared the performance of 16 pilots who received classroom instruction and simulator training in aeronautical decision making with that of 13 subjects trained under a control condition which focussed on basic instrument flying. Before and after this training, subjects in both groups were evaluated on simulated cross-country VFR flights. All simulators were conducted in the generically configured cockpit of a Singer-Link GAT-1 two axis-simulator with movable pedestal. The simulator provided no visual depiction.

Before beginning their training, subjects in the experimental group completed a ten-item self-assessment pilot attitude inventory. This instrument is a modified form of the "Pilot Decisional Attribute Questionnaire" and yields scores which presumably reflect the relative strength of each of the five hazardous thought patterns. The four hours of classroom instruction were based on the Aeronautical Decision Making for Instrument Pilots text (Jensen and Adrion, 1984) and emphasized the hazardous thoughts. This was followed by four simulator training sessions conducted by full-time ERAU flight instructors who had volunteered for the project. Each instructor had received eight hours of special training on the hazardous thought patterns and on the procedures to be used during the simulator training. The simulators were all VFR cross-country flights during which several critical events occurred. The instructors selected one of four possible routes of flight for each session. No flight scenario or critical event was used twice. The specific events used for each subject were selected by the instructors on an ad hoc basis from among those listed in Table 2. The duration and complexity of the flights increased systematically over the course of the four simulations as shown in Table 3.

Subjects in the control group received four hours of classroom instruction on basic instrument flying from the same ERAU faculty member who taught aeronautical decision making to the experimental group. They also participated in four instrument flight simulator training sessions. These simulations followed the same time schedule and were conducted by the same flight instructors who conducted the simulator training for the experimental group.

The performance of subjects in both groups was evaluated on flight simulations administered before and after the training. Before beginning these pretest and posttest simulations, each subject was reminded that he was to act as the pilot-in-command of a night cross-country VFR flight which was to be conducted as a Line-Oriented Flight Training (LOFT) exercise, "exactly like an actual flight". No information other than the route of flight was provided unless specifically requested by the subject.

During the pretest flight, each subject pilot experienced three critical events in sequence: 1) the failure of all navigation reception while outbound from the departure airport VOR: 2) changing weather conditions which resulted in both the departure and destination fields dropping below VFR minimums; and 3) the failure of all communication receivers. The post test flight was similar to the pretest, but included three critical events which had not previously been used in the training with that particular subject. In addition, the noise level and turbulence was increased progressively during this flight in order to increase pilot stress.

Two performance measures were obtained on the pretest and posttest flights. At the time of the flight itself, the experimenter completed a ten-item checklist of activities related to the flight. These items appear in Table 4. This procedure yielded a score which could range from zero to ten for each subject. A second measure of performance was obtained by having each subject's record from both the pretest and posttest flights independently evaluated by five raters who were not involved in the study and were unaware of the details of the experimental design. All raters were Certified Flight Instructors and Designated Examiners. Three held Airline Transport Pilot certificates and two held Commercial Pilot Certificates. The raters had no way of knowing whether a record came from a subject in the experimental or control group, or whether the flight represented a pretest or posttest simulation.

Using both a graphic record of the flight and the checklist described above, raters assigned a score ranging from -5 to +5 to each flight. A rating of +5 indicated the "best possible judgment", while a rating of -5 was applied to the "worst possible judgment". Raters were instructed to base the ratings on their expectations for an average general aviation pilot with 200 hours of flight experience. They were specifically cautioned to avoid evaluating the "skill" of the pilot.

RESULTS & DISCUSSION

The scores assigned by the five raters were summated by computing the median score for each subject's pretest and posttest flight. These median ratings were compared to the checklist scores assigned by the experimenter at the time of the flight, and a high level of agreement was noted. Pretest checklist scores correlated $r = +0.64$ with median pretest ratings, and posttest check list scores correlated $r = +0.86$ with median posttest ratings. This suggest that both measures of the dependent variable reflect the same dimension, presumably that of judgment, risk assessment and decision-making ability.

The effects of the special training were examined using both the checklist scores and the median flight ratings as indices of change. Random assignment was effective in equating the experimental and control groups at the outset of the experiment. There was no significant difference between the experimental and control group in either pretest checklist scores (t = 0.43, df = 27) or in ratings of the pretest flight (t = 0.38, df = 27). This data is shown in Table 5.

An examination of the posttest flight records revealed a highly significant difference between the experimental and control group on both measures of the dependent variable. Both checklist scores (t = 8.41, df = 27) and flight ratings (t = 4.57, df = 27) indicated that the experimental group performed significantly better on the posttest than did the control group. This data is shown in Table 6. The pretest and posttest checklist data for both groups is depicted graphically in Figure 1. The flight ratings data are shown in Figure 2.

A somewhat more sensitive measure of change is provided by using each subject as their own control and examining the changes in the dependent variable measure from pretest to posttest. This change score reflects a highly significant difference between the experimental and control group with respect to both checklist scores (t = 7.39, df = 27) and flight ratings (t = 5.14, df = 27). Compared with the control group, the experimental group evidenced a significantly greater amount of change on both variables following training. This data is shown in Table 7 and illustrated graphically in Figure 3.

IMPLICATIONS & CONCLUSIONS

The results provide an exceptionally clear demonstration of the effectiveness of the simulator-based judgment training program. Subjects who received four hours of classroom instruction in risk assessment and decision making followed by four instructional simulations in which they experienced several critical in-flight events performed significantly better than did control group subjects when later evaluated on their handling of such events. This suggests that effective judgment training can be accomplished without reliance upon actual aircraft flight time.

Moreover, the study also demonstrated that the judgment training program can be used effectively with pilots who are beyond the ab initio stages of their training. In contrast to previous investigations, all of the subjects in the present study were well beyond the private pilot certificate when they began their training. The manual used herein was designed for students who are beginning their instrument training, and is more appropriate to the Air Force UPT Program than earlier versions of civil pilot judgment training materials.

Thus, the authors recommend that the judgment training model tested in this study, along with classroom instruction and flight simulation training in the use of good risk-assessment and decision-making skills in the handling of critical in-flight events, be incorporated into the Air force UPT Program.

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Table 1
Sample

	Experimental Group	Control Group
Number of Subjects	16	13
Age (years)	20.9	21.2
Flight Experience (hours)	197.3	203.0

Table 2
Critical In-Flight Events

A. destination airport closed due to an accident
B. severe turbulence
C. drop in oil pressure; no change in oil temperature
D. departure field goes IMC
E. suction failure; AI and HI inoperative
F. loss of navigation station signal
G. loss of two-way radio communication
H. pitot-static system failure
I. partial loss of engine power
J. radar contact lost during radar vectoring
K. low fuel
L. flight vectored into restricted area
M. 30 minute delay for landing upon arrival at destination airport
N. PCL lighting inoperative upon arrival at destination airport
O. pilot given vectors opposite the desired direction of flight
P. pilot cleared to take off immediately behind B-727
Q. pilot advised FSS does not have copy of flight plan
R. scattered cloud deck at cruising altitude
S. smoke or burning odor in cockpit

Table 3
Training Simulations for Experimental Group

Flight No.	Duration (mins)	Critical Events
1	15	2
2	30	4
3	45	6
4	60	8

Table 4
Checklist of Pilot Decisional Activities

1. requested preflight weather briefing
2. activated flight plan
3. checked fuel
4. requested radar advisories
5. checked weather enroute
6. accurately computed ETA for first intersection
7. activated flight plan to alternate field
8. initiated DR procedures following equipment failure
9. elected cruise altitude above MEA
10. requested assistance and/or confessed problems

Table 5
Pretest Checklist Scores and Flight Ratings

	Experimental Group (N = 16)		Control Group (N = 13)	
	Mean	S.D.	Mean	S.D.
Checklist Score	4.06	1.53	4.31	1.49
Flight Rating	- 2.75	1.48	-2.92	0.76

Table 6
Posttest Checklist Scores and Flight Ratings

	Experimental Group (N = 16)		Control Group (N = 13)	
	Mean	S.D.	Mean	S.D.
Checklist Score	8.63	1.50	3.46	1.81
Flight Rating	+ 1.63	2.80	- 2.54	1.90

Table 7
Changes in Checklist Scores and Flight Ratings

	Experimental Group (N = 16)		Control Group (N = 13)	
	Mean	S.D.	Mean	S.D.
Checklist Score	+ 4.56	1.86	- 0.85	2.08
Flight Rating	+ 4.38	2.42	+ 0.39	1.56

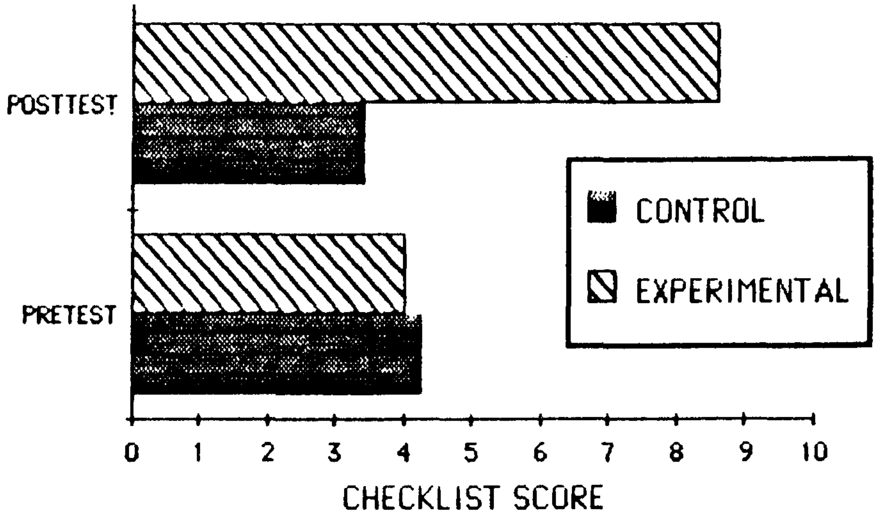

Figure 1. Pretest and posttest checklist scores.

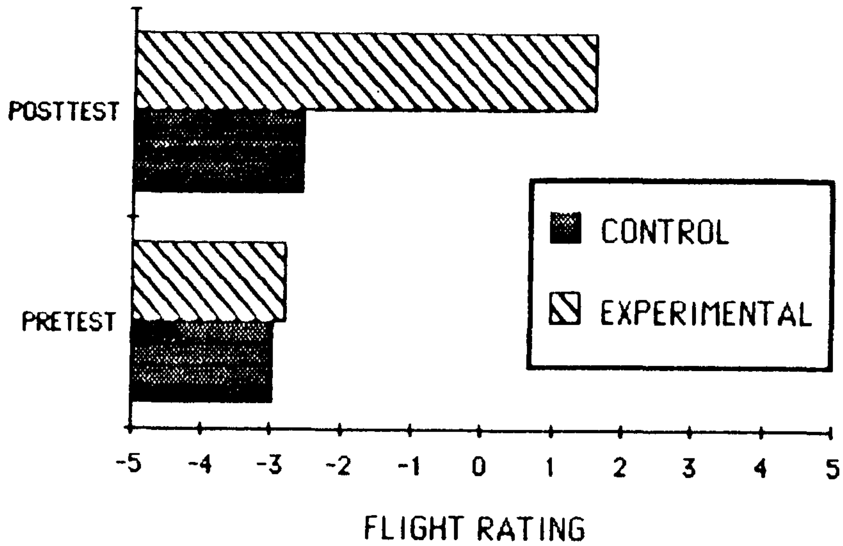

Figure 2. Pretest and posttest flight ratings.

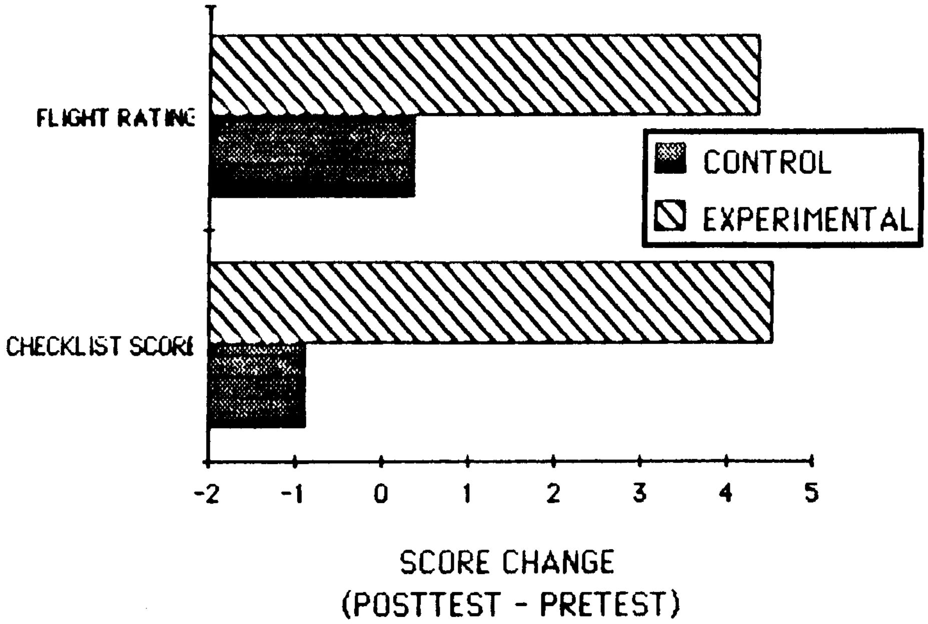

Figure 3. Changes in checklist scores and flight ratings following training.

Appendix A

Judgment Training Syllabus

Each lesson of the Judgment Training Syllabus which follows sets forth a unit of classroom instruction or a unit of simulator instruction. Neither the time nor the number of periods to be devoted to each lesson is specified - only recommended. The test project devoted 4 hours of classroom instruction to Lesson 1 and 2 hours 30 minutes (4 sessions) to Lesson 2.

Each lesson includes an Objective, Content and Completion Standard.

Lesson No. 1

(Recommend 4 hours of instruction)

Objective:

Traditional pilot training emphasizes the pilots knowledge about the aircraft and the flight environment. Judgment training focuses on the pilots additional need for accurate and complete self-knowledge. The success of this training course thus greatly depends upon teaching the student to think more carefully and throughly about his attitudes and behaviors.

Upon completion of this lesson and when presented with a series of true flying situations the pilot will be able to identify hazardous thought patterns and substitute thoughts which promote good judgment.

Additionally he will define the factors causing stress, explain the effects of stress on performance and outline strategies for overcoming high stress which reduces judgment making abilities.

Content: (Student should read and complete the entire "Aeronautical Decision Making" Manual during this lesson.)

1. Pilot Decisional Attitude Questionnaire (PDAQ)
2. Aeronautical Decision Making
    a. The pilot judgment problem
    b. Relationship of judgment to training
    c. Attitudes in decision making
    d. The poor judgment chain
    e. Antidotes for hazardous thoughts
3. Influences and resolution of stress
    a. Define stress
    b. Factors causing stress and effects of stress
    c. Coping with stress

Completion Standard:

The lesson will have been successfully completed when the student can accurately, 100 percent of the time, identify the hazardous thought contained in five given flight situations and apply the appropriate antidote. Additionally, the student will formulate a strategy for coping with stress consistent with the techniques outlined in the "Aeronautical Decision Making for Air Force Pilots" manual.

Lesson No. 2

(Recommend 5 simulated flights -
including the evaluation flight)

Objective:

When given a solo cross country flight in the simulator, the pilot will demonstrate stress coping techniques and good decision making strategies for dealing with preprogram critical in-flight events.

Content:

This lesson should be completed using a series of simulated flights as follows:

Flight No. 1 - 15 min. - 2 critical events
Flight No. 2 - 30 min. - 4 critical events
Flight No. 3 - 45 min. - 6 critical events
Flight No. 4 - 60 min. - 8 critical events
Flight No. 5 - 60 min. - 8 critical events

The flights and critical in-flight events should be selected from a prepared Teaching Outline (see Appendix B), and once used should not be repeated until Flight No. 5. Flight No. 5 should involve a combination of events different from those used in Flight No. 4. Each flight should be conducted as a full-mission simulation (FMS) which lies at the high end of the range of fidelity associated with mission-oriented simulation (MOS).

1. Preflight discussion.
   a. Provide departure point, route and destination for the planned flight.
   b. Pilot should use actual data for that day in planning the flight.

2. Simulated flight.
   a. Critical in-flight events as selected by the instructor.

3. Post flight critique.
   a. Emphasize application of knowledge and skills acquired in Lesson No. 1.

Completion Standard:

The lesson will have been successfully completed when the pilot can recognize the situation presented as one inviting poor judgment and applies the appropriate techniques as presented in Lesson No. 1.

Appendix B

Teaching Outline

(The Flight and Critical In-Flight events listed here are specific to the test project and will need to be changed for use in the Air Force simulator).

NAME______________________

Indicate the lesson, flight plan and critical events below

LESSON: (Circle one of the following)

1 2 3 4 5

****

FLIGHT PLAN (Circle the appropriate number to the left of the plan used)

1. Plan a VFR cross country; SEA to Gain County.
2. Plan a NIGHT VFR cross country; Green Airpark to Waycross County.
3. Plan VFR cross country; Gain County to Newton to Green Airpark.
4. Plan VFR cross country; SEA to Zang to Moyer Memorial.
5. Plan VFR cross country; SEA to Newton to Green Airpark.

****

CRITICAL IN-FLIGHT EVENT (Circle the letter to the left of each event used)

A. Upon opening flight plan student is told destination airport closed because of an accident.
B. Severe turbulence.
C. Drop in oil pressure; no change in oil temperature.
D. Departure field goes IMC.
E. Suction failure; AI and HI.
F. Loss of navigation station signal.
G. Loss of two way radio communication.
H. Pitot - Static system failure.
I. Partial loss of engine power.
J. Radar vectors for spacing and radar contact lost before intercept vector given.
K. Low fuel situation.
L. Vector into restricted area.
M. Pilot informed of a 30 minute delay for landing upon arrival at destination.
N. Upon arrival at destination pilot is told PCL lighting inoperative.
O. Vectors opposite the desired direction of flight.
P. Cleared to take off immediately behind a B-727.
Q. Told FSS does not find copy of FAA flight plan.
R. Student told to increase speed to arrive at destination 15 minutes early (low fuel state).
S. Student told that scattered cloud deck is at cruising altitude (reported ceiling is 3000 feet higher).
T. Student informed of smoke or burning odor in the cockpit.

****

Indicate Hazardous Attitudes Observed: ...Invulnerability; ....Macho; ....Impulsivity; ....Resignation; .... Anti-Authority

A Study of College Level Academic Courses for Airport Management Personnel

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Abstract

The purpose of this research was to determine and compare the responses of public use airport managers in Arizona, New York, North Carolina, and Ohio to an opinionaire developed for the study. Specific areas investigated were academic courses most desirable for a future airport manager, if a college degree was important, and should the airport manager have experience as a pilot or mechanic.

A review of the related literature indicated that post-secondary education in aviation and airport management was important to practitioners. It was also found that colleges and universities are becoming more involved in aviation education.

The 298 public use airport managers selected for the study included 108 members of the American Association of Airport Executives (AAAE) and 109 non-AAAE members. Each potential respondent received a survey packet which included the opinionaire and supporting documents.

A total of 103 of the 298 potential respondents returned their opinionaire. The respondents had an average age of 44.2 years, were 91% male, had been in their present position an average of 8.1 years, and had been in airport management an average of 11.5 years. Additional information from the respondents included their highest academic degree, their major, and the aviation activity and the Federal Aviation Administration facilities at the airport that they were responsible for managing.

The study revealed that there was agreement among the sample as to whether many of the suggested academic courses should be included in the collegiate preparation of future airport managers. A suggested academic major could include Airport Operation, Airport Internship, Airport Planning, Aviation Law, Aviation Safety, Management, Finance, Economics, Accounting, and Labor Relations. Additional courses that could be considered as a minor or support area include Marketing, Air Transportation, Computer Operation, Business Law, Passenger Operations, Aeronautics, Insurance, Air Traffic Control, Statistics, National Airspace, Air Cargo Handling, Air Carrier Operations, and Aviation Insurance.

The importance of a college degree and a recommended college major of business or aviation was determined. The respondents indicated that it was important that the airport manager had experience as a pilot.

Introduction

The history of aviation has been full of invention and innovation. The very act of man attempting to fly has served as a basis for technological developments that spanned centuries. As a result of the first flight and the developments that were to follow, a method of transportation has been born that is like no other in modern history. "Aviation...has achieved a transportation significance not even its pioneers dreamed possible" (Serling, 1983, p. 247).

The dramatic expansion of air travel in recent years has presented the aviation community with numerous problems. One specific challenge is that airports, an extremely important cog in the transportation infrastructure, have developed from grass covered fields "on the edge of town" into small cities that serve thousands of passengers as well as tons of air freight every day.

Today's airport has grown from the first two-passenger "terminal," a grass runway, a hangar housing a one man airplane, and one small shovel to what can best be called self contained cities. In 1903, airport management was easy; in the 1980's, as part of an industry built on challenge, it has become the most demanding of the new professions (Smith, Odegard, & Shea, 1984). The operation of these airports requires management that is cognizant of good business practices and informed about aviation as well. The words of Frederick (1949) that "...it is well for the airport manager to be a flyer, but it is even more important that he (<u>sic</u>.) be a businessman" (p. 138) are more significant than ever before in the history of aviation.

Statement of the Problem

Many colleges or universities have students enrolled in two year (Associate degree) and four year (Bachelor's degree) aviation and airport management academic programs. It is the intent of those students to prepare themselves to meet the future workplace demands and challenges of an airport manager by obtaining a post-secondary education. There is little evidence, however, that current courses of study for collegiate aviation and airport management programs have been based on a traditional curriculum model. Some educators are concerned as to whether there is a specific major or course of study that should constitute the academic preparation for future managers of airports in the United States.

Academic preparation as defined by this study included any post-secondary education in aviation management and academic support areas. Specific courses consisted of a composite of higher education academic courses as recommended by collegiate, industry, and government sources as being appropriate for persons wishing to pursue post-secondary majors in aviation management in general and airport management/operation in particular. This study sought to establish whether there was congruence between those courses and the academic preparation as recommended by individuals currently employed as managers of public use airports.

Significance

The significance of this study is threefold. First, by identifying a validated curriculum model for persons wishing to be future airport managers, a more relevant and effective educational experience is possible. Secondly, colleges and universities that wish to offer academic course work in airport management/operation will have evidence to assist in the development of future programs. Finally, boards of control with airport management positions may find the results of this study helpful in the screening of potential candidates.

The opportunity for academic advisors at both secondary and higher education levels to provide students with a more realistic picture of the academic requirements associated with pursuing a career in airport management/operation may also be helped by the results of this study. There is also a possibility that persons currently employed in aviation management positions may be encouraged by the findings of this study to pursue additional study.

Little data are available from persons in aviation management/operation as to the academic preparation needed to meet the challenges that are routinely encountered in the workplace. By more accurately defining the necessary academic qualifications required of professionals in the field, persons entering this labor force may more realistically plan their academic preparation prior to entering the job market.

Design of the Study

Research Questions

Is there a specific academic curriculum that should be required of students enrolling in higher education airport management programs? How important do airport managers think it is that they are/were pilots and/or mechanics? How important is a college degree to an airport manager? If a college degree is important, what should be the academic major?

Subjects

Subjects for this study were managers of public use airports in Arizona, New York, North Carolina, and Ohio. The selection of these states was based upon the desire to solicit responses from states located in different geographic sections of the United States but yet containing a significant proportion of the nation's airmen, airplanes, and airports. The aviation community of these states represented 8% of the public use airports, 11% of the airplanes, and 11% of the certified airmen of the total United States population (National Association of State Aviation Officials, 1983).

There were two subgroups within the sample. One group of airport managers were members of the American Association of Airport Executives (AAAE) and the other subgroup were not members of the AAAE.

Sample Selection

The NASAO Databank '83 (National Association of State Aviation Officials, 1983) stated that there are 12,937 airports in the United States of which are publicly owned. To determine the necessary sample size for the study the following formula was utilized (Tuckman, 1978).

$$N = (z/e)^2 (p) (1 - p)$$

N is the necessary sample size, z is the standard score corresponding to a given level, e is the proportion of the sampling error in a given situation, and p is the estimated proportion of cases in the population. In this study, the confidence level was set at 955 (.05) or 1.96z, the proportion of sampling error set at 10% (.10), and the proportion of public use airports in the population determined to be 35% (.35). The following sample size was calculated.

$$N = (1.96/.10)^2 (.35)(.65)$$

$$N = 87$$

It was determined that a sample containing 275-300 public use airports would reduce sampling error and add to the stability of the findings according to Tuckman (1978). Arizona, New York, North Carolina, and Ohio contained 375 public use airports and represented 8% of the population. The selection of potential respondents and the development of a mailing list utilized Who's Who in Airport Management (American Association of Airport Executives, 1985), the Airport Managers List (Arizona Aeronautics Division, 1985), the New York Airport Directory (New York Aviation Bureau, 1984), Airport Managers (North Carolina Department of Transportation, 1985), and the Ohio Airport Directory (Ohio Division of Aviation, 1984).

Instrument

An opinionaire was developed and tested in Indiana and served as the data gathering instrument for the study. The instrument contained three parts.

The first part, Section A, contained thirty-one academic courses that a student could enroll in to prepare for a position as an airport manager or aviation supervisor. These courses were a composite of course offerings from the aviation management curriculum of several institutions of higher learning (Bowling Green State University, 1983, Florida Institute of Technology, 1984, Georgia State University, 1985, and Indiana State University, 1984) and the Airway Science Curriculum Demonstration Project (Office of Personnel Management, 1983b). A Likert scale of 1, 2, or 3 (1- Of Little Value, 2 - Of Some Value, and 3 - Should be Required) was utilized for responses.

The second part, Section B, consisted of questions relative to the importance of a college degree, whether the manager should be/have been a pilot or mechanic, and what academic major is important. A Likert scale of 1, 2, 3, 4, or 5 (1 - Of No Value, 2 - Little Value, 3 - Some Value, 4 - Great Value, and 5 - A Must) was utilized for responses. The third part, Section C, included demographic questions about each respondent's airport.

Procedure

A survey packet containing a cover letter, the opinionaire, a stamped return envelope, and a return postcard were sent to each potential respondent. The recipient was encouraged to complete the opinionaire as quickly as possible and return it and the postcard immediately. The postcard contained a code number that indicated that the respondent had returned their survey instrument without specifically identifying their opinionaire. Each potential respondent who had not returned their opinionaire within 14 days was sent a reminder postcard.

The Data

Responses from the returned opinionaire were entered on a microcomputer. Statistical analysis was accomplished with Statistics with Finesse (Bolding, 1984).

Section A and Section B were analyzed by sample sub-group (AAAE and non-AAAE) and as a whole. The analysis included the number of responses to each academic course and the percentage of those responses. Section B analysis additionally includes specific cross-tabulations by various sub-groups. Section C includes tallies and percentages with respect to age, gender, academic degree, years in aviation management, and years in present position. The activity and facilities at the respondent's airport was also included in the analysis.

Respondents

A total of 103 or 34% of the opinionaires was returned. Sixteen or 25% were returned from Arizona, 32 or 36% from New York, 20 or 31% from North Carolina, and 28 or 34% from Ohio.

Seven or 7% of the opinionaires were returned without the coded postcards being mailed. The number in parenthesis in all tables indicate percentages.

Table 1

Opinionaire Returns

State	Total Sent	Total Return		AAAE Sent	AAAE Return		Non-AAAE Sent	Non-AAAE Return	
	N	N	%	N	N	%	N	N	%
Arizona	63	16	(25)	31	13	(43)	32	3	(09)
New York	89	13	(36)	37	20	(54)	52	12	(24)
North Carolina	64	20	(31)	19	12	(63)	45	8	(18)
Ohio	82	28	(34)	21	9	(42)	61	19	(32)
Unknown		7	(07)		1	(02)		6	(12)
Totals	298	103	(34)	108	55	(50)	190	48	(25)

The total population of the study contained two groups, 108 airport managers who were members of the American Association of Airport Executives (AAAE) and 190 who were not members of the organization. Of the 108 AAAE members, 55 or 50% returned their opinionaires. By state, 13 or 43% of the AAAE members in Arizona, 20 or 54% in New York, 12 or 63% in North Carolina, and 9 or 42% in Ohio responded. One survey packet in Arizona was undeliverable.

The returned opinionaires for non-AAAE respondents totaled 48 or 25%. By state, 3 or 9% of the non-AAAE members from Arizona responded, 12 or 24% responded from New York, 8 or 18% responded from North Carolina, and 19 or 32% of the potential respondents in Ohio returned their opinionaires. Two packets were undeliverable.

The demographic information from the sample provided data on each respondent's gender and age, years in airport management, years in present position, and academic degrees and majors. The gender of the respondents, as indicated in Table 2, was 94 or 91% male, while 8 or 8% of the respondents were female.

Table 2

Gender and Age of Respondents

	AAAE		Non-AAAE		Total	
	N	%	N	%	N	%
Male	50	(91)	44	(91)	94	(91)
Female	4	(07)	4	(08)	8	(01)
Unknown	1	(02)	0	(00)	1	(01)
Years						
Under 29	4	(07)	4	(09)	8	(08)
30 to 39	16	(30)	13	(28)	29	(28)
40 to 49	19	(35)	12	(26)	31	(31)
50 to 59	11	(20)	12	(26)	23	(23)
Over 59	4	(07)	6	(13)	10	(09)
Unknown	1	(02)	1	(02)	2	(02)
Average	43.6		45.1		44.3	

Note. The mid-point age for the respondents under 29 years of age and over 59 years of age was arbitrarily set at 24.5 years and 64.5 years.

Eight or 8% of the respondents were under 29 years of age, 29 or 28% were between 30 and 39, 31 or 31% were between 40 and 49, 23 or 23% between 50 and 59, and 10 or 9% were over age of 59. The average age of the respondents was 44.2 years.

Table 3 contains the data relative to the respondents' years in airport management and in their present position. In the portion of the table that pertains to the respondents' years in airport management, one AAAE and three non-AAAE respondents did not respond.

Table 3

Respondent's Years in Airport Management and Present Position

	Airport Management						Present Position					
	AAAE		Non-AAAE		Total		AAAE		Non-AAAE		Total	
Years	N	%	N	%	N	%	N	%	N	%	N	%
Under 5	7	(13)	15	(34)	22	(22)	24	(45)	15	(34)	39	(40)
5 to 10	17	(31)	11	(25)	28	(22)	18	(34)	13	(30)	31	(32)
11 to 15	15	(28)	8	(18)	23	(23)	7	(13)	9	(20)	16	(16)
16 to 20	6	(11)	3	(07)	9	(16)	2	(04)	2	(05)	4	(04)
Over 20	9	(17)	7	(16)	16	(16)	2	(04)	5	(11)	7	(07)
Unknown	1	(02)	3	(07)	4	(03)	2	(04)	3	(07)	5	(05)
Average	12.5		10.3		11.5		7.0		9.4		8.1	

Note. The mid-point for respondents with over 20 years in a category was arbitrarily set at 25 years and with under 5 years at 2.5 years.

Seven or 13% of the AAAE members had less than 5 years of airport management experience while 15 or 34% of the non-AAAE respondents had been in airport management for a similar period. The AAAE respondents had an average experience level in airport management of 12.5 years, the non-AAAE respondents of 10.3 years, and the total respondents had an average of 11.5 years of experience.

The years of experience of the respondents in their present position are also contained in Table 3. A total of five or 5% did not respond. The AAAE respondents had an average experience level in their present position of 7.0 years, the non-AAAE respondents of 9.4 years, and the total respondents had an average of 8.1 years. Forty-two or 78% of the AAAE members had been in their present position for 10 years of less while 28 or 64% of the non-AAAE respondents had held their present position for a similar period.

The highest academic degree of the respondents is reported in Table 4. All AAAE members had at least a two year degree while 11 or 23% of the non-AAAE members had no post-secondary degree. Fifty-two or 49% of the respondents had a Bachelor's degree and 16 or 29% of the AAAE respondents had a Master's degree. One AAAE respondent had a doctorate.

Table 4

Highest Academic Degree of Respondents

	AAAE		Non-AAAE		Total	
	N	%	N	%	N	%
High School	0	(00)	11	(23)	11	(10)
Two Year	10	(18)	8	(17)	18	(17)
Bachelor's	28	(51)	24	(50)	52	(49)
Master's	16	(29)	4	(09)	29	(18)
Doctorate	1	(02)	0	(00)	1	(01)
Unknown	0	(00)	1	(02)	1	(04)

Academic Course Analysis

The data in Table 5 show the responses to the questions that were contained in Section A of the opinionaire. A three point Likert Scale (1 - Of Little Value, 2 - Of Some Value, and 3 - Should be Required) was utilized and respondents were asked to indicate whether they thought a specific academic course should be included in the major or support area of a future airport manager's academic preparation. Information in this table reports the percentage of the total response in each category.

The academic courses that are reported as "should be required" by more than 50% of the total respondents include Management (96%), Airport Operation (93%), Airport Internship (87%), Finance (84%), Airport Planning (82%), Aviation Law (79%), Aviation Safety (63%), Economics (56%), Accounting (54%), and Labor Relations (52%). The AAAE respondents, in addition to the academic courses previously mentioned, indicated that Air Transportation (58%) "should be required." The non-AAAE respondents indicated that Aeronautics (54%) "should be required."

Academic courses that were indicated as "of little value" by over 50% of the respondents include Electronics in Aviation (52%) and Man and Technology (56%). The AAAE respondents, in addition to the academic courses previously mentioned, indicated that Instrument Flight (59%) was "of little value," while non-AAAE respondents stated that Aviation History (65%) and Travel and Tourism (60%) were "of little value" to a future airport manager.

Table 5

Ranking of Academic Courses by Percentage of Responses

Course	AAAE (N = 55)			Non-AAAE (N = 48)			Total (N = 103)		
	1	2	3	1	2	3	1	2	3
Management	00	02	98	02	04	94	01	03	96
Airport Operation	00	05	95	02	07	91	01	05	93
Airport Internship	00	10	90	02	13	85	01	12	87
Finance	00	10	90	02	17	81	01	15	84
Airport Planning	00	13	87	02	24	74	01	17	82
Aviation Law	00	15	85	06	23	71	03	18	79
Aviation Safety	14	31	55	06	21	73	11	26	63
Economics	05	33	62	17	33	50	11	34	56
Accounting	09	31	60	06	48	46	08	38	54
Labor Relations	04	31	65	04	58	38	04	44	52
Business Law	13	24	63	17	52	31	14	38	48*
Air Transportation	06	36	58	15	52	33	10	43	47*
Aeronautics	20	48	32	12	33	54	17	41	43*
Insurance	17	54	29	17	35	48	16	45	38*
Passenger Operations	14	44	42	13	61	26	14	51	35*
Computer Operations	04	49	47	20	63	17	11	55	34*
Air Traffic Control	18	53	29	16	44	40	18	49	34*
Aviation Insurance	31	40	29	20	40	40	26	41	34*
Marketing	04	65	31	13	54	33	08	59	33*
National Air Space	20	47	33	25	44	31	21	47	32*
Air Carrier Operation	22	51	27	21	48	31	24	47	29*
Statistics	05	62	33	29	52	19	17	57	26*
Meteorology	41	52	07	26	43	31	33	48	19
Air Cargo Handling	20	67	13	26	55	19	23	62	16*
Aviation Weather Services	38	51	11	24	59	17	31	55	14
Air Carrier Economics	18	67	15	39	50	11	28	60	12
Travel and Tourism	29	58	13	60	31	09	43	46	11
Instrument Flight	59	39	02	37	46	17	49	41	10
Man and Technology	48	41	11	64	33	03	56	37	07
Electronics in Aviation	59	40	01	44	48	08	52	43	05

Note. * indicates that the combined total of columns 2 and 3 is equal to or greater than 75%.

The asterisk in Table 5 is used to show the academic courses that 75% or more of the respondents indicated were "of some value" or greater to a future airport manager. These courses and the percent of such response include Marketing (92%), Air Transportation (90%), Computer Operations (89%), Business Law (86%), Passenger Operations (86%), Aeronautics (84%), Insurance (83%), Air Traffic Control (83%), Statistics (83%), National Airspace (79%), Air Cargo Handling (78%), Air Carrier Operations (76%), and Aviation Insurance (75%).

Supplementary Information

Table 6 contains the data relative to the responses to the question of the importance of a college degree to a future airport manager. Sixty-nine or 71% of the respondents indicated that a college degree is of "great value" or "a must." This

Table 6

Responses to the Importance of a College Degree

Degree	Of No Value		Little Value		Some Value		Great Value		A Must	
	N	%	N	%	N	%	N	%	N	%
A Degree	3	(03)	2	(02)	25	(25)	31	(32)	38	(39)
Associate	5	(05)	19	(20)	51	(52)	13	(13)	9	(09)
Bachelor's	4	(04)	2	(02)	26	(25)	35	(34)	34	(34)
Master's	12	(12)	23	(23)	37	(37)	26	(26)	2	(02)
Doctorate	36	(36)	36	(36)	16	(16)	12	(12)	0	(00)

average came from 44 or 85% of the AAAE and 25 or 53% of the non-AAAE members indicating this response. None of the AAAE members indicated that a college degree would be "of no value" or of "little value" while 5 or 10% of the non-AAAE participants indicated either a "no value" or "little value" response.

The responses to the question of the recommended college major for an airport manager are shown in Table 7. Forty-five respondents reported that business was the recommended major. A major in aviation was recommended by 25 respondents. No percentages are reported in Table 7 because numerous opinionaires either included no response or more than one response to this question.

Table 7

Responses to Recommended Academic Major

Major	AAAE	Non-AAAE	Total
Business	29	16	45
Aviation	19	6	25
Engineering	3	3	6
Not Important	4	2	6
Psychology	1	1	2
Natural Science	0	1	1

The importance of the airport manager having experience as a pilot or a mechanic is reported in Table 8. Fifteen or 28% of the AAAE members indicated that being a pilot was of "great value" or "a must" while 25 or 50% of the non-AAAE members indicated a similar response. Whether the airport manager should have experience as a mechanic was indicated as being "of no value" or of "little value" by 68 or 66% of the total.

Table 8

Responses to the Importance of Being a Pilot or Mechanic

	Of No Value N	%	Little Value N	%	Some Value N	%	Great Value N	%	A Must N	%
					AAAE					
A Pilot	7	(13)	13	(24)	20	(36)	12	(22)	3	(06)
A Mechanic	14	(26)	28	(51)	11	(20)	2	(03)	0	(00)
					Non-AAAE					
A Pilot	3	(06)	2	(04)	19	(40)	18	(38)	6	(12)
A Mechanic	6	(12)	20	(42)	17	(35)	4	(08)	1	(02)
					Total					
A Pilot	10	(10)	15	(14)	39	(38)	30	(29)	9	(09)
A Mechanic	20	(20)	48	(46)	28	(26)	6	(06)	1	(02)

Conclusions

This research is an initial effort in determining an academic curriculum for future airport managers. Due to the small number of opinionaire returns, an extensive statistical analysis would be both non-productive and possibly misrepresentative of the population. The reader must, accordingly, use caution in the interpretation of any information. The conclusions that follow are based upon the findings from specific questions contained in the opinionaire developed for this study and upon what limited literature was available. The following conclusions were drawn:

1. A college degree for a future airport manager may become more important. There was strong support (71%) of the respondents indicated that a college degree was "of great value" or "a must") for a college degree among the sample respondents.

2. A Bachelor's degree is perhaps the minimum degree necessary or desirable for an airport manager. Sixty-nine or 68% of the respondents indicated that a Bachelor's degree was of "great value" or "a must." A combination of aviation and business appeared to constitute the best academic major.

3. The content of the following academic courses was recommended by respondents for the major in an airport management curriculum. Academic courses that received more than 50% group response indicating that each "should be required" for a future airport manager may have enough support to be considered as a major. These courses included Management (96%), Airport Operations (93%), Airport Internship (79%), Aviation Safety (63%), Economics (56%), Accounting (54%), and Labor Relations (52%).

4. A number of academic courses could be considered as a minor or support area so as to broaden the field of emphasis for a future airport manager. These courses were rated as of "some value" or "should be required" by over 75% of the respondents. The courses included in this group are Marketing (92%), Air

Transportation (90%), Computer Operation (89%), Business Law (86%), Passenger Operations (86%), Aeronautics (84%), Insurance (83%), Air Traffic Control (83%), Statistics (83%), National Airspace (79%), Air Cargo Handling (78%), Air Carrier Operation (76%), and Aviation Insurance (75%).

5. The airport manager should have experience as a pilot. Seventy-eight percent of the respondents indicated that being a pilot was "of some value" or greater in the background of an airport manager.

6. The airport manager does not need to be or have been a mechanic according to the respondents of this study. There was little support for this among participants.

Recommendations

1. The University Aviation Association should consider the findings of this research as a starting point for further study of collegiate airport management programs.

2. The American Association of Airport Executives might disseminate the findings of this study to the membership of the organization.

3. The Federal Aviation Administration could undertake a study to determine the number of positions that are actually available for graduates of aviation management programs.

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Promoting General Aviation Transportation in Community Economic Development Through General Aviation Public Airport Managers and State Department of Aeronautics Officials

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Abstract

It is very difficult to pinpoint the specific "transportation development needs" of general aviation airports and their surrounding communities. Often, insufficient management expertise at individual airports, coupled with the state's occasional unfamiliarity with specific community problems, hinders the state's effective administration of airport assistance programs. Therefore, state officials would benefit from the airport administrators' opinions concerning how state programs might be modified to best meet individual airport needs. This paper describes a study which reveals "differences in perceptions" between the Alabama Department of Aeronautics (DOA) and individual general aviation public airport managers.

This study examines qualitative perceptions of 15 airport factors, such as paved runway length, adequate taxiways, approach aids, hangar/tie-down space, and strong airport management, plus community support areas, such as nearby hotel/motel, industrial park, and ground transportation. Airport managers judged these factors at their own airports, ideal airport, and at several chosen as a control mechanism. Airport managers were also asked to reveal sources and amounts of funding received for capital projects and operational needs. When compared with funding data from official sources, significant discrepancies were observed.

Data were obtained through a mail survey. Of the 79 strictly general aviation public airports surveyed, 54 responses were returned (68% response rate). Analysis revealed many significant differences in perception factor scores. Not only were there differences in perceptions between airport managers and DOA officials, but also between the managers' perceptions of their own airports versus the "ideal airport" revealing 10 areas where improvements are recommended (including the perception factor of strong airport management).

Promoting General Aviation Transportation in Community Economic Development Through General Aviation Public Airport Managers and State Department of Aeronautics Officials

It is very difficult to pinpoint the specific "transportation developmental needs" of general aviation public airports and their surrounding communities. Often, insufficient management expertise at individual airports, coupled with a state's occasional unfamiliarity with specific community problems, hinders effective administration of the state airport assistance program. Therefore, state officials should benefit from the "airport administrators' opinions" concerning how state programs might be modified to best meet individual airport needs. This paper describes a study which reveals "differences in perceptions" between a state-level aviation department, the Alabama Department of Aeronautics (DOA), and individual Alabama general aviation public airport administrators. State officials can use this information to maximize state programs by pinpointing areas of greatest need.

The paper highlights airport needs which are being effectively met, plus those areas which might be deficient and in need of further assistance. The data can be used to determine if these airports, in general, are self-sufficient. It can be approximately determined what capital requirements will be needed for the next three years. Reviewing capital expenditure funding and operational income, including sources, makes it easier to analyze how federal, state and local monies are utilized on a state planning level. Ratios, of aviation industry generated funds to public assistance funds, can be used in demonstrating to what extent public general aviation airports are user-supported. In addition, the physical operating data can be used in pinpointing projects in most need of improvement or development.

Method

Subjects

The subjects for this research were the "administrators" from public-owned, public-use, noncommercial airports within the Alabama airport system (N = 79) and officials of the Alabama Department of Aeronautics. Some airports have regular airport managers, but most are served by persons who administer to the airport on a part-time/secondary occupation basis. Some of the airports do not have administrators, but are supervised by an airport board, a county commission, or a city/count clerk. A few of the respondents were mayors of the small communities in close proximity to the airport. The names and addresses of the airport administrators were obtained from the Federal Aviation Administration 5010 forms and verified by telephone contact. Data were derived from primary sources.

Procedure

The research examines confidential information concerning capital projects, plus perceptions in the operations area. The researchers selected 15 qualitative factors which might be considered important to have at/near an airport for attracting/promoting industrial and economic development in the nearby community. The factors include:

- Paved Runway < 4,000'
- Paved Runway > 4,000'
- Adequate taxiways
- Runway/Taxiway surface condition
- Approach aids (ILS, VASI)
- Control tower
- Ground transport (taxi, car)
- Hangar, tie-down space
- Commuter air service
- Nearby hotel/motel
- Industrial park
- Jet fuel
- Aircraft servicing (FBO)
- Aircraft parts/repair
- Strong airport management

Airport administrators judged these factors at their own airport, a hypothetical "ideal" airport and at six airports chosen as a study control mechanism. Data were obtained through mail survey method and follow-up phone calls. Of the 79 strictly general aviation public-owned, public-use airports surveyed, 54 (n = 54) responses were received (68% response rate). Data were then organized into charts for analysis.

The first part of this paper presents a summary of the survey itself, and details of data collection. Then a discussion is given of each section of the survey and results obtained. The next section denotes the findings of the study as they relate to the survey questions. Finally, the study is summarized, conclusions are presented, and recommendations are given.

Survey of airport administrators was accomplished using a questionnaire developed specifically for this study. Part I of the questionnaire deals with airport capital needs. Respondents listed significant capital improvements and large equipment purchases for both fiscal years 1985 and 1986. Included were funding sources, amount of funds, and primary reasons (developmental, safety, or maintenance) why the project was needed. Administrators were also asked to estimate their capital project needs for fiscal years 1987 through 1989. The second half of the financial section (Part I) covers airport operations income for fiscal years 1985 and 1986. The first question specifically asks "if the airport had been able to cover operating expenses from airport user charges or other airport incomes." Administrators then listed sources and amounts of operating incomes, and were asked to send a copy of their operating budget (for expenses). The final question in this section asks "if they were familiar with the state assistance program," and to please comment on it.

Part II of the survey deals with operational aspects. Airport administrators were asked to give their perceptions by rating six pre-selected (control) airports as to the airports' capability to support community industrial and economic development; respondents were specifically asked not to look up airport information via directory or map, but to just "give their perceptions." The selected airports included one highly developed, and one underdeveloped, airport in the three Federal Aviation Administration categories of Basic Utility, General Utility, and Transport. These airports, whose capabilities were known to DOA, were chosen so as to compare airport administrators' perceptions against a controlled entity. Administrators' perceptions were then gathered pertaining to the importance of 15 qualitative factors that might help promote industrial and economic development in the nearby community. The last area (of Part II) combined the first two areas of perceptions in that it asks administrator perceptions of the 15 qualitative factors at their own airports, at the "ideal airport," and at the same six "control airports." The researchers also obtained, for comparison purposes, DOA perceptions in the same areas. Those areas in which opinions varied significantly, by 1.5 or more factor points, were noted.

Results

Airport Capital Needs

Of those airports surveyed, 50 of 79 responded with financial information regarding capital expenditures in 1985, 1986 and future needs for 1987-1989. Administrators were asked to describe the item, the source and amount of funding, and the prime reason for the expenditure (developmental, safety, or maintenance). For 1985, respondents claimed they had received $6,360,229 from the Federal Airway Improvement Program, $281,175 from the Alabama State Department of Aeronautics, $934,440 from local city or county assistances, and $2,000 from private sources. In comparing these monies with the official funding information from the Federal Aviation Administration and DOA, some discrepancies were found. In 1985, the FAA granted, to those airports who *responded to the survey, $2,028,844 (AIP) and the DOA, $279,363. While the DOA amounts show only a difference of $1,812, the FAA difference is $4,331,385.*

For 1986, the figures also showed some inconsistencies. The total claims from those airports responding were Federal AIP, $3,668,026; State DOA, $53,795; local, $547,009; and private, $0. The official sources supplied the following: FAA/AIP, $2,049,863, and DOA, $361,246. The difference in the FAA/AIP official and claimed is $1,618,163; DOA, $307,451.

All were instances where they claimed more than they actually received, except the 1986 DOA differences in which airport administrators claimed $307,451 less than was actually allocated.

In estimating future capital funding needs through 1989, airport administrators claimed they would need $13,893,452 from the FAA and DOA, and $2,608,870 from local funds. The FAA has already approved $1,315,321 for 1987 capital projects.

It is also significant to note percentages of "aviation industry generated funds" versus "public assistance funds." Aviation industry generated funds would include Federal AIP, State Airport assistance funds from aviation fuel tax, and private sources. Public assistance funds would include other state programs and local city or county assistance. Exhibit 1 summarizes these percentages for claimed funding amounts, as well as official funding amounts, since there were discrepancies between these two amounts. It also includes the ratio of aviation industry generated funds to public assistance funds for fiscal years 1985 and 1986.

In 1985, the ratio of "Aviation Industry Generated Funds" to "Public

Assistance Funds" was 7.1:1 for claimed (federal and state) amounts and 2.5:1 for official (federal and state) amounts; the differences between the claimed and official ratios is 4.6. For 1986, the ratio on "Aviation Industry Generated Funds" to "Public Assistance Funds" for claimed (federal and state) amounts was 6.8:1, and for official (federal and state) amounts, 4.4:1; the difference here is 2.4.

Also, in this section was a place for administrators to record for what purposes funds were used. Airport administrators were given three categories to assign their capital expenditures to: developmental (D), safety (S), and maintenance (M). Exhibit 2 summarizes these amounts for fiscal years 1985, 1986 and 1987-1989.

It is important to note that not all respondents answered the D-S-M part of the questionnaire, and some that did answer, did so incorrectly, so that public assistance totals here are less than those given in Exhibit 1, where all given information was used.

Airport Operations Funding

When asked if the airport had been able to cover operating expenses from airport user charges or other airport incomes, of the 50 who responded with this information, 26% said "yes", and 74% said "no".

Sources and amounts of operational incomes were then recorded for fiscal years 1985 and 1986. Exhibit 3 summarizes these amounts, again comparing aviation industry generated funds and public assistance funds.

The information in Exhibit 3 does not include the response from Selma. In reviewing Selma's budget, it was found that large incomes were gained from rental property on the airport site (Selma's Craig Field is a former Air Force Base, with personnel housing which is apparently being rented. This situation is quite unusual and warrants the exclusion of Selma's very large non-airport incomes from those of other airports).

For the operating incomes of all other respondents, in 1985, aviation industry generated funds to public assistance funds were 1.0:1. In 1986, this ratio was 1.3:1. This indicates an almost 50-50 ratio for both years.

Of the 50 airports who responded with financial information, 26% sent a budget and 74% did not. Of those (13) who did send a budget, few provided the researchers with sufficient operating expenses information to compare with operations funding received. Some sent a city budget which provided little airport information; some repeated the capital expenditures; and some repeated the operational funding received. Needless to say, inaccurate information in this area makes the data less than desired.

A summary of administrators' comments on the State of Alabama's Airport Development Program (ADP) is included. Results indicate that 56% of the respondents are aware of the state assistance program, and 44% are not. While most of the airports which did give comments were already aware of the program, a few comments came from airports unfamiliar with it. In summarizing the comments, three main points were made.

Many who had already been successful in obtaining assistance, were very satisfied with the program. Adjectives, such as excellent, cooperative, efficient, well-administered, valuable, and helpful, were used. Second, a few respondents claimed the funding level of Alabama DOA is far below that of other states and needs to be increased greatly. In particular, details mentioned were the desire to see the $50,000 ceiling lifted; adversity to the

50-50 plan (50% grant funds matched with 50% local match, cash or inkind) due to the fact that rural airports do not generate enough direct monies to support the 50-50 plan; and displeasure with the lack of assistance to very small airports. It was also felt that this assistance needs to stress industry location. The third, and most often mentioned comments, dealt with the purported fact that the program needs to be more widely publicized. Respondents in this area felt more effort should be made to help communities become more aware of what, and how much funding is available; who qualifies for the program; plus more information on the procedure for application for state aid. In general, airports claimed they want more information so they will be better able to take advantage of available funds.

Operations

This section begins with perceptions concerning the "capability of six control airports to promote economic and industrial development in surrounding communities." Exhibits 4, 5 and 6 show a comparison of these perceptions between DOA, the airport's administrator, and the average general opinion.

When comparing results in Exhibits 4, 5 and 6, it is important to note that questionnaires were not received from two of the six control airports. These two were among those considered to be underdeveloped. All relationships between either average general opinion and DOA, or DOA and the airport manager, or average general opinion and the airport manager are highlighted with an " * " if there is a 1.5 or greater difference. Average general opinion factor scores were calculated by taking the total points of the responses and dividing it by the number of responses to obtain the average.

The Basic Utility airports are Bay Minette Municipal and Elba (Carl

Folsom), of which Bay Minette is the more highly developed. The General Utility are Gulf Shores-Jack Edwards and Butler-Choctaw County; the more highly developed in this category is Gulf Shores. Airports in the Transport category are Marion County and Fairhope; of these, Fairhope Municipal is a more highly developed airport.

In comparing the preceding DOA opinions with the average perception scores from airport administrators, it was found that highly developed Basic Utility Bay Minette was given an average score of 3.47, and less developed Carl Folsom was given an average of 2.76. In the General Utility category, highly developed Gulf Shores-Jack Edwards received a 3.95, and less developed Butler-Choctaw County, a 3.29. Finally, in the Transport category, highly developed Fairhope received a 3.71 and less developed Hamilton-Marion County, a 3.49.

In the second part of the operations section, perception of fifteen airport factors are as illustrated in Exhibit 7. They ranked from 1 to 5, perceiving from very unimportant to very important. The airport administrators' scores were calculated by dividing the total points of the responses by the number of responses, and thereby obtaining an "average response" per factor.

*Areas where a difference of 1.5 or greater exists are highlighted with an " *." According to this table, all sections are in close agreement - less than 1.5 point difference - except that of Paved Runway < 4,000'. DOA gave this factor a score of 5 (important), while airport administrators gave it a 2.280 (unimportant).*

The last part of the operations section of the survey asks airport *administrators to score the adequacy of these same 15 factors at "their" airport, the "ideal" airport, and at the six "control" airports. Exhibit 8 is a chart showing the average perception score for each airport, for each factor given, to the degree that the airport definitely does not offer (1), or definitely does offer (5) the listed factor. These numbers were obtained by taking the point total of the responses for each factor at each airport, and dividing it by the number of responses, to obtain the "average response."*

Discussion

In analyzing the questionnaires, it became quite evident that most airport administrators, through no fault of their own, were somewhat lacking in understanding many of the basic perceptions of aviation management; many work on a part-time/secondary occupation basis. From telephone conversations, it was found that many were confused by aviation-related questions. In most instances where rural airports were administered by county clerks, there was obviously insufficient managerial expertise, as well as a lack of aviation knowledge. Another related problem in this area occurred in that initial phone calls were made to determine appropriate persons to fill out the survey; it often occurred that this person passed the survey on to someone else. These situations created problems in adequacy of information provided, continuity, as well as follow-up.

Airport Capital Needs

Of those who did return questionnaire, 60% did receive Federal or State money and 40% did not. Of those who did not respond, 50% did receive Federal or State grants and 50% did not. These close percentages indicate that previous receipt of assistance is not a standard characteristic of those that *did, or did not, respond.*

In the area of capital need, there were significant discrepancies between federal and state monies claimed by respondents, versus that officially recorded by the FAA and DOA. For 1985, respondents claimed they had received $6,360,229 from the Federal AIP, and $281,175 from the State DOA. Official FAA and DOA sources revealed that these amounts were $2,028,844 and $279,363 respectively. While the DOA amounts show only a difference of $1,812, the FAA difference is $4,331,385. In reviewing the FAA description of funding for 1984, several projects, whose funding was allocated in 1984, were not completed until 1985 and were thus accounted for in 1985 by the airports. This explains some of the discrepancies between official sources and respondents' claims.

In 1986, the figures still showed some inconsistencies. The total claims from those airports responding were $3,668,026 Federal AIP, and $53,795 state DOA. The official sources supplied the following: $2,049,863 FAA/AIP, and $361,246 DOA. The difference in official versus claimed is $1,618,163 FAA/AIP, an $307,451 DOA.

Referring to Exhibit 1 ratios of Aviation Industry Generated Funds to Public Assistance Funds were calculated for both claimed and official amounts. In 1985, this ratio was 7.1:1 for claimed and 2.5:1 for official amounts. In both cases, this indicates the aviation industry did provide more than public assistance in 1985. In 1986, the claimed amounts came to a ratio of 6.8:1 and the official amount, 4.4:1. This, again, reveals the aviation industry provided more funding for capital projects in 1986 than did public assistance. As for future requirements through 1989, only $1,315,321, of the $13,893,452 the airports claimed they would need, has already been approved by the FAA for 1987. This is only 9.5% of the total needed through 1989.

When selecting the appropriate reason "why" a capital project was done, it *can be seen from Exhibit 2 that airport administrators spent most of their capital funding on developmental projects and the least on safety projects for both 1985 and 1986. In 1985, 78.0% of funding was spent on Development, 5.2% on safety, and 16.8% on maintenance. In 1986, the percentages were: development, 83.7%; safety, 1.6%; and maintenance, 14.7%. The same trend was indicated for 1987-1989 in that 66.6% would be used for development; 15.0% for safety, and 18.4% for maintenance. This reveals that airports recognize a need for development.*

Again, problems arose in that not all respondents gave a reason for their expenditures. Also, many of those that did, gave multiple reasons, not assigning specific amounts to specific purposes. This lowered the accuracy of information again confirming the problem with insufficient managerial/aviation expertise. For those respondents who did not give reasons, or whose reasons were ambiguous, we did not use their responses in calculating total amounts in Exhibit 2.

Airport Operations Funding

Of the 50 airports who responded with financial information, 74% said they were not able to cover operating expenses from airport user charges or other airport incomes. Unfortunately, only a few usable budgets were sent, so it was impossible to determine to what extent operating expenses were not covered. However, as Exhibit 3 shows, it is possible to determine ratios of Aviation Industry Generated Funds to Public Assistance Funds in determining to what extent Alabama general aviation public airports are dependent on public assistance funding for operations. For 1985, this ratio was 1.0:1. In 1986, it was 1.3:1. This indicates an almost 50/50 ratio for both years. This reveals that, in general, the airports are very dependent on public assistance funds, almost on an equal/matching basis with aviation industry generated funds. In other words, general aviation is not paying for itself on a dollar *for dollar basis, although, there are other secondary community support roles that an airport can fulfill.*

In briefly summarizing respondents comments on the DOA Airport Development Program, three main points were made. First, many who had received assistance were pleased. Second, some felt that the funding level in Alabama is too low and difficult to obtain. The third, and most often mentioned, was the fact that many knew nothing about the program and how to apply. Associated with this point is the fact that it was found (by survey and phone) there had been several airport administrators who recently started working in that position. This would indicate respondents are perhaps too new on the job to know about such state assistance programs.

Operations

*Exhibits 4, 5 and 6 reveal perceptions of the six control airports by the DOA, that airport's manager, and the average response (general opinion). All fifteen factors were scored and compared. Any differences of 1.5 or greater between either general opinion and DOA, or DOA and the airport manager, or general opinion and the airport manager, are indicated by a " * ." The perceptions measured the "capability to promote economic and industrial development in the surrounding communities" of the six airports.*

The mean average of respondent opinion confirmed DOA's (control) opinion in that Bay Minette Municipal received an average of 3.47 and Carl Folsom Airport (Elba) 2.76; Jack Edwards Airport (Gulf Shores), 3.95 and Butler-Choctaw County, 3.29; and Fairhope Municipal 3.71 and Marion County, 3.49. These numbers are consistent with, and support, DOA opinion, indicating the respondents perceived the same general capabilities of airports.

Exhibit 7 depicts a comparison of "perception of importance" of the fifteen airport factors. They were scored from 1 to 5, perceiving from very unimportant to very important. The only area where DOA and general opinion of importance differed by 1.5 or greater was in the category of "Paved Runway < 4,000'". DOA gave this factor a score of 5 (important), while airport administrators gave it an average of 2.28 (unimportant). DOA gave a score of 5 to both > 4,000' and < 4,000' indicating that either is important, depending upon specific characteristics of the individual airport. For example, if the community could only support an airport requiring a 3,500' runway, then it would not be economical to install a 4,500' runway before it was needed. The respondents felt that a runway > 4,000' was more important (4.65) versus a runway < 4,000' (2.28). This indicates they feel a longer runway is more important. Of the 55 who responded with this information, 55% have runways < 4,000' and 45% have runways, ≥ 4,000'. Since these percentages are almost 50/50, this reveals that those with runways > 4,000' agree that the longer length is advantageous, while those with runways < 4,000' see a need for the developmental advantages of longer runways. A longer runway naturally attracts larger planes including business jets, and should attract industry and other community developmental programs.

Exhibit 8 reveals general opinion concerning the perceived ability of eight airports to offer (5), or not (1), the 15 factors. Respondents gave perceptions at "their" airport, "ideal" airport, and at six "control" airports.

Many interesting relationships occurred here. In comparing perceptions between "their" airport and "ideal" airport, and whether or not the factor is offered, it was found in most cases respondents gave "their" airport a lower score for the factor than they did the "ideal" airport. (The only factor where the "ideal" airport offers less is the factor of Paved Runway < 4,000'). This indicates most administrators feel their airport is less than ideal and desire some improvement and development. This also supports the claim of future need for capital improvements of $13,893,452, as was stated in the

Capital Projects section.

For the "ideal" airport, the three factors with the lowest scores which respondents felt would probably be less offered were Paved Runway of < 4,000' (2.78), a Control Tower (3.419) and Commuter Air Service (3.809). The three factors they felt most important to have at the ideal airport are Runway/Taxiway Surface Condition (4.795), Strong Airport Management (4.814), and Paved Runway > 4,000' (4.864).

At their own airports, respondents felt that the three least offered factors were commuter air service (1.404), control tower (1.500) and jet fuel (2.542). The three most offered factors at their airports were paved runway < 4,000' (3.553), hanger/tie-down space (3.560) and runway/taxiway surface condition (3.760).

Two factors least found at "their" airports were also perceived to be least found at the "ideal" airport: Control Tower and Commuter Air Service. One factor found most at "their" airport, as well as the "ideal" airport, was runway/taxiway surface condition.

Again, the runway factors played an important role. For the "ideal" airport, the least offered would be a Paved Runway of < 4,000' and the most offered would be paved runway > 4,000'. This indicates a desire for the advantages of a longer runway and the development they can attract.

From Exhibit 8, a comparison of the "ideal" airport versus the other airports reveals some areas of difference. Several factors received higher scores for "ideal" airport when compared to "your" airport and the six "control" airports. These factors are: Approach Aids, Control Tower, Hangar/Tie-down Space, Ground Transport, Commuter Air Service, and Strong Airport Management. The fact that the "ideal" airport is the only one that strongly offers these factors indicates respondents would like to see these things, in particular, developed more thoroughly at their airports.

Recommendations

1. Because of a lack of managerial and aviation expertise on the part of airport administrators, it is felt that an airport management training program would help eliminate inefficiencies in administering to these airports. One alternative is a video-taped short-course on aviation management through a university's extension program; a cost-effective program has been developed for the Southeastern Airport Managers Association (SAMA) by Auburn University, and will be available summer of 1987. The six 2-hour tapes can be sent to administrators for study at their convenience, thereby eliminating a need for travel to conferences, etc.

2. Since there were discrepancies between claimed and official sources of funding from the FAA and DOA, it would be beneficial to develop a system for reporting airport funds received. Also, requiring federal funds to flow through the state office (channeling) before being distributed to individual airports, would allow for a more thorough awareness of fund distribution.

3. As was strongly suggested by respondents in their comments on the DOA Airport Development Program, a concerted effort should be made by Alabama DOA to publicize the state's Airport Development Program. The airports should be informed as to funds available, who qualifies, how to apply, etc.

4. In trying to attract industry to Alabama, it would be beneficial to conduct similar research on a national or regional level. This would help reveal to what extent Alabama's state assistance compares to that of other states, and could reveal a need for an increase in airport assistance funding in order to compete with other states for industrial and economic development.

Exhibit 1 - Alabama Airport Funding Sources 1985 - 1986

1985

	Claimed Federal and State			Official Federal and State		
	Aviation Industry Generated Funds	Public Assistance	Total	Aviation Industry Generated Funds	Public Assistance	Total
Private	$ 2,000	----------	(0.17%)	$ 2,000	--------	(0.1%)
Federal	$6,360,229	----------	(83.9 %)	$2,028,844	--------	(62.5%)
State	$ 281,175	----------	(3.7 %)	$ 279,363	--------	(8.6%)
Local	----------	$934,440	(12.33%)	----------	$934,440	(28.8%)
	$6,643,404	$934,440	$7,577,844	$2,310,207	$934,440	$3,244,647
	(7.1:1)			(2.5:1)		

1986

	Claimed Federal and State			Official Federal and State		
	Aviation Industry Generated Funds	Public Assistance	Total	Aviation Industry Generated Funds	Public Assistance	Total
Private	-------------	--------		--------------	---------	
Federal	$3,688,026	--------	(85.9%)	$2,049,863	---------	(69.3%)
State	$ 53,795	--------	(1.3%)	$ 361,240	---------	(12.2%)
Local	-------------	$547,009	(12.8%)	--------------	$547,009	(18.5%)
	$3,741,821	$547,009	$4,268,830	$2,411,109	$547,009	$2,958,118
	(6.8:1)			(4.4:1)		

Exhibit 2 Capital Expenditure Categories

1985

Development %	Safety %	Maintenance %	TOTAL
$706,600 - 78%	$47,000 - 5.2%	$152,300 - 16.8%	$905,900

1986

Development %	Safety %	Maintenance %	TOTAL
$491,200 - 83.7%	$9,525 - 1.6%	$86,450 - 14.7%	$587,175

1987-1989

Development %	Safety %	Maintenance %	TOTAL
$3,951,500 - 66.6%	$889,000 - 15.0%	$1,090,900 - 18.4%	$5,931,400

Exhibit 3 Operational Income

	1985			1986		
	Aviation Industry Generated Funds	Public Assistance	Total	Aviation Industry Generated Funds	Public Assistance	Total
User Charges	$264,477	--------	(34.6%)	$412,497	--------	(47.6%)
Federal	$115,213	--------	(15.1%)	$ 72,495	--------	(8.4%)
State	--------	$383,719	(50.2%)	----------	$380,814	(44.0%)
Local	--------	$ 500	(0.1%)	----------	0	
	$379,690	$384,219	$763,909	$484,992	$380,814	$865,806
	(1.0:1)			(1.3:1)		

Exhibit 4 Perceptions of Airport Development Factors - Basic Utility Airports

Basic Utility

	Bay Minette Municipal (+)			Carl Folsom (Elba) (-)		
FACTORS	General Opinion	DOA	Airport Manager	General Opinion	DOA	Airport Manager
Runway <4,000'	3.519	5	5	3.464 *	5	D
Runway >4,000'	3.069 *	5 *	1	2.750 *	1	I
Adequate Taxiways	2.800	3 *	1	2.714	2	D
Runway/Taxiway Condition	3.548	4	3	3.207	3	
Approach Aids	2.345	3	2	2.037	1	N
Control Tower	1.464	1	1	1.296	1	O
Hangar/tie-down	2.833	3	2	2.517	3	T
Ground Transport	2.517	2	2	2.074	1	
Commuter Service	1.724	1	1	1.385	1	R
Nearby Hotel/Motel	2.933	2	3	2.536 *	1	E
Industrial Park	2.536 *	1	1	2.192	1	S
Jet Fuel	2.517 *	1 *	4	1.815	1	P
AirCraft Service (FBO)	3.323	4	4	2.138	1	O
AirCraft parts/repair	3.032 *	5 *	3	1.893	1	N
Strong Airport Management	2.900	3	3	2.571 *	1	D

72.

Exhibit 5 - Perceptions of Airport Development Factors - General Utility Airports

General Utility

FACTORS	Butler Choctaw County (-) General Opinion		DOA		Airport Manager	Jack Edwards (Gulf Shores) (+) General Opinion	DOA		Airport Manager
Runway <4,000'	3.462	*	5		5	3.741	5		5
Runway >4,000'	2.767		4		5	3.993	3	*	5
Adequate Taxiways	2.517		2		3	3.800	4		5
Runway/Taxiway Condition	3.379		3	*	5	4.031	3		4
Approach Aids	2.034		3		3	3.033	4		5
Control Tower	1.214		1		1	1.586	1		1
Hangar/tie-down	2.700		4		4	3.344	4		3
Ground Transport	2.071	*	1		3	3.355	4		3
Commuter Service	1.407		1		1	2.267	1	*	5
Nearby Hotel/Motel	2.517	*	1	*	4	3.710	5	*	1
Industrial Park	2.192		1	*	5	2.793	2	*	5
Jet Fuel	1.536		1		1	3.774	4		5
AirCraft Service (FBO)	2.345	*	4	*	1	3.750	4		5
AirCraft parts/repair	1.931		3	*	1	3.438	3	*	5
Strong Airport Management	2.621		3	*	5	3.548	5		4

Exhibit 6 - Perceptions of Airport Development Factors - Transport Airports

Transport

FACTORS	Marion County (-) General Opinion	DOA	Airport Manager	Fairhope Municipal (+) General Opinion	DOA	Airport Manager
Runway <4,000'	3.269	* 5	D	3.583	5	* 1
Runway >4,000'	4.167	5	I	4.656	5	5
Adequate Taxiways	3.200	2	D	4.129	5	4
Runway/Taxiway Condition	3.667	* 2		4.156	5	5
Approach Aids	2.679	4	N	3.355	4	3
Control Tower	1.321	1	O	1.586	1	1
Hangar/tie-down	3.300	3	T	3.844	4	3
Ground Transport	2.414	3		3.548	* 2	* 4
Commuter Service	1.536	1	R	2.034	1	1
Nearby Hotel/Motel	3.000	3	E	3.467	3	4
Industrial Park	2.615	4	S	2.889	4	3
Jet Fuel	2.883	4	P	3.933	5	5
AirCraft Service (FBO)	3.097	3	O	4.031	5	4
AirCraft parts/repair	2.839	2	N	3.906	4	4
Strong Airport Management	2.833	* 1	D	3.806	4	* 1

Exhibit 7 - Importance Weighting of Airport Development Factors

FACTORS	*DOA*		*Airport Administrators*
Paved Runway < 4,000'	*5*	*	*2.28*
Paved Runway > 4,000'	*5*		*4.65*
Adequate Taxiways	*4*		*4.29*
Runway/Taxiway Surface Condition	*5*		*4.49*
Approach Aids	*4*		*4.45*
Control Tower	*2*		*3.42*
Hangar/Tie-down Space	*5*		*4.26*
Ground Transport (taxi, car)	*5*		*3.75*
Commuter Air Service	*3*		*3.08*
Nearby Hotel/Motel	*3*		*3.81*
Industrial Park	*4*		*4.15*
Jet Fuel	*4*		*3.98*
Aircraft Servicing (FBO)	*5*		*4.27*
Aircraft Parts/Repair	*3*		*3.73*
Strong Airport Management	*5*		*4.48*

DOA = Department of Aeronautics Officials.
** = Significant difference in factor scores.*

Exhibit 8 Perceptions of Airport Administrators about Various Airports

FACTORS	Your A.P.	Ideal A.P.	Bay Minette	Carl Folsom	Jack Edwards	Butler Choc.	Marion Co.	Fairhope Munic.
Paved runway less than 4,000'	3.553	2.744	3.519	3.464	3.741	3.462	3.269	3.583
Paved runway greater than 4,000'	3.184	4.864	3.069	2.750	3.933	2.767	4.167	4.656
Adequate taxiways (twy)	2.958	4.721	2.800	2.714	3.800	2.517	3.200	4.129
Runway/taxiway surface condition	3.760	4.795	3.548	3.207	4.031	3.379	3.667	4.156
Approach aids (ie ILS, VASI)	2.600	4.791	2.345	2.037	3.033	2.034	2.679	3.355
Control tower	1.500	3.419	1.464	1.296	1.586	1.214	1.321	1.586
Hangar, tie-down space	3.560	4.705	2.833	2.517	3.344	2.700	3.300	3.844
Transport (ie taxi, car rental)	2.625	4.535	2.517	2.074	3.355	2.071	2.414	3.548
Commuter air service	1.404	3.809	1.724	1.385	2.267	1.407	1.536	2.034
Nearby hotel/motel	3.408	4.349	2.933	2.536	3.710	2.517	3.000	3.467
Industrial park	3.140	4.256	2.536	2.192	2.793	2.192	2.615	2.889
Jet fuel	2.542	4.512	2.517	1.815	3.774	1.536	2.833	3.933
Aircraft servicing (FBO)	3.041	4.548	3.323	2.138	3.750	2.345	3.097	4.031
Aircraft parts/repair	2.837	4.341	3.032	1.893	3.438	1.931	2.839	3.906
Strong airport management	3.333	4.814	2.900	2.571	3.548	2.621	2.833	3.806

1 = Definitely does not offer.
5 = Definitely does offer.

Development of Aviation Management Coursework

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Running Head: DEVELOPMENT OF AVIATION MANAGEMENT COURSEWORK

Abstract

Students graduating from aviation programs frequently move into careers that have a significant management component. As a result aviation management courses have evolved in aviation curricula to prepare graduates for these positions. However, many of these courses fall far short of their potential because relatively few aviation faculty are prepared to teach in this area, there is little interaction between these faculty, and the size of the market does not warrant publication of textbooks with adequate depth. The objective of aviation management courses should be to provide enough depth in the unique aspects of a particular field of aviation to enable the student to engage in critical analysis and problem solving in that field. In addition, the courses should be structured in a manner that allows students to integrate material and apply management skills. What is needed is a broad based organized effort to identify appropriate content for aviation management courses, and to develop activities which will meet the objectives of these courses. This paper presents a potential program to meet the first need, and two examples which illustrate the type of activities that can be used to meet the second need.

Development of Aviation Management Coursework

Most Aviation programs include course offerings in the area of Aviation Management such as Air Transportation, General Aviation Management, or Airport Management. Some programs even offer a degree with titles similar to Aviation Management.

These courses and programs have evolved from a number of sources. Some of the programs were designed from their outset to prepare students to enter various management positions, but other programs consist of courses which were implemented in aviation programs that concentrated primarily on the technical aspects of the aviation industry such as flight training or maintenance training. This latter approach was quite natural since many of the graduates of these programs were employed in management positions or moved into jobs with a significant management component.

But what is unique about a managing an airport, an airline, or a general aviation operation? Why not just prepare a person to be a manager. Why should special training be required to be a manager in the aviation industry? People come out of business schools and move into management in many industries without special training in that particular industry. Why should aviation be any different. And if special training is required, what specific material should be taught? This question has been addressed by aviation departments as they developed curricula, by the professors assigned to teach aviation management courses, and by others interested in this area. The question has been answered many ways, however, for a number of reasons the resulting courses have varied widely in subject matter, depth, and quality.

Based on personal experiences teaching in this area, discussions with other professors and department chairpersons, examination of course outlines, and reviews of textbooks, I believe there is a need to clarify the objectives of aviation management courses and provide a foundation for their development. It is necessary to define the function of the courses in the overall curriculum, and identify their appropriate content and structure.

Many of the courses currently taught tend to be heavily descriptive, and cover such a broad range of topics that they often lack depth in any one area. In addition, they lack the structure that would provide students with the opportunity to practice their management skills. There are a number of reasons aviation management courses haven't developed to their fullest potential. First, many professors assigned to teach the aviation management courses have a teaching background that is not well suited to these types of courses. Most technical aviation teaching fits into the category which Dressel (1980) referred to as discipline-centered teaching. In discipline-centered teaching the "Course is based solely upon the concepts, principles, theories, and methods characteristic of the discipline" (Dressel, 1980, p. 126). He suggests that these types of courses typically are taught using lectures and standard texts with an emphasis on systematic coverage of a body of knowledge. This is quite different from the more student-oriented teaching that may be required to convey management concepts effectively. Generally this approach requires a method of instruction that "..emphasizes student involvement and interaction as a means of personal and social development." (Dressel, 1980, p. 126).

Second, there is a lack of communication among people working in this field. There are relatively few people involved in teaching aviation management, most of these are geographically separated, and there is not a strong centralized effort to develop and give direction to the field. Because of this the experience individual professors gain in this area is rarely disseminated to others. As a result instead of advancing the field, the practitioners are continually rediscovering the answers to questions that others already addressed but did not disseminate.

A third reason for lack of full development of aviation management courses is that textbooks, which often stabilize and provide direction for a field of study such as this, are not adequate. Although there are several good texts that cover specific aspects of aviation management, most are written to try to fit a broad range of classes (which is necessary due to the small size of the overall market). As a result the same aviation management text may be found in exploratory courses in community colleges, and also in capstone courses offered in the university degree programs. These texts are usually written for the lower level classes and consequently have deficiencies for the upper level classes that must be overcome by additional material prepared by the professor.

In summary, the problem with Aviation Management is that it does not have a clearly defined curricular content or structure. This is due to many faculty members lack of background to shift easily into this area; to the lack of interaction between people teaching in this area; and to the inadequacy of published materials for the diverse needs of courses in this area.

The purpose of this paper is to promote an improvement in the quality of aviation management courses. This will be done by identifying the course structure and the types of materials appropriate for inclusion in these courses, and by recommending a manner for professors in the field of aviation management to interchange ideas and to build a foundation of materials that can be used to tailor aviation management courses to the needs of the institution offering the program. This paper will attempt to define not the specific subject material that would go into an aviation management course, but rather the type of material, problems, exercises, and projects that are appropriate.

Course Content and Structure

Introduction

There have been hundreds of definitions or descriptions of a manager's job, but for the purposes of this paper it is important to note that managers integrate a body of knowledge for the purposes of planning, execution, and control of some activity. The managers role is an active one. It is not just understanding a body of knowledge or being able to recall specific facts, but also the application of his knowledge. A manager must understand a body of knowledge to perform the job of management just as a pilot must understand a body of knowledge in order to operate an airplane. But the job of managing is the active application of this knowledge just as the job of a pilot is the active application of his knowledge. Consequently the management coursework should provide both the body of knowledge required by a manager in the aviation industry, and also provide the structure that allows students to actively practice the management functions. This is not to say that each course must contain both the teaching of new material and practice of the management functions. It may be that within a curriculum several courses teach just the facts, principles, modes of inquiry, and skills that are needed by a manager in the aviation industry, while other courses are built almost entirely around the integration and application of this knowledge.

> Almost by definition, skill and distribution requirements should come early in the student's career, and the integrative courses should either be distributed throughout or concentrated at the end. (The Carnegie Foundation for the Advancement of Teaching, 1977, p. 14).

Transmission of Knowledge

To think critically, to be able to develop creative solutions, to understand how a specific decision affects the whole, etc. it is necessary to have depth of knowledge of the subject. For instance, a person put in charge of the flight training department obviously must be knowledgeable in the field of flight instruction, but in order to operate effectively he or she should also be competent in numerous other areas. It is necessary to understand the cost of operating airplanes, and how different operating practices are likely to affect these costs. It is necessary to understand the aviation industry safety standards and the philosophy behind the development of these standards; it is necessary to understand the relationship that typically exist between the airport and its operators; it is necessary to be aware of the potential legal liabilities, and how to manage the risk associated with this liability by balancing insurance and other programs. The list could be extended much further.

It has often been said that the reason many aviation businesses are not successful is that they are run by pilots or mechanics rather than businessmen. But there are also many examples of failures of aviation operations run by men who were very successful in other forms of business, but lacked adequate knowledge of the field of aviation. For instance there are a number of instances of successful automobile dealers who were unable to effectively operate an airplane dealership. In addition many people who are successful in one aspect of the GA business have trouble when they try to expand into others. This is not from lack of knowledge of business, but lack of knowledge of the particular aviation business. Many industries can hire new employees directly out of business schools and train them to be managers in business operations such as retail stores, insurance, manufacturing operations, etc. However, putting a business school graduate directly into a GA operation would not usually be considered a feasible approach because there is so much specialized knowledge that is required to perform adequately.

McPeck (1981) makes the point that it is impossible to engage in activities such as critical thinking without a thorough knowledge of the subject area. He continually stresses the point that thinking, critical thinking, problem solving, and other forms of analysis cannot exist in the absence of a subject area. The following statement made in an analysis of the contribution made by the field of logic is typical.

> However, there is one significant point for which the positivists must be given due credit, and that is that logic, as such, is used for the assessment and justification of arguments and theories once they have been presented. But it cannot generate (or formulate) hypotheses, theories or arguments in a problem-solving situation. Having the tools of logic available to help us do this checking is valuable indeed; but they are virtually useless in helping us to find our way out of problematic situations the solutions to which depend on possibilities and hypotheses. Logic can help to eliminate hypotheses, conjectures and plausible solutions, but it cannot provide them. In the most common problem-solving situations within disciplines and working fields of knowledge, the most difficult - and perhaps most important - phase is that of producing a

hypothesis, conjecture or alternative that is worth checking or trying out (McPeck, 1981, p. 15).

This same concept can be extended to managing any type of operation where the characteristics of the industry play an important part in the decision making process. It is often not the assessment of various alternatives that is most important, but the development of those alternatives. Arguments that a good manager can manage any type of business (and that experience in a particular industry is not necessary) typically cite instances in which successful people have moved from one industry to another. The fact that is overlooked is that these managers typically depend heavily on the knowledge and advice of managers at lower levels in the organization.

The point being made here is that whatever subject matter is included, it needs to be covered in adequate depth to give the student the material needed to engage in critical thinking, problem solving, and other skills. McPeck (1981) stresses that this should include the foundations of various types of beliefs or the epistemology of the field. "In short, the epistemology of various fields, more than anything else, provides one with the requisite knowledge to employ his critical acumen effectively." (p. 156).

It must also be kept in mind that as students move into management positions they will continue to acquire knowledge of their specific field, and it is probably most important that they learn from their formal education the types of material that are important to exercising their analytical skills. "It [a formal education] acquaints them with ways of learning and makes it possible for them to educate themselves." (The Carnegie Foundation for the Advancement of Teaching, 1977, p. 152).

Integration of Material

Insuring that aviation management courses have the proper content is one part of the problem, but equally important is the structure of the classes. Exercises, projects, and other activities need to be developed that require students to apply the basic concepts learned in English, computer science, business, aviation, and human relations classes. These activities should not involve recital of facts but the application of ideas and concepts to problems. These projects should involve such things as finding the right airplane for a particular job, making a forecast of where an industry will be in five years, selecting the best of two airlines to work for and then justifying the decision, etc. The key here is in using the skills.

An analogy about learning to fly may help to make this point a little clearer. In a college program that is designed to prepare professional pilots the students are taught skills at a number of different levels. They are provided with descriptive material regarding the nomenclature and structure of an airplane, some descriptive aerodynamic theory, and they are told about how to fly an airplane and to make it perform in a given manner. They are then required to apply this basic learning so that they develop the motor skills necessary to actually fly a training airplane. While they are involved in this process they also learn judgement and decision making skills. Once they have completed their training and have a commercial certificate they are still relatively inexperienced and can only handle the simplest of commercial flying tasks, but they have proven they are capable of learning the motor skills and the decision making processes necessary to advance. And they have a broad foundation on which to build.

At the present time we are offering most aviation management students only the descriptive part of their management preparation. If aviation students are to go into the aviation job market with an advantage over other majors they need to be provided with more than just descriptive training. In addition, the student has not found out if the work of aviation management suits him or her (pilot candidates frequently find that they do not want to pursue a flying career); nor has the student been given the opportunities to develop the actual skills that will be used; nor has the student proven that he or she is capable of learning and applying these skills.

The aviation management courses must be designed to build managers and develop their capabilities, and also to provide a way to judge a student's performance as a manager. Programs must be developed to allow direct observation of a students abilities in a managerial role. This is difficult since most of the traditional class structures do not provide the situations needed to accomplish this. However many professors have done work in this area and there are activities which will meet these objectives. In the following section two examples are presented that have been used in this manner and found to be quite successful.

Examples

Following are two examples of activities that incorporate the ideas presented above. They involve the transmission of basic knowledge to the students, require that the students integrate basic business concepts and skills with the aviation material, and these provide an opportunity for students to apply management skills. Both of these activities are computer based simulations of business situations which are major units used within two aviation management courses. Even though these are both computer simulations it is not intended to imply that these are the only types of activities that will produce the desired results.

The Aircraft Sales Simulation

Description. This simulation is normally used in a class that studies the general aviation industry. It is a simulation of companies that buy used airplanes on the wholesale market and sell them on the retail market. Typically three to five companies are involved in the simulation with two to four students running each company.

The companies are provided with a list of forty airplanes describing each in adequate detail to allow the determination of its retail price based on an aircraft "blue book" or "price digest". Based on this information, and data on their company's fixed and variable cost of operation, students bid for airplanes they would like to buy for their inventory, and indicate the sales price they would set for the airplane.

All of the bids are stored in computer files until the master program is run by the instructor. This program collects the bid information and allocates the airplanes to the company that is the highest bidder with enough of their allocated quarter million dollars of flooring left to purchase the airplane. Once the airplanes are allocated through this auction process, the computer determines the expenses the company would incur based on the standard fixed costs, and variable costs based on the inventory level. The simulation next generates buyers for the airplanes and determines which airplanes would sell. If a company has set the sales price for an average airplane at its nominal value then it will have about a fifty percent chance of selling. Airplanes that are priced higher than they should be have less of a chance of selling, and those priced lower than nominal have a better than average chance of selling. The chances of an airplane selling is also affected by the company's reputation that is determined by whether it has a reputation for pricing airplanes high or low.

The results of the simulation are printed out with each company receiving an income statement for their company, and an activity report that shows which airplanes were bought and sold that month, and which are available for purchase at the next auction.

Basic Material. In the process of participating in this simulation the students learn a great deal about general aviation airplanes. For instance, during the evaluation of these airplanes and through class discussion they are exposed to the base prices; the standard equipment levels; the value of additional equipment such as avionics; the cost of engine overhauls; the impact that major damage history has on the airplanes value; and other factors that affect the value of the airplane.

Basic Concepts. In determining operating strategies the students must deal with basic business concepts such as the tradeoff between markup and sales volume (low price / high volume vs. high price / low volume); they must deal with probability concepts since in any given month the sales volume is partially determined by chance; they must develop adequate record keeping systems to track trends in their own business and in the market; and they must devise a method of identifying the airplanes with the greatest profit potential.

Management Skills. Due to the number of airplanes and the possibility of making a mistake in evaluation it is necessary to carefully manage the company's resources. The students must develop a system that provides adequate time to plan company strategy, insures that data is entered in a timely manner, and provides for adequate control to insure one student does not make mistakes that will cause significant losses for the company (which impacts the grades for all the students in that company).

The Airline Simulation

Description. This simulation is used in an air transportation class and involves three airlines that are competing over a four city network. Each airline is typically run by three to five students who try to make changes to improve the profitability of their airline. The students are given information about aircraft operating expenses including the lease costs, operating costs, and passenger capacities of available airliners. They are also given information on the demand for each city pair including the number of passengers, the approximate desired travel time demand distribution, and the dominate type of travel (business, tourist, etc.).

The simulation is normally run one quarter (three months) per round. That is, the students start with the income statements and traffic statistics with the initial operating conditions. They then decide on the changes that should be made to obtain a competitive advantage, and implement those changes. The simulation is then run and they are provided the results of three months operation under those conditions.

The students can change the departure times of flights, add or delete flights or connecting schedules, change the type of airplane used, change advertising and service levels for individual routes, and change the fares on individual routes. Since having all of these factors variable from the beginning would be overwhelming, the simulation is typically started with only one factor being variable at a time, and then working into multiple variables.

Basic Material. In the process of participating in this simulation the students learn a great deal about the airline industry. In order to operate effectively they must understand the terminology used on income and traffic statements, the relative expenditures in various parts of the airlines operation, typical operating costs, how these costs are affected by variations in the level of expenditures, and factors that have an effect on demand for particular airlines services. In addition, due to the number and complexity of potential alternative courses of action, it is necessary for each company to develop an electronic worksheet (such as Lotus 1-2-3) in order to evaluate these alternatives.

Basic Concepts. In determining operating strategies the students deal with basic business concepts such as market share, market penetration, and price elasticity. They learn the importance of taking competitive response into account in their decision process, and they pick up an appreciation for the tremendous complexity of an airline operation. Setting up a schedule for as few as four cities with four to six airplanes is extremely challenging, and the results generally demonstrate the rewards of diligence.

Management Skills. Because of the complexity of the operation and the volume of data that must be analyzed at the end of each round it is important that each group be run effectively. It is absolutely essential to establish standardized procedures which insure that each person does a proper job of analysis, and reports it in a manner that enables intelligent decisions to be made regarding needed changes. This simulation gives the instructor an excellent opportunity to evaluate the students analytical abilities, their ability to integrate previously learned material, and their ability to function as a leader and as a team member.

Conclusion and Recommendations

This paper has attempted to provide a focus on the types of material and the structure that is appropriate for aviation management classes. These concepts need to be discussed, refined, and narrowed to the point that they provide guidelines for the development of aviation management courses. In addition, work needs to be done on identifying and assembling the facts, principles, skills, and modes of analysis that should make up the content of the courses. This should be an ongoing process and result in both informal exchanges and the publishing of papers.

Along with work on the appropriate content for these courses, efforts must be made to develop and disseminate a wide variety of projects, games, simulations, and other activities that will provide a stimulating learning environment, and will provide the opportunity to apply knowledge accumulated from previous experiences. This approach is already being used in other disciplines where there is a need for new and innovative projects that can be used in the educational process.

> The American Association of Physics Teachers has conducted a survey of introductory physics courses for use in preparing instructional modules (independent units of instruction with clearly defined objectives),

and both the American Institute of Biological sciences and the American Geological Institute have sponsored development of teaching materials and special reports related to undergraduate education (The Carnegie Foundation for the Advancement of Teaching, 1977, P. 42).

Individuals have already accomplished a great deal in this area, but it is inefficient for individual faculty members to try to meet these objectives on their own. A centralized effort is needed to focus attention on this area and to provide both informal and formal opportunities for the exchange of ideas and materials. The need for work to clarify and integrate structure, content, and objectives is stressed by Dressel (1980). This idea is summarized in the statement:

> No course and no program of courses can attain optimal impact until the interrelationships of the structure including experiences, content, and materials with the activities and interactions of students and teachers have been clarified and exploited in reference to the achievement of program objectives and the social outcomes upon which these are based. For most individuals, content becomes meaningful only as it is presented through meaningful and relevant structures. (p. 25).

Because of the relatively small number of courses offered in aviation management, and the geographical dispersion of faculty members, it is important that an organized effort be made to implement the processes mentioned above. An independent organization set up for these purposes is not viable due to the limited number of potential participants, which makes an existing organization the most likely possibility.

The University Aviation Association (UAA) seems to be the most logical choice to organize efforts aimed in this direction. Most of the institutions involved in aviation management are represented in the UAA, and it has communication channels in place to tie together the interested parties. It publishes papers which can be used for the development and dissemination of work in this area, and it could provide the central exchange needed to disseminate course materials that are developed.

The result of an effort in this area will be an improvement in the quality of the aviation students, and in upgrading of the reputation and status of aviation programs.

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A Resource Consortium To Develop Interactive Videodisc Training For Airway Sciences

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Running Head: A Resource Consortium For Airway Sciences

Abstract

Increasingly, the responsibility for training the nation's aviation professionals will be that of collegiate Airway Science Curricula. One of the most effective methods for meeting growing demand in education is through computer aided instruction, most notably interactive videodisc training systems. While few observers can deny the benefits of interactive videodisc training, there are legitimate limitations to developing custom applications. An interactive videodisc training program typically requires a commitment of both information and financial resources. Educational institutions often find the requirements greater than they are able to provide individually. However, a consorted effort of universities, government agencies, and industry can develop a system which would be more sophisticated than any one group could develop alone. The first experiment examines the applicability of interactive videodisc training in aviation. The second is an experiment by educational institutions working together to create an interactive videodisc course. If the experiments show that interactive videodisc training has a place in aviation education, and that the cooperative efforts for developing courseware are possible, then the University Aviation Association is the ideal forum to coordinate an interactive videodisc project for Airway Science.

A Resource Consortium To Develop Interactive Videodisc Training For Airway Sciences

In a recent discussion with novice computer users, Dr. Richard Byrne warned, "Do not attempt to use computers to solve your problems." The astonished audience of aviation professionals listened to the computer science professor from the University of Southern California explain that the machines are simply tools which can help an organization become more productive. Computer technology is best utilized in areas of an organization where it is most proficient. "Computers can help you do the things you do well, even better." (Byrne, Note 1)

This idea is the foundation for using computer aided instruction in aviation training. The demand for well trained professionals in nearly all aviation fields is one of the most critical issues facing the industry. Traditional approaches for training people in aviation related fields have attempted to react to this need. The effort has been successful, but the need for training more people will continue. The future of aviation education is an ideal application of Dr. Byrne's message.

Greater demand for aviation personnel is primarily due to industry growth. Deregulation has allowed price competition among air carriers. Consumers have benefited from lower fares, and the cost of air travel has declined relative to other types of transportation. Overall demand for air service has increased, and the result has been more traffic in the airspace system.

The economic forces that have spawned more air traffic have had an obvious impact on the number of personnel required to service that need. When striking air traffic controllers were fired in 1981, the need for aviation professionals increased further. Replacement and expansion have caused a massive training effort by the Federal Aviation Administration (FAA). The need for more training has occurred in both the public and private sectors of aviation.

Airline pilots are being hired at an unprecedented rate, and more of the group is reaching mandatory retirement age. The training dilemma of meeting the greater demand for people with necessary skills has been compounded by declining supply at the same time. More military trained flight crews, maintenance technicians, and air traffic controllers have found the new programs for armed service personnel enticing enough to re-enlist. The flight schools at fixed based operations that have trained so many general aviation pilots and maintenance personnel are suffering the effects common to general aviation. Despite the poor timing of surging demand and waning supply, the quality of the training received by professionals in the aviation industries has been extremely high. This is a credit to the organizations involved in aviation training, and is exemplified by the safety of the entire system.

Yet there are problems facing the aviation industry. The well publicized safety issues are ultimately reflected in those responsible for staffing the system. The pressure to assure safe air travel is not likely to subside. Many people feel the first step is to assure that those involved in the system continue to be well trained. Computer aided instruction can assist in the training of aviation professionals by helping trainers do what they do well, even better.

Interactive videodisc training, the form of computer assisted instruction that integrates full motion video, audio, three-dimensional animation, computer graphics, and text, is widely recognized as being one of the most effective instructional delivery systems. Caution is warranted for viewing interactive videodisc (IVD) training as a panacea for the problems facing educators. Interactive video cannot compete solely as a substitute for conventional means of instruction. Rather, it must compliment traditional methods in improving the overall effectiveness of teaching and/or training. (Kannan, 1986). There are benefits that extend to nearly all applications using the technology. However, the ultimate test of a technology's effectiveness in an industry segment is its acceptance by the users. The first experiment judges the potential for IVD applications in aviation training.

No system with the potential benefits of IVD is without limitations. One of those most often cited regarding interactive videodisc systems is the cost. Computer hardware and peripherals represent a relatively minor portion of an IVD training system's cost. The development cost of interactive videodisc courseware is the major expense in custom projects.

Once development is complete, the cost of copies is miniscule. Therefore, shared development costs can yield a synergistic effect to courseware creation. Those organizations that share the subject matter can have a course which is more effective than they would be able to produce individually with the same resources. The second study is an experiment in cooperation among educational institutions using interactive video to solve a common problem.

Cooperation in an environment as vicious as that currently exhibited in aviation may seem a remote concept to some observers. Regardless of whether the industry members are battling among themselves, or with government agencies, the common element among all participants in the system is the need for highly qualified, well trained professionals. The responsibility for providing the necessary training should be at the collegiate level. Vertical integration of colleges and universities that can offer aviation education will enable them to be the conduit between supply and demand of aviation professionals. A cooperative effort from industry, government, and universities can yield a highly effective training curriculum which benefits all participants. Initial steps toward this cooperative goal in aviation training have been taken. The University Aviation Association has formed a team of information sources to work with the Federal Aviation Administration to standardize a curriculum which will be used as a benchmark for Airway Sciences taught at universities throughout the country. Some airlines are anticipating the future demand by working with university placement office internship programs. The potential exists for a resource consortium to develop interactive videodisc courseware for Airway Sciences. The focal point of the consortium is the University Aviation Association. The participating universities will be able to expand their programs. Meanwhile, industry and government will be supplied with the quality of personnel they seek. Ultimately, the entire system will benefit through a safer system for air travel.

Experiment 1

Method

Subjects. One hundred-seventy-three pilots from a major U.S. airline participated in a demonstration and subsequent survey to determine their acceptance of interactive videodisc training. Their professional flying experience ranged from two to thirty-eight years with a mean of 14.8 years. The demonstration took place in the airline's pilot crewroom at one of its airport domiciles. All pilots based at that domicile received a brochure describing the experiment. Pilots participated in their time before, after, or between scheduled flights. The site was selected because of the volume of air traffic through that location, but the sample included pilots from various crew bases. The pilots who participated spent an average of twenty minutes examining IVD and ten minutes completing a questionnaire. The sample size represented approximately ten percent of the total pilot force of the carrier. The participants were told that their responses would be used in compiling a report to the carrier's management.

Apparatus. The equipment used in the demonstration was a level-three interactive videodisc system consisting of a microcomputer and videodisc player. The student station accepted inputs from a touch sensitive screen and had an option of speaker or headset for audio output. Three different demonstrations were available for the sample group. The first course was a wave soldering technique used in quality control for manufacturing circuit boards. This was an application of IVD for teaching psychomotor skills. The second demonstration emphasized cognitive skills in a management simulation game. The final demonstration course, and the one preferred by most participants, was course for teaching separation rules to air traffic controllers.

Procedure. Those pilots who were willing to participate in the demonstration were asked to work through one or more of the modules in the demonstration. Because no demonstration of specific pilot training courseware was available, the pilots were instructed to focus on the technological features of the delivery system rather than the courseware demonstrated. When the users felt they had a good understanding of the system's capabilities, they were given a questionnaire. A sample questionnaire is included in the appendix. Preliminary information about the sample group indicated that some of the pilots had been exposed to other types computer aided instruction. However, these systems lacked the motion video and audio features of IVD. The survey was designed to obtain the attitude of those who had never experienced any type of computer training, but also judge the attitude of those who could compare IVD to their previous exposure.

Results

The Babcock Graduate School of Management at Wake Forest University, Winston-Salem, NC, was selected to develop the survey questions and complete the analysis because of its excellent reputation and location. Overall, the pilots reacted favorably to the use of IVD as an instructional method. Of these pilots, 92.2% responded favorably or very favorably to the demonstration. Pilots who had previously experienced other computer-aided instruction, and pilots overall, significantly rated IVD higher than other computer-aided instruction in terms of the method being interesting, clear, well-paced, and easy to learn from.

	Mean Values	
Scale	IVD	Other CAI
Boring "1" to Interesting "7"	5.8649	4.4054
Confusing "1" to Clear "7"	6.0822	4.6438
Poorly Paced "1" to Well Paced "7"	5.944	4.5417
Difficult to Learn "1" to Easy to Learn "7"	6.137	4.6027

Pilots were asked to rate six factors that may contribute to the effectiveness of an instructional program. They were told to place a "1" next to the factor they felt was most important in their own case, a "2" next to the second most important fact, and so forth until they had marked all six factors. The mean values, ranked in order of importance by pilots, are found below.

Clarity	2.461
Interesting	2.922
Control	3.101
Pacing	3.533
Scheduling	3.910
Technology	4.177

In addition, pilots rated IVD as having more effective potential as an instructional technique than synchronized slide-tape. They responded that IVD was equally effective as classroom instruction but less potentially effective than flight simulators. The sample responded that IVD would be most effective when used in recurrent and differences training. In addition, they felt that IVD would be effective in training airline personnel other than pilots.

Pilots were presented with four common alternative instructional techniques. They were asked to rate IVD's potential compared with the listed alternative on a 1 to 5 scale. "One" was IVD much less effective than the alternative and "5" was IVD much more effective. The mean values are given below.

Instructional Alternative	Mean Value
Classroom instruction	3.123
Synchronized slide-tape	4.268
Flight simulators	2.368
Other computer-aided instruction	3.961

The results show that the pilots felt that IVD was more effective than synchronized slide-tape and other computer-based instruction. They responded that it was about equal to classroom instruction while it was potentially less effective that flight simulators. (Clapper, 1986)

Experiment 2

Method

Subjects. Eight school districts from the public school system in the state of Pennsylvania are involved in a program to provide a "Teacher Induction" interactive videodisc. School districts in the state are organized into Intermediate Units that serve as a super-structure for providing services to individual districts. These include, but are not limited to, media services, special education teachers, and facilities for assisting students with special requirements. There are twenty-nine Intermediate Units in the state. Intermediate Unit Number Thirteen (IU13) was targeted for the experimental development project. Of the twenty-three school districts within the IU13, a consortium of eight are participating in the project. There was no limit to the number of school districts that could participate. IU13 was selected because of its proximity to the courseware developers.

Apparatus. The equipment specifications for the Teacher Induction courseware was designed to meet particular needs of the educational consortium. The members desired to utilize existing hardware if possible to minimize capital expenditures. All of the standard benefits of interactive videodisc systems needed to be incorporated. The most common type of computer equipment in the educational institutions is an Apple IIe microcomputer system. The system engineers determined that the computers could be reconfigured to make use of the installed base of hardware. The systems were designed to utilize a standard videodisc player and would have the touch sensitive monitor capability.

The Forum For Organization. The state of Pennsylvania mandates that certain programs are available in the public school system. One such program is a Teacher Induction course for all new teachers to become familiar with the methods of record keeping, discipline, and numerous general procedures that have traditionally been learned on the job. Recognizing that the methods which were being used by some of the school districts were not successful, the Technology Committee of the IU13 met with an interactive videodisc producer to explore the possibilities of developing a standard course.

A proposal was presented to the committee, curriculum coordinators, and superintendents of each district. Under the terms of the development agreement, the videodisc producer would forego its standard profit level and provide a program of higher value than the purchase price. In addition, the company would allow a flexible payment schedule for the schools. The course was recognized as having great market potential, but the goal was to solve problems within the participating districts.

Results

The goals of the experiment were common to all the consortium members: (a) First, the development of the course was designed to solve a problem. The school districts sought a solution to the state requirement for providing teachers with an induction to the school system. They recognized the problem, independent of the mandate, and saw IVD as an ideal solution. (b) Secondly, there was an opportunity for various sized school districts to interact with one another. Small school districts could learn from larger districts, and each could share unique problems. (c) The final goal centered on the technology itself. There is a good deal of positive public image surrounding those organizations that are involved with the latest technological advancements. The political nature of the public school system in most states makes officials aware of the need for such pursuits. In conjunction with that, the revenue generated from courseware sales in other districts would be shared with the development consortium. The IVD course would be seen by residents in the school district as an effective method to deliver the material, and a nontraditional alternative to funding public education.

The overall results of the project are not known because development and marketing of the course are not complete. However, the initial interest and commitment from the school districts is sufficient to begin development of the course. Each district is making the financial outlay necessary to fund the project, and providing the information, personnel, and facilities for production. (Davis, Note 2)

Discussion

The research presented in the experiments provides a foundation for inferences supporting the thesis. The first experiment was conducted to determine if interactive videodisc training had a place in aviation education. Many of the system's benefits seemed to be excellent adaptations of the technology, yet other touch-screen computer training systems were not received as well by the users. The results showed that the technological advancements that allowed an interactive audiovisual training system with database capabilities was an improvement that the users felt could be used in numerous aviation related applications.

The second experiment showed that a consortium of educational institutions with a common purpose found interactive videodisc training to be a delivery system that not only met their primary objectives, but yielded additional benefits as well. The technology is perhaps the most effective method of utilizing the schools' human, equipment, and financial resources. Their common purpose is not unlike the focus of the University Aviation Association.

While this primary research makes a very strong case for supporting an aviation education consortium utilizing interactive videodisc training, there is other information that leads one step closer to that conclusion. This existing data serves as secondary research for supporting involvement in the effort. The information pertains to the University Aviation Association's current cooperative effort, and the previous inclination of private sector involvement with universities.

The climate for cooperation exists in the University Aviation Association and it is exhibited in the organization's work in the Airway Science Curriculum. The curriculum was created by a committee of educators working under the joint sponsorship of the Federal Aviation Administration and the University Aviation Association. (Naughton, 1986) The benefits of a standard curriculum to the UAA is that aviation education can be expanded or introduced at many universities. They can attract students to meet the demand for graduates in aviation fields. The FAA is committed to hiring a certain number of graduates, and benefits from hiring employees that have been through the curriculum which they sanctioned. The graduates hired by the FAA will enter at a higher salary grade than those not graduating from the Airway Science Curriculum. It should be noted that the Administration will not mandate how the courses are taught. According to Don Higgins, Manager of the Airway Science Curriculum project, the Administration will recognize universities that meet the "spirit and intent" of the curriculum. (Higgins, Note 3)

The final element in the secondary research supporting the thesis is the involvement of airline industry participants. In a recent article regarding pilot training, Cliff Naughton, Associate Editor of Professional Pilot magazine, discussed this opportunity.

> While the major airlines appear still hesitant toward programs of co-op education, work/study plans, and internships, and still shy away from even talking about sponsoring the training of lower time pilots, some are moving. (Naughton, 1986)

He cites examples of several carriers beginning to work with training institutions to bridge the pilot experience gap. Richard J. Ferris, Chairman of United Airlines, indicated his desire for input to the education process.

> Newly licensed mechanics from fully accredited schools are well trained, but their skills would be more compatible with airline industry expectations if airlines advised technical schools of their needs, reviewed curricula, and evaluated apprentice programs. (Ferris, 1986)

Involvement by air carriers has been sporadic and fragmented at this point. There is a great deal of pride and philosophical differences among the airline training departments. However, those who would support a resource consortium would have input to the methods of training. The long-term benefits of participation in a successful program would give them access to a source of graduates, and make the training within each carrier more efficient as graduates reach that level.

Conclusion

Cooperation exists among members of the educational community in sharing information for standard curricula. Private and public sector leaders in aviation have demonstrated an understanding of the problems of training aviation professionals. The logical step is for the University Aviation Association to take the lead role in the concerted involvement of industry, government, and academia.

Many organizations for which training and education is a priority have found interactive videodisc training to be the most effective method for instructional delivery. Many of them face a similar imperative demand for skilled graduates that is needed in aviation professions. The large organizations that provide complete training services to corporate pilots have long known the benefits of interactive videodisc training systems to supplement their classroom and simulator time. The opportunity exists for universities to utilize this type of system by pooling their resources for development. An interactive videodisc training curriculum for Airway Sciences could be the binding element among the major participants in an airspace system that is in dire need of affordable efficient training and cooperation.

Reference Notes

1. Byrne, Richard. Presentation at the National Air Transportation Association, Inc. Conference, March 1986.
2. Davis, Geoffrey L. Personal communication, June 1987.
3. Higgins, Donald. Personal communication, June 1987.

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Clapper, James M. Pilot Attitudes Toward The Use of Interactive Videodisc Technology. Wake Forest University, June 1986.

Ferris, Richard J. The Changing World of Work. United: The Magazine of the Friendly Skies, November 1986/7.

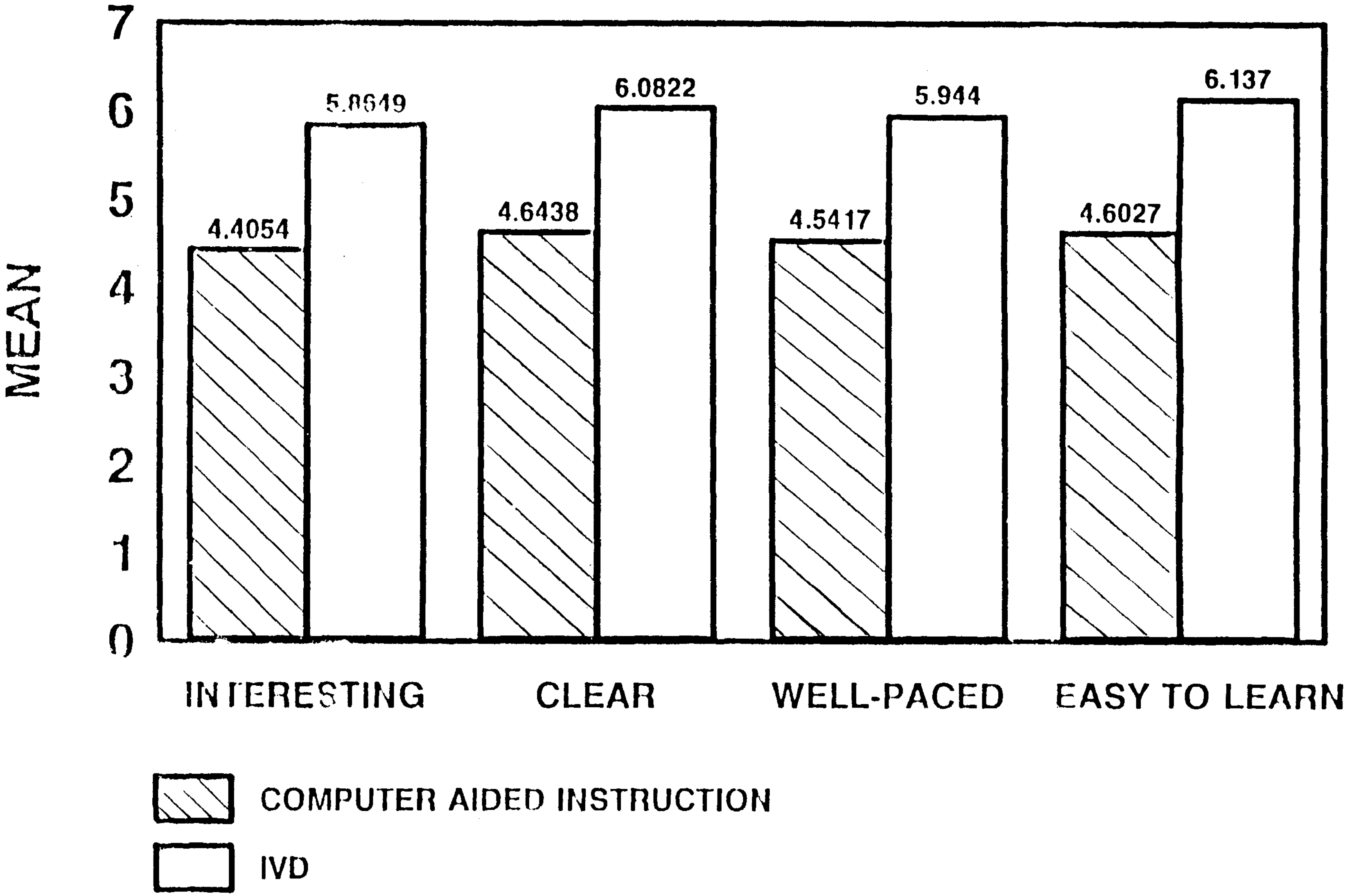
Kannan, Nat The True Power of Interactive Video: The Role of the Authoring Language. The Videodisc Monitor, July 1986.

Naughton, Cliff Producing The Professional Pilot, Professional Pilot, December 1986, pp 46-50.

Figure Caption

Figure 1. Pilot survey comparison of interactive videodisc and other computer aided instruction.

Figure 2. Pilot survey reaction to interactive videodisc training for aviation. 737-300 pilots represent those who have used other computer aided instruction.


MEAN
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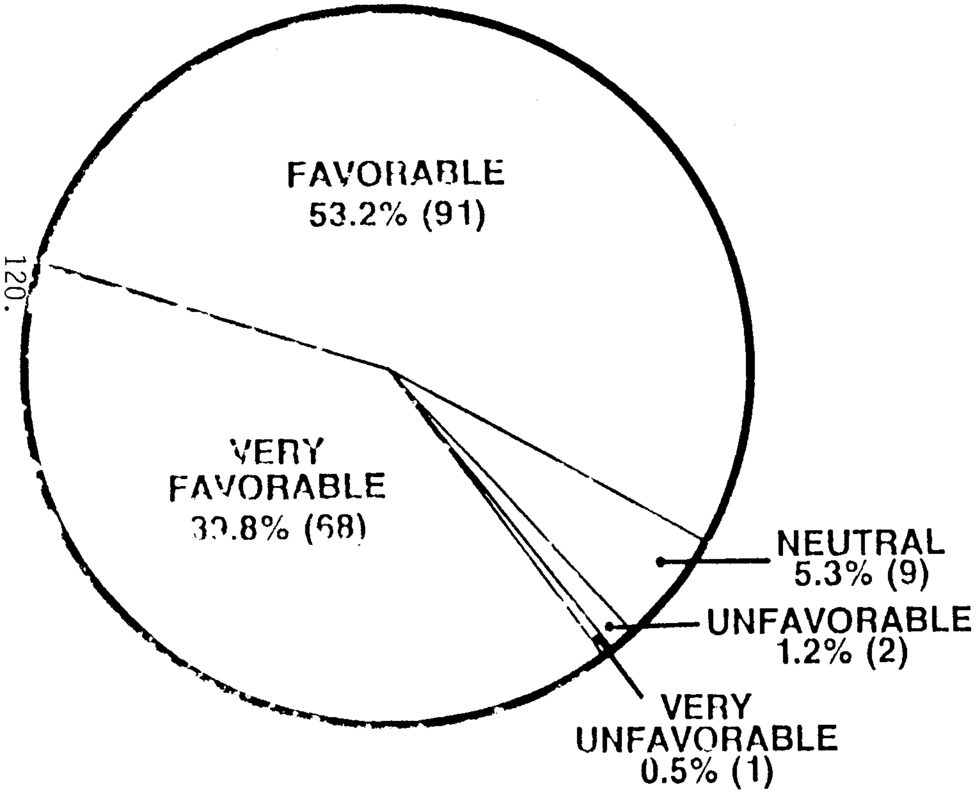
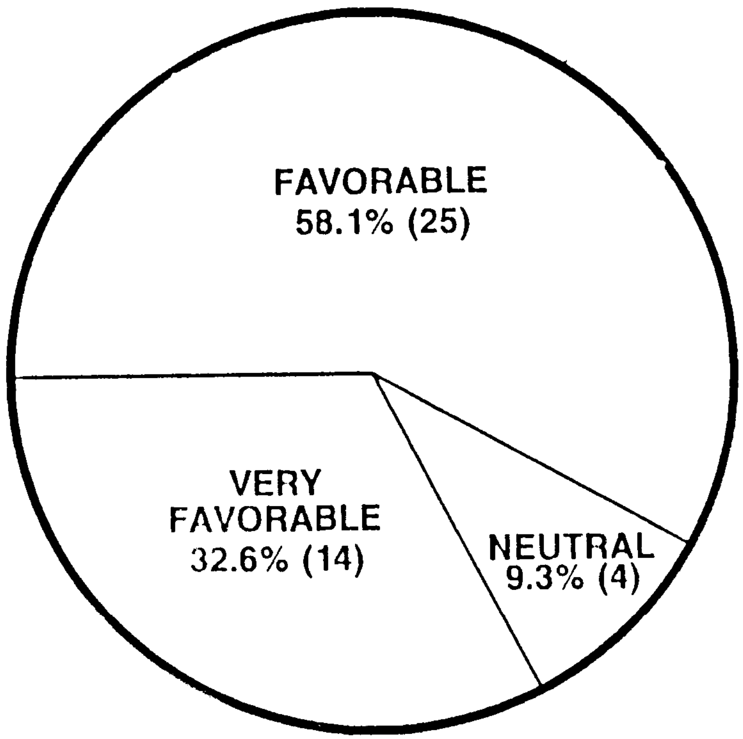
5.944
4.6027
6.137
INTERESTING
CLEAR
WELL-PACED
EASY TO LEARN
COMPUTER AIDED INSTRUCTION
IVD

BI9M.1

ALL PILOTS



737-300 PILOTS



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Appendix

Appendix A. Survey questionnaire used in the pilot opinion survey.

PILOT OPINION STUDY
INTERACTIVE VIDEODISC TECHNOLOGY

You have just experienced a demonstration of interactive videodisc (IVD) technology. We are interested in your opinions of the potential of IVD technology as a training tool within the airline industry. Please take a few minutes to answer the questions below. The responses you provide will remain anonymous but will be very important to us in assessing the potential of this technology. Thanks for your help.

1. Please indicate which demonstration you viewed.
   Wave Soldering ______-1   Management Simulation ______-2 (7)

2. Have you experienced interactive videodisc technology like this before?
   Yes ______-1   No ______-2 (8)

3. Overall, what was your reaction to this demonstration?
   Very favorable ______-5   Favorable ______-4   Neutral ______-3   Unfavorable ______-2   Very unfavorable ______-1 (9)

4. Below are several scales, each with a pair of descriptors, that could be applied to this IVD demonstration. For each, please circle the number that most reflects your own position on that scale.

Boring	1	2	3	4	5	6	7	Interesting	(10)
Confusing	1	2	3	4	5	6	7	Clear	(11)
Poorly paced	1	2	3	4	5	6	7	Well paced	(12)
Difficult to learn from	1	2	3	4	5	6	7	Easy to learn from	(13)

5. a. Have you experienced computer-aided instruction other than interactive videodisc or flight simulators before? Yes ______-1   No ______-2 (14)

   b. If so, please rate this other computer-aided instruction on the scales below.

Boring	1	2	3	4	5	6	7	Interesting	(15)
Confusing	1	2	3	4	5	6	7	Clear	(16)
Poorly paced	1	2	3	4	5	6	7	Well paced	(17)
Difficult to learn from	1	2	3	4	5	6	7	Easy to learn from	(18)

6. Listed below are four common alternative instructional techniques. In each case, we are interested in your opinion of IVD's instructional potential compared with the listed alternative. If you have no experience with a particular technology, just skip to the next one.

	IVD Much **More** Effective	IVD Somewhat **More** Effective	Both Equally Effective	IVD Somewhat **Less** Effective	IVD Much **Less** Effective	
Classroom instruction	5	4	3	2	1	(19)
Synchronized slide-tape	5	4	3	2	1	(20)
Flight simulators	5	4	3	2	1	(21)
Other computer-based instruction	5	4	3	2	1	(22)

7. If interactive videodisc courses were developed with the help of experienced pilots, and these were individualized, self-paced courses with instructor interaction, how would you rate your feelings toward taking such courses?
   Very Positive ______-5   Positive ______-4   Neutral ______-3   Negative ______-2   Very Negative ______-1 (23)

8. Use of IVD technology could make it possible for pilots to take training courses at their own convenience in various hub airports throughout the system. Please indicate on the scale below how desirable to you this sort of convenience would be.
   Extremely desirable   5   4   3   2   1   Not at all desirable (24)

(Continued on back)

9. Please use the scale below to indicate how effective you think pilot training courses using IVD technology could be for each of the following kinds of training.

	Extremely Effective				Not at all Effective	
Initial training	5	4	3	2	1	(25)
Upgrade training	5	4	3	2	1	(26)
Recurrent training	5	4	3	2	1	(27)
Transition training	5	4	3	2	1	(28)
Differences training	5	4	3	2	1	(29)

10. Listed below are six factors that may contribute to the effectiveness of an instructional program. Please read the entire list, then place a "1" next to the factor you feel is most important in your own case, a "2" next to the second most important factor, and so forth until you have ranked all six factors.

- Interesting presentation ______ (30)
- Appropriate pacing of material ______ (31)
- Clarity of material presented ______ (32)
- Participant control over material presented ______ (33)
- Convenience in scheduling ______ (34)
- Instructional technology used ______ (35)

11. If you could improve the design, training method, or materials for any course you've had, which one would you pick first?

______________________________ (36-37)

12. Was there anything about the interactive videodisc demonstration that you particularly:

Liked? ______________________________ (38-39)

______________________________ (40-41)

Disliked? ______________________________ (42-43)

______________________________ (44-45)

13. How effective do you think IVD technology could be for training airline personnel other than pilots?

Extremely Effective 5 4 3 2 1 Not at all effective (46)

These final questions will allow us to understand the characteristics of those who have seen this demonstration and allow us to group your answers with those from others like yourself. They are not meant to identify you.

14. What is your total number of years of professional flying experience? ______ (47-48)

15. Please indicate whether you are currently trained on each of the aircraft listed.

727	Yes ______-1	No ______-2	(49)
737	Yes ______-1	No ______-2	(50)
F-28	Yes ______-1	No ______-2	(51)

16. Have you received training on 737-300 differences?

Yes ______-1 No ______-2 (52)

Thanks again for your help!