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THE JOURNAL

The *Journal of Air Transportation (JAT)* mission is to provide the global community immediate key resource information in all areas of air transportation. Our goal is to be recognized as the preeminent scholarly journal in the aeronautical aspects of transportation. As an international and interdisciplinary journal, the *JAT* provides a forum for peer-reviewed articles in all areas of aviation and space transportation research, policy, theory, case study, practice, and issues. While maintaining a broad scope, a key focal point of the journal is in the area of aviation administration and policy.



Development

The *JAT* was conceptualized to fulfill an international void of scholarly publications in this area as identified by the primary organizers. It is envisioned that aviation leaders will utilize the *JAT* as a key decision-making tool. Scholarly rigor and standards will be uncompromised with regular evaluation by the Editorial Board and Panel of Reviewers.

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Scope

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- Aviation Administration, Management, Economics, Education, Policy, Engineering, Technology, and Science
- Intermodal Transportation
- Aerospace Education and Flight
- Airports and Air Traffic Control
- Air Transportation Systems: Domestic, International, Comparative
- Aviation/Aerospace Psychology, Human Factors, Safety, and Human Resources
- Avionics, Computing, and Simulation
- Space Transportation Safety, Communication, and the Future
- Other areas of air and space transportation research, policy, theory, case study, practice, and issues

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Dr. Brent Bowen is Director and Distinguished Professor, Aviation Institute, School of Public Administration, University of Nebraska at Omaha, and the University's Director of Aviation and Transportation Policy and Research. Bowen attained his doctorate in Higher Education and Aviation from Oklahoma State University and a Master of Business Administration degree from Oklahoma City University. His Federal Aviation Administration certifications include Airline Transport Pilot, Certified Flight Instructor (Gold Seal), Advanced Instrument Ground Instructor, Aviation Safety Counselor, and Aerospace Education Counselor. Dr. Bowen's research on the development of the national Airline Quality Rating is regularly featured in numerous national and international media, as well as refereed academic publications. Dr. Bowen has in excess of 250 publications, papers, and program appearances to his credit. His research interests focus on aviation applications of public productivity enhancement and marketing in the areas of service quality evaluation, forecasting, and student recruitment/retention in collegiate aviation programs. He is also well published in areas related to effective teaching and has pioneered new pedagogical techniques. Dr. Bowen has been recognized with awards of achievement and commendation from the American Marketing Association, American Institute of Aeronautics and Astronautics, Federal Aviation Administration, Embry-Riddle Aeronautical University, W. Frank Barton School of Business, Travel and Transportation Research Association, World Aerospace Education Association, and others.

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Sorenson Best Paper Award Recipient
**ETHICS EDUCATION IN UNIVERSITY AVIATION
MANAGEMENT PROGRAMS IN THE US: PART
ONE—THE NEED**

**Dale B. Oderman
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West Lafayette, Indiana**

ABSTRACT

This three-part study examines how four-year universities in the United States with baccalaureate programs in aviation management include ethics instruction in their curricula. Based on a literature review, no research exists to describe the current status of teaching ethics to aviation students. Yet concurrently, unethical activities reported in the media involving the aviation industry indicates a need for such programs. Part One of this study justifies the need for ethics education and develops a series of hypotheses to evaluate the current status of ethics instruction, which was investigated and will be reported on in Parts Two and Three of this study, respectively

INTRODUCTION

Stories about the unethical behavior of individuals in our society appear regularly on the front page of newspapers and on evening news broadcasts. In career area after career area, ethical lapses shake the confidence of the public, whether it is disreputable corporate business dealings, political scandals, medical malpractice, legal corruption, or improper relationships between personnel in the nation's military services. In fact, in 1997, the Ethics Officer Association reported that nearly half of the nation's workers had engaged in some sort of unethical or illegal acts during the previous year (Nearly half, 1997).

The aviation industry has its own share of problems in this regard; examples of unethical conduct in individuals and organizations abound.

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For instance, a mechanic in a large regional airline claimed he found evidence of sabotage in the form of cut wires on an aircraft brake system. However, investigators later discovered the mechanic had cut the wires himself in an effort to get a fellow employee fired (Chicago mechanic charged, 1997). In another case, the U.S. Department of Transportation's Office of Inspector General (1998) charged a large American air cargo carrier with parting out parts from two Boeing 727 aircraft. The carrier had purchased two 727s from a foreign air carrier and falsified the records to show that the aircraft had been maintained according to U.S. airworthiness standards. Then the company sold parts of the aircraft as if they had been receiving regular airworthiness inspections and servicing. All of the equipment transfer tags, which accompanied the parts, were fraudulently marked to show the parts in serviceable condition, and many of these parts were critical assemblies to be used on other aircraft. The collusion existing among the company's high-ranking management personnel necessary to accomplish all this is especially noteworthy.

Generally, in corporate America the principal motivation to act unethically is selfish interest such as competitive advantage, higher revenue, or individual advancement, and the results usually appear in the loss of something of dollar value to competitors or customers. Unfortunately, the consequences of unethical conduct in the aviation world sometimes extend beyond things to which a dollar value can be assigned. Often it results in lost lives.

Perhaps one of the most noteworthy incidents of this in recent history took place in the Florida Everglades in May 1996 and involved a ValuJet Airlines accident in which 110 passengers and aircrew members died. Most people heard the press reports about some oxygen-generating canisters causing an on-board fire shortly after takeoff, which eventually raged out of control before the pilots could safely return to land in Miami. What most people do not understand is that the accident could have been prevented altogether if certain personnel involved had acted ethically. Through a complex chain of events the oxygen canisters were illegally put on board the ill-fated aircraft for shipment. In violation of maintenance checklists, the canisters had not been properly prepared for shipment by contracted maintenance facility personnel when originally removed from other aircraft. Nevertheless, the mechanics and supervisory personnel involved certified the work as though it had been done! In the official accident report the National Transportation Safety Board (NTSB, 1997) said,

The Safety Board is alarmed at the apparent willingness of mechanics and inspectors at the SabreTech facility to sign off on work cards indicating that the maintenance task had been completed, knowing that the required safety

caps had not been installed, and at the willingness of those individuals and other maintenance personnel (including supervisors) to ignore the fact that the required safety caps had not been installed. The Safety Board has long been concerned about false maintenance entries, and their sometimes catastrophic implications. (p. 116)

Later in the report the NTSB said, “It is very likely that had safety caps been installed, the generators would not have activated and *the accident would not have occurred* [italics added]” (p. 135).

General Statement of the Problem

The obvious question at this point is what can be done to correct situations such as the ones cited above. Referring to similar events, Pelikan (1992) said that poor ethical conduct on the part of university graduates reflects poorly on the university education those graduates received. While serving as President of the College Board, Stewart (1988) stated that, “schools and colleges have a crucial obligation to transmit an ethical sense and an understanding of moral values to our young people” (p. 11). Bok (1986) called for courses in “moral reasoning and the analysis of ethical dilemmas in both undergraduate and professional school curricula” (p. 172). Indeed, a growing number of higher education academic fields have initiated ethics instruction as part of their curricula. Most prominent in this author’s search were the fields of law, medicine, business administration, and public administration; some other disciplines have begun to explore this arena as well.

Though it would be nearly impossible to measure the effect of ethics education in the subsequent professional lives of university graduates, many people from a wide variety of positions are calling for ethics to be part of collegiate curricula (Bok, 1986; Pelikan, 1992; Stewart, 1988). As will be discussed later, it appears that several preliminary conclusions can be drawn about the programs that so far have established instruction on ethics as a part of a student’s education. Those programs that are making the most progress in incorporating ethics education are characterized by support for the inclusion of this subject from the administrators of those programs (Brody, 1989; Piper, Gentile, & Parks, 1993; Rhode, 1995). College faculty and staff in programs that have infused ethics as a pervasive part of their curricula (i.e., as an integral facet of the curriculum, not merely as an adjunct course taught as a separate subject unrelated to a student’s major) report this approach to be more successful in accomplishing program goals than previous ethics instruction programs (Bundy, 1995; Link, 1989; Spaeth, Perry, & Wachs, 1996; Strike, 1990). Closely related to the previous points, programs that successfully adopt ethics into their curricula involve many of the department’s faculty members in teaching

and modeling ethics across the spectrum of course offerings in the department (Hafferty & Franks, 1994; Menkel-Meadows & Sander, 1996; Piper et al.; Spaeth et al.).

After an extensive search of the literature to date, this author has found that no one has addressed the subject of bringing ethics into the aviation management curriculum. Yet, it should be quickly apparent from reading professional aviation literature that ethical problems exist within the aviation industry, one that is a highly technical industry with a high percentage of college graduates in its ranks. Such graduates are filling management positions at all levels in the commercial airline industry, the aerospace manufacturing industry, federal aviation organizations, the airport management industry, corporate aviation departments, and a host of other organizations that daily affect the lives of millions of people. It stands to reason that a strong ethical value system accompanied by impeccable behavior should be required of individuals with such responsibilities. So as a first step in pursuing the inclusion of ethics in aviation administration curricula, it would be wise to ascertain the state of the current situation in such departments in the United States pertaining to ethics education for aviation students.

Research Questions

The purpose of this three-part study is to examine university departments, which offer baccalaureate degrees with aviation management (or its equivalent) as an academic major, in order to describe the current state of ethics education within those departments. The study will be accomplished in three parts. First, ethics will be defined, ethics education will be justified, and a series of hypotheses will be developed to guide research into the status of ethics education in the aviation education arena. Second, using a survey instrument, answers to the following major questions will be sought:

1. Are aviation administration departments requiring the teaching of ethics as an intentional part of their curriculum?
2. If ethics is a planned part of the curriculum, how is it taught and who is teaching it? For example, is it: (a) an adjunct course or courses taught by someone from outside the department, (b) a course or courses taught by someone from within the department, (c) a subject taught by intentionally integrating ethics into many courses within the department, or (d) some combination of all the above?

3. Is there a relationship between the importance that the department head places on ethics and whether the department incorporates ethics into its curriculum?
4. Is there a relationship between the ethical perceptions of the department head and whether the department incorporates ethics into its curriculum?

A third phase of the study will follow the initial statistical analysis of the responses to the survey. Individual interviews will be done to discover and describe why ethics is being taught or not taught. If ethics is being taught, follow-up questions to be answered will deal with how to best accomplish the objective of teaching the subject to collegiate aviation management students. If ethics is not being taught, follow-up questions will deal with reasons for not doing so. The results of Parts Two and Three of this study will be reported in separate papers.

Review of the Literature

The following literature review will begin with some definitions and cautions to guide the discussion of the subject of ethics. Then the idea of justification of ethics instruction will be raised. In so doing, the author will describe some theoretical information regarding ethical decision-making and moral judgment, and he will follow with empirical research based on these theoretical constructs. Based on this justification for ethics education, the author will describe the efforts to establish such programs in several academic fields in higher education. These efforts will be summarized with the intent of guiding the research outlined above for Parts Two and Three of this study. Before actually going on to Parts Two and Three, it will be necessary also to review several concepts dealing with the subject of educational change and how that process occurs.

Some Definitions and Cautions

Prior to discussing ethics education, it is important to begin with a few definitions concerning the term ethics and to raise a few cautions about any study that enters this realm. The Oxford English Dictionary (Michaelis, 1989) defines ethics as “the science of morals; the department of study concerned with the principles of human duty” (p. 421). The Standard College Dictionary (Simpson, 1963) states ethics is “the study and philosophy of human conduct, with emphasis on the determination of right and wrong” (p. 455). Strike (1988) continues in this vein by saying, “ethical issues concern questions of right and wrong—our duties and obligations, our

rights and responsibilities” (p. 156). In sum, ethics deals with standards of conduct.

Having arrived at a standard of conduct by some process, one then must go one step further. Ethics and morals are closely related. Ethics tell you what the standards are—what you ought to do or what you should do. Morals deal with the application of ethical standards to actual conduct. Morals reveal what you actually do. Because of the close relationship, it is very difficult to talk about one without discussing the other, particularly when talking about an actual issue. In fact, many would say it serves no purpose to have standards unless those standards influence behavior. And conversely, it makes little sense to talk about right and wrong conduct without basing the discussion on some set of standards.

Several other terms are frequently used in discussing this area: moral issue, moral agent, ethical decision, and unethical decision. Jones (1991) has given the following definitions:

A moral issue is present where a person’s actions, when freely performed, may harm or benefit others...A moral agent is a person who makes a moral decision...An ethical decision is defined as a decision that is both legal and morally acceptable to the larger community...An unethical decision is either illegal or morally unacceptable to the larger community. (p. 367)

Even in reading the terms just defined, one can see they are loaded with subjectivity, and consequently, with controversy. For instance, who decides whether an issue harms or benefits others and what degree of harm or benefit is needed to fit the definition? If an ethical decision is defined as one that is acceptable to the larger community, who is this community that decides what is acceptable, and how much is larger? Thus, a few cautions are needed before proceeding further.

First, ethics is an emotionally charged issue. Some larger issues in the field of ethics appear to be black and white; however, most fall in the realm of gray. For example, most people, if asked, would support the ethical standard that it is wrong to kill another person. However, as soon as some actual circumstances are considered, the question is no longer so cut-and-dried. Thus, individuals in American society have vigorously debated related subjects like capital punishment, euthanasia, infanticide, abortion, war crimes, and crimes against humanity without reaching much consensus on the ethical standards involved on any of them. Although laws may have been passed or judgments rendered, debate continues. The question still rages regarding who will set the standards for what is and is not ethical. In many instances, this is the very crux of the issue itself. In this respect, this study will not address how departments or professors should teach particular ethical issues. This paper will be aimed at addressing whether the subject is included within a curriculum. Actual course content and

objectives and specific course pedagogy are subjects for follow-up studies after an initial survey of the academic field is completed.

A second caution deals with terminology. Many people use the terms ethics and morals interchangeably as though they are synonymous. As mentioned above, in the clearest sense they have slightly differing meanings. Ethics deal with the standards of behavior, while morals deal with actual conduct. Some authors have not made this distinction in their writing and direct quotes will reflect this; however, this author will try to maintain the difference when using these words.

Justifications for Ethics Education

Justification for incorporating ethics into college curricula is the first critical issue that needs to be discussed. Merely showing that unethical behavior problems exist does not necessarily demonstrate that ethics instruction at the university level is needed to correct a societal trend. Therefore, the most important place to begin is to see if any previous theory-based or empirical studies have been published which give some justification for including the subject at all in higher education coursework. In short, the big question is simply whether instruction in ethics can bring about changes in ethical judgment, and thus affect moral conduct as well.

The first justification for teaching ethics comes from simple logic—you teach ethics whether or not you formally teach ethics. Piper et al. (1993) described a five-year project which began in 1987 to bring ethics to an already intense curriculum at the Harvard Business School. The authors begin by speaking to skeptics who would say you can not teach ethics to postgraduate students. They state, “What faculty are silent about and what they omit send a powerful signal to students” (p. 6). Rhode (1995) said, “Faculty who decline, explicitly or implicitly, to address ethical issues encourage future practitioners to do the same.... The most important characteristic of effective professional responsibility programs [ethics] is the message that the subject is itself important” (p. 140-141).

If nothing is said about the subject of ethics, a subtle, but dynamic message has been transmitted that ethics is not important enough to be considered in this curriculum. And if it is not important enough to be in this curriculum, it is also not important enough to be considered in the career to follow. Saying nothing about the subject because one is convinced it will have no impact whatsoever is prejudging students who enroll in college degree programs. A simple illustration of this principle is that some people will drink and drive and kill themselves and others in the process; however, that does not mean legislators should revoke the laws regarding drinking and driving and that others should abandon all efforts to educate the public on this issue. So it is with ethics.

A typical objection is that it is too late to give university students ethics education because they have already formed their moral standards based on their developmental years, and it is not possible to change their thinking. A related argument against ethics education is that the classroom is an artificial world and, thus, it is useless to discuss ethics in the classroom because things will change in the real world with all of its situational pressures. To answer these objections subjectively, a number of authors (Menkel-Meadow & Sander, 1995; Menzel, 1997; Rhode, 1995) stated that students enjoy discussing ethical issues when presented in an interesting way. Empirically, Rhode pointed to studies that demonstrate that people in early adulthood do make significant changes in how they deal with moral issues. Also, in a survey of 234 Masters of Public Administration alumni, 75 percent said they had faced a work-related ethical dilemma, and about 70 percent of them said their ethics education helped them respond to the situation (Menzel, 1997). Additional empirical evidence follows as a second reason to teach ethics.

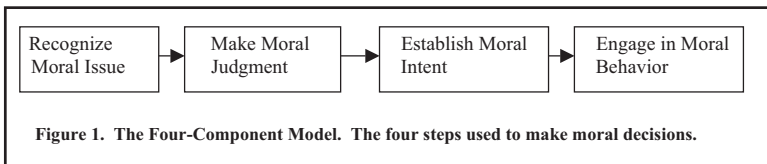
A second justification for teaching ethics comes from evidence of the effectiveness of teaching the subject matter. Although the number of publications dealing with empirical evidence for the effectiveness of ethics education is far less than the number dealing with the theoretical and pedagogical aspects of teaching the subject, some empirical evidence does exist for teaching ethics (Rest & Thoma, 1986). The ideal situation would be that researchers establish an experiment in which they randomly select two groups of students and give them some kind of pretest to establish their ethical level before treatment. Then they have half of the students take a curriculum with no ethics education while the other half takes the identical curriculum except that it includes ethics education. Finally, they would look at the groups some time later and compare their ethical conduct on the job, and they would try to draw conclusions about the impact of ethics education. Needless to say, this idealized scenario would be nearly impossible to conduct with any degree of validity.

A major limitation, therefore, of empirical studies to determine the success of ethics education in the form of changed behavior is that they simply do not exist. Brody (1989) said, "Our program, like most others, has not engaged in any formal evaluation process, in large measure because we have not yet been able to define how such a process would work" (p. 717). Ales, Charlson, Williams-Russo, and Allegrante (1992) stated, "Most faculty concurred that it was not possible to measure the immediate impact of the [ethics] course on students' abilities to think about ethical issues" (p. 407).

However despite the limitations, some work has been done to determine the effect of ethics education. To understand it, two concepts need

explanation: ethical decision-making and moral development. There are models on the process that individuals follow when working through a specific scenario requiring an ethical decision. Such models outline a step-by-step process going from recognition of an issue as one that is an ethical one (or that has ethical implications) to the actual action resulting from a decision on the issue. Fraedrich and Guerts (1990) call for an understanding of this concept as an essential part of ethics education. There are also views on what has been called moral development theory. Models have been devised which describe how an individual develops his or her reasoning ability to make decisions on ethical issues. For ease of discussion, the author will refer to models, views, perspectives, or constructs in these areas as those dealing with (a) the ethical decision-making process and (b) developing moral judgment.

The ethical decision-making process. Rest, Bebeau, and Volker (1986) developed a model of ethical decision-making and behavior called the Four-Component Model (see Figure 1), which has been referenced in literature dealing with how individuals choose ethical courses of action (Jones, 1991). Although more complex models exist to describe this concept, particularly when considering individuals in organizational settings, the Four-Component Model is sufficient to understand the empirical evidence for teaching ethics. In the first step of this model an individual recognizes a decision-making situation as one that involves an ethical issue. Next, the individual makes an ethical judgment; that is, he or she decides what the ethically correct course of action should be. Third, the individual establishes moral intent. This means that knowing the correct course of action and the competing influences, the individual decides mentally to follow the ethical course of action. Finally, the person must actually perform what is ethically required in the given situation. This step in the process is the place where ethics becomes morals.



Although this model seems rather simple and straightforward, it begs answers to a number of questions. For Step 1, for example, it questions how an individual comes to recognize issues as ones involving ethics. Regarding Step 2, it questions how individuals decide what is the ethical course of action. For the last steps, it questions how a person develop the

willpower to mentally decide to do what is right and then actually do it in the face of competing courses of action. A model on developing moral judgment answers some of these questions.

Developing moral judgment. For over thirty years a highly referenced model dealing with moral development is the one proposed by Kohlberg (Jones, 1991; Kohlberg & Turiel, 1971; Petrick, 1992; Trevino, 1986). In it Kohlberg describes six stages of moral development which address the questions raised in the preceding paragraph about the first two steps of the Four-Component Model. Kohlberg and Turiel stated that people develop progressively through the stages as they mature morally, and that the “stages have been validated by longitudinal and cross-cultural study” (p. 416). Individuals develop morally from middle childhood to adulthood through three levels, each made up of two

Table 1. Kohlberg’s Model of Cognitive Moral Development

STAGE	WHAT IS CONSIDERED RIGHT
LEVEL 1 - PRECONVENTIONAL	
Stage One - The punishment and obedience orientation.	The physical consequences of action determine its goodness or badness regardless of the human meaning or value of these consequences.
Stage Two - The instrumental relativist orientation.	Right action consists of that which instrumentally satisfies one’s own needs and occasionally the needs of others.
LEVEL 2 - CONVENTIONAL	
Stage Three - The interpersonal concordance or “good boy - nice girl” orientation.	Good behavior is that which pleases or helps others and is approved by them.
Stage Four - The law and order orientation.	There is orientation toward authority, fixed rules, and the maintenance of the social order.
LEVEL 3 - PRINCIPLED	
Stage Five - The social-contract legalistic orientation.	Right action tends to be defined in terms of general individual rights and in terms of standards which have been critically examined and agreed upon by the whole society.
Stage Six - The universal ethical principle orientation.	Right is defined by the decision of conscience in accord with self-chosen ethical principles appealing to logical comprehensiveness, universality, and consistency.

stages. These levels and stages are tabulated in Table 1 using excerpts from Kohlberg and Turiel.

As can be seen, people at Level One operate from self-interest so as to avoid punishment or to promote self-benefit, thus reminding one of childhood motives for acting in certain ways when instructed by adults. Those in Level Two (which according to Kohlberg includes most of American adults) conform to the expectations of good behavior of society or some smaller segment of society. Only at Level Three (less than 20% of American adults) do individuals act in accordance with universal ethical principles. "Persons at a higher level of moral development not only reason better, but they act in accordance with their judgments" (Kohlberg & Turiel, 1971, p. 414).

Kohlberg's research along with that of others (e.g., Trevino, 1986) indicates that individuals make ethical decisions from the particular stage of moral development that they have reached regardless of the ethical dimensions of the circumstances surrounding the decision. That is, they get to the second step of the Four-Component Model regardless of the circumstances surrounding the decision. However, linkage between thought processes and actual actions, that is, going to the third and fourth steps of the Four-Component Model, is more problematic (Trevino). The research of other authors in this area has shown that individual conduct will vary as the issues change and as external influences come into play (Couch, Hoffman, & Lamont, 1995; Ferrell & Gresham, 1985; Jones, 1991).

Empirical linkage. The Kohlberg Model and the Four-Component Model intersect at the first two steps of the Four-Component Model. Rest and Thoma (1986) reviewed research to evaluate the effects of educational programs and interventions designed to promote the development of moral judgment. Specifically, they did a meta-analysis of 55 studies, which had all used the Defining Issues Test (DIT) to assess the impact of moral education programs on moral judgment development. They drew six conclusions from their review, of which four apply to the topic of this study and are listed below:

1. Moral education programs emphasizing dilemma discussion (peer discussion of ethical dilemmas with the teacher as the discussion leader) and those emphasizing personality development (programs that promote reflection about self and about self in relation to others) both produce modest but definite effects, with the dilemma discussion method having a slight edge.
2. Academic courses in the humanities and social studies (courses in which the emphasis is placed on learning some body of academic

knowledge) do not seem to have an impact on moral judgment development.

3. Programs with adults (24 years and older) seemed to produce larger effect sizes than programs for younger subjects; however, several artifactual explanations may account for this trend.
4. Interventions longer than 12 weeks have no more impact than interventions of 3-12 weeks; however, durations less than three weeks tend to be ineffective when measuring moral judgment by the DIT. (p. 85-86)

The authors admitted that taking the conclusions of this study regarding improved moral judgment to the third and fourth steps of the Four-Component Model, that is, improvements in moral behavior, would be extremely difficult. Nevertheless, they “would expect there to be at least some modest correlation between moral judgment and behavior” (p. 87). However, Kohlberg and Turiel (1971) stated, “Experiments demonstrate that principled persons act more honestly and live up to their beliefs in the face of inconvenience and authority more so than do people or children at lower stages” (p. 414). Thus, a second justification for incorporating ethics instruction into higher education curricula is that teaching ethics can improve moral judgment.

Efforts to Incorporate Ethics Instruction in College Curricula

There have been efforts within several academic disciplines to incorporate ethics instruction as part of their curricula. Before seeking to describe the current state of affairs within the aviation management major, it would be important to have an understanding of the efforts that have been made by others to date. Particularly important to note would be such things as what they have done, what factors have enhanced such plans, why they have proceeded the way they have, what problems they have encountered along the way, and how they have responded to those problems.

Law schools. One would expect that law schools had been teaching ethics since the beginning as it would appear that ethics is an integral part of a law curriculum; however, such is not the case. In fact, it has only been since the mid-1970s that the American Bar Association has required law schools to provide ethics instruction for their programs to be accredited (Rhode, 1995). Simply incorporating a required ethics course, however, created many problems. As Metzloff and Wilkins (1996) stated,

The litany of problems associated with that course is widely accepted. Required since the mid-1970s, the course on ethics has been an unwanted

stepchild in many institutions. In most schools, it was the only or one of the few required courses; its mandatory nature breeds resentment among students. (p. 2)

One law school that did have more success instituting their ethics curriculum was the University of Notre Dame. In 1974 the Notre Dame faculty adopted a mission statement that included the dual objectives of teaching substantive and procedural issues and of “sensitizing our students and other scholars to the many ethical dilemmas that lawyers and clients face” (Link, 1989, p. 485). Rather than just teaching a required course on the subject, the faculty decided to utilize a pervasive method to teach ethics, that is, they wanted all faculty members to address ethics in all courses as appropriate to the subject matter of the courses.

The Notre Dame program still includes a required first-year ethics course. Their reasoning for doing so is important to understand:

The ethics course is taught at the beginning of the first semester because the faculty wants to catch the students while they are still unspoiled, while they still have a high level of idealism. More important, we believe that the ethical focus creates an ambience that will strongly affect their law school career as well as their eventual professional decision making. (Link, 1989, p. 489)

The first-year course lays the foundation, and the inclusion of ethics in the balance of the curriculum infuses ethics into the rest of the coursework. A third year applied ethics course summarizes everything in the law school program.

While other law schools had problems with their ethics instruction, Notre Dame proceeded with an effective program. There are several reasons for their success. First, it was based on a mission statement adopted by the faculty. Second, they sought and received confirming advice from the dean of another respected law school. Finally, they had as a faculty member one of the “leading legal ethics scholars in the country” (Link, 1989, p. 485).

Gradually, other renowned law schools began to address the issue. In 1987 the University of Pennsylvania Law School established its Center on Professionalism. Spaeth et al. (1995) discussed what motivated this university to take action:

While the leaders of the profession proclaim its fundamental virtue, and while teaching and writing about legal ethics flourish, reprehensible behavior even among the most acclaimed lawyers persists. It is our earnest conviction that this situation will not change unless the law schools accept some responsibility for teaching the profession’s ideals not only to law students but to practicing lawyers and judges. (p. 154)

The University of Pennsylvania had taught the required course as an upper level course. By self-admission, it was “if not a disaster, close to it”

(Spaeth et al., 1995, p. 154). Not only did students not like the course, but professors also tried to avoid teaching it. Professors did not seek tenure by doing research in the area. They disliked preaching on the subject. They did not like teaching a subject in which they had little practical experience. Thus, the Center on Professionalism was created to instruct a vital subject area while overcoming the myriad problems associated with ethics instruction. The model they used was the pervasive method with a creatively taught required course at the beginning of the curriculum and a series of modules subsequently taught throughout the remaining portion of law school (Spaeth et al.).

In analyzing their developmental process several key elements stand out. First, the Center saw the need to develop materials that faculty could use so they would not flounder in the classroom. Second, to do this they convened advisory committees consisting of practicing lawyers, teachers, judges, and non-lawyers to create practical scenarios for use in discussing essential points. As a result, the cases that the committee developed had very practical application directed to the future careers of the students. Third, after development of the materials, they were all test-taught, and a teacher's guide was written to enable all professors to teach the coursework even if they had not participated in the materials development. Spaeth et al. (1995) summarized their thoughts as follows:

In our view, if the effort is to succeed, it must be the result of an informal but self-conscious partnership of the bench, bar, and academy. But the academy, we believe, should take the lead, for it has resources of time for reflection and scholarship, and it can bring a searching objectivity to the task, beyond the resources of the bench and bar. (p. 172)

The stimulus for other law schools to seriously think about the way they included ethics in their curricula came with a large monetary grant. In December 1990, the W. M. Keck Foundation began its Law and Legal Administration Grant Program. Between 1991 and 1995 the Keck Foundation granted about \$5 million in 23 gifts to schools for the principal purpose of improving ethics education methodology. It is very interesting that Metzloff and Wilkins (1995) termed this effort in the early 1990s as an "important commitment to an area of law that was *admittedly still in the developmental stage* [italics added]" (p. 1). In November 1995, deans and legal scholars from sixty law schools gathered at Duke University to share lessons learned. A synopsis of those lessons follows.

Rhode (1995) described how Stanford Law School instituted the pervasive approach to teaching ethics. She cited several important considerations in establishing such a program. "Effective programs generally require a strong institutional commitment to the subject, together with well-structured course materials and methods for evaluating student

performance” (p. 141). She stated that it was because of encouragement from the school’s dean in conjunction with the Keck grant that more faculty members subscribed to the effort. Once initiated, an ongoing improvement plan has been critically important as well. Stanford now distributes annotated bibliographies with good teaching materials to aid professors in teaching the subject.

Initiating this approach at Stanford has not been without problems. Needless to say, the pervasive approach only works if professors concur with it. If professors are unwilling to discuss the issue or treat it seriously, students quickly adopt similar attitudes. Thus, poor or soured treatment of the subject could be worse than no treatment at all. Stanford overcomes this by allowing professors to opt out of being part of pervasive ethics although few have chosen to do so. To help in this area, Rhode (1995) said that choice of instructional materials is important.

Faculty at UCLA utilized the Keck grant to develop a pervasive approach also. According to Menkel-Meadow and Sander (1996), faculty members interested in legal ethics formed a working group, and within that group they developed a series of teaching problems. The working group meetings became weekly seminars for professors to experiment with various teaching methods. In essence the working group atmosphere along with the projects undertaken in the group gave faculty the foundation they needed to build their own expertise to the point where they believed they could adequately address the subject in relation to the courses they taught. Bundy (1995) reported the same effect on faculty at the University of California at Berkeley Law School. “A clear benefit of the Keck Project...is the very considerable integration of ethics into the academic lives of our faculty” (Menkel-Meadow & Sander, p. 134).

The UCLA faculty drew several conclusions from their initial efforts to infuse the curriculum with ethics. First, the pervasive approach must not just rely on a little bit of ethics in a lot of courses; there must be a course (best taught in the first year) which includes the foundational concepts and structures of ethics. Bundy (1995) confirmed this point as well from the perspective of the California-Berkeley experience. Second, if more faculty members include ethics in their courses, then the overall effect will be greater. In other words synergy is at work with increased breadth and depth of ethics coverage. Third, it is wise to continue the working group meetings, but “structured leadership and funding help to make these sessions more timely, better organized, and better staffed” (Menkel-Meadow & Sander, 1996, p. 137). Finally, Menkel-Meadow and Sander cited the need for continued leadership and funding from outside academia since the higher education community is “somewhat resistant to change” (p. 138).

Medical schools. Just as one would expect the legal profession to have had ethics instruction in its higher education curricula for quite some time, one would also expect the medical profession to have had the same due to the integral nature of medical practice with certain ethical issues. Indeed, one hears of the Hippocratic Oath and assumes medical students have discussed its implications for centuries. However, most medical schools in the United States did not have ethics in their curricula until the 1970s (Gillon, 1996). Thus, just as law schools have begun fairly recently to incorporate ethics instruction, the same is true for medical schools. And just as some law schools have made notable advances, so have some medical schools.

In July 1983, with the support of a grant from the DeCamp Foundation, a conference was held at Dartmouth College on the subject of including medical ethics in medical school curricula (Culver et al. 1985; Gillon, 1996). In a report of that conference, Culver et al. (authors from eight different medical schools) summarized the state of affairs for the medical school community at that time.

Formal teaching of ethics in the medical school curriculum has increased greatly during the past 15 years. Yet, schools vary in how much attention they give the subject, and even those that do offer courses vary considerably in the form and content of their curricula.... A medical school dean or curriculum committee surveying the current state of education in medical ethics might conclude that nothing has evolved that might serve as a national standard for adequate instruction. They might also conclude that courses in ethics are fine so long as one or more interested faculty members want to teach them, but that no deeper institutional commitment needs to be made and that no additional resources need to be devoted to the teaching program. (p. 253)

Culver et al. concluded “that the field is now sufficiently developed and the need for the application of ethical knowledge and skills in medicine sufficiently compelling to justify a recommendation that all medical schools require basic instruction in the subject” (p. 253). Going further, Culver et al. suggested several key aspects to such a program, which have also been supported by Weatherall (1995) of the medical school at Oxford University. Teaching of the subject should be interdisciplinary, meaning that clinicians and ethicists, who usually do not have training in each other’s fields, should cooperatively teach the subject of medical ethics. The authors outlined what could be called a pervasive method for teaching ethics in a medical school program-required course(s) in the pre-clinical years devoted to ethics and small-group discussion of ethics during the clinical years (especially as applied to specific cases on which medical students are working). In this regard they recommended that ethical consultation be available at teaching hospitals. Finally, they stated that to be effective, ethics instruction must be “rigorous and precise...taught unapologetically...challenging...and measured” (p. 253). To this list

Weatherall added one more essential characteristic. Leadership for instituting and continuing such a program must reside in one person or department of the school so that responsibility for the program is grounded.

Although ethical issues permeate the practice of medicine, the debate as to whether ethics instruction should be a formal part of medical education is not cut and dried. Hafferty and Franks (1994) presented three conflicting perspectives on this issue, which really summarize the thoughts of most authors across the whole spectrum of educational specialties:

First...past ills in the practice of medicine and the conduct of science can be corrected and future ills avoided only if ethics instruction is accorded a greater formal presence in the medical school curriculum Second...while it may be possible to teach the knowledge base of, or information about ethics...one's moral character basically is established prior to entry into medical school and...course materials or even an entire curriculum will not decisively reshape a student's personality or ensure ethical conduct in the future.... Third...while one's ethical posture is most deeply shaped by long-standing personal and family values and beliefs, if it is to be influenced by current work and training environments the most influential vehicle involves informal processes such as "general clinical experience," peer interactions, "ward rounds," and "role models" rather than formal course work in ethics or related topics. (p. 862)

Hafferty and Franks (1994) challenged all three perspectives and say that ethics should not be regarded as a body of knowledge and skills to be used as the situation arises, but rather ethics should be framed as a part of the future physician's professional identity. They proposed several parts to a curriculum. Although formal instruction by itself is not sufficient, it should be done early and continued through the student's tenure in the program. More important is the hidden curriculum that students receive via socialization—"the processes by which people acquire the values and attitudes, the interests, skills, and knowledge—in short, the culture—current in the groups of which they are, or seek to become a member" (p. 865). In other words, formal instruction is important, but even more important is the modeling of ethics by faculty during all aspects of medical training.

Brody (1989) described a program started in the early 1980s to teach medical ethics at Baylor University. Although they offer formal courses as electives for first-year students, the major effort at Baylor is through required case conferences during clinical rotations. The Baylor staff considers three ingredients as crucial in using this method. First, "conferences must be scheduled regularly" (p. 715). Since the conferences deal with real patients, students get an understanding of how ethical issues are handled in real life. Second, "the conferences must focus on the review of cases...that have troubled the students" (p. 716). Third, enough time

must be allocated to adequately talk about the problems raised. The Baylor staff has found it essential to have the active support of the department chairperson in order to make this effort a success.

Ales et al. (1992) reported on the development of a required medical ethics course at Cornell University Medical College. The Cornell course was designed by faculty consensus, that is, 15 physicians from a variety of medical specialty areas met to develop a case-based course which would be taught to second-year students prior to beginning clinical clerkships. The idea was to provide them with a basis “to think critically and systematically about ethical issues faced by practicing physicians” (p. 406). Cases were developed for each medical specialty, and students were given the cases and relevant readings to prepare ahead of time. A six-step method was presented in the course to help students organize their thinking on the cases. Groups of 10 to 15 students would then meet with a faculty expert to discuss the cases. Open and candid discussion contributed to the course receiving high marks for satisfaction on post-course student evaluations.

Business administration schools. Addressing the issue of teaching ethics in business administration schools began in the late 1950s with the publishing of books which encouraged education beyond just vocational training (Gilbert, 1992). Buchholz surveyed initial efforts to do this in 1979 (Fraedrich & Guerts, 1990). This study of business school deans and faculty found that most believed the subject to be important and recommended that courses in values be required. A follow-up study to this initial survey was done in 1987, and the results showed that a third of business schools had a special course in their curriculum that dealt primarily with ethical issues in business. In 1988 the Ethics Resource Center completed another follow-up study which showed that three quarters of the responding schools included ethics somewhere in their curricula (Fraedrich & Guerts, 1990; Gilbert, 1992; McNair & Milam, 1993).

To answer the question of why teach business ethics, Gilbert (1992) pointed to a number of previous works which “conclude that awareness of and clear practical thinking about moral issues in business do not happen spontaneously; hence the need to teach business ethics in business schools” (p. 6). Although ethics has been traditionally taught as theory in philosophy departments, he stressed the need for the subject to be taught with practical application to business in mind and that it should be taught by one with a mastery of philosophical writings as well as familiarity with business. He recommended teaching the subject early in the curriculum so principles could be applied to all functional courses. Fraedrich and Guerts (1990) discussed a number of existing problems with teaching ethics; however, they recommended using a series of constructs in a course on ethics to enable students to understand ethical decision-making. Using such

constructs will help them understand how they can bring ethics into the business setting.

Not surprisingly, since Bok (1986) advocated ethics education while president of Harvard, the Harvard Business School has led the way in establishing such a program. Piper et al. (1993) described a five-year project which began in 1987 to bring ethics to an already intense curriculum at Harvard. Harvard designated a core group of professors to develop the curriculum. After looking at three options (a required course, elective courses, or distribution of ethical topics across existing courses), they decided all three should make up an integrated curriculum. Harvard requires an introductory course of all first-year students, and the focus is to discuss the issue up front to insure it is recognized as a key concept to be dealt with throughout the student's entire tenure in the program. In addition, by design, each professor addresses applicable ethical principles in all of the other courses taught, and electives are available for those interested. Integrating all three course options capitalizes on the strengths of each option while minimizing the weaknesses of any one separately.

However, curriculum does not make the program successful by itself. Piper et al. (1993) pointed to three primary reasons for the successful implementation of the ethics program at Harvard. First, it had the support of the leadership of the university and the business school. Second, it had the support of the school faculty. Third, Harvard pursued faculty training and development. In summing up the Harvard experience, Piper et al. stated,

The evidence is clear: our students are not the problem. Almost all of them are eager to talk about purpose and principle, to explore the systemic causes and consequences of unethical behavior, to study outstanding leaders and organizations as they grapple with ethical dilemmas.... The problem rests with the failure of education to encourage and assist students in their search for purpose and worth. (pp. 148-149)

When discussing Harvard's program to incorporate ethics into their curriculum, another factor should be added as a contributor to its establishment. In 1987 Harvard Business School received a gift of \$20 million from former Securities and Exchange Commission Chairman, John Shad, to bring ethics education into the curriculum, and alumni contributed another \$10 million to this effort (Bryne, 1992). This enabled the faculty to devote time and effort to the task of developing courses and 35 case studies used in the program. Jones (1989) said that Harvard's prestige among business schools has led to other schools adopting or considering similar actions, and he pointed to MIT and Georgia Tech as specific examples.

Within the business administration discipline, McNair and Milam (1993) conducted a more focused survey of over 200 faculty members in the accounting field on the subject of ethics education as related to

accounting. The study revealed several important conclusions. First, they found that nearly 70 percent of the survey participants thought there was a need for more coverage of ethics even though over 77 percent of the respondents said they already gave some course time to the subject. The authors thought this was a first step to improvement. Additionally, “communication between faculty and administrators could serve to stimulate interest further” (McNair & Milam, 1993, p. 801).

McNair and Milam (1993) documented some problems needing resolution. The highest-ranking obstacle according to faculty members surveyed is time—time to include ethics in the curriculum. Second, more materials need to be developed although some professional accounting organizations and companies have produced cases and videos. Third, faculty members need training in the proper method of using cases in the classroom. To resolve these problems, the authors recommend one key ingredient—administrative interest. The survey indicated that only 35 percent of the schools’ hierarchies encouraged including ethics in accounting coursework. Over 95 percent of the participants said there was little reward for incorporating ethics into courses. “This lack of encouragement from administrators and failure to include [it] in the reward structure are two additional areas that can be addressed” (p. 806).

Public administration schools. Closely related to business administration is public administration, and such schools have also been involved in the effort to institute ethics in their curricula. According to Hejka-Ekins (1988) and Menzel (1997), the increasing prevalence of political scandals beginning with Watergate has focused attention on the issue of ethics education within the public administration field. A series of surveys done among schools accredited by the National Association of Schools of Public Affairs and Administration (NASPAA) tracked an interesting trend. A 1978 study showed that 43.3 percent of NASPAA schools offered an ethics course. In 1980 this figure stood at 21.1 percent. A 1986 survey by Hejka-Ekins (1988) showed that 31.4 percent of NASPAA schools were teaching ethics, and this statistic led her to state, “It seems reasonable to say that the development of a separate course in administrative ethics has remained a low priority among NASPAA schools over the last decade” (p. 886). In this study Hejka-Ekins used a questionnaire to initiate further contact with faculty members in those schools that offered an ethics course, and she found that “most courses had been incorporated into the curriculum...due to the persistent efforts of one or more individuals who were able to convince the faculty of the need” (p. 886).

Since that study, NASPAA “incorporated language into its curriculum standards that called for public administration programs to ‘enhance the student’s values, knowledge, and skills to act ethically and effectively’” in

the late 1980s (Menzel, 1997, p. 224). Since then, many additional public administration schools adopted ethics courses into their curricula, and as previously reported in this paper; it appears that the courses are having an impact on graduates.

Other academic disciplines. Authors from other academic disciplines have made important, but isolated, contributions to the literature on the subject of teaching ethics (e.g., Allegritti & Frederick, 1995, and McMinn, 1988 in the area of psychology; Bivins, 1993 in journalism; McCaleb & Dean, 1987 in communication; Patterson & Vitello, 1993 in health education; and Stotsky, 1992 in English composition). They concurred that ethics instruction should be an important part of the curriculum; however, most of their work is aimed at curricular objectives or pedagogy for particular courses rather than at broader issues of incorporating ethics into a whole curriculum.

Concerning departments or schools of education, Strike (1990), who has written rather extensively on the subject of ethics instruction within the higher education community, is one of the few who proposes a deliberate, planned school-wide ethics curriculum. He established the need for such by describing education as a profession, and as such, it must be “capable of sustained ethical behavior apart from extensive external monitoring” (p. 47). He added that “ethical conduct is thought to be largely a product of training. The norms and standards of the profession are supposed to be internalized during formal education of the professional” (p. 47).

An essential aspect of Strike’s (1990) position is that ethics must be part of the entire curriculum. “The crucial thing about instruction in professional ethics is that it permeate the curriculum for practitioners. If it does not, those unfortunate enough to have to teach courses in professional ethics will be voices crying in the wilderness” (p. 52). He made several recommendations about such a curriculum for training educators in the area of professional ethics. First, “some values and moral concepts...will be internal to subject matter and are best acquired in the process of learning subject matter.... Second, there may be moral concepts that are implicit in what students learn in teacher education courses” (p. 51). In other words, dealing with ethical problems in education should be discussed to some degree during courses such as pedagogy and educational psychology. Finally, “there is a significant role for direct instruction in professional ethics” (p. 52).

Synopsis of lessons from non-aviation curricular areas. At this point, it is useful to summarize some key points that are common to the research done by all the academic schools above in order to draw together the lessons learned from these efforts to establish ethics as an essential part of higher education

curricula. These lessons serve as the foundation of hypotheses for further analysis concerning current efforts to incorporate ethics instruction in aviation management curricula.

Lesson 1. Many people and organizations from a cross-section of society in general, professional organizations, and academia are calling for ethics to be part of college curricula. The reasons vary; nevertheless, the opposite viewpoint that ethics should not be taught is rarely, if ever, raised and supported by writers on this subject. Hypothesis: people in the aviation community believe that ethics should be part of college aviation administration curricula, and few people voice the opposite opinion.

Lesson 2. The faculty members and administrators most closely associated with programs that have attempted to incorporate ethics in their curricula conclude that support from higher levels of a college's administration is an important factor in the success of the undertaking. Support can be most readily seen in resources for faculty training and materials production and in openly awarding recognition to those involved with the curricular development of the program. Hypothesis: those aviation programs that have already included ethics in their curricula are more likely to have higher-level administrative support for doing so as seen in resources for ethics instruction and in recognition of those involved with it.

Lesson 3. Even in the absence of higher-level support, leadership from the department head can result in an effective ethics education component in the curriculum. Additionally, the enthusiastic efforts of one professor or a very small group of faculty members has led to the initiation of viable ethics instruction at some colleges and universities. Hypothesis: those aviation departments that already have ethics as part of their curriculum are more likely to have department head support for it or at least one aviation professor who has led efforts to include ethics in the curricula.

Lesson 4. Multiple authors across disciplines conclude that ethics is best taught by the pervasive method. The pervasive method means that ethics is a required part of the curriculum, and it appears in all related coursework not just as an adjunct that is taught as separate subject matter unrelated to the other coursework required for the degree. When ethics is best included in an academic program, it is not just an introductory course taught from outside the department. Hypothesis: those aviation departments that do the best job of including ethics in their curricula are those that use the pervasive method.

Lesson 5. Closely related to the above points is that the whole faculty should be involved in the teaching and modeling of ethics across the spectrum of course offerings; it should not just be relegated to one or two specialists outside, or even within, the department. Faculty members internal to specific departments would be more comfortable and more

effective in teaching ethics if they have received some training in this field. Hypothesis: those aviation management departments that desire to do the best job of incorporating ethics in their curricula are more likely to have many faculty members teach the subject internally and are more likely to provide training to their faculty to accomplish this.

Lesson 6. A number of individual universities and/or academic disciplines have received impetus to begin a program of ethics instruction from sources outside the university organization. Specifically, outside grants have provided monetary resources to get started, and academic accrediting agencies have provided impetus by requiring ethics-related goals in order to achieve accreditation. The involvement of practitioners from related industries or professions has proven to be a good support network in several fields in the form of help in course material development. Hypothesis: those aviation programs that already incorporate ethics in their curricula are more likely to have been influenced by outside agencies in the form of supporting resources or accreditation requirements.

Lesson 7. Modeling of ethical principles by faculty and staff is an essential ingredient of any effort to teach ethics. Hypothesis: those aviation departments that want to be most effective in their presentation of ethics will be those in which faculty and staff members model the ethical principles they are teaching.

Lesson 8. Besides lack of higher-level administrative support, the key obstacles to incorporating ethics are lack of time for ethics instruction in an already-packed curriculum, lack of good course materials, and lack of trained faculty. Hypothesis: the principal obstacles that aviation departments face when initiating ethics education in their curricula are lack of time in an already-packed curriculum, lack of good course materials, and lack of trained faculty.

A rather extensive review of the literature has failed to find any writings on the subject of incorporating ethics instruction in higher education programs in aviation management. Is ethics being taught in these programs? Have faculty members and administrators already seen the need for such instruction? What are they doing now? These questions and others will be investigated in Parts Two and Three of this study using the summary points and hypotheses above as a guide. However, the absence of any writings on the subject would justify the initial thought that not much has been done to date. Thus, it would appear that including ethics instruction in aviation administration programs could be an instance where educational change is needed.

The Concept of Educational Change

As discussed above, various academic schools have initiated new programs to incorporate ethics into their curricula. Some of the methodology has been covered as well as discussions of hindrances, plans of action, and important considerations necessary to make such programs successful. In all of these cases, educational change was an underlying concept. In each case, an individual, a group of individuals, or a whole department saw a need to change an established curriculum to include something new and different. Although this present study is not a study on educational change per se, it would be very beneficial at this point to briefly look at some theory regarding the subject as something that would inform the present research effort. As nothing has been published about ethics instruction in aviation management curricula, such efforts might be in their infancy. Thus, concepts associated with educational change may provide valuable insight into these beginning efforts.

Fullan and Stiegelbauer (1991) devised a four-step model for educational change, which is useful in plotting the progress of such change as it occurs. The model is shown in Figure 2. The initiation phase includes everything done until a decision is made to change something in an educational program. The implementation phase covers the initial efforts to use the new changes, and usually includes the first two to three years of experience after adoption. Continuation refers to everything done after implementation as a new change becomes part of the routine program. The term, outcome, describes the results of how the new change has improved the educational program. As Fullan and Stiegelbauer indicated, this is a simplified model. Often changes bounce back and forth between phases as additional changes to the original changes are initiated to improve the program even further.

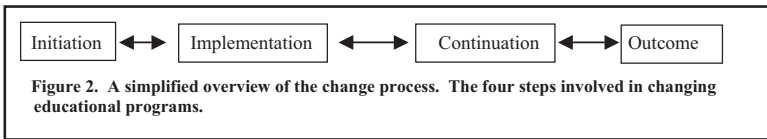


Figure 2. A simplified overview of the change process. The four steps involved in changing educational programs.

The ethics instruction programs just described above fall into the Fullan and Stiegelbauer model somewhere. Since the first phase is probably the most crucial in educational change (i.e., if one can not get past this stage, one will never get any further), it is useful to look at this phase briefly. The incorporation of ethics in an educational curriculum must begin here. If it can not get past the hurdles of phase one, ethics will never become part of

the curriculum. If someone or some department can initiate the project in the first place, then according to the success stories referenced above, such a program stands a more favorable chance of successful implementation.

Factors influencing educational change. Fullan and Stiegelbauer (1991) suggested a list of eight factors, which affect initiation of educational change. Although they applied these eight factors to the K-12 educational environment, seven of them can be readily applied to the higher education level as well. First, they cited existence and quality of innovations. They stated that there is no shortage of innovations; the question becomes one of assessing the quality of innovations. “The lessons of the past have made people in education more careful in taking on unproven new change programs; and limited resources force them to be even more selective” (p. 52). Applying this to the subject of this study, one would say that since nothing has been published on successful adoption of ethics teaching in aviation management programs, departments would be hesitant to initiate and fund such a change to their program. Ethics instruction might be regarded as a short-term fad without long-term merit, or it might be regarded as too expensive to initiate.

The second factor mentioned by Fullan and Stiegelbauer (1991) is “the selectivity that occurs as a result of differential access to information” (p. 53). In describing this, they said that some educators are less traveled than others. For that reason they are not familiar with innovations that are being initiated. Related to this factor, this author would add that those educators who have spent more time in the aviation industry would probably have encountered more actual ethical dilemmas, and thus, would be more aware of the ethical problems in the industry from personal experience. This could be a motivating factor in wanting to do something about the problem.

“Initiation of change never occurs without an advocate” (Fullan & Stiegelbauer, 1991, p. 54). Thus, they announced the third factor, and they identified one of the most powerful advocates as the chief administrator. Such an administrator may be hard to identify by title at each college or university. It may be the university president; it might be a dean; it may be the department head. All of these could easily fill this role, but the point remains that an individual in one of these positions can be a strong advocate for a particular change, or that same individual can be a powerful barrier to the change ever happening. Certainly, adoption of an ethics curriculum would be easier if a chief administrator supports such a change.

A fourth factor influencing change is teacher advocacy (Fullan & Stiegelbauer, 1991). Thus, individual professors who strongly endorse an issue may unilaterally make changes in the parts of the curriculum over which they have authority. At the higher education level, individually-

initiated change is even more readily possible than at the K-12 level because of academic freedom, tenure, and individual control over course content. Thus, a professor, who sees the need for ethics instruction, can initiate such instruction in the courses he or she teaches. If successful, this professor could be a catalyst for incorporating ethics instruction on a wider basis within that professor's department.

Fullan and Stiegelbauer (1991) stated that a fifth factor affecting initiation of change is an external change agent, any advocate for change that is outside the academic department. For instance, many universities offering aviation management programs have industrial advisory committees which keep the university updated with industry trends and needs. Such a committee could provide feedback to the university staff on the need for graduates with some knowledge of ethical decision-making. Another example would be a company or professional organization, which would provide a monetary grant to initiate a program to incorporate ethics into the curriculum.

A sixth factor is new policy and funds. On the K-12 level Fullan and Stiegelbauer (1991) inferred that this factor encompasses federal and state policies and funds associated with these changes. However, on the collegiate level, this could easily refer to policies of accrediting bodies. If such accrediting bodies required some instruction in ethics in order for university aviation administration programs to be accredited, ethics would have to be taught in some form. Although mandating such courses in this manner might create initial opposition, it might also create an atmosphere in which departments endeavored to do the best they could to successfully incorporate ethics into their curricula.

The final factor raised by Fullan and Stiegelbauer (1991) is that schools make decisions to adopt change from either a problem-solving or bureaucratic orientation. Schools looking at change from the problem-solving perspective will regard additional funds as a chance to solve local problems and as a stimulus to improve present programs. Those looking at change from the bureaucratic perspective regard change as a method to receive additional resources to be used for other purposes or as a way of receiving recognition for innovation. Summarizing the work of other authors, Fullan and Stiegelbauer said that schools generally follow the bureaucratic mold. Specifically, schools adopt change more readily when innovations add resources without requiring behavioral change, ease external pressure for change, and receive approval from "peer elites" (p. 60). "Bureaucratically speaking, then, the political and symbolic value of initiation of change for schools is often of greater significance than the educational merit and the time and cost necessary for implementation follow-through" (p. 61). What this statement means for initiation of ethics

instruction can be summarized by simply saying that the more extensive the curricular change, the less likely it is to receive support. A small cosmetic change involving another department offering an ethics course to assuage some external requirement will receive support long before an aviation department is likely to approve a complete curricular change that involves teaching ethics pervasively.

Synopsis of hypotheses concerning educational change. These seven factors raised by Fullan and Stiegelbauer (1991) add a framework to guide research on the initiation of change in any curricula. These factors were considered in the design of this research project. It should be noted that some of these factors overlap with and complement lessons learned from other academic areas. This is expected since the discussion of lessons from other academic areas was founded on educational changes in the curricula of these other subject areas regarding their initiation of ethics instruction. The following summarized list of hypotheses for each factor mentioned by Fullan and Stiegelbauer (1991) serve as items for evaluation in Parts Two and Three of this study.

Factor 1. Aviation departments hesitate to initiate and fund ethics instruction programs because little has been published on the subject within the aviation academic community.

Factor 2. Aviation departments that currently incorporate ethics in their curricula have department heads with greater experience in the aviation industry.

Factor 3. Aviation management departments that currently include ethics in their curricula tend to have department heads that support such efforts.

Factor 4. Those aviation programs that have ethics as part of their curricula tend to have at least one professor with a demonstrated interest in teaching ethics.

Factor 5. Aviation departments that currently include ethics in their undergraduate programs tend to have been influenced by organizations outside the university in the form of requests to include ethics in the curriculum or resources to include ethics.

Factor 6. Aviation departments that presently include ethics in the plans of study of their students are more apt to have accreditation standards requiring ethics to be part of their curricula than those departments without such standards.

Factor 7. The process of initiating change to include ethics in aviation management curricula will be slow, proceeding step-by-step rather than going from no ethics in the curriculum to the pervasive inclusion of ethics in a very short time span. Defining slow or short time span is arbitrary, but as seen in the literature review such efforts to pervasively bring ethics into

the curricula of other academic areas took several years to accomplish. The same would be expected in aviation management curricula.

CONCLUSION

The importance of teaching ethics to aviation management students has been demonstrated. Anecdotal evidence has been provided to show that individuals and organizations in the aviation industry have made ethical errors, which have led to a range of results from illegal financial gain to the endangerment of human lives. Teaching ethics at the higher education level is justified for two reasons. First, logic says that one teaches ethics whether or not ethics is formally taught; saying nothing on the subject transmits a loud message that it is not important. Second, there is empirical evidence that ethics can be effectively taught to college students.

Since there has been nothing published on the subject of teaching ethics in aviation management curricula, the current status of the inclusion of ethics in such curricula is unknown. To investigate this subject more, a preliminary review of literature was conducted to discover how other academic curricular areas approach the matter of ethics instruction. Additionally, the concept of educational change was studied to provide background information on what it takes to introduce new educational concepts into a curriculum. This literature review yielded a number of lessons and hypotheses which can now be used as the basis for the research done in Parts Two and Three of this study on ethics education in university aviation management programs. The results will be documented in subsequent reports.

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THE RELATIONSHIP BETWEEN FIDELITY AND LEARNING IN AVIATION TRAINING AND ASSESSMENT

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ABSTRACT

Flight simulators can be designed to train pilots or assess their flight performance. Low-fidelity simulators maximize the initial learning rate of novice pilots and minimize initial costs; whereas, expensive, high-fidelity simulators predict the real-world in-flight performance of expert pilots (Fink & Shriver, 1978; Hays & Singer 1989; Kinkade & Wheaton, 1972). Although intuitively appealing and intellectually convenient to generalize concepts of learning and assessment, what holds true for the role of fidelity in assessment may not always hold true for learning, and vice versa. To bring clarity to this issue, the author distinguishes the role of fidelity in learning from its role in assessment as a function of skill level by applying the hypothesis of Alessi (1988) and reviewing the Laughery, Ditzian, and Houtman (1982) study on simulator validity. Alessi hypothesized that there is a point beyond which one additional unit of flight-simulator fidelity results in a diminished rate of learning. The author of this current paper also suggests the existence of an optimal point beyond which one additional unit of flight-simulator fidelity results in a diminished rate of practical assessment of nonexpert pilot performance.

INTRODUCTION

Fidelity is a concept that expresses the degree to which a simulator or simulated experience imitates the real world. It has been viewed as a critical variable in the design of both mechanical simulators and computerized simulation experiences. For years, the aviation-training community has held fast to the belief that a high level of fidelity is required to produce the highest level of transfer of learning to the actual equipment. This concept was driven by intuitive appeal, as exemplified by Klauer (1997) in the following text: “The closer a flight simulator corresponds to the actual flight environment (i.e., high physical fidelity), the more skills will transfer to the aircraft” (p. 13). This current paper provides evidence that supports

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the viewpoint that this common belief may not always be true for all learners in all cases involving training and assessment in flight-simulation devices. Furthermore, it distinguishes the level of fidelity required of simulation devices designed to optimize the transfer of learning throughout the training cycle from that required of simulation devices designed to assess performance in the actual aircraft.

The total-fidelity concept may be most appropriate for the training and assessment of expert pilots who readily identify and process all the visual, aural, and other contextual cues of real-world aviation tasks. Novice pilots can become overwhelmed with total fidelity. Implemented in part-task emergency trainers, however, high levels of fidelity that are limited to actual equipment in the cockpit, excluding the fidelity of the real-world, out-of-the-cockpit environment, may be quite effective for novice pilots. This is because, initially, novice pilots must first familiarize themselves with the look, shape, location, and feel of the actual devices in the cockpit to aid in the memory and execution of emergency procedures. The procedures should become second nature for survival. Most flight-training programs require memorization of these procedures before actual flight, reflecting motivation, safety consciousness, and good piloting habits. An example might be extinguishing a simulated engine fire or responding to a simulated engine failure. If the novice pilot cannot perform the maneuver on the ground, then grave difficulty performing the procedure in the air, where dynamic situations require more attentional resources, can be expected.

The fidelity of a real-world flight environment may detract from, rather than enhance, the performance of a novice pilot (Miller, 1974). This stands to reason because, when it comes to assessment in the real world, expert pilots are expected to react accurately and efficiently, whereas novice pilots are expected to make frequent mistakes in the learning process. It can therefore be deduced that high fidelity is desired in simulation-based assessment devices that propose to predict expert pilot performance in real-world situations; however, the same may not hold true for the practical assessment of pilots with skill and experience levels falling between novice and expert. Moreover, high levels of total fidelity may be of little value for enhancing the transfer of learning of novice pilots, except for limited procedural checklists in part-task trainers. With part-task trainers, novice pilots can build confidence in procedural knowledge, while enhancing safety and learning from mistakes (Feifer, 1994).

Empirical evidence on the relationship between the degree of flight simulator/simulation-device fidelity and learning transfer and learning rate can be misleading if the reviewer fails to carefully scrutinize the learning stage of the participants in the experiments. Failure of researchers to

consider the learning stage(s) of the sample population may corrupt simulator/simulation-fidelity studies that (a) propose to predict participant performance on the operational equipment in the real world, or (b) propose to measure the ability of a simulation device to transfer learning to actual operational equipment in real-world operations.

FIDELITY RESEARCH

Alessi (1988) and Valverde (1973) outlined some of the major studies providing empirical evidence on the relationship between the degree of flight-simulator fidelity or simulation-device fidelity and learning rate and transfer of learning. For example, Wolfe (1978) found that medium fidelity is better for learning than low fidelity in business simulations where the degree of complexity of the business simulation concurrently represents the degree of fidelity. Roscoe (1971, 1972) and Povenmire and Roscoe (1973) found that initial training in a flight simulator was more efficient than in actual aircraft, up to a point, after which transfer of learning began to decrease.

Cox, Wood, Boren, and Thorne (1965) and Grimsley (1969) discovered there was no difference in learning rate and transfer of learning in mechanical flight simulators with different degrees of fidelity. Similarly, Hopkins (1975) discovered that motion fidelity in mechanical flight simulators had no significant effect on learning. Koonce (1974), however, clarified that motion fidelity in mechanical flight simulators holds a measure of importance for expert pilots, but no value for novice pilots. These few studies are examples demonstrating the importance of confirming the learning stage of each study participant before generalizing the findings of any research or specific relationships between degree of fidelity and learning, transfer of learning, and the ability of a simulator/flight-simulation device to predict performance in the real world on actual operational equipment. It is important that such verification is specifically addressed in the findings of any related study.

General-Aviation Trainer Effectiveness

Povenmire and Roscoe (1973) conducted research on the effectiveness of the incremental transfer of a ground-based general-aviation trainer (GAT)-the Link GAT-1. The study sought to assess the cost effectiveness of training novice student pilots for private-pilot certification in the Piper Cherokee PA-28-140B trainer aircraft. The practical issue of determining the amount of training that would be required on a low-fidelity ground-based simulator to reach a marginal rate of return and training effectiveness, in terms of time and cost through student achievement of

private-pilot certification, was addressed. The ultimate purpose of the study was to determine the point beyond which the Link GAT-1 ground-simulation device became inefficient in terms of cost for optimizing transfer of learning for private-pilot certification of novice pilots in the Piper Cherokee PA-28-140B aircraft. Low fidelity characterized the Link GAT-1 trainer, which was used to transfer the skills of novice pilots to high-fidelity operational equipment in real-world airspace. Consequently, the issue of fidelity and the associated transfer of learning for novice pilots was a focus of the research. However, no further generalizations or applications to intermediate or expert pilot-skill level should be gleaned from the Povenmire and Roscoe study.

The sample population of the Povenmire and Roscoe (1973) research consisted of 65 inexperienced student pilots who completed a private-pilot Aviation 101 course at the university serving as the study site. The gender and age of the participants were not disclosed. They had no prior flight instruction and were considered novice student pilots. The study population was divided into one control group and three experimental groups. Participants within the three experimental groups were selected from six regularly scheduled flight-operation class periods offered by the institute of aviation within the participating university. They were then randomly assigned to primary flight instructors and to one of the three experimental groups—Group 3, Group 7, or Group 11—also referred to as the *transfer groups*. The control group received no training in the Link GAT-1 simulation device. The experimental groups received 3, 7, and 11 hours of training, respectively, in the simulation device. Both the control group and the transfer groups received routine training in the Piper Cherokee PA-23-140B aircraft until completion of their flight training. Only data from the 65 participants who successfully completed flight training were used to determine the effectiveness of the transfer from the Link GAT-1 simulation device to the Piper Cherokee PA-23-140B aircraft. Transfer effectiveness was determined by comparing the total time required to train each participant within both study groups.

The routine flight syllabus used in the Povenmire and Roscoe (1973) study was characterized by incremental 10-hour flight evaluations in the Piper Cherokee PA-23-140B aircraft, as well as a final recommendation by the primary and secondary flight instructors confirming the readiness of the student for the private-pilot check-ride. The primary and secondary instructors would typically fly together with the student on a single flight to assess the suitability of their joint recommendation. The instrument used to evaluate flight performance was the Illinois Private Pilot Performance Scale (Povenmire, Alvarez, & Damos, 1970). This scale is claimed to have an observer-to-observer reliability of .80 (McGrath & Harris, 1971; Selzer,

Hulin, Alvarez, Swarzendruber, & Roscoe, 1972). The instrument was used in conjunction with the Federal Aviation Administration Practical Test Guide for Private Pilot Certification (U.S. Department of Transportation, Federal Aviation Administration, 1970). Ten maneuvers were scored for each student participating in the Povenmire and Roscoe study who was recommended for the check-ride. The maneuvers were scored at each incremental, 10-hour stage check. Equal weight was assigned to each maneuver on each check. Maneuver performance measures were based upon four to six variables that could be quantified by the primary flight instructor on all of the stage checks. For example, if the student deviated beyond the maximum 10-degree-of-heading parameter, the maximum deviation would be recorded.

The instructors pooled the scores of each maneuver from the preterminal recommendation flight for all those confirmed as ready for the terminal flight. Passing scores were tallied by the maximum amount of deviation made from the predefined parameters for each of the 10 maneuvers. From this pool of scores, a standard deviation was calculated for each maneuver. Subsequently, a modified z score was assigned for each maneuver by dividing the deviation criteria by the standard deviation established from the pool of passing scores. The mean z score was then calculated for each incremental, 10-hour check flight, for each student, up to the final check flight. The z scores of each 10-hour stage checkpoint were plotted on a chart in a straight line; specifically, between each 10-hour, 20-hour, 30-hour, and final check flight for each student. From this chart, a straight line was calculated for each member of the pool. The average of all the scores of the recommended students from the control group and the three experimental groups was used as the private-pilot flight criterion.

Table 1 reveals the number and distribution of students who completed flight training in the Povenmire and Roscoe (1973) study. Table 2 reveals the specific amount of flight time required for students within both the control group and experimental groups to pass their terminal flight checks for certification as private pilots. Table 3 reveals the flight time in hours that students in both study groups accumulated to attain the private-pilot proficiency criterion (i.e., the z score). Table 4 reveals the results of the analysis of variance (ANOVA) determining the number of hours of flight time the successful students of both groups accumulated to pass their terminal check-rides. This analysis was conducted independently (i.e., the control group without Link GAT-1 training and the three experimental groups with 3, 7, and 11 hours of training in the Link GAT-1 simulation device, respectively) with unequal numbers of students. Table 4 also reveals that the average flight times at which participants in both study groups passed their terminal flight checks differed both orderly and

Table 1. Flight-Training Completion Rates

<i>Group</i>	<i>Total students</i>	<i>Students passed</i>	<i>Students failed</i>	<i>Percentage passed</i>
Control	20	14	6	70
3 hours in GAT-1	14	13	1	93
7 hours in GAT-1	14	9	5	64
11 hours in GAT-1	17	10	7	59
Totals	65	46	19	71
Nonexperimental	20	17	3	85
All students	85	63	22	74

Note. GAT = ground-based general-aviation trainer. Adapted from "Incremental Transfer effectiveness of a Ground-Based General Aviation Trainer," by H. Kingsley Povenmire and Stanley N. Roscoe, 1973, *Human Factors*, 15(6), p. 537. Copyright 1973 by the American Psychological Association. Adapted with permission.

Table 2. Flight Hours Needed to Pass Final Check and Summary of Resulting Transfer Measures

<i>Data Type</i>	<i>Control Group</i>		<i>Transfer Groups</i>	
	<i>0</i>	<i>3</i>	<i>7</i>	<i>11</i>
Hours in GAT-1	0	3	7	11
Hours in Cherokee	41.3	44.8	42.7	37.3
	45.6	44.8	42.7	37.5
	48.0	47.5	40.2	40.7
	49.0	44.3	43.3	39.6
	46.0	40.6	42.5	34.8
	43.3	25.6	42.8	35.8
	43.7	32.4	35.8	40.1
	53.7	43.2	35.0	37.1
	41.2	36.8	28.2	34.8
	41.6	39.3		41.6
	51.2	39.0		
	38.0	40.1		
	50.8	45.0		
	42.5			
N	14	13	9	10
\bar{X}	45.42	40.26	38.62	37.93
σ	4.51	6.00	5.07	2.45
Cumulative Savings		5.16	6.80	7.49
Incremental Savings		5.16	1.64	0.69
Transfer (%)		11.00	15.00	16.00

Note. GAT = ground-based general-aviation trainer. Adapted from "Incremental Transfer effectiveness of a Ground-Based General Aviation Trainer," by H. K. Povenmire and S. N. Roscoe, 1973, *Human Factors*, 15(6), p. 538. Copyright 1973 by the American Psychological Association. Adapted with permission.

reliably, as indicated by a probability factor ($p = .0014$) based upon a summary of the ANOVA for the independent groups. Table 5 reveals the results of the ANOVA determining the flight times at which successful students in both the control and experimental subgroups achieved the private-pilot performance criterion. The difference between the mean times calculated for the participants of the control and transfer groups to reach the performance criterion and pass the terminal check-ride was not statistically significant.

Table 3. Flight Hours Needed to Reach Proficiency Criterion and Summary of Resulting Transfer Measures

<i>Data Type</i>	<i>Control Group</i>		<i>Transfer Groups</i>	
	<i>0</i>	<i>3</i>	<i>7</i>	<i>11</i>
Hours in GAT-1	0	3	7	11
Hours in Cherokee	29.54	47.59	33.78	35.62
	47.23	39.88	41.52	30.55
	42.64	60.00	41.94	43.76
	42.26		38.88	34.45
	37.71	45.54	57.74	33.99
	34.32	23.56	47.56	28.93
	45.46	25.74	37.70	34.46
	40.48	38.82	25.87	59.27
	50.40	41.54	19.46	32.33
	46.15	38.65		
	52.24	34.48		
	39.41	36.75		
	70.56	46.29		
	42.5			
\bar{N}	14.00	12	9	10
\bar{X}	44.49	39.90	38.27	37.30
σ	9.64	9.76	11.28	8.82
Cumulative Savings		4.59	6.22	7.19
Incremental Savings		4.59	1.63	0.97
Transfer (%)		10.00	14.00	16.00

Note. GAT = ground-based general-aviation trainer. Adapted from "Incremental Transfer Effectiveness of a Ground-Based General Aviation Trainer," by H. K. Povenmire and S. N. Roscoe, 1973, *Human Factors*, 15(6), p. 539. Copyright 1973 by the American Psychological Association. Adapted with permission.

Table 4. Analysis of Variance in Times Final Flight Check Passed

<i>Sources of variance</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Hours in GAT-1 (Groups: 0, 3, 7, 11)	3	141.97	6.19	.0014
Participants/Groups	42	22.93		
Total	45			

Note. GAT = ground-based general-aviation trainer. Adapted from "Incremental Transfer Effectiveness of a Ground-Based General Aviation Trainer," by H. K. Povenmire and S. N. Roscoe, 1973, *Human Factors*, 15(6), p. 539. Copyright 1973 by the American Psychological Association. Adapted with permission.

Table 5. Analysis of Variance in Times to Reach Private-Pilot Performance Criterion

<i>Sources of variance</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Hours in GAT-1 (Groups: 0, 3, 7, 11)	3	124.82	1.29	.2914
Participants/Groups	42	96.95		
Total	45			

Note. GAT = ground-based general-aviation trainer. Adapted from "Incremental Transfer Effectiveness of a Ground-Based General Aviation Trainer," by H. K. Povenmire and S. N. Roscoe, 1973, *Human Factors*, 15(6), p. 539. Copyright 1973 by the American Psychological Association. Adapted with permission.

Implications. There were no standardized instructor lesson plans for the Link GAT-1 simulation device documented in the Povenmire and Roscoe (1973) study. The implication here is that, due to a lack of well-defined, standard operational procedures for the type and quality of training in the Link GAT-1 simulation device, the data collected in the study may have been compromised. This is because the data may have reflected the degree of instructor effectiveness with the students in the experimental groups, rather than the degree of simulator effectiveness and transfer of learning from the Link GAT-1 simulation device to the Piper Cherokee PA-23-140B aircraft. This may account for the inverse relationship between the percentages of students who passed within each experimental group and the number of hours each experimental group was exposed to the Link GAT-1 simulation device (see Table 1). The researchers commented that a chi-square test indicated a probability coefficient of 0.5 for the differences in the success ratios among the control group and the three experimental groups; however, this observation is moot. The important point is that, if the type of treatment received by each experimental group in the Link GAT-1 simulation device had been controlled, the probability of differences in success ratios among the control group and the three experimental groups as factors of chance may have been reduced. Furthermore, most instructors

are not taught how to use the simulator as an effective instructional tool, which could have also affected the results.

Accurate assessment of the amount of student learning that transferred from the Link GAT-1 trainer to the Piper Cherokee PA-23-140B aircraft was partially dependent upon the point at which student-learning curves intersected precalculated criterion levels of private-pilot performance. It was also determined by the number of flight hours required to pass the terminal check-ride in the Piper Cherokee PA-23-140B aircraft. The reason the two measures were proposed was because of the varying learning rates among the participants. The implication is that this variation must be controlled to ensure that the findings measure transfer of learning rather than learning rate. To account for this variable, a least-squares criterion straight line was “fitted to all the check scores each student received on the Illinois Private Pilot Performance Scale throughout training” (Povenmire & Roscoe, 1973, p. 537).

Finally, a gradual reduction in the effectiveness of the Link GAT-1 simulation trainer used in the Povenmire and Roscoe (1973) study, in terms of transfer of training, was evident. The implication is that, as the skill level of the learner improves, low-quality fidelity devices become less effective in terms of the funds invested to build them versus their training efficiency. The larger implication here, however, is that the level of fidelity in flight-simulator devices built to transfer learning to real-world operational tasks in real-world operational airspace may need to be adjusted to the learning stage of the respective pilot for optimal transfer. Furthermore, degree of fidelity, learning stage of the student, and the goals of the training device are not mutually exclusive.

It is evident from the Povenmire and Roscoe (1973) research that the learning stage of students must be clarified, controlled, and monitored throughout an experiment before applying the evidence to practical use in training pilots or assessing pilot performance on flight-simulation devices. Without this understanding, unsound generalizations can potentially be made that could result in impractical expense, especially due to the high cost of fidelity (Miller, 1953). Furthermore, the potential for implementation of unsound generalizations may radiate to professional educators, psychologists, and cognitive engineers who could mistakenly apply such findings to the learning/assessment process. Therefore, the learning stages of student pilots must be clearly distinguished when comparing empirical evidence on studies proposing relationships between the degree of fidelity in flight-simulator devices and transfer of learning, learning rate, and prediction validity of student performance on actual operational equipment in the real world.

Training fallacies. Schneider (1985) provides empirical evidence and an excellent overview of the training fallacies that can potentially result from unsound generalizations. One of these fallacies is that practice always makes perfect. This is not always true. For example, in the flight domain, novice pilots must develop time-sharing skill, which allows them to efficiently divide their limited attentional resources to the many tasks encountered both inside and outside the cockpit. By optimizing performance of a single task, novice pilots can inadvertently fixate on a single component of a time-shared task. This, in turn, can inhibit the division of attention that is required of a time-shared task (e.g., scanning instruments during a flight maneuver). In this manner, a negative transfer of learning can occur, in terms of the critical time-shared skills novice pilots must develop to achieve acceptable levels of flight proficiency.

Antithetically, the fallacy that total-task training is required for maximal transfer of learning may be true for the expert pilot who is familiar with high-fidelity environments and who can only improve his or her learning level through challenging and somewhat unfamiliar flight scenarios accompanied by demanding flight tasks (Schneider, 1985). Transfer of learning through these high-skill tasks may lead to automation and further reduce workload. However, the same might not be true for the intermediate pilot who is more unfamiliar with such tasks. In this case, the intermediate or novice pilot could falter in performance (Wiggins, 1997).

Another training fallacy is that extrinsic motivators for expert pilots inhibit concentration (Schneider, 1985). This suggests that external stimulus will always interfere with experts who perform tasks requiring heavy concentration. Conversely, boredom sometimes accompanies tasks of repeated concentration because the task is a familiar one. An interfering stimulus may provide the extra level of difficulty that sparks a challenge within the expert, along with greater and more efficient concentration. Schneider also revealed the fallacy that the primary goal of skill training is accurate performance. This cannot be true of air-traffic controllers who must focus their attention on the general separation of aircraft while concurrently attending to the accuracy of pilot readbacks while the pilots are flying on final approach to landing. Although it is important for the expert controller to attend to the accuracy of pilot readbacks, the real-world mission is to ensure the separation of aircraft.

Another fallacy is that the conceptual understanding of systems that is acquired in the classroom will develop needed performance skills within the flight domain. Although the conceptual understanding of systems obtained within a training program may enhance procedural knowledge, the time-sharing skills required of pilots can only be developed via hands-on experience. The fallacies documented by Schneider (1985) should

always be considered when conducting experiments where degree of fidelity, learning rates, and learning stages are pivotal factors.

The Alessi Hypothesis

From an intuitive viewpoint, it would appear that the higher the level of fidelity in flight simulators and in flight simulation, the higher their prediction validity would be for pilot performance on operational equipment in real-world airspace (i.e., check-rides in actual airspace on operational equipment). It is tempting to carry this hypothesis one step further and deduce that the closer mechanical and computerized simulators can emulate the real world, the more efficiently they can train and aid in the transfer of learning to the actual equipment in real-world operational scenarios. Such a deduction, however, could be misleading without consideration of the stage of the learner. The learner is an integral part of the machine-environment system.

Alessi (1988) clearly illustrated the role of fidelity within different learning stages. He hypothesized the existence of a marginal rate of return on learning and fidelity based upon the stage of the learner. The law of diminishing returns states that a point exists beyond which one additional unit of simulation fidelity results in a diminished rate of return on investment. Figure 1 prompts the following question: How much fidelity should be programmed into a simulation experience or built into a mechanical simulator? Alessi (1988) proposes that the degree of fidelity on a computerized simulation experience should match the goal and the training stage of the learner. Miller (1953) originated this viewpoint and his original terminology for fidelity was *degree of simulation*. He hypothesized the existence of a relationship between the degree of learning transfer, cost, and engineering simulation. He recognized that the higher the degree of fidelity, the higher the cost of the training device. Furthermore, Miller recognized that the more familiar students became with a simulator or simulation device designed for transfer of learning, the greater amount of fidelity they needed to sustain adequate transfer-of-learning rates (i.e., positive transfer). Hays and Singer (1989) pointed out that “task types and the trainee’s level of learning, as well as other variables, interact with Miller’s hypothesized relationships” (p. 31). The viewpoint espoused by Alessi (1988) is that fidelity is only critical in terms of how much should be used in flight-simulation experiences, not necessarily that high amounts of fidelity are needed for all learners in all cases. Students may benefit from increased amounts of fidelity as their training progresses.

Alessi and Trollip (1991) proposed the following four stages of effective instruction: presentation, guidance, practice, and assessment. Each stage of instruction should present increasing degrees of simulation fidelity

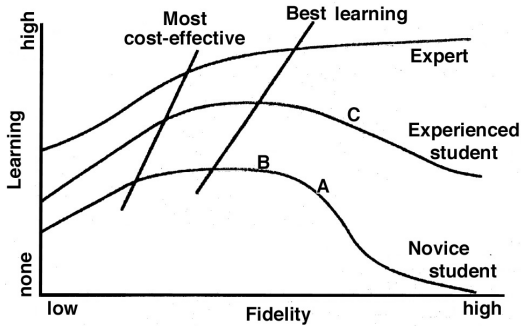


Figure 1. This illustration displays the relationship between degree of fidelity and learning for novice, experienced learners, and expert learners. (Alessi, 1988, p. 42).

constrained by return on investment and the stage of the learner. Regarding the assessment stage, Gagne (1954) suggested that the highest level of fidelity should be reserved for measuring (i.e., assessing) performance of expert pilots. He recognized the existence of diminished rate of return on the learning rate of expert pilots with increased fidelity alone and, furthermore, that expert pilots require high levels of fidelity and difficult tasks to enhance transfer of learning. The implication here is that there is a point beyond which training devices fail to sufficiently motivate experts, even with high degrees of fidelity, if the design of the simulator and/or simulation device fail to sufficiently challenge the ability of the individual to handle novel tasks of increasing difficulty. On the other hand, novice pilots may be overburdened or confused by excess fidelity and/or a training task that is overly difficult for learning or assessment purposes. Therefore, interface designers, educators, experimental psychologists, cognitive engineers, and other aviation experts must weigh the state and training stage of the learner when determining the extent of fidelity to program into mechanical simulators and computerized simulation devices (Flach, Hancock, Caird, & Vicente, 1995).

The information that expert, intermediate-level, and novice pilots process is not always the same; therefore, the spare capacity of limited attentional resources for each piloting-skill level will not be the same for all tasks. What is overwhelming for the novice pilot may be handled with ease by an expert who will have more spare capacity to attend to other tasks upon completion of a given task or set of tasks. Antithetically, the novice pilot may fail to process certain visual and aural cues that would induce

added workload for the intermediate- or expert-level pilot. This could prove disastrous in situations that require accurate and efficient processing of critical information for flight safety. Clearly, simulators and simulation devices must be designed for the learning stage of the learner. Consequently, it is imperative to distinguish the roles of fidelity for training and assessment by the goals of the simulator or simulation device *and* the stage of the learner when using such devices as learning and assessment tools. Finally, the concept of learning and assessment must be viewed as complementary to training.

The Training Cycle and the Learner

A clear understanding of the general relationship between training, instruction, and performance assessment is necessary before comprehension of the specific differences between the role of fidelity in flight instruction and performance assessment is possible. As described earlier, Alessi and Trollip (1991) viewed the relationship between fidelity, stage of the learner, and task difficulty in the following four proposed stages of instruction: presentation, guidance, practice, and assessment. Assuming that these four stages of instruction are increasingly demanding, requiring the learner to expend added attentional resources with tasks of increasing difficulty (Kahneman, 1973; Norman & Bobrow, 1975), the state of learners and their stage of training become mandatory considerations in determining the amount of fidelity to use in simulators and simulation devices.

Figure 2 illustrates the major subsystems within the training cycle. It identifies instruction as a component of training and assessment as a component of instruction. It illustrates that, in addition to the state of the learner, training goals, objectives, and tasks must be considered during the needs-assessment stage of any training program. Assessment is embedded within the development and implementation stage of any training-program design.

Similar to the design cycle of computer products, the final stage of the training cycle provides feedback for practical issues such as cost, time to train, and assessment accuracy. This process can be applied to simulators and simulation devices used to transfer learning to actual equipment, as well as to devices implemented to assess (i.e., measure) terminal performance (i.e., check-rides). The concept of training effectiveness emerges from these relationships. This concept requires measurement of the transfer of learning to real-world equipment to achieve positive results. It also requires measurement of the ability of any specific device to predict trainee performance in the real world (i.e., prediction validity). There is a distinct difference in these two measures because a training device is not

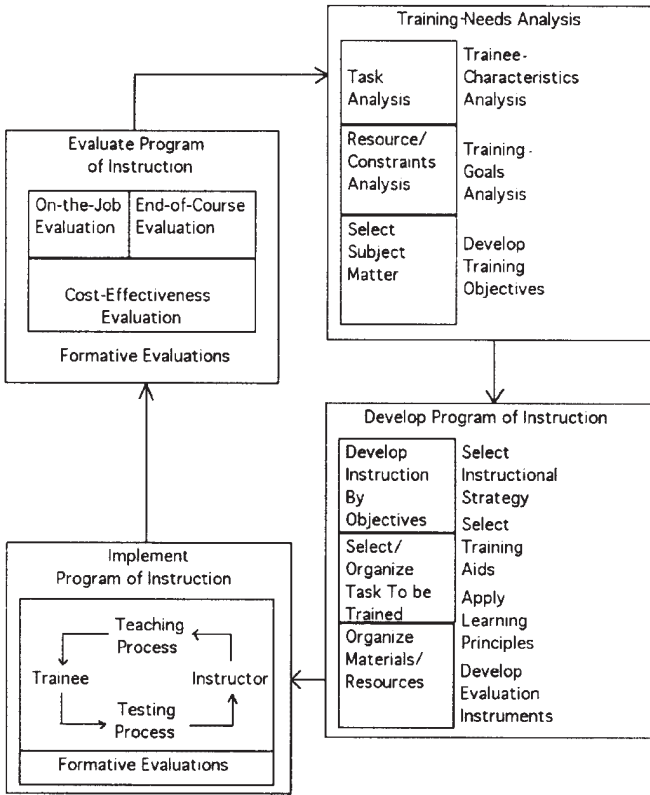


Figure 2. This figure illustrates the role of assessment within the training cycle. (Hays & Singer, 1989, p. 8).

required to be validated to aid in the transfer of learning; however, a device that predicts performance *does* require validation. Therefore, the concepts of learning and performance assessment are separate, yet inseparable, elements of training.

Transfer of Learning Versus Prediction of Performance

Laughery et al. (1982) conducted a study that distinguished between the discrete characteristics of simulation devices built to ensure a high transfer of learning and those built to predict real-world performance. The research demonstrated that a KC-135 Boom-Operator Part-Task Trainer (BOPTT), configured to simulate refueling of an F4 fighter-jet aircraft, was an

effective simulation device for ensuring higher transfer of learning for an experimental group of boom operators qualified to refuel the B-52 aircraft in their initial training. Despite the high transfer of learning from the simulation trainer, the device was not reliable in predicting student performance for the F-4 refueling categorization.

The control group in the Laughery et al. (1982) study, comprised of participants with no training in the C-5 (large cargo aircraft) or F-4 configuration versions of the simulation trainer, scored *100% qualified* on an actual C-5 in-flight refueling experience. These individuals had also previously qualified in the refueling of the B-52 aircraft. This demonstrated that initial qualification for refueling the B-52 aircraft was similar to the refueling experience of the C-5. Prediction validity of the BOPTT was 100% for the refueling of the C-5 for both the control and experimental groups who were all initially qualified to refuel the B-52 aircraft. Therefore, although a training device of high fidelity can aid in the transfer of learning, the concept of transfer cannot be generalized to assessment or to prediction validity of a simulation device without considering the state of the environment (e.g., refueling the C-5 versus the F-4).

The purpose of the Laughery et al. (1982) study was twofold: (a) to measure and compare the transfer of learning for both groups to determine if a part-task trainer could optimize operational costs and training time, and (b) to determine if BOPTT was a valid predictor of performance for refueling fighter jets and cargo aircraft using operational aircraft in operational airspace. The research was divided into two phases. The first was conducted at a California Air Force base and involved simulation training on the BOPTT and categorization briefings for the C-5 and F-4 aircraft. The second phase was conducted at the home squadrons of the study participants and involved actual in-flight evaluations on refueling the C-5 and F-4 aircraft. In Phase 1, 30 student boom operators, who were initially qualified to refuel the B-52 bomber aircraft in flight, were divided into a control group and an experimental group. Five students were selected each month over a period of 6 months from six separate classes of flight-line-designated trainees. Initially, six students were to comprise the control group; however, after half of the experiment was completed, it was decided that 10 students should comprise the control group and 20 should be assigned to the experimental group to increase the accuracy of the learning transfer.

The second phase of the Laughery et al. (1982) study measured the number of real-world flights required for the students in both study groups to qualify on fueling operations for both the C-5 cargo aircraft and F-4 fighter-jet aircraft. The students in both the control and experimental groups had received the same training, using the same training syllabus, up

through their graduation and solo flight. Prior to evaluating the ability of both groups to refuel the C-5 and F-4 aircraft, the groups received separate research treatment. The control group received what was termed *Treatment A*, and the experimental group received *Treatment B*. Treatment A consisted of separate categorization briefings for the F-4 fighter aircraft and the C-5 cargo aircraft. Treatment B consisted of Treatment A, plus two one-hour simulation experiences on refueling a C-5 cargo plane and three one-hour simulation experiences on refueling the F-4 fighter aircraft. The device used to deliver the simulation experiences to the experimental group was the KC-135 BOPTT, which could be configured for novice, intermediate, or expert pilots (Clapp, 1985).

The BOPTT was built with a student station and boom-operator pallet with window operator controls and indicators (Laughery et al., 1982). To simulate oncoming aircraft needing refueling, a model of a C-5 or F-4 aircraft, which was scaled down 100 times, was viewed outside the training device. The BOPTT housed a 20-inch aerial refueling boom, and the 1/100 scale model of the C-5 or F-4 was mounted on a gimbal that delivered pitch, roll, and yawing moments. A closed-circuit video displayed the appropriate aircraft onto a cathode-ray-tube screen 20 inches outside the student's window. The model boom was located between the window and the model aircraft. The student could manipulate the boom mechanism by extending it and simulate connecting it to the aircraft. Environmental features, such as clouds, were visible on the cathode-ray tube. Engine noise and noise from operation of the boom could be heard through speakers inside the boom operator's station. The BOPTT simulation device showed the approaching C-5 cargo aircraft or the F-4 fighter-jet aircraft from a simulated 1.5-mile distance up to the refueling point from the window of the KC-135 aircraft. The device allowed for manipulation of independent variables such as turbulence, trajectory of the oncoming aircraft to the refueler aircraft, and refueling speed and altitude. It was also able to simulate five piloting-skill levels.

Procedures. Following simulation training in C-5 and F-4 fueling on the BOPTT, the students in the experimental group of the Laughery et al. (1982) study were evaluated on a real-time refueling-assessment flight for the C-5 cargo aircraft and on another for the F-4 fighter-jet aircraft. Students participating in the control group received no refueling-simulation training on the BOPTT for either C-5 cargo or F-4 fighter aircraft. The evaluation proposed to measure the ability of the students in both study groups to refuel both the C-5 and the F-4 aircraft in actual operational airspace. A training and evaluation squadron located at the base serving as the study site conducted the experiment with a sister squadron located at another training facility within the state of California.

The Boom-Operator Qualification-Performance Measurement Form was used as the criterion for both study groups in the Laughery et al. (1982) research. The instrument measured student execution of critical procedures, communications, boom control, and boom operation. The experimental group was evaluated on each simulation experience and on each actual flight for the C-5 and F-4 aircraft. The control group was evaluated on actual flights only. Following data collection at the participating base, a questionnaire was subsequently distributed to the home squadrons of the participants to gather data on the actual amount of time they required to qualify in the refueling of the C-5 and F-4 aircraft.

Table 6 illustrates the design of the Laughery et al. (1982) study. Table 7 reveals the number of flights required for the student participants to qualify in the refueling of the C-5 and F-4 aircraft at their home squadrons. A one-way ANOVA on the number of flights required for the students in the control group, experimental group, and their classmates to qualify in the C-5 and F-4 aircraft indicates a significant difference among the three research treatments among the control and experimental groups ($p < .05$). This suggests that significant savings can be realized with categorization training via implementation of the BOPTT.

Table 8 provides the number and percentages of students from both of the study groups who were found either qualified or unqualified to refuel the F-4 fighter aircraft from the KC-135 aircraft at the end of the applied treatments. Although all of the participants in the experimental group were found qualified to refuel F-4 fighters in the BOPTT, only half of them qualified on the actual equipment in the air. Only 20% of the control group qualified for refueling the F-4 fighter aircraft at the end of their respective

Table 6. Study Design: Categorization Research

<i>Groups</i>	<i>C5</i>		<i>F4</i>	
	<i>CAT</i>	<i>Evaluation</i>	<i>CAT</i>	<i>Evaluation</i>
Control (10 Subjects)	CAT briefing	Actual C-5 air refueling	CAT briefing	Actual F-4 air refueling
Experimental (20 Subjects)	Two 1-hour BOPTT missions	Actual C-5 air refueling	Two 1-hour BOPTT missions	Actual F-4 air refueling
	CAT briefing		CAT briefing	

Note. CAT = categorization; BOPTT = boom-operator part-task trainer. Adapted from "Differences Between Transfer Effectiveness and Student Performance Evaluations on Simulators: Theory and Practice of Evaluations," by K. R. Laughery, J. L. Ditzian and G. M. Houtman, 1982, Proceedings of the I/ITEC Interservice Industry Training Equipment Conference, USA, p. 219. Copyright 1982 by ITEC. Adapted with permission.

Table 7. Flights Required to Qualify

<i>Groups</i>	<i>No. of Flights</i>				
	<i>One</i>	<i>Two</i>	<i>Three</i>	<i>Four</i>	<i>Five</i>
Control	3 (37.5%)	1 (12.5%)	2 (25.0%)	1 (12.5%)	1 (12.5%)
Experimental	6 (42.85%)	6 (42.85%)	2 (14.3%)		
Other ^a	5 (17.9%)	11 (39.3%)	8 (28.6%)	2 (7.1%)	2 (7.1%)

Note. Adapted from “Differences Between Transfer Effectiveness and Student Performance Evaluations on Simulators: Theory and Practice of Evaluations,” by K. R. Laughery, J. L. Ditzian and G. M. Houtman, 1982, *Proceedings of the I/ITEC Interservice Industry Training Equipment Conference, USA*, p. 220. Copyright 1982 by ITEC. Adapted with permission.

^a These individuals did not participate in the test program but were classmates of the participating members.

research treatment. This clearly indicated that the BOPTT was useful in transferring learning to the F-4 aircraft; however, it was not a valid predictor of performance on real-world F-4 refueling operations.

Table 8. In-Flight Performance for Fighter Category (F-4) Qualification

<i>Group</i>	<i>Considered qualified in aircraft</i>	<i>Considered unqualified in aircraft</i>
Control	2 (20%)	8 (80%)
Experimental	10 (53%)	9 (47%)

Note. Adapted from “Differences Between Transfer Effectiveness and Student Performance Evaluations on Simulators: Theory and Practice of Evaluations,” by K. R. Laughery, J. L. Ditzian and G. M. Houtman, 1982, *Proceedings of the I/ITEC Interservice Industry Training Equipment Conference, USA*, p. 220. Copyright 1982 by ITEC. Adapted with permission.

Table 9 displays data indicating that all of the students participating in the Laughery et al. (1982) study-in both the control and experimental groups-were found to be qualified in the refueling of the C-5 aircraft from a KC-135 aircraft platform. It was impossible to determine if the BOPTT was a valid predictor of performance on the C-5 refueling operations because all of the student participants were considered qualified to refuel this aircraft from the KC-135 aircraft following their respective research treatments. Consideration should be given to the fact that all of the students in both study groups had been initially qualified to refuel the B-52 aircraft from the KC-135 before the research treatments were received; therefore, it could be concluded that the fueling operations of B-52 and C-5 aircraft are very similar.

The implication here is that near transfer of learning must be distinguished from far transfer of learning when making generalizations

Table 9. In-Flight Performance for Cargo Category (C-5) Qualification

<i>Group</i>	<i>Considered qualified in aircraft</i>	<i>Considered unqualified in aircraft</i>
Control	8	0
Experimental	13	0

Note. Adapted from "Differences Between Transfer Effectiveness and Student Performance Evaluations on Simulators: Theory and Practice of Evaluations," by K. R. Laughery, J. L. Ditzian and G. M. Houtman, 1982, *Proceedings of the I/ITEC Interservice Industry Training Equipment Conference, USA*, p. 220. Copyright 1982 by ITEC. Adapted with permission.

related to learning transfer and prediction validity of simulation devices (Osgood, 1949). Self-transfer is the improvement or decrement of the learner that results from repeated practice of the same event. Near transfer is the improvement or decrement that results from repeated practice of different, but very similar events. Far transfer is the improvement or decrement that results from repeated practice of dissimilar events in a similar domain. All three types of transfer must occur for optimal effectiveness of training and evaluation. Theoretically, each type of transfer should precede the other in the learning process because learning is a cumulative process. Likewise, in the training and assessment of novice, intermediate, and expert pilots under training, methods of learning and assessment should be consistently aligned with the appropriate level of learning taking place throughout the training cycle.

Implications. Laughery et al. (1982) demonstrated the basic difference between the relationship of near transfer of learning with far transfer of learning as it relates to the discovery of prediction validity and transfer of learning from simulation devices to actual equipment in real-world operations. Some simulators may propose to accurately assess student performance in real-world operational aircraft, while others may propose to measure transfer of learning only. Those such as the BOPTT when it is in the B-52 configuration, claim to do both in environment-specific configurations. The BOPTT did not, however, prove to be a good predictor for aircraft categorization assessment, even though it was indeed an excellent tool for improving learning rate in refueling the F-4 aircraft.

A clear understanding of the definition of terms is critical when making generalizations from experimental studies. For example, *transfer* is defined by Gick and Holyoak as "the change in the performance of a task as a result of the prior performance of a different task" (cited in Cormier & Hagman, 1987, p. 10). Osgood (1949) defines transfer as the ability to perform the same task in the same environment. It involves the ability of a student to demonstrate skills learned from practice on a training device to

performance on the actual operational equipment. Apparently, refueling of the C-5 aircraft was similar enough to the refueling of the B-52 aircraft that slight environmental changes did not affect performance on the same category of aircraft. Consequently, under the definition of transfer provided by Osgood, prediction validity of the BOPTT in the B-52 configuration would be high for the actual refueling of the C-5 cargo aircraft. However, this was not true for F-4 fighter-jet refueling operations because the environment was sufficiently different. The definition of transfer provided by Gick and Holyoak would require a different target situation (cited in Cormier & Hagman, 1987). Learning from one situation could be transferred to a new situation with some environmental differences.

The *prediction validity* of a simulation device is the expression of its ability to accurately assess the flight performance of a student on real-world equipment in real-world airspace. If the performance scores attained on a simulation device closely match scores on the same tasks with actual operational equipment, then the simulation device is said to have high prediction validity. However, this does not mean that simulation devices that are valid predictors of the performance of real-world tasks are effective for transfer of learning. Similarly, devices that prove to be effective for transfer of learning may not be valid predictors of performance on actual equipment (see Table 8). For a simulation device to be a valid predictor of performance, the device itself must be validated. However, as demonstrated by Laughery et al. (1982), the same requirement is not always necessary to maximize transfer of learning, or even to realize a positive transfer of learning.

CONCLUSION

In conclusion, the degree of fidelity and the learning stage of the learner are mutually interdependent variables that must be considered when designing flight simulators intended for transfer of learning or performance assessment. It is important to recognize the similarities and differences between simulators designed for performance assessment and those designed for transfer of learning. The environment of the target skills is also a pivotal component. When all these elements are considered it becomes apparent that degree of fidelity, learning stage of the learner, learning rate, and the environment are not mutually exclusive. Further research is necessary to discover if there is a point beyond which one additional unit of fidelity will result in a diminished rate of practical (i.e., cost-effective) assessment for pilots who are between the novice and expert stages of learning. What must be considered, however, is that optimal performance assessment and transfer of learning in flight training is best served with

shared goals and aligned values and expectations by all pilots, instructors, training departments, examiners, and licensing authorities (Telfer & Moore, 1997).

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SEARCH AND RESCUE OPERATIONS OF AIRCRAFT IN AFRICA: SOME COMPELLING ISSUES

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ABSTRACT

The world aviation community has felt the compelling need for a well-coordinated global programme for search and rescue operations of aircraft ever since commercial aviation was regulated in 1944. Guidelines and plans of action for search and rescue have therefore been considered critical in the event of an aircraft accident. This fact is eminently brought to bear in the continental regions of Africa and South America in particular, where vast expanses of land are still uninhabited or sparsely populated and controlled flight into terrain (CFIT-where an aircraft may crash on land while still under the control of technical crew) is a common occurrence. There are numerous guidelines that have been adopted under the umbrella of the International Civil Aviation Organization which are already in place for the provision of search and rescue operations pertaining to aircraft. However, when an accident occurs in the territory of a State, there are sensitivities involving the State in which the aircraft concerned was registered and issues of sovereignty which have to be considered. Additionally, issues such as the voluntary nature of the search and rescue services offered, confidentiality, timeliness of such operations, fairness and uniformity all play a critical role. This article addresses the issue of search and rescue operations in Africa and examines in some detail where the world aviation community is right now and where it is headed in this important field of human endeavour.

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INTRODUCTION

At the 16th Plenary Session of the General Assembly held in Cairo from 21-26 April 2001, the African Civil Aviation Commission (AFCAC) adopted Resolution S16-7 calling African States to participate in the AFCAC Search and Rescue (SAR) technical cooperation programme. The Commission, through this resolution, also instructed the AFCAC Bureau, *inter alia*, to work, through appropriate means, toward the improvement of SAR services in Africa, in close cooperation with the International Civil Aviation Organization (ICAO). The ICAO is a specialized agency of the United Nations responsible for the regulation of international civil aviation.

After the events of 11 September 2001, it is only natural to assume that there is heightened awareness of the possibility of aircraft being used as weapons of destruction in the future. From a social and political perspective, the world has to prepare for eventualities leading up to SAR of aircraft that may need to be located without loss of time and with the passengers and crew rescued. There are already two international treaties on the subject. The Brussels Convention for the Unification of Certain Rules Relating to Assistance and Salvage of Aircraft at Sea, established September 29, 1938, has unfortunately not been ratified by the requisite number of States and has therefore not come into effect. The Brussels Convention contemplated only assistance and salvage operations at sea. The other Convention is the Chicago Convention of 1944, which requires the 187 Contracting States of the ICAO to fulfil their obligations under Article 25 which provides:

Each Contracting State undertakes to provide such measures of assistance to aircraft in distress in its territory as it may find practicable, and to permit, subject to control by its own authorities, the owners of aircraft or authorities of the State in which the aircraft is registered to provide such measures of assistance as may be necessitated by the circumstances. Each Contracting State, when undertaking search for missing aircraft, will collaborate in coordinated measures which may be recommended from time to time pursuant to this Convention. (ICAO, 2000a)

Annex 12 to the Chicago Convention elaborates on this fundamental requirement by qualifying that Contracting States shall arrange for the establishment and provision of SAR services within their territories on a 24-hour basis. Contracting States are further requested to delineate the SAR process under Annex 12 on the basis of regional air navigation agreements and provide such services on a regional basis without overlap (ICAO, 1975). A SAR region has been defined in Annex 12 as “an area of defined dimensions within which SAR service is provided” (ICAO, 1975,

Standard 2.2.1) where boundaries of SAR regions should, insofar as practicable, be coincident with the boundaries of corresponding flight information regions.

Although, as discussed, the basic principles of SAR have been in place since 1952 (since Annex 12 was adopted by ICAO—AFCAC has, with considerable wisdom, recognized in its latest Resolution S16-7 that grave shortcomings exist in the African and Indian Ocean (AFI) region in the SAR field. The Commission was quick to recognize that there was a lack of human and financial resources in many African States, making it difficult for these States to comply with ICAO Standards and Recommendations, especially those of Annex 12.

The dilemma facing many States extending both to airports and airlines, relates to the lack of rapid response, adequate equipment and well-trained crews, all of which are critical to passenger survival in the event of an aircraft disaster. Although most States are particularly mindful of these compelling needs, they are by no means confined to a particular region. An example of this crisis can be cited with the 1980 incident of a Saudi Arabian Airlines L-1011 catching fire shortly after leaving Riyadh Airport. Although the pilot turned back for an emergency landing and made a perfect touchdown, nearly 30 minutes passed before firemen managed to go in, by which time all passengers and crew had perished. This could have been a survivable accident (Morrow, 1995). To the contrary, a hijacking incident involving a Boeing 767 aircraft on the shores of Comoros, in November 1996, when the aircraft crashed due to lack of fuel, showed how spontaneous reaction from even non-trained professionals at rescue efforts could help. In this instance, the quick response of tourists at the scene ensured that 51 of the 175 passengers on board were saved (Report, 1996).

This article will outline principles of responsibility of States and political, economic and humanitarian consequences pertaining to SAR of aircraft within their territorial boundaries. It is not the intent of this article to address issues pertaining to rights in recovery of costs incurred in SAR of aircraft and passengers. For this aspect of SAR see Kadletz, 1997.

POLITICAL ISSUES

Annex 12 to the Chicago Convention requires Contracting States to coordinate their SAR organizations with those of neighbouring Contracting States (Recommendation 3.1.2.1) with a recommendation that such States should, whenever necessary, coordinate their SAR operations with those of neighbouring States (ICAO, 1975, Standard 3.1.1) and develop common SAR procedures to facilitate coordination of SAR operations with those of neighbouring States (Standard 3.1.2). These provisions collectively call

upon all Contracting States to bond together in coordinating both their SAR organizations and operations.

At the 32nd Session of the Assembly, held in 1998, ICAO adopted Resolution A32-14, Appendix O which addresses the provision of SAR services. This Resolution refers to Article 25 of the Convention in which each Contracting State undertakes to provide such measures of assistance to aircraft in distress in its territory as it may find practicable and to collaborate in coordinated measures which may be recommended from time to time pursuant to the Convention.

The Resolution mentions Annex 12 to the Convention which contains specifications relating to the establishment and provision of SAR services within the territories of Contracting States as well as within areas over the high seas. The resolution recognizes that Annex 12 specifies that those portions of the high seas where SAR services will be provided shall be determined on the basis of regional air navigation agreements, which are agreements approved by the Council normally on the advice of regional air navigation meetings. Annex 12 also recommends that boundaries of SAR regions should, insofar as practicable, be coincident with the boundaries of corresponding flight information regions.

Article 69 of the Convention, which is also outlined in the Resolution, specifies that, if the Council is of the opinion that the air navigation services of a Contracting State are not reasonably adequate for the safe operation of international air services, present or contemplated, the Council shall consult with the State directly concerned, and other States affected, with a view to finding means by which the situation may be remedied, and may make recommendations for that purpose; and the air navigation services referred to in Article 69 of the Convention include, inter alia, SAR services.

In taking into consideration the above facts, the Assembly resolves in A32-14 that the boundaries of SAR regions, whether over States' territories or over the high seas, shall be determined on the basis of technical and operational considerations, including the desirability of coincident flight information regions and SAR regions, with the aim of ensuring optimum efficiency with the least overall cost. If any SAR regions need to extend over the territories of two or more States, or parts thereof, agreement thereon should be negotiated between the States concerned.

The Resolution also calls upon the providing State, in implementing SAR services over the territory of the delegating State, to do so in accordance with the requirements of the delegating State, which shall establish and maintain in operation such facilities and services for the use of the providing State as are mutually agreed to be necessary. Any delegation of responsibility by one State to another or any assignment of responsibility over the high seas shall be limited to technical and

operational functions pertaining to the provision of SAR services in the area concerned. Remedies to any inadequacies in the provision of efficient SAR services, particularly over the high seas, should be sought through negotiations with States which may be able to give operational or financial assistance in SAR operations, with a view to concluding agreements to that effect.

Furthermore, the Resolution declares that any Contracting State which delegates to another State the responsibility for providing SAR services within its territory does so without derogation of its sovereignty; and the approval by Council of regional air navigation agreements relating to the provision by a State of SAR services within areas over the high seas does not imply recognition of sovereignty of that State over the area concerned.

It is also stated in the Resolution that Contracting States should, in cooperation with other States and ICAO, seek the most efficient delineation of SAR regions and consider, as necessary, pooling available resources or establishing jointly a single SAR organization to be responsible for the provision of SAR services within areas extending over the territories of two or more States or over the high seas.

Finally, the Resolution calls on the Council to encourage States, whose air coverage of the SAR regions for which they are responsible cannot be ensured because of a lack of adequate facilities, to request assistance from other States to remedy the situation and to negotiate agreements with appropriate States regarding the assistance to be provided during SAR operations.

The legal validity of Resolution A32-14, as substantive law recognized under public international law, and therefore binding on States, is a relevant. They have also adduced reasons for recognizing resolutions adopted within the United Nations' system as affirmations of recognized customary law and as expressions of general principles of law recognized by States. Some confirmation of these arguments has been given by the ICJ when the Court, over a period of years, recognized the force of several declarations adopted within the United Nations (ICJ, 1970; 1975).

In practical application however, non-observance by States purportedly bound by such resolutions would render such States destitute of the desired legal effect. This would essentially be the case if there are negative votes or reservations attached to an Assembly resolution. In the case of A32-14, however, there is no question of reservation as the Resolution was adopted by consensus.

The real utility of an Assembly resolution lies in the fact that primarily it supplements the absence of law in a given area by filling a legal lacuna that has not been filled by a formal legislative process. Treaty law making is often long-winded and involves a cumbersome process. A resolution offers

a quick fix while embodying principles in a declaration that introduces legitimacy and validity to a given principle or group of principles. In this context, it would be correct to assume that the ICAO Standards and Recommended Practices (SARPs) referred to earlier in this paper on the subject of the implementation of Annex 12 are of equal persuasion. Together, the resolution and SARPs have a clear and substantial impact, reflecting the meticulous and thoughtful work that have gone with the development of these instruments and recognized importance of safety and efficiency of civil aviation (Joyner, 1997).

In the case of the Africa-Indian Ocean Region, the ICAO Regional Air Navigation Plan (1997), in Part V addresses issues of SAR by pointing to the provisions of the ICAO Search and Rescue Manual (Doc 7333), referring in particular to the need for aircraft to carry specified equipment (Section 3.1), carry out paper and communications exercises (Section 3.3.a) and, more importantly, for the need for States to pool their resources and provide mutual assistance in the case of SAR operations. The Plan calls for precise agreements between States to implement these measures (Section 4.1). The ICAO Regional Air Navigation Plan also calls upon States, in order to ensure compatibility between aeronautical and maritime SAR regions (SRRs), and aeronautical SAR authorities, to maintain close liaison with their maritime counterparts and the International Maritime Organization (IMO).

In 1985, ICAO signed a memorandum of understanding (MOU) with the IMO concerning cooperation with respect to safety of aircraft operations to and from ships and other marine vehicles and of aeronautical and maritime SAR activities. Both ICAO and IMO signed this understanding with a view to ensuring the best possible coordination of activities between the organizations in matters concerned with the safety of aircraft operations to and from ships and other marine vehicles and with aeronautical and maritime SAR operations, agreeing to make arrangements for consultations between the Secretariats of the two organizations in regard to these matters, with a view to ensuring consistency or compatibility between services and procedures in all cases where joint efforts or close cooperation may be required and in order to avoid any unnecessary duplication of efforts by them.

In determining the allocation of responsibilities of the two organizations to ensure safety of aircraft operations to and from ships and other marine vehicles, the following principles are applied:

1. All matters which are directly connected with the design, construction, equipment and operation of aircraft in general, and of helicopters in particular, should be regarded as falling primarily

within the field of responsibility of ICAO.

2. All matters which are directly connected with the design, construction and equipment of ships and other marine vehicles and their operation should be regarded as falling primarily within the field of responsibility of IMO.
3. Matters which do not fall clearly within sub-paragraphs 1 and 2 above should be regarded as the responsibility of both organizations and dealt with by appropriate collaboration between them.

In determining the allocation of responsibilities of the two organizations in respect of SAR in maritime areas, the following principles are applied:

1. All matters which are directly connected with SAR by aircraft in general, and with air SAR facilities and operating procedures in particular, should be regarded as falling primarily within the field of responsibility of ICAO.
2. All matters which are directly connected with SAR by marine craft in general, and with marine SAR facilities and operating procedures in particular should be regarded as falling primarily within the field of responsibility of IMO.
3. Matters which do not fall clearly within sub-paragraphs 1 and 2 above should be regarded as the responsibility of both organizations and dealt with by appropriate collaboration between them.

The MOU also provides that any draft amendment to Annex 12 to the Convention on International Civil Aviation (ICAO, 1975) being considered by ICAO or any amendment to the Technical Annex to the International Convention on Maritime Search and Rescue (ICAO, 1979) being considered by IMO and related to matters covered by this MOU will be communicated by the organization proposing the amendment to the other organization. Similarly, draft amendments to the ICAO SAR Manual or to the IMO SAR Manual which are related to matters covered by this MOU will be communicated in due time to the other organization with a view to keeping both manuals aligned as closely as possible.

The consultations referred to above should also take place with respect to matters falling primarily within the responsibility of one or the other organization, so that each organization may, when it deems it necessary, safeguard its responsibilities and interests in these matters and thereby ensure effective cooperative action whether carried out by one or the other or both organizations.

In practice, the two Secretariats are required to take all available steps to ensure that the consultations referred to in paragraph 1 are undertaken before either organization proceeds to take definitive action on matters subject to this MOU. The two Secretariats are also expected to make available to each other relevant information and documentation prepared for meetings at which matters covered by this MOU are to be considered.

Both Organizations have also agreed to take appropriate steps to ensure that relevant advice from other organizations and bodies are made available in matters covered by this MOU, in accordance with the regulations and procedures of the respective signatory organization.

All the above mentioned documents cited bring to bear the compelling need for the critical link between the legislative nature of the documentation and implementation of State responsibility. All the law making and guidance material, declarations and resolutions would be destitute of effect if there was no element of State responsibility to give legitimacy to the instrument by complying with and adhering to the instruments.

When discussing principles of State responsibility in the field of SAR, it is an uncontrollable fact that the provisions of the Chicago Convention, as an international treaty, are binding on contracting States to the Convention and therefore are principles of public international law. The ICJ, in the North Sea Continental Shelf Case (1970), held that legal principles that are incorporated in treaties, such as the common interest principle, become customary international law by virtue of Article 38 of the 1969 Vienna Convention on the Law of Treaties (United Nations General Assembly, 1969). Article 38 recognizes that a rule set forth in a treaty would become binding upon a third State as a customary rule of international law if it is generally recognized by the States concerned as such. Obligations arising from *jus cogens* are considered applicable *erga omnes* which would mean that States using space technology owe a duty of care to the world at large in the provision of such technology. The ICJ (1974) in the Barcelona Traction Case held:

[A]n essential distinction should be drawn between the obligations of a State towards the international community as a whole, and those arising vis a vis another State in the field of diplomatic protection. By their very nature, the former are the concerns of all States. In view of the importance of the rights involved, all States can be held to have a legal interest in their protection; they are obligations *erga omnes*. (p. 269-270)

The International Law Commission (1976) has observed of the ICJ decision:

[I]n the Courts view, there are in fact a number, albeit limited, of international obligations which, by reason of their importance to the international community as a whole, are—unlike others—obligations in respect of which all States have legal interest. (p. 29)

The views of the ICJ and the International Law Commission, which has supported the approach taken by the ICJ, give rise to two possible conclusions relating to *jus cogens* and its resultant obligations *erga omnes*: a) obligations *erga omnes* affect all States and thus cannot be made inapplicable to a State or group of States by an exclusive clause in a treaty or other document reflecting legal obligations without the consent of the international community as a whole; and b) obligations *erga omnes* preempt other obligations which may be incompatible with them.

Some examples of obligations *erga omnes* cited by the ICJ are prohibition of acts of aggression, genocide, slavery and discrimination. It is indeed worthy of note that all these obligations are derivatives of norms which are *jus cogens* in international law.

International responsibility relates both to breaches of treaty provisions and other breaches of legal duty. In the Spanish Zone of Morocco Claims case, Justice Huber observed, “Responsibility is the necessary corollary of a right. All rights of an international character involve international responsibility. If the obligation in question is not met, responsibility entails the duty to make reparation” (RIAA, 1925, p. 641).

It is also now recognized as a principle of international law that the breach of a duty involves an obligation to make reparation appropriately and adequately. This reparation is regarded as the indispensable complement of a failure to apply a convention and is applied as an inarticulate premise that need not be stated in the breached convention itself (Re. Chorzow, 1927). The ICJ affirmed this principle in 1949 in the Corfu Channel Case by holding that Albania was responsible under international law to pay compensation to the United Kingdom for not warning that Albania had laid mines in Albanian waters which caused explosions, damaging ships belonging to the United Kingdom. Since the treaty law provisions of liability and the general principles of international law as discussed complement each other in endorsing the liability of States to compensate for damage caused by space objects, there is no contention as to whether in the use of nuclear power sources in outer space, damage caused by the uses of space objects or use thereof would not go uncompensated. The rationale for the award of compensation is explicitly included in Article XII of the *Liability Convention* which requires that the person aggrieved or injured should be restored (by the award of compensation to him) to the condition in which he would have been if the damage had not occurred. Furthermore, under the principles of

international law, moral damages based on pain, suffering and humiliation, as well as on other considerations, are considered recoverable (Christol, 1991).

The sense of international responsibility that the United Nations ascribed to itself had reached a heady stage at this point, where the role of international law in international human conduct was perceived to be primary and above the authority of States. In its Report to the General Assembly, the International Law Commission (1949) recommended a draft provision which required that, "Every State has the duty to conduct its relations with other States in accordance with international law and with the principle that the sovereignty of each State is subject to the supremacy of international law" (p. 21).

This principle, which forms a cornerstone of international conduct by States, provides the basis for strengthening international comity and regulating the conduct of States both internally—within their territories—and externally, towards other States. States are effectively precluded by this principle of pursuing their own interests untrammelled and with disregard to principles established by international law.

ECONOMIC ISSUES

Economic aspects of SAR operations related to aviation have been on the agenda of ICAO for a considerable time. At ICAO's Conference on the Economics of Airports and Air Navigation Services (ICAO, 2000b) held in Montreal from 19 to 28 June 2000, the Conference considered that, in 1996 a recommendation had been made by an ICAO Air Navigation Services Economics Panel, that existing policy be amended to allow for costs of SAR services performed by establishments other than permanent civil establishments such as military, to be included in the cost basis for air navigation services charges. The ICAO Council had not approved the Panel's recommendations pending a Secretariat Study of the implications concerned. A subsequent survey carried out by the ICAO Secretariat of Contracting States had resulted in only a limited number of responses, precluding a conclusion as to the wishes of States on this issue. The Conference therefore agreed that there was a need for follow-up of the Secretariat Study, as well as information from many States that had not responded to the survey in the first instance.

The Secretariat drew attention to the humanitarian aspects of SAR operations where States did not wish to charge for services rendered spontaneously and on an emergency basis. The Conference noted that under the International Convention on Maritime Search and Rescue, States were obligated to render gratuitous assistance to any person in distress and

that there was no attendant cost-recovery mechanism in SAR in the maritime field. Based on the above deliberations, the Conference recommended that ICAO undertake further study as to the position of States and the implications of amending ICAO policy with regard to recovery of costs for civil aviation related to SAR services presided by other than permanent civil establishments (ICAO, 2000b, Recommendation 23). As for further work on the subject, the Conference recommended that ICAO develop guidance on the establishment of organizations at the regional level for SAR activities and conduct a study on the establishment of regional or sub-regional SAR mechanisms and how they might be funded as regards civil aviation (Recommendation 24).

ICAO's policies on charges for airports and air navigation services were revised consequent to the Economics of Airports and Air Navigation Services Conference in 2000. These policies were published by ICAO in 2001. As a fundamental principle, the Council considers that, where air navigation services are provided for international use, the providers may require the users to pay their share of the related costs; at the same time, international civil aviation should not be asked to meet costs that are not properly allocable to it. The Council therefore encourages States to maintain accounts for the air navigation services they provide in a manner which ensures that air navigation services charges levied on international civil aviation are properly cost-based.

The Council also considers that an equitable cost recovery system could proceed from an accounting of total air navigation services costs incurred on behalf of aeronautical users, to an allocation of these costs among categories of users, and finally to the development of a charging or pricing policy system. In determining the total costs to be paid for by charges on international air services, the list in Appendix 2 of ICAO document 9082/6 (ICAO, 2001) may serve as a general guide to the facilities and services to be taken into account. Guidance on accounting contained in the *Airport Economics Manual* (ICAO, 1991) and the *Manual on Air Navigation Services Economics* (ICAO, 1997) may be found useful in this general context. Moreover, the Council specifically recommends that States consider the application, where appropriate, of internationally accepted accounting standards for providers of air navigation services that maintain separate accounts.

It is recommended that, when establishing the cost basis for air navigation services charges, the cost to be shared is the full cost of providing the air navigation services, including appropriate amounts for cost of capital and depreciation of assets, as well as the costs of maintenance, operation, management and administration. The costs to be taken into account should be those assessed in relation to the facilities and

services, including satellite services, provided for and implemented under the ICAO Regional Air Navigation Plan(s), supplemented where necessary pursuant to recommendations made by the relevant ICAO Regional Air Navigation Meeting, as approved by the Council. Any other facilities and services, unless provided at the request of operators, should be excluded, as should the cost of facilities or services provided on contract or by the carriers themselves, as well as any excessive construction, operation, or maintenance expenditures. The cost of air navigation services provided during the approach and aerodrome phase of aircraft operations should be identified separately, and so should the costs of providing aeronautical meteorological service, when possible. Air navigation services may produce sufficient revenues to exceed all direct and indirect operating costs and so provide for a return on assets (before tax and cost of capital) to contribute towards necessary capital improvements.

In determining the costs to be recovered from users, government may choose to recover less than full costs in recognition of local, regional, or national benefits. It is for each State to decide for itself whether, when, and at what level any air navigation services charges should be imposed, and it is recognized that States in developing regions of the world, where financing the installation and maintenance of air navigation services is difficult, are particularly justified in asking the international air carriers to contribute through user charges towards bearing a fair share of the cost of the services. The approach towards the recovery of full costs should be a gradual progression.

The Council recommends that the allocation of the costs of air navigation services among aeronautical users be carried out in a manner equitable to all users. The proportions of cost attributable to international civil aviation and other utilization of the facilities and services (including domestic civil aviation, State or other exempted aircraft, and non-aeronautical users) should be determined in such a way as to ensure that no users are burdened with costs not properly allocable to them according to sound accounting principles. The Council also recommends that States should acquire basic utilization data in respect of air navigation services, including the number of flights by category of user (i.e., air transport, general aviation, and other) in both domestic and international operations, and other data such as the distance flown and aircraft type or weight, where such information is relevant to the allocation of costs and the cost recovery system. Guidance on cost allocation is contained in the *Manual on Air Navigation Services Economics* (ICAO, 1997), and the *Airport Economics Manual* (ICAO, 1991), although States may use any accounting approach they consider meets their particular requirements.

The Council further recommends that States should ensure that systems used for charging for air navigation services are established so that any charging system should, so far as possible, be simple, equitable and, with regard to route air navigation services charges, suitable for general application at least on a regional basis. The administrative cost of collecting charges should not exceed a reasonable proportion of the charges collected. The charges should not be imposed in such a way as to discourage the use of facilities and services necessary for safety or the introduction of new aids and techniques. The facilities or services provided for in the ICAO Regional Air Navigation Plan(s) or in any recommendations of the relevant ICAO Regional Air Navigation Meeting as are approved by the Council are, however, considered to be necessary for general safety and efficiency. Charges should be determined on the basis of sound accounting principles and may reflect, as required, other economic principles, provided that these are in conformity with Article 15 of the Convention on International Civil Aviation (ICAO, 2000a) and other principles in this document. The system of charges must be non-discriminatory both between foreign users and those having the nationality of the State or States responsible for providing the air navigation services and engaged in similar international operations, and between two or more foreign users. Where any preferential charges, special rebates, or other kinds of reduction in charges normally payable in respect of air navigation services are extended to particular categories of users, governments should ensure, so far as practical, that any resultant under-recovery of costs properly allocable to the users concerned is not shouldered onto other users. Any charging system should take into account the cost of providing air navigation services and the effectiveness of the services rendered. The charging system should be introduced in such fashion as to take account of the economic and financial situation of the users directly affected, on the one hand, and that of the provider State or States, on the other. Charges should be levied in such a way that no facility or service is charged twice with respect to the same utilization. In cases where certain facilities or services have a dual utilization (e.g., approach and aerodrome control, as well as en-route air traffic control) their cost should be equitably distributed in the charges concerned. The charges levied on international general aviation should be assessed in a reasonable manner, having regard to the cost of the facilities needed and used and the goal of promoting the sound development of international civil aviation as a whole.

HUMANITARIAN ISSUES

SAR operations conducted gratuitously and with the intent to save human lives and property are what legal commentators call humanitarian intervention, which is considered to be a basic moral response of one human being to another, to save the latter's life. One definition identifies

“humanitarian intervention as the proportionate transboundary help, including forcible help, provided by governments to individuals in another [S]tate who are being denied basic human rights and who themselves would be rationally willing to revolt against their oppressive government” (Teson, 1956, p. 5).

The general principle of intervention for the provision of relief on moral grounds has been subject to a great degree of intellectual polarization. One view is that if humans are dying, one has got to help at all costs (Lillich, 1973). The other is that the mere act of treating humanitarian intervention as an extant legal doctrine would be to erode the applicable provision of the United Nations Charter on recourse to force.

The principle of non-intervention has been strongly espoused in order that sovereignty of a State is retained as sacrosanct. This view is substantiated by the following argument (Hall, 1924; Lawrence, 1923; Scott, 1916):

1. The good Samaritan must fight for the right to perform his act of humanitarian intervention and may end up causing more injury than he averts;
2. The authorization for forceful and unilateral humanitarian assistance may be abused; and,
3. Unilateral recourse to force even for genuinely humanitarian purposes may heighten expectations of violence within the international system and concomitantly erode the psychological constraints on the use of force for other purposes.

The essence of intervention is compulsion. Compulsion could either take place through the use of force, armed or otherwise. The legal question, with regard to the inviolability of the sovereignty of a State is not whether the intervention concerned was an armed or unarmed one, but whether it was effected unilaterally under compulsion or threat by the intervening State (deLima, 1971). Starke (1977) is inclined to stretch the principle of sovereignty to accommodate external involvement by a State in the affairs of another in special circumstances:

...“Sovereignty” has a much more restricted meaning today than in the eighteenth and nineteenth centuries when, with the emergence of powerful highly nationalised States, few limits on State autonomy were acknowledged.

At the present time there is hardly a State which, in the interests of the international community, has not accepted restrictions on its liberty of action. Thus most States are members of the United Nations and the International Labour Organization (ILO), in relation to which they have undertaken obligations limiting their unfettered discretion in matters of international policy. Therefore, it is probably more accurate today to say that the sovereignty of a State means the *residuum* of power which it possesses within the confines laid down by international law. It is of interest to note that this conception resembles the doctrine of early writers on international law, who treated the State as subordinate to the law of nations, then identified as part of the wider "law of nature." (p. 106)

Oppenheim (1955) holds a similar view that the traditional law of humanity is incorporated into contemporary international law. He views this attitude as, "Recognition of the supremacy of the law of humanity over the law of the sovereign State when enacted or applied in violation of human rights in a manner that may justly be held to shock the conscience of mankind" (p. 312). Some authorities in international law also believe that intervention should, if absolutely necessary, be effected when there is cogent evidence of a breakdown in the minimum guarantees of humanity (Hall, 1924, Hyde, 1945; Lawrence, 1923; Stowell, 1921; Wehberg, 1938).

Accordingly, it may be argued that any act of intervention aimed at saving the lives of human beings which are in danger, would be legally and morally justifiable. Fernando Teson (1956) argues that since the ultimate justification for the existence of States is the protection and enforcement of the natural rights of the citizens, a government that engages in substantial violations of human rights betrays the very purpose for which it exists and so forfeits not only its domestic legitimacy, but also its international legitimacy as well. He goes on to say:

I suggest that from an ethical standpoint, the rights of States under international law are properly derived from individual rights. I therefore reject the notion that States have any autonomous moral standing—that they hold international rights that are independent from the rights of individuals who populate the State. (p. 15)

Schwarzenberger (1971) analyses the concept somewhat clinically and concludes that in the absence of an international *jus cogens* which corresponds to municipal *jus cogens* of advanced communities, where the latter prevents the worst excesses of inequality of power, the supremacy of the rule of force would prevail.

There is also a contrasting view that humanitarian intervention is generally resorted to by States only in instances of serious abuses of human rights by one State upon its people or others. Dr. Michael Akehurst (1977) argues that if a State intervenes forcibly on the territory of another in order to protect the local population from serious human violations, such an

armed intervention could inevitably constitute a temporary violation de facto of the territorial integrity of the latter State, and to an extent of its political independence, if carried out against its wishes. Akehurst (1984) goes on to assert, "Any humanitarian intervention, however limited, constitutes a temporary violation of the target State's political independence and territorial integrity if it is carried out against the State's wishes" (p. 105).

The doctrine of humanitarian intervention is thought of by some commentators as an invention of strategy to circumvent the strong *jus cogens* nature of the principle of sovereignty and inviolability of States to which Dr. Akehurst refers. Professor Brownlie (1963) is of the view that States have generally invoked the doctrine to give support to their commercial and strategic considerations. The United Kingdom legislature recently considered the view of the British Minister of State who was of the view, "When members of the United Nations act in a forcible manner either they should do so within and under the authority of the United Nations or that which they do should be authorised by the principles of international law" (Hansard, 1993, col. 784).

Clearly, this statement establishes the view that international law in the context of intervention is *jus cogens*. The British Foreign Office has supported this position in the following language:

The best case that can be made in support of humanitarian intervention is that it cannot be said to be unambiguously illegal...but the overwhelming majority of contemporary legal opinion comes down against the existence of a right of humanitarian intervention. (UKMIL, 1986, p. 619)

Despite this strong alignment towards anti-humanitarian intervention, it is believed that there is a school of thought within the British legislature that is prepared to accept unilateral intervention as justifiable under customary international law in cases of extreme humanitarian need (Lowe & Warbrick, 1993).

The author supports the view that despite these divergent views, the non-intervention principle remains sacrosanct as a contemporary postulate of international law and deviations from the principle, although recognized as ethical and moral in certain instances by scholars, would be justified only in extreme cases (Vincent, 1974).

CONCLUSION

The essence of SAR operations in aviation is cooperation, which is embodied as a fundamental principle in the Preamble to the Chicago Convention which states, *inter alia*, that it is desirable to avoid friction and to promote that cooperation between nations and peoples upon which the

peace of the world depends. At the root of international cooperation is the element of assistance, and in this sense the maritime regulations which admit of gratuitous help are both significant and laudable. Although it is not the intention of this paper to recommend that all SAR operations be gratuitous, it certainly behoves the community of States to encourage all States who are in a position to give assistance without charge, to do so. Humanitarian assistance is an integral element of diplomatic unity and co-existence.

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STRATEGIC CLASSIFICATION AND EXAMINATION OF THE DEVELOPMENT OF CURRENT AIRLINE ALLIANCE ACTIVITIES

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ABSTRACT

Previous research argues that despite the fact that strategic alliances have become an important feature of the world airline industry, little rigorous analysis has been done on the effects of these alliances. This is partially because there is a lack of precise definitions to specify different types of airline alliances in the literature. This research identifies several categories of airline alliances through a strategic classification of the current alliance activities involving the major airlines for the period 1989 to 1999. The classification enables this research to examine how strategic alliance activities are evolving, particularly to compare how airlines in North America, the European Union and the Asia Pacific region have committed to different alliances. Findings show that there is a significant difference between the number and scope of alliances adopted in the three aviation markets. These findings facilitate research to further analyse the impact of market liberalization on various formations of strategic airline alliances.

BACKGROUND

In the 20th century, companies have experienced changes in a diverse environment, including the shake-up of the social structure, economic progress and technological advances (Limerick & Cunnington, 1993). The social structural evolution resulted in dismantled hierarchical cultures within industries. The economic changes resulted in a change of lifestyle patterns and increased consumption (Goeldner, 1992). The technological changes have lifted the industrial society into an information society (Limerick & Cunnington). The progress of information technology has allowed communication, research and development, rapid fund transfer and business coordination through the global network. These social, economic

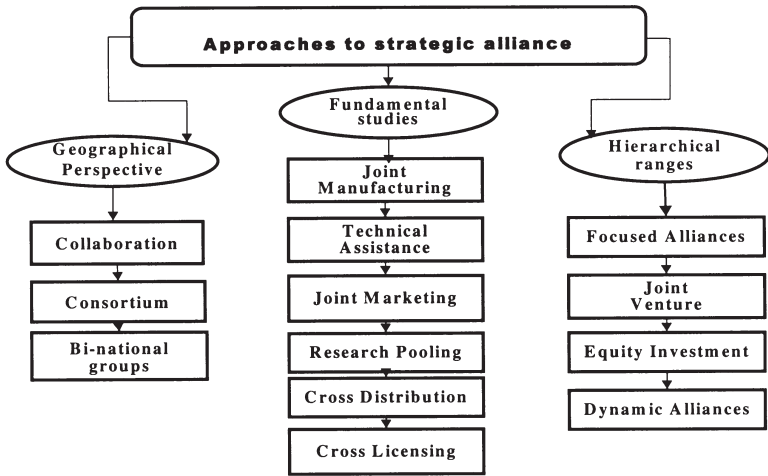
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and technological changes are paving a way for organizational globalization. Facing this changing environment, most industries have adopted various management strategies. Strategic alliances have been employed as one of these management strategies.

Enterprises pursue alliances for the purposes of being able to cultivate multinational markets, save time in learning curves, share resources and manage risks, gain global brand reputations, and develop economies of scale and scope. In line with an increasing number of enterprises entering strategic alliances, various approaches to strategic alliances have also appeared in the current literature. These approaches can be viewed from generally three perspectives: geographical scope (see Byttebier & Verroken, 1995; Dussauge & Garrette, 1995), fundamental alliances (see Pucik, 1998; Kanter, 1989), and hierarchical ranges (see Faulkner, 1995; Pucik; Robinson & Clarke-Hill, 1994). The concepts of these perspectives are shown in Figure 1, and discussed briefly below.

Figure 1. Major perspectives of study strategic alliances in the current literature



The geographical perspective studies strategic alliances in terms of collaboration, consortia, and bi-national groups (Byttebier & Verroken, 1995; Dussauge & Garrette, 1995). The fundamental studies, for instance those by Pucik (1998) and Kanter (1989), review strategic alliances in terms of joint ventures, technology change, licensing, cross-distribution, and coproduction. In turn, hierarchical ranges, in terms of Faulkner (1995), Pucik (1998), and Robinson and Clarke-Hill (1994,) emphasize the levels

of cooperation in an alliance such as simple coordination or complex alliances in nature and features. The simpler forms of alliances can be seen as more focused alliances such as research and development or sharing resources. The more complex forms refer to more integrative alliances, which may involve equity investments and various higher levels of coordination, joint manufacturing, cross distribution of products, and cross-licensing.

Despite the two economic depressions due to the Gulf War during 1990, and the Asian financial crisis in 1997, the airline industry has experienced several growth periods (Wang, Pendse & Prosser, 1998). Meanwhile it has been seen that it is not just the number of alliances that has increased in the last decade; there are also various types of alliances emerging (Wang & Evans, 2001). The term airline alliance has been used to describe an accord, partnership, cooperative agreement, joint operation, marketing alliance or code sharing agreement (IC, 1997). The strategic alliances forged in air transport markets also include intercontinental alliances (Oum & Taylor, 1995). Intercontinental alliances are the largest and fastest growing type of international alliance. An across border alliance crosses geographical areas like Asia Pacific, Europe and North America continents through activities like code sharing. Their aim is to expand operations abroad.

In 1992, the US started to pursue the potential of bilateral open skies agreements. The most significant progress in airline alliances was on January 11, 1993, when the US Department of Transportation approved the Northwest/KLM commercial cooperation and integration agreement under a grant of antitrust immunity. KLM and Northwest were since then free to join together in creating a unified global airline system. The Northwest/KLM's commercial cooperation and integration agreement, under a grant of antitrust immunity showed an entirely new level of cooperation between the two carriers in air services.

From 1993, both joint activities and marketing alliances made progress. Some carriers created frequent flier programs (FFPs), and joined together to handle ground service through joint services and marketing, sharing capacity and joint operation of FFPs. In 1994, airline alliances moved towards a stage of multilateral air transport alliance, such as single-skies agreement, air transport liberalization (open skies), multilateral aviation rights, and cooperative agreements. From 1995, airline alliances stepped further towards regional aviation blocs, blocking space agreements, and open skies agreements. However, the US had to take its air service agreement negotiations as hard-ball bilateral liberalization, recognized by the US Department of Transportation, due to the market situation and hence different attitudes towards open skies between Asian, European and North American carriers (Airline Business, 1998).

Critically, the five major alliance sectors emerged in the airline industry in 1996, after the spate of alliance-building activities started from 1994. The Star Alliance was formally established in 1997, and followed by oneworld in 1998, in the mean time more airlines entered these two global alliances or other global groupings (Oum, Park & Zhang, 2000). While more dynamic airline alliances are emerging, there are more memorandums of understanding signed between countries, which enabled operating the Fifth and Seventh Freedom Rights¹ of Air, and some even included agreements of domestic flights (cabotage).

What follows is a consideration of the influential features of alliances adopted in the air transport markets, and how airlines are involved in different forms of alliances. Answers to these questions enable researcher to further examine the effects of airline alliances on airline performance. In attempting to address these general questions, several problems are identified.

Research Problems

There are increasing numbers of airlines entering alliances and increasing levels of involvement in the alliances. However, the effects of strategic alliances on firm performance and on industry organization have received relatively less attention from academics (Oum, Park & Zhang, 2000). The general alliance research in previous studies mostly discusses functions and motivations of strategic alliances (e.g., Varadarajan & Cunningham, 1995; Vyas, Shelburn & Rogers, 1995). Some of the studies just describe how to choose partners (e.g., Brouthers, Brouthers & Wilkinson, 1995). In the airline industry, some of the studies examined airline routes or network systems. The several studies that have examined airline alliances are mainly focused on code share or airline alliances in general. Very few studies have examined the effects of joint activities and marketing alliances. More critically, most of the studies have not controlled for industry specific effects and specific alliance effects (Park, 1997; Park & Cho, 1997). Airlines exercise different tactics on different routes thus different levels of cooperation may have different degrees of effects.

In aiming to examine effects of alliance alliances, this research confronts another problem which is a lack of clear definitions of the alliances in the current literature, possibly resulting from the complex features and the changing tactics of airline alliances (Wang & Evans, 2001). For example, the equity alliance (Jennings, 1990) between Singapore, Delta and Swissair formed in 1990 was an agreement for the coordination of international fares and flight schedules, the loaning of flight attendants and opening the possibility of joint buying opportunities. This alliance encompassed the same characteristics of today's global grouping of Star

Alliance or oneworld. It was reported as an equity alliance (Jennings), but, in fact, has no equity swaps. On the other hand, the alliance between British Airways and United, similar to Singapore/Delta/Swissair alliance included schedule coordination and code sharing of international flights, and was called a marketing alliance (Jennings).

The route-specific agreement between the airlines of Garuda of Indonesia and Japan Airline is also called a strong marketing alliance by Garuda. However, Japan Airline officials have trouble remembering the agreement exists (Jennings, 1990). This alliance is actually a route-specific agreement. Similarly, in 1990 Alitalia and Iberia signed an agreement to provide each other reciprocal access to their Southeast Asian and Central American networks. The nature of the agreement shows that this deal is a bilateral agreement on route specific services, but it is called a natural collaboration in their business reports (see Whitaker, 1990).

Similar to the US open skies, the Andean countries' alliances are also called open skies. In mid-May 1991, all of a sudden, more skies over the Andes were opened (Booth, 1991). In 1993, the presidents of the five Andean countries—Bolivia, Colombia, Ecuador, Peru and Venezuela—signed an agreement, to set up an open skies regime. In 1994, Malaysia, Indonesia and Thailand forged a regional bloc called the Northern Growth Triangle (Hooper, 1997). This regional alliance has later stemmed out the idea of open clubs, approached by some researchers and airline business experts. It thus can be questioned whether all these liberal forms of alliances should be considered in the studies of effects of the integrative alliances in the airline industry.

Code share also varies in terms of concepts and agreements. There are different agreements within code share alliances such as parallel and complementary alliances (Park, 1997). Code share, according to the International Civil Aviation Organization (ICAO, 1997) are block space arrangements, which occur when a number of passenger seats and/or specified cargo space are purchased by an air carrier for the carriage of its traffic on an aircraft of a second air carrier. The code share between Air Canada and All Nippon Airways is an agreement on only the limited flights between the routes of Osaka-Vancouver and Tokyo-Toronto (Airline Alliance Survey, 1999). However, the code share between Air Canada and United entails the comprehensive code share agreements on several hundred flights, including joint marketing, one-stop check-in and lounge access. Thus, it can be questioned whether partners involved in simple code sharing benefit in the same way as partners entering comprehensive code sharing. Thus, to what extent does the term code share apply?

The problems discussed above show airline alliance activities are complex in features and forms. There is, however, no clear definition or specific terminology of these alliances. This problem confuses research and observation in airline alliance studies, and may have partly contributed to the limited studies in the current literature that have examined the effects of airline strategic alliances. The five emerging Global Alliances, started in 1996, have already accounted for 57.1% of the world total revenue passenger kilometers, and share more than 59.0% of the world total operation revenue of the airline industry by 1999 (Airline Business, 1999). Thus, it is important to study airline alliances, and hence the effects of the different types of airline alliances.

Importantly, the stages of market liberalization between North America (NA), the European Union (EU) and the Asia Pacific (AP) region AP may have affected the progress of the airlines entering strategic alliances. It has been argued that the US has been moving towards open skies while most of the markets in the AP region are still regulated with only a few AP airlines invited to enter the open skies (Eleck, Findlay, Hooper & Warren, 1999; Hooper & Findlay, 1998; PC 1998).

The problems indicated above are the background of this research's central issues:

Research Issue 1: What are the features and patterns of the development of airline alliances in the air transport markets?

Research Issue 2: Is a significant difference among airlines' formation of alliances in North American, the European Union and the Asia Pacific region?

STRATEGIC CLASSIFICATION OF AIRLINE ALLIANCES

This part of the study examines the concepts of different types of airline alliances while attempting to create a framework for strategic classification of the airline alliances. As airline alliances vary in features and areas of cooperation, the classification is important, enabling research further examining the development of airline alliances and their consequences.

Route Specific Services

During the period of 1989 to 1999, international airlines launched numerous route specific services negotiated under bilateral Air Service Rights (ASRs). It therefore is important to know how the new route-specific agreements, coexisting with other types of alliances, contribute to

airline performance. Thus, the bilateral route specific services are classified as *Type One Alliances*, suggesting a simple and basic form of airline alliance agreements.

Since the 1944 Chicago Convention, all commercial aspects of international air transport have been governed by bilateral air service agreements (ASAs). Each international airline faces a complex web of ASAs signed by its home state (Oum & Yu, 1997). ASRs are a product of a complex global network of ASAs that guarantee the scheduled and non-scheduled (charter) airlines certain traffic freedoms (PC, 1998). Currently ASAs are based on the principle of reciprocity, an equal and fair exchange of rights between countries.

The route specific services examined by this research refer to the agreements based on bilateral traffic rights between countries. Although the agreements vary in form, they generally specify services and routes to be operated between the two countries' designated airlines and the capacity to be provided by each airline (Oum & Yu, 1997; Rimmer, 1997). The agreements offer carriers access to entry and hence enable carriers to operate flight services across country borders within the limits the rights permit. The bilateral services may also include services beyond these limits. For example, Air Canada launched a weekly Toronto-Berlin/Schonefeld route, using fifth freedom rights from Paris.

Code Sharing

Code sharing has become a popular form of airline alliance. Code share is classified as *Type Two Alliances* in this research. Code share, compared with the route specific services, is a step forward in the progress of alliance development in terms of the alliance features. Code share provides cooperation between carriers other than just providing access for city-pairs or non-stop flights. Under code share, the agreements often involve one airline buying blocks of seats on the other airline's flights and reselling them (GAO, 1995). Under a code sharing agreement, one partner (the code sharing partner) assigns its airline designator a code to the flight of its partner (the operating carrier) (ICAO, 1997).

A block of seats agreement can be negotiated with the number of seats available to the code-sharing partner determined upfront. The most complex alliances operate sophisticated computerized seat management systems that allow both partners to manage the capacity effectively on a seat-by-seat basis on a particular route, on a range of flights within a region, or on a global basis coordinating activities over many countries (BTCE, 1996).

An example of code share is the Canadian and Qantas alliance. Canadian and Qantas have a code sharing agreement on the Vancouver-Honolulu-Sydney route where Canadian serves the Vancouver-Honolulu section and Qantas serves Honolulu-Sydney section of the route (OAG, 1999). Code share alliances enable a participating carrier to enter thin markets that it would not otherwise serve profitably on its own. For example, Qantas formed a code sharing alliance with Air Vanuatu on the Australia/Vanuatu route, as load factors would not be viable if it introduced its own aircraft onto the route (BTCE, 1996)

Parallel and complementary alliances in nature are also code share alliances. Parallel operation of flight service refers to the coordination in competing routes or the same route (Park & Zhang, 1998). For example, between Vancouver, Canada and Sydney, Australia a code share service is offered under either Canada or Qantas. This service is actually operated by Canada between Vancouver and Honolulu and by Qantas between Honolulu and Sydney (ICAO, 1997).

Complementary code sharing is an alliance on different routes rather than parallel routes. According to Park and Zhang (1998), a complementary alliance is the case where two firms link their existing networks and build a new complementary alliance network in order to feed traffic to each other. According to the Industry Commission (IC, 1997), complementary code sharing is when two airlines code share on different, but connecting routes, usually to feed traffic between two sectors.

Typically code sharing is accompanied by a suite of other coordinated services designed to provide passengers with smooth connections between flights operated by the partner carriers (ICAO, 1997). On-line service belongs to the category of code share. On-line service refers to enabling passengers to fly by one airline on behalf of another airline based on a formal alliance arrangement between the two airlines. Interline service refers to customers flying or using transport services of more than one airline (ICAO). On-line service agreements are generally aimed at facilitating international passenger movements, as without an alliance agreement, passengers have to fly on an airline other than the one identified on the ticket (ICAO). On-line services also allow partners to provide more alternatives in destination choices through their expanded networks, which offer more convenient itineraries to passengers (Park, 1997).

Joint Activities

If a code share agreement is multiple cooperation in nature, it can be regarded as a *Type Three Alliance*. In Type Three Alliances, the cooperation is no longer limited to just exchanging designation code or buying a block of seats but involving multiple cooperation of ground services. The current

literature shows that various airline alliances are mixed together under equity or joint operations. This research aims to separate alliances having only code share or block space sales from those with multiple areas of joint activities including the coordination of ground handling, joint use of ground facilities, coordination of flight schedules, joint maintenance, purchase of aircraft and fuel and staff training. Creating connection services is also a potential joint activity. Connection services normally involve the coordination of baggage checks and honouring of tickets between airlines, but the identity of each carrier is maintained (ICAO, 1997).

Marketing Alliances

Marketing alliances include the global groupings. The five emerging global, marketing alliances appeared in the global air transport market from late 1996 to 1999. These five alliances are the Star, Qualiflyer (or Excellence), oneworld, Northwest/KLM (or Global Wings) and Air France/Delta (Airline Business, 1999). These groups of global alliances are defined in Table 1.

Table 1. The emerging global alliance groupings

AIR FRANCE/DELTA	GLOBAL WINGS	ONEWORLD	STAR ALLIANCE	QUALIFLYER
Delta Airlines	Northwest	American Airlines	United Airlines	Swissair
Air France	KLM	British Airways	Lufthansa	Sabena
Aeromexico	Continental	Qantas	Airline Canada	Thy Turkish
Austrain	Alitalia	Cathay Pacific	Thai International	Tap Air
Korean Air	Malaysia	Canadian	SAS	AOM
		Iberia	Varig	Lauda Air
		Finnair	Air New Zealand	Crossair
		Lanshile	Ansett Australia	Air Europe
			All Nippon	
			Singapore	

Note: From Airline Alliance Survey. Airline Business Special Issue July 1999, pp. 39-65.

Star Alliance brought together eight carriers in 1997, and was joined by Ansett Australian and Air New Zealand in 1999. The Singapore and Lufthansa alliance was formed on November 24, 1997 and, by the end of 1999, Singapore also became a member of the Star Alliance. All Nippon Airways joined the group in October 1999 (Airline Business, 1998; 1999).

By 1999 the Star Alliance network covered more than 760 destinations and 112 countries. The alliance allows access to over 250 Star Alliance lounges around the world, reciprocal FFPs participation and recognition, through check-in, streamlined airport operations, cargo cooperation, joint purchasing, advertising and promotions (Airline Business, 1999).

The formation of oneworld in 1998 was presented as a brand name for a global network. Finnair and Iberia joined the group in September 1999, and Lan Chile became a member of the group in 2000. A third major global group, Global Wings, has coalesced around KLM and Northwest who formed an alliance in 1989, later joined by Continental Airlines, and Malaysian Airlines, who both signed the Joint Venture Agreements in 1999. In November 1998, Alitalia and KLM announced the Master Cooperation Agreement, and since November 1999 Alitalia became a member of the group (Airline Business, 1999).

European Quality Alliance (Qualiflyer), which started in 1994, includes Swissair, Austrian, and SAS. In 1995, however, SAS faced three alternatives: alliances with Lufthansa, KLM or British Airways. In 1997, SAS joined Star Alliance and Austrian joined the Air France/Delta group. According to Airline Business (1999) this group currently also has seven other European Airlines as members. The last sector, according to Oum, Park and Zhang (2000) refers to the Air France and Delta group (see also Airline Business, 1999).

Marketing alliances are aimed at marketing passenger services and creating customer satisfaction through various cooperative operations. These types of alliance often involve high integration and coordination of flights, scheduling, advertising and FFPs (GAO, 1995). For example, FFPs enable passenger to accrue frequent flier miles on their home carrier's plans even if they fly on a partner's flight and also permit them to use FFPs rewards on each other's flights (Oum, Park & Zhang, 2000). The alliances are easier for travellers to accumulate mileage because the alliance network serves more cities than does a single carrier (IC, 1997; Oum, Park & Zhang). These types of alliance have the key characteristics of cooperation in the marketing field.

Some international airlines have entered regional groupings prior to global marketing alliances. These regional blocs have agreements covering the same areas of cooperation and hence can be regarded as marketing alliances.

Sharing the Computer Reservation System (CRS) is also part of the activities of marketing alliances. Alliance partners can obtain competitive advantages over non-aligned competitors on the CRS display. Travel agents use the CRS of major international airlines and these airlines have entered into alliances. A code shared non-stop flight is listed twice in the CRS

because each partner places their individual code of the same flight on the system (Park, 1997). The same service using different airline designation codes and flight numbers may appear a great number of times, due to code sharing services (ICAO, 1997). Thus, the alliances for sharing the CRS enable airlines to obtain marketing advantages.

Generally, marketing alliances aim to offer better service quality, more advantages through the larger networks, more destinations available, flexible tickets, and bonus points. Marketing alliances, also through global grouping, share the CRS, offer FFPs, and coordinate other passenger services.

Open Skies

In 1992, the US adopted an open skies regime and came to pursue a more liberal form of alliances in world air transport markets. The Northwest/KLM alliance started in 1989 (Airline Alliance Survey, 1999; 2000) is an example of open skies in that partners have long-haul code sharing and a comprehensive marketing agreement, on the North Atlantic, in the US, Europe, Africa and the Middle East. They also have joint FFPs. They cooperate on ground handling, sales, catering information technology, cargo and maintenance, and joint purchasing (Alliance Survey in Airline Business, 1999). These can show some characteristics of the broad commercial alliances under the open skies.

In 1993, the US Department of Transportation granted anti-trust immunity to the alliance between Northwest and KLM, which allows the airlines from both countries unrestricted entry and capacity rights between and beyond both countries (PC, 1998). This permitted the airlines to conduct extensive code sharing and to jointly market capacity and determine fares without fear of legal challenge from the competing airlines (IC, 1997). This shows another characteristic of open skies—broad commercial alliances.

American Airlines and Canadian also signed a broad commercial agreement under the US open skies regime. This alliance also provides Canadian with a range of services including accounting, data processing and communications, operations planning, pricing and yield management, international services, passenger services training and US originated reservations (Airline Alliance Survey, 1999). American Airlines also invested \$190 million in Canadian for 25 percent of Canadian's voting shares and 8.99 percent of its convertible preferred shares (Park, 1997). This shows another feature of broad commercial alliances under open skies.

According to the open skies policy outlined in Appendix A the broad commercial alliances show the removal of restrictions on the ability of airlines to operate services between two countries. Normally, the memorandum of understanding includes code share agreements on international and domestic flights, reciprocal FFPs, lounge access, through check-in, integration of boarding procedures, computer reservation system linkage, joint marketing and sales programs.

The regional blocs or open club in the AP region and the open skies in the five Andean countries also show the characteristics of broad commercial alliances. The five Andean countries' open skies include partners of Bolivia, Colombia, Ecuador, Peru and Venezuela who signed an agreement in 1993. However, the alliance between Cathay Pacific/South African Airways formed in 1998 belongs to marketing alliances, as the memorandum of understanding leads only to a code share agreement, FFPs, and ground handling. Compared with other types of alliance, broad commercial alliances under open skies in general are more liberal in areas of cooperation and dynamic in features.

Summary of the Classification and Research Questions

In the above analysis, the current airline alliances are identified as the five major categories: bilateral route specific services; code share; joint activities; marketing alliances; and broad commercial alliances (open skies). This classification system is based on systematic observation of airline alliance activities and supported by the concepts of the theoretical studies by the information papers and academic research. A framework of the strategic classification is provided in Appendix B.

This theoretical examination enables the researcher to further explore how each type of alliance activities increases in the airline industry, and particularly in the three aviation markets: NA, the EU, and the AP region. It also investigates how each airline has adopted different alliances. Towards these objectives, this research develops research questions and hypothesis as follows:

Question 1: How many strategic alliances have been formed by the airlines in general from 1989 to 1999?

Question 2: How have the five types of alliances increased from 1989 to 1999?

Question 3: How are the airlines involved in the different types of alliances from 1989 and 1999

Question 4: How are the airlines in the three regions of North America, the European Union and the Asian Pacific region involved in the five types of alliances from 1989 and 1999?

Hypothesis 1: There is a significant difference in the number and forms of strategic airline alliances between the three regional aviation markets.

METHODS

Methods employed for this research are descriptive statistics and analysis of variance. The research hypothesis involves analysis of variance, and, hence, ANOVA technique is employed. This enables the comparisons of the means of numbers and types of airline alliances between the three groups, and seeks whether there is a significant difference between the groups based on likelihood ratios (F ratio) obtained. An ANOVA essentially answers the simple question of whether there are differences between the groups. This is a *path analysis* (Tabachnick & Fidell, 1996). The path analysis enables further examination of the critical factors involved in formation of an airline alliance in future studies.

The samples used for the study are described in Table 2. The 27 major airlines sampled are the members of the ICAO. These airlines are also the major international carriers or mostly the flag carriers of the NA, the EU and the AP region. Importantly, they are where the critical issues were raised by previous studies, and hence the focus of this research.

Table 2. Airlines included in the research sample

NORTH AMERICA AIRLINES	DESIGN CODE	EUROPEAN AIRLINES	DESIGN CODE	ASIAN AIRLINES	DESIGN CODE
Air Canada	AC	Air France	AF	Air India	AI
American	AA	Alitalia	AZ	Air NZ	NZ
Continental	CO	British Airways	BA	All Nippon	NH
Delta Airlines	DL	KLM	KL	Cathay Pacific	CX
Northwest	NW	Lufthansa	LH	Air China	CA
SAS	SK	Swissair	SR	Japan Airlines	JL
United	UA	Virgin Atlantic	VIR	Korean	KE
Canadian	CDN			Malaysia Airlines	MH
USAir	AL			Qantas Airways	QF
				Singapore	SQ
				Thai Airways	TG

Focusing on these airlines, the airline alliance data were collected from *Airline Business*, including 5,518 monthly issues of electronic journals from 1989 to 1999. These issues have been accessed on the Internet at the web site page <http://ezproxy.scu.edu.au>. Information of global alliances was gathered from Special Report of Airline Business, July 1999, and July 2000, including the Airline Alliance Survey, the Global Grouping, and Mergers Revised.

Five type of alliance identified by the theoretical study can be seen in ordinal ranges (see Table 3). These ranges enable the analysis to separate a simple alliance from higher levels of cooperation between partners in examining the effects of the different types of alliances. Another set of variables used are the three phases, which specify the earlier stage of airline alliance (Phase 1 from 1989 to 1992), the developing stage (Phase 2 from 1992 to 1995) and the developed stage (Phase 3 from 1995 to 1997). These measures enable the comparison of the development of alliances to be made between different historical stages. Further, the three regional aviation markets are the focus of the hypothesis. All these variables are shown in Table 3.

Table 3. Measures and variables employed for this research

VARIABLES	SPECIFICATIONS	
Types of Alliances	Type 1	Bilateral
	Type 2	Code share
	Type 3	Joint activities
	Type 4	Market alliances
	Type 5	Open skies
Year indices	1, ...,11	1989-99
Three phases	Phase 1	1989-92
	Phase 2	1992-95
	Phase 3	1995-97
Regional aviation markets	i, ...,g i≠g	NA, EU, AP

Normality of the variable is required in estimations done by methods of maximum likelihood and generalised least squares (Bacon, 1997). The criteria value for testing the normality is from a z-distribution, based on a significant level desired (Tabachnick & Litschert, 1994). The data normal distribution was examined by SPSS Data Exploration, through which skewness and kurtosis statistics were obtained, and then calculated. The z score obtained by skewness statistics was further divided by the standard error. The z score of kurtosis followed the calculation procedures of $z \text{ score} = \sqrt{\text{kurtosis statistic} / \text{std.error}}$. These z scores were then checked against the critical ratio desired ($z \text{ score} = \pm 3.5$). A value exceeding ± 2.6 is

used as a critical ratio for rejecting the assumption about normality of the distribution for this research. The results in Table 4 show that all the data were normal distribution, except open skies, which however, meet the critical ratio of skewness.

Table 4. Normality test results for the alliance data

	KOLMOGOROV- SMIRNOV		SKEWNESS	KURTOSIS
Variables	Statistic	Df	Statistic (Critical ratio)	Statistic (Critical ratio)
Bilateral	0.16	286	1.10	0.56
Code share	0.20	286	1.60	2.60
Joint activity	0.17	286	1.40	1.90
Marketing	0.24	286	1.09	1.90
Open skies	0.38	286	2.50	6.70*
Total alliance	0.14	286	1.30	1.60

*departs from normal distribution

Following the normality test, the analysis is conducted. The next section reports results of the descriptive studies and hypothesis test.

RESULTS

The following results are from the study of the first question concerning the number of strategic alliances formed by the airlines in general from 1989 to 1999, as outlined in the theoretical section of theoretical study (see Table 5).

Results in Table 5 show there were 1,211 alliances in the major air transport markets between 1989 and 1999. British Airways, American Airlines, and United Airlines had the largest numbers of alliances between 1989 and 1999, followed by Air Canada, Qantas, Scandinavian Airlines Air France, Lufthansa and Japan Airlines.

The development of the five types of airline alliance is examined. The following results are from the examination of how the five types of alliances have increased from 1989 to 1999. Figure 2 shows that bilateral services were the fastest developing route services. There were a total number of 171 new services launched by 1995. However, the growth rates went down while the international airlines increased agreements under the US open skies regime and other kinds of cooperation during 1996 and 1999. Code sharing alliances developed at the most rapid speed after 1992. In 1999 there were a total number of 363 agreements signed by the 27

Table 5. Summary of the alliance activities of the airlines, 1989-99

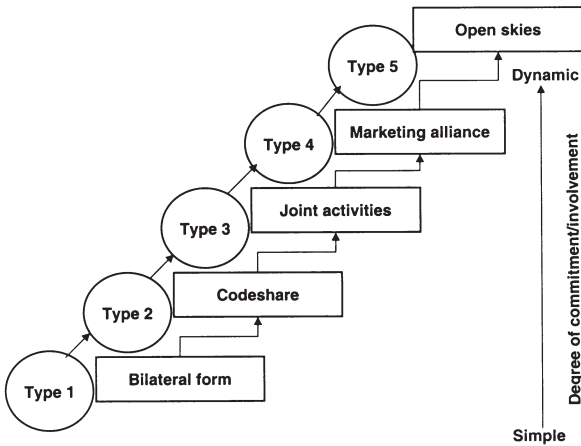
AIRLINE	RANK	TOTAL ALLIANCES	AIRLINE	RANK	TOTAL ALLIANCES
BA	1	89	NZ	15	45
AA	2	81	DL	16	41
UA	3	77	SQ	17	34
QF	5	77	TG	17	33
AC	4	76	MH	18	36
SK	6	69	AZ	19	33
AF	7	62	CA	20	22
LH	8	55	NH	21	25
JAL	9	51	KE	22	22
SR	10	49	AL	23	20
KL	11	46	CDN	24	17
CO	12	45	AI	25	14
CX	13	38	VIR	26	9
NW	14	45	Total		1211

Note: Airlines are ranked based on total number of alliances formed from 1989 to 1999.

major international airlines. It hence shows that code share was the most popular form of alliance between 1989 and 1999.

Joint activities (total number 302) and marketing alliances (total 269) had a parallel growth pattern since 1996. Marketing alliances became the third most common alliance among the five types of alliance activities, and

Figure 2. Scales of the five types of alliances



increased from 9 in 1992 to 269 by 1999. It was not until 1994 that the numbers of broader commercial alliances started to increase. However, the growth was very rapid increasing from 2 in 1992 to 57 in 1999.

Following the study of the development of the five types of airline alliance, the examination evaluated how each airline was involved in the different types of alliances.

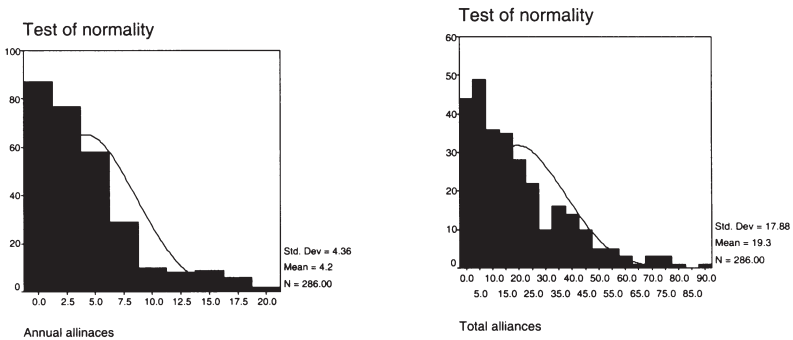
Table 6. Summary of the type of alliance involvement of the airlines, 1989-99

Rank	Airline	Airline Code	Bilateral	Code Share	Joint Activities	Marketing (Global)	Open Skies	Total
1	BA	8	8	22	29	28	2	89
2	AA	7	9	33	15	20	4	81
3	UA	25	21	20	10	20	6	77
4	QF	20	20	23	20	14	0	77
5	AC	1	18	13	19	24	2	76
6	SK	21	4	15	22	27	1	69
7	AF	2	4	27	11	17	3	62
8	LH	17	3	15	20	16	1	55
9	JAL	14	12	17	18	4	0	51
10	SR	23	2	26	7	11	3	49
11	KL	15	11	13	9	9	4	46
12	CO	11	8	12	8	12	5	45
13	NW	19	20	8	2	9	6	45
14	NZ	4	9	13	14	8	1	45
15	DL	12	6	19	7	6	3	41
16	CX	9	5	5	20	8	0	38
17	MH	18	3	16	13	2	2	36
18	AZ	5	6	13	2	6	6	33
19	SQ	22	8	3	15	4	3	33
20	TG	24	1	4	20	7	0	32
21	NH	6	13	7	4	1	0	25
22	CA	10	9	6	7	1	0	23
23	KE	16	3	16	2	1	0	22
24	AL	26	15	3	0	1	1	20
25	CDN	28	0	6	1	8	2	17
26	AI	3	2	3	7	2	0	14
27	VIR	13	0	5	0	3	1	9
Total			220	363	302	269	57	1211

Results in Table 6 show that during the 11 years, different international airlines had different concentrations in forming different types of strategic alliance at different periods of time. British Airways was found to have the largest number of marketing alliances and joint programs. American Airlines had the largest number of code share agreements. United, KLM, Northwest and Alitalia had the largest number of open skies agreements. USAir was first in the number of bilateral agreements.

The examination of the differences among the three regions focused on how each market has been involved in alliance activities. Results from the exploration of the bilateral alliances are shown in Figure 3. The airlines of the AP region developed the largest number of the bilateral services from 1990 to 1994. NA airlines, however, were faster with the development of bilateral services after 1993. They reached a total number of 97 alliances by 1999. EU airlines had the smallest number of the new bilateral services until 1998, when they increased by 76, and became the second largest market in terms of these activities. The airlines of the AP region increased the new bilateral services by a larger number between 1990 and 1991. They were then steady until 1999.

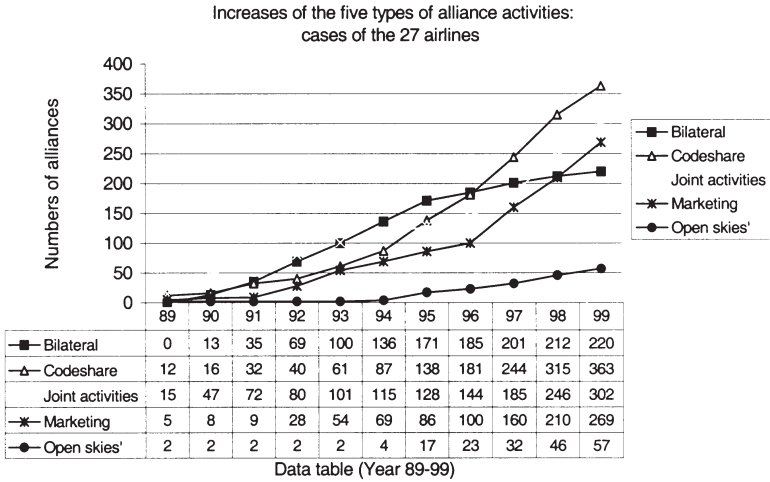
Figure 3. Normal plots-the alliance data



Results for code share activities are shown in Figure 4. The three markets increased code share activities modestly before 1994. EU airlines had rapid growth after 1994, with a total number of 85 code share agreements signed by 1997, followed by NA airlines with 74 agreements. By 1997, the airlines of the AP region had a smaller number of code share agreements.

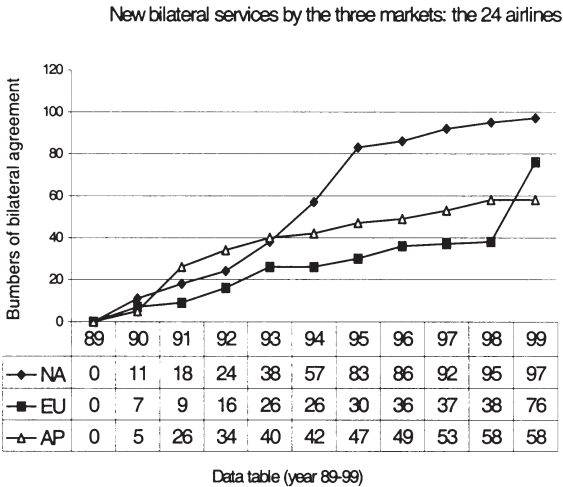
Results for joint activities are shown in Figure 5. The AP region airlines were leading in the number of the joint activities from 1989 to 1999, with a total of 109 agreements. This was followed by EU airlines. The number of

Figure 4. Summary of the increases of the five types of alliance activities of the 27 airlines 1989-1999



Note: a) This figure uses accumulated data of alliances of each year
 b) Assessment based on monthly issues and special issues of Airline Business 1989-1999

Figure 5. Summary of the new bilateral services by the three markets



Note: a) 0= data were not available for 1989
 b) This figure uses nested data of new bilateral services
 b) Assessment based on monthly issues and special issues of Airline Business 1989-1999

joint activities by EU airlines increased rapidly from 1996 to 1997, with 100 agreements signed in 1999. The airlines of NA, on the other hand, had fewer joint program agreements, with only 62 formed with other international airlines between 1989 and 1999.

Results from the investigation of the development of marketing alliances are shown in Figure 6. Before 1991, there were few marketing alliances, and the activities developed slowly in the markets. However, EU airlines had a leap in 1992, and increased the number of alliances from 2 to 12. NA airlines also had rapid progress during that time, and developed from 8 alliances in 1992 to 28 by 1996.

In fact, both NA and EU airlines had increases between 1996 and 1999, with the total numbers of marketing alliances increased from 59 to 117, when many airlines joined the Star Alliance and oneworld. On the other hand, AP region airlines had the smallest number of marketing alliances between 1989 and 1999, with a total of 32. However, in 1997 they increased the number of marketing alliances from 9 to 20, and by 1999 eight of the airlines became members of global alliances.

Results from the exploration of the open skies activities are shown in Figure 7. From 1994 to 1997, the US signed open skies agreements with 12 NA and EU countries. There were no AP region countries that had entered the US open skies at that stage. However, in 1994, Malaysia, Indonesia and Thailand entered a regional bloc, and signed a joint Memorandum of Understanding. By 1997, a few AP region countries were invited to enter the US open skies. The trends in Figure 7 show that the US open skies activities developed rapidly in NA and EU from 1994.

Figure 6. Summary of the code share

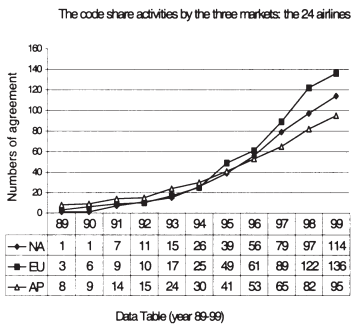
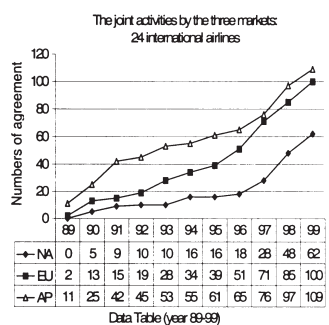


Figure 7. Summary of the joint activities



Note: a) These figures use accumulated data of the activities
 b) Assessment based on monthly issues and special issues of Airline Business 1989-1999

In addition to the US open skies and Asia regional blocs, there were also several bilateral open skies agreements signed by the airlines of South America. Prior to 1991, a bilateral open skies agreement was signed between Colombia and Venezuela. In mid-May 1991, all of a sudden, more skies over the Andes were open. The presidents of the five Andean countries, Bolivia, Colombia, Ecuador, Peru and Venezuela signed an agreement, to set up an open skies regime by 1993. The agreement was to create a single aviation market. They also launched deregulation within the region in December 1991. The Scandinavia region also opened up, which enabled Norway and Sweden greater competition between their carriers in the context of negotiations with the European Community on full participation in the single air transport market.

As the research presumes that there are differences between the number and types of alliances of the carriers, this presumption is expressed as:

$$\sum (al)_i \neq \sum (al)_k \dots\dots\dots (3.1) \quad i=1,2,3, i \neq k$$

$$\sum_{j=1}^5 (al)_{ij} \neq \sum_{j=1}^5 (al)_{kj}$$

where $\Sigma (al)$ stands for the sum total of alliances, subscript i and k is a market, respectively, subscript j is an alliance specific dummy variable, and $\sum_{j=1}^5$ is the sum total of one type for the five types of alliances.

The analysis is directed at testing the hypothesis which supposes there is a significant difference in the number and forms of strategic airline alliances between the three regional aviation markets. The results in Table 7 shows there was a significant difference in numbers of strategic airline alliances between the three aviation markets ($F = 5.05, df = 2, p < 0.007$). The means showed that NA airlines on average engaged in more alliances (mean = 5.2) than EU airlines (mean = 4.5), and AP region airlines (mean = 3.3). The results also show that there was a significant difference between the three markets in numbers of joint activities ($F = 6.2, df = 2, p < 0.002$), marketing alliances ($F = 17.4, df = 2, p < 0.000$), open skies agreements ($F = 28.5, df = 2, p < 0.000$) and route specific services ($F = 12.5, df = 2, p < 0.000$). However, there was no significant difference in the number of code sharing activities between the airlines of NA, the EU and the AP region. AP region airlines, in fact, forged more numbers of joint activities than the airlines of the other two markets, as the means shown. The test results corroborated the descriptive study to support the hypothesis.

Table 7. Difference in alliances between the three markets, 1989-1999

Variables	F	Df	Mean			Sig.
			NA	EU	AP region	
Annual new alliances	5.05	2	5.2	4.5	3.3	0.007
Route specific (bilateral)	12.5	2	7.8	3.4	5.4	0.000
Code share	2.5	2	5.5	6.1	4.2	0.086
Joint activities	6.2	2	3.5	4.8	6.1	0.002
Marketing	17.4	2	4.5	5.6	1.7	0.000
Open skies	28.5	2	1.1	0.8	0.06	0.000

CONCLUSIONS

The research commenced with an attempt to address the central research issues:

Research Issue 1: What are the features and patterns of the development of airline alliances in the air transport markets?

Research Issue 2: Is there a significant difference among airlines' formation of alliances in North American, the European Union and the Asia Pacific region?

Four questions were studied towards addressing the research issues. Findings show that after the economic recession worldwide, different features of alliance agreements were not just signed by NA and EU airlines but also took shape in the AP region. Route specific alliances were once a major form of alliance to enable airlines to access other countries. It was however regularly replaced by dynamic forms of strategic alliance. Airlines of the US and the EU increased strategic alliances following deregulation and liberalization. South American countries, Colombia and Venezuela, signed the first bilateral open skies agreement in the region. Five Andean countries set up an open skies regime in 1991, effected in 1993, to create a single aviation market in South America.

Airline alliances underwent a significant change in 1992, when the US started to pursue the potential of bilateral open skies agreements. The most significant progress in airline alliances was on January 11, 1993, when the US Department of Transportation approved the Northwest/KLM commercial cooperation and integration agreement under a grant of antitrust immunity. KLM and Northwest were then free to join together in creating a unified global airline system.

In 1993, some larger carriers initiated FFPs, and joined together to handle ground services through cooperation and marketing alliances, sharing capacity and joint operation of FFPs. In 1994, airline alliances moved towards a stage of multilateral air transport alliance, such as single-

skies agreements, air transport liberalization (open skies), multilateral aviation rights, and cooperative agreements. From 1995, airline alliances moved further towards the creation of regional aviation blocs, blocking space agreements, and open skies agreements. Critically, five major alliance sectors emerged in the airline industry in 1996, since the spate of alliance-building activities started from 1994. The Star Alliance was formally established in 1997, followed by oneworld in 1998, and more airlines entered these two global alliances or other global groupings.

This research also tested the hypothesis of whether there are any significant differences among the three regional aviation markets of NA, the EU and the AP region. Results show that there is a significant difference between them regarding the number of alliances entered and the features of alliances entered. The significant differences are shown in the numbers of joint activities, marketing alliances, open skies and route specific services. The results obtained through the multiple examinations agreed with each other to show that the research hypothesis is supported.

This research shows that the airline industry has developed different features of alliances in various areas of cooperation. The airline alliances are similar to, but also different from, the collaboration and consortia of other industries. The similarities are the nature of collaboration involving horizontal bi-national groups and consortia engaged by multiple partners of different countries, such as the Star Alliance and oneworld. The differences are the complex features, as well as, areas of cooperation. These areas of cooperation are linked to the characteristics of the airline industry and hence the motivations of the industry. Findings of this research provide information for studying the formation of strategic airline alliances.

Findings of this research have implications for the development of concepts and features of airline alliances, and, hence, contribute to the strategic airline alliance literature. The strategic classification system contributes to studying the typology of strategic airline alliance, as little research has been done to specifically identify or classify current airline alliances according to their overall nature and features. The five types of airline alliances range from simple alignments to integrative forms and these concepts are important for measuring the nature and features of airline alliances and for examining the development of airline alliances.

The Airline Alliance Survey (1999) has listed the current registered airlines' alliances as a total of 856 between 1987 to 2000. This research recognizes a total of 1,211 alliances by accumulating each year's new alliances of the 27 international airlines from 1989 to 1999. This data is accessed through the researchers' examination of 5,518 issues of *Airline Business*. It needs to be reindicated that this number of alliances includes bilateral route specific services. It has been acknowledge that more than

one third of international airline alliances were terminated between 1995 and 1998 (Li, 1999; Oum, 2000). This may further explain the difference with the numbers obtained by this research and the Airline Alliance Survey (1999). The data information provided by this research is important for examining how the numbers and features of strategic airline alliances are increasing with the liberalization process, regulatory policy, and economic factors.

Previous studies argued AP region airlines have been seen as generally entering into few alliances with each other or with other airlines (Eleck et. al., 1999; Graham, 1997, Hooper, 1997; Li, 1998; PC, 1998; Oum, 1998). These arguments generally show a concern of the aviation sector in the AP region in forming strategic alliances. This leads to a question of the impact of market liberalization on formation of strategic airline alliances. As this research has identified types and numbers of strategic airline alliances, it enables further analysis of the impact of the liberalization on formation of airline alliances, to contribute to air transport market liberalization debates. The future prospect of airline strategic alliances is seen as increasing and stable and the survival rates of airline alliances have been improving very rapidly during the last decade, and this trend is likely to continue in the future (Oum, Park & Zhang, 2000). This study further contributes to analysis of the effects of strategic airline alliances in the future.

ENDNOTE

1. The Fifth Freedom Right of Air is the right of an airline from country A to carry revenue between country B and other countries, C., D., etc. The Seventh Freedom Right of Air is the right of an airline formed in one country to carry revenue traffic between two points within another country.

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APPENDIX A
US OPEN SKIES POLICY

1. Open entry on all routes between the bilateral partners;
2. Unrestricted rights for partner airlines to operate between any international gateways in the United States and participating countries, including to intermediate and beyond points;
3. Unrestricted capacity, frequency and aircraft on all routes;
4. Flexibility for airlines in setting fares within certain guidelines;
5. Liberal charter and cargo arrangements;
6. The ability of carriers to convert earnings into hard currency and return those earnings to their homelands without restriction;
7. Open code-sharing opportunities;
8. Rights for carriers to perform their own ground handling in the partner country;
9. The ability of carriers to enter freely into commercial transactions related to their flight operations; and
10. A commitment for non-discriminatory operation of, and access to, computer reservation systems

Source: Airline Business, 1992; Subcommittee on Aviation 1997.

APPENDIX B
FRAMEWORKS FOR THE STRATEGIC CLASSIFICATION OF
THE AIRLINE ALLIANCES

TYPES	DEFINITIONS
TYPE 1 (Route Specific Services)	Route specific alliance refers to the prime Bilateral Air Service Agreement signed between two countries, to enable flights between cities of the two countries, or boost capacity or frequencies of flight service between cities of the two countries (or may grant beyond rights, to use intermediate stops or beyond services). The bilateral agreement of six weekly Singapore-New York services signed between Singapore and USA enables three flights agreement operated via Brussels and three via Frankfurt is an example. A trading-beyond-right between Korea and India enables Korean Airlines to fly from India to Europe and Egypt, in return for the right to Air India to fly from Seoul to the United States is another example.
TYPE 2 (Code Share)	Code share refers to block space agreements, or code share on a number of city-pair markets. These agreements often involve one airline buying blocks of seats on the other's flights and reselling them: Qantas and Air Nuigini operate a route-specific alliance, which involves code sharing on flights between Cairns and Port Moresby and Mount Hagen. An agreement between United Airlines and Ansett enables passengers to travel to Sydney on a United Airlines flight and connect with Ansett flights to eight Australian cities. Code share also involves one airline's designator code shown on flights operated by its partner airline. Code sharing agreements allow each airline involved to provide services with its partner's flights even though it does not operate the aircraft itself. For example, Canadian Airlines and Qantas had a code-sharing agreement on the Vancouver- Honolulu- Sydney route where Canadian served the Vancouver-Honolulu section and Qantas served the Honolulu-Sydney section of the route.

Type 3 (Joint Activities)	Joint activities generally refer to joint venture, collaboration or cooperation including joint purchasing of aircraft and fuel. The joint operation is within the areas of cooperation in joint use of ground facilities, coordination in ground handling, coordination of flight schedules.
Type 4 (Marketing Alliances)	A marketing alliance involves cooperative agreements on ticketing service, share of CRS, FFPs and joint advertising, including milestones such as Star Alliance. To this extent, a marketing alliance may cover some of the joint activities, as the marketing alliance can also involve joint use of ground facilities, coordination in ground handling, coordination of flight schedules and on-line and interline co-operations under the agreement of global alliances. Marketing alliances include oneworld, Star, Qualifier, Air France/Delta Global Wings (Northwest/KLM), and other similar regional based alliances.
TYPE 5 (Open Skies)	Open skies refers to the alliances initiated by the US between some American, European Union and a few Asian Pacific countries. The alliances, formed under the US bilateral open skies policy, are basically commercial alliances in nature, being more integrative in levels and areas of cooperation, compared with the other types of alliances. The memorandum of understanding normally covers code share agreements on international and domestic flights, reciprocal FFPs, lounge access, though check-in, integration of boarding procedures, computer reservation system linkage, joint marketing and sales programs. Open skies may involve a single aviation market, free access to the markets, full traffic rights, and may also grant anti-trust immunity. However, few countries so far have been granted these rights (Also see the open skies policy in Appendix A).

Sources: Airline Business, 1989-1999; General Accounting Office, 1995; IC, 1997, 1998; ICAO, 1997; Park, 1997; Oum, Park, & Zhang, 2000

BOOK REVIEW

BUTTON, K. & STOUGH, R. (2000). *Air Transport Networks—Theory and Policy Implications*. Northampton, MA: Edward Elgar. Pp. 377. ISBN 1-84064-429-X. \$95US, hardcover.

REVIEWED BY CHIEN-TSUNG LU, Omaha, Nebraska

Air transportation is one of the important transportation models expanding its influence to the dynamics of global economy (Wells, 1999). After the US airline deregulation in 1978, the dramatic increase of domestic as well as international aviation services (e.g., passengers and cargos), have shifted the complexity of the aviation system to a higher level (Clougherty, 2000). To date, airlines are encountering more fiercely competitive markets; and inevitably have to maintain a higher intra-dependent network or alliance for lower operational cost (Brueckner & Whalen, 2000) and seamless services (Staniland, 1996), which helps them to better compete with business rivals and survive.

The major tasks of Button and Stough's book *Air Transport Networks—Theory and Policy Implications* are twofold: to interpret air transportation related theories and to examine practical views. The authors, Kenneth Button and Roger Stough, did not aim to examine the merits of engineering development. In fact, they focused on the development of air transportation service, airport infrastructure, network, air freight, and safety issues in relation to policy development and mandates. Because air transportation has contributed an essential section to global economy, this book began with the analysis of airline economics and provided the enthusiastic readers a general idea about the economic importance of air industry.

Chapter two further outlined in detail the contribution of air transportation to the traditional economy such as the interpretation of demand and cost, the logic of pricing, and yield management. Yield management, in particular yield revenue, was regarded as a critical

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dependent variable resulting from the combined calculation of several independent variables such as determined fare, overbooking rate, flight arrangement and fleet optimization. As the authors illustrated, airlines are profit-seeking business. Therefore, yield management played a crucial role in airline operation. Most importantly, because the perspective of airline deregulation was that it could generate profits aplenty, new business rivals wanted to entry. The increased amount of airlines had triggered business competitions—price wars and route adjustment. Thus, in order to attract more passengers, providing lower airfares was the prior tactic after deregulation. In addition, cutting low-profit or no-profit routes was a strategy to reduce operational cost. Although, from the investors' standpoint, implementing price wars and reducing costs were rational, the competing scenario inevitably initiated new policies from the government in order to protect the air service for the public. In particular, those living in remote communities should also share the advantage of air transportation. In fact, two decades following the deregulation in 1978, the net profits of airlines remained extremely low even though there was a dramatic expansion of airline operation. From the perspective of airline operators, strategic alliance has been a major feature to expand service, share facilities and manpower, inter-exchange promotion, stimulate potential demands, reduce operational cost, and ultimately increase net profits.

Air service is a type of network service now. Chapter three outlined the importance of network as well as the introduction of various network models. Via the economic analysis, the authors gave the audiences a big picture regarding the relationship between the airline network and operational cost. The domestic airline network of a specific country was relatively small in relation to the global one. Thus, to mandate a domestic regulation would involve a global correspondence. In the same vein, changes in the format of airline networks cannot avoid the update of related regulations such as the bilateral agreement of the Chicago Convention and the pricing policy of International Air Transport Association (IATA). Moreover, the policy change would not be limited to a singular operational item, but would also contain the other essential factors such as taxation, ownership, competition, licensing, product purchase, and research.

Chapter four demonstrated the concepts of quantitative data usage because quantified information was an important resource for decision making. As stated by the authors, quantitative analysis helped to locate the operational gaps and weakness for government and the industry in order to fix the deficits, to forecast future trends accurately, and to generate better public goods. In other words, data collection should be reliable and trustworthy in order to provide useful results and contribute appropriate ex ante policy decisions and more efficient ex post policy executions.

Chapter five demonstrated three case studies regarding the policy change before and after airline deregulation in the U.S., Canada, and European Union (EU). In the case of the U.S., the author began with addressing aviation reform in the U.S. aviation history prior to 1978. These historical narratives built a solid foundation for airline deregulation. The Airline Deregulation Act of 1978 focused on several major operational areas such as the government's release of regulated pricing, business entry and exit, routes, and the air transportation service to remote community. The short-term impact after deregulation showed a different outcome instead of the predicted situations by policy makers. Instead of a predicted expansion of air service in the late 1970s, the domestic market immediately showed negative effects as illustrated by a shrunken domestic economy, the development of ground transportation, low-fare airlines, and price increases of fuels and wide-body aircraft. In the early 1980s, most airlines still retained their belief as indicated by the dramatic increase of non-stop flights. Therefore, additional capitals were invested to establish more new entrants and consequently created intensive competitions among counterparts. The airports were equally expanded due to the increase of airlines. Yet by mid-1981, because of the increase of fuel price, the expansion of large airlines, and hub airports, the industry saw only a short-term effect and the substantial reduction of air service occurred later on. Pricing strategy wars were another significant factor during the first few years after deregulation; because discount fares were issued and resulted in a dramatic profit reduction. Fortunately, the air transportation safety was improved stemmed from the technology development.

The long term effect has resulted in the increase of commercial operations due to the reduction of airfare and implementation of hub-and-spoke logic. Specially stated by the authors, "fare remained lower in real terms than under regulation" (p.100), but lower-fare strategy had also moved the profit down to the marginal level regardless of passenger expansion. The fierce competition created a playground for price wars but also encouraged business mergers. In addition to the costs of fuels, parts, and labors, the operational expenditures of an air carrier involved other items. Yet they were traditionally ignored such as facility rents, noise abatement costs, safety and risk management, and insurance fees. From the standpoint of policy making, the need for a new policy or policy mandate was mainly determined by the fact of whether "the burden of costs outweighs the benefits generated" (p.109). Unfortunately, "airlines had been overoptimistic in their claims about the service they could offer" (p.109); and the cases of flight cancellations, delays, and customer complaints were increased after deregulation.

Under the bilateral agreement, airlines could expand and connect their domestic flights to international routes based on hub-and-spoke system. However, foreign carriers could not implement the same strategy because this agreement was limited by the U.S. government. In Canada, aviation liberalization was launched a decade after the deregulation in the U.S. Based on the “Canadian gradualism” (p.129), which learned lessons from the deregulation experiences in the US., the Canadian government gradually phased their aviation reforms that augmented to allow more room for the government and more time for the industry to react. Not until the 1980s did the deregulation in Canada occur. The Canadian airlines provided more services in lieu of launching price wars under the fare control from the government. The embracement of *de facto* flexibility in the policy played a guiding role during this period. This *de facto* flexibility, from time to time, loosened the barriers of pricing, competition, slot acquisitions for incumbents. The Canadian airline mergers were inevitable in the late 1980s for cost reduction, powerful market position, and higher traffic density. Then hub-and-spoke system was adopted and combined with the acquisitions of regional airlines by major Canadian carriers for a better feeder service.

In EU, most flights are international within European continent. Countries individually regulated their own aviation in order to protect public interests. The separated airline regulations of individual countries helped to protect the domestic benefit but simultaneously impeded airline alliances. Yet, the barriers were partially removed by a series of legislative activities—domestic reform, bilateral agreements, and Open Skies agreement. Three legislative packages contributed policy mandates in reducing airfare, expanding routes and flights, and ultimately enhancing airline networking across European nations.

Chapter six further expanded these points and focused on the gap of the aviation network. The authors also outlined the gradual development of expanded airline liberalization and the trend of global multi-agreement among airlines. In addition, the impact to environment, safety, and society from multi-agreement was also discussed in terms of required policy negotiation.

The next three chapters have an economic perspective. The authors addressed the impact of the global transport network on airport infrastructures and capacity, market stability, monopoly, and ownership. This discussion helped the aviation audience, in particular, the business investors, to thoroughly understand the economic impact related to market liberalization. Market stability was a critical issue discussed and empirically analyzed by the authors. As argued by Button and Stough, “market liberalization has in general enhanced both the technical and

dynamic efficiency of network industries” (p. 189). Yet, the logic of the multi-agreement in association with liberalization complicated the policy decision in relation to the global network implementation. Airport pricing and infrastructure was no exception. Particularly in Europe, low-cost entrants were an important stimulus in facility usage changing airport policy.

Chapter ten specifically discussed the local economic issues surrounding a hub city. This included the remodeling of a facility, infrastructure expansion, manpower recruitment, navigation system maintenance, taxation collection, and the nearby area’s economic development. An accurate business forecasting could effectively predict a guaranteed benefit and attract investors. A time series trend and multivariate analysis were typically used to demonstrate the economic scenarios centered at a hub city.

Chapter eleven and twelve dictated another important feature of the air transportation—the relationship between airfreight and aviation network. Air cargo increasingly relied on the aviation network due to the success of liberalization, technological developments, and policy reforms. Air freight offered a dynamic interaction, or a de facto dynamics, between shippers and policy makers, between policy makers and liberalization, between liberalization and airport infrastructure, and between airport infrastructure and freight carriers. All of the aforementioned aviation actors, as stated by the authors, “can combine to provide an integrated service to users, or they can act as substitutes and compete for customer’s demands” (Button & Stough, 2000, p. 309).

Chapter thirteen discussed safety and environmental issues under the global alliance. Globalization has made policy making more difficult and complex. To insure the commitment of safety enhancement and environmental protection associated with liberalization and the global alliance, policymaking was regarded critical upholding the proposed safety equation advocated by Button and Stough. Safety related policies among alliance airlines, such as security, passenger service, information availability, management incentive, and lobby power, were primarily discussed. The environmental impacts were also prescribed. Benefits gained from aviation liberation and airline alliance should not outweigh the other issues of air and noise pollution. Unfortunately, although policy makers had a variety of policy instruments dealing with environmental problems, the pursuit of a clean air transportation network were only partially accomplished. Many environmental challenges are still facing policy makers today.

Button and Stough offered a useful interpretation in light of the relationship between airline activities and policy changes. In particular, the

aforementioned three cases proposed by the authors pointed out some important issues. This includes the following areas. The agreement of airline networking should be a slow process. How to make the best usage of airports, fleets, and infrastructure and simultaneously reduce price was and should be always the core question associated with each negotiation across time and location. The regulatory reform from the bilateral agreement regarding the three cases possesses an important challenge to the aviation industry as a global network. From the historical perspective, the authors provided valuable summaries for the readers as they explore and learn about aviation policy reforms. The authors gave a detailed explanation and offered insights regarding the theoretical development of the aviation network and associated policy reforms across time and countries. Technical and economic analyses were especially well explained, which helped readers to adopt genuine concepts affecting aviation liberalization, alliances, and the network. Accordingly, the authors expressed their expertise in a compelling fashion throughout the entire book.

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