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As the University Aviation Association continues to mature as an organization of aviation educators and the institutions they serve, so too has the amount and quality of scholarly activity conducted by UAA members grown. This is evident from the addition of concurrent education sessions and seminars at UAA meetings, as well as in the quality and number of submissions to the **Collegiate Aviation Review**. As a long-time member of the UAA Publications Committee, it is particularly gratifying to the Editor to see this growth in scholarly activity, along with the opportunities provided by the Association for members to share their work with others.

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Thomas Q. Carney, Ph.D.
Editor
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STATEMENT OF OBJECTIVES

The **Collegiate Aviation Review** is published annually by the University Aviation Association, and is distributed to the members of the Association. Papers published in this volume were selected from submissions that were subjected to a blind peer review process, and were presented at the 1998 Fall Education Conference of the Association.

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

The University Aviation Association accomplishes its goals through several objectives. These objectives are:

> To encourage and promote the attainment of the highest standards in aviation education at the college level.
>
> To provide a means of developing a cadre of aviation experts who make themselves available for such activities as consultation, aviation program evaluation, speaking assignments, and other professional contributions that stimulate and develop aviation education.
>
> To furnish a national vehicle for the dissemination of intelligence relative to aviation among institutions of higher education and governmental and industrial organizations in the aviation/aerospace field.
>
> To permit the interchange of information among institutions that offer non-engineering oriented aviation programs including business technology, transportation, and education.
>
> To actively support aviation/aerospace-oriented teacher education with particular emphasis on the presentation of educational workshops and the development of educational materials in the aviation and aerospace fields.

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Setting the Foundation for Effective Learning: Utilizing the Cognitive, Affective, and Psychomotor Domains to Establish Rigorous Performance Learning Objectives in Postsecondary Aviation Programs

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Abstract

Institutions of American higher education have become increasingly scrutinized by governmental agencies, organizations, and the public (Wingspread Group on Higher Education, 1993). Accountability to these constituents has presented itself as a unique challenge to higher education. Greater accountability has also manifested an increased demand for effective assessment programs (Banta, Lund, Black, & Oblander, 1996). Accountability and assessment have undoubtedly emerged into postsecondary aviation as well. Consequently, aviation programs must continually justify their existence in providing a highly needed and important resource to society by preparing well-educated and skilled graduates for the workplace. If credible assessment programs reveal problems in educational outcomes, then likely candidates for review are the performance learning objectives in the classroom.

The authors present the argument that rigorous, well-developed performance learning objectives provide the underlying foundation for effective learning. The importance of establishing clearly stated, specific performance learning objectives and its relationship to the learning environment are also discussed. Effective performance learning objectives will not only enhance student learning experiences in the aviation classroom, but will favorably affect program strength and ultimately, institutional effectiveness.

Introduction

In a fast-paced society where many aviation students have greater opportunities to learn in high technological classroom environments, perhaps nothing can be more frustrating for students to encounter than vague, poorly written, or in some instances, non-existent performance learning objectives. Students who manage to complete aviation courses with substandard or, at best, an average comprehension of the course material, may encounter substantial difficulties in applying knowledge across academic interdisciplinary lines as well as incorporating practical application of basic aeronautical knowledge in their chosen professions. Even worse, some studies (Wingspread Group on Higher Education, 1993; the National Adult Literacy Survey, 1993) have indicated that despite technological innovations and advances, an increasing number of students are unprepared to meet the requirements of daily life such as using basic skills involving reading, writing, and elementary problem-solving. This finding strongly suggests that the widespread evaluation, enhancement, and implementation of clear performance learning objectives is not only timely, but very necessary.

Technology undoubtedly plays an increasingly important role in student learning. In a study conducted by Witiw and Kelly-Benjamin (1997), the researchers found that students' knowledge of basic aviation meteorology increased significantly in a technologically advanced aviation meteorology course. However, the most technologically advanced equipment in the classroom should neither be used as a replacement for rigorous performance learning objectives nor should be relied upon by faculty as an adequate substitute for effective educational outcomes. Developing rigorous performance learning objectives is paramount and should be inconsequential to the faculty member's decision to incorporate high technological equipment in assisting instructional delivery.

Developing clear learning objectives has many advantages for students. According to Renner (1993), the student gains a better understanding of the instructor's expectations and the instructor can actually see the subject matter that has to be taught. This will subsequently allow for the concise promulgation of course objectives to the students. Student confusion and frustration can be substantially limited or eliminated altogether, making the learning experience an enjoyable process.

Clear learning objectives also provide the instructor with a precise roadmap necessary for the instructional process to progress steadily and with coherence throughout the duration of the course. Unnecessary duplication of instruction can be drastically reduced if not eliminated altogether. Clear learning objectives also provide students with a necessary roadmap to navigate confidently through the course expectations in a progressive, coherent manner and may subsequently enhance the students' overall course knowledge retention level. This factor becomes highly significant when challenging students' basic problem-solving abilities in the classroom and should be a fundamental part of every aviation students' acquired academic skills. Thus, the educational expectations and criteria can ill-afford to be ambiguous.

Foundational Issues in Developing Performance Learning Objectives

Research has indicated that many college campuses invest too much effort in establishing credentials for their students to achieve, often at the expense of assessing knowledge, skills, and competencies (Wingspread Group on Higher Education, 1993). Establishing specific performance learning objectives in the classroom is of paramount importance in laying the underlying foundation for student learning. This, inevitably, will enhance the credentials students are working towards acquiring.

By utilizing the cognitive, affective, and psychomotor performance objective domains from Bloom (1956, 1973) to facilitate the development of specific learning objectives, educators can enhance the overall quality and effectiveness of their instructional materials. Renner (1993) more recently described Bloom's three performance objective domains in the form of teaching points that educators can use to address learners' needs by challenging the learner to (a) recall, recognize or expand knowledge (cognitive domain), (b) develop attitudes, feelings, values, or appreciations (affective domain), and (c) acquire skills involving tools, procedures, and techniques (psychomotor domain).

Addressing the three teaching points in the aviation classroom is crucial. The aviation industry is encountering profound growth and change (Kaps & Ruiz, 1997). In order to maintain the academic readiness that must necessarily accompany these changes, aviation educators need to continually strive to challenge student learning through new and innovative educational methods. Thus, the implementation of specific performance learning objectives within the classrooms of postsecondary aviation may provide educators the means to much more accurately discover, launch, and perfect new teaching methods through experimentation. This could prove to be mutually beneficial to both the educator and student. The student would have the advantage of accurately portraying the instructor's expectations of academic performance within the class, which in turn, may enable the student to more effectively set and achieve academic goals on an individual basis. The educator has the advantage of being able to establish a more effective baseline of expected academic performance which can be utilized to measure student progress.

The Importance of Appropriate Terminology Usage

The intelligible usage of subject specific terminology is perhaps as important as cognizance of the three learning domains when creating or revising curricula. When the objectives of the course are ambiguous or not clearly delineated, confusion may result that could prove to be an academic detriment to the student. Thus, it is imperative that educators take the responsibility and initiative in the deliberate selection of appropriate terminology in the development of clear and effective performance learning objectives. By doing so, educators can ensure that students will be able to determine exactly what is expected of them in the classroom, a situation that is paramount for student academic success.

In order for students to determine exactly what is expected of them in the classroom, educators need to select appropriate terminology in developing clear and effective learning objectives. For example, words such as know, appreciate, and understand are vague and provide an avenue for widespread interpretation unlike more precise words such as analyze, define, describe, list, and repair (American Center Association for Vocational Instructional Materials, 1977). In developing clear performance learning objectives, Table 1 contrasts the differences in using vague terms versus specific terms.

Table 1
Terminology Usage Comparisons

Vague	Specific
1. know the atmospheric conditions ideal for airframe icing	1. identify two atmospheric conditions ideal for airframe icing
2. develop an appreciation for ideal conditions conducive to ice formation	2. analyze the conditions conducive to ice formation
3. understand how to respond to ice formation	3. implement corrective action in response to ice formation

In Table 2, an illustration is provided that incorporates a specific performance learning objective for students enrolled in an aviation meteorology course followed by a discussion of each learning domain. The specific terms illustrated in Table 1 were incorporated into the learning objective exemplified in Table 2.

Table 2

Topic: Aircraft Structural Icing

Learning Objective: Given the appropriate equipment and materials, the student will be able to correctly <u>identify</u> two main types of aircraft structural icing, <u>analyze</u> the conditions which are conducive to the formation of icing and <u>implement</u> corrective action in response to ice formation.

Teaching Points

Knowledge (Cognitive Domain)	Attitude (Affective Domain)	Skill (Psychomotor Domain)
*Two conditions ideal for icing: 1. flying in visible precipitation, and 2. temperature is 0º Celsius or colder.	*Remain extra alert when encountering icing conditions.	*How to avoid icing conditions.
*Rime ice: rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets.	*"Aircraft structural ice can be inherently dangerous to safe flight."	*How to deviate out of icing conditions.
*Clear ice: glossy, clear, or translucent ice formed by the relatively slow freezing of large super-cooled water droplets.	*"Substantial ice build-up could kill me (us)."	*How to use de-ice anti-ice equipment (if applicable).
	*"The safety of the air-craft and its occupants in icing conditions is my responsibility and my highest priority!"	*How to develop a smooth and consistent flow check for encoun-tering icing con-ditions.

<u>Note.</u> Knowledge (Cognitive Domain) teaching points are definitions from the <u>Aeronautical Information Manual</u> (p. 7-1-22, 23), by the AOPA Air Safety Foundation, 1997, Pittsburgh, PA: Superintendent of Documents.

The Cognitive Domain

Educators need to effectively integrate learning strategies into all three learning domains to enhance the learning experience. In evaluating the three teaching points, educators have historically placed great emphasis on cognitive domain learning with little or no emphasis on the affective and psychomotor domains. This is highly significant as Bloom (cited in Anderson & Sosniak, 1994) argued that even though information or knowledge is an important educational outcome, few educators would view this as the primary or sole outcome of instruction. This predication by Bloom continues with the assertion that some evidence is needed to show that students can apply the knowledge that they have gained to practical situations and problem solving. To further complicate matters, some researchers argue that educators have even failed to address strong knowledge-based areas (i.e., the cognitive domain) as Freire (1971) stated that "students are not called upon to know but to memorize the contents narrated by the teacher. Nor do the students practice any act of cognition, since the object towards which that act should be directed is the property of the teacher" (pp. 67-68).

Despite substantial teaching emphasis on the cognitive domain, some studies (Daggett, 1995; Wingspread Group on Higher Education, 1993) have indicated that students are having problems in knowledge application. In charting Bloom's cognitive model to an application model, Daggett (1995) found weaknesses in students' abilities to effectively apply knowledge across disciplinary boundaries and to predictable/unpredictable situations (see Figure 1). According to Daggett (1996) in a more recent study, "America may do well in the world in teaching the upper levels of Bloom's; this does not mean, however, that students are able to translate that high-level instruction into real-world applications" (p. 9). For the aviation meteorology student, Daggett's argument can easily be assimilated. For example, memorizing two types of aircraft structural icing for an examination may not prove to be difficult. However, memorization of material for an examination does not mean the student has the ability to use the practical application of knowledge in specific situations. Simple memorization of material is neither a guarantee of academic success, nor is it a true measure of an individual student's subject knowledge retention level. This factor presents challenges in the academic environment that are unique, but by no means insurmountable. The establishment of strong knowledge-based principles in the cognitive domain will prove to be beneficial to students, particularly when applying these skills through psychomotor and affective activities to unpredictable/unfamiliar situations.

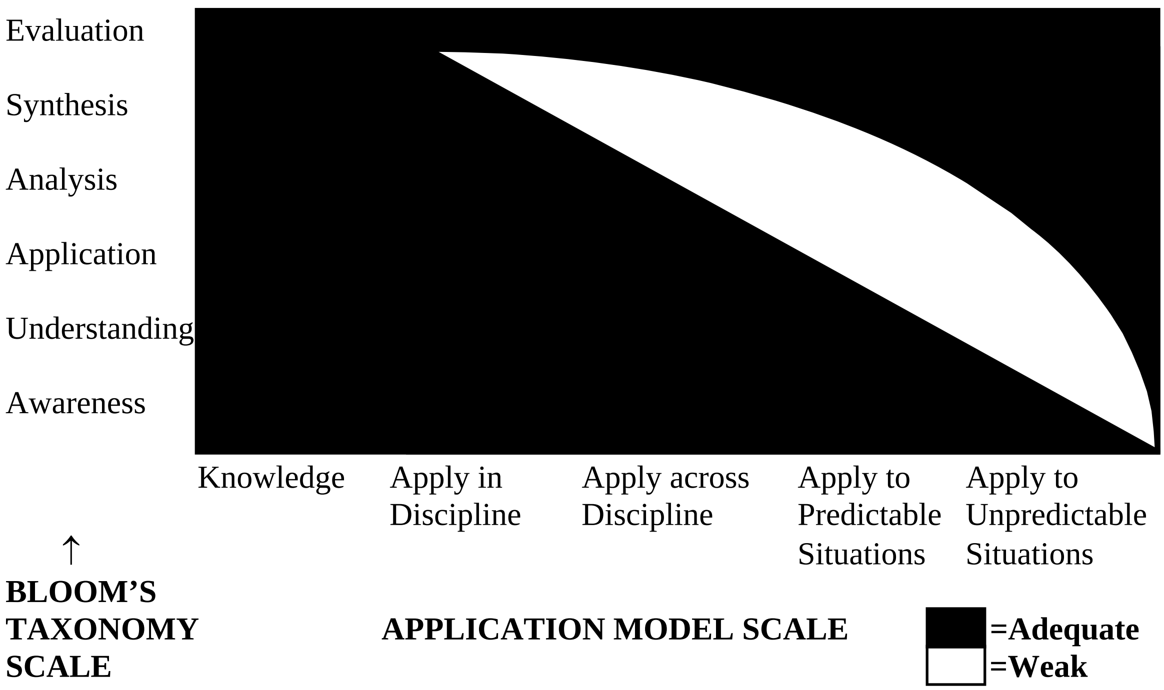

Figure 1. Weak areas of student learning in Bloom's cognitive domain across an application model. From Testing and Assessment in American Schools—Committing to Rigor and Relevance (1995) by W. R. Daggett.

The Affective Domain

Perhaps the most difficult aspect of teaching lies in the students' affective domain. Bloom (1956) stated that "objectives in this domain are not stated very precisely; and, in fact, teachers do not appear to be very clear about the learning experiences which are appropriate to these objectives" (p. 7). According to Paul (1985), not all learning is rational and the process that leads to a belief or a change in belief may be more important than belief itself. Educators can influence student behavior through positive or negative experiences, but what about changing their beliefs or preconceived attitudes regarding specific subject matter? Challenging students to rethink their values and revisit their behavioral reactions to situations in a process over time may provide instructors with an effective means to influence affective domain behavior and make rational assessments of student progress.

The aviation meteorology student's affective behavior may not exhibit "more alertness" during icing conditions or for that matter, may not exhibit any type of concern at all. According to Bloom (1973), an individual is more apt to achieve a "readiness to revise judgments and to change behavior in the light of evidence" (p. 183). In the case of the aviation meteorology student, the "light of evidence" may be a newfound belief that death becomes a realistic possibility from uncontrolled structural ice buildup as a result of a real life experience, simulation, or classroom based discussion. This, invariably, may be sufficient enough to change behavior within the affective domain.

Less dramatic than a real life close encounter with death, academic exercises such as role playing provide learners with the opportunity to try out new behaviors in a controlled setting. This also provides the instructor with a unique opportunity to observe student attitudes and subsequent responses to controlled, yet changing situational stresses. For example, a flight simulation provides a learning environment controlled by the instructor and the implementation of affective performance learning objectives of the course can be viewed by the instructor while being experienced firsthand by the student. This also provides the instructor with the invaluable opportunity to vividly illustrate the importance of aviation safety to the student as an integral part of the overall learning objectives, which carries with it the possibility of reinforcing positive situational attitudes within the affective domain of the student.

The Psychomotor Domain

Although Bloom (1956) recognized the existence of the psychomotor domain, he argued that developing a classification for these objectives would not have been useful. However, Harrow (1972) developed a working and useful taxonomy for the psychomotor domain to address the concerns of educators who deal primarily in the psychomotor domain. The purpose of Harrow's taxonomy is to assist educators in building skillful and efficient execution of movement tasks and patterns in natural locomotor, non-locomotor, and manipulative movements. Harrow observed that the modern educational system has the potential to help students by providing them with meaningful, sequentially organized movement activities. Educational concepts such as these harbor many potential benefits for the aviation student because a great deal of aviation related tasks are highly dependent on the proficient execution of tasks that lie within the psychomotor domain.

Although some of the skills in the psychomotor domain may appear outwardly simple, some psychomotor skills can become extremely complex, particularly when incorporating other learning behaviors into psychomotor skills. Harrow (1972) argued that when purposeful movement is being executed, a person is coordinating the cognitive, psychomotor, and affective domains. For example, regarding the psychomotor skill how to use de-ice/anti-ice equipment, a student elects to move a switch or a series of switches to activate the equipment at a given point in time. The event is predicated on the student using cognitive domain behaviors to determine when atmospheric conditions are conducive to the utilization of de-ice/anti-ice equipment and affective domain behaviors to determine that the current buildup of structural ice is inherently dangerous to safe flight.

A simplified illustration of a psychomotor skill for using de-ice/anti-ice equipment involves the utilization of a flow check through a basic simulation exercise. For example, the student who is developing a psychomotor skill in the application of proper operating procedures in employing anti-ice may start at the overhead panel from left to right, work diagonally, and then from left to right in a Z-pattern. In itself, the flow check does not necessarily require the student to utilize knowledge or exhibit some type of behavior (attitude). However, by physically "motioning" through operating procedures, the student's psychomotor skills are further developed in successfully implementing corrective action in a timely and efficient manner in response to the formation of aircraft structural icing.

Regarding the implementation of strong performance learning objectives within the psychomotor domain, Harrow (1972) affirms that the psychomotor domain is purported by many educators to be the easiest of the three domains for writing specific educational objectives because psychomotor behaviors for the most part, can be observed and measured. Therefore, the importance of the psychomotor domain and its relationship to effective educational outcomes in the postsecondary aviation learning environment should not be underestimated.

Teaching Points in Various Domains

Elements initially found in one domain often contain teaching points that encompass other domains. Renner (1993) provided an example by pointing out that some behaviors, such as avoiding injuries within a given learning objective, are an attitude and a skill. The psychomotor skill how to avoid icing conditions is predicated on the student's ability to analyze the two conditions ideal for icing in the cognitive domain and to implement corrective action accordingly. Affective domain behaviors such as remaining extra alert when encountering icing conditions will invariably play a role in the implementation of corrective action as well. Specific psychomotor skills such as changing power settings, altitudes, and airspeed also requires a cognitive awareness of identifying specific numbers from the pilot's operating handbook.

By incorporating Bloom's learning domains and Renner's teaching points, aviation educators can develop scenarios involving unpredictable events that challenge students' abilities. The example presented in Table 2 can be used by educators as a platform to develop specific performance learning objectives covering the three learning domains. From the illustration how to deviate out of icing conditions in an unforecast weather situation, psychomotor skills will also require students to exercise knowledge (cognitive domain) by knowing the ideal conditions for structural icing.

Conclusions

Technology cannot replace strong performance learning objectives in the classroom. Effective learning outcomes are paramount if educators expect to communicate their expectations to students in a clear and concise manner. Simply learning the material from a class provides unique challenges for most students without burdening them to decipher the meanings of weak or non-existent performance learning objectives. Utilizing state of the art equipment to deliver instructional materials to students should be used to complement, not replace effective performance learning objectives.

Educators need to be aware of the three learning domains and how they interrelate. Traditionally, assessment programs have revealed that educators have focused primarily on the cognitive domain at the expense of the affective and psychomotor domains (Banta, Lund, Black, & Oblander, 1996). Challenging students to rethink their values and behavioral reactions to situations over time has the potential of providing a very positive and rewarding learning experience. Establishing effective performance learning objectives is imperative in providing the necessary tools for students to successfully navigate through entire courses and academic programs. This, in turn, will provide an avenue for assisting students in meeting the ultimate challenge that lies ahead after graduation—facing unpredictable situations in careers and life itself.

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Developing a model of four-year aviation program quality:
A grounded theory approach

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Abstract

There has been a rapid increase in the number of four-year aviation programs in the U.S., from 20 programs in 1968 to over 70 programs today (UAA, 1994). The quality of these programs is difficult to determine since no research, other than accreditation standards, could be found concerning what criteria comprise a high quality four-year aviation program. Furthermore, having aviation professionals prepared through quality academic programs seems essential for the safe operation of the U.S. air transportation industry. The purpose of this qualitative study was to identify criteria that support a definition or theory of quality within four-year aviation programs in the U.S. Using Glaser and Strauss' (1967) grounded theory approach, data were collected from U.S. baccalaureate aviation program administrators and directors of training from U.S. major, national, and regional airlines. Eighty-two responses (63% response rate) were used in the analysis. Categories of criteria emerging from the study, such as curriculum, students, and faculty, were used to develop a model for four-year aviation program quality. Results of this study have implications for aviation program administrators and faculty for developing higher quality four-year aviation programs by placing more emphasis on identified criteria of program quality.

Introduction

Professional baccalaureate aviation programs have increased in numbers during recent years throughout the United States. In 1968 there were approximately 20 baccalaureate aviation education programs in the country, according to the University Aviation Association (UAA), the only professional organization representing the non-engineering element in collegiate aviation (UAA, 1989, 1994). Today there are 70 baccalaureate aviation programs in the country offering flight education in conjunction with a four year degree (UAA, 1994). Other related specializations offered by these baccalaureate aviation programs include airport management, aviation administration, aviation maintenance management, and air traffic controller education.

A rapid expansion of America's air transportation industry from 182 million passenger miles flown in 1982 to over 400 million passenger miles flown in 1991 (Wells, 1993) is a main factor for the increased number of aviation programs along with a decreasing number of ex-military pilots since the 1970s (Federal Aviation Administration [FAA], 1993). The significant increase in passenger miles flown requires a greater number of aviation personnel along with more sophisticated technology and equipment to operate in the same amount of airspace. As a result, aviation professionals must be more knowledgeable, better prepared, and more capable of making critical decisions to continue to ensure the safety of passengers, flight crew members, and the general public. Because pilots, aviation and airport managers, administrators, and air traffic controllers are in command of hundreds to thousands of lives daily, these professionals need superior preservice programs. Having aviation professionals prepared through quality academic programs is essential for the safe operation of today's and tomorrow's air transportation industry.

Background Literature

The literature on academic program quality in higher education can be categorized into areas of emphasis. These areas are: 1) context and input indicators of quality, 2) process and outcome indicators of quality, and 3) literature addressing a shifting view toward academic program quality.

Context and Input Indicators of Program Quality

In a review and critique of literature and research concerning program quality in higher education, Conrad and Blackburn (1985b) advanced the argument that academic quality "in this country has multiple dimensions and can be seen in many contexts" (p. 285). Most scholars agree that quality is not likely to be the same at different types of academic institutions (Astin, 1985; Conrad & Wilson, 1985; Millard, 1991). High quality programs in research universities as compared to high quality programs in community colleges will have different attributes. However, after synthesizing the literature, Conrad and Blackburn (1985b, p. 285) give the following elements commonly found in quality academic programs:

1) Faculty: quality programs are almost always related to characteristics of the faculty responsible for the implementation of the curriculum;
2) Facilities: quality programs have facilities necessary for their success such as well-equipped laboratories, appropriate library holdings, computers, and all the material things needed for the desired learning to take place;
3) Finances: quality programs have adequate financial support including the resources to maintain the operation, provide for faculty travel, and attract and retain outstanding faculty;
4) Curriculum: quality programs have a curriculum which has sufficient breadth and depth of courses; and
5) Students: quality programs have a sufficient number of students to provide for an adequate mix to foster students' learning from one another, and yet not so many students that individualized attention is lost.

Kuh's (1981) extensive literature review used Stufflebeam's context-input-process-product model (Stufflbeam et al., 1971) to identify indices of quality in undergraduate programs. Context indicators of quality were size, clarity and consistency of institutional purpose, organization processes (i.e. decision making strategies), financial resources, and student living environments (Kuh, 1981). Input indicators of quality identified in the model were student ability and student demographics, as well as nonintellectual characteristics such as aspirations

(Kuh, 1981).

Process and Outcome Indicators of Program Quality

Academic programs having context and input indicators of quality may not be deemed of high quality after assessing educational process or outcome variables as indicators of quality. Conrad and Blackburn (1985b) identified other correlates of program quality that are educational process or outcome variables. These correlates are less quantifiable, and include "leadership of program administrators, esprit of students and faculty, morale of students and faculty, clarity of purpose, and a healthy organizational climate" (p. 286). Esprit was described as a cooperative attitude among students as well as among faculty, whereas morale was more of an individual student and faculty trait. Although studies listing these characteristics as quality program indicators were sparse (Kuh, 1981), they still may play a part in developing and maintaining a quality academic program.

Additional characteristics associated with program quality are exhibited through the personal actions of students, faculty, and administrators. Examples include "achievement, persistence, purpose, worth, beauty, meritoriousness, and character" (Conrad & Blackburn, 1985b, p. 286). Other ingredients of quality academic programs discussed by Conrad and Blackburn's (1985b) literature review include accountability, efficiency, effectiveness, and excellence. Quality certainly encompasses accountability, meaning a program meets some minimum set of standards and achieves its goals. It also includes efficiency. "A quality program will more likely be efficient than inefficient" (Conrad & Blackburn, 1985b, p. 287). However, effectiveness and excellence, as well as accountability and efficiency are often used interchangeably as synonyms for quality (Cameron, 1987).

Kuh's (1981) literature review also revealed educational process and outcome variables as indicators of quality. Kuh categorized these indicators into Stufflebeam's (1971) process and product segments of the context-input-process-product model.

Process or involvement indicators of quality were:

1) instructional activities provided by faculty,
2) informal interaction between students and faculty, and
3) degree and kind of effort both students and faculty invest in their respective roles.

Product Indicators (Outcome Indicators) of Quality were:

1) persistence,
2) student achievement (i.e., GRE scores),
3) intellectual and social/emotional development of students, and
4) alumni achievements such as income and community service (Kuh, 1981).

The literature's emphasis on process and product indices of quality supports the position that assessors of quality should not overlook these important areas.

Shifting View of Program Quality

The overriding theme in the literature concerning academic program quality and effectiveness is that scholars find it hard to agree on which indicators should be used to determine program quality (Cameron, 1987; Tan, 1992). They have listed many input variables as noted in reviews of research literature and an increasing number of environment and outcome variables. For example, Astin's (1985, p.60-61) "talent-development" concept of educational quality is that "true excellence lies in the institution's ability to affect its students and faculty favorably, to enhance their intellectual and scholarly development, and to make a positive difference in their lives." This view of quality, labeled the value-added view, does focus more on process (environment) and outcome indicators of quality.

Conrad and Pratt (1985) also present questions about processes such as what should be the percentage of time devoted to teaching, research, and service in the university, and, what does a commitment to those percentages look like in terms of academic processes? Examples of these academic processes are faculty-student interactions and development of students' critical thinking and problem solving ability. The processes taking place within the design of an academic program can be very important indicators of program quality. Also, the "extra curriculum" needs to be considered in an evaluation of academic program quality since the activities of students outside the classrooms certainly may enhance or detract from the overall learning experience of each student (Conrad & Pratt, 1985; Kuh, Schuh, Whitt, & Associates, 1991). The extra curriculum may include events such as professional group meetings that are held on or nearby the campus.

All of these considerations point to a multidimensional approach in defining indicators of quality academic programs. Quality indicators should be examined at the program level as well as the institutional level (Fairweather & Brown, 1991). According to higher education literature, (Astin, 1991; Pace, 1990) focusing more on processes and outcomes will help gain a better perspective on the overall indicators of quality in academic programs.

This researcher did not find any studies in aviation or education journals identifying factors of aviation program quality or specific methods of measuring aviation program quality other than the accreditation standards. This lack of specific baccalaureate aviation program quality criteria gives rise to many questions. These questions include: 1) What are the indicators aviation program administrators should establish in developing a high quality aviation program, 2) How does one know if a baccalaureate aviation program in this country is of high quality, and 3) What criteria should be used to determine a program's quality? Although initial accreditation standards have been implemented, the accreditation criteria mainly address input variables (e.g., resources, facilities, faculty) of a baccalaureate aviation program. Little assessment of an aviation program's environment or outcome variables are mentioned. However, the current emphasis in the literature is on the environment of academic programs as well as the outcomes of those programs. It seems appropriate to study all aspects of U.S. baccalaureate aviation programs in a quest to find a comprehensive set of criteria that support a definition or theory of quality within baccalaureate aviation programs.

Purpose

In an effort to promote higher quality U.S. baccalaureate aviation programs, the overall purpose of this study was to identify criteria that, as indicators of program quality, support a ranking of the highest quality programs. This manuscript identifies the indicators of quality among the highest quality U.S. baccalaureate aviation programs.

Methodology

In the absence of any studies on baccalaureate aviation program quality, an independent measure of quality was administered in this research study. Aviation industry and aviation education experts were asked to identify the highest quality baccalaureate aviation programs in the country for the purpose of finding corresponding criteria to support the identified high quality programs. This procedure allowed experts to focus on specific criteria they identify as characteristic of the highest quality programs. An example of this type of research was accomplished by Mijares (1988) in another professional baccalaureate program--criminal justice. Through grounded theory research using Glaser and Strauss' (1967) constant comparative analysis, criteria used to support a ranking of programs went beyond a reputational ranking of baccalaureate criminal justice programs.

The methodology for this study, based on Glaser and Strauss' (1967) grounded theory constant comparative analysis, was chosen because the literature did not provide a clear definition of quality, especially in regard to professional baccalaureate aviation programs. Since quality is addressed in the literature as multi-dimensional, context specific, and shifting more toward process and outcome variables of the academic environment, a grounded theory approach to studying aviation programs, a relatively new academic program in higher education, seemed the most appropriate.

The unit of analysis in this study was U.S. baccalaureate aviation programs offering flight education as part of an aviation-related baccalaureate degree. There are 276 post-secondary education institutions in the United States offering non-engineering aviation programs (UAA, 1994). Of these institutions, 70 offer baccalaureate degrees in aviation-related areas involving some form of flight education. These 70 baccalaureate programs were identified from the most current Collegiate Aviation Directory (UAA, 1994). The 70 baccalaureate programs are generally located at Carnegie classified comprehensive I and II institutions throughout the country with a few at research universities and private nonsecular colleges. This research focused on these 70 programs since the other 206 institutions are either associate degree programs or certificate offering programs and are quite diverse in nature. There are also six baccalaureate aviation programs that did not offer any flight education in conjunction with aviation management degrees that were not included in this study. In order to keep the study's context specific, as recommended by Conrad and Pratt (1985), these programs were not included in this study since the study focused on only those academic programs providing flight education as an integral part of the baccalaureate degree.

Subjects

The sample population for this study included all 70 U.S. baccalaureate aviation program administrators and 89 U.S. aviation industry experts. The 89 aviation industry experts included 16 top-level FAA administrators, 18 directors of flight operations/training from U.S. based major/national airlines, and 55 directors of flight operations/training from U.S. based regional airlines. Because the number of regional airlines in each of the nine FAA regions varies widely, regional airline directors of flight operations/training were randomly selected from the nine FAA regions in the United States using probability proportionate to size sampling (Babbie, 1973). Thus, 37.5% of the regional airlines in each region were queried to obtain a sample size of 55. Fifty-five regional airlines were selected in an effort to obtain 27 responses (approximately 50%) from the regional airlines so that the combined industry and government (FAA) response would be approximately the same as the academic administrators' response.

Instrumentation

The instrument was an open-ended questionnaire designed to gather data for qualitative analysis. The questionnaire was pilot tested on a random sample of nine directors of operations/training from the U.S. regional airlines. The pilot test results showed that follow-up telephone calls were effective in obtaining a 67% response rate. The data obtained in the pilot study also showed 1) there was a range of quality existing in U.S. baccalaureate aviation programs, 2) there was some agreement as to which programs are the highest quality programs, and 3) the criteria used to identify these high quality programs showed similarities among respondents. Minor modifications in instrumentation and protocol were made as a result of the pilot study.

Participation was invited through a cover letter to each identified expert, with an explanation of the survey and a discussion of the study's possible benefits. Consent to participate was indicated by returning the questionnaire. A phone number was included for study participants to call if a report of the completed study results was desired.

Data Collection

The 130 experts were asked to select and rank programs they felt were the ten highest quality baccalaureate aviation programs in the country; they also listed criteria that formed the basis for their rankings. The requirement for listing criteria was used to prompt the experts to base their rankings on more than just reputation. The frequency with which a program was ranked in the top ten was used to quantify the dependent variable in the study, program quality. The criteria given by the experts were analyzed through Glaser and Strauss' constant comparative analysis and identified as indicators of program quality. The researcher carried out the study while affiliated with the University of Michigan. Therefore, respondent bias of identifying the researcher with a particular aviation program would not be an issue.

Participants were asked to complete and return the questionnaire in a prepaid addressed envelope. Follow-up postcards were sent to participants that had not returned the questionnaire. A follow-up letter was sent to all non-respondents twice after the postcards were sent. Finally, telephone calls were initiated eight weeks after the questionnaires were first mailed to all non-respondents. If the respondent requested to answer questions over the telephone, the same protocol was followed and questions were asked exactly as they appeared on the questionnaire. Table 1 summarizes the phase one data collection response rates.

Because all but one FAA expert felt they were either not in a position to judge the quality of U.S. baccalaureate aviation programs or it would be a conflict of interest if they did judge the programs, the 16 FAA experts were dropped from the sample population of experts. Colleges or universities that had discontinued their baccalaureate aviation program were also dropped from the sample. Similarly, regional airlines that had ceased operations were not included.

Table 1. Phase One Response Rates

Response Rates		
Group	**Sample**	**%**
Academic Administrators	48 of 68	71%
Major/national airline directors of flight operations/training	10 of 18	56%
Regional airline directors of flight operation/training	24 of 44	55%
Overall Response Rate	82 of 130	63%

Results and Discussion

The criteria obtained from the questionnaire were used to develop a grounded theory of quality in baccalaureate aviation programs using Glaser and Strauss' (1967) constant comparative analysis. Glaser and Strauss' methodology identifies the dependent variable as the constant (program quality) and the independent variables as the comparative data (quality criteria). The dependent variable in this study was measured by the frequency of top ten rankings of the baccalaureate aviation programs, while the criteria given by the experts to support the top ten rankings were the independent variables and identified as indicators of quality.

Data obtained from the three groups of experts (aviation program administrators, major/national airline directors of operations/training, and regional airline directors of operations/training) were analyzed separately to determine degree of group variability. The criteria were compiled by ranking for each expert group. For example, all the criteria listed for each number one program ranked by the academic administrators were grouped together followed by all criteria for the number one program ranked by the major/national directors of flight operations/training.

The criteria from the three groups of experts were used to develop a model of program quality in U.S. baccalaureate aviation programs. Ten categories evolved from the criteria listed by the experts to form a model of quality in U.S. baccalaureate aviation programs. Some subcategories were identified to more clearly define particular categories. The ten categories, all indicators of program quality in U.S. baccalaureate aviation programs, and the subcategories are defined as follows:

1. <u>Curriculum</u>

    a. Curriculum - the breadth and depth of course offerings within the aviation program as well as within the college/university where the program is located.
    b. Scholarship - the degree that high academic standards are upheld--the academic rigor and academic credibility of the aviation program.

2. <u>Students</u>

    a. Performance of graduates - the desired abilities displayed by the aviation program graduates while on the job, primarily at the regional airlines.
    b. Number of students - the number of aviation students within the program as well as the number of students attending the college/university campus. Experts indicated small, medium, and large aviation programs and small, medium, and large college/university campuses as indicators of quality. No clear trend developed.
    b. Student selectivity - establishing minimum grade point averages or ACT scores for entrance into the aviation program.

2. <u>Faculty</u>

    a. Faculty - the qualifications and technical expertise of the aviation program's faculty and flight instructors.
    b. Instruction - the quality and level of flight instruction given in simulators, aircraft, and the classroom.
    c. Dedication - sincere, ceaseless efforts by personnel within the aviation program to offer the best education possible.
    b. Research - the degree that aviation program faculty and administration carry out investigations to create new knowledge in the field.

2. <u>Program Activities</u>

    a. Student development/internships - the number and variety of student development opportunities including co-op programs, internships with airlines, industry seminars, professional meetings, etc.
    b. Flying team - the perceived success of the aviation program's flying team to the degree it contributes to the overall quality of the program.
    c. Industry relations - the ability of the aviation program to actively seek out and establish internship and co-op programs as well as establish on-going working relationships with industry representatives for the improvement of aviation education within that particular program.

d. Student placement - the degree to which the aviation program aggressively attempts to find employment for its graduates within the aviation field.
e. Student placement - the degree to which the aviation program aggressively attempts to find employment for its graduates within the aviation field.
f. Alumni relations - the degree the aviation program actively receives input from its alumni to enhance its program.
g. Service - the degree the aviation program provides help and expertise to the general public in aviation related areas.
h. Graduate school - the perception that a graduate program in aviation enhances the undergraduate education of a particular aviation program.
i. Advertising - the perception more advertising provides for a higher quality aviation program.
j. Minority recruitment - efforts to recruit and obtain more minority students enhances the aviation program's educational experience.

2. Equipment - the number and variety of simulators and aircraft the aviation program has for use by its students. Computer equipment is also included.

3. Facilities

   a. Facilities - the physical plant of the aviation program, i.e., buildings, classrooms, airport hangars, briefing rooms, etc.
   b. Location - the geographic location of the program provides for a better education for the student.

2. Leadership

   a. Leadership - the demonstrated ability of the aviation program's administration and faculty to lead their program toward excellence.
   b. Innovation - the ability of aviation program administration, faculty, and staff to continually think of improved ways of educating our future aviation professionals.

3. Resources

   a. Resources - the internal and external funding sources available to the aviation program.
   b. Grantsmanship - the ability of the aviation program to successfully compete for outside agency funding.

9. Reputation - the general knowledge by the expert that the aviation program is well respected in aviation education/aviation industry circles.

10. Value (cost) - the perception that the aviation program's offerings are worth the cost of

tuition and flight program fees.

Table 2 identifies the percentage of experts from each of the three expert groups that mentioned each of the ten criteria categories. The academic administrators view quality aviation programs from more of a multi-dimensional perspective than experts from the aviation industry, especially experts from the regional airlines. The regional airline experts focused almost entirely on the student category, specifically the performance of graduates. When combining all three groups, the order of importance for each criteria category that emerged was 1) curriculum, 2) students, 3) faculty, 4) program activities, 5) equipment, 6) facilities, 7) leadership, 8) resources, 9) reputation, and 10) value.

TABLE 2. Percentage of Each Expert Group Mentioning

Each Indicator of Quality Category

	Academic Administrators N=68 %[a]	Major Airlines N=18 %[a]	Regional Airlines N=44 %[a]	All Groups Combined N=130 %[a]
Curriculum	88	43	18	67
Students	50	71	100	63
Faculty	74	57	9	58
Program Activities	62	29	9	46
Equipment	53	14	9	38
Facilities	47	14	9	35
Leadership	18	29	9	17
Resources	26	0	0	17
Reputation	24	14	0	17
Value	6	14	0	6

[a] Percentages figured by dividing total number of experts mentioning criteria for the top ten programs by the number of experts mentioning criteria for each category.

Developing a Model of Aviation Program Quality

The quality criteria listed by the experts formed the ten categories for the development of a model that depicts the make-up of program quality in U.S. baccalaureate aviation programs. Figure 1 displays the model with the ten criteria categories. The diameter of the circle for each category of the model represents the approximate percentage of experts mentioning criteria within each indicator of quality category.

The ten indicators of quality within the model resemble other academic program quality studies to some extent. For example, Mijares' (1988) study of criminal justice programs found similar indicators, or factors, leading to a reputation of program excellence. The similar factors were curriculum, faculty, resources and facilities, and students. Also, Mijares' study identified size as a separate factor, whereas in this study, it was associated with students, similar to Conrad and Blackburn's (1985) study. However, other factors identified in the Mijares study, dissimilar to this study, were public service, association activity, graduate school, and age. Reasons for these differences may be numerous, but could include the fact that criminal justice programs emerged prior to a majority of aviation programs. Additionally, when considering these dissimilar factors, it is interesting to note that even in two relatively new professional academic programs such as criminal justice and aviation, academic program quality is defined differently. This does support Conrad and Pratt's (1985) research suggesting program quality be defined within a specific context. The results also support one of Fairweather and Brown's (1991) perspectives on academic program quality, that academic program quality is dependent upon departmental or program variables and not institutional variables. For example, most of the indicators of quality defined in the model of program quality in U.S. baccalaureate aviation programs pertain to specific departmental characteristics and not institutional characteristics.

Multi-dimensional Nature of Four-year Aviation Program Quality

The criteria for program quality data obtained were certainly multi-dimensional in nature, given the frequency different criteria were listed by the aviation education and aviation industry experts. Granted, the criteria listed by aviation industry experts were not as extensive as criteria listed by the academic administrators. However, the emphasis the industry placed on the performance of aviation program graduates is understandable, since it is a critical element in the airline industry’s day-to-day operation. Having well-educated aviation professionals readily able to meet the high pressure demands of the airline industry is essential for the continued success of the company. Thus, the perception by the airline industry that the performance of graduates is the overriding and predominant indicator of quality appears to be well founded.

It is interesting to note that the criteria used by the experts paid little attention to the reputation of the baccalaureate aviation programs, a variable often criticized in the past for having too much emphasis in academic program quality studies. The differences between academic administrators and industry, though, do suggest that academic administrators should possibly be focusing more attention on what happens to their graduates within the aviation industry in order to monitor where changes in their particular aviation program need to be made.

Some bias in the quality criteria data may be present, since the regional airline directors of operations/training were not as familiar with as many of the baccalaureate aviation programs as the academic administrators. When it came to ranking programs, the regional airline directors could only rank programs that they knew about, and those programs tended to be programs located nearby. However, the bias was counteracted by the fact that among the FAA regions of the country from which the regional airline experts were selected, the response rates from each region were similar. Thus, the regional bias factor should have canceled itself out with similar response rates from all regions.

A discussion of which criteria or indicators of quality identified are most important is warranted. Through an examination of Figure 1, it is appropriate to state that the experts listed the curriculum category most frequently as a criterion for quality. Using these qualitative data, curriculum would be listed as the most important indicator of quality followed by students, faculty, program activities, equipment, facilities, leadership, resources, reputation, and value. These criteria categories, or indicators of quality, all play a part in how the aviation education and aviation industry experts view quality.

Implications of the Study

The implications of this research study verify that program quality is multi-dimensional in nature, similar to Conrad and Blackburn's (1985) study of graduate programs and congruent with one of Fairweather and Brown's (1991) perspectives on quality. Identifying the indicators of U.S. baccalaureate aviation program quality in this study supports the premise that the indicators contain input, environment, and outcome variables. Industry mainly focused on student outcomes as an indicator of quality while the academic administrators focused on environment and input variables such as curriculum, faculty, students and program activities. Although the experts did not provide supportive data that aviation program quality is primarily defined through environment and outcome variables, it is evident from the criteria obtained that a shift toward these areas has occurred in baccalaureate aviation programs. This shift also may be occurring in other professional education programs. Researching other professional academic programs to validate the results of this study, including two year aviation programs, would be beneficial.

The information produced as a result of the study should not be considered conclusive in nature. Since this is the first attempt at identifying indicators of quality in U.S. baccalaureate aviation programs, further research is needed to compliment the study. Additionally, a more comprehensive review of a greater number of U.S. baccalaureate aviation programs would also prove helpful in providing supportive data as to which indicators of quality should garner the most attention when providing the highest quality baccalaureate aviation education.

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The Navstar Global Positioning System: A Global Utility?

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Abstract

Satellite-based navigation systems are one of the fastest growing sectors of the space industry. The Navstar Global Positioning System (GPS) is a fully operational US military satellite-based navigation system. New applications, both civilian and military, are continually being developed for GPS and increasing numbers of users worldwide are becoming dependent upon this technology. The airline industry is but one segment of the rapidly growing GPS user base. New technologies evolving from GPS are quickly advancing the usefulness of GPS, which presents the need for international and national policy. The users of GPS technology, such as the airline industry, are having considerable influence over the development of GPS policy as a result of civil users exercising increasing control over the system.

The use of GPS for navigation by the airline industry presents the unique challenge of integrating air and space law. This paper will discuss pertinent legal and policy issues that will affect the development of GPS policy such as liability, sovereignty, and GPS availability. According to some authorities, as GPS becomes an international utility it may present the requirement for an international organization, like the International Civil Aviation Organization (ICAO) or another consortium to establish the policy. The International Telecommunication Satellite Organization (INTELSAT) may serve as a model for a navigational consortium. This paper examines the various national and international organizations that may serve as models to develop GPS policy in the future.

Introduction

Space-based navigation systems, such as the Navstar Global Positioning System (GPS), are one of the fastest growing sectors of the space industry. New applications, both civilian and military, are continually being developed for GPS and increasing numbers of users worldwide are becoming dependent upon this technology. The airline industry is but one segment of the rapidly growing GPS user base. New technologies evolving from GPS are quickly advancing the usefulness of GPS, which presents the need for formulating international and national policy. The use of GPS for navigation by the airline industry presents a unique challenge of integrating air and space law. This paper discusses pertinent issues that will affect the development of GPS policy such as liability, sovereign control of assets, and GPS availability. This paper also examines the various national and international organizations that have developed, or may develop, GPS policy in the future.

Legal Issues

Sovereignty

The use of GPS for navigation by the airline industry presents the unique challenge of integrating air and space law. Air law is derived primarily from *The Convention on International Civil Aviation* (Chicago Convention). It recognizes that states have exclusive sovereignty over airspace above their territory (Larsen, 1993). Sovereignty means that a nation-state has total jurisdiction and control over all internal actions, people, and resources within its borders. Aircraft must operate within this legal regime based upon national sovereignty.

However, the GPS satellites exist in outer space where a different legal regime applies. *The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and Other Celestial Bodies* (Outer Space Treaty) states that "outer space, including the moon and other celestial bodies is not subject to national appropriation by claims of sovereignty, use or occupation, or by any other means" (Outer Space Treaty, 1967). Nonappropriation of outer space means that no sovereign state can claim outer space for itself. It also states "A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body" (Outer Space Treaty, 1967). Outer space itself is not subject to sovereign appropriation but nations exercise sovereignty over space objects like GPS satellites. Space law changed the traditional application of sovereignty, which is the cornerstone of air law. There are fundamental differences between the legal regimes that govern outer space, where GPS is located, and those regimes governing sovereign airspace.

Air and Space Law: Choice of Law

The use of a space-based navigation system for aircraft navigation presents the choice of which law will apply. In the future, aerospace law may be established and will be common to both types of law. The Future Air Navigation System (FANS) will play a crucial role in the integration of air and space law, resulting in the development of aerospace law (Bhatt, 1994). FANS combines aircraft navigation, the use of which is based upon sovereignty, with space-based systems that operate in an environment based upon nonsovereignty. FANS will provide immense safety and economic benefits based on international cooperation. However, the benefits provided by the FANS cannot be realized unless the system is implemented globally, which will depend upon international cooperation. At least some observers believe that cooperation is beginning to replace the notion of sovereignty with the world's airline industry moving toward deregulation and pursuit of a global market economy (Bhatt, 1994).

Currently, nation-states are responsible for developing, implementing, and maintaining their ground-based air navigation systems. Nation-states must adhere to international Standards and Recommended Practices (SARPs), established by the International Civil Aviation Organization (ICAO), but they also are responsible for developing their own domestic regulations, procedures, and policy regarding air navigation. Nation-states would forfeit some control over their air navigation systems if they use GPS; therefore, their claim of absolute sovereignty over airspace may be weakened over time. Nation-states are concerned about the ramifications of civil aviation using GPS as their primary means of air navigation. They are concerned that this arrangement will cause them to become dependent upon the US for air navigation services. This entails becoming dependent upon the US military, which operates GPS. The fact that GPS is controlled by the US military is a major obstacle to its international acceptance (Kaiser, 1994). Furthermore, the shutdown of ground-based domestic navigation aids would give the US tremendous bargaining power over nations at the end of the ten or fifteen year operating period (Kaiser, 1994). Nation-states do not want to become dependent upon the US for their air navigation system because it places them in a vulnerable position.

The international community may only receive the immense benefits from a space-based navigation system with the acceptance of certain limitations on national sovereignty. As nation-states began engaging in space activities it affected their sovereign rights, and their relationships with and within the international community. As a result of space activities, nation-states are less able to control the information that enters and leaves their borders (Wriston, 1988). For instance, individuals anywhere in the world, with a GPS receiver, can access the navigation information provided by GPS regardless of their location. A sovereign nation may not be able to prevent an individual, within their borders, from using the navigation information provided by GPS. In a strict sense, they cannot control the GPS signal that is penetrating their sovereign airspace. Nation-states can prevent airlines under their regulatory control from using GPS. However, as the immense benefits provided by GPS grow, it will become increasingly difficult to prevent its use. Political pressure may eventually cause nation-states to authorize the use of GPS for the aviation community.

Liability Implications

There is growing concern regarding the potential liability implications of GPS as a result of the increase in civil users and applications. In the past, the US government stated that the use of GPS data was strictly at the user's own risk until the system became fully operational (Spradling, 1990). Now that the system is fully operational the issue of liability must be addressed. Liability is an important legal issue affecting the operation of GPS partly because the risk of personal injury and damages is an economic factor (Larsen, 1993).

There are two pertinent sources of potential liability regarding GPS. The ability to warn users of erroneous information or degraded coverage is one source of liability (Spradling, 1990). The US government is under no legal obligation to provide GPS data to civil users, but they must exercise due care in ensuring the system is functioning properly and must warn users promptly when it is not (Spradling, 1990). In short, when the government offers navigation services, thereby inducing users to rely upon that service, they may be liable for damages caused by their negligence.

Currently, GPS provides two warning mechanisms. First, a satellite health message is transmitted as part of the GPS signal that is received by users (Spradling, 1990). The second warning mechanism, specific to aviation users, is the Notice to Airmen (NOTAM) system. Selective Availability (SA) is the second potential source of liability only if the Standard Positioning Service (SPS) accuracy is not maintained as published (Spradling, 1990).

The scope of liability must be discussed to ascertain the circumstances under which the US government might be held liable for injury and damages resulting from the operation of GPS. The US may assert sovereign immunity as a defense to any claim, which means the government must consent to be sued (Spradling, 1990). However, the U.S. Congress has passed several laws that waive immunity in certain instances. The Federal Tort Claims Act (FTCA) waives governmental immunity in claims against the US for damages arising from a loss of property, personal injury, or death, “caused by the negligent or wrongful act or omission of any employee of the Government while acting in the scope of his office or employment under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred” (US Code, 1346 (b)).

The waiver of governmental immunity is qualified by several important statutory exceptions which reinstate the government’s immunity status. Three of the statutory exceptions are particularly important in regards to GPS. Two exceptions include discretionary acts and claims arising in foreign countries. Generally, the government cannot be sued in these instances. However, if the claim is based on facts where the government’s conduct was negligent, it may still be possible to bring a claim.

The discretionary function exception is the most important of the three. This exception states that sovereign immunity will not apply to claims arising out of “the exercise or performance or the failure to exercise or perform a discretionary function or duty on the part of a federal agency or an employee of the government” (US Code 2680, (a)). For example, in 1980 a federal court stated that the government’s decision to illustrate a television tower on an aeronautical chart, into which the plaintiff’s spouse crashed their aircraft, was a discretionary act. Once the government decides to depict these hazards on the charts, then they can be held liable if it is not done correctly (Spradling, 1990). In this case, the court ruled that the government was not liable because the television tower was depicted properly on the chart. The government’s decision to degrade the accuracy of the Precision Positioning Service (PPS) to that available through the SPS, by implementing SA, is discretionary. The government can be held liable in cases involving the SPS, since it is a discretionary act, but they cannot be held liable for PPS because it is not discretionary. For instance, Acme Airline cannot sue the government for damages resulting from an accident claiming that the accident would not have occurred if they had access to the PPS, instead of the SPS.

The second exception to the FTCA’s waiver of governmental immunity is that it is inapplicable to situations where the claim arises in a foreign country (US Code, 2680 (k)). When the facts indicate that the negligent act took place in international airspace or outer space, the fact that the outcome occurs in a foreign country or territory does not rule out the possibility of claims under the FTCA (Spradling, 1990). For example, if an Acme Airlines aircraft crashes in Italy, caused by a negligent act which caused erroneous GPS data to be uplinked to a satellite from the Master Control Station in Colorado, then the airline can make a claim against the US government under the FTCA. The third and last exception, claims arising out of combat activities, is more narrow requiring only that combatant activities be the cause of the damages. If combatant activities “caused” the government to degrade or delete the SPS signal then the government would be immune without the question of negligence being raised (US Code, 2680 (j)).

In summary, there are some important general principles that are probably relevant to the liability implications of GPS for the US government. First, the US most likely has a duty to warn civil users of problems within the system that may cause an adverse result. The inability to warn users of system failures in real time is of great concern, particularly to the aviation community. The legal implications of this deficiency are uncertain at this time. The US will be held liable for operational level negligent acts or omissions. The US most likely will not be liable for damages as a result of the combat activities of the US military. Lastly, it probably will be the responsibility of the civil GPS users to match the known capabilities and limitations of GPS with the degree of risk involved with their activities (Spradling, 1990).

The unique features of GPS distinguish it from similar air traffic control and ground-based air navigation system cases. The geographical coverage is greater than any previous air navigation system, extending beyond US territory and international waters. Another cause for concern is that, in theory, there is a potential for a major catastrophe. Should the system experience a massive failure, thousands of users would be impacted at once (Spradling, 1990). For example, a complete system failure would have disastrous consequences for a Boeing 747-400. It can carry over 400 passengers, flying over long Pacific routes using GPS as the primary means of navigation, without Omega or inertial navigation system backup. To date, the issue of liability implications regarding GPS has received little attention from the legal community. Eventually this issue will be brought to the forefront as the world's airline industry, along with other civil users, increasingly utilize and become dependent upon GPS technology.

Institutional Considerations

Currently, there are no institutions that have the broad mandate needed to establish policies regarding the aviation community's use of space-based navigation systems for air navigation. However, there are several organizations that may be qualified to regulate certain aspects of GPS applications.

International Civil Aviation Organization (ICAO)

The Chicago Convention governs navigation of aircraft. It establishes the objectives of ICAO, which are the orderly growth of civil aviation worldwide, development of aircraft designs, and development of airways and airports (Chicago Convention, 1944). Most importantly, ICAO is charged with ensuring that the world is provided with safe, regular, efficient, and economical air transportation (Bhatt, 1994). ICAO is the institution that develops minimum SARPs for use of navigation satellites by aircraft. Based on the Chicago Convention, member-states are responsible for implementing the initiatives adopted by ICAO in the form of SARPs (Larsen, 1994).

ICAO, through the implementation of the FANS, is ensuring that its objectives will be fulfilled well into the twenty-first century. The implementation of a revolutionary technology such as FANS will require global coordination based on accepted policies. Member-states have recognized the need for ICAO's leadership in the global implementation of FANS, which is necessary for all nations to realize the benefits of this space-based technology (Kotaite, 1994). To respond to its member-states' request, the ICAO Council established a high-level task force, consisting of twenty-two capable individuals with managerial experience at the senior executive level in the international airline industry. The role of the task force is to advise the Council on the most effective method of implementing the FANS (Kotaite, 1994). The establishment of the Task Force and development of new policy has demonstrated ICAO's success toward integrating a space-based navigation system, such as GPS, into the aviation community.

However, the implementation of FANS, which is a space-based technology, will increase

ICAO's involvement in establishing space law and policy. The question at hand is whether ICAO is the proper institution to establish policies regarding the aviation community's use of space-based navigation systems for air navigation. ICAO already serves as a forum for the discussion of issues relating to the use of navigation satellites for air navigation, communication, surveillance, and air traffic management. ICAO also examines legal issues pertaining to the providers and users of navigation satellites (Larsen, 1994). To date, ICAO has been able to accommodate the wide variety of changes that have occurred in the world's aviation community. Some of these monumental changes were the introduction of the jet age and wide-body aircraft, which had not only a tremendous impact on the aviation community but the entire world. The use of space-based navigation systems for communication, air traffic management, and air navigation is having a similar impact.

ICAO has been successful in regulating and establishing policy for the world's civil aviation community for over 50 years. It is likely that ICAO is the proper institution to regulate and establish policy for the aviation community's use of space-based navigation systems. Although the involvement of space technology is a new element added to the traditional concept of airspace, it does not change the fact that ICAO is the only global institution that has the jurisdiction to regulate specific issues of aeronautical communications, air navigation aids, and other issues concerned with the safety, regularity, and efficiency of air navigation.

Office for Outer Space Affairs

The United Nations (UN) Office for Outer Space Affairs would perhaps be a more appropriate organization to implement and establish policy for the use of GPS and other space-based navigation systems. The Office for Outer Space Affairs is tasked with promoting the use of space technology applications, and implementing the decisions of the General Assembly and United Nations Committee for the Peaceful Uses of Outer Space (UNCOPUOS) relating to the peaceful uses of outer space (United Nations, 1992). However, the Office for Outer Space Affairs does have a broad mandate that accommodates all the civil uses of space-based navigation systems and their function is somewhat regulatory in nature. ICAO has the more specific function of regulating the international aviation community, and is becoming increasingly involved with regulating the aviation community's use of GPS. However, GPS is a space-based system, which implies that the Office for Outer Space Affairs would be responsible for regulating its use. Perhaps in the future, it may be beneficial for both ICAO and the Office for Outer Space Affairs to work together in regulating and establishing policy for the international aviation community's use of space-based navigation systems. Presently, there are no organizations that have extensive experience developing both the aviation and space policy that would be required for aviation-related GPS applications. Therefore, some observers have suggested that perhaps an international consortium would be the appropriate institution to develop and implement policy regarding aviation and other GPS applications.

International Telecommunications Satellite Organization (INTELSAT)

The consortium frequently cited as a model for a GPS consortium is INTELSAT. INTELSAT is a telecommunications satellite consortium begun in 1965 with one satellite, and has expanded to a network of nineteen satellites connecting over 750 Earth station antennas (Potter, 1992). *The INTELSAT Agreement and Operating Agreement* established INTELSAT as a "single global commercial communications satellite system" to "provide expanded telecommunications services to all areas of the world" (White and White, 1988). INTELSAT consists of 136 countries, all of which are part owners (de Selding, March 1996). INTELSAT shares are a capital contribution that is proportional to an ownership share in the satellite cooperative. However, the amount of capital investment is adjusted annually to represent the percentage of utilization made of the system by each member. Utilization charges from various services are in addition to ownership costs and this constitutes INTELSAT's operating revenues (White and White, 1988). INTELSAT's role is the space segment provider and system design authority. In terms of business, it does not sell services to the end users; instead it recovers the cost of their activities from the ground segment operators who provide the services to end users (Shin, 1993).

INTELSAT has many positive attributes that support its use as a model for an international navigation satellite consortium. Ownership in such an organization is held internationally and membership is voluntary. Another practical attribute of INTELSAT is that it allows for the formation of a large critical mass where economies of scale can be achieved (Potter, 1992).

Space-based navigation technology would be able to achieve economies of scale, as did telecommunication technology, through the creation of an international consortium and developing cheaper technology. It would be advantageous for an international navigation satellite consortium to duplicate the positive characteristics of INTELSAT.

There are also many attributes of INTELSAT that are incompatible with an international navigation satellite consortium. INTELSAT was created to provide global coverage, which GPS already provides (Potter, 1992). It was also established to provide critical infrastructure, but the space and control segment infrastructure for GPS is already in place (Potter, 1992). However, more infrastructure will be needed if GPS is to be used by the aviation community. For example, countries will have to develop and implement augmentation systems, similar to the Federal Aviation Administration's (FAA) Local Area Augmentation System (LAAS), that will allow aircraft to use GPS for instrument approaches. The enormous costs associated with building a global satellite network, considering the short design life and large size of early satellites, required vast financial resources (Potter, 1992). The size, design life, and overall costs associated with building satellites have decreased dramatically since INTELSAT was formed. The GPS satellites are highly sophisticated and have a design life of over seven years.

The structure of an international navigation satellite consortium would need to be consistent with the growing commercialization of space activities and should encourage competition. Any future international navigation satellite consortium should incorporate some of INTELSAT's characteristics, such as non-discriminatory access and voluntary participation, but should not use the organization as a strict model. The political environment and circumstances under which INTELSAT was created are considerably different from those of today.

Policy Issues

Accessibility and Control

GPS was originally conceived as a military space-based navigation system during the Cold War. GPS was part of the space race with the former Soviet Union in which both sides were trying to dominate the new "high ground." A study conducted by the National Academy of Public Administration (NAPA) and the National Research Council (NRC) stated that GPS "is rapidly becoming a de facto global utility with immense benefits" (NAPA & NRC, 1995). The idea that GPS is becoming a "de facto global utility" is inconsistent with the US exercising absolute control over GPS. GPS has been extremely successful in regards to accomplishing its military objectives. However, it has also produced invaluable benefits to many civil users worldwide. As a result of civil utilization of GPS, future policy must also focus on international cooperation and nondiscriminatory access, as well as its strategic value. The Outer Space Treaty states that, "The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interest of all countries" (Outer Space Treaty, 1967). The principle of freedom of outer space is based on the idea that the interests of the entire world community are best served through freedom and not on absolute control by a few nations. International law requires states that have accepted the Treaty to carry out the exploration and use of outer space in the common interest of all humankind.

Control was identified as a crucial element in determining international acceptance of GPS as an air navigation system. Currently, GPS is controlled by the US military. User-states are concerned that GPS service can be interrupted or the precision can be downgraded at the discretion of the US military. The use of GPS for air navigation will require substantial investments by the user-states; therefore, they will need a commitment from the US that they will provide nondiscriminatory access to the corresponding user-states (Shin, 1993). For instance, it would cost user-states millions of dollars to develop a system, similar to the FAA's Wide Area Augmentation System (WAAS), that enables aircraft to utilize GPS as the primary source for enroute air navigation. However, over time it will be less expensive to develop and operate a GPS-based air navigation system, as compared to the current ground-based systems.

There are several options that would address concerns regarding nondiscriminatory access and establish equitable control for user-states. Contractual relationships in some form may provide adequate control for user-states (Kaiser, 1994). Multilateral and bilateral agreements, similar to those already used in the airline industry, between the US and user-states may also be an acceptable alternative. Another option is the establishment of an international navigation satellite consortium similar to the INTELSAT. INTELSAT functions on the basis of nondiscriminatory access and equitable control for member-states (Shin, 1993). A formal contractual relationship would be a legal method to bind the US to comply with user requirements.

There are many reasons why it is in the best interest of the US to encourage the international acceptance of GPS by meeting the concerns about control. First, it would give the US an opportunity to institute user charges (Kaiser, 1994). The user-state must be willing to contribute financially to the operation of GPS when they are granted guaranteed access through some form of control. A contractual agreement between the US and a user-state would require that the user pay a predetermined amount for the navigation services used. Under this type of agreement the US would be more willing to make GPS available for a longer period than the ten or fifteen year operating period (Kaiser, 1994). Furthermore, if the US does not take further steps to promote the acceptance of GPS, other nations will be inclined to use the Global Navigation Satellite System (Glonass) or develop their own space-based navigation system.

The US, being a leader in space exploration and a signatory to the Outer Space Treaty, has the responsibility of facilitating international cooperation and making the benefits derived from space activities available to all nations. There are several courses of action that can be taken by the US to promote the international acceptance of GPS. The US should reassert its commitment to provide permanent international access to GPS and state its intention to consider international interests in the future development of the system (NAPA & NRC, 1995). SA should be eliminated because its military effectiveness is undermined by the existence of augmentation systems such as Differential GPS (D-GPS) (NAPA & NRC, 1995). The continuing degradation of the GPS signal through SA is a great inconvenience for civil users. Furthermore, the military's use of SA promotes uncertainty among civil users worldwide about the US's commitment to provide access to GPS (NAPA & NRC, 1995). The military will maintain its position regarding SA until they develop an alternative method to retain the strategic value of GPS.

According to at least one view, the political feasibility of further degrading the SPS signal for military purposes is quickly diminishing (NAPA & NRC, 1995). For example, further degradation of the signal, once the world's airline industry becomes dependent upon GPS as their primary source of navigation, would have disastrous consequences. The Department of Defense (DOD) discussed GPS control and management issues with the Department of Transportation (DOT). If the DOD relinquished some GPS control to the DOT it would ease concerns of the international community regarding the military's operation of the system (NAPA & NRC, 1995). Also, the DOT would be a competent U.S. government representative for negotiating any contractual agreements with user-states.

The Federal Radionavigation Plan: Toward an Integrated Federal Policy

The Federal Radionavigation Plan (FRP) serves as the planning and policy document for all present and future federally provided common-use radionavigation systems (United States FRP, 1995). A memorandum of agreement between the DOD and DOT, signed in January 1993, established the policies and procedures to ensure an effective working relationship between the two departments regarding the civil use of GPS (United States FRP, 1995). There are several objectives of the FRP that are particularly pertinent to the development of GPS policy. The first objective is to establish an integrated federal policy and plan for all common-use civil and military radionavigation systems (United States FRP, 1995). A well-integrated and consistent federal policy will promote international acceptance of GPS and will facilitate its commercial use. The next objective is to define and clarify new or unresolved common-use radionavigation system issues (United States FRP, 1995). GPS was developed as a military system but is becoming a "de facto global utility," which presents many concerns about protecting its role in national security. These and many other issues will have to be resolved through the development of federal policy. The final objective is to provide a focal point for user input (United States FRP, 1995). The amount of user input that will need to be taken into consideration, during the future development of the system and associated policy, will increase as the worldwide user base continues to grow.

The FRP contains several US government policies and practices that set a precedent for future GPS policy. First, is the promotion of national and international standardization of civil and military radionavigation aids (United States FRP, 1995). ICAO's FANS facilitates international standardization of civil air navigation systems, which renders increased safety and efficiency for the aviation community. Implementation of GPS as the world's standard in the air is contingent upon international acceptance of the system (United States FRP, 1995). Next, the US government has provided comprehensive management of all federally provided common-use radionavigation systems through DOD/DOT interagency agreements (United States FRP, 1995). This entails some policy making and management functions of GPS being turned over to the DOT from the DOD. The DOD releasing some control of GPS to the DOT may facilitate the international acceptance of GPS.

Lastly, the US government is trying to ensure that the private sector is considered in the development, operation, and maintenance of all the systems required to provide common-use radionavigation aids in support of the FRP (United States FRP, 1995). As the airlines continue to implement GPS into their operations and eventually become dependent upon the system, they will want their concerns and requirements to be considered in the development of policy and in the evolution of the system itself. Together, these policies and practices are establishing a precedent for future GPS policy that will promote international cooperation and commercial growth.

The Federal Aviation Administration's GPS Implementation Plan

The FAA has developed the GPS Implementation Plan for Air Navigation and Landing, which describes FAA activities in implementing the use of GPS by aviation users for navigation and landing. The FAA is using its Satellite Navigation Program to develop new capabilities that are rendering significant economic and safety benefits to the entire aviation community (FAA, 1994).

The FAA's mission, as stated in the 1994 FAA Strategic Plan, is to provide a safe, efficient and responsive aviation system (FAA, 1994). The US National Airspace System (NAS) is the best in the world; however, its capability is limited by the technology contained in the current systems. The FAA's goals for the future NAS are based upon the implementation of GPS, which will reduce the current technological limitations placed upon the system and increase efficiency (FAA, 1994). To date, the FAA has dealt with many technical aspects of GPS such as establishing standards for the manufacture of GPS avionics. However, they have not been as successful in addressing the coinciding policy issues. The FAA's overall strategy is to work concurrently on the technical, operational, and policy aspects of its Satellite Navigation Program to bring the benefits offered by GPS to the aviation community as soon as possible (FAA, 1994).

GPS Policy Studies: The National Research Council (NRC)/National Academy of Public Administration (NAPA) and RAND/Critical Technologies Institute (CTI)

NAPA and NRC Study

The *1994 National Defense Authorization Act* mandated that an independent study, funded by the DOD, on the future management and funding of GPS be conducted (NAPA & NRC, 1995). A report, *The Global Positioning System: Charting the Future* was published as a result of the joint study conducted by NAPA and the NRC. It builds on the work of previous studies and is intended to advise Congress, the secretaries of defense and transportation, the President, and the American public, on the actions needed to ensure the continued success of GPS in meeting military and civilian needs (NAPA & NRC, 1995).

The NAPA panel concluded that GPS is an invaluable asset that is quickly becoming a "de facto global utility" (NAPA & NRC, 1995). The NAPA panel presents some recommendations to help maintain US leadership in satellite radionavigation. First, the President should adopt specific national goals to guide GPS policy and implementation. The US should also maintain its commitment to make GPS available to all users free of direct charges (NAPA & NRC, 1995). In 1991, the DOT announced that it had no intention of limiting civil access to GPS in the near future, and that it would give at least six years advance notice before implementing any restrictions. Furthermore, the US commitment to keep GPS available for use by the international aviation community was reiterated in a letter from FAA Administrator David Hinson to ICAO in October 1994 (NAPA & NRC, 1995).

Charting the Future recognizes the importance of GPS to national security. The NAPA panel recommends that the DOD develop the capability to counter adverse use of GPS to retain its military advantage. SA is no longer effective at accomplishing its purpose; therefore, it should be turned down to zero immediately and deactivated after three years (NAPA & NRC, 1995). Augmentation systems used by the aviation community, such as D-GPS and WAAS, have defeated the purpose of SA, making it an inconvenience for users.

The report recommends further that the US should develop a more effective mechanism of governance by incorporating civil agency participation in policymaking, and offering a greater influence over civilian, commercial, and international interests in the future evolution of GPS (NAPA & NRC, 1995). The airline industry, being a major user of GPS, should have a stronger voice in the development of the system. Finally, stable federal funding for GPS will be necessary in the interest of national security and public safety. However, the possibility of contributions from other nations due to growing international participation should be pursued as well (NAPA & NRC, 1995).

The NAPA panel proposes some national goals that will promote the establishment of a national strategy and guidelines for GPS. Several of these goals are of particular importance to the international airline industry. The first goal states that the US should maintain an efficient and effective space-based navigation system that is responsive, highly accurate, and reliable (NAPA & NRC, 1995). The US should maintain its leadership in space-based navigation systems by promoting the future development of GPS and growth in commercial applications. The US needs to establish policies governing the availability, use, and funding of GPS that are concise and agreeable for all major users. Finally, the US needs to provide a flexible management structure that is capable of adapting to a rapidly changing environment (NAPA & NRC, 1995).

The NAPA panel further advises, in order to meet these national goals, that the President should promulgate an executive order to develop a national strategy for GPS and establish a GPS Executive Board (NAPA & NRC, 1995). The Executive Board should be responsible for governance oversight, policy setting and guidance, funding, and overall GPS coordination, including augmentation systems. The panel also recommends that the Board's membership extend beyond the DOD and DOT to include a representative group of domestic and international GPS users (NAPA & NRC, 1995). These recommendations suggest that the world's airline industry will more than likely have a member of the Board that represents their interests.

Overall funding recommendations from the NAPA panel state that Congress and the Administration should treat GPS as a public good, paid for by general tax revenues (NAPA & NRC, 1995). For national security reasons, it is imperative that funding for GPS come from a consistent and dependable source. It is also proposed that the costs of D-GPS and WAAS could be covered by the Aviation and Airways Trust Fund without raising taxes (NAPA & NRC, 1995).

GPS funding is an important issue because it presents the question of why US taxpayers should carry the financial burden of supporting a system that benefits users worldwide. In February 1994, the Congressional Research Service (CRS) studied several possible funding mechanisms (NAPA & NRC, 1995). Initially, CRS considered a user fee for the SPS, but concluded there was no fee collection method that could generate revenue without being cost prohibitive. A profit tax on commercial users was also examined. But it was concluded that this would jeopardize the competitiveness of US companies because collecting the tax from international users would be difficult (NAPA & NRC, 1995). The willingness of foreign governments and users to support GPS financially is mostly contingent upon the willingness of the US government to permit foreign control and participation in the system's management.

Finally, fees similar to those used for the FAA's Airport and Airways Trust Fund could be used to assess fees for D-GPS services (NAPA & NRC, 1995). Raising the taxes for the Airport and Airway Trust Fund may be necessary because it will help pay for the cost of augmentation systems and as a possible method of cost recovery for basic GPS activities (NAPA & NRC, 1995). There are several strong arguments for considering the use of the Trust Fund as a revenue source for GPS. The fund already exists so no additional legislation would be necessary to create tax-collecting mechanisms, and those affected would already understand the mechanism. The revenue that could be generated through the Trust Fund would be significant. The latest estimates for the Airport and Airways Trust Fund indicate that the balance in the trust fund will grow to $9.3 billion by the year 2000 (NAPA & NRC, 1995). The US airline industry would more than likely oppose any increase in taxes for the trust fund.

There are also some valid reasons why taxes for the Aviation and Airways Trust Fund should not be raised, but the funds can still be used to meet GPS costs. There seems to be no economic justification, regarding augmentation systems, for raising the fees. The D-GPS and WAAS have been justified by the FAA and the US Coast Guard on the basis of cost-benefit studies (NAPA & NRC, 1995). It is important to proceed cautiously with regards to increasing trust fund taxes because the system may change in the near future to allow a more direct-charge system based on the proposal to corporatize the FAA (NAPA & NRC, 1995). Most importantly, the airline industry is trying to emerge from financial difficulties and increasing Trust Fund taxes could result in an added financial burden on the industry. The US airline industry lost $10 billion dollars from 1991 through 1993, but many airlines have reported profits since 1995.

RAND's CTI Study

The White House Office of Science and Technology Policy (OSTP) and the National Science and Technology Council (NSTC) asked RAND's Critical Technologies Institute (CTI) to examine the major policy issues regarding GPS and to recommend solutions for addressing them (CTI, 1996). The report, titled *The Global Positioning System: Assessing National Policies*, was conducted by CTI and released in March 1996. CTI's report identifies the US government's lack of clear GPS policy as a key issue. CTI suggests that the US develop broad GPS policy that will serve as a guideline for more comprehensive policy in the future. It is important that this policy consider the interests of military, commercial, and international GPS users. Also, the policy should reassure all users that GPS will continue to operate in a stable, reliable manner, and provide civilian signals free of direct charges (CTI, 1996).

CTI makes several strong recommendations concerning the strategic value of GPS. CTI's study states that the US should ensure the GPS space segment remains subject to its control in order to protect national security interests (CTI, 1996). The study states that the US should ensure that GPS is funded and maintained in a stable manner, free of direct user charges, to promote the international acceptance of GPS (CTI, 1996). CTI's study also suggests that local-area augmentations should not be managed by international organizations because of their limited range, national interest in retaining local control, and a lack of effective methods of enforcing international control (CTI, 1996). Most local-area augmentations are already under the control of the private sector and national governments. Furthermore, the study provides that international governance of wide-area augmentations would enhance the international acceptance of GPS (CTI, 1996). Finally, the US should not deter the development of private ground augmentation services except when national security and public safety are compromised (CTI, 1996).

In regards to foreign policy, the study recommends that the US try to facilitate international participation in providing commercial GPS-related goods and services. However, the US should refrain, and encourage other nations to refrain, from providing wide-area augmentations until mechanisms, like military countermeasures or diplomatic agreements, are put in place that would deal with misuse (CTI, 1996).

Comparing and Contrasting the Two Studies

The two studies are different in several aspects. Some of the disparity between the studies may stem partly from the sponsoring organizations' dissimilar backgrounds. NAPA and the NRC are affiliated with the civilian sector and tend to represent the interests of the scientific community. Conversely, although RAND is no longer directly affiliated with the military, they often tend to reflect military interests due to their strong affiliation in previous years. The NAPA and NRC study recognizes the importance of GPS to national security, but they recommend the eventual deactivation of SA. The study recommends that the DOD develop new technology that allows them to retain the strategic value of GPS. The CTI study favors the DOD's position much more strongly. For instance, the CTI study recommends that the DOD retain control over GPS. The NAPA and NRC study suggests that some control over GPS might be transferred to the DOT. Next, the CTI study states that the US government should continue funding GPS, because a stable and reliable funding source is essential. Conversely, the NAPA and NRC study presents the possibility of developing alternative funding sources.

The two studies are similar in several aspects as well. First, both studies recognize GPS as a valuable asset and that the number of users is rapidly increasing worldwide. They conclude that the US should maintain its commitment to make GPS available to all users free of direct charges. The availability of GPS directly affects the international acceptance of GPS, which both studies also identify as an important issue. The studies state further that it is important for the US to maintain its leadership in satellite radionavigation. They both recommend that the US develop GPS policy that considers the needs of civil, commercial, and international users. Although both studies recognize the importance of the civil uses of GPS, the CTI study strongly recommends that the civil applications of GPS not take precedence over military applications or degrade the strategic value of GPS.

The Clinton Administration's GPS Policy

The development of uniform GPS policy is identified as a key issue in both studies. On March 29, 1996, the Clinton Administration announced its new GPS policy. The White House OSTP, and the White House National Security Council were responsible for developing the new government policy on GPS (de Selding, April 1996). The policy promises that commercial users will continue to have access to the GPS signal without charge. The policy also states the US government will turn SA to zero within ten years (de Selding, April 1996). This will give the military adequate time to develop a new method of denying enemies access to the GPS signal. The Clinton Administration contends that the new GPS policy will promote the already rapid commercialization of GPS services.

Conclusion

Comprehensive GPS policy needs to be established and should address pertinent issues such as liability, sovereignty, and availability. The DOT, FAA, and ICAO are national and international organizations that will develop future GPS policy. However, the creation of an international navigation satellite consortium is a viable alternative as well. It is evident that any policy must be based upon the values established in the Outer Space Treaty. International cooperation must be the cornerstone of future GPS policy, especially with the development of many foreign GPS augmentation systems. GPS is an extraordinary navigation system providing benefits that have only begun to be realized.

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List of Acronyms

CRS	Congressional Research Service
CTI	Critical Technologies Institute
D-GPS	Differential GPS
DOD	Department of Defense
DOT	Department of Transportation
FAA	Federal Aviation Administration
FANS	Future Air Navigation System
FRP	Federal Radionavigation Plan
FTCA	Federal Tort Claims Act
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
INTELSAT	International Telecommunications Satellite Organization
LAAS	Local Area Augmentation System
NAPA	National Academy of Public Administration
NAS	National Airspace System
NOTAM	Notice to Airmen
NRC	National Research Council
OSTP	Office of Science and Technology Policy
PPS	Precision Positioning Service
SA	Selective Availability
SARPs	Standards and Recommended Practices
SPS	Standard Positioning Service
UN	United Nations
UNCOPUOS	United Nations Committee for the Peaceful Uses of Outer Space
WAAS	Wide Area Augmentation System

Post-secondary Aviation Education: Preparing Students to Manage Airports of the 21st Century

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Author Note

This study on the perceptions of airport managers regarding aviation education is one aspect of a paper entitled Airport internships: Combining formal education and practical experience for a successful airport management career, which was prepared as a requirement for the American Association of Airport Executives Accreditation program. Findings presented do not necessarily reflect the views of my employer, the Hillsborough County Aviation Authority.

Abstract

Preparing for a successful career in airport management is a goal of many, but the dynamics of this industry are introducing complexities into aviation education. This article presents findings on the viewpoints of airport managers nationwide regarding the most appropriate fields of study, academic degrees, and aviation courses. Utilizing the 1996-97 AAAE Membership Directory and Yellow Pages of Corporate Members (American Association of Airport Executives, 1997), a written mail survey was sent to a nationwide random sample of 200 airport managers in January 1998. Results, which are presented using percentage distribution tables and descriptive statistics, show that the majority of airport managers view their career as challenging and interesting, consider management the most appropriate major field of study, consider airport administration and airport finance the most important aviation academic courses, and feel that a Bachelor's degree, when combined with experience, is the highest-level academic degree preferred by employers.

Introduction

The aviation industry is in a constant state of change. To describe the industry as dynamic may, in fact, be an understatement. Airports, which are one aspect of this industry, are maturing, but at the same time being forced to quickly adapt to the evolving environment in which they operate. Substantial measures are being taken in areas such as airport security, capacity, and funding on a nationwide and even international basis. Airport managers are at the helm of "professionally managed enterprises that are the engines of local and regional economies" (National Civil Aviation Review Commission, 1997, p. II-5).

This is not to say, however, that U.S. airports exist as domestic islands. More so today than ever before, the airport business is truly global. Airports that exist thousands of miles apart are becoming interconnected, simply due to expanding route systems and passengers that are demanding to stay in touch with the world. These demands are having serious effects on the world's air transportation system. Reported in the 1997 World Development Survey, in fact, the world's air travelers are expected to double from one billion to more than two billion over the next twenty years. This increase in demand must be accommodated, and airport managers will be forced to effectively utilize their facilities in managing this growth (National Civil Aviation Review Commission, 1997). In reacting to these demands, airport managers are required to be knowledgeable in many areas. Continuing education for current airport managers occurs nationwide on a daily basis. In addition, students aspiring to enter the field should seek formal post-secondary training in aviation. Through this education, students will understand the past and more fully appreciate the complexities of the future, thus being better equipped to manage airports of the 21st century.

The late 1960s marked the beginning of a new era in commercial aviation, with the arrival of the Boeing 747 jumbo jet in 1969. Coincidentally, this time period also seemed to mark a new generation for America's universities. During this time, a number of programs in aviation were founded at many of the nation's largest universities. In fact, more aviation programs leading to a Baccalaureate major were established in one year, 1968, than in all years combined since 1950. Seven aviation programs leading to a Baccalaureate major were established by U.S. universities in 1968. Further, this year marked the record high for the number of aviation programs established leading to an Associate degree. Students witnessed 11 Associate degree aviation programs begin that year. In sum, taking into account all aviation programs ever established by U.S. educational institutions, 1968 accounted for 11 percent of the Baccalaureate major aviation programs and 12 percent of the Associate degree aviation programs (University Aviation Association, 1994).

Due to the growth in the number and types of aviation programs during this time, much disparity existed among programs. For example, some programs offered certificates, rather than four-year degrees. The University Aviation Association (UAA), which was founded in 1947, decided to address this lack of uniformity and assist students in pursuing an appropriate aviation program. In 1976, the UAA published the College Aviation Accreditation Guidelines for the purpose of establishing nationwide standards regarding curricula, courses, and credits for Associate, Baccalaureate, and Master's aviation programs (University Aviation Association, 1976).

These nationwide standards further strengthened aviation programs by providing stability during one of many growth spurts in the aviation industry. Ironically, indirect assistance was also received as a result of a nationwide strike by approximately 10,800 air traffic controllers in August 1981. The majority of these Professional Air Traffic Controllers Organization (PATCO) members, who ignored President Reagan's order to return to work, were subsequently fired. Because of this, the Federal Aviation Administration (FAA) saw a need to train replacement controllers. As a result, the FAA and Administrator Lynn Helms gathered a task force of educators in 1982 to design a Baccalaureate curriculum to provide the FAA with future technical managers. The program, Airway Science, was soon implemented at several universities. As of December 1996, there were 56 institutions offering Baccalaureate Airway Science degrees and 6 offering Associate degrees in this major (Kiteley, 1996).

Further, in 1992, the UAA incorporated the Council on Aviation Accreditation (CAA) for the purpose of granting specialized accreditation to aviation programs. This specialized accreditation may be in addition to institutional accreditation obtained by the institution. As of July 1998, there were 13 universities nationwide with accredited aviation programs through the

CAA. Additionally, there were six universities offering programs which were candidates for CAA accreditation. Of the 13 accredited schools, there are a total 48 accredited programs being offered. However, of these 48 programs, only 7 are a Bachelor's degree in Aviation Management/Administration. Only one program, which is offered by the University of North Dakota, specifically has an airport title, that of Bachelor of Business Administration in Airport Management (Council on Aviation Accreditation, 1998).

In addition to aviation programs being accredited by the CAA, individuals in the airport management profession may become accredited through the American Association of Airport Executives (AAAE). This organization was founded in 1928 to represent airport management throughout the U.S. The AAAE Board of Directors formally adopted the Accreditation process in 1954. To apply for consideration to the Accreditation program, applicants must meet the following qualifications: be at least 21 years of age, posses a four year degree or eight years of public use airport experience, have at least one year of management experience at a public use airport, and be a current affiliate member of the AAAE. Prior to obtaining the A.A.E. designation, qualified candidates must successfully complete a written examination, a management research paper, an oral examination, and obtain three years of experience at a public use airport. Once accredited, these executives must complete 55 Continuing Education Units (CEUs) every 2 years to remain active. According to Will James, AAAE, of the 4,000 AAAE members, approximately 600 are active Accredited Airport Executives (personal communication, October 28, 1997).

Purpose

This paper specifically focuses on preparing students to manage the airports of the 21st century. For this to be effectively accomplished, both universities and their aviation management students should be aware of the perceptions of airport managers regarding four important areas: (a) descriptive words applicable to the airport management career, (b) major fields of study, (c) academic degrees, and (d) aviation academic courses.

Methodology

Participants

In selecting participants for this study, the 1996-97 AAAE Membership Directory and Yellow Pages of Corporate Members (American Association of Airport Executives, 1997) was utilized, as this directory contains a comprehensive listing of airport managers nationwide. In fact, the AAAE has members at the primary air carrier airports, which enplane 99 percent of the airline passengers throughout the nation, as well as at many smaller airports. Each individual member airport was counted to arrive at a total population of 690 airports. Out of this total, the goal was to receive 150 (n) usable surveys; therefore, assuming a response rate of 75 percent (p), the selected sample size was 200 (N) [n/p = N]. Each airport in the Directory was numbered alphabetically and a random numbers table was used to arrive at 200 randomly selected numbers

(Alreck and Settle, 1995). These numbers were then matched to the corresponding airports to arrive at a random sample of 200 airports. The recipient selected was the person known as Airport Manager or by similar title at each of the 200 airports. In addition to the simplified random nature of the design, the sample was chosen without replacement. In sum, each participant had an equal probability of being selected, and once selected, would not be chosen again.

Survey Instrument

Since perceptions were the main end product desired in this study, it was decided that a survey instrument would be utilized (see Appendix A). As a result, the author designed a four-page survey instrument specifically for this study. All questions were closed-ended to allow for easier coding of data. Further, many questions were scaled on a five point Likert scale. This was used to "obtain people's position on certain issues or conclusions" (Alreck & Settle, 1995, p. 116).

To reduce a misunderstanding among survey participants, the researcher decided to begin the survey with a definition of Airport Manager, which was defined as "the individual managing all facets of the day-to-day activities of the airport and known by such titles as Executive Director and Director of Aviation." This definition was included to reduce any misunderstanding that may arise when this term was encountered in the survey. The survey then moved into Section A, which was composed of an adjective checklist. This section allowed some exploratory research into how airport managers feel about airport management as a career. This type of question was included for the benefit of current students who may be interested to know the percentage of survey respondents considering the career stressful or political, for example.

Two sections of the survey instrument directly related to this study focused on (a) academic fields as a major area of study and (b) aviation academic courses. Both sections were scaled on a Likert scale to allow for opinions of airport managers to be gauged on this five-point scale. Choices included 0 (Don't know), 1 (extremely unimportant), 2 (unimportant), 3 (neutral), 4 (important), and 5 (extremely important). Participants were instructed to circle the number that most closely corresponded to their perception about each item.

The section focusing on academic fields of study presented 17 major fields of study ranging from Accounting to Speech Communication. These fields of study are identical (with the exception of the field airport management being added) to those used by Fuller and Truitt (1997) in gauging opinions of airport consultants.

The next section focuses on aviation academic courses that are available through many undergraduate aviation programs. Course offerings through several undergraduate aviation programs were consulted to arrive at a listing of 16 aviation courses ranging alphabetically from Air Cargo and Logistics to Private Pilot Ground. In this way, listed courses are generic to many aviation programs, rather than being specific to one university. Several of these courses are identical to those used by Kaps and Widick (1995) in gauging the perceptions of 25 airport managers at the nation's largest airports.

The section focusing on the descriptive words stated, "Which of the following words describe your airport management career?" Participants were instructed to place a check in any and all boxes that applied. Regarding major fields of study, participants were asked, "In preparing students for a successful career as an airport manager, how important do you feel each of the following academic fields is as a major area of study?” Regarding academic degrees, participants were asked, “What do you feel is the highest-level academic degree preferred by employers, when combined with experience to attain a position of airport manager?” Lastly, regarding courses, participants were asked, “In preparing students for a successful career as an airport manager, how important do you feel each of the following academic courses is?”

Procedure

In the cover letter accompanying each survey, participants were instructed on the reason for the research, how they were chosen, the importance of their participation, the estimated time required to complete the survey, and the fact that participation was voluntary. Further, they were told to skip any questions they did not want to answer.

Two hundred surveys were mailed on December 30, 1997. As of January 12, 1998, a response rate of 43 percent (86 surveys) had been received. Following the advice of Fowler (1993), a reminder postcard to all non-respondents was mailed emphasizing the importance of the study and the benefit of a high rate of response. One hundred and three postcards were mailed to all nonrespondents on January 15, 1998. This reminder mailing gave recipients the opportunity to receive another survey by fax, but only one recipient made such a request. This second mailing resulted in a total survey response rate of 66 percent, with 132 usable surveys being returned by the established deadline.

Data Analysis

Once the surveys were returned, a statistical analysis program, SPSS for Windows, was utilized to analyze the survey results. Descriptive statistics were produced, including frequencies, means, and standard deviations. The results are reproduced in this article in a tabular format to allow for easy comparison among categories. The intent was to analyze the results in a manner similar to Fuller and Truitt (1997), so as to allow comparison among viewpoints of airport managers and airport consultants. The Fuller and Truitt study was somewhat more technical in evaluation, and considers such topics as software programs used by consultants. Further, their study of academic courses was specific to those offered by the Master of Public Administration degree at Southern Illinois University. However, the evaluations of fields of study are almost identical, and some of the courses they evaluated may also be compared to the results presented in this study.

Results

Demographics

Because of the 34 percent (68) of survey recipients who did not respond, one may ask if this introduced nonresponse bias into the results. The respondents of this survey very closely match the AAAE membership at large. In fact, AAAE membership is composed of non-hub, other commercial service, and general aviation airports (75 percent), large hub (5 percent), medium hub (8 percent), and small hub (12 percent) [Susan Lausch, AAAE, personal fax, February 20, 1998]. The survey respondents were composed of non-hub, other commercial service, and general aviation (72 percent), large hub (7 percent), medium hub (9 percent), and small hub (13 percent).

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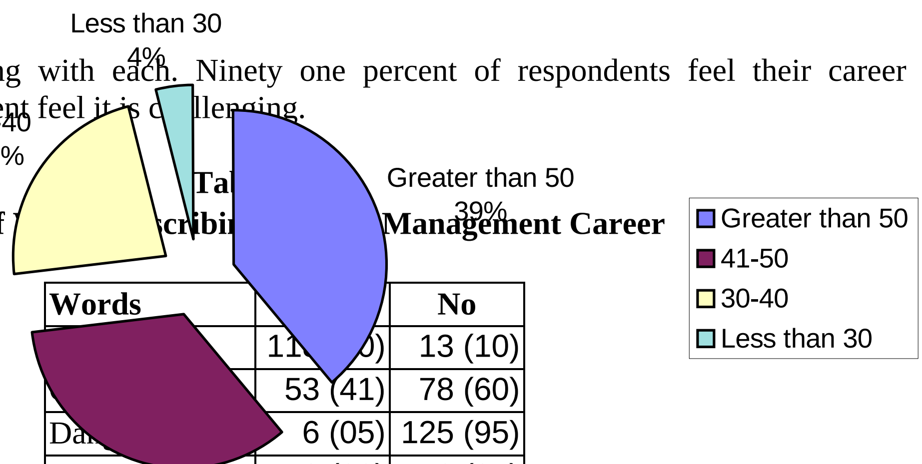
The respondents were 88 percent male and 12 percent female. Thirty-nine percent of participants were more than 50 years of age, with 34 percent and 23 percent being between 41 and 50 years of age and 30 to 40 years of age, respectively (see Figure 1). Further, 45 percent of respondents are known as Airport Manager, with 20 percent being known as Airport Director.

Descriptive Words

Figure 1
Ages of Respondents (in years)

The first section of the survey listed 15 adjectives to allow airport managers to describe their airport management career. The data in Table 1 show those words and the numbers and percentages



of respondents agreeing with each. Ninety one percent of respondents feel their career is interesting and 90 percent feel it is c[illegible]llenging.

Ta[illegible]
Evaluation of [illegible]scribi[illegible] Management Career

Words	[illegible]	No
[illegible]	11[illegible] ([illegible]0)	13 (10)
[illegible]	53 (41)	78 (60)
Da[illegible]	6 (05)	125 (95)
Disappointing	12 (09)	119 (91)
Easy	6 (05)	125 (95)
Enjoyable	89 (68)	42 (32)
Exciting	76 (58)	55 (42)
Fulfilling	72 (55)	59 (45)
Important	88 (67)	43 (33)
Interesting	119 (91)	12 (09)
Low-Paying	23 (18)	108 (82)
Political	91 (70)	40 (31)

Rewarding	90 (69)	41 (31)
Secure	18 (14)	113 (86)
Stressful	83 (63)	48 (37)

Note 1: Number in parentheses represents percentages.
Note 2: Row percentages may not total 100 percent due to rounding.
Note 3: Words are listed in alphabetical order as they appeared on survey instrument.
Note 4: N = 131 for all cases.

These two words claimed the majority; however, respondents also identified the following words as describing their airport management career: political (70 percent), rewarding (69 percent), enjoyable (68 percent), important (67 percent), stressful (63 percent), exciting (58 percent), and fulfilling (55 percent). Words receiving very little agreement are dangerous (5 percent) and easy (5 percent).

Table 2
Evaluation of Words Describing Airport Management Career
Ranking of Mean Ratings

Words	M	SD
Interesting	1.092	0.290
Challenging	1.099	0.300
Political	1.305	0.462
Rewarding	1.313	0.465
Enjoyable	1.321	0.469
Important	1.328	0.471
Stressful	1.366	0.484
Exciting	1.420	0.495
Fulfilling	1.450	0.499
Competitive	1.595	0.493
Low-paying	1.824	0.382
Secure	1.863	0.346
Disappointing	1.908	0.290
Dangerous	1.954	0.210
Easy	1.954	0.210

Note 1: Rating system utilized as follows:
1 = Yes (Agreed)
2 = No (Disagreed)
Note 2: Words are listed by ascending value of mean.
Note 3: M = mean; SD = standard deviation

The data in Table 2 show a listing of the descriptive statistics related to each word. Words are listed in ascending order by value of mean. The lowest mean equates to the highest level of agreement. The means simply confirm the findings presented in the percentage distribution table (Table 1).

Table 3
Evaluation of Fields of Study

Field of Study	Extremely Un-Important 1	Un-important 2	Neutral 3	Important 4	Extremely Important 5	*n*
Accounting	4 (03)	7 (06)	35 (28)	64 (50)	17 (13)	127
Aviation Management	0 (00)	1 (01)	13 (10)	61 (48)	53 (41)	128
Applied Science/Technology	5 (04)	19 (16)	61 (50)	35 (29)	1 (01)	121
Computer Science	1 (01)	12 (09)	44 (34)	57 (44)	15 (12)	129
Economics	1 (01)	15 (12)	39 (30)	59 (46)	15 (12)	129
Engineering	4 (03)	14 (11)	54 (42)	52 (40)	5 (04)	129
Finance	0 (00)	4 (03)	16 (13)	73 (57)	35 (27)	128
Foreign Language	32 (28)	36 (31)	41 (35)	7 (06)	9 (00)	116
Geography	21 (17)	31 (25)	58 (47)	12 (10)	1 (01)	123
International Relations/Business	16 (14)	23 (20)	49 (42)	24 (21)	5 (04)	117
Law	6 (05)	12 (10)	34 (27)	63 (50)	11 (09)	126
Management	0 (00)	0 (00)	0 (00)	63 (49)	66 (51)	129
Marketing	0 (00)	3 (02)	17 (13)	74 (57)	36 (28)	130
Political Science	2 (02)	20 (16)	49 (39)	45 (36)	10 (08)	126
Psychology	7 (06)	21 (17)	58 (47)	31 (25)	6 (05)	123
Public Administration	0 (00)	2 (02)	17 (13)	60 (47)	50 (39)	129
Speech Communication	1 (01)	4 (03)	18 (14)	58 (45)	47 (37)	128

Note 1: Number in parentheses represents percentages.
Note 2: Row percentages may not total 100 percent due to rounding.
Note 3: *n* reflects all valid cases, excepting "Don't Know" responses and nonresponses.

Fields of Study

Tables 3 and 4 show the level of importance placed on certain fields of study by airport managers. The top five fields (rated important and extremely important) are as follows: Management (100 percent), Aviation Management (89 percent), Public Administration (86 percent), Marketing (85 percent), and Finance (84 percent). In contrast, airport consultants viewed the above fields in the following manner: Management (62 percent), Public Administration (73 percent), Marketing (9 percent), and Finance (9 percent) [Fuller and Truitt, 1997, p. 72].

Table 4
Evaluation of Fields of Study
Ranking of Mean Ratings

Fields of Study	**M**	**SD**
Management	4.512	0.502
Aviation Management	4.297	0.680
Public Administration	4.225	0.731
Speech Communication	4.141	0.830
Marketing	4.100	0.703
Finance	4.086	0.721
Accounting	3.654	0.894
Computer Science	3.566	0.846
Economics	3.558	0.874
Law	3.484	0.953
Political Science	3.325	0.893
Applied Science/Technology	3.314	0.838
Engineering	3.310	0.837
Psychology	3.065	0.921
International Relations/Business	2.821	1.047
Geography	2.520	0.917
Foreign Language	2.198	0.916

Note 1: Rating system provided for evaluators was as follows:

0 = Don’t Know
1 = Extremely Unimportant
2 = Unimportant
3 = Neutral
4 = Important
5 = Extremely Important

Note 2: Only responses 1-5 were used in calculating statistics.
Note 3: M = mean; SD = standard deviation

Academic Degrees

Regarding academic degrees, 50 percent of respondents have completed a Bachelor's degree and 32 percent have completed a Master's (see Truitt, Hamman, & Palinkas, 1994). For those students aiming to attain a Master's, it should be noted that 67 percent of respondents feel that a Bachelor's degree is the highest degree preferred by employers. Only 29 percent feel a Master's is preferred. The law of diminishing returns only truly comes into play when one contemplates a Doctorate degree. Zero percent of respondents feel employers prefer this degree. The reader must remember that this question focused on the preferred degree, *when combined with experience,* to attain a position of airport manager.

Table 5
Evaluation of Academic Courses

	Extremely Un-Important	**Un-important**	**Neutral**	**Important**	**Extremely Important**	
Course in Curriculum	**1**	**2**	**3**	**4**	**5**	***n***
Air Cargo and Logistics	2 (02)	13 (11)	58 (48)	43 (36)	5 (04)	121
Air Traffic Administration	3 (02)	21 (17)	58 (47)	38 (31)	4 (03)	124
Air Transportation	0 (00)	7 (06)	36 (29)	65 (52)	16 (13)	124
Airport Administration	0 (00)	1 (01)	5 (04)	43 (33)	81 (62)	130
Applied Meteorology	10 (08)	31 (25)	56 (44)	28 (22)	1 (01)	126
Airport Finance	0 (00)	1 (01)	11 (09)	55 (42)	63 (49)	130
Aviation Insurance	7 (06)	14 (11)	41 (32)	54 (43)	11 (09)	127
Aviation Labor Relations	1 (01)	9 (07)	52 (41)	52 (41)	12 (10)	126
Aviation Law and Regulation	1 (01)	0 (00)	20 (15)	74 (57)	35 (27)	130
Aviation Marketing	1 (01)	1 (01)	17 (13)	74 (57)	37 (29)	130
Aviation Safety	0 (00)	2 (02)	14 (11)	59 (45)	55 (42)	130
Aviation Policy and Planning	1 (01)	1 (01)	15 (12)	70 (54)	42 (33)	129
Aviation Communication	2 (02)	7 (06)	34 (27)	64 (51)	19 (15)	126
International Aviation	7 (06)	20 (17)	62 (53)	26 (22)	1 (01)	116
Principles of Transportation	3 (02)	14 (11)	52 (41)	46 (36)	12 (09)	127
Private Pilot Ground	12 (09)	20 (16)	39 (31)	37 (29)	19 (15)	127

Note 1: Number in parentheses represents percentages.
Note 2: Row percentages may not total 100 percent due to rounding.
Note 3: Courses are listed in alpabetical order as appeared on survey instrument.
Note 4: *n* reflects all cases excepting "Don't Know" responses and nonresponses.

Academic Courses

Many undergraduate aviation programs have a few core courses that one must take and then electives from which the student must choose. To assist students in this task, sixteen aviation courses were listed for respondents to rate (see Tables 5 and 6). Two courses which received above 90 percent (combining important and extremely important categories) are Airport Administration (95 percent) and Airport Finance (91 percent). These two picks are in line with the major fields of study discussed earlier. Other courses which received high marks of importance are: Aviation Policy and Planning (87 percent), Aviation Safety (87 percent), Aviation Marketing (86 percent), Aviation Law and Regulation (84 percent), Aviation Communication (66 percent), Air Transportation (65 percent), Aviation Insurance (52 percent), and Aviation Labor Relations (51 percent). The following courses were not rated as highly: International Aviation (23 percent), Principles of Transportation (45 percent), and Private Pilot Ground (44 percent). This latter one, Private Pilot Ground, was rated neutral by 31 percent and a combination of unimportant and extremely unimportant by 25 percent of respondents. In contrast to this study, of the 10 aviation courses included in the 1995 study by Kaps and Widick, the following 3 were ranked highest in the "top ten preferred courses" category: airport operations/management (83 percent), airport planning (67 percent), and aviation regulation (56 percent). The "top ten preferred courses" category included all courses (general, aviation, and management) recommended by the 1979 University Aviation Association's "typical aviation management curricula" (Kaps and Widick, 1995, p. 158).

Table 6
Evaluation of Academic Courses
Ranking of Mean Ratings

Academic Courses	M	SD
Airport Administration	4.569	0.609
Airport Finance	4.385	0.675
Aviation Safety	4.285	0.718
Aviation Policy & Planning	4.171	0.719
Aviation Marketing	4.115	0.711
Aviation Law & Regulation	4.092	0.698
Air Transportation	3.726	0.758
Aviation Communication	3.722	0.845
Aviation Labor Relations	3.516	0.797
Principles of Transportation	3.394	0.892
Aviation Insurance	3.378	0.983
Air Cargo & Logistics	3.298	0.782
Private Pilot Ground	3.244	1.173
Air Traffic Administration	3.153	0.827
International Aviation	2.948	0.822
Applied Meteorology	2.833	0.892

Note 1: Rating system provided for evaluators was as follows:
0 = Don’t Know
1 = Extremely Unimportant
2 = Unimportant
3 = Neutral
4 = Important
5 = Extremely Important
Note 2: Only responses 1-5 were used in calculating statistics.
Note 3: M = mean; SD = standard deviation

Conclusion and Recommendations

The 66 percent response rate for this survey is quite high and simply shows that many airport managers are dedicated to this issue and feel this research is a worthwhile endeavor. In comparison, Alreck and Settle report that “[m]ail surveys with response rates over 30 percent are rare. Response rates are often only about 5 or 10 percent” (1995, p. 35).

Regarding gender, it appears that females are disproportionately under-represented in airport management. While this may be true, the 12 percent of responding females is somewhat higher than 6 percent of responding females in a 1994 study by Truitt, Hamman, and Palinkas. Actually, this equates to a 100 percent increase in the number of females involved in the airport management profession during the past 4 years. Therefore, it appears that females are being recognized for their knowledge of airport management and thus, contributing to the diversity of the profession.

As stated earlier, the fields of study presented in this paper are identical (with the exception of the field “airport management” being added) to those used by Fuller and Truitt (1997) in gauging opinions of airport consultants. It would be desirable for this same continuity to exist in studies involving all aviation majors so those viewpoints from the respective professionals in each field could be gauged. This information could then be utilized by universities in most adequately preparing students for careers in aviation.

The descriptive words were included in this survey to mostly assist students who are contemplating careers in airport management. As we all know, it is easy for students to become comfortable in the academic environment, yet not truly understand the implications for their career choice. By studying the results, one realizes that, according to the airport managers surveyed, the field is interesting and challenging. For students admiring these characteristics, airport management may be a reasonable choice. However, these students should also realize that the field is political, stressful, and not very easy, according to the survey results.

Although the fields of study reported are probably similar to widely accepted views about the profession, universities must be careful in interpreting this information. Although aviation management is rated highly as a preferred field of study, so too are management, marketing, finance, public administration, and speech communication. As a result, it is quite conceivable that there are many more students aspiring to be airport managers than we think currently exists. Students and universities alike must not assume, therefore, that only aviation programs are producing future airport managers.

As stated earlier, this study corresponds somewhat to that carried out by Fuller and Truitt (1997) on gauging the perceptions of airport consultants. The fields of study is the one area where both research efforts are identical, with the exception of aviation management as a major being added in this study. In comparing the results from these two studies in this area, one discovers that the field of public administration was rated highly in both cases. Forty-three percent of airport consultants rated public administration extremely important. Similarly, 39 percent of airport managers rated this field extremely important. Due to the involvement of “ . . . money, people, and politics . . . ” in the airport industry, public administration appears to be a logical field of study for prospective airport managers (Fuller and Truitt, 1997, p.71).

In times of competition, increased productivity and knowledge become mandatory for individuals seeking employment security in any industry. Bachelor’s degrees are no longer appearing solely on the resumes of the privileged few. Four-year degrees are quite common and many are seeking master's degrees to maintain that edge. Therefore, institutions of higher learning may be perplexed as to why 67 percent of respondents feel that a Bachelor's degree is the highest degree preferred by employers to obtain a position of airport manager. The author believes that a Master's degree would certainly assist a qualified candidate in obtaining a position of airport manager. However, the finding can be read as 67 percent of respondents feel that a Bachelor's degree is the highest-level degree needed to satisfy the educational requirement of an airport manager position. In contrast to the Fuller and Truitt (1997) study, 13 percent of airport consultants feel that a Master's degree is necessary, while 29 percent of airport managers feel a Master's degree is preferred.

A similar area of research involving this and the study by Fuller and Truitt (1997) is that of academic courses. Although the survey choices were quite different between the two, one major finding was uncovered in each case. Thirty percent of airport consultants rated Airport Administration as being extremely relevant. Sixty-two percent of airport managers agreed with this finding and rated the course extremely important. Although quite a substantial difference exists between these two percentages, this finding was the most similar of all the choices provided by the two studies. It must be remembered that the courses presented in the Fuller and Truitt (1997) study are specific to those offered by the aviation administration concentration in the Master of Public Administration program at Southern Illinois University. The courses presented in the survey by this researcher, however, were quite generic. Again, the intent was to allow for further studies to be conducted in the future with these same generic courses so as to allow for comparison of findings among the differing aviation industry positions, such as pilots, air traffic controllers, etc.

The most surprising finding regarding the aviation courses particular to this research effort was the fact that private pilot ground was rated <u>neutral</u> by 31 percent of respondents and a combination of <u>unimportant</u> and <u>extremely unimportant</u> by 25 percent of respondents. This combined neutral and unfavorable rating of 56 percent seems large considering that many airport manager positions advertised in AAAE's nationwide newsletter, <u>Airport Report</u>, prefer a private pilot certificate. This matter should not be taken lightly due to the approximately $4,000 one must currently spend to obtain this specialized training.

In addition to similarities with Fuller and Truitt (1997), this research effort also corresponds somewhat with that of Kaps and Widick (1995). Although their study, involving 25 "large airport" managers, focused on courses in three educational areas (general, aviation, and management), some comparisons may be drawn. Specifically, of the three highest-rated aviation courses, only airport operations/management (83 percent) corresponds to the 95 percent received by airport administration in the study carried out by this researcher. Kaps and Widick, due to utilizing the recommended aviation management coursework by the UAA for their study, did not include Airport Finance as a choice in their survey. Financial management, however, was included. This course, a management rather than aviation course, was ranked first in the 1995 study (95 percent). Similarly, Airport Finance was ranked second in the 1998 study (91 percent) Lastly, of the 10 aviation courses in the 1995 study, zero respondents rated a pilot certificate as top 10. This seems to follow the finding of low importance in the 1998 study in which the subject received a combined neutral and unfavorable rating of 56 percent.

To summarize the findings of this research effort, the following recommendations are presented:

Aviation management students

1. Review Tables 1 and 2 to determine if an airport career is truly desired.
2. Review Tables 3 and 4 to determine how applicable your academic major is to the field of airport management.
3. Review Tables 5 and 6 to evaluate the most appropriate aviation courses for your academic career.

Universities

1. Increase marketing efforts toward aviation students.
2. Research the possibility of offering a Master's degree in Aviation to further educate students about the future complexities of this industry.
3. Seek program accreditation through the Council on Aviation Accreditation.
4. Do not assume that aviation programs alone are producing future airport managers.

These recommendations summarize the main findings of this survey research. They are based mainly on the viewpoints of 132 airport managers who are members of the American Association of Airport Executives. Even so, these viewpoints represent expert opinions in the airport industry and should not be taken lightly. Those parties desiring to enter the field, instruct the field, and advance the field would be well advised to heed these recommendations. Responding to the increasing educational challenges of the aviation industry is the first step in improving the air transportation system of the next millennium.

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Appendix A

Airport Manager Survey

*Note: The entire survey provides data on more subjects than were discussed in this paper.

Sections A, C, D, and E are of particular interest to the readers of this paper.