U
A
A

1983 Proceedings

University Aviation Association
Fall Educational Conference

October 1983
Edited by
James M. Daley

Sponsored by
University Aviation Association and the
College of Business Administration, Wichita State University

ACKNOWLEDGMENTS

The publication of the University Aviation Association 1983 Proceedings represents a landmark in the maturation of the Association. The papers presented in this volume demonstrate that the members of the Association continue to grow in terms of their knowledge and their research. This reflects well, not only on the members of the University Aviation Association, but serves as a bench mark for future members and old members to surpass; it seems true that, academically, we either grow or we die.

Without the assistance and cooperation of the officers and members of the University Aviation Association, as well as several members of the Wichita State University community, this volume could not have been prepared. Although many individuals contributed, there are a few whom the editor would like to specifically address thanks. From the University Aviation Association, in addition to the members who contributed their quality papers which make up this volume, Bill Beckwith and Bill Geibel provided invaluable coordination and guidance. From the Wichita State University community, Dr. Fred Kraft, Chairman of the Department of Marketing and Small Business, and Mr. Bryan Clark, Graduate Research Associate, offered invaluable financial or technical assistance to the completion of this project. To all who assisted, thank-you.

September 1983 James M. Daley
Wichita, Kansas

UNIVERSITY AVIATION ASSOCIATION

1983 OFFICERS

BOARD OF TRUSTEES

STRATEGIC IDENTIFICATION OF DOMESTIC
AIR EXPRESS MARKETS:
ASSESSING ALABAMA'S MARKET POTENTIAL

Henry B. Burdg
Management Specialist
Auburn Technical Assistance Center
and
Assistant Professor of Aviation Management
Auburn University

August 1, 1983

Auburn Technical Assistance Center
202 Langdon Annex
Auburn University, Alabama 36849
(205 826-4684)

Running Head: Air Express

Submitted to: University Aviation Association
Aviation Management Track
August 5, 1983

Strategic Identification of Domestic Air Express Markets:
Assessing Alabama's Market Potential

Abstract

The air express submarket of the air cargo industry plays a vital role in the movement of "time sensitive," high value, small-sized parcels. Air express is growing at a fast pace as shippers become more aware of the value of time utility. To meet the ever increasing demand for air express services many companies are being formed and the critical examination of markets is essential in planning for business growth.

This paper describes a methodology by which the demand for air express services can be estimated. The air express demand model uses published secondary data which allows simple applications to estimate order of magnitude market potentials on a city, county, or state basis. The model is used to evaluate the air express market potential for the state of Alabama, segmented on a 2-digit SIC code market basis.

Strategic Identification of Domestic Air Express Markets: Assessing Alabama's Market Potential

Introduction

The air cargo industry is segregated into three major product/service submarkets, freight, mail, and express or priority traffic. Although air cargo historically has played a minor role (significantly less than 1.0% by tonnage and ton-miles) in the movement of our nation's domestic intercity freight, the air mode plays a vital role in the movement of "time sensitive" high value to weight commodities where another transportation mode will just not suffice. Cummings (1978) highlighted a recent Air Transport Association study which projected total domestic air cargo to grow over three-fold from 1975 to approximately 10.2 million enplaned tons by the year 2000. Manufacturers, distributors, service firms, agricultural concerns, and even the individual nonbusiness shipper are consciously becoming aware of the value of time associated with their shipments and the tradeoffs offered by the air transport mode versus a competitive surface mode. Shippers are now more than ever evaluating freight decisions based on the total cost approach as described by Davis (1982). Thomas R. Oliver, Senior Vice President - Marketing and Customer Service, for the Federal Express Corporation labels the movement of air cargo as "high priority logistics." The anticipated growth in air cargo reflects the latent value now being recognized by shippers.

In recent years there has been a great deal of activity in the air express submarket. Although the express concept began in 1927, the industry has now experienced a rebirth. Feldman (1983) concludes that the poor and declining reputation of the U.S. Postal Service was one of the reasons for the increased activity. Cummings (1979) sees the increased activity as a result of the collapse of REA Express in the early 1970s breaking a forty-year monopoly on the movement of express freight. Following REA's demise the CAB ordered the airlines to establish priority freight service; quickly following was the formation of all freight airlines, such as the Federal Express Corporation. Since the mid to late 1970s, the domestic air express submarket has again exploded with activity in the wake of airline and air cargo deregulation.

The average weight of a typical air express package is approximately 12 pounds (50–70 pounds is usual industry maximum limit) with an average replacement value of approximately $22.00 as reported by J. Golden (personal communication, April 20, 1979). Donoghue (1983) finds that on average, general air freight generates revenues at about $0.50 per pound while express contributes about $3.50 per pound. Lyon (1983) found express revenues at about $4.00 per pound. Express traffic therefore tends to be small package, high value to weight air freight. Express freight can be found moving in all levels of air service between all service points, from major hubs to the typical county airport. Express traffic, although still in the process of establishing itself in a growth phase of its lifecycle, is expected to keep pace with the overall growth of domestic air freight. Cummings (1978) reports a four-fold increase since 1975, projecting nearly 121.6 million route ton-miles (102,000 tons) by the year 2000, an average annual growth rate of 5.9% (enplaned express tonnage growing at a 5.6% annual rate). However, a more recent industry survey conducted by Henderson (1983) reports a large 20%-30% increase in small package air freight from 1982 to 1983. The total domestic market is estimated at $2 billion, Feldman (1983).

The vast majority of the major target markets for air express (major metropolitan areas) are presently being serviced by one or more of the priority freight air carriers: courier service, air forwarders, scheduled airlines, belly freight, or all cargo airlines. The market potential in these major hub areas is high and will sustain the operation of several competing express carriers.

There is a point at which markets become marginal in generating enough demand for air express services that a critical market potential analysis becomes necessary to justify the initiation, continuation or removal of service to a particular market. In addition, in following the concept of the hub-spoke market configuration as described by Hagedoorn and Crittenden (1979), Kjelgaard (1982), and Speas (1979). certain pockets of demand can be identified and evaluated in and around a major hub. If the potential is large enough an air express feeder network could be profitably established via commuter airline service agreements to feed the central hub, such as described by Cummings (1979).

The purpose of this paper is to describe a rudimentary methodology for evaluating the domestic air express market potential for specific target markets. The methodology is then used to evaluate the potential for the state of Alabama and its smaller submarkets. Specific attention was given to segmenting the demand for air express services into distinct target markets by industrial classifications. The results of the analysis are presented in terms of an expected number of express parcels per day. A post-analysis survey was initiated to verify and substantiate the research.

Methodology

The primary demand for air express can be estimated from a simple functional relationship between number of employees in a given industry classification and a usage rate per employee. The generic demand model that has been used is:

$$AE_t = \sum_{k=1}^{n} N_{kt} R_{kt}$$

AE = Demand for air express　　k = number of market segments

N = Number of Employees　　t = time period

R = Usage rate per employee

The demand analysis is refined through the process of market segmentation that identifies target industries and their different usage factors for air express services. Over 99% of the existing air express volume is generated from the business sector. It will be upon this general sector and especially the specific industry classifications identified as leading air express users, that the demand analysis for air express was focused.

The physical boundaries defining the market area proposed for analysis are then specified. Using data from such publications as the Bureau of the Census' County Business Patterns businesses can be identified by industry classification along with employment levels. These data are then used to drive the generic demand model, summing the demand for air express on an industry by industry basis.

Profile of Air Express Commodities

Commodities that are shipped by air generally have common characteristics which can be segregated and arranged to form a typical air cargo profile. Using a rudimentary form of market segmentation with attributes as the discriminator products with the greatest potential for small parcel air express shipment are identified by use of the Standard Industrial Classification, SIC Codes. Certain products are more adaptive to distribution by air than are others and historically, certain types of products are more often shipped via the air cargo mode than are others. Products have to be analyzed in relation to the systems concept of marketing and production. Therefore, this analysis encompasses not only the characteristics of the physical product, but also relationships to the producer's environment and the consumption market environment.

Jackson and Brackenridge (1971) conclude that companies with typically wider product ranges and greater proportions of slower moving inventories are potentially good candidates for air shipment. Inventory levels of slow moving product items which require a high overhead safety stock can be reduced by using distribution. However, in general the use of air distribution can reduce levels of transit stock as well as levels of static stock while manintaining or improving the same degree of customer service.

The level of customer service that an individual company provides is a key management decision. The use of air distribution and/or specifically, air express, can greatly improve the speed of product delivery, however, the increased customer service level must be balanced against the increased transportation costs.

As a rule, products with a higher value per unit weight have a greater economic potential for air shipment. Transportation charges are typically based upon weight and not the value of the shipment. Therefore, as value per unit weight increases the proportion of associated transportation costs to total costs (value of item plus shipping charges) become less significant.

The evaluation of a product strictly on the basis of replacement value and weight, however, will produce misleading results. The best perspective is gained by viewing the total products' value in relation to its replacement cost in dollars and the utility gained by having the parcel at its intended destination. The utility concept is the underlying principle which makes air express desirable. To illustrate this point, suppose that a major assembly line in an Atlanta manufacturing plant was idle due to a broken part valued at $13.47. The down-time was costing the plant $500.00 an hour in lost revenue and idle manpower. It is easy to see that if by shipping a replacement part by air express saves even a days time that the added expense for air shipment is totally justified with an approximate savings in excess of $12,000.00 using the average 12 pounds per parcel, (Value per unit weight goes from $1.12/pound to $1000.00/pound).

The utility concept brings forth the second common characteristic and that is a degree of urgency. Most descriptions about air shipments have coined this characteristic as emergency or nature of cargo, however, emergency describes only one class of cargo. Most air shipments have a relatively high degree of urgency associated with the product movement.

Urgency could be measured in dollars lost or opportunity loss in relation to the cost and time differential of using the next fastest mode of transportation.

Perishability, economic deterioration, or obsolescense are common characteristics of most air cargo shipments. The key is to have products reach the markets when they have maximum potential commercial value. This encompasses not only food items but also fad items, dated materials, printed matter, and so on.

The nature of the cargo has an important bearing on the decision to ship by air. Cargo of a high technological basis and a high value added component are good candidates for air cargo. Products of a delicate nature are common to air transportation.

Market characteristics of air cargo shipments include areas of high demand, high number and varied location of sales outlets, and an urgency of demand. Air shipment is also used to penetrate new markets and where a high level of customer service is required.

From the generalized characteristics of air cargo select attributes evolve which describe products which have a high probability of being shipped via air express. The air express attributes described by Jackson and Brackenridge and others are listed in Table 1.

A survey was initiated to question the major United States air express companies on the types of cargo carried and their marketing techniques. From the responses it was determined that the largest single user of air express services was the classification of business services. This accounted for approximately 13% of the package movements by volume. The business

Table 1

Air Express Product/Market Attributes

High value to weight ratio
High mark-up
High overheads
Unpredictably fluctuating demand/emergency needs
High degree of obsolescence/perishable
Light weight - low bulk
Require air transportation environment
New product
New market
High substitutability
Requirement of good customers service
Time - limited market
Many sales outlets
Slow moving stock
Poor-quality alternate transportation choice

services group includes such items as, advertising services; credit reporting and collection services; mailing reproduction, and stenographic services; personnel services; computer and data processing services; research and laboratory testing; etc. The other leading air express commodity groups and approximate volume breakout are shown in Table 2. The leading air express

user classifications that were developed from the survey were used in the determination of air express Standard Industrial Classification (SIC) Codes. For this study the two digit SIC Code provided a broad identification of high usage industries.

Industry Usage Rates

The demand for air express is analyzed on a market by market basis and segregated by user classification. The results will lend themselves to the specific identification and location of businesses that are the most probable potential users of air express services. The air express usage rates were calculated from survey data obtained from air express carriers. The usage rates for the different industry classifications are also shown in Table 2. These rates correspond to the potential one-way movement of air express packages developed from national averages. The results indicate the largest consumption rate of air express services per employee is the Instruments and Related Products classification averaging one daily parcel per every 16 employees in that industry.

A detailed study was undertaken by Sletmo (1972) which analyzed the demand for air cargo. The air express segment was studied in relation to a static demand model using Civil Aeronautics Board data from 1947 through 1968. Some important results were presented that have implications on this study. Air

Table 2

Air Express Industry Usage Rates[1]

SIC Code	Market Share (%)	Classification	Estimated Daily Usage Rate Parcel: #Employees	Parcels/Employee
38	6	Instruments & Related Products	1:16	.0636
36	12	Electric & Electronic Equipment	1:35	.0283
35	10	Machinery, Except Equipment	1:38	.0266
27	7	Printing and Publishing	1:43	.0232
89	5	Miscellaneous Services	1:58	.0172
73	13	Business Services	1:62	.0160
28	5	Chemicals and Allied Products	1:63	.0160
37	4	Transportation Equipment	1:149	.0067
50	8	Wholesale Trade-Durable Goods	1:170	.0059
34	3	Fabricated Metal Products	1:263	.0038
--	27	Miscellaneous Users[2]	1:907	.0011
	100%			

[1]Usage rates represent average daily one-way package movements our of state.

[2]No one user having greater than 2% of remaining volume; with non-business volume less than 1%.

express and air freight, although having similar commodity characteristics, have vastly different economic characteristics. Air express was determined to have a price elasticity which is not significantly different than zero.

The conclusions indicate that the demand for air express is highly inelastic in relation to price. This conclusion is supported by the air express urgency characteristic which was described previously, where the price of the service loses its significance in relation to the concept of place utility.

Sletmo's study also estimated the income elasticity for air express to be positive and highly significant. Therefore as the general level of production increases so also does the quantity demanded of air express services.

Cross-price elasticities for air express were calculated using both truck and air freight as competing modes of transportation. Sletmo states, "the signs suggest that air express may be complementary to truck and air freight services", rather than competitive over the same short-haul routes.

Alabama's Air Express Market Potential

The generic demand model described earlier was applied using industry data from the state of Alabama. It was determined that there was a potential for approximately 3,680 one-way daily small package parcel movements from the state. The results are shown in a summary form in Table 3. This type of information

enables the strategic identification of target markets to focus company resources in a more efficient manner.

It should be noted that although the other industries category generates the most parcels per day (990) there are some 58,000 firms generating demand. Based

Table 3

Alabama

Employment and Consumption, Air Express Services for Selected Industries

SIC Code Number	SIC Code Name	[1] Number of Production Employees	Number of Firms	Average Number of Daily Parcels Per Employee	Industry Total Parcels Per Day	Parcels Per Firm Per Day
73	Business Services	26,181	1,572	.0160	419	0.3
36	Electric and Electronic Equipment	18,798	110	.0283	532	4.8
35	Machinery, Except Electric	16,732	442	.0266	445	1.0
50	Wholesale Trade-Durable Goods	44,164	3,608	.0059	261	0.1
27	Printing and Publishing	9,492	438	.0232	220	0.5
38	Instruments and Related Projects	3,386	47	.0636	215	4.6
28	Chemicals and Allied Products	13,262	137	.0160	212	1.5
89	Miscellaneous Services	8,760	1,116	.0172	151	0.1
37	Transportation Equipment	19,606	146	.0067	131	0.9
34	Fabricated Metal Products	27,461	402	.0038	104	0.3
--	Other Industries	900,370	58,319	.0011	990	0.0
	Totals	1,088,212	66,337	---	3,680	0.1

[1] In those cases where specific employment size was not provided, the mid-point of the employment range was used. Production employees were estimated using either the Alabama or national ratio of total employees to production employees, for that industry.

[2] NA - Consumption data not available.

Source: United States Department of Commerce, Bureau of the Census. Alabama County Business Patterns 1979. CBP-79-2. Washington, D.C.: Government Printing Office, 1981.

upon an average number of parcels per firm per day, the other industries classification is the worst prospect giving way to the electric and electronic equipment (4.8 parcels/firm/day) and instruments and related projects (4.6 parcels/firm/day) classifications.

County Business Pattern data and state manufacturing directories provide more detailed data on a county and city basis. For example, from further analysis it was determined that approximately 50% state's potential electric and electronic equipment air express shipments are generated from the Huntsville area alone, while only 6% from the Birmingham area.

Conclusion

Many of the decisions to be made when developing a market strategy are based upon an understanding of the characteristics of the market, such as generic demand. This paper has outlined a simple methodology by which air express firms can evaluate markets. Critical decisions regarding the initiation, sustenation, or eradication of service can be aided when following the proposed methodology. A true marketing approach to business is a prerequisite to long-run profitability; the air cargo industry is no exception.

References

Air Transport Association of America. (1978), Domestic and international United States connected cargo forecast 1975-2000. Washington D.C.: The Macro Forecast Task Force of the Economic Analysis and Forecasting Committee.

Breakthrough in express delivery of small parcels. (1979, November-December). Zip, pp. 20-24.

Commuter cargo: a hop, skip and another big jump. (1978, September). Aircargo Magazine, p.8.

Cummings, S. (1978, October). The long look ahead - air cargo through 2000. Aircargo Magazine, pp. 4-8.

Cummings, S. (1978, December). Expansion the watchword of commuters cargo operations. Aircargo Magazine, pp. 15-19+.

Cummings, S. (1979, January). Small is big in the air package business. Aircargo Magazine, pp. 7+.

Cummings, S. (1982, September). Chase banks on traffic unit to cut air tab. Aircargo Magazine, pp. 27-28.

Davis, H. (1982, June). Recomputing the air freight equation. Aircargo Magazine, pp. 26-28.

Donoghue, J. (1983, February). Convertibles, conversions, castoffs & combis, aircraft that move the freight. Air Transport World, pp. 28-31.

Ekedahl, D. (1978, December). Widening horizons beckon commuter cargo. Aircargo Magazine, pp. 21-24.

Enstad, R. (1982, June). Small packages give big lift to air cargo. Commerce. pp. 19-22+.

Feldman, J. (1983, February). The wonderful world of air express. Air Transport World, pp. 20-27.

Hagedoorn, A.H., & Crittenden, J.B. (1979). Shipping by air - is the value of your time worth it? Proceedings of the 10th Annual Pittsburgh Conference: Modeling and Simulation, 10, Part II. 391-396.

Henderson, D. (1983, February). Air freight industry sees traffic decline in 1983. Air Transport World, pp. 16-18.

Howe, R. (1978, December). Air Wisconsin enters a new era. Aircargo Magazine, pp. 22-23+.

Howe, R. (1979, January). Overhaul recommended for priority freight services. Aircargo Magazine, pp. 16-17.

Jackson, P., & Brackenridge, W. (1971). Air cargo distribution. London: Gower Press.

Kjelgaard, C. (1982, September 25). Federal Express: new aircraft and electronic mail. Flight International, pp. 910-911.

Lyon, M. (1983, February). Federal Express: how the rich get richer. Air Cargo World, pp. 30-31.

Sletmo, G. (1972). Demand for air cargo - an econometric approach. Bergan, Norway: Institute for Shipping Research, Norwegian School of Economics and Business Administration.

Smith, J. (1981, May). Market intelligence: the smart thing to do. Aircargo Magazine, pp. 26-30.

Speas, R. (1979, July). The central air cargo hub. Airport Services Management, pp. 18-21+.

FACILITIES PLANNING
FOR
AVIATION EDUCATION

by

Bruce L. Hutchings, AIA, ASLA
School of Architecture
University of Illinois
Urbana, Illinois 61801
(217) 333-1330

and

William Geibel
Institute of Aviation
University of Illinois
Urbana, Illinois 61801
(217) 333-3052

ABSTRACT

The importance of properly designed physical facilities as an environment for the delivery of an aviation and education program cannot be over emphasized. While excellent teaching can and does take place in inadequate physical settings, the delivery process and related human experience both for teachers and students invariably suffers. At the same time, the decision making process involved in producing suitable facilities for any aviation related activity has become exceedingly complex. Growing sophistication of technology and state of the art of aviation systems, changing educational programs, complex administrative structures, and difficulties in the economy and ability for institutions to fund building programs all serve to complicate any well intentioned building development goals.

It is essential that a broad based comprehensive planning and design process be utilized if the product of any building development is to achieve requisite facility objectives. Short term, expedient approaches to replacement of inadequate facilities invariably result in an equally short lived solution to the problem. Even worse, they often complicate longer range development opportunities due to the absence of an overall masterplan, and usually create a poor architectural image. The planning process must incorporate a successful integration of client/users and planning/design professionals as well. Input and expertise from all parties involved must come together in a continuing interaction and dialogue. The key words in any facility development endeavor are comprehensive planning and professional interaction.

This process has been applied to the long range facility needs of the Institute of Aviation at the University of Illinois in Urbana-Champaign. A review of the methods and techniques utilized in this project can be beneficial in developing insights for application to other similar programs.

INTRODUCTION

The challenge of flight with its lure of adventure has been a recurring theme throughout civilized history. The experience of flight is still a dream for many. Aviation as we know it today is more than just flying, however. It is a vast system, with vehicles used as tools in transportation, business, public services, sport, and national defense. Its product touches each of us almost every day of our lives.

Aviation is an important element of our educational system. Aviation education materials can be found at almost all grade levels. In the elementary programs aviation can be used in teaching traditional subjects bringing relevency to the learning process. At the secondary or high school level its uses are directed toward career awareness and development, and the enlightenment of an informed society. At the college or university level programs in aviation are directed at career development and research.

With the rapid advancements in technology, our interdependence on aerospace/-aviation products and the opening of the new frontier of space, aerospace/aviation education is an important addition to the total education of our citizens.

Facilities, the physical man-made environment which society has produced to serve its diverse needs, are vital to any educational mission. As the level of specialization increases, the importance of the architecture designed specifically for the mission and program involved increases dramatically. As humans are extremely adaptable it is possible to get by with discomfort, inconvenience, inefficiency and generally unattractive surroundings. However, both the quality of the performance and the sense of enjoyment and satisfaction of the individuals involved is immeasurably enhanced if the physical setting is of a high architectural level. It is clear the rationale exists for appropriate facilities to serve the mission of aviation education. The challenge is to seek the best method for achieving the proper physical product.

FACILITIES PLANNING--THE PROCESS

As modern society has grown in complexity, both from the standpoint of technological expansion and human potentials, the planning and design professions have also expanded their capabilities. Traditional professional expertise for delivery of physical facilities to meet functional and human needs has broadened to include the entire range of environmental problem solving considerations. In a day and age where physical, economic, and human resources are both in high demand and short supply, it is essential that the process of creating physical facilities be pursued with the utmost care and precision. This is not a simple task.

In recent years, numerous terms have evolved to better describe the notion of a broad based planning and design expertise. Comprehensive planning, master planning, total systems planning, and facility programming all refer to the general concept of comprehensive problem solving for physical development. Obviously, the exact nature of any procedure will depend greatly on the type, scale, and magnitude of the project and its related issues. The general underlying theory is based on an analytical and systemic process for bringing about physical solutions to identified needs.

As such, basic steps would include problem scoping (determining needs, defining goals and objectives, and identifying priorities), project analysis (needs assessment and feasibility), and project synthesis (physical development).

As the scale of any facility project expands, the importance of a comprehensive masterplanning phase also increases. Such a process can involve a wide variety of tasks important to critical pre-facility design decisions. These include site selection, environmental impact assessment, functional planning, etc. The site selection process itself has become a major area of professional endeavor in the last few years.[1]

At the more specific level of building design, a similar growth in importance of pre-design analysis has emerged. It is widely referred to as facility programming, and has become a specialized area of expertise.[2] It is basically a process for handling information in order for an architect to make proper design decisions. Facility programming emphasizes identification and analysis of user needs in relation to physical, economic, and social factors affecting the project. The product is a program document which can vary in levels of complexity and detail. The most general is referred to as a master program while the most specific is called a component program. It identifies precise design requirements for a component of a facility.[3] Whatever the scale of application, facility programming is essential to the design decision making process. The success of such a process is dependent on an interactive information sharing activity between the design professional and those by whom the facility will be utilized (the client user).

Applications in Aviation.

Airplanes, those elements around which the entire aviation industry revolves, represent the ultimate in both beauty and efficiency of design. The rapid development of the aviation industry has resulted from the maximum output of human endeavor and resourcefulness. Inherent in this achievement, whether it be in the aircraft technology itself, the evolution of an on-board and ground-based control system, or on the management of a vast world-wide airline traffic system, has been the reliance on a comprehensive systems planning approach to problem solving.

> "Aviation plans being developed today must consider all elements on a total system basis...professionals, in attempting to find the best solution must consider all system interfaces, and, in particular, the suitability of his solution to the other elements of the total system environment."[4]

Further, the importance of such a process for aviation training, research, and educational resources is not a new idea. It should be a natural outgrowth of systems planning approach to overall aviation needs. It is somewhat paradoxical, therefore, that aviation education programs in many instances are content to operate within a physical environment that is obsolete, generally unplanned professionally, and usually without any future plan or program for improvement.

If there is any industry which could be well served by a systematic and comprehensive planning approach to facilities needs it is aviation education. The dimension and variety of educational demands are particularly diverse.

Academic opportunities range from business and management subjects to human factors and advanced instrument technology studies. Teaching methods range from hands-on maintenance and flight programs to human psychology instruction. Facility needs range from sophisticated laboratories to general hangar spaces. The implications for specialized supportive facilities design are apparent and underscore the need for utilization of the most advanced state of the art in facilities planning methods. Unfortunately, what is too often found is a willingness to construct new structures (with the objectives of expediency and economy), originally designed for and probably best suited for storing corn.

APPLICATION--UIUC INSTITUTE OF AVIATION FACILITIES

The consideration of future facility needs for the Institute of Aviation at the University of Illinois in Urbana-Champaign has incorporated a comprehensive facilities planning approach in a rather unique way. Review of the process and techniques utilized in this process can serve as an important example for others. By examining a given case study it is possible to obtain new insights on approaches to similar type projects. Hopefully, the sharing of knowledge gained from each such experience can aid in the cumulative expertise and capability for application to other aviation education developments in the future.

Background

Willard Airport at which the Institute of Aviation is located is a state owned facility, operated by the University of Illinois. Located 5 miles south of the cities, it serves the Champaign-Urbana area for commercial, private, and corporate aviation, in addition to the Institute of Aviation with its academic and research programs. The Institute of Aviation, which has the additional mission of management and operation of the entire airport, is located in its entirety at Willard Airport. (See Fig. 1.)

Aviation education at the University of Illinois had its beginnings in the early 1940's when the University made the decision to construct and operate an

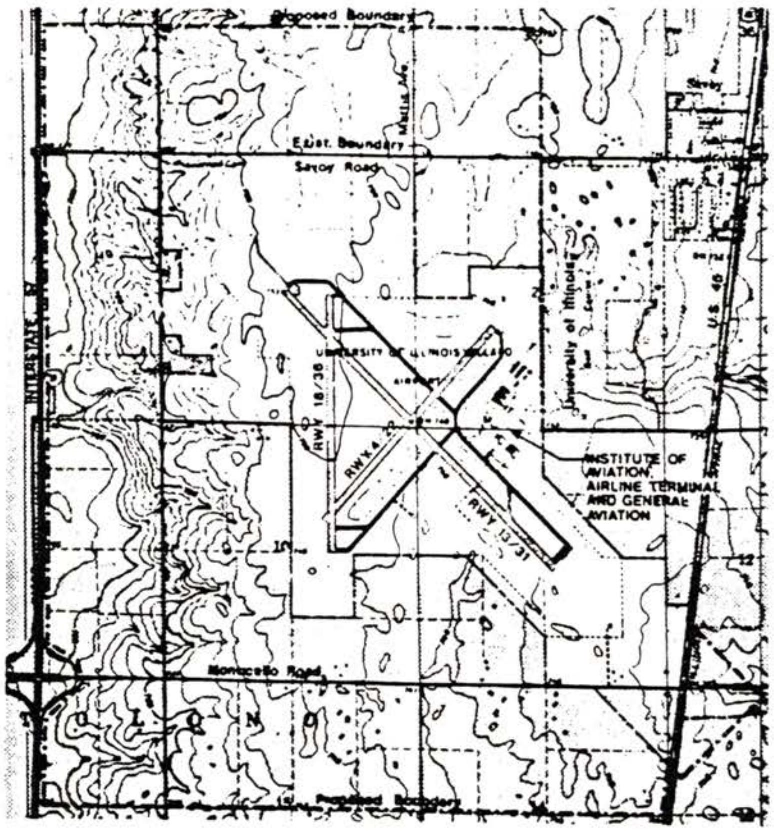

FIG. 1
WILLARD AIRPORT

airport. In 1941 a program sponsored by the University of Illinois, the Illinois Aeronautics Commission, the legislature and local businesses was undertaken to create a University airport at Urbana/Champaign. Funding was subsequently received from the Legislature in 1943 and upon completion in 1945 was officially dedicated with formal ceremonies in front of the main hangar.

In the years following the 1945 dedication, over 35 buildings were constructed including surplus Quonset buildings for classrooms and labs, T-hangar, business-executive hanger, fire station, terminal building and research facilities, all of which are in use today.[5]

Aviation programs at the University stemmed from a recommendation in 1945 to the Board of Trustees from an Advisory Board on Aeronautics to "facilitate a comprehensive program of aviation education." It was through these recommendations that in May 1946 the flight training program was initiated. Two years later the aircraft maintenance curriculum was approved with the first class graduating in 1950. Today the University of Illinois Institute of Aviation is responsible for the academic programs of flight, maintenance, and research, and other commercial operations of Willard Airport for the University.

In 1974, a comprehensive master plan for the airport was completed, but never was officially adopted.[6] Physical change continues to take place however, and some form of long range plan is essential if the change is to be orderly and effective. Expansion of facilities for the Institute in the past has been hampered by the lack of an accepted plan for the airport as a whole.

The Institute's academic and research program operates out of facilities which are totally obsolete and inadequate to the mission of the program. The present (1983) academic setting for aviation programs at the Institute is a post-World War II temporary Quonset hut environment. They have been adapted and modified over the years, and are basically structurally sound. However, they are extremely inefficient and are poorly equipped for use as a modern aviation education program operation. Figure 2 illustrates existing conditions.

FIG. 2
EXISTING FACILITIES

During the years of major University physical expansion, the Institute of Aviation was low on the priority list for new facilities. In recent years Institute needs have become critical, but serious curtailment of building construction funds has occurred. Thus, badly needed new construction has not taken place. Planning for new facilities has been pursued, however, in spite of the gloomy climate for achieving results. The Institute administration has long realized the need for pursuing long-range program goals, and in 1975 a planning study was initiated. It included both an academic development study as well as facility development needs.

Academic Planning

An academic plan was completed in 1976.[7] It outlines the educational objectives for the Institute both for the short-range and long-range. The two-year program currently in place is projected for upgrading to a four-year program in the future. Over the long-range the Institute includes plans for a graduate program in aviation studies.

One unique and useful aspect of the Institute planning process has been the establishment of a planning advisory committee. This committee has been made up of representatives from the various fields within the aviation industry nation wide. The group has been utilized periodically over the years for input and reaction to concepts and ideas for Institute improvement in both programmatic and facility areas.

Physical Planning

In 1975, a facility planning committee was established. The need for representation by design professionals was recognized and provided by the faculty of the University of Illinois School of Architecture. This involvement has continued intermittently over the years up to the present time. As no immediate construction was contemplated and no funds were available for professional services, this participation by Architecture faculty and subsequently, graduate students has served as a successful alternative.

An initial problem needs assessment phase was conducted by the Institute facilities planning committee. This included a period of investigation of other aviation and education programs and related facilities. It was during this time that the idea of utilizing a class of graduate students in Architecture to pursue a complete facility planning and design study emerged.

In architectural education a proven instructional method is the design studio, and the Institute of Aviation project provided an ideal vehicle for an educational experience due to its complexity and reality. At the same time, this academic planning exercise served the Institute administration well. It provided an initial exposure by the staff to the process of physical planning without all the constraints and limitations inherent in a real study. It provided a vehicle by which the staff could better understand its facility problems and needs as they related to present and future mission goals. It provided a means for visualization of a number of facility design concepts and alternatives. Perhaps most importantly it reinforced the importance of and need for a comprehensive planning approach to Institute facility needs.

As an initial step in the study, an overall planning methodology was developed by Professor Bruce Hutchings of the Architecture faculty. It served as a procedural guide during the six month period for conduct of the study and also served as a framework for a follow-up evaluation.[8] A diagram of this process showing sequence of steps involved, contextual definitions, and related planning techniques of each step is illustrated in Figure 3.

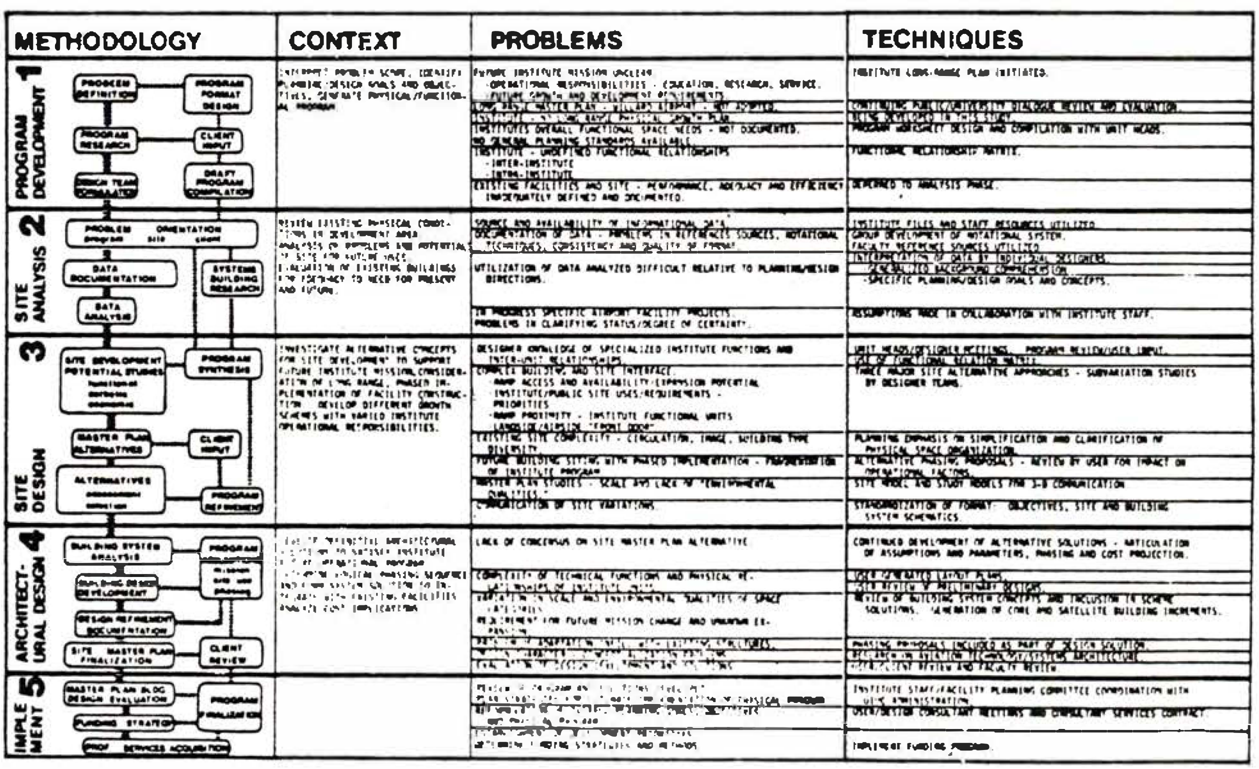

FIG. 3
PLANNING METHODOLOGY

Four key procedural activities in the process are identified with subactivities within each. The major product of phase 1 was a building program. For this study a format was created for use by Institute staff in identifying operational activities and associated space requirements. Compiled forms were then used by the architects as a reference for building design requirements. A functional relationship using a matrix for illustration was also prepared to aid in programming. These aids are illustrated in Figure 4.

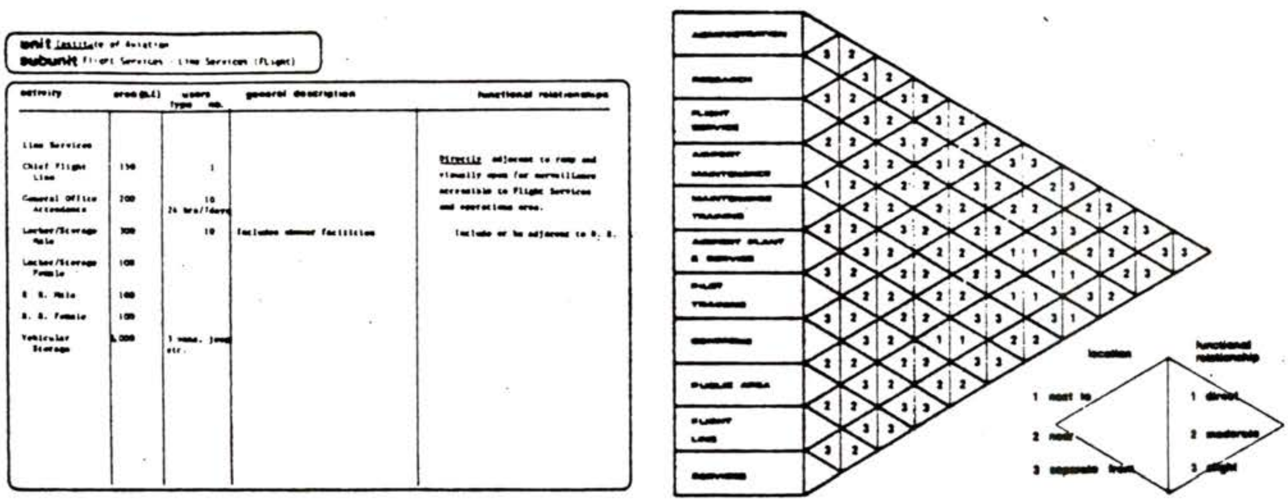

FIG. 4
PROGRAM FORMAT & MATRIX

Site analysis has become an inherent part of any medium to large scale building projects and rather sophisticated assessment theory and analysis techniques have been developed.[9] Applications of such techniques are invaluable in dealing with unique environmental conditions and their impact on building design.[10] In the Institute of Aviation study numerous environmental issues and problems were identified. One of the most serious of these involved conflicts in site circulation (See Figure 5).

During the masterplanning phase a number of innovative concepts were explored, as very few limitations were present to the designers. In any development project where numerous activities and separate buildings are present the masterplanning phase is critical to the overall decision making which must follow. While a masterplan can and should be subject to change, general

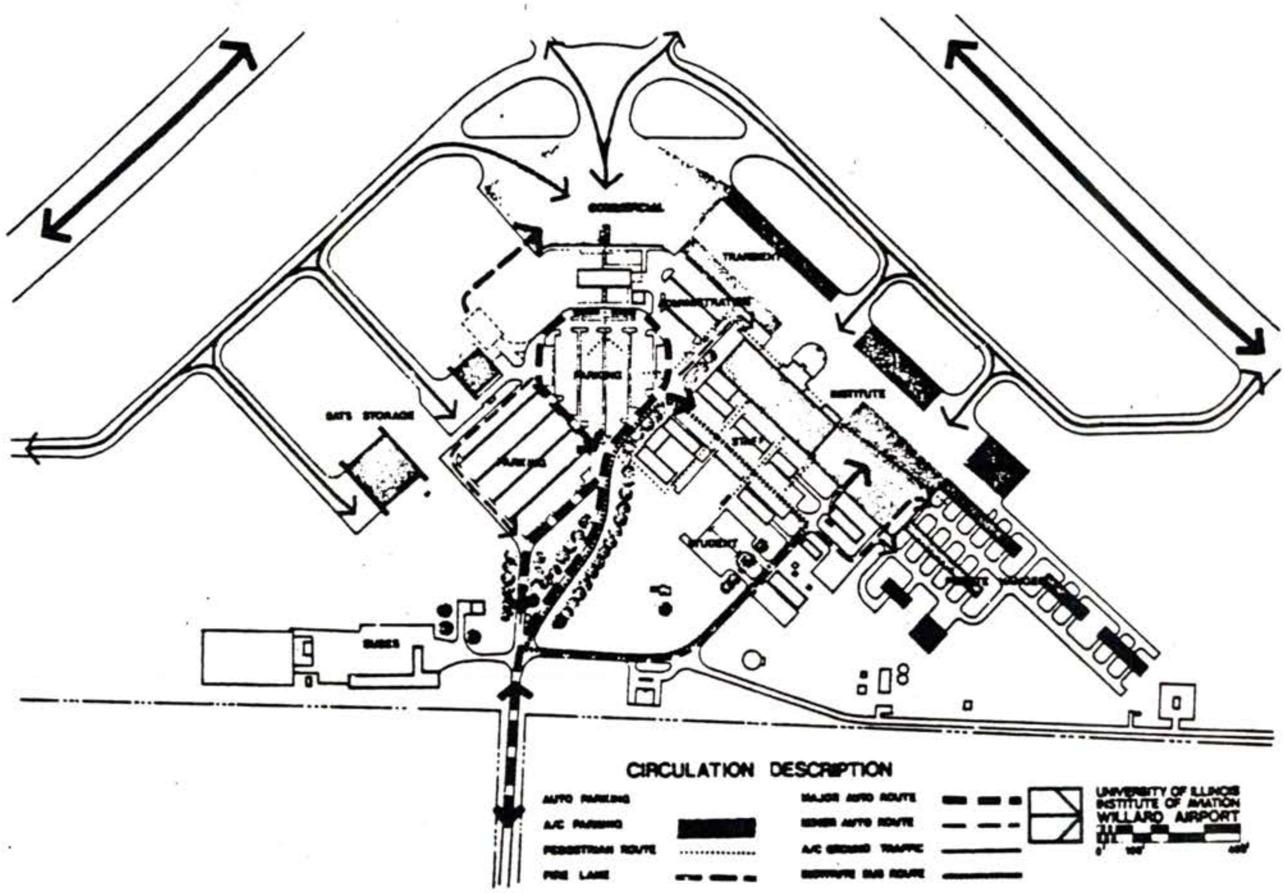

FIG. 5
CIRCULATION ANALYSIS

committments to and decisions on overall site systems organization have to be made. A physical masterplan provides a vehicle for this decision making process. Once developed such a plan can then serve as framework for orderly and efficient land use, circulation, and specific facility planning developments to follow over an extended period of time.

In the architectural design phase a variety of concepts were explored ranging from adaptation of an infill of new construction between existing Quonset structures, to a completely new facility based on an expandable building system concept. This latter idea accommodates a phased construction program as well as establishing an architectural expression in keeping with the current aviation technology. (See Figure 6.) All design studies were accompanied by a construction cost analysis to further complete the level of design knowledge.

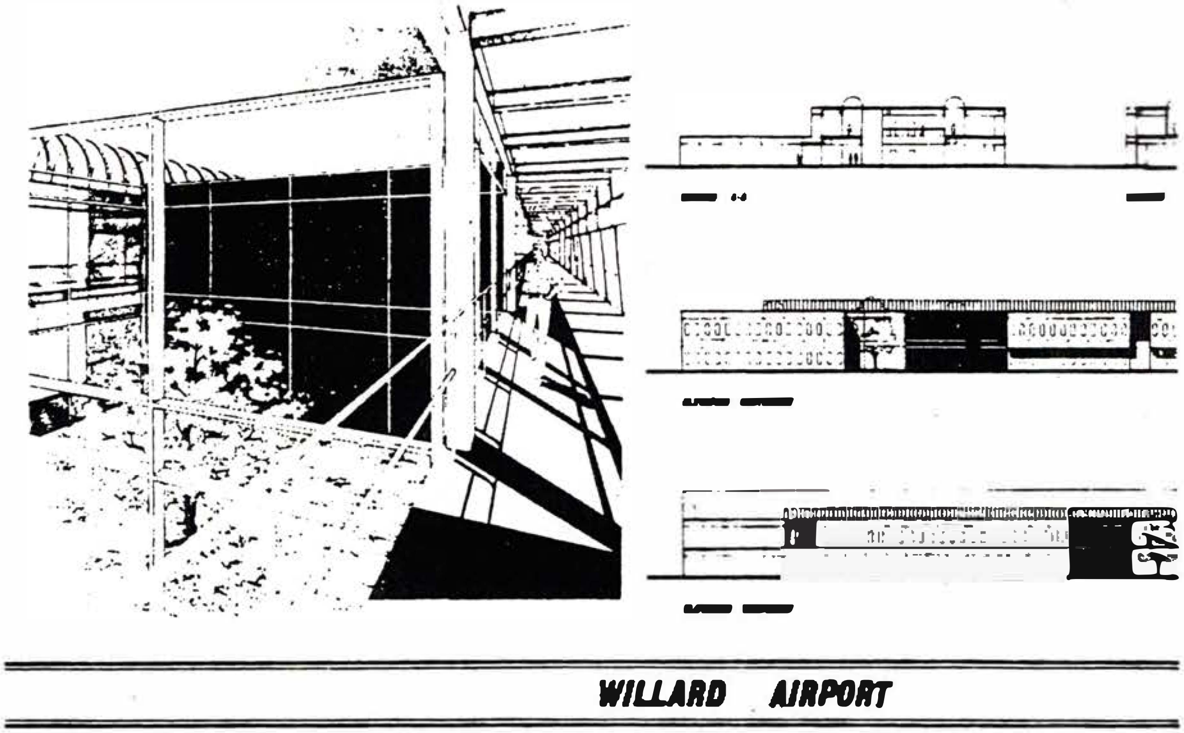

FIG. 6
FACILITY DESIGN

Current Planning

Following completion of the study by the students in 1979 and final presentation of their work to the Institute staff, no further planning activity took place until the summer of 1981. The prospect of University funding for new Institute facilities had not changed or improved during the intervening years. The Aircraft Systems Department of the Institute, under the direction of Dr. David DePue, and with the concurrence of the Institute Director Dr. Henry Taylor, applied for and received a grant from the State of Illinois Board of Education, Division of Adult Vocational and Technical Education. The proposal consisted of three major objectives:

1. To become familiar with other aviation education institutions of an exemplary nature.

2. To determine model facilities and project aviation program needs of the Institute of Aviation.
3. To project Institute facilities needs for the present and into the future.

This study included visitation and documentation of other facilities, use of consultants for planning and program development, and conducting of a facilities planning seminar to review progress of the study.

Professor Bruce Hutchings from the School of Architecture, who had directed the earlier student study, was invited to participate. Based on experience with the earlier study, and related professional experience over the years on institutional planning and design projects both in the United States and overseas, his recommendation was to incorporate the findings into an Institute Facilities Master Plan. In order to assure a proper fit of individual department needs with other existing and possible future facilities for the Institute, a general long-range development strategy needed to be prepared. Further, in order to pursue funding possibilities, promotional material was needed which could illustrate in a visual way an image of a possible future facility.

It was decided that the product of the study should be a three-dimensional concept model suitable for illustration of an overall future facility as well as a physical tool for ongoing planning studies.

General Institute goals relative to facility development were identified early in the process. They were:

1. Create new identity and physical image.
2. Centralize departmental locations.
3. Unify operational activities and combine overlapping functions.
4. Create long-range facility development strategy.

Other physical changes which had occurred subsequent to the student design study also limited the options for future Institute development. These included expansion to and remodeling of the present terminal facility, and establishment of a new fixed base operation. Figure 7 illustrates a firmly fixed general landuse pattern on the site. Figure 8 illustrates the current fragmented arrangement of Institute operations.

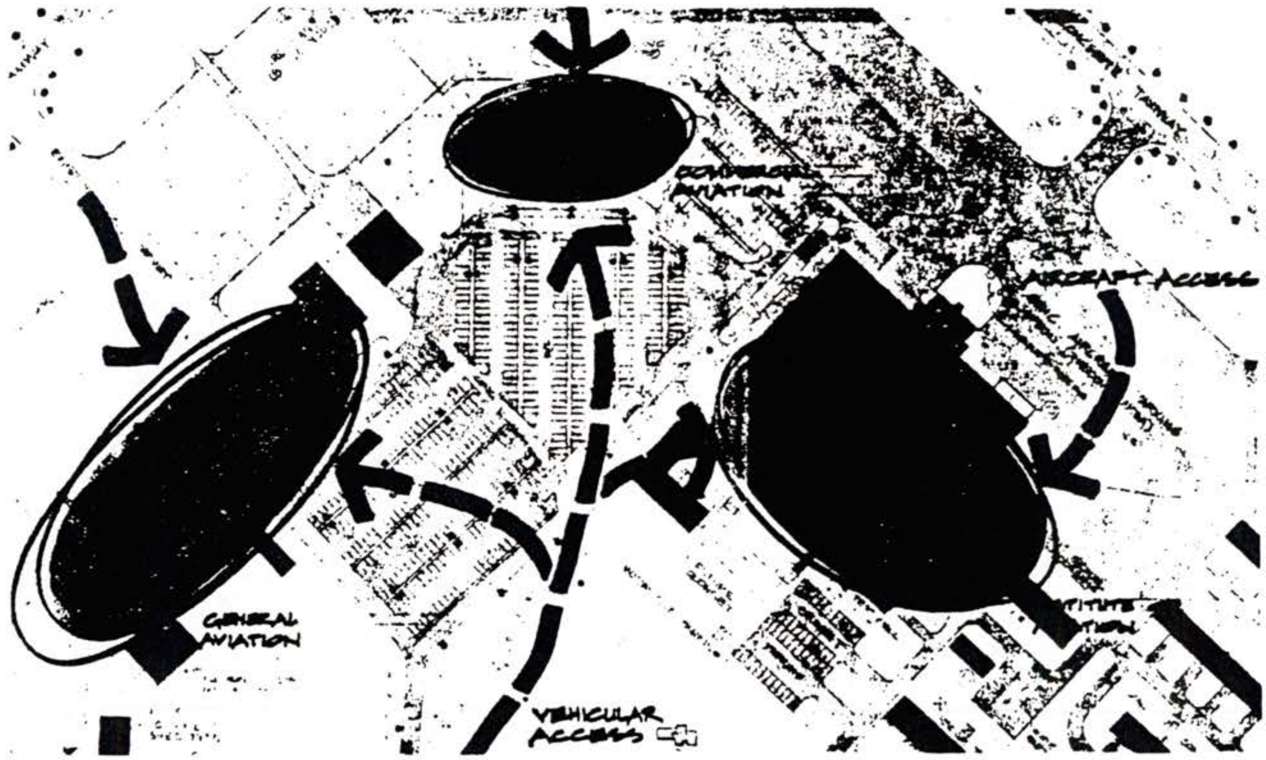

FIG. 7
EXISTING LANDUSE

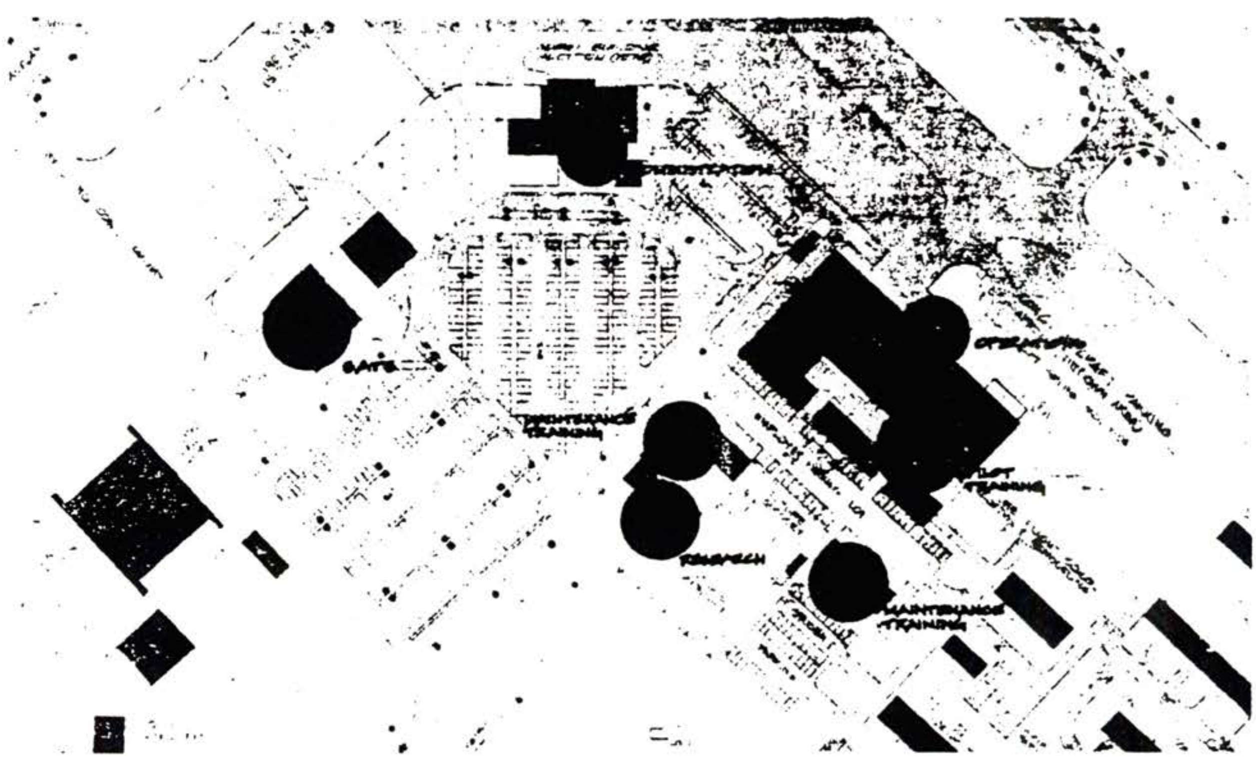

FIG. 8
INSTITUTE DEPARTMENT LOCATIONS

As the Institute needed to remain in operation using existing structures concurrent with any new facility development, the concept plan needed to be organized such that connection to both existing facilities and future construction could occur. Also, the Institute operation is such that both an airside front door and a landside front door are important features. These needs gave importance to the idea of an internalized pedestrian circulation system which could serve as an organizing framework for connecting of various operational components. These various constraints and ideas are illustrated in a conceptual bubble diagram overlayed over existing site conditions. (See Figure 9.)

This concept was then developed into a more definitive diagram. This was done utilizing both the programmatic areas developed in the previous study and the current program completed by the aircraft systems facility committee. (See Figure 10).

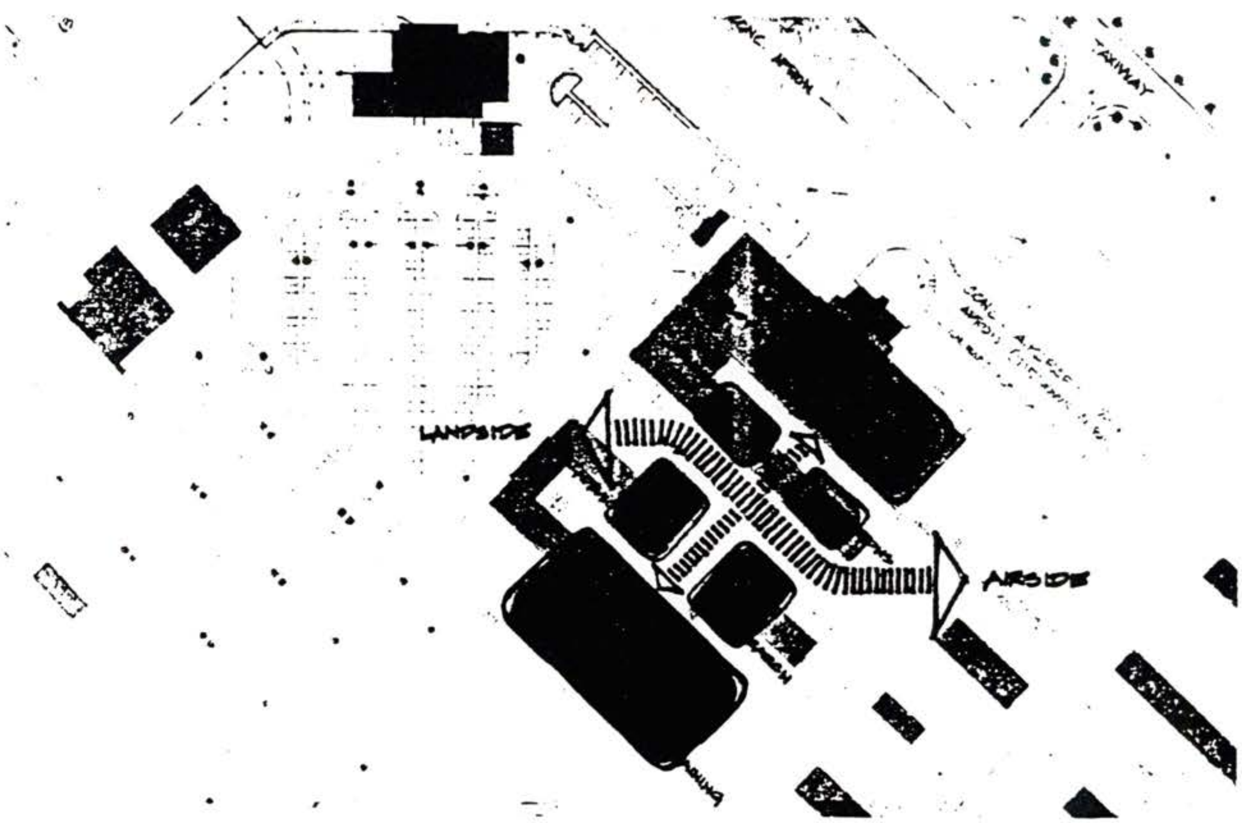

FIG. 9
FUNCTIONAL CONCEPT

In the summer of 1982, the seminar was conducted with the planning material presented, discussed, and analyzed. Minor organizational changes were suggested, prepared, and reviewed by the Institute staff during the summer. Following this, the concept development model was constructed. It was prepared in a manner to show both existing conditions as well as phased approaches to new facility construction.

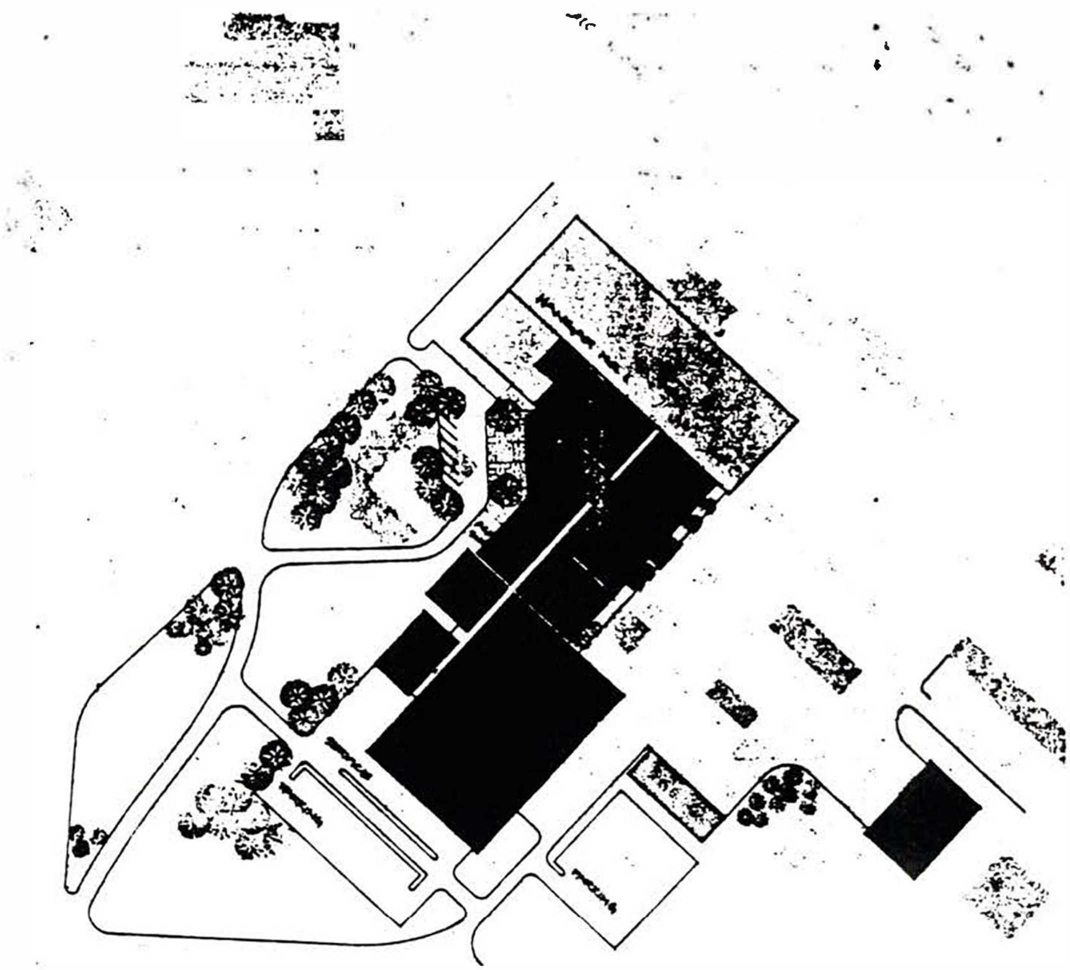

FIG. 10
CONCEPT DEVELOPMENT

Figures 11, and 12 illustrate the model as a three-dimensional concept. The first shows partial development of phase one (the Aircraft Systems Department). Figure 12 is an oblique angle view of the completed complex focusing on the landside front door.

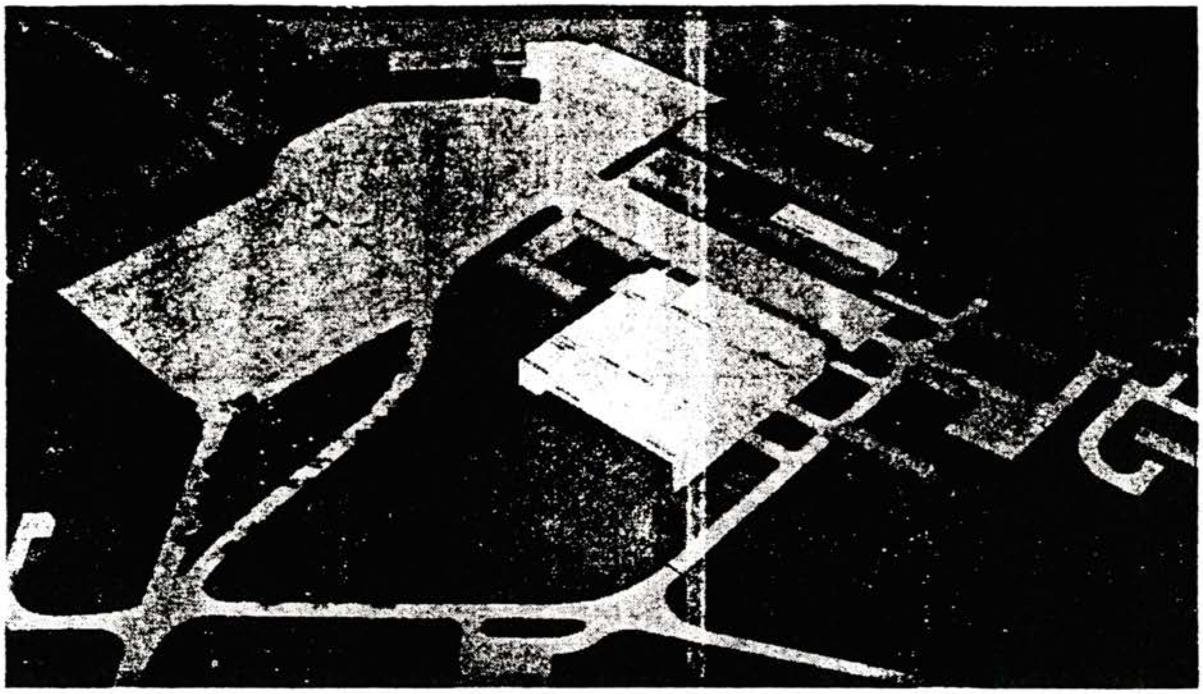

FIG. 11
CONCEPT MODEL - PHASED CONSTRUCTION

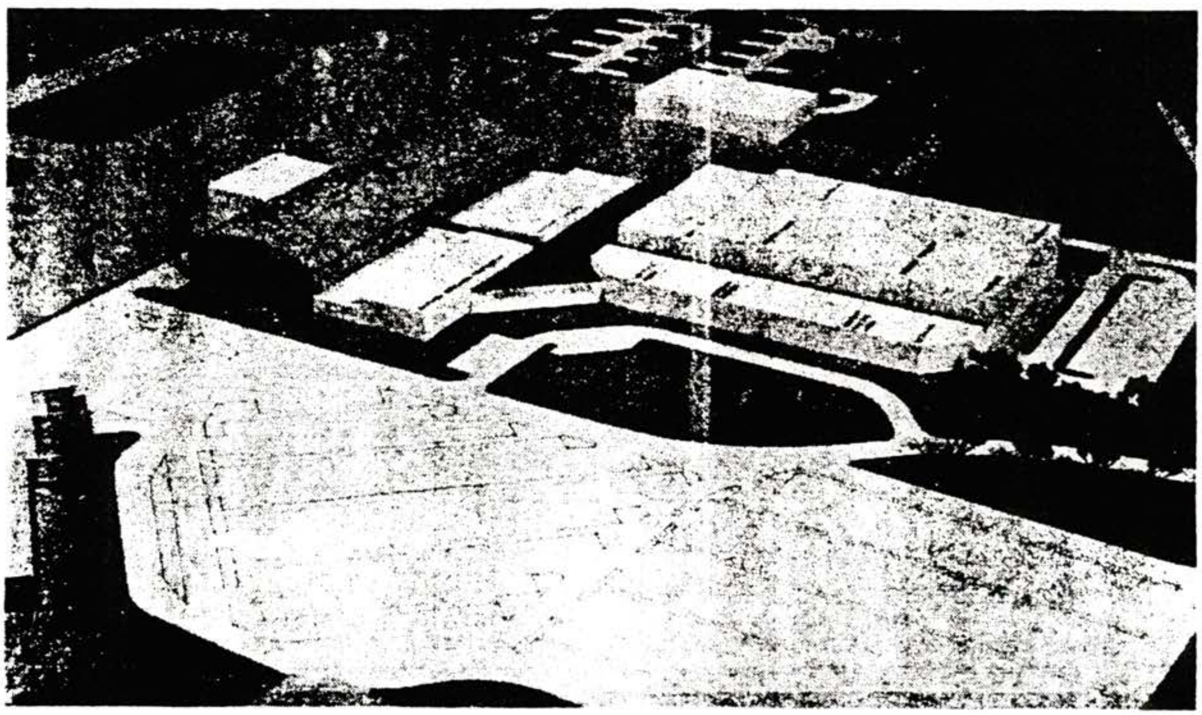

FIG. 12
CONCEPT MODEL - LANDSIDE VIEW

This most recent planning effort has resulted in two important products. The first is a definitive architectural program and functional plan for one component of the Institute, the Aircraft Systems Department. Detailed space needs and functional relationships have been identified by maintenance staff after a thorough investigative process. The second product is a model for development of the entire Institute facility needs into the foreseeable future. These products represent two extremes of scale. The first is detailed and finite, the second is generalized and conceptual. However, the first without the second is incomplete. An overall vision for the future is an essential part of any partial construction effort. While not yet a definitive architectural design, the concept plan does achieve a three-dimensional form and identity. As such it can serve as both a promotional resource and a physical framework for the planning and guiding of construction to follow over the years.

CONCLUSIONS

No doubt the old adage that "nothing is new, it's all been done before", applies to the planning process just discussed. However, review and analysis of new applications of accepted methods remains as a useful exercise, if only to confirm what is already known. The major value of such a review really is to enlighten those who may not have had previous exposure to such a comprehensive process and, to offer the possibility of new insights to those who have. Learning from the experience of others is a most fundamental, but useful educational technique.

A number of key issues can be readily identified from this case study. First and foremost, comprehensiveness of method and scope of planning effort are essential. This has been clearly emphasized throughout this project. Included is the idea of understanding of and responsiveness to constraints and opportunities arising from the planning analysis itself. The analysis should encompass physical and environmental considerations as well as human and economic ones.

Secondly, in any physical planning process the issue of interaction and sharing of ideas and knowledge is critical. The clients and facility users have a firsthand and indepth knowledge of both operational and functional needs. A close working relationship with planning and design professionals who are involved in any given project must take place. In addition, several specific design professionals working on an interdisciplinary team basis are normally vital to a successful outcome.

A third primary issue is that of adaptability and flexibility to change. This applies both to the products of the planning and design process, as well as the method by which the realization of facility needs is achieved. Masterplans for hypothetical future facilities which cannot accommodate change may be worthless, and to many worse than no masterplan at all. A masterplan must be utilized as a general framework for orderly progression from what exists to what will eventually occur. At the same time the environment for accomplishing facility development, especially within educational institutions, has changed over the years, and will no doubt continue to change in the future. The various techniques and methods of facility planning must be utilized in a flexible and changing manner in order to accommodate this evolving economic climate.

Finally, perseverance is also a mandatory ingredient. Organizations should not forego planning for future facility needs just because the present outlook is bleak. If planning for the future has taken place, the stage is set for a series of actions which should follow, whatever the time frame.

REFERENCES

1. Williams, E. A., Massa, A. K., "Siting of Major Facilities", McGraw-Hill, N.Y. (1983), p. 29.

2. Palmer, M. A., "The Architects Guide to Facility Programming", AIA, Washington, D. C. (1981), p. 3.

3. Ibid., p. 23.

4. Cerchione, A. J., et al., (ed.), "Master Planning the Aviation Environment", U. of Arizona Press, Tucson (1970), p. 29.

5. Hanson, D. (ed.), "Decade with the Institute of Aviation", University of Illinois at Urbana-Champaign (1979).

6. Howell, H. H. "Airport Master Plan, University of Illinois - Willard Airport", State of Illinois Dept. of Transportation Project #72P-1-03 (1974).

7. Craig, J. M., Jr., et al., "A Long Range Plan for the Academic Development of the Institute of Aviation", University of Illinois (1976).

8. Hutchings, B. L., "Evaluation of the Facilities Planning Process for the Institute of Aviation", Unpublished Research Report, Graduate Research Board, University of Illinois (1977).

9. Fabos, J. G., "Planning the Total Landscape: A Guide to Intelligent Land Use", Westview Press, Boulder, Co. (1979).

10. Hutchings, B. L., "Climatic Determinants in Campus Design", Paper in Proceedings of International Conference on Energy Conservation, Planning and Design, Pergamon Press (1981).

This page intentionally left blank.

CURRICULUM DEVELOPMENT / INTEGRATION

SINGLE CONCEPT SIMULATION

By:

Richard A. Molenaar

University of North Dakota
Box 8216, University Station
Grand Forks, ND 58202
(701) 777-2791

When questioning why students should major in aviation while attending a college or university rather than simply flying at an FBO, two factors that must be considered in curriculum design come to mind: 1. Depth and coverage of aviation subjects; 2. Integration of flight training in course work.

Of these two considerations, the most difficult to attain is curriculum integration. The problem appears to be amplified by a number of factors which include a four year variable time block, weather, illness, financial problems, and either over or under ambitious advancement in the flight curriculum.

The military solves this problem by controlling the entire lives of the students. Since this is not an option that is available to us as educators, we should examine integration as a specific problem.

There are really only four distinct areas in completion of commercial and instrument certification. They are as follows:

1. Private Certification
2. Commercial Maneuvers and Commercial Cross Country Flying
3. Complex Aircraft Operations
4. Instrument Procedures

The integration of flight and ground curriculums is generally fairly simple during private certification because all students start from approximately the same level. Also, the quantity of flight and ground activities fall nicely within a one semester or two quarter time block. Therefore, we have accepted the private pilot course as a fairly well integrated program by nature rather than design. Commercial maneuvers and cross countries during commercial certification are really glorified exercises spawned from private certification. Except for Lazy 8's and Chandelles, there is very little new information involved. Therefore, during this block of commercial instrument training, little integration is necessary, and possible co-requisite subjects of interest should include aerodynamics, advanced navigation methods, and applied meteorology. These would enrich the learning experience while the student is flying to proficiency within commercial standards.

Complex aircraft operations should have an integrated course on advanced systems, but as far as introducing new and different types of flight maneuvers, again there is very little new information to be covered. Complex aircraft operate nearly as basic trainers, and fly nearly like basic trainers, other than the operation of the propeller and the landing gear.

The most difficult and important area by far for academic and flight integration, is that of instrument flight. In our present world of complex nav systems and the stress of the importance of instrument competence, this is probably the area that collegiate aviation education can excell in well beyond the traditional level of basic flight training.

We, at the college level, should be continually searching for better methods of teaching flight related subjects, yet most of us still work with 1950 vintage training aids and blackboards. This is not to say that these aids do not have a place in today's classroom, but they should not be relied on as primary aids. Slides and filmstrips are an extremely passive method of education and many times are extremely boring to the students. Therefore, what might be required is an entirely new concept of aviation education...or is it so new?

I am currently in the process of developing a new approach to the education of professional pilots. This program is based on theory of learning levels adopted from the government publication "Aviation Instructors Handbook" and includes four levels of learning:

1. Role
2. Understanding
3. Application
4. Correlation

These correspond roughly with Blooms Taxomony on Education. Super-imposing these learning levels when developing a mental mode of learning activities we get the following:

STAGE 1.	STAGE 2	STAGE 3	STAGE 4
ROTE	UNDERSTANDING	APPLICATION	CORRELATION
CLASSROOM PRESENTATION	SINGLE CONCEPT SIMULATION	AIRCRAFT FLIGHT SIMULATION	FLIGHT TRAINING

It is my belief that we are making significant progress in the first, third, and fourth stages, but aviation programs are inadequate in helping students develop stage two, level two understanding. Traditionally, educators have assumed that understanding takes place if we explain things clearly in our lectures and presentations. However, I now believe that some form of learning process which requires a more active role on the part of the student is needed. The best approach to meet that need is through simulation.

Simulation, however, takes many forms and can exist at a variety of levels and degrees of complexity. To distinguish between simulation at stage two (understanding) and stage three (application), I have chosen to use the term "Single Concept Simulation" at stage two, and "Aircraft Flight Simulation" at stage three.

Stage three simulation requires a machine of extremely high quality that can reproduce the flight experience as accurately as possible. This experience should have, at a minimum, the audible and visual sensation of flight. Hopefully, the mid-priced machines will eventually produce the physical sensation of flight with motion simulation as well. This level of simulation involves itself in the application of the understanding level of knowledge to the realm of flight operations, integrated with the development of psychomotor development. It is at this point that the student begins to "put it all together".

Stage two learning helps the student give meaning and understanding to facts and the basic rote knowledge acquired at stage one. It involves the student in conceptual and abstract thinking. Since concepts generally center around a limited or singular subject, I felt that the term "single concept" is appropriate. To provide the impetus to get students actively thinking at this stage, I believe some form of simulation has the greatest potential. Furthermore, simulation is seen in a very broad sense in that its purpose is to place the student in an imagined or psychologically contrived situation which requires active participation on his part. Simulation may involve hardware, but it can also be as simple as a problem on the chalkboard or an overhead transparency.

One of the critical areas of understanding in the course of flight training is that of radio navigation. To effectively steer an aircraft about in a complex world of electronic signals, the student must grasp the relationship between ground based radio transmissions, aircraft position with respect to the radio station, and necessary control manipulations to achieve the desired flight path. This understanding cannot be achieved through stage one learning alone but must involve learning the understanding level, stage two.

Actually this learning could be done in an aircraft simulator, but because of the complexity, high cost and intimidating nature of these simulators, what I have in mind is a simpler simulation device that is computer generated, nonthreatening, relatively inexpensive, and adapts itself to the single concept simulator approach.

Presently, educational concepts are introduced in the classroom. Usually, only a blackboard, overhead transparency or slides are available as learning aids. This arrangement not only generates a lack of enthusiasm from the students, but it almost enhances the passive enrollment that is so destructive in the learning process. It is in this passive learning that I hope to somewhat alter with this new approach. This new concept is exciting in that it is a different approach to general aviation education.

Due to the relatively low cost of this type of simulator, a flight simulation lab area with between 20 and 40 single concept simulators could be developed for the same price as one new complex flight simulator such as Frasca or AST. This lab area could be an actual classroom where the students would be sitting at a single concept simulator rather than a desk, or the lab could be used for various types of lab sessions. There are many advantages to this concept:

1. A particular student will learn about a specific concept in class and then within a number of minutes or hours, he will utilize that knowledge. When that utilization occurs in a single concept simulator, it would occur in the nonthreatening environment of the academic world, rather than the high cost, high pressure world of flight training. The understanding level of learning is much more easily attainable without the embarrassment of small failures with their personal flight instructors, and also without the pressure generated from $1.00 per minute simulators.

2. Many studies have been done on the retention of material when it is presented in different ways. Traditionally, things that are merely heard have a low retention rate. Unfortunately, lecture is the most common method of instruction in higher education. If some type of visual aid is used, retention

seems to improve. Educators have tried to help alleviate this problem with the use of films, slides, overhead transparencies, film, and blackboards. This situation is manageable, but lacks participation and realism so necessary in the learning process. The ultimate learning seems to occur when the students hear, see and do particular tasks involved in the aviation process. It is this principle the single concept will directly address.

3. In considering reinforcement, another factor that must be taken into account is the timely nature of that reinforcement. Too many times the reinforcement occurs long after the learning experience of the classroom has taken place. With single concept simulation, the reinforcement will occur almost instantaneously, with very little loss of retention. There will be reduced time periods between the hearing and seeing exposure in the act of participation. I feel that this timely use of the simulation is absolutely essential to the program's overall success. It is also this timely reinforcement that is almost impossible to attain when attempting to actually integrate traditional flight training operations in to an academic environment. This is due to the fact that students in the flight curriculum might all be at a slightly different level when certain concepts are introduced in the class. For some, the needed reinforcement might be months away without single concept simulation.

This concept of aviation education is very exciting. Single concept simulation could serve as a model for all aviation education, and hopefully serve as a concept for many academic disciplines facing the types of integration problems that are so apparent in aviation.

In considering the advances of integration, scheduling, timely reinforcement and overall education standards that single concept simulation would make possible, the potential for this concept becomes more and more evident. The pleasant consideration about the entire single concept idea is that all the hardware and software is available commercially at the present time. The only requirement in initiating a single concept program is the addition of the simulator and the devotion of an academic department to experiment in the best interests of undergraduate aviation education.

CONCEPT.DTA/107

This page intentionally left blank.

AN INTEGRATED, MODULE BASED, FLIGHT TRAINING PROGRAM

Dr. John H. Schultz
Academic Dean

and

Professor Thomas Teller, Chairman
Aviation Division

Daniel Webster College
Nashua, New Hampshire 03063
(603) 883-3556

AN INTEGRATED, MODULE BASED, FLIGHT TRAINING PROGRAM

ABSTRACT

In an attempt to make flight training more consistent with present demands and future trends a modular flight training program has been developed which combines classroom instruction, computer aided and managed instruction, latest audio visual aids, state of the art ground training devices and a unique mix of aircraft not generally found in a college based flight training program. All these elements are integrated into a tightly controlled and carefully sequenced set of training objectives with major goals delimited by the completion of specific training modules. A set of eight modules comprises a training regime which, upon completion leads to the attainment of private and commercial certificates and an instrument rating. Wasted time is virtually eliminated, the quality of the flight experiences is enhanced dramatically by establishing new performance standards.

AN INTEGRATED, MODULE BASED FLIGHT TRAINING PROGRAM

INTRODUCTION

Methods of flight training have not changed appreciably since they were first standardized in the 1930's. Although machines and electronic systems have made quantum jumps in sophistication since that time, basic flight training procedures have changed very little. General aviation pilots are being trained today for tomorrow's jobs sometimes using yesterday's techniques. This is understandable in today's highly competitive marketplace because, for many engaged in the delivery of flight training to a wanting public, change is not only threatening, it is expensive. One training arena where change is beginning to become visible is that of the college based flight program. A quiet evolution has been taking place as more and more colleges have become aware of the academic component of flight training and have designed programs which are not only academically defensible but are also professionally sound.

In Schukert's Collegiate Aviation Directory (1982), more than 400 colleges and universities are listed which offer college level aviation/aerospace studies. Even though the statistical information may already be out of date, almost 60% offer some form of credit for flight experience. Some schools offer credit for ratings earned or for FAA tests passed, others only give credit for classes taken and/or for flight training given within a program developed and offered by the college itself. Some of the latter schools offer a complete package from ground school classes through flight ratings whereas others contract out the flight training portion of the program to local fixed base operators or allow the students to achieve their ratings at any appropriate flight school. Many schools own and operate their own aircraft, while others operate them on an exclusive lease basis. Some operate a combination of both. Many have simulators available while others do not. Very few programs are similar in design or operation. It appears, however, that the majority of the programs offer the flight training portion through an outside fixed base operation and that most of the degree programs are less than a full four years. With the most important component of the training program, i.e., the actual flight training, being done outside of the control of the college, such institutions are less capable of developing and offering new directions or innovations. Unless the entire program can be controlled, from the classroom to the flight line, originality is not an expected outcome.

Several years ago, Daniel Webster College had a flight training program in which students were exposed to the academic components of the program in regularly scheduled ground school classes which followed the usual FAA sequence, Private, Commercial, Instrument and then Flight Instructor, ... if the money held out. Flight training was offered through a local fixed base operator but, though students were encouraged to do so, they were not obligated to take their training there. This loose arrangement led to flight proficiencies which were, at best, inconsistent and, at worst, occasionally poor. In fact, it began to appear that the training program, except for the quality of the ground school classes, on the whole, was only marginally better than that which could be gotten at any good independent flight school. It was obviously time for a change.

MODULE BASED FLIGHT TRAINING

In the Fall of 1981, the college began the phased development of a new flight training program which was planned to integrate four components; (1)classroom learning, (2)computer aided instruction with technologically advanced visual aids, (3)computer managed flight simulator instruction and (4)flight training in a mix of aircraft not heretofore used in primary training. The intent of the newly designated program was to attract those students whose interests are toward a professional career and who have the motivation, intelligence and commitment to take advantage of it. The program was also designed to recapture the sort of spirit which usually attracts students to flight initially and to sustain that interest once they had made the commitment.

Our objectives were twofold. First we wanted to provide, for our students, the best opportunity possible to hone their flying skills in anticipation of vocations as flying professionals. Second, and equally important, we hoped to develop new insights into the flight training task and to develop a range of new methods and techniques to share with the flying community.

The first step in the evolution was the development of the flight training component with the college in complete control. The college released the FBO from further obligations and assumed responsibility for offering the flight training itself. It secured the exclusive use of a complement of new primary training aircraft and thereafter required that students do their flying exclusively within the college program if they wished to get academic credit for the experience. The college also took delivery of a new Aviation Simulation Technology AST-201 ground training device which was to be integrated into the program as a major component of the ground training regime. Students were allowed, in fact encouraged, to use the simulator as often as they wished without charge. The college chose to view the simulator as a training aid which should be offered for the convenience of the student, not as a profit center for the institution. The the efficacy of the principle and the wisdom of the choice can be seen readily in the extensive use of the machine by the students and in the imperceptible down time during its many hundreds of hours of use.

The next step involved a careful review of the operating context and skills and knowledge factors required of a professional pilot. The product of this review was an index of more than 200 specific learning objectives which were further prioritized and organized into a learning hierarchy. The resulting learning outline formed the framework for a new ground and flight training curriculum.

Based upon our observations and reflections to this point, three key decisions were made:

1). A review of the newly proposed learning objectives showed that only about 60% of those listed were reflected in the standards for Private and Commercial Pilot Certificates with Instrument Rating, and the hierarchy that emerged from our work did not closely parallel the learning hierarchy reflected in conventional Private/-Commercial/Instrument training courses.

For this reason, the decision was made to set aside the Private/Commercial/Instrument Training standards and sequence in the preparation of the new course, except for appropriate checks to ensure that the required completion would be met by the new course.

2). Many of the new learning objectives seemed, for various reasons, to be beyond the range of conventional Commercial/Instrument training practices in level of sophistication and equipment required. Although individual objectives were not immune from cost/benefit considerations, the decision was made to proceed under the assumption that all objectives could be met, and focus further work on how best to meet them. The decision led to substantial new investment in the college's flight simulation capabilities and the addition of several unique aircraft to the training fleet.

3). A strong implicit message in the list of learning objectives was the importance and breadth of instrument flying knowledge and skills, or more accurately the importance of well integrated visual and instrument flight references for aircraft control and navigation purposes. The observation was made that conventional practice, which takes an "intensive" approach to instrument training, seems somewhat at odds with the desired end product, ie. well integrated visual/instrument perspective.

For this reason the decision was made to adopt an "extensive" approach to instrument training which merges as completely as feasible, the use of visual and instrument flight references for control and maneuvering and for navigational purposes, from beginning to end.

THE PROFESSIONAL PILOT TRAINING COURSE

The Professional Pilot training Course which proceeded from this work consists of a sequence of eight integrated ground and flight training modules including 204 hours of flight training and 224 hours of ground training.

Each module is based on the mastery of the body of aeronautical knowledge and critical flying skills which are uniquely appropriate to the developmental level of the student at a particular stage of his/her training. Individual modules combine the use of classroom instruction, texts and other professional reading, video learning labs, advanced computer managed flight simulators, and intensive aircraft flight instruction in a range of machines, from motorgliders to standard and complex trainers, including high performance aerobatic trainers.

In the design of the modules, critical objectives were set as the end points for each module. They do not necessarily coincide with the attainment of a license or rating. The modules are designed to meet training objectives not simply to establish eligibility for certificates. The airman certificates become byproducts not end products of the system and certification is almost ancillary to the process.

Pricing the modules has led to another break with traditional practice. Whereas most schools price by the hour, we have gone to a specific rate for a given module which, in most cases, reflects the complexity of the individual module. In the final analysis, however, prices do not vary significantly between modules. The major reason for going to this flat fee system was to avoid the problems which arise when a student suddenly discovers that the training is costing more than anticipated or is not going as quickly as hoped. Too often such under such circumstances the student drops out at an awkward point in the training sequence, or at one which makes it difficult to resume later training without substantial repetition or cost penalties. Often such students are lost entirely never to return to flight training or to the college. We estimate that flight students can be exposed to 40% more material and significantly higher quality experiences yet with a substantial net decrease in cost. An abbreviated description of the content and objectives of each of the basic modules follows:

INTRODUCTION TO FLIGHT (24 Hours/16 Dual/8 Solo/4 Instr.)

Mastery of the fundamentals of aircraft control and maneuvering by visual and instrument reference. Student will qualify for solo during this phase. The module includes a fairly conventional pre-solo sequence except for much greater emphasis on instrument flight references. Following solo, the student gains additional proficiency through the use of precision flight maneuvers such as Chandelles, Lazy 8's, etc.

FLIGHT DYNAMICS I (24 hours/16 Dual/8 Solo/3 Instr.)

Development of an understanding of the dynamics of flight including aerodynamics, stability and control, energy management and localized phenomena such as wind shear, through the use of motorglider training, and development of an improved sense of spatial orientation though the use of precision aerobatics by visual and instrument reference. During this phase the student will qualify for solo in a motorglider.

NAVIGATION I (24 hours/8 Dual/16 Solo/3 Instr.)

Mastery of the fundamentals of navigation emphasizing position awareness, course planning using pilotage, dead reckoning and electronic navigation references and flight in the national airspace system. Student will qualfiy for night solo, and solo cross-country, and for a Private Pilot Certificate (airplane, single engine land).

FLIGHT DYNAMICS II (24 Hours/12 Dual/12 Solo/4 Instr.)

Mastery of dynamic planning and precision control and maneuvering of aircraft by visual and instrument reference through additional motorglider practice and advanced precision aerobatics by visual and instrument reference; mastery of the fundamentals of complex aircraft systems and procedures. Student will qualify for solo aerobatics and solo in a complex aircraft.

AIR TRAFFIC SYSTEM I (24 Hours/18 Dual/6 Solo/18 Instr.)

Mastery of the fundamentals of control and maneuvering of the aircraft and flight procedures in the Air Traffic Control (ATC) System. Emphasis upon position awareness using electronic references and critical safety aspects of mixed visual and instrument references and transitions.

NAVIGATION II (36 Hours/12 Dual/24 Solo/12 Instr.)

Mastery of integrated visual/instrument enroute and terminal procedures, use of visual and radio aids to navigation, fundamentals of flight crew coordination, weather awareness and critical weather phenomena. Extended practice and cross-country flight using integrated visual instrument navigation references and flight crew coordination.

NOTE: Students will meet skill requirements of FAA instrument rating during this course. If the current NPRM affecting aeronautical experience requirements of the instrument rating is approved substantially as proposed, students will qualify for an instrument rating during this course.

AIR TRAFFIC SYSTEMS II (24 Hours/18 Dual/6 Solo/18 Instr.)

Mastery of planning, procedures and techniques of flight in the ATC system by integrated visual and instrument reference including flight in international airspace; use of long range navigation systems. Practice in busy terminal hub areas.

ADVANCED DYNAMICS II (24 Hour/12 Dual/12 Solo/12 Instr.)

Comprehensive review and directed practice of each of the key learning objectives of the professional flight sequence. During this phase the student will qualify for a Commercial Pilot Certificate with Instrument Rating (airplane single engine).

Additional modules are available for students who wish to attain Instructors's or Multi-engine ratings. Also, other flight related academic courses are part of the program structure and are required adjuncts to the training courses. A series of aviation management based electives round out the student's aviation component of the degree program.

Advantages are realized both by the college and by the student. The college has a sophisticated flight program which is unique among colleges offering such programs. The student has a flight program of exceptional quality which inculcates high levels of profess- ionalism. It offers a range and depth of experiences which are unusual in a basic training environment and which are both efficient and effective. Through the use of simulation and the attendant training and learning devices the student is well equipped to deal with future training in a professional setting, whether it is military, corporate/business, commuter or airline training.

Initial response by students and prospective students has been very positive, reflected in a substantial increase in entering flight students, and the highest retention are among flight students that the college has ever experienced.

ONGOING DEVELOPMENT WORK

At the present time development is continuing in cooperation with Aviation Simulation Technology on an interactive training system as an adjunct to the ground training devices. A computer interface has been developed which will allow information from the simulator to be analyzed by a peripheral computer. Information concerning performance can be interpreted by the computer and can be compared to standards appropriate to the lesson being conducted. Ultimately, in the later stages of the development of this Interactive Training System (ITS) actual control of these segments of the training will be in the computer program operating the training sequence. Standards of performance will be established for all simulator lessons and student performance will be measured against these standards.

Such information will be compared, scored, evaluated, stored and retrieved as needed. The ITS will give us an opportunity to establish a set of objective standards against which measurements can be made and which will allow a level of testing and assessment not previously available in general aviation.

CONCLUSION

The paper describes a newly developed flight training program which integrates four components, computer aided and computer regulated instruction, simulation, classroom learning, and flight training in a unique mix of aircraft not normally found in college based flight programs. The intent of the program is to make the flight skills development process more congruent with the realities of the air traffic system as it affects pilots now and in the future. At the same time the program is designed to give substantially more exposure to flight problems and to present experiences and challenges which exceed present minimum requirements.

New standards and direction in flight training, as reflected in several recent NPRMs, are being actively considered by the FAA in response to the industry. This new integrated modular training program in place at the college is to anticipate these changes and may, in effect, help to set new directions and standards for the industry. Even if the certification criteria do not change, this training program is totally amenable to continuation within the present system so the flexibility to adapt to either certification system is assured through the program design.

REFERENCES

SCHUKERT, MICHAEL A., 1982 Collegiate Aviation Directory: A Guide To College Level Aviation Aerospace Study, 128 pp. Kendall-Hunt Dubuque, Iowa

AVIATION CURRICULUM DESIGN

by

Pamela M. McDermott, EdD, ATP

Chairman

Flight Department

University of South Alabama

Mobile, Alabama 36688

phone: (205) 431-6450

ABSTRACT

Historically, aviation education has been in the hands of the pilot poorly qualified as an educator. With the explosion of knowledge in the past quarter century, it is imperative that aviation education be addressed by professional aviation educators.

The key to curriculum design is organization. There are many models for the organization of curriculum design. Examples are given of from three to sixteen steps. All may be apply to aviation curricula.

A seven step model of curriculum design is applied to the design of pilot curricula to demonstrate how aviation curricula may be designed.

Pilots should not find curriculum deisgn difficult, because they already have the ability to organize. The aviation curriculum designer must cross-qualify from aviation to curriculum design to full knowledge of resources such as funding and educational delivery systems.

AVIATION CURRICULUM DESIGN

INTRODUCTION

Knowledge was expected to double between 1960 and 1967 according to Werner Von Braun, in his _Libraries and the Space Age_ (Hass, 1965). This can be extrapolated to imply that knowledge has multiplied by another three and one-half times since 1967. Numbers aside, there is little question that the body of knowledge for which we , as educators, are responsible is growing very rapidly, and must be managed with increasing expertise and organization. In aviation education this is particularly true.

Aviation education, only eighty years old, has not come a very long way. To put it another way, the "art" of flight was passed from one minimally experienced pilot to another. With few exceptions, for the first four decades, "...flight instruction was often relegated to those aviation pioneers who were in urgent need of funds. Usually, flight instruction was simply a means to an end; its uncertain and sometimes meager income was often the only way a dedicated airman could pursue his profession...he often had only rudimentary knowledge of aeronautics of flight and knew even less about the principles and techniques of teaching" (_Illustrated Encyclopedia of Aviation and Space_) , 1971, p. 840). Today, the majority still fit this description, with the possible addition that they may also lack the maturity that comes with chronological age.

In aviation, as in every technological field, the body of knowledge is exploding, and instructors are having an increasingly difficult time staying ahead. It is imperative that we approach the problem as professional aviation curriculum designers. Design demands not only organization, but also maintenance of currency in the curriculum.

BODY

In order to contend with the aviation knowledge explosion, we must be well-organized. For pilots, that certainly is not a difficult task, since we are generally organized at least to the extent of following check lists and procedures set down for us. Checklisting can be used in developing curricula for aviation.

We can adopt any of a multitude of models for curricular organization. The models range from very general ones of four steps or less. One model presented by Dressel (1968, p.30-31), is:

1. Definition of objectives

2. Selection of Objectives

3. Organization of Experience

4. Evaluating the Impact

The four steps presented by Ralph Tyler (1950) presented in question form:

1. What educational purposes should we seek to obtain?

2. What educational experiences can we provide?

3. How can these educational experiences be effectively organized?

4. How can we determine whether the purposes are beign obtained?

Both of these models say about the same thing, and can be analogized to the check list for an airplane where, for example, Step 1 is "exterior inspection complete".

An even shorter model is John Goodlad's (1975)

1. Values

2. Educational Aims

3. Learning opportunities.

This model probably provides good points on which to meditate, but it doesn't provide enough "checklisting" for the aviator.

For those of us preparing curricula, the four-step model may not be complete, but it may be helpful for those times when we are simply thinking things through on a large scale.

When we need more definition, we can go to considerably more detailed models. One of the most detailed, and one which certainly requires a written copy when we aare working with it is that presented informally by the Department of Educational Leadership of The Florida State University (1980). The fifteen steps presented are:

1. Identify the problem

2. Define the program purpose

3. Develop area analysis (demographic data)

4. Conduct needs assessment

5. Establish priorities

6. Set program goals

7. Examine alternatives and barriers

8. Select a course of action

9. Choose objectives

10. Identify resource requirements

11. Prepare implementation plans

12. Design the program

13. Implement the program

14. Monitor and evaluate the program

15. Design feedback and updating mechanisms

16. Modify the prgoram to improve results

Certainly, this model serves its purpose well, with its attention to detail. It can be analogized to a "nut-by-nut" preflight checklist. This is highly desirable for the beginner in curriculum design , and certainly provides te experienced curriculum designer with a quality control mechanism. Between the sixteen-step Florida State model and the three-step model of John Goodlad (1975) and the four-step models of Tyler (1950) and Dressel (1968) are numerous models of six to eight steps. These are the models which many people follow. Hilda Taba's (1962) model provides seven clear steps of organization:

1. Diagnose needs

2. Formulate the objectives

3. Select the content

4. Organize contents

5. Select the learning experiences

6. Organize the learning experiences

7. Determine what should be evaluated and the methods of evaluation.

We, in collegiate aviation, have an obligation to lead the aviation industry in curriculum development. We must be willing to change, to improve, and to perfect constantly. To do this we must understand the curricular design models as they apply to us. Let's take the Taba (1962) steps individually and discuss some strategies for developing aviation (pilot) curricula?.

Step 1. Diagnose needs. Who wants it? and Why? Generally, we are responding to demands from the university or college, the community served, and the aviation community. The strongest demand from the aviation community seems to come from the Federal Aviation Administration (FAA). We don't move forward, except as an intellectual exercise, until we have determined that that there is a valid need for the curriculum we are developing. Someone wants it and has an acceptable reason.

Step 2. Formulate the objectives. What do we want from our curriculum? What do the others desiring the curriculum want? Are we training recreational pilots? Military pilots? Professional pilots? To what level are we training? Specifically define what the student will know and be able to do at the successful completion of the curriculum. This should be somewhat detailed since subsequent steps will be developed by specific reference to this step.

Step 3. Select the content. What elements must we cover to meet our objectives? Sources for this are demands of the FAA as found in regulations, and the Written and Flight Test Guide Advisory Circulars. With the elements required for civilian certification, we have a part of the requirement. We alsomust consider the elements we have determined are necessary from our own experience, and from the experience and demands of others in all areas of aviation. One method which provided a listing of content for pilot training up to the specialization level was to derive a list from FAA Written and Flight Test Guides through the Instrument and Commercial Pilot levels, and from curricula of the Navy, Air Force, and three university schools. The outcome list consisted of 765 elements. Since some of these elements clearly did not apply to civilian flight (formation flying, for example), the list was evaluated with a Delphi Survey of a panel of twelve aviation education experts from representative areas of the aviation industry. Ninety-four percent of the elements on the list were validated for pilot training up to the specialization level (McDermott, 1983). This strategy for determining the content of a pilot curriculum, though time-consuming, provides some useful insights for the pilot curriculum developer. The same method, with or without the Delphi mechanism, is appropriate for updating the curriculum alluded to in Step 7.

Step 4. Organize the contents. Is there a logical sequence of instruction to follow? In aviation, there is generally a fairly clear definition of organization of content in pilot curricula. You certainly wouldn't attempt to cover ILS approaches before you covered straight-and-level flight, for example. There are, however, some grey areas in aviation curriculum content organization. These areas demand a little more time and attention to organize. These areas are subjects as diverse as regulations, flight computer operations, medical facts, aerodynamics, and documentation. You must make decisions about the sequence in which you will present each broad category, and then the sequence in which you will present elements within the category. Tradition is invaluable here, but cannot replace the willingness to try new axproaches to sequence of learning. Particularly in the collegiate aviation school, experience and experimentation go hand-in-hand.

Step 5. Select the learning experiences. What methods are best used to assure that the student will master the subject quickly and thoroughly? This area is one where the university and college aviation curriculum designer really diversifies. We must have reasonable knowledge of all of the resources available, ranging from sophisticated flight trainer/simulators to simple mock-ups. Of course, aircraft play a large role, too. Thm curriculum designer must be familiar with all of the delivery systems available, locally and on the market. Since this is a dynamic area, ever-growing, it requires considerable effort just to keep abreast of the "state of the art".

The ubiquitous chalkboard is always a part of an education delivery system, but even that is improved with a "marker board" on which the user writes with variable-colored felt tip markers, and projects images wither with a slide projector or an overhead projector. He then can write directly on the projected image. These systems are only the tip of the iceberg of delivery systems available. With today's technology, we have video systems available, and computer systems, and computer-video systems. The computer-laser-disk "Star Wars" game that is currently the rage in video arcades has enormous potential in the aviation learning setting. It is incumbent on the curriculum designer to understand the delivery systems, to choose the best for the learning situation, and to compromise this only with availability of resources. His resourcefulness will certainly reduce the need to compromise.

Step 6. Organize the learning experiences. How may we arrange the learning experiences to follow the pattern established with the organization of content? If the contents are well organized, and the learning experiences are well determined, this step may be fairly routine. To be considered should be such things as scheduling, so that equipment and instructors are not over-booked. This often requires a rather complex choreography to optimise use of these resources. Maintenance for all mechanical parts of delivery systems must also be planned. Part of this organization must take the human element into account. What can the student best deal with, and when can he best deal with it? For example, should the new student go first to the airplane for an introductory flight, or should he have a full-fledged lesson with specific learning outcomes, or should he have the first lesson in the simulator, where he learns only about the operation of the aircraft? The choices at every step are numerous. The above example demonstrates that the selection of the learning experiences and their organization are closely intertwined.

The curriculum must deal with educational philosophies, and balance them against the more mundane consideration of resources and finances. If money is no object, the latitude in organization of learning experiences, and the selection of them, is quite broad. When, however, the designer is dealing with limited funding either from the student, or from another resource, he must frequently compromise the ideal with the realistic. The ideal may be considered to provide "integrated" instruction, wherein academics and in-flight experiences are interlaced. The cost to the institution or the student may dictate that the academics be totally separated from the in-flight experiences. Frequently the choices are far from easy.

Step 7. Determine what should be evaluated and the methods of evaluation. Is the curriculum working? How can we find out? How well is it working? This step is as important as the six preceding steps. The curriculum must be validated to assure that it is providing the results for which it was designed. In aviation the success of the curriculum is critical. Flaws can be expensive in lives and money. Clearly, the pilot completing the curriculum must be able to demonstrate skills, and there are many ways to test this, the most popular being the check flight. The acquisition of flight time or experience is not enough. Demonstration of specific skills is mandatory. But there is not enough time, nor are there enough resources, to demonstrate all of the skills a pilot must acquire, so selection of those skills which incorporate other skills, and optimise the check flight is imperative. For example, a perfectly executed instrument approach unequivocally demonstrates the pilot's ability to fly the airplane in straight-and-level flight, in climbs, glides, and turns with reference solely to the instruments. But, must the approach be perfect? That is a question in all evaluation. What are the criteria which establish acceptable performance? Again, the curriculum designer must spend considerable thought.

Determining the student's success in achieving the goals of any curriculum in only half of the evaluation process. The program must, itself, be evaluated constantly. Expecially in aviation, which is so dynamic, the curriculum must be evaluated constantly to assure that every thing new is covered. One method is to review all documentation originally used to provide the content for the curriculum, and glean any new elements. This, combined with review of all current aviation literature, assures better currency. Perhaps a survey of aviators to learn their ideas will strenghthen the evauluation of content. Feedback from students who have completed the curriculum and have experience in the field is slow, and lags behind other methods of gaining information, but it has its uses in curriculum evaluation. In maintaining the recency of the curriculum, the designer has an ongoing job.

CONCLUSIONS

Designing an aviation curriculum is not unlike designing any curriculum. The aviator would not attempt to design a curriculum in psychiatry unless he is also a psychiatrist. Aviation curriculum designers must be aviators. They must also be cross-qualified in curriculum design. Attaining this skill ought not to be difficult for the aviator. The ability to organize already exists. The curriculum designer has many models from which to choose. Some are perhaps too simple for effective design, especially for the neophyte. When the aviation curriculum designer chooses his model of design, he is well on the way to an effective curriculum. Of course, the curriculum designer must know his resources as well as his subject.

No step in any curriculum design is totally independent of the other steps. At the very least, decisions made in later steps may require the alteration of an earlier step. The designer should be fully prepared to this to happen, and should respond accordingly.

REFERENCES

Dressel, Paul Leroy

College and the university curriculum. Berkeley, CA.; McCutcham, 1968.

Goodlad, John.

The dynamics of educational change. New York; McGraw-Hill, 1975.

Hass, Glen and Wiles, Kimball, ed.
Readings in curriculum. Boston: Allyn and Bacon, 1965.

The illustrated encyclopedia of aviation and space, formerly above and beyond. Los Angeles: AFE Pres, 1971.

McDermott, Pamela M.
A standardized aviation pilot training program. Ann Arbor, MI.: University Microfilms, 1983.

Taba, Hilda.
Curriculum development: theory and practice. New York: Harcourt, Brace and World, 1962.

Tyler, Ralph W.
Basic principles ofcurriculum and instruction. Chicago: University of Chicago Press, 1950.

This page intentionally left blank.

This Page intentionally left blank.

REVIEWER NOTES

A Review by Richard Kraemer of the Paper "Strategic Identification Of Domestic Air Express Markets: Assessing Alabama's Market Potential"

Professor Henry B. Burdg provides a well documented history and description of the air express market which has quadrupled in the past ten years. The major metropolitan areas are becoming saturated with blossoming companies scrambling for a piece of the action. Serious interest in developing methodology for evaluating marginal market is surfacing.

The author presents a simple model for predicting the expected number of express parcels generated per day as a function of the number of employees in industry classifications and a useage rate per employee for that industry. Census data provides the employee and industry numbers. Survey data from air express carriers was used to calculate useage rates per industry.

The author's well documented look at the elasticity of demand for air express relative to the standard variables raises some interesting characteristics. Studies that show a zero price elasticity are supported by the previously discussed express urgency characterisitic "where the price of the service loses its significance in relation to the concept of place utility". This along with a strongly positive income elasticity and a positive rather than negative impact from other means of freight services all seem to support the author's simple model.

The author applies his model to data for the state of Alabama producing reasonable values of potential and valuable information about the regions of the state where that potential exists. This well written and well documented thesis may prove to be a valuable tool for the air express industry to analyze market potential in detail. Detailed market knowledge will produce better business decisions resulting in continued success of the industry and maximum service to the users.

A Review by Richard Kraemer of the Paper "Facilities Planning For Aviation Education"

Professors Hutchings and Geibel have provided us with a thorough, detailed chronology in theory and in practice of the "right way" to go about planning facilities for aviation education. The tasks and activities in the state of the art of the facilities planning process are initially introduced and defined clearly, concisely and briefly enough to be valuable to those of us not trained in these matters. The rest of the paper is a well articulated discussion of the application of these principles and methodology at the University of Illinois Institute of Aviation facilities.

The comprehensiveness required for most effective facilities planning is demonstrated in the breadth of academic and facility development studies pursued and the depth of the methodology applied to the physical planning done. The superior product produced from the application of such detailed, complex, professional planning expertise demonstrates the need for this expertise and the need for continuous interaction between the aviation faculty users and the design professionals. This need so strongly emphasized and demonstrated in the paper is also reflected in the disciplines of the co-authors.

The Institute Of Aviation tapped a highly competent and cost effective source of comprehensive facilities planning assistance through their collaboration with the School Of Architecture at U. of Ill. The professional and personal interaction of the two different faculty groups was much more than would have occurred with commercial consulting and the benefit to the university is twice as great. Besides the professional growth of the faculty, the professional and educational experience provided to the students by the activities is at the highest level of the goals of our educational institutions.

The requirement for flexibility and adaptability of facilities planning is demonstrated by the evolution of the Institute plan over the 10 year period of major activity in the recent past. The Institute Of Aviation experience has demonstrated the fruits of perserverence described as one of the binding ingredients of the formula for success in the quest for facilities. The hard work that was done when no funds were available paved the way for creating and maximizing the benefit of funding sources. As facility funding opportunities arise, maximum advantage will be obtained because of the comprehensive and thorough planning that has been prepared.

A Review by Richard Kraemer of the Paper "Curriculum Development/Integration Single Concept Simulation"

Professor Richard A. Molenaar has described a learning enhancement scheme, being developed at the University of North Dakota. The aim is to improve the rate, depth, and timeliness of acquiring understanding of individual flight training elements of knowledge or "single concepts". This is accomplished through the use of "simulation" at an earlier stage of training and in a simpler and less costly format than has been traditionally done.

Although not well described, the simulation format appears to be an application of student interactive computer programming using the mini/micro computer industry hardware and software. If there has been any development or utilization of hardware, software, or curriculum associated with this project it is unfortunate that these were not described in more detail in the paper.

The author makes a good case for the specific advantages of single concept simulation with well documented learning enhancement principles such as rapid reinforcement, non-threatening environment, utilizing knowledge in situations requiring active participation, and the multi-sensory see, hear and do. However, I disagree with most of the generalities and opinions the author states in the beginning of the paper concerning the integration of flight and ground curriculums. Almost any pilot educator would disagree with some of the statements made by the author. None of those statements are necessary for the communication of the single concept simulation idea or the establishment of its potential value in pilot training curricula. Readers can be unnecessarily antagonized or alienated before reaching the material the author really wants to talk about. If page two were removed and replaced later on with a page describing more of what the author is actually doing or directing to be done, the paper could be a better piece of work.

A Review By Richard Kraemer of the Paper "An Integrated, Module Based, Flight Training Program"

Dr. John H. Schultz states what we in the business all know to be true about college flight training: "That the training program, except for the quality of the ground school classes, on the whole, (is) only marginally better than that which (can) be gotten at any good independent (commercial) flight school". This is because most college programs do not control the flight training.

A few changes were made in the flight training program at Daniel Webster College. The college secured exclusive use of a complement of new conventional and unconventional training aircraft and took complete control of the flight training component of their program. They designed a four year degree program around eight basic training modules. These were based on the mastery of a body of aeronautical knowledge and critical flying skills appropriate to the developmental level of the student at that stage of training. They are not based on FAA minimum standards or license certification requirements. The modules combine the use of classroom instruction, texts and other professional reading, video learning labs, advanced computer managed flight simulators free to students, and intensive aircraft flight instruction in a range of machines, from motor gliders to standard and advanced trainers, including high performance aerobatic trainers. The intent was to attract those professional career minded students who have the motivation, intelligence and commitment to take advantage of it while recapturing the spirit which attracts students to flight and sustaining that interest once they had made the commitment.

The author has carefully, quietly and competently reported to the world that every pilot educator's wildest dream is alive and well at Daniel Webster College. I have personally designed this same program in collaboration with several faculties at several colleges as have many others in the field of pilot training. Dr. Schultz and company have succeeded magnificently where I have always failed miserably. My hat is off to you as I am sure is true for the vast majority of college pilot training faculty.

It is important to realize the all important but very subtle ingredient in the success of this effort. Without the political and financial support and commitment of the college, this outstanding program would be another stack of proposals gathering dust along with the rest of ours. The college listened to the faculty, believed they knew what they were doing and took the risk to let them try it. The result, as every faculty tries to convince their college, is a unique program where "flight students can be exposed to 40% more material and significantly higher quality experiences yet with a substantial net decrease in cost". "The overwhelming response of the students (is) reflected in the highest retention rate among flight students that the college has ever experienced". The faculty is proud and happy, the students are proud and happy, the college is proud and happy. Are you listening administrators, deans and presidents? Your aviation faculty is.

A Review by Richard Kraemer of the Paper "Aviation Curriculum Design"

Dr. Pamela M. McDermott has researched the education literature to determine accepted organizational steps in curricular design models. She has selected one seven step model, and used it to "discuss some strategies for developing aviation (pilot) curricula".

The seven step curricula design organization model chosen by the author is surprisingly similar to the seven step F.A.A. standard lesson plan organization model learned by all F.A.A. flight instructors: Objective, Elements, Schedule, Equipment, Instructor's Actions, Student's Actions, Completion Standards. We have all carried this organizational model with us as we have "cross-qualified" from flight instructors to college educators. It is comforting to learn that this "checklist" is probably a very good one. However, continuing with the author's airplane checklist analogy; there are many check lists that begin with the step "exterior inspection complete". We need to know more of the meat of exactly what must be done, why it is important, and how these actions relate to the total success of the aircraft operation.

If the author, as chairperson of a university flight department, has actually designed a flight training or other aviation curriculum, as indicated in the references for this paper, then sharing that creation and any experience in using it would be most beneficial. Dr. McDermott has apparently done substantial and creative work in determining appropriate content for pilot training curricula as alluded to in the body of the paper being reviewed here. Having been the recipient of F.A.A., university, and military pilot and flight instructor training, I would be very interested in the author's list of 765 flight training elements and those included in the 94% that were validated for training up to specialization. That information would be something that could help improve university pilot training curricula because it is the validated substance of the content to be selected from in step 3 of Dr. McDermott's chosen curriculum design organizational model.