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"Success," as defined by Merriam-Webster, is "the satisfactory completion, outcome, or result of a venture." With the publication of the University Aviation Association's 1986 Proceedings, the authors have successfully articulated and contributed new information to the growing body of knowledge in the discipline of aviation education. Congratulations to those authors whose papers were reviewed and published.

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The understanding and advancement of knowledge is the cornerstone of success.

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AIR TRAFFIC CONTROLLER TRAINING: THE ROLE OF THE UNIVERSITIES

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ABSTRACT

In the wake of the air traffic controllers' strike of 1981, Transportation Secretary Drew Lewis called upon the nation's colleges and universities for help in rebuilding the ATC system. Five years later, the new role for the universities envisioned in that call for help has yet to be realized.

In this paper, the author examines the problems the FAA has encountered in trying to rebuild the ATC system and some factors inherent in the ATC occupation that contribute to many of those difficulties. He then proposes a more direct role in air traffic controller training for the colleges and universities through an Airway Science concentration in Air Traffic Control.

INTRODUCTION

The air traffic control system in the United States has absorbed a number of shocks during the past eight years. Deregulation of the airline industry has increased the amount of scheduled traffic while simultaneously imposing new patterns of demand on the system. In the midst of the deregulation process, the air traffic controllers' strike in 1981 reduced the staffing of the system literally overnight. Predictions of system recovery within three years have proven optimistic--some say fantastic. Nearly five years later staffing and workload continue to strain the ATC system's capacity.

Shortly after the strike, Transportation Secretary Drew Lewis suggested that the FAA would need the help of the colleges in rebuilding the system. The Airway Science curriculum was the result. [1] Airway Science has given the college programs a focus and some influence on FAA recruitment needs. But the results are slow to be seen. As of April, 1985, 102 FAA employees have been hired under the Airway Science announcement--and only three of those were "pure" Airway Science graduates, the others having met equivalent reuqirements. [2] Clearly the program has thus far fallen far short of its goals and its impact has been minimal.

What, then, can be done by the colleges and universities? What, exactly, should their role be--not just in rebuilding the system today, but in the rebuilt, advanced system of the next century? The answer must be found in an examination of the problems besetting the ATC System, the particular characteristics of the work, and the strengths of the universities in aviation.

PROBLEMS - SYSTEM UNDER SEIGE

In recent years, there has been no shortage of investigations into the air traffic system. Both internal and external studies have produced consistent findings. The Jones Report of 1984, found traffic saturation exceeding the capabilities of an inadequately staffed, inexperienced workforce beset by declining morale. [3] The Government Accounting Office in March 1986 released the results of a year long study which claimed that controllers were overworked and not receiving adequate training, overtime use was excessive, and morale was declining. [4] The American Federation of Government Employees conducted a telephone survey of air traffic controllers and found the two most cited problems are inadequate staffing and inexperienced controllers. [5]

The consistency of these criticisms is unmistakable. The simultaneous growth in traffic since deregulation and loss of an experienced workforce in the PATCO strike have drastically upset the balance of the staffing to workload ratio. Perhaps to some extent, that upset has in turn contributed to the morale problems.

As consistent as the critics are, they do not seem to be overstating the case. Five years after the PATCO strike, the ATC workforce seems to be nearing recovery very slowly. In July 1981, 16,244 air traffic controllers were employed by the FAA. As of February 28, 1986, there were 13,958. [6] What is more critical is the shortage in fully qualified controllers. In 1981, 13,200 controllers, 80% of the total, were full performance level (FPL) controllers. Today there are only 8,673 FPL controllers (62%). The remainder are developmentals in training or Air Traffic Assistants (ATA's) who perform flight data functions. The FPL percentage varies from facility to facility. San Francisco International Tower, for example, has 100% FPL staffing, while Oakland Center has only 38%. In general, terminal facilities have a higher percentage of FPL's than en route centers, and the busiest facilities have the lowest percentages. [7] This of course exacerbates the staffing to workload problem and magnifies the effect on the entire system.

While staffing remains low, demand continues to grow. Nearly 38 million instrument operations were handled by FAA facilities in 1984--only 400,000 short of the prestrike high reached in 1980, and well ahead of the 32 million handled in 1982. This volume is further complicated by the growth of commercial operations. While general aviation operations are more than 3 million below the 1980 levels, air carrier and air taxi operations are up nearly 3 million. Thus, a significant portion of the IFR demand has switched categories from general to commercial. [8] The scheduling patterns of the commercial carriers have also undergone change since deregulation. While airlines have long scheduled arrivals and departures in clusters during the most popular travel hours, the growing popularity of "hub and spoke" operations has intensified the peaks and valleys of traffic flow in and out of airports, [9] further straining the thin staffing.

In order to meet this demand, controllers are working longer hours, and spending more time on control positions. In fiscal year 1980, the FAA used 377,000 hours of overtime (approximately 23 hours per controller), at a cost of $8.1 million. In the 1985 fiscal year 908,000 hours were used (approximately 63.5 hours per controller) and cost $28 million. [10] As one supervisor has said, "There are just so many six-day work weeks in a person."[11]

Those days are growing longer, too. Supervisors and managers polled in the GAO study felt that only three hours of an eight hour shift should be spent on a radar position. The rest of the shift should be filled by time on non-radar positions, training, rest breaks, etc. [12] Before the strike, controllers were spending 4 to 4 1/2 hours on radar. In 1984, the time was up to 6 to 6 1/2 hours. [13] In addition, supervisors are spending an average of 35% of their time on positions, leaving their supervisory duties unfulfilled.[14]

Despite these pessimistic figures, the air traffic system remains safe and appears to be efficient. While average daily operations at centers increased 3.15% and 2.7% at towers in 1985, operational errors were down more than 25% and average daily delays were down 17.4%.[15] And since 1981, no accident involving passenger planes has been attributed to controller error.[16] The critics acknowledge this, but add that the margin of safety is being stretched increasingly thin and recommend restrictions be placed on traffic growth until staffing goals are reached.[17]

Technological changes are coming which will alleviate much of the workload-staffing problem. Historically, technological improvements have allowed controllers to handle more aircraft and maintain narrower separation minima. This has held true for the introduction of radar in the 1950's, secondary radar in the 1960's, and automated radar displays in the 1970's.[18] The FAA's National Airspace System Plan (NAS Plan) proposes even higher levels of automation to increase safety, personnel productivity, and system capacity. While meeting the demands of increased traffic, advanced processing and display systems will reduce the required staffing by one-third by the year 2000.[19] Some data transmissions between the ground and aircraft will be made by Mode S transponder rather than voice, further reducing controller workload.[20]

But these advances are middle to long range solutions. In the meantime, the remaining alternatives are restricting traffic or increasing staffing; the former being the more distasteful choice from both economic and political perspectives. So the FAA prefers the latter and plans to hire 500 new controllers in fiscal years 1986 and 1987.[21] But the attempts to reach staffing goals are being complicated by higher than expected attrition rates in the ATC training program. New controllers must go through 12 to 15 weeks of training at the FAA Academy in Oklahoma

City followed by two to five years of on the job training (OJT) at their field facilities. The Academy training is designed to screen out those students who lack the requisite talents to become controllers and, thus, send only the most likely candidates to the field.[22] During the five yeras prior to the strike, the failure rate averaged 30%. Since 1981, Academy attrition has been nearly 50%. This is some 15% higher than expected, largely due to fewer students entering with prior military ATC experience.[23]

Attrition on the input end of the pipeline is compounded by attrition at the output end as well. Approximately 2,700 controllers--20% of the total--are eligible to retire.[24] Currently, new controllers entering the FAA are barely keeping up with those leaving. As of September, 30, 1985, the controller workforce numbered 13,998; as of February 28, 1986, the total was 13,958. The number of FPL's has grown from 8,315 to 8,673 over the same period--a very slow increase.[25] But this maintenance level could deteriorate rapidly. A proposal before Congress would change how federal retirement income is taxed. Should such a change come about, 80% of the controllers and 82% of the supervisors eligible to retire say they would do so. This would set the FAA recovery effort on its ear. But whether or not a flood of retirements hits the system, the present maintenance level inflow is inadequate to meet staffing goals. Several solutions are being discussed.

Some in Congress, led by Representative Guy V. Molinari (Rep.-NY) believe "there is only one source (of)...trained, experience controllers...,"--the fired PATCO controllers--and the FAA should tap that source. But this solution leads to its own set of problems. First, those ex-controllers have been "off the boards" for nearly five years, and would require a good deal of retraining. They are not, therefore, an immediate source. But more important is the effect their return would have on the controllers who stayed on in 1981.[26] In a survey taken after the strike, 89% of the controllers questioned were opposed to unconditional rehiring of the strikers. After the often bitter and abusive picketing at ATC facilities, many controllers would be uncomfortable at best working with rehired strikers, and morale could be expected to fall further.[27]

The FAA has implemented several programs of its own to help alleviate the problems. In February 1986, a cross-option program was instituted which provides incentive for controllers to transfer from terminal facilities to the more understaffed enroute centers, and some 500 controllers have already volunteered to participate. But this may become a case of "robbing Peter to pay Paul" if terminal staffing is sacrificed.[28]

A second innovation is currently underway. Training and automation functions at the en route centers are being contracted out to private industry in an effort to reduce non-control staff positions. This will return qualified personnel now holding staff positions to operational positions.[29]

But these are all short-term measures for what is a long-term problem. What is needed is a plan to build a larger, better trained workforce which will reduce workload and resultant stress and allow supervisors to return to supervisory duties. This in turn would help to improve some of the FAA's morale problems and improve efficiency.[30] And the only way to do that is to hire and train more controllers.

But if the solution is that apparent and that easy, why hasn't it been done? The answer lies in some problems inherent in training controllers and in some problems in the FAA's technical training program.

An air traffic controller is very much an information processor. The core skills involved are the acquisition and interpretation of information, the formation of a three-dimensional mental picture of the situation, the development of a decision, and the communication of that decision to the pilot. These skills have remained fairly stable despite technology and workload changes.[31] The difficult tasks for a controller are planning rather than performance tasks, and require cognitive more than psychomotor skills.[32] These skills must be overlearned to become automatic, which will lead to reduced reaction time, reduced effort and fatigue, increased smoothness, and increased resistance to stress.[33] This involves a type of processing which is automatic and requires extensive training to develop.[34] This training is expensive--approximately $175,000 in direct and indirect costs to provide a fully trained controller.[35]

Futhermore, air traffic control is a high performance skill. Besides requiring extensive training, many people fail to develop proficiency.[36] Not everyone is suited to the task. While the requisite talents are not necessarily rare, not everyone possesses them. This is the root of the attrition in ATC training. Given the high costs involved, the FAA has expended a great deal of effort to identify and eliminate candidates lacking those talents. In 1950, aptitude testing was initiated to screen out unlikely candidates. In 1960, the Civil Aeromedical Research Institute (Research was later dropped from the name) was established and it has since been the body responsible for collecting and analyzing data on training performance. CAMI continuously evaluates the effectiveness of and modifies as necessary the aptitude testing.[37] The test in use since October 1981, is fairly predictive of training success. Dr. Carol Manning, a CAMI personnel research psychologist says "there is a significant relationship" between the aptitude test score and success at the FAA Academy.[38]

CAMI has also conducted studies of biographical data collected on incoming students to further identify factors relating to success in the Academy. Age is the strongest factor identified--the older a person is when entering the Academy, the less likely he is to succeed. While prior ATC experience is a signficant factor, other non-ATC aviation experience is an unreliable indicator. Level of education does not relate to success, but academic achievement in high school appears to be related.[39] Based on this informtion the FAA has set limits on aptitude test scores and age (30 years) for newly hired controllers, and does not require education beyond a high school diploma.

Once hired, the new controller enters a centralized training program at the FAA Academy that has a dual purpose--provide the trainee with the knowledge required for field training, and to again screen the trainees so that only those demonstrating aptitude are passed on the the field facilities.[40] Graduates then go to their facilities for one to two years of on the job training and return to the Academy for radar training after certifying in the tower cab at terminal facilities and on non-radar positions at en route centers. After 17 days of radar training, they return to their facilities for radar OJT, finally reaching FPL status after a total of two to five years of training.[41]

This is a long, difficult process made even more difficut by weaknesses in the training system. Some of these are long-standing problems, others are a result of the pressures to rebuild the system quickly. Many of them are recognized by the FAA and they are addressed in the Air Traffic Management Plan (the personnel equivalent of the NAS Plan).

Training personnel confront a confusing proliferation of directives with often seemingly contradictory requirements. The OJT program suffers from a lack of standardization. The content of some courses is outdated. Equipment deficiencies limit realistic training--the military spends three weeks training in tower cab simulators, while the FAA uses table top airport models.[42, 43] Solutions to these problems are subject to budget constraints, but attempts are being made to address them. Recent changes to the Academy program are designed to perform more training at the Academy and thereby relieve field facilities of some of the OJT burden. Also, more emphasis is being given to placing new trainees in facilities based on their performance at the Academy, thus improving their chances of success and reducing "wasted" training in the field.[44]

Hiring and training more controllers, then, is not quite as easy as it sounds--nothing ever is. Since hiring is based on placement on the Office of Personnel Management register, and placement on the register is based largely on aptitude test scores, hiring more trainees means hiring candidates with lower scores. Experience indicates that this will increase the attrition rate so that proportionately even more trainees must be hired to increase the output of trained controllers; and this runs up against the wall of budget cuts.

Since trainees with prior ATC experience generally fare better in the Academy, the next alternative is to hire more of them--and that is, in fact, what the FAA has done in the past. But that pool of former military controllers has diminished over the past fifteen years.[45] Furthermore, not all ATC experience is equal. Former military controllers with ratings only but no operational experience and those with only VFR operational experience tend to do no better than trainees with no experience,[46, 47] further reducing the size of the pool.

Therefore, this source is simply not adequate to the increased staffing needs.

The problem, then, appears to be two-fold: first, how to increase the capacity of the training pipeline and second, how to reduce attrition so that more candidates entering the pipeline come out as FPL controllers.

Increasing capacity within the FAA's training program will be extremely difficult in the age of Gramm-Rudman-Hollings. All federal agencies are being forced to cut programs and reduce personnel. Since ATC operational functions must take precedence, and administrative functions can only be cut so far, training programs will surely suffer some cut backs. Thus, the FAA may need to consider increasing training capacity externally and finally turn to the colleges and universities for more direct support in training controllers.

THE ROLE OF AIRWAY SCIENCE

One of the "larger purposes" of the Airway Science Program was to develop a common recruiting source for federal, state, and private aviation employers,[48] and the FAA has stated an intention to evaluate the program to determine its ability to satisfy air traffic requirements.[49] But education in itself does not improve the success rate in ATC training. In fact, college graduates have a higher attrition rate than any other group based on level of eduction (30.9%). This applies equally to those who listed aviation related courses of study.[50]

This seems to bode ill for the prospects of assistance from the Airway Science Program. Experience would seem to indicate that a college degree, even one in aviation, is of little help to the controller trainee. However, most aviation degree programs have typically concentrated on either professional pilot training or aviation management. Few programs have included air traffic control as more than a course or two within other concentrations. Those schools which have included ATC as a concentration have been limited to VFR tower training due to the non-availability of radar simulators. The Airway Science curriculum echoes this tendency, offering only a three credit course in ATC.

For The Airway Science program to contribute appreciably to improving ATC staffing, the curriculum will need revision. The single ATC course must be expanded into a separate concentration in air traffic control which would include several courses in advanced ATC theory and procedures. The curriculum could be designed to include the academics now taught at the FAA Academy. Program graduates would need to attend the Academy only for a comprehensive examination to ensure a base of requisite knowledge, followed by the screening portion of the present Academy program. These trainees would thereby spend four to six weeks at the Academy as opposed to the current twelve to fifteen weeks. Furthermore, the advanced ATC courses should be designed to include practice in the control procedures used in the screening laboratory. Evidence suggests that such practice helps.

Since the late 1960's, the FAA has offered a Predevelopmental Program as part of its "Upward Mobility" effort. This program provides a year of training to help women and minorities "acquire the necessary training and experience to enter the ATCS developmental training program." During Phase II of the Predevelopmental Program, students are taught basic aviation and air traffic--very much the same material covered in the present Airway Science curriculum. Further training, including 11 weeks of practice for the non-radar control lab used in the Academy screening, occurs at selected field facilities.[51]

Data collected by CAMI indicate that Predevelopmental graduates have a 5 to 10 percent better than average pass rate in the non-radar lab.[52] This would seem to indicate that if a student is prepared with specific training in ATC he is more likely to succeed in the Academy training. Such preparation is likely to be nearly as useful to the student as ATC experience. It would seem to follow that a well-designed curriculum which included laboratory courses in air traffic control skills would provide excellent preparation for the FAA Academy program and appreciably improve the student's chance of success. In addition, such courses would serve as a screening process themselves, as some students discover they are unsuited to or simply dislike ATC.

Non-radar laboratories are relatively inexpensive and simple to set-up. They require, at the minimum, flight progress strips and holders to record traffic information, a simulation area airspace chart, a clock, and a board to hold the strip-holders. The instructor can respond to the student's "transmissions" or other students can act in the role of pilot.

Radar laboratories are also no longer out of the reach of university budgets. Radar simulators with a high degree of realism are increasingly available at reasonable cost. These systems are not realistic equipment trainers--they typically run on standard microprocessor terminals. But the simulated radar presentation and operational characteristics are very realistic, enabling the student to learn and practice the cognitive and planning skills required. The psychomotor skills of setting-up and using a particular type of radar console is appropriately learned on the job.

With such equipment available at reasonable cost, a university can develop a lab for advanced ATC courses which would be capable of teaching all the skills now taught in the FAA Academy. Standardization could be ensured by periodic on-site program evaluations by FAA personnel and by evaluations of graduates' performance. In addition, a radar laboratory would be a valuable addition to the basic ATC course presently in the curriculum, providing those students going on to other aviation career fields more insight into and understanding of the ATC system. Thus they will be better able to see the implications of their decisions and policies for the ATC system and of system changes for their operations.

The exact content of an air traffic control curriculum can be developed only after an in depth evaluation of the existing ATC training program curriculum and an analysis of its strengths and weaknesses. But some starting points can be suggested. The core Airway Science curriculum would, of course, be retained.

The forty semester hours in the area of concentration might include:

History of ATC	3 hours;
Control Tower Operations	3 hours;
Non Radar Lab	4 hours;
Radar Lab	5 hours;
Meteorology	3 hours; and
Weather Reporting and Analysis	3 hours.

The remaining twenty nine hours would consist of courses in sociology, psychology, communications theory, and management.

Also, it is imperative that students be evaluated early in the program to ensure that they are medically qualified for ATC positions, and that they be required to take the OPM aptitude test before committing themselves to the concentration. Those students not meeting medical standards or scoring low on the aptitude test would be counselled by their faculty advisors to enter one of the other areas of concentration.

In effect, the development of the concentration would serve to decentralize training. The program would act as a supplement to the FAA Academy, producing graduates with background equivalent to that of Academy graduates, and prepared to step into the field portion of the training program after a brief orientation and evaluation.

Expanding the role of the universities in this way offers several advantages. First, it would incrase the capacity to train air traffic controllers by opening a new avenue for that training. The Universities can become an external resource for the FAA, supplementing the number of controller trainees passing through the Academy and compensating for the diminishing pool of ex-military controllers. This could provide a consequential assist to the FAA's attempts to reach and maintain its staffing goals.

The decentralization of ATC training implicit in this proposal carries with it some advantages as well. As the technological advances in ATC, and aviation in general, proceed apace, innovative ways of employing that technology will be needed. Such innovation is fostered by decentralization since more minds are at work on similar problems. Innovation can also be expected in the training approaches, techniques, materials, and equipment used. Application of the expertise and resources of the universities to the field of ATC can be expected to generate new ideas and new methods.

Certainly such decentralization and innovation carry the seeds of a new problem--loss of standardization. But a quality assurance program can be developed which would ensure standardization and review of new approaches and techniques.

The improved training techniques and the strong academic basis in the Airway Science curriculum could also be expected to improve the quality of the employees entering the FAA. With their background in management and a wider understanding of the aviation industry, they would have the potential of being more effective staff specialists and managers as they progress in their careers. They would be better equipped to implement the technological changes to come and better able to relate to and work with professionals in other aviation fields.

Finally, a partnership with the universities is in line with the trend toward increased government use of privatization. Privatization can be a cost effective means of accomplishing support functions, such as training, by relying on contracts with the private sector. Such a partnership with the universities can help the FAA meet its personnel needs in the face of increasingly restrictive budgetary contraints.

This proposal amounts to a significant change in FAA training policy. The agency has been reluctant to relinquish responsibility for ATC training to outsiders--and understandably so, given the nature of the job and the need to ensure quality. The safety and efficiency of the ATC system depends on a quality product--well trained, professional controllers. But that reluctance is giving way before the forces of budget cuts and the dilemma of seemingly perpetual staffing shortages. The system cannot remain both safe and efficient without some new source of personnel to man the positions in the system. The universities, through the Airway Science program, can become that source. The time for a marriage of interests and efforts seems at hand.

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AVIATION SAFETY COURSES WITHIN THE COLLEGIATE AVIATION CURRICULUM

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RUNNING HEAD: AVIATION SAFETY COURSES

ABSTRACT

A review of current literature that identifies issues in aviation safety that can be addressed by collegiate aviation within the aviation curriculum. A survey of colleges and universities with existing aviation programs was conducted in May and June of 1986 that reveals the extent of aviation safety offerings within the present aviation curriculum. Definitions of aviation safety issues are suggested that identify the issues as individual topics of study that can be developed for inclusion within the aviation curriculum. The conclusion offers recommendations for additional research in the area of aviation safety courses and steps to be taken by collegiate aviation to improve aviation safety study within the collegiate aviation curriculum.

The expansion of aviation in the United States over the past eight years has had significant impact on the industry and on all who are associated with and support the industry. The growth in commercial aviation since passage of the Airline Deregulation Act of 1978 has resulted in increased public use of aviation transportation and an increase in the number of persons who aspire to a career in this growing and exciting field. This has resulted in a concurrent growth in aviation related education programs. Those postsecondary institutions with existing aviation programs have enjoyed increased enrollments and expanding programs while others have taken steps to begin new aviation related offerings.

It is during this time of growth that aviation educators would do well to take the time to examine where their programs are going and to assess the effectiveness of these offerings. By doing so, the mistakes that might otherwise be brought on by the pressures of demand can be avoided and changes in programs and curriculum can be implemented that will insure quality education for our graduates.

This paper examines one part of the aviation curriculum, aviation safety, with the intent of encouraging other educators to do the same. A review of current literature was conducted to identify issues in aviation safety that could appropriately be addressed in aviation program curricula. A survey was conducted of colleges and universities with existing aviation programs to determine what is being offered in the area of aviation safety. Definitions are suggested that delineate the various aviation safety issues as individual topics of study.

Finally, a conclusion is offered that makes recommendations for additional research in the area of aviation safety and for steps that can be taken by collegiate aviation to improve aviation safety study within the collegiate aviation curriculum.

Aviation Safety

The aviation industry is highly visible and open to public scrutiny. The media is quick to publicize even the slightest concern over the role that aviation plays in American society and its impact on the economy and gives even greater attention to issues of aviation safety. Aviation accidents play big on the evening news and newspapers, continually playing up concerns over such issues as the effectiveness of the Federal Aviation Administration's inspector force and the safety of the air traffic control system. Recent changes in the commercial aviation segment brought on by Deregulation seems to have the media concerned that competitive pressures may result in less attention and resources being devoted to the safety of the airlines. Yet, in spite of this, the record proves that all segments of the aviation industry are safer now than they have ever been in history.

Aviation safety statistics published by the National Transportation Safety Board show that the accident rate per 100,000 aircraft hours for all scheduled Part 121 carrier services has dropped from 0.767 in 1974 to 0.230 in 1985. The rate for commuter carriers has gone from 5.13 accidents per 100,000 aircraft hours in 1975 to 1.06 in 1985 while that for on-demand air taxis has dropped from 6.02 to 4.89 during the same time. The accident rate for general aviation operations has also declined from 15.2 per 100,000 aircraft hours in 1974 to 8.56 in 1985 (see Table 1). (National Transportation Safety Board [NTSB], 1981) The United States Air Force proudly reports the lowest accident rate ever was achieved in 1985 at 1.6 accidents per 100,000 hours flown. This in comparison to a rate of 506 accidents per 100,000 hours in 1922 (the first year records were kept) and rates of 2.9, 2.3, and 1.7 in 1979, 1982, and 1983, respectively. (Rhodes, 1986)

Insert Table 1 About Here

The historical improvement in aviation safety has been the result of advancing technology being applied to every facet of aircraft design, maintenance and operation, as well as improved systems support and government regulation. Considerable resources and large sums of money were spent over the decades to acquire technologically improved aircraft and to establish the traditions of standardization, approval, and modification in the light of operational experiences. (International Civil Aviation Organization [ICAO], 1984) Regulatory bodies such as the Federal Aviation Administration have evolved with the industry and have intensified their surveillance and control of aircraft design, manufacture, maintenance, and operation. The air traffic control facilities and other supporting systems are in a continual cycle of improvement and expansion. Thus, aviation safety has improved to the

TABLE 1

Aviation Accident Rates Per 100,000 Aircraft Hours for Scheduled Part 121 Services, Commuter Carriers, On-demand Air Taxis, and General Aviation from 1974 through 1985.

Year	Scheduled Part 121	Commuter Carriers	Air Taxis	General Aviation
1974	0.767	****	****	15.2
1975	0.572	5.13	6.02	13.9
1976	0.394	3.63	5.07	13.2
1977	0.362	3.83	4.78	12.9
1978	0.348	4.68	5.58	12.1
1979	0.358	4.44	4.34	9.9
1980	0.221	3.23	4.70	9.9
1981	0.380	2.50	5.42	9.5
1982	0.234	2.08	4.08	10.0
1983	0.275	1.23	4.55	9.4
1984	0.190	1.20	****	****
1985	0.230	1.06	4.89	8.56

NOTE: **** indicates data not available. From National Transportation Safety Board, Annual Report to Congress, 1985. June 1, 1985, Place of Publication: Washington, DC point where the industry as a whole can brag about being one of the safest modes of transportation available to the public.

There is no doubt that today's aviation industry enjoys the best safety record in history. Even the tragic accidents in the U.S. and abroad during 1985 cannot overshadow the fact that a high level of safety has been achieved in all segments of the aviation industry. However, statistics can be misleading. A study of the world fleet of air carrier jet aircraft from 1960 to 1981 by the Flight Safety Foundation, Inc. acknowledges the improvement in accident rates but also points out that the rates have leveled off since the early 1970's. This report states in part that, ". . . there has been a general stabilizing of the accident rate in the past decade of two to four accidents per million departures with the probability that, if no changes are introduced, this rate will remain essentially unchanged." (Bates & Wood, 1982)

This indicates that the traditional approaches to accident prevention, as valuable as they have been, are not enough if further improvements are to be made in aviation safety. The Flight Safety Foundation, Inc. states in their report that, "The data tells us that our airframes systems and powerplants, as well as maintenance, air traffic control, and weather factors have reached a high level of reliability and that the human factor is still the prevalent factor in the existing accident rates. Operator error has remained at over 70 percent." (Bates & Wood, 1982) The International Civil Aviation Organization echoes this statement in their Accident Prevention Manual where they say, "In the past, the enforcement of regulations to enhance aviation safety was usually successful enough to be considered the only method needed. However, in recent years the accident record has not shown significant improvement. This has led to the belief that additional 'non-regulatory' accident prevention measures are needed." (ICAO, 1984)

Robert Dippi reported in the March-April 1983 issue of Illinois Aviation that ". . . human behavior is the number one cause of flying accidents. Between 1973 and 1977, pilot-in-command errors were the causal, or related, factor in 83 percent of all general aviation accidents and 88 percent of the fatal ones." (Dippi, 1983) The U.S. Air Force also recognizes these facts by stating, "The solution to lowering the aircraft mishap rate even more lies in the operations area, or, more specifically, in the human factors that contribute to accidents." (Rhodes, 1986)

Unfortunately, the study of human factors has been limited and its application to aviation safety is often overlooked. For example, pilots are provided with considerable training in operating an aircraft, the mechanical aspects of the machine, the hazards of weather, etc. But little attention is given to the person's own behavior, attitudes, limitations, vulnerabilities, and motivation. (ICAO, 1984) Federal Air Regulation Part 141 requires that private pilots have 35 hours of ground training that includes, ". . . the safe and efficient operation of airplanes, including high density airport operations, collision avoidance precautions, and radio communication procedures." (Federal

Aviation Administration, 1974) The same regulation sets additional requirements for the more advanced ratings, but none of them specifies the inclusion of human factors training. When human factors are considered, their scope and application is often limited to pilots. (ICAO, 1984) The pilot is only one part of the aviation system and constitutes only one factor in the total human behavior equation. Mechanics, meteorologists, designers, manufacturers, air traffic controllers, and managers all have input to aircraft operations and are subject to the same human behavior factors. Man has succeeded in designing and building highly sophisticated, technologically advanced aircraft capable of achieving impressive safety records, but the limiting safety factor is man himself.

There are other aviation safety issues, some of which are related to human behavior and some that are not. They include design and engineering, systems design and organization, management, safety program management, and accident investigation. Although all are related and none stand alone, each is unique enough to be considered a separate topic.

Human Engineering is the title given to that aspect of aviation safety that deals with design and engineering. The military began to realize the importance of human engineering during World War II. The services were experiencing examples of equipment that was designed in such a way that it became a factor in degradation of performance. The military learned that, in many instances, it was the design of the equipment that was the causal factor in incidents and accidents. This led to military specifications requiring military equipment contractors to "human engineer" their products and created a job market for human factors specialists. Human engineering is described as, ". . . an interdisciplinary technology . . . its concern is with the systematic adaption of machines, tasks, and environmental conditions to the attributes of people." (Bond, Bryan, Rigney, & Warren, undated)

Systems Design and Organization is a function of management. Its concern is with proper design of a system or organization so as to insure effective lines of communication, command, and control. The recent shuttle disaster has been attributed, at least in part, to poor systems design and organization.

Management, as a topic of aviation safety, is concerned with management procedures and techniques and their effect on the worker's ability to perform appropriately, management decision processes and their effect on aviation safety, and with management attitudes and philosophies. Its concern is with the entire realm of management and supervisory techniques such as motivation, hiring practices, task assignment and evaluation along with decision modeling, authority, and accountability. (Wood, 1979)

Safety Program Management addresses the design and placement within the organization of a staff department or individuals with prime responsibility for researching and advising management on safety issues. It includes research and information gathering systems as well as certain techniques such as safety audits and surveys, safety training, hazard reporting systems, and safety directives. (Wood, 1979)

Accident Investigation is an after the fact process designed to identify causes and make recommendations for prevention. It would be nice if this task were never required, but it does perform a necessary and vital function. As a separate topic of aviation safety it includes pre-accident planning, organizing to investigate, investigative procedures, analysis, findings, recommendations, and reports. (Wood, 1979)

Although human behavior appears to be the prime limiting factor in aviation safety and one deserving of special consideration by the academic community, there is plenty of room for consideration of all of the other aviation safety issues. A particular curriculum, depending on its primary concentration, may properly include any one of all of these issues.

Aviation Safety Course Survey Results

A survey was conducted in May and June of 1986 to determine the extent to which colleges and universities who offer aviation related programs are addressing safety within their curriculum. Survey questionnaires were mailed to approximately 250 institutions and responses were received from 76 of them. The survey instrument and a summary of the responses are included as an Appendix to this paper.

The survey did not ask schools to list elective course offerings in aviation safety but did ask each respondent to list, by course number, the title and credit hours of those courses offered and taught at least once each academic year that have a content specifically dedicated to aviation safety. Respondents were also asked to provide a course description and course outline for each course listed. Out of 41 two year institutions who responded, 7 of them listed such courses as being required for their aviation related AA or AAS degrees. Responses were received from 35 four year schools. Among these, 13 reported required aviation safety courses and 5 reported elective aviation courses.

Respondents were also asked to indicate their academic offerings by degree and title, if they owned/leased and operated their own aircraft for flight training purposes, and if they owned/leased and operated their own aircraft simulators for flight training. Respondents had been asked to list their required aviation safety courses with the appropriate degree, but only about half of the respondents did so. Therefore, it was impossible to report the data with each aviation safety course as being required for a specific degree. Table 2 is a listing of the aviation safety course offerings as they were reported on the survey by the respondents.

Insert Table 2 About Here

Certain conclusions can be drawn from the data. The most obvious being, of 41 two year schools who responded, only 7 reported offering a course with a content specifically dedicated to aviation safety as a requirement for degree completion. Of the 35 four year schools who responded, only 13 reported offering a required aviation safety course.

Before going any further it should be understood that the data received on the survey does not indicate that our colleges and universities are not teaching aviation safety.

TABLE 2

Aviation Safety Course Offerings as They Were Reported by Respondents to the Aviation Safety Course Survey.

Course Number	Credit Hours	Course Title	Required For:
		Two Year Schools	
AT233	3 SH	Aviation Safety	AAS
APT308	3 QH	General Aviation Safety	AAS
AERO40	3 SH	Aviation Safety and Accident Investigation	AA Comm. Pilot
ASC2470	3 SH	Flight Physiology/Psychology	AAS
AERO27	3 SH	Aviation Safety & Human Factors	AAS Comm. Pilot & Air Traffic Controller
AERO210	3 SH	Aviation Safety	AAS
218	3 QH	Human Factors in Flight Operations	AA Pro Pilot
		Four Year Schools	
AV349	3 SH	Aviation Safety/Accident Investigation	BS Flight & Adm/Mngmt
205	2 QH	Aviation Physiology & Safety	BS Flight
4010	3 SH	Aviation Safety	BS Flight & Adm/Mngmt
PR&T4050	3 SH	Aviation Safety	BS & MS
CAV372	3 SH	Aviation Safety	BCA

(Table Continued)

TABLE 2 - Continued

Course Number	Credit Hours	Course Title	Required For:
		Four Year Schools - Continued	
AM405	3 QH	Aviation Safety	BS Prof Flight & Awy Science
AS408	3 SH	Flight Safety	AAS & BS
AS409	3 SH	Aviation Safety	BS
AE308	3 SH	Flight Safety	BS Av Mngmt, Flight, & ATC
BS106	3 SH	Human Factors in the Cockpit	BS Av Mngmt, Flight, & ATC
410	2 SH	Aviation Safety	BS
411	3 SH	Accident Investigation	BS
	2 SH	Aviation Safety	BS Awy Science
		Four Year School Electives	
205	2 SH	Aviation Safety	BS
307	3 SH	Flight Safety	
A03040	3 QH	Aviation Safety	BS
A03041	3 QH	Search, Survival, & Rescue	BS
AVI140	5 QH	Aviation Safety	AS Adm/Mngmt

NOTE: A total of 25 aviation safety courses were reported by a total of 21 schools with some schools reporting more than one course. Seven out of forty-one two year schools reported required aviation safety courses. Thirteen out of thirty-five four year schools reported required courses and five of them reported electives only.

It should also be noted that this paper is not intended to imply that aviation safety is not being taught. Safety has always been an integral part of all aviation related curriculums. A number of comments were received from respondents that indicated their concern with the implications of the survey. These comments are included in the summary of the survey which is included as an Appendix to this paper. The one comment received that probably best describes the safety content of the current aviation curriculum states, "When are we really not teaching safety?"

One unexpected conclusion of the data is that, of those schools offering one or more of the Airway Science concentrations, they do not all offer a required course dedicated to aviation safety. Since an aviation safety course is required for approval of an Airway Science Curriculum, it can only be assumed that this requirement is being met by including aviation safety as a topic within other courses.

An attempt was made to distinguish between those schools who owned/leased and operated their own aircraft and simulators for flight instruction purposes and those who did not in relation to aviation safety course offerings. As it turned out, a clear majority of the four year schools who reported degree requirements that included a dedicated aviation safety course also reported owning/leasing their own aircraft and simulators. However, the exact opposite was true for two year schools.

A total of 20 required courses specific to aviation safety were reported by the 76 respondents. Of these, 10 were not reported in relation to a specific degree title. However, of the remaining 10, 9 were reported as being required for completion of a flight degree, 3 were reported as required for an air traffic control degree, and 4 for administration/management degrees. This, along with other comments received on the survey, indicates that most respondents associate aviation safety courses with flight and have not considered them for inclusion in other aviation related programs.

The final conclusion to be drawn is taken from the aviation safety course descriptions and course outlines provided by the respondents. Over half of the courses reported are titled "Aviation Safety" yet a review of the summary of the course descriptions, goals, and course topics indicates considerable disagreement among the respondents as to what is considered as appropriate for a course in aviation safety. A comparison of those courses related to a specific degree title such as flight or air traffic control also reveals disagreement in course descriptions, goals, and topics. This suggests a lack of consensus within collegiate aviation as to a definition for aviation safety courses and the appropriateness of various safety topics to different aviation programs.

There is no doubt that colleges and universities who offer aviation programs include safety as a topic within their programs of study. Some are required to do so by federal regulation such as FAR Part 141. Many of the respondents offered comments to the effect that safety was a prime concern to them and is being emphasized throughout their aviation programs. But there is doubt as to whether or not enough consideration is being given to individual safety topics of study; especially in light of current aviation safety issues. The human factor issue has been of prime concern to the aviation industry since it was identified as a block to achieving further improvements in the aviation safety record. Other, equally important aviation safety issues have surfaced that should be considered as a prime concern to those who would manage or supervise aviation operations. It should also be recognized that aviation safety is the responsibility of all aviation professionals and not just pilots and air traffic controllers. Finally, collegiate aviation appears to be lacking in guidelines that would help to determine the appropriateness of various aviation issues and topics to each of the aviation areas of concentration and to the various aviation related degree programs.

Aviation Safety Issues and Topics

A review of aviation safety research and literature reveals a number of safety issues that are readily identifiable as individual topics of aviation safety. Nearly all of these topics are broad enough in their scope that each could be developed into individual aviation safety courses and some could be combined to form aviation safety disciplines. Each aviation concentration (flight, maintenance, air traffic control, engineering, etc.) is unique and it would not be appropriate to include all aviation safety issues and topics in every aviation concentration curriculum. However, aviation issues and topics can be individually defined in such a way as to make them readily distinguishable so that judgements could be made as to their appropriateness for inclusion in each aviation concentration and in a way that would allow tailoring each topic to the specific needs of each concentration.

The following is an attempt to identify at least the more common aviation safety issues and to define them as specific topics. Each definition is intended to be specific as to issue but broad in content so as to avoid specifying their inclusion in any one aviation concentration or to imply judgements as to their appropriateness for inclusion in specific curriculums. Each is also intended to be broad enough in scope that their content could be tailored to meet the needs of a particular aviation concentration if judged to be appropriate for inclusion.

Aviation Safety Regulations - Federal, state, and local regulations designed to control and direct the actions of individuals involved in aviation maintenance, management, and operations in such a way as to insure the safety of the operation. The specifics of the regulation as to content, intent, application, and enforcement are included.

Mechanical Aspects of Aviation Safety - The use and control of tools and machines in a manner that gives consideration to maintenance and operator skills and techniques, mechanical and design limitations, and their appropriate application to task accomplishment in a way that insures the safety of the operation.

Aviation Weather - The atmosphere as an operating medium and those operational skills and techniques necessary to insure safe operations within this medium. The identification and avoidance of atmospheric hazards is included.

Aviation Physiology - The effects of aviation operations on the human body, the biological limitations of the human being as they relate to aviation, and life-style habits that enhance a person's ability to operate in the aviation environment.

Aviation Psychology - Human behavior as it relates to man within the aviation environment. Including, but not limited to, motivation, emotion, self discipline, risk perception, judgement, and decision making. Specifically intended to include all aviation occupations and not limited to flight operations.

Human Relations in Aviation - The interactions among people within the aviation environment. To include team or crew interactions, the supervision and management of people within an organization and concepts such as communications, group dynamics, peer pressure, responsibility, accountability, authority, and discipline.

Aviation Safety Management - Management's responsibility for safety and accident prevention within an aviation organization. The concepts, procedures, and techniques of resource allocation, organizational design, decision modeling, task assignment, delegation of authority and responsibility, establishment of organizational goals and priorities, and risk management are included.

Aviation Safety Program Management - The organizational staff function responsible for designing aviation safety programs, conducting safety surveys, inspections and investigations and for advising management on matters related to safety. It includes safety education and training, cost analysis, reports and reporting systems, data collections and analysis, hazard identification and elimination, incentive and award programs, motivational concepts, safety directives and policies, and the techniques for conducting safety audits, surveys, and inspections.

Aviation Accident Investigation - The knowledges, skills, procedures, and techniques employed in aviation accident investigations for the purpose of identifying and making recommendations for the elimination of causes and hazards. Includes pre-accident planning, organizing to investigate, investigative techniques, analysis, findings, and recommendations.

Human Engineering - The knowledge, skills, procedures, and techniques of design and engineering that result in the systematic adaptation of machines, tasks, and environmental conditions to the attributes of people. An interdisciplinary topic that includes, among others, psychologists, anthropologists, mathematicians, physicists, and engineers.

Conclusion and Recommendations

Collegiate aviation has expanded within the last eight years to meet the demands of those who wish to pursue a career in the expanding aviation industry. As colleges and universities implement new programs and expand existing offerings in response to this demand, consideration should be given to the appropriateness and effectiveness of these offerings. One area of study that deserves the attention of the collegiate aviation faculty is aviation safety. Although safety has traditionally been an integral part of the aviation curriculum, current issues in aviation safety suggest that this area of study should be expanded beyond the traditional approaches.

The subject of safety within aviation has expanded beyond compliance with regulations and the proper manipulation of mechanical controls and machines. Advancements in design and technology have resulted in significant improvements in aviation safety, but these approaches appear to have reached their limits for the further elimination of aviation hazards and accidents. The aviation industry is now turning to human factors in the search for additional improvements in the aviation safety record. This concern includes physiology, psychology, human relations, safety management, safety program management, accident investigation and human engineering as well as the traditional approaches to aviation safety. The focus has expanded beyond the air crew as the primary determinants of operational safety to the role of mechanics, meteorologists, designers, manufacturers, air traffic controllers, managers, and others whose decisions and actions have an effect on the safety of aviation operations.

Survey responses from 76 colleges and universities who offer aviation related programs indicates that collegiate aviation has not given full consideration to aviation safety as a separate topic within the aviation curricula. The responding schools indicate their concern for aviation safety, but few have moved beyond the traditional safety emphasis within their programs. In addition, there does not appear to be a consensus of opinion within collegiate aviation as to the definition of aviation safety topics, nor is there agreement as to the appropriateness of specific topics to the various aviation curriculums.

A review of aviation safety literature reveals a number of aviation safety issues that can be defined as individual topics for the purpose of study and consideration for inclusion within aviation related curriculums. If agreement could be reached on the definition of these individual safety issues, that would serve as a guide to further agreements as to the appropriateness of each topic to existing and new aviation courses of study.

The following recommendations are offered as a means by which collegiate aviation might undertake additional research and studies of aviation safety for the purpose of developing guidelines for the inclusion of aviation safety topics within the various aviation related offerings and curricula. The intent is to encourage the aviation faculty to examine both their own programs of study and collegiate aviation as a whole to determine the appropriateness and effectiveness of current aviation safety courses of study.

The first recommendation is for the University Aviation Association to take the lead in encouraging further reviews and research into aviation safety as a topic of study within the collegiate aviation curricula. One way that this might be accomplished is to form a committee within UAA to undertake a study of aviation safety to further define the aviation safety topics and make recommendations as to their appropriateness to certain concentrations and curriculums. Another would be to encourage individual faculty members to involve themselves in research by coordinating and reporting their efforts.

Once data from individual research efforts has been analyzed and the committee recommendations have been given due consideration, the University Aviation Association could then develop expanded aviation safety course guidelines for inclusion in the UAA's aviation program accreditation requirements. An expansion of aviation safety course accreditation requirements beyond what is currently required for Airway Science Curriculum approval would result in the various safety issues being appropriately addressed throughout collegiate aviation's curriculum.

Certainly, no one can dispute the vital role that safety plays in aviation operations and the aviation industry. Improvements to the aviation curricula in the area of safety could lead to significant improvements in future aviation safety records.

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APPENDIX

Aviation Safety Course Survey. The survey instrument responses to the survey, a summary of reported safety course goals, descriptions, and topics, plus a summary of 'other comments' received on the survey.

AVIATION SAFETY COURSE SURVEY

^^^

NAME AND ADDRESS OF INSTITUTION

____

____

____

PERSON COMPLETING THIS SURVE
NAME: ______________________
TITLE: ______________________
PHONE: ______________________

Total number of respondents = 76

Type of Institution. 41__ Two Year ____ Four Year
Credit hour system. 24__ Semester 17__ Quarter

^^^

Please indicate by an "X" which of the following aviation related academic offerings are available at your institution.

	ASSOCIATE	BACCALAUREATE		MASTERS		
	DEGREE	MINOR	MAJOR	DEGREE	CONCENTRATION	PHD
A & P	20					
AVIONICS	4					
FLIGHT	26					
AIRPORT MNGMT	7					
ADM/MNGMT	13					
AIR TRAFFIC CONTROL	6					
FLIGHT ATTENDANT	5					
ENGINEERING	5					
AV SAFETY__	1					
AERO EDUC__	1					
AV DESIGN	1					
AV COMPUTERS	1					
AV ELECTRONICS	1					

Which of the following Airway Science concentrations are offered by your institution ? _3__ Airway Science Management _2__ Airway Computer Science ____ Aircraft Electronics Systems ____ Aircraft Systems Management ____ Aviation Maintenance Management

^^^

Please list by course number, title, and credit hours those courses offered by your institution and taught at least once each academic year that have a content specifically dedicated to aviation safety. Also, please indicate, by title, if the course is required for program completion.

COURSE NUMBER	CREDIT HOURS	COURSE TITLE	REQUIRED FOR (specify AA, AAS, BA, BS, Minor, or Concentration and Title)
____7 schools reported offering aviation safety courses.			AA = 2 AAS = 6

IF POSSIBLE, PLEASE ATTACH A COPY OF THE COURSE DESCRIPTION AND COURSE OUTLINE FOR EACH COURSE LISTED ABOVE.

Please use the following space to give a general description of the structure and requirements of each course listed above

(SEE NOTE 4)

_1____ (Y/N) If your institution does not now offer a course with a content that is specifically dedicated to aviation safety, are there plans to offer such a course within the next academic year ?

^^

Y = 12; N = 29 - 26 out of 41 report offering flight.
______ (Y/N) Does your institution own/lease and operate its own aircraft for the purpose of flight training ? (As opposed to contracting with an outside agency).

Please indicate the number and type of aircraft available for flight training through your institution. Include those available through contracts with outside agencies.
(SEE NOTE 1)
12/9_ Single Engine 6/7__ Twin Engine 0/0_ Turbo-Prop 0/1_ Jet
Other(specify) 1/0 Helo ______ ______ _____ _____ _____ _____

Y = 25; N = 16 - 26 out of 41 report offering flight.
______ (Y/N) Does your institution own/lease and operate its own aircraft simulators for flight training ? (As opposed to contracting with an outside agency).

Please indicate the number and type of aircraft simulators available for flight training through your institution. Include those available through contracts with outside agencies. ______ ______________________
______ _______(SEE NOTE 2)_______ ______ ______________________

Please check the flight ratings available through your institutions flight training offerings.
(SEE NOTE 3)
12/9 Private Pilot 12/9 Commercial 12/9 Instrument 12/6 CFI
10/6 CFI-I 4/1_ ATP Other(specify) 5/1 ME 2/2 ME-I ________
2/0 Rotorwing 1/1 SEA 1/0 AG Training

^^

NOTE 1 Numbers indicate; Those who reported that they DO own/lease and operate their own aircraft for the purpose of flight training/Those who DO NOT.

NOTE 2 The numbers and type of simulators listed were; 4 - ATC710; 5 - ATC510; 6 - ATC610; 1 - ATC810; 3 - Flightmatic 206; 1 - Flightmatic 204; 8 - GAT-I; 2 - AST300; 5 - Frasca 101; 1 - Frasca 100; 1 - Frasca 122

NOTE 3 Numbers indicate; Those who reported that they DO own/lease and operate their own aircraft for the purpose of flight training/Those who DO NOT.

NOTE 4 Course descriptions and other comments are summarized on a separate page.

AVIATION SAFETY COURSE SURVEY

NAME AND ADDRESS OF INSTITUTION

Total number of respondents = 76

PERSON COMPLETING THIS SURVEY
NAME: ____________
TITLE: ____________
PHONE: ____________

Type of Institution. ____ Two Year 35__ Four Year
Credit Hour System. 28__ Semester 7___ Quarter

Please indicate by an "X" which of the following aviation related academic offerings are available at your institution.

	ASSOCIATE	BACCALAUREATE		MASTERS		
	DEGREE	MINOR	MAJOR	DEGREE	CONCENTRATION	PHD
A & P	5	2	4			
AVIONICS	3	2	2			
FLIGHT	8	9	17			
AIRPORT MNGMT	6	4	7	1		
ADM/MNGMT	1	4	12	2	2	
AIR TRAFFIC CONTROL	1	2	5			
FLIGHT ATTENDANT						
ENGINEERING	3	3	11	8	1	5
AV SAFETY__	1			1		
AERO EDUC__	1	1	1	2		1
MAINT MNGMT		2	1			
AIR TRANSPORT ENGINEERING				1	1	

Which of the following Airway Science concentrations are offered by your institution ? _9__ Airway Science Management _7__ Airway Computer Science _4__ Aircraft Electronics Systems _12_ Aircraft Systems Management _6__ Aviation Maintenance Management

Please list by course number, title, and credit hours those courses offered by your institution and taught at least once each academic year that have a content specifically dedicated to aviation safety. Also, please indicate, by title, if the course is required for program completion

COURSE NUMBER	CREDIT HOURS	COURSE TITLE	REQUIRED FOR (specify AA, AAS, BA, BS, Minor, or Concentration and Title)
____18 schools reported offering aviation safety courses. (SEE NOTE 1)			
			REQUIRED AAS = 2 BS = 22 BCA = 1 MS = 1
		ELECTIVES BS = 5	

IF POSSIBLE, PLEASE ATTACH A COPY OF THE COURSE DESCRIPTION AND COURSE OUTLINE FOR EACH COURSE LISTED ABOVE.

Please use the following space to give a general description of the structure and requirements of each course listed above

(SEE NOTE 4)

_1____ (Y/N) If your institution does not now offer a course with a content that is specifically dedicated to aviation safety, are there plans to offer such a course within the next academic year ?

Y = 16; N = 19 - 26 total flight programs reported amoung 35 schools
______ (Y/N) Does your institution own/lease and operate its own aircraft for the purpose of flight training ? (As opposed to contracting with an outside agency).

Please indicate the number and type of aircraft available for flight training through your institution. Include those available through contracts with outside agencies.
(SEE NOTE 2)
16/4_ Single Engine 14/4_ Twin Engine 3/0_ Turbo-Prop 0/0_ Je
Other(specify) 1/0 Glider 0/1 Aerobatic_____ _____ _____ ____

Y = 20; N = 15 - 26 total flight programs reported amoung 35 schools
______ (Y/N) Does your institution own/lease and operate its own aircraft simulators for flight training ? (As opposed to contracting with an outside agency).

Please indicate the number and type of aircraft simulators available for flight training through your institution. Include those availabl through contracts with outside agencies. ______ ____________
______ _______(SEE NOTE 3)_______ ______ ______________

Please check the flight ratings available through your institutions flight training offerings.
(SEE NOTE 4)
17/7 Private Pilot 17/7 Commercial 17/7 Instrument 15/7 CFI
17/7 CFI-I 7/1_ ATP Other(specify) 5/0 ME 6/0 ME-I ________
1/0 B727 FE

NOTE 1 Respondents were not asked to list elective courses; only those required for degree completion. Course descriptions are summarized on a separate page.

NOTE 2 Numbers indicate; Those who reported that they DO own/leas and operate their own aircraft for the purpose of flight training/Those who DO NOT.

NOTE 3 The numbers and type of simulators listed were; 2 - ATC710; - ATC610; 1 - AST300; 3 - GAT; 2 - AST201; 1 - Vista Matic; 3 - ATC810; 3 - Frasca 141; 1 - Pacer; 1 - Frasca 1026; 1 - Frasca 1036; - ATC510; 1 - IFR Flight Synthetics; 1 - DC-8; 1 - B-727; 1 - B-707.

NOTE 4 Numbers indicate; Those who reported that they DO own/lease and operate their own aircraft for the purpose of flight training/Those who DO NOT.

NOTE 5 Course descriptions and other comments are summarized on a separate page.

The following is a summary of the responses recieved on the Aviation Safety Course Survey to the question, "Please use the following space to give a general description of the structure and requirements of each course listed above" and to the request for "a copy of the course description and course outline for each course listed above".

FOUR YEAR INSTITUTIONS:

Goals/Course Descriptions;

To introduce students to Aviation Safety...review of accident reports to understand the major cause factors and methods of prevention.

To provide an opportunity to research and prepare a comprehensive safety program for an aviation business.

The effect of flight on human physiology, including hypoxia, barotrauma, vertigo, fatigue, drugs, vision and preventive medicine with a review of accident reports and other materials related to causal factors in aviation accidents and aviation safety.

... an introduction to significant elements involved with the safe operation of aircraft and associated equipment both in flight and on the ground. ...safety philosophies, programs, research and agency roles.

To develop a knowledge of contributing factors affecting aviation safety and fostering control methods and techniques to reduce accidents related to aircraft and the aviation field.

...to develop desired habits and attitudes in regard to aviation safety.

To develop safety consciousness in students preparing for jobs in the aviation field and produce safer workers.

...preparation of individuals as safety specialists and leaders...

Trends in aviation safety practices with an emphasis on future safety enhancement.

Providing an opportunity for students to develop a body of information and training which will aid them in safe flight practices.

...the principles and application of flight safety.

...management's responsibilities for flight safety programs.

...aircraft operator's responsibility for flight safety.

...principles involved in aircraft accident investigation.

...identifying major problem areas, evaluate safety programs and recognize the value and ultimate impact of the accident prevention program. Human factors...government agencies...

...procedures which would enhance safe revovery of aircrew and passengers in the event of an aircraft crash...search grids and methods...survival and first aid...rescue procedures...

Pilot performance as influenced by attitude, motivation and perception. Ideal and practical, personal and organizational safety goals and procedures.

Aviation safety for non-flying students...program evaluation, impact of accidents on industry...

...the purpose of installing before-the-fact attitudes in pilots...a self-philosophy that accidents constitute a needless waste of human and material resources which can be prevented.

...a basis for aviation managers to develop responsible professional attitudes, and understand processes of risk management in flight operations.

...identify operational areas of greatest vulnerability.

...behavioral guidelines essential in professional airmanship.

Safety Course Topics;

Safety education...ground and flight safety...weather...safety programs...federal safety legislation...NTSB/FAA authority and responsibility...aircraft accident investigation...pre-accident planning...field investigation...investigative techniques...human factors engineering...safety engineering...philosophical approach to aviation safety...psycology of copilot assertiveness...command judgement...responsibility, authority, and capability...discipline... fatigue...pilot error...stress management...aircraft automation... line crew training...misfueling...shop safety...crash/fire/rescue... airport hazards and controls...accident prevention programs... the Air Traffic Control system...ultralight safety...risks in flying... crashworthiness...human factors...history...aircraft maintenance...hazardous material handling...safety organizations...aeromadical factors...aircraft design...life support equipment and procedures ...post crash factors...accident investigation...flight safety and its application to the space age...basic aerodynamics...aircraft performance...fear of flying...accident statistics...fire safety...wind shear...defensive flying...memory...decision making...the role of flight simulators

TWO YEAR INSTITUTIONS:

Goals/Course Descriptions;

the evaluation and interpretation of their indications...weight and balance problems...Federal Aviation Regulations appertaining to safe flight, including the use of the Airman's Information Manual. Medical facts and discussion of accident reports.

...become familiar with the causes of aircraft accidents, and understand techniques and procedures to prevent this from happening.

Major causes of aircraft incidents, non-fatal accidents and fatal accidents. Covers primary and causal factors which contribute to aircraft accidents.

...to provide the student with a study of the fundamentals essential to the safety of flight. It includes the A.I.M. Exam-O-Grams, Advisory Circulars, local safety bulletins, a study of accident reports, accident reporting procedures, and good flight planning practices.

...course taught by an FAA Inspector...

The major goal is...the hope that each student will develop an improved attitude towards the maintenance of body and mind as applied to the safe operation of an aircraft.

...to prepare the pilot for safe flight by presenting certain physiological and psychological facts which have critical bearing on the operation of an aircraft.

Evaluation and analysis of factors which lead to preventable aircraft accidents. Includes the study of aircraft accident cause factors, with emphasis on human behavior as it relates to the environment of the pilot and air traffic controller.

...enhance the pilot/air traffic controller's ability to conserve life and property.

...increase the student's knowledge and awareness of the relationship between man and aircraft.

...the practice and factors relating to the preparation of aircraft for safe operation including moving, operating, and servicing an aircraft on the ground; and properly loading for flight.

Safety Course Topics;

FAA Act of 1958...emergency landings...weather...stall and spin recovery procedures...spatial disorientation...aviation medicine...winter flying...mountain flying...hazardous materials...icing...static electricity...propeller operation and care...NTSB responsibilities...human factors...physical and psychological factors...crash survival...mishap investigation...hypoxia...hyperventilation...oxygen equipment and use...visual illusions...vertigo...pilot attitudes which will contribute to safe flight...night flying...systems and mechanical concepts...midair collisions...mechanical failure...FAA's certification programs and research concepts...alcohol and drugs...perceptions in aviation...human engineering

A SUMMARY OF "OTHER COMMENTS" RECIEVED ON THE SURVEY

Ground schools contain a unit on safety.

(this course is) not required but makes every time offered -- each semester.

(safety is) integrated in all aspects of other program subjects/courses.

When are we really not teaching safety ?

Although no one course is devoted primarily to safety - the private, commercial and instrument ground schools devote at least one section to safety. NTSB reports, handling airborne emergencies, etc. The Aviation Management course also devotes one chapter to safety procedures for airport operations...all are required for the degree program.

Our program is dedicated to safety. We do not feel we can teach private pilots, commercial, instrument, navigation, meteorology, aircraft and engines without an emphasis on safety.

Safety included in classes.

We stress safety in all courses offered.

If a specific course on just safety were developed we would be interested in the course outline and referance materials.

...working with Department of Health and Safety on ... courses as a cognate area for our Aviation Administration program.

CORPORATE PERCEPTIONS OF JOB SATISFACTION AND EDUCATIONAL NEEDS

by

C. Elaine McCoy
The Ohio State University
Department of Aviation

September 1986

Submitted to:
University Aviation Association

CORPORATE PERCEPTIONS OF JOB SATISFACTION AND EDUCATIONAL NEEDS

C. Elaine McCoy
The Ohio State University
Department of Aviation

During the winter of 1986, The Ohio State University Department of Aviation conducted a survey of randomly selected National Business Aircraft Association members. The survey served two explicit purposes (1) addressing the need for information to be used in the design of a course at OSU in corporate flight operations; and (2) assessing the needs of the industry for workshops and seminars in communication and management.

Direct information from corporate flight departments was sought to insure that the practical concerns of the corporate pilot or flight department manager be combined with organizational communication and management strategies tailored to the specific needs of the industry. This information was gathered through a series of scaled responses, and through closed and open ended questions. Industry cooperation and support has been excellent. The questionnaire's design provides insight into the perceptions of corporate pilots and managers regarding a number of factors that pertain to their degree of job satisfaction.

Public attention regarding aviation continues to focus on the airlines. Expansion, collapse, takeovers, hires, furloughs, unions, and routes all receive media attention. Primarily through the media, the general public and many prospective aviation professionals have become aware of the pilot shortage and the projected continued hires by major lines. Even among many commercial pilots the traditional goal continues to be attaining a major airlines captain slot despite the two-tier pay scales and changing benefits.

The rites of passage for a non-military pilot to build experience traditionally consisted of a progression from flight instructor to Part 135 then to corporate or to regionals then to majors. Those entering the corporate market have tended to remain in it. The corporate market on the surface seems healthy. The NBAA reports an increase in member aircraft (5,547) and corporate membership (2,941) in 1985. Except for 1983, membership shows an approximate growth of 10% per year. Company loyalty is often high, although conditions in corporate flight departments are known to vary greatly. What is there about the corporate arena that allows it to retain high time experienced professionals who have one of the best safety records in the business? Is it in the best interest of the industry that corporate aviation be such a well kept secret?

This study only provides an introduction to such questions. The paper examines those aspects of the OSU survey results which indicate the degree of satisfaction that survey respondent corporate managers and pilots exhibit regarding their perceptions of (1) their own company compared with other corporate flight operations; and (2) their position in their own company compared with a similar position with a major airlines. Those educational needs identified by the NBAA members as beneficial to either students soon to be operating in the corporate environment or to individuals already in the field are briefly addressed as well. Additional information obtained through follow-up in-person and telephone interviews is included. Respondent anonymity is maintained.

The survey

The survey consists of a cover letter and a three page questionnaire (see Appendix A). The letter states the two-fold purpose of the survey and assures participants of anonymity. Within each envelope the corporation received were two questionnaires. The recipient was requested to provide one to the Chief Pilot and one to the Chief Pilot's organizational superior.

The initial nine items are demographic in nature and pertain to the respondent's position, the number of personnel for whom s/he is responsible, number of aircraft, flight certificates, mechanic certificates, flight time, age, sex, and whether the company is a Part 135 certificate holder. Of particular interest was the position of the respondent indicated as Chief Pilot, Manager, Both, or Other.

A two-part job satisfaction scale follows. Part I, having fifteen items, asks the respondent his/her perception of their own flight department compared with other corporate departments. Part II consists of twelve items duplicating twelve items in Part I and asks the respondent to compare his/her current position with a similar position with a major airlines. Three of the initial set were deemed inappropriate in the airlines response categories.

Two subsets of questions followed. The first directed at pilots (5 items) and the second at managers (6 items).

Two final open-ended questions solicited information concerning (1) interest in professional seminars, (2) topics for those seminars, and (3) topics deemed most beneficial for undergraduate students.

At the conclusion of the questionnaire, a space was provided for voluntary signatures and phone numbers. Respondents indicated whether or not they could be contacted for further information.

The participants

All participants were randomly selected within categories from the National Buisness Aircraft Association Directory. Categories and restrictions were as follows:

All participants were businesses based in the United States;
A minimum of two corporations from each state were selected;
A minimum of 20 corporations having less than 5 aircraft; and
A minimum of 20 corporations having 15 or more aircraft.

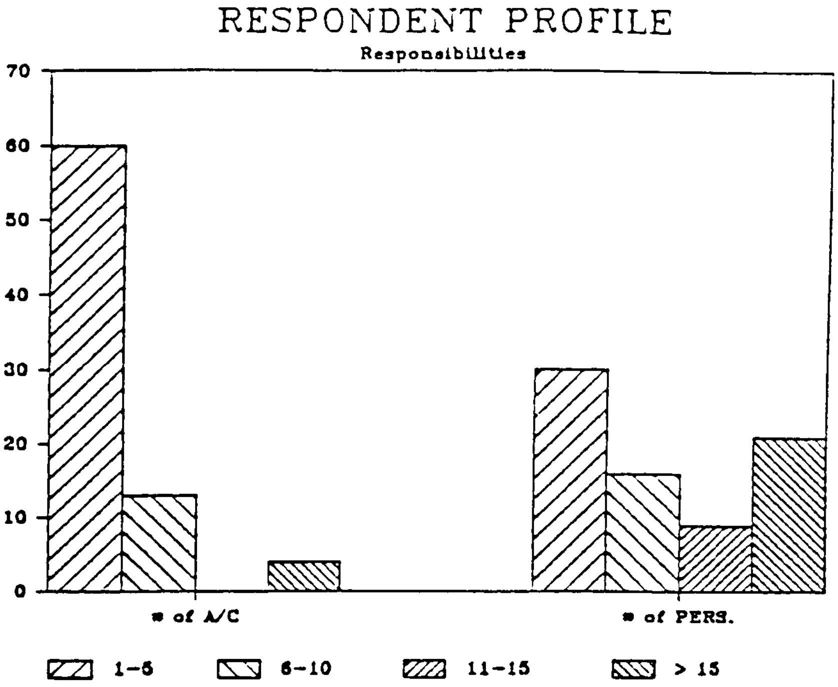
The balance of the initial mailing of 200 envelopes (400 questionnaires) was random without consideration for category. A second mailing of 41 additional envelopes (82 questionnaires) focused on additional Ohio area companies.

Approximately twenty-one percent of the questionnaires were returned. Fifty-two per cent of active responses indicated a willingness for further discussion and exchange of information.

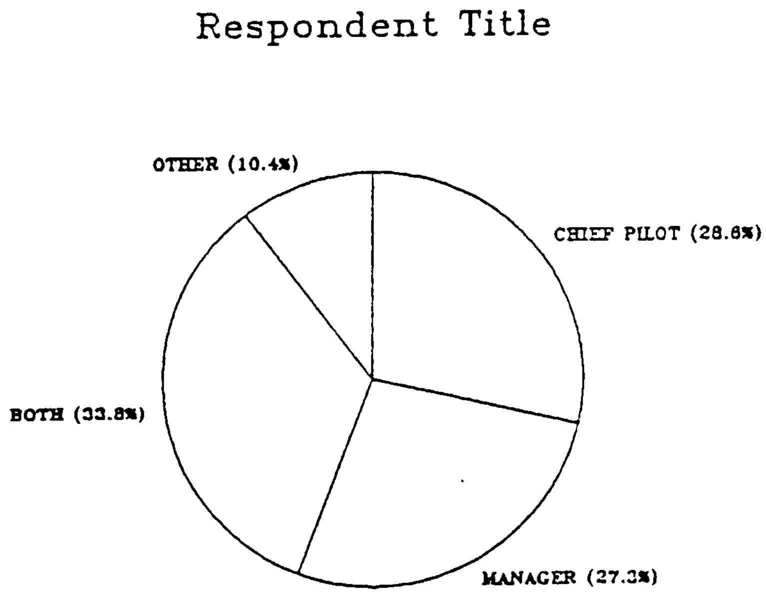
Profile of respondents

The typical respondent is a male, 36-50 years of age, with more than 5000 hours of flight time and an ATP.

RESPONDENT PROFILE

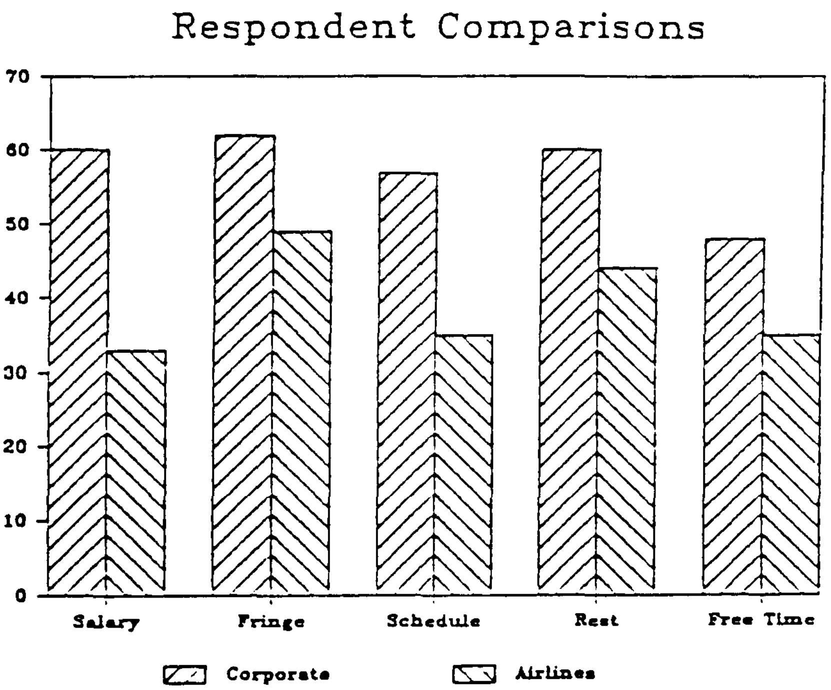


Distribution was fairly even for Chief Pilot, Manager, and Both categories. All respondents are male.

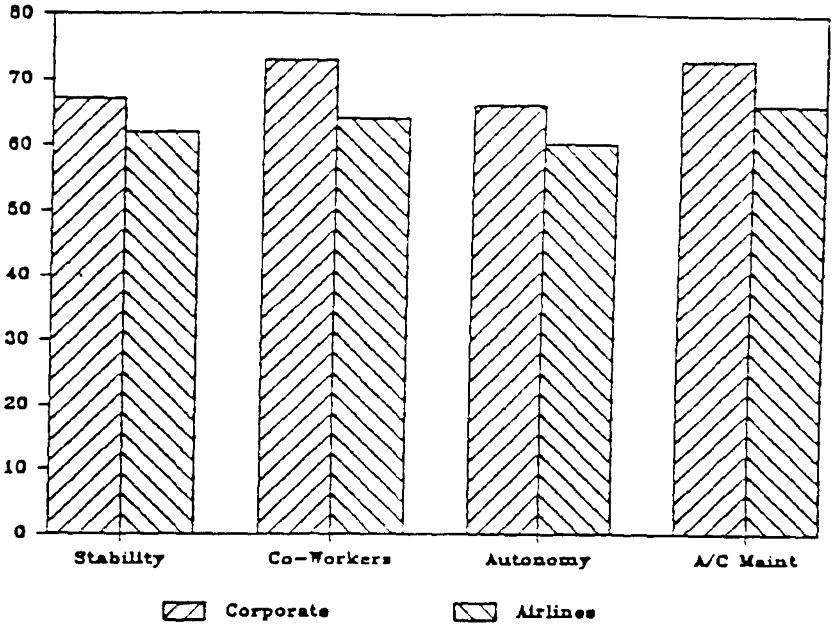


Results: Job Satisfaction

The survey results indicate that corporate pilots and managers have a high degree of job satisfaction. They consistently rated their own company as excellent or good--better than average--compared with other corporate flight departments. The home company was highly rated in terms of: salary, 86% (of respondents rating it excellent or good); fringe benefits, 81%; schedule 74%; rest 78%; free time 64%. However, when comparing their own companies to comparable airlines positions corporate positions fared less well. On salary only 41% rated the company better; on fringe 41%; on schedules 49%; rest, 61%; free time, 45%. These comparisons are noted on the following bar graphs labeled "Respondent Comparisons." These bar graphs give raw number comparisons for the categories indicated only for the better than average or positive responses. In each topic area the home company compared well with other corporations, and less favorably with airlines positions. For example, looking at the presentation of respondent comparisons concerning "Salary" on the bar graph, sixty respondents perceive their own company as Excellent or Good compared to other corporate flight departments. When the respondents are asked to compare their own companies with similar airlines positions only thirty-three rank the home company as Excellent or Good. By inference, the airlines are perceived to be more competitive in terms of salary. In areas concerning stability, co-workers, autonomy, and aircraft maintenance, corporate and airlines positions were both very positive and closely rated.



Respondent Comparisons



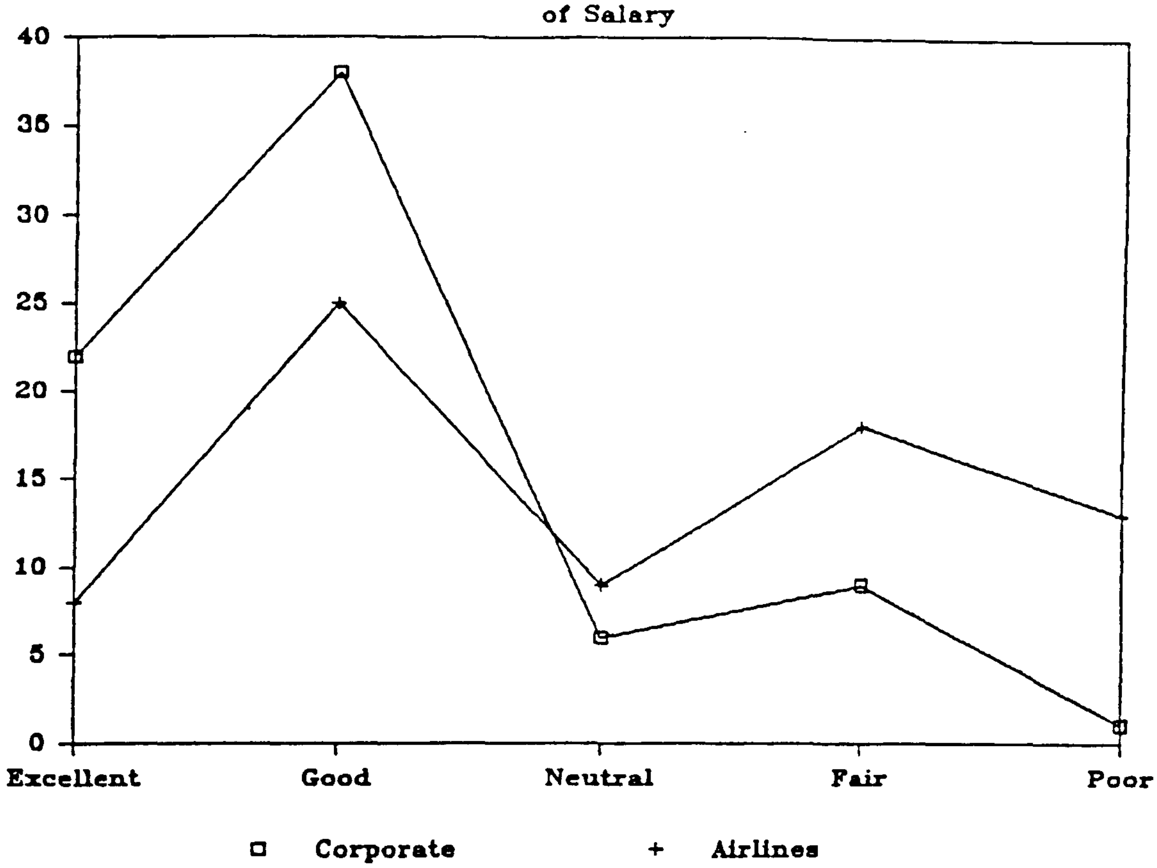
Terminology. Responses incorporate certain understandings of the terms used in the categories and these word-meaning fields can differ greatly. "Airlines" indicates Part 121 scheduled major carriers. "Rest," for example then, for an airlines pilot generally is scheduled time off-duty. Duty time consists of a fairly constant busy day. Corporate pilots who rated their own "rest" as less adequate, often wait for several hours at destinations or spend portions of duty days at the hanger. That time can be characterized either by the boredom of waiting or by the tension associated with aircraft or weather or passenger problems. Such time, indeed, is not "rest," and it differs from the flight schedule of the airlines who have canned flight plans, weather departments, etc. The same corporate pilots may fly constantly throughout the next day criss-crossing the country with very little "rest" of any kind. The two positions have different "workstyles" that are at times difficult to translate equitably.

While the scaled ratings of perceptions of airlines positions would suggest that airlines positions would be preferable, in response to the question to pilots, "Are you considering flying for an airlines?" only two answered "yes" giving pay, travel benefits, and family as reasons. One of these respondents is 23-35, with an ATP and 5000+ hours. The other is 36-50, with an ATP and 5000+ hours. Only one other response even mentioned considering a flying job with another company.

A closer look at the responses across the rating scale that includes the negative evaluations is provided for "Salary," "Schedule," "Fringe Benefits," and "Free Time." These categories elicited the greatest variation in degree of satisfaction in the comparison of corporate life with perceived airlines positions.

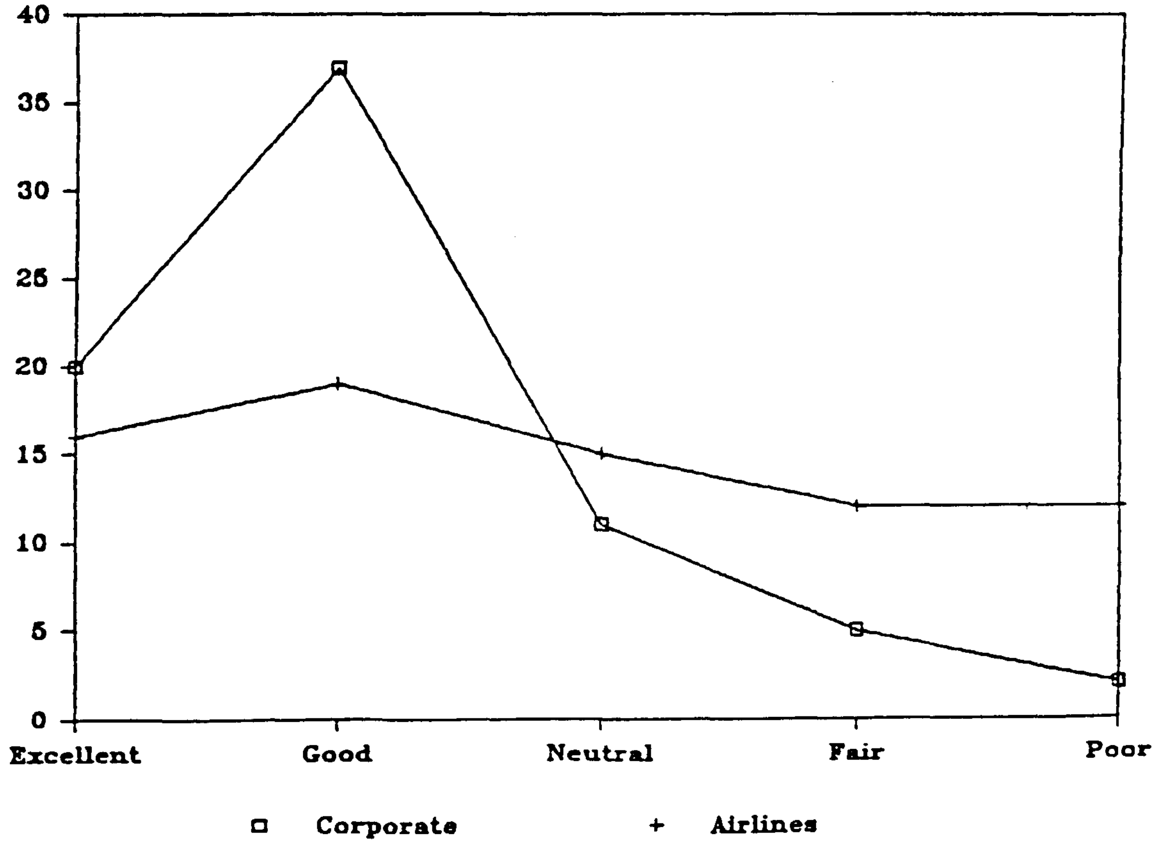
Respondent Comparisons

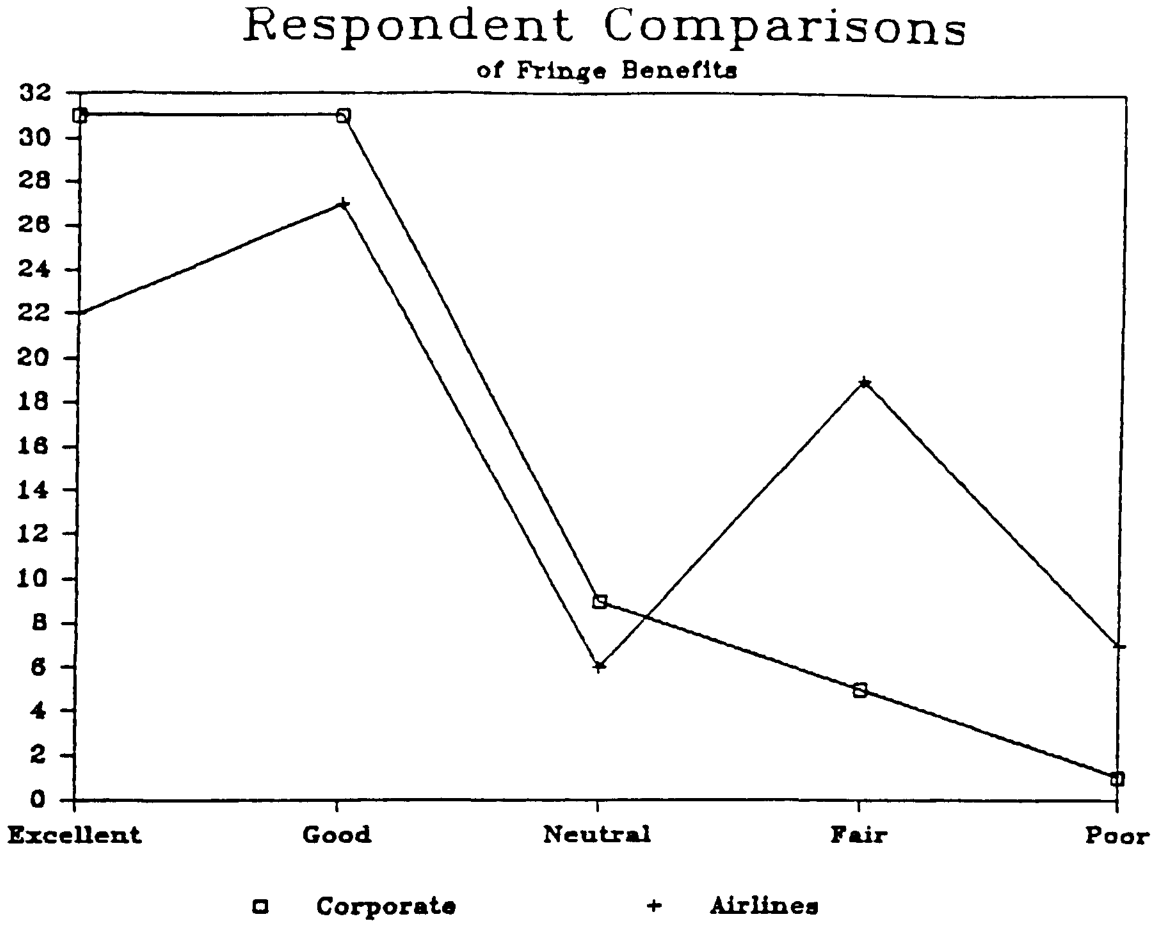
of Salary

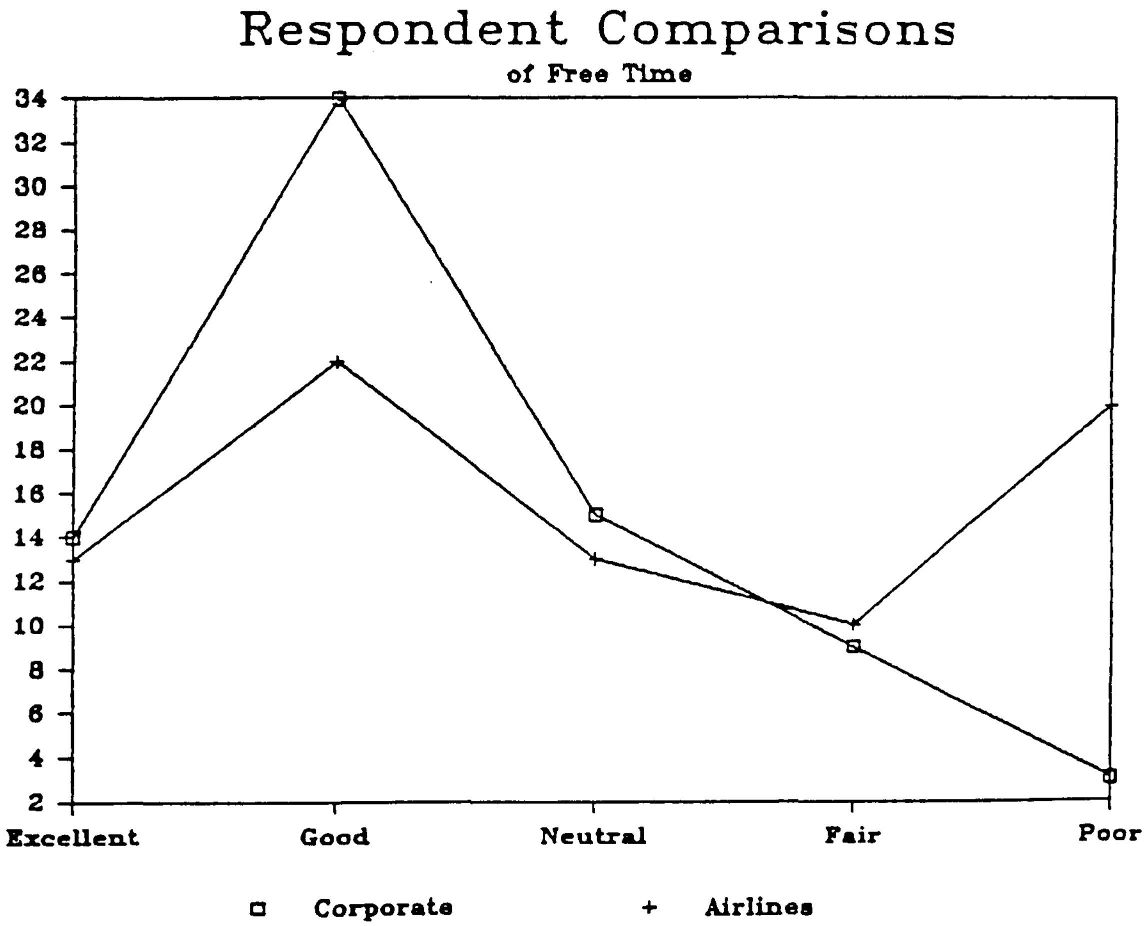


Respondent Comparisons

of Schedule with:




Respondent Comparisons
of Fringe Benefits
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Excellent
Good
Neutral
Fair
Poor
Corporate
Airlines


Respondent Comparisons
of Free Time
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
Excellent
Good
Neutral
Fair
Poor
Corporate
Airlines

Respondents were strongly affirmative of their own company's competiveness with regard to each of these areas when compared with other corporations. As these line graphs indicate, however, the division was more evenly divided between those indicating positive and negative comparisons of their position when compared with an airlines.

The comparison of this information with those responses to the question of considering flying for an airlines, 2.5% affirmative, seems inconsistent. A return to the profile of respondents may help explain this. Not all respondents are professional pilots. A small number are strictly management positions. Approximately 5% indicated no flight certificates, 9% Commercial, and 83% ATP. More importantly, pilots established in one aviation system may well be hesitant to leave for the bottom of a seniority list in a new one. While most pilot respondents have ample flight experience for airlines positions, 82% having more than 5000 hours, age and the career experience that it implies must be considered as well. While 55% are 36-42, another 32% are between 51-65.

At this time, pilots with both experience and age are being hired by airlines, but after years of working in one aviation "system" and becoming accustomed to a life/workstyle, not many may actually wish to give up their position with a company. That personal decision would not preclude them from rating their corporate position lower than airlines since in their perception and to the best of their knowledge <u>had they</u> followed the airlines track when they started they believe that a comparable current airlines position would provide them with better salary, fringe benefits, free time, etc. Pilot perceptions concerning airlines often mix actual knowledge obtained from airlines pilots with a somewhat mythical image of the #1 Seniority Captain and "having made it." During the years that many of these respondents chose their career path, a multitude of ex-military pilots competed for positions with the majors while others chose to go into corporate. Non-military aspirants faced an extremely competitive market.

Increasing management responsibility also tends to discourage transfer to airlines positions. Twenty-two percent of the respondents are responsible for six or more aircraft and sixty percent are responsible for a staff of six or more.

Interestingly, perceptions of relative autonomy favored the airlines, but only slightly. While the supervision, care and overall involvement of the corporate pilot with his specific aircraft is more apparent in many aspects, the fact that PIC responsibilities make members of both pilot groups the final authority in the cockpit may serve to nullify other differences. One respondent reflects an attitude heard at times in general discussion that corporate pilots often indicate a pride and almost elitism in having corporate responsibilities compared with "bus drivers" as some describe airlines pilots. This attitude does not evidence itself in the specific response categories of this survey. Corporate pilots, as another respondent noted, often complain of less overall autonomy in that being on call for flights disrupts any personal plans and that is perceived as a corporate invasion into homelife. This is one area that varies with the flight department. Some operations provide pilots a month advance notice with Monday through Friday flight schedules. Airlines autonomy is seen linked with seniority in that seniority brings the ability to choose aircraft, routes and therefore schedule, and even flight crews.

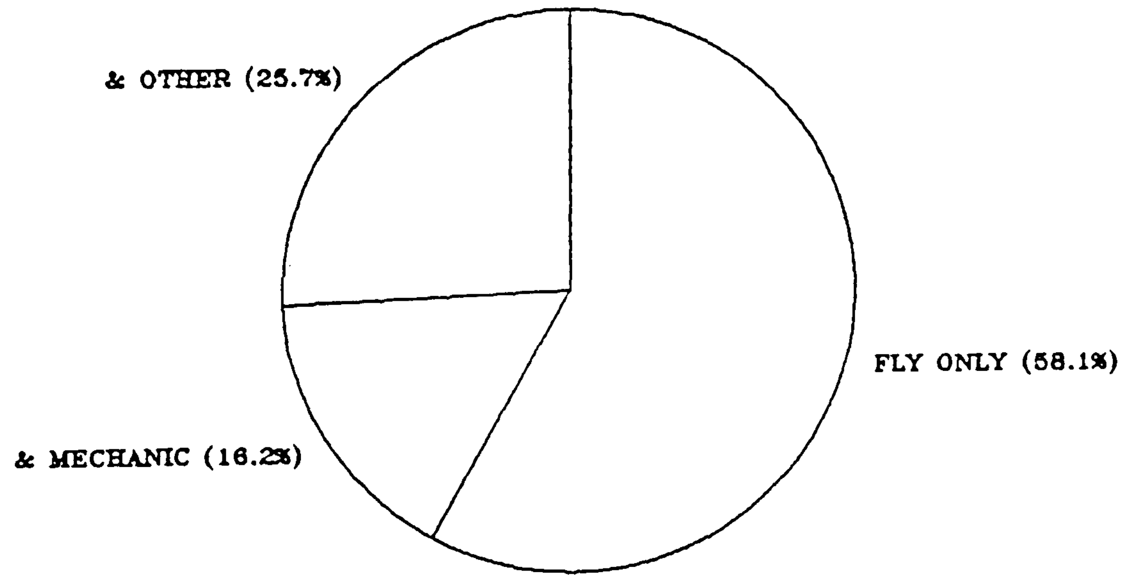
Perceptions of supervisors, coworkers, and employees indicates satisfaction and respect. Additionally, both pilots and managers indicate that executives have a realistic grasp of the job of those involved in the flight department (62%). Managers believe that pilots do have a clear understanding of the flight department's position in the company (93%).

Management choice in hires

According to the survey, management still wants pilots who fly only. Fifty-eight percent indicated this choice. Sixteen percent want pilots with mechanic certification, and twenty-six percent would like pilots who can work in other capacities for the company.

Management Desires

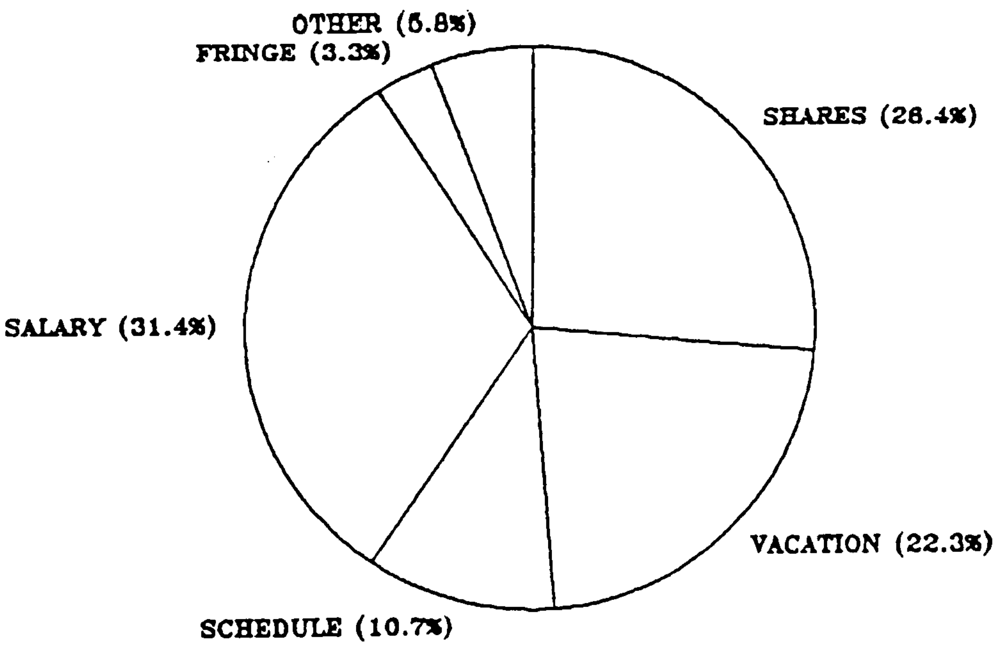
Pilots Who:



Corporate flight departments vary greatly in size, flight time and numbers of pilots available for hours flown. This diversity undoubtedly affects these choices. While initially it would seem cost effective for pilots who wait for several hours per day to have other duties, this is often impractical and may impinge on scheduling and possibly on the pilot's attention to flight concerns. The argument can be made that pilots who fly- only will base flight decisions only on flight conditions thus resulting in greater safety. Business pressures to produce through sales, or reports, etc. could potentially affect pilot duties and decisions. A combination of an A&P and pilot certificate is very attractive to corporations. The mechanic certificate allows a cross-check of maintenance performed, better troubleshooting and problem descriptions, greater familiarity with the limits and capabilities of aircraft systems. The mechanic certificate is a plus for one already a pilot. A common problem for management becomes one of the right seat pilot/mechanic hired primarily as a mechanic wanting to be a fulltime captain.

Management Incentives for Pilots. In response to "What incentives are offered to pilots to keep them with the company?" respondents stressed salary, shares, vacation, increased control over schedule, fringe benefits, and miscellaneous other incentives.

Management Incentives



The high percentage of those offering shares in the company obviously would reinforce company loyalty as would increased input to schedules and company policy (one example from the "other" category).

Areas of respondent educational concern

In response to questions soliciting topics for seminars and for the course, respondents provided a long list of areas of concern. When compiled and organized responses can be categorized as Communication, Management, and Other. Although not directly mentioned in the survey, communication elicited the greatest number of responses. Within "Communication," the following were identified as needs for continued education and improvement of skills: written and spoken communication, interpersonal, leadership, organizational, personnel relations, public relations, and cockpit resource management. "Management" topics include overall financial management, cost analysis, goal setting, cost center management, budgeting, time and resource management. "Other" includes hijacking and terrorism, aircraft maintenance, safety, dispatch and scheduling, and airport operations.

These items were solicited by open-ended, non-directive questions. Therefore the recurrent appearance of the same topics and themes across the diverse respondents indicates a pervasive concern in the industry.

Conclusion

The survey reveals a high degree of job satisfaction, an interest in increasing skill and performance in communication and management, and a willingness to assist others in preparation of careers in corporate aviation. Certainly, this interest and willingness of those established in the business to cooperatively reach out to assist the future aviation professionals of tomorrow is a credit to the corporate aviation industry.

The survey indicates a high level of company loyalty among corporate representatives. Mutual respect is evident among co-workers, supervisors, and employees. The adherance to the highly rated home company falters in the face of the major airlines market as perceived by corporate pilots. The allure of the major airlines slot as more or less ideal continues despite the changes in that branch of the industry.

A useful and informative extension of this introductory work would be a comparison of the lifestyle/workstyle of the two aviation branches with an attempt made to identify the basis for career preference by the pilots. The impact of early entry of younger, less experienced pilots into airlines positions upon the long term interests of corporate aviation can be speculated, but is not yet clear. It may well be time for corporate marketing experts to identify motivational keys that will attract the best possible pilots for the industry.

In order to incorporate their wealth of long term experience in the field, this survey was addressed to an experienced group of Chief Pilots and Managers. The views of these individuals well established in the field may differ from those of new pilots entering the market. Any additional work should address designated age and experience groups in both fields.

OSU

The Ohio State University

Corporate Flight Department Survey

Please indicate: Chief Pilot______Dept. Manager_____Both______
Other______________

Number of aircraft for which responsible:
1-5______ 6-10_____ 11-15_____ 16-more______

Number of personnel for whom responsible:
1-5______ 6-10_____ 11-15_____ 16-more______

Flight Certificates: None___ Commercial___ ATP___

Mechanic Certificates: None___ Airframe___ Powerplant___ AI___

Flight time: None ______ under 1500_____ 1500-3000______
3001-5000_______ 5001-more _____

Your age: 23-35_____ 36-50______ 51-65______ 66-more_______

Your sex: Male _____ Female______

Is your company a 135 certificate holder? Yes___ No___

****

Please rate each of the following. Compared with other corporations operating flight departments you would rank yours:

	Excellent 1	Good 2	Neutral 3	Fair 4	Poor 5
Salary					
Fringe benefits					
Schedule					
Free time					
Adequate rest between trips					
Your supervisor					
Your employees					
Your coworkers					
Job stability					
Aircraft types					
Aircraft maintenance					
Aircraft cost of operations					
Recurrency training					
Autonomy					
Your company overall					

Please rate your position compared with your perceptions of a similar position with a major airlines.

	Excellent 1	Good 2	Neutral 3	Fair 4	Poor 5
Salary........................					
Fringe benefits...............					
Schedule......................					
Free time.....................					
Adequate rest between trips....					
Your coworkers................					
Job stability.................					
Aircraft types................					
Aircraft maintenance..........					
Aircraft cost of operations....					
Recurrency training...........					
Autonomy......................					

<u>If you are working primarily as a pilot answer the following</u>:

Do you believe that your job is endangered by legitimate no-go decisions?
Yes_____ Sometimes______ No________

Are you considering another flying job?
Yes______ No_______ If YES, why?__________________________
____

Are you considering flying for an airlines?
Yes______ No_______ If YES, why?__________________________
____

Do the managers and executives in your corporation have a realistic grasp of your job?
Yes______ No_______

Do the managers and executives consider the flight department as
____ an integral component of business operations, or
____ as an unnecessary convenience subject to budget cuts.

<u>Managers of flight departments:</u>

Do your pilots have a clear understanding of the department's position in the organizational structure of the company?
Yes______ No_______

Do you want pilots who:
fly only______
hold flight and mechanic certificates_______
can work in other capacities for the company_________

What incentives are offered to pilots to keep them with the company?

shares in the company______ increased vacation________
increased control over schedule_____ higher salary____
other____

Is your department organized as a profit center?

Yes_____ No_______

Rank criteria used to determine whether staff take the company plane or fly commercial airlines?

cost _____ executive's time_____ commercial accessibility of destination_____ prestige _____ public relations____
marketing impact of use of private plane____
other ____

Maintenance is performed in-house or farmed-out based on:

type of maintenance required _______ cost_______
complexity______ relative time to complete_____
other____

Both pilots and/or managers:

Would you attend a workshop on organizational management and communication designed especially for corporate flight departments and led by individuals with practical experience?

Yes_______ No______

If YES, list two topics you believe to be most useful.

1. ____
2. ____

What would you recommend that we include in a course on Corporate Flight Departments for undergraduate aviation students that would be of the MOST value for them?

Please use the back of this sheet for any additional comments.

Optional: ____
Name Company

____
Phone

May we contact you for further assistance based on your training and practical experience?

Yes______ No______

A MASTER'S DEGREE IN PUBLIC ADMINISTRATION FOR AVIATION: IS THERE A NEED?

by

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ABSTRACT

This paper describes the need and structure for a masters degree in public administration with an aviation administration concentration (MPA-A). The paper was suggested by an on-going effort to establish such a degree at Southern Illinois University at Carbondale. This effort has focused on the fact that the U.S. aviation industry consists of 2,107,190 employees, including over 110,000 civilian government jobs related to aviation. With this many people working in the field, there would be a need to improve the quality of future, entry-level employees as well as current employees of public aviation agencies.

The degree format suggested for the MPA-A includes the following components: (a) a core public administration curriculum (15 hours); (2) an aviation administration/decision-making curriculum (12 hours); (3) an elective course (3 hours); (4) a research report (6 hours); and (5) and internship (6 hours). This degree is expected to be used by graduates to gain employment in such agencies as the Federal Aviation Administration, state aeronautics agencies and local airport authorities.

Introduction

The purpose of this paper is to describe the need for an aviation-related public administration graduate degree. This paper was suggested by the on-going effort to establish such a degree at Southern Illinois University at Carbondale. This effort was begun in 1985 and is still underway. It was discovered early in the process that the University Aviation Association was ". . .not aware of any other graduate program of this type that is currently offered in the U.S." (Kiteley, November 20, 1985). This lack of other similar programs was of some concern as well as some reassurance to SIUC. The concern grew out of the fear that there was something wrong with the concept since no other institutions were offering an aviation related public administration master's degree. The reassurance was provided by the fact that there would be no overlap with an existing program. However, both the concern and reassurance pointed to the need for justification of this new degree for the aviation community.

In order to address the question of the need for a Master's in Public Administration in Aviation, or MPA(A), this paper will first describe the size of the public or government portion of the aviation industry. Next, the potential industry needs for, and uses of, such a degree will be explored. This will be followed by a discussion of the evolution of the MPA(A) concept. Then, a possible structure of an MPA(A) degree will be presented followed by conclusions and recommendations.

Size of the Aviation Industry Segment to be Served

One of the key arguments in favor of offering the Master's in Public Administration (Aviation) degree is the overall size of the public sector of the civilian aviation industry.

In a paper presented last year to the University Aviation Association, it was noted that 110,838* of the total of 2,107,190 aviation industry jobs in America were in government. The government figure represents 5.3 percent of the total (David A. NewMyer, UAA 1985 Proceedings, pp. 38-39). The following major categories of aviation-related civilian government employment are present in America (NewMyer, p. 43):

Federal Aviation Administration	45,877
National Aeronautics and Space Administration	33,000*
Other Federal Agencies	10,000
State Agencies	2,000
Local Governments	20,000
	110,873

*NASA figures not included in the original 1985 estimate.

With a combined total of 78,873 employees, the Federal Aviation Administration and the National Aeronautics and Space Administrations dominate civilian government aviation employment. This number represents 71.1 percent of the total. Local governments, which primarily own and operate airports, are the other major civilian aviation government category with 20,000 employees or 18.0 percent of the total.

Potential Aviation Industry Uses of the MPA(A)

There are three key ways in which the MPA(A) can be used to improve the performance of the government portion of aviation industry:

1. To improve the caliber of new, entry-level employees of public aviation agencies;
2. To improve the caliber of existing employees in public aviation agencies;
3. To meet the overall educational goals of an agency or a national group of aviation professionals.

While there is no particular support for the idea that a master's degree is needed for entry-level employment within the aviation industry, it is increasingly clear that a bachelor's degree is becoming a minimum credential for employment. This move toward requiring at least a bachelor's degree for employment will put more value on a master's degree.

Since 1983, the Federal Aviation Administration has been involved in the development of an Airway Science Curriculum. A key goal of this curriculum is to prepare future employees of the Federal Aviation Administration. As noted in 1983, the FAA's current work force is too focused on their occupational area:

> The FAA is composed of a work force in which technical professions such as air traffic control and electronics technology predominate (Figure 1). Individuals in these occupations may possess limited educational backgrounds in that, for many, formal academic training concluded with high

school (Figure 2). As a consequence, some FAA employees are narrowly focused in their occupational area.

The breadth of knowledge or commitment to aviation may not extend beyond the task at hand. These limitations can have serious implications for employees' ability to perceive their role within the total system and to progress to supervisory and managerial positions with the necessary leadership and human relations skills.

Of equal concern is the adaptability of such employees to an increasingly technical and automated environment such as is envisioned within the NAS Plan. Over the next 20 years, FAA jobs will evolve from a preponderance of direct interface with operational equipment to an interface characterized by sophisticated automated controls and diagnostic devices. Thus, the skills and aptitudes to today's work force will need to be enhanced since an advanced skill level and skill mix for which there is no direct or immediate preparation will be required. Employees will have to possess the broad-knowledge base, perspective, and flexibility to accept and cope with this transition in the workplace. (Federal Register, March 18, 1983, p. 11672)

In addition to this existing narrowness of the FAA work force, the FAA is also an agency with a fairly limited amount of formal education among its existing staff. In fact, only 15.4 percent of its employees, or 7,064 people, had bachelor's degrees in 1983. (Federal Register, March 15, 1983, p. 11673)

Airway Science Curriculum graduate projections for the next three fiscal years (FY) indicate that 190 total graduates will be available in FY 1986, 381 in FY 1987 and 630 in FY 1988. This means that FAA hopes to improve upon its percentage of agency employees with bachelor's degrees by hiring some of these Airway Science graduates over the next two or three years. Such hiring of bachelor's degree holders will place further pressure on the agency to continue to support graduate education for its existing staff. Therefore, while a master's degree is not required for most entry-level positions in the FAA, a master's degree will increasingly become the key credential to be obtained by those who want to be promoted within the FAA once they are working there.

The Federal Aviation Administration has clearly stated its need for a "public administration" type of degree for the purpose of upgrading the education levels of FAA employees. 1983 figures noted that the FAA as a whole had only 2.2 percent of its employees, or 1,009 employees, had master's degrees (Federal Register, March 18, 1983, p. 11673). Another way to explain the need for graduate education for the FAA staff is to note that the FAA's Management Training School will continue to train large numbers of new management personnel throughout the 1980's and into the early 1990's (Donald Higgins, telephone conversation, May 26, 1986). This continuing internal management training effort of the FAA is evidence of the need to enhance the capability of FAA's management staff. If all of FAA's managers already had graduate degrees, the internal training needs of the FAA would move from the basic management focus to a more advanced management focus. Hopefully this change in focus will increase the capability and productivity of the FAA staff.

Outside the FAA, the American Association of Airport Executives (AAAE) has adopted the bachelor's degree as the minimum academic standard of eligibility for their professional membership requirements. "Executive Candidates must be at least 21 years of age, of good moral character, and possess a four year college degree" (AAAE, Professional Membership Requirements, March 1984, p. 1). The AAAE professional membership requirements also mandate a written examination, the preparation of a thesis (or research paper) and an oral examination. Upon the successful completion of all of these requirements, the Executive Candidate becomes an "Accredited Airport Executive" or "AAAE." The similarity of this process to graduate education has encouraged many airport managers to pursue a master's degree because of the minimum additional effort involved beyond the accreditation program.

The pursuit of minimum educational goals of various public agencies has meant that master's degrees have been increasingly important as an educational credential for public agency employment in general. In the aviation industry such statements of educational goals have not been wide spread. The FAA made such a statement of future educational goals in 1983:

> Over the next 20 years, FAA jobs will evolve from a preponderance of direct interface with operational equipment to an interface characterized by sohphisticated automated controls and diagnostic services. Thus, the skills and aptitudes of today's work force will need to be enhanced since an advanced skill level and skill

> mix for which there is no direct or immediate preparation will be required. Employees will have to possess the broad-knowledge base, perspective and flexibility to accept and cope with this transaction in the workplace. (Federal Register, March 18, 1983, p. 11672)

The FAA's managers were also mentioned in the plan:

> Attention has also been focused on the FAA's supervisory and management training program. The mandatory aspects of initial training for individuals newly selected for such positions have been reinforced and the content reoriented to a greater emphasis on human relations, leadership, accountability rather than on procedural requirements. More funds have been allocated to the training function in general, and more managers and supervisors have been urged to enroll in supplemental management training. For other employees, the agency is recommending preparatory training courses to enhance potential for first-line supervisory positions. (Federal Register, March 18, 1983, p. 11673)

Since then, Administrator Helms requested a master's degree in 1983, it can be assumed that such a degree is still part of the educational goals of the FAA. As with many of the ideas from that time, there is great difficulty in obtaining FAA funds for such goals. Thus, little movement has been made toward meeting this goal. A state-level official agrees that this need for a master's degree in aviation is broad-based:

Most airport managers and government personnel were former military personnel who loved aviation and became managers and administrators because they were familiar with the 'territory.' Today, the airport manager, administrator, or government employee has to be versed in a variety of fields; not just snow removal, operations, etc.

Although AAAE began certification several years ago to increase the overall quality of airport managers, no real movement to upgrade the governmental employee qualifications was made. The Airway Science program was a step in the right direction, a master's program is a necessary complement. (James V. Bildilli, in a letter dated November 6, 1985)

An airport manager stated the need for the master's degree in a more historical perspective:

It is our understanding that the Political Science Department of Southern Illinois University is considering the development of a degree program entitled 'Masters of Public Affairs in Aviation.' This master's program could be beneficial to the airport management profession. Twenty years ago universities such as SIU assisted in the development of the Airport Management Profession by creating undergraduate degree programs in Airport and Aviation Management. It now seems appropriate to expand this academic involvement by establishing a Master's Program. . ." (James E. Johnson, A.A.E., in a letter dated November 1, 1985)

The Evolution of the Public Administration (Aviation) Concept

In 1983 then-Administrator of the Federal Aviation Administration J. Lynn Helms wrote to the nation's aviation-oriented post-secondary institutions to ask their support of a new aviation curriculum. This new curriculum, "Airway Science," was envisioned by Helms to have both an undergraduate facet and a graduate facet:

> There are two other facets of the Airway Science Program which are equally important. These are bachelor's and master's degree programs for existing FAA employees. . . The master's program will be similar to a master's in public administration on the human and financial side of management.

This statement was made in the context of an appeal for post-secondary aviation university and college assistance in dealing with the huge training and education burden associated with upgrading the National Airspace System (NAS). Since that original appeal, over 30 separate institutions have received approval from the University Aviation Association Airway Science Curriculum Committee to offer from one to five separate concentrations of the undergraduate Airway Science Curriculum. However, there has been limited response to the request for a new master's degree in public administration related to the FAA's needs. It should be noted, however that there are four institutions already providing aviation-related master's degrees in such areas as aviation safety, technology, and business administration.

One of the reasons for the lack of response is that there is little direct incentive for such a development in terms of FAA supported student placement, FAA financial assistance, or any other institutional support mechanism. Although the FAA never really followed up on its original idea for a master's degree, faculty and administrative staff at Southern Illinois University at Carbondale have carried the idea forward as a major institutional, programmatic goal. The pursuit of this goal resulted in the unanimous approval of the "New and Expanded Program Request" for an Aviation Administration concentration in SIUC's existing Master's in Public Affairs by SIUC's Graduate Council. While only an initial step in the approval of the proposal as a new offering of the university, this initial approval did indicate that the graduate faculty of SIUC were convinced of the need for this program.

A Possible Structure of the MPA(A)

Based on the fact that an MPA program was already in place, SIUC has proposed to offer an MPA(A) in Illinois. The components of the proposed program are: 1) the core curriculum (15 credit hours), 2) the additional curriculum (12 credit hours), 3) an elective course (3 credit hours), 4) a research report (6 credit hours), and 5) an internship (6 credit hours). The description of and rationale for each component follow.

The core curriculum consists of the courses required of all MPA students. Its purpose is to provide students with the body of knowledge central to the study of public administration and to the work of public administrators. This curriculum has evolved with the MPA faculty's continuous study of the standards of the National Association of Schools of Public Affairs and Administration (NASPAA), the practices of other highly regarded MPA programs, and the values and needs of the community of practicing public administrators. The five courses in this curriculum are:

(1) Seminar in Public Management

(2) Public Budgeting and Fiscal Management

(3) Public Personnel Management

(4) Program Analysis and Evaluation

(5) Organization Theory and Behavior

This core curriculum has been developed with special attention to NASPAA standards. These standards specify the theory and skills which must be imparted in all MPA programs. The core curriclum of the SIUC MPA program was approved in the 1979-80 NASPAA review and has since been altered and enhanced (1984-85) to take account of new or modified standards. We are confident that this curriculum is in conformance with national standards and that it is indeed appropriate to all MPA students, regardless of concentration or career goals.

The additional curriculum consists of two components: 1) quantitative techniques for decision-making, and 2) aviation policy and administration. The student will be required to take one course in the first component and three in the second. The courses available (and from which the student may choose) in each component are:

(1) Decision Making

- (A) Operations Research; or,
- (B) Forecasting and Decision-Making Models; or,
- (C) Management Information Systems; or,
- (D) Policy Analysis; or,
- (E) Topical Seminar in Public Administration (Tools and Techniques).

(2) Aviation

- (A) Aviation Law and Regulation
- (B) Issues in Civil Aviation Policy
- (C) Advanced Airport Administration
- (D) Advanced Aviation Safety

The requirement of a course in "Quantitative Techniques for

Decision Making" rests on the assumption that aviation administrators, regardless of their specific tasks, are all concerned with the highly-complex work of air traffic and safety. This requires an understanding of computer-based data management, simulation, modeling, and analysis. In all five courses in this component, students will be allowed to use aviation data in individual projects.

The second component of this curriculum, "Aviation Policy and Administration," provides the substance of contemporary administration in the aviation field. All four courses will give attention to recent research and literature and important case analyses, and they will be structured in such a way as to require application of theory and skills required in core courses.

In both components of the additional curriculum, it is important that some choice among courses is allowed. This will enable students to choose courses best suited to their respective career goals and academic backgrounds.

This curriculum has been developed after study of the general NASPAA standards regarding concentrations and specializations, and the structure of the curriculum is consistent with these standards. There are no NASPAA standards specific to an MPA concentration in aviation administration. However, standards specific to other concentrations (i.e., public works administration) have served as a guide.

Students not required to take an inferential statistics prerequisite will have allowance for one elective course within the 30-hour coursework requirement. This elective requirement may in many cases be fulfilled by taking the remaining aviation course in the additional curriculum. In other cases, however, the student's career goals may be best served by an additional course in an area such as administrative law, statistics, or operations research. In all instances, the choice must be made after consultation with the faculty advisor.

Each student will be required to conduct a research project and write a research report. This requirement is common to all MPA students. The major objective of the requirement is to provide students with a supervised research experience, in which it is expected that analytical and critical skills important to a public administration career will be sharpened. A three-person faculty committee will be appointed to supervise and evalute the project, with the committee's chairman acting as the student's research advisor.

An attempt is made to accommodate the research report to the applied, terminal nature of the MPA degree and to the mid-career status of many MPA students. The report may be applied and it may utilize methodologies such as the case study, participant observation, and comparative analysis, as well as the more theoretical and quantitative approaches commonly associated with contemporary social science research.

The standard requirement of the research report is that it be a systematic and scholarly study of some issue, problem, or concept in public administration. In the case of the Aviation Administration concentration, the expectation is that the student will research some administrative issue or problem in the aviation field.

The MPA program requires an oral examination of all students. The examination is scheduled upon completion of coursework and the research report. It is administered by the student's three-person committee and gives attention to both coursework and the research report. The student is especially expected to defend the methodology and findings of his or her report and to demonstrate understanding of the relationship between the report and relevant public administration theory and practices.

The MPA program has an internship component. Students admitted to the proposed program as pre-entry students will be required to serve an administrative internship in a public or quasi-public organization in the aviation field, unless they request and are granted permission to substitute coursework.

An effort is made to place all MPA students in internships that are closely related to their respective career goals. For example, students committed to a city management career intern in one of the positions available in several cities. The attempt to match career goals with the internship is considered especially important in a formal program concentration like aviation administration. Interns would be placed only in an aviation organization, and a further attempt would be made to match the internship with more specific career goals (i.e., Airport Management).

MPA internships are for a period of either one semester (4.5 months) of full-time work or two semesters (9 months) of half-time work. The intern's stipend is negotiated with the host agency. An attempt is made to keep stipends consistent with the graduate assistant rate of the University.

Concluding Remarks

As the aviation industry continues to grow and evolve, changes in aviation education are required. One key change will be the addition of more graduate aviation education programs to meet the technological and managerial needs of the aviation industry and its work force. An integral part of this industry and its work force is the public sector, or government agency, presence. People working in this segment of the industry have less specific choices for aviation-related graduate education. With over 110,000 people working in public sector aviation, not counting the military it is apparent that there is an unmet need. The fact that the largest single employer included within the 110,000 employees (the Federal Aviation Administration) has asked for a master's degree in public administration to serve its needs is an indicator of need and interest in this area.

The fact that a university is now in the middle of attempting to propose the MPA(A) degree is an indicator of interest in responding to the FAA's request. It is also an attempt to meet an even broader aviation industry need including those at state and local government agencies as well as within private aviation businesses with extensive public agency contact.

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