“METRO” A NEW CONCEPT
IN AIRPORT DESIGN
THESIS PROJECT 1976
WILLIAM J. FENTON
- PROGRAM
  SITE SELECTION
  SITE ANALYSIS
  SITE DEVELOPMENT
  SCHEMATICS
INTRODUCTION:

The purpose of this project is to design an airport which can best serve and be served by the Indianapolis area. Airports are currently being planned ten and twenty years in advance and are still out of date by the time they are ready for service. Due to dwindling surpluses of land, rising costs, over crowded airspace, and other factors, it has become necessary to improve, and improve the utilization of, existing airfields as the prime method of meeting future airport needs.

Given the location of Indianapolis and the excellent system of highways available, the city has truly become the "Crossroads of America". This area is already one of the nation's largest freight distribution centers and has proven a profitable area for industrial development both large and small.

With this idea in mind, I propose an airport facility which would specialize in the areas of "Corporate Jets" and "Air Cargo" operations. In other words this airport would cater to the business person and the type plane a corporation might own and operate.
PROJECT PROPOSAL:

The purpose of this thesis project shall be to plan a facility which will fulfill a current need while at the same time looking ahead and planning for future trends. I have had a special interest in selecting a project in the public service area, and in particular the "Air Transportation Industry". Air transportation of any kind is currently expanding at phenomenal rates. Airports are being planned 10 and 20 years in advance and are still out of date by the time they are ready for service. Due to, dwindling surpluses of land, rising costs, over crowded airspace, and other factors, it has become necessary to improve the utilization of existing airfields as the primary method of meeting future airport needs.

One of the ways available to the planner confronted with the problems of most effective utilization of multiple landing fields in a large metropolitan area is the designation of certain or all fields as single-purpose airports. Changing technology and procedures relative to aircraft size, safety, maintenance, and air traffic control, indicate the need for segregating various types of air operations wherever practical. A form of specialized airports can be visualized for a variety of purposes. Some of the advantages of a specialized Airport System would be:
- Improved air traffic safety, routes could be more clearly delineated and operating zones of certain types of aircraft more readily prescribed.
- Better location of airfields in relation to problems of noise, height limitations, climatic conditions, and ground transportation networks.
- Passenger service and service facilities may concentrate on the effective handling and processing of a particular kind of traveler.
- Improved ground transportation and air feeder-system planning.
- Decreased cost of airport facilities because these also would be specialized to meet a specific need.
- Better handling of air cargo through the improved utilization and efficiency of specialized cargo processing and handling equipment.
- Better design, runways, taxiways, parking, fueling, and terminal facilities, can be specifically designed for specialized needs.

The basic capabilities of such airports differ in each metropolitan area because of differences in weather, geography, size and type of ground transportation network, and demand. It has been my decision to work with the
Indianapolis metropolitan area because it is most familiar to me. A map of this area and the airport sites considered is on the next page. This area consists of the eight counties surrounding Indianapolis for which the Indianapolis Metropolitan Planning Commission is responsible. This Commission has developed an Airport System Plan for the area which will involve the construction of a new "reliever" airport for the city, to be built on the south-east side of town, and improvements made on several surrounding smaller airports. Though their plan does not involve an airport such as the one I am proposing, the information the plan has provided has been most useful.

Due to the location of the Indianapolis area and the excellent system of hiways available, the city has truly become the "Cross-roads of America". This area is already one of the largest freight distribution centers in the country and has proven a profitable area for industrial development both large and small. According to the U.S. Chamber of Commerce one of the most important factors
in industrial site selection is airport availability and whether it is convenient for transportation of goods and personnel. With this idea in mind I propose an airport facility which would not only offer the necessary services, but would specialize in the areas of "corporate jets" and "air cargo" operations. The FAA predicts that within 10 years private corporations and individuals will be flying 8,000 jet aircrafts while domestic airlines will have only 3,500.
OBJECTIVE:

According to FAA regulations this airport will be classified as a "Basic Transport" type airport. That is, it will be able to handle planes up to 60,000 pounds and have a primary runway of between 4,000 - 5,400 feet. This will accommodate up to 100% of the current "corporate jet" fleet depending on climatic conditions and most of the air cargo planes used by these corporations.

There is no attempt being made in this project to handle the large cargo planes (above 60,000 pounds) due to size and weight. These planes are currently being serviced by Wier Cook Airport on the southwest side of Indianapolis and it would defeat the purpose of this specialized airport to include them in the scheme.

Further design specifications for this class airport can be found in Advisory Circular 150/5300-6 published by the Federal Aviation Administration.

This facility will involve three basic areas of operation:

A. TERMINAL FACILITY CATERING TO THE "CORPORATE JET" TYPE CUSTOMER. This is the part of the airport where a person waits for his flight whether he is waiting for a charter service or his own plane to be readied. The terminal
will house the pilot as well as the passenger service areas and the personnel and equipment providing the services. A forecast of future expected aircraft that would use such a terminal in this area is given below.

**FORECAST OF AIR CARRIER OPERATIONS**

<table>
<thead>
<tr>
<th>Year</th>
<th>Scheduled</th>
<th>Other</th>
<th>Air Taxi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>82,274</td>
<td>15,148</td>
<td>17,592</td>
<td>115,014</td>
</tr>
<tr>
<td>1975</td>
<td>86,000</td>
<td>19,000</td>
<td>18,500</td>
<td>123,500</td>
</tr>
<tr>
<td>1980</td>
<td>103,000</td>
<td>27,000</td>
<td>19,000</td>
<td>149,000</td>
</tr>
<tr>
<td>1985</td>
<td>120,000</td>
<td>30,000</td>
<td>20,000</td>
<td>170,000</td>
</tr>
<tr>
<td>1990</td>
<td>135,000</td>
<td>30,000</td>
<td>21,000</td>
<td>186,000</td>
</tr>
<tr>
<td>1995</td>
<td>140,000</td>
<td>30,000</td>
<td>22,000</td>
<td>192,000</td>
</tr>
</tbody>
</table>

**B. "AIR CARGO" FACILITY INCLUDING PROCESSING AND STORAGE:** As airports and freight forwarders develop larger and more efficient facilities for transshipment of air cargo from shipping point to final delivery point, the future of air cargo will be greatly improved. Speed of shipment on long hauls is the prime inducement to ship by air. Many shippers find the higher unit cost of air cargo more than justified by reduced requirements for on-hand stock inventories. This facility will have to be able to transfer goods from one mode of transportation to another quickly and efficiently as well
as have the storage capabilities of long
and short term warehousing. A forecast of the
future expected cargo operations in this
area is illustrated below.

MAIL AND CARGO FORECAST
(Annual Tons Enplaned)

<table>
<thead>
<tr>
<th>Year</th>
<th>Mail</th>
<th>Freight</th>
<th>Express</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>8,223</td>
<td>20,620</td>
<td>1,843</td>
<td>22,463</td>
</tr>
<tr>
<td>1975</td>
<td>10,000</td>
<td>30,000</td>
<td>3,000</td>
<td>33,000</td>
</tr>
<tr>
<td>1980</td>
<td>13,000</td>
<td>50,000</td>
<td>4,000</td>
<td>54,000</td>
</tr>
<tr>
<td>1985</td>
<td>17,000</td>
<td>76,500</td>
<td>5,500</td>
<td>82,000</td>
</tr>
<tr>
<td>1990</td>
<td>21,000</td>
<td>107,000</td>
<td>8,000</td>
<td>115,000</td>
</tr>
<tr>
<td>1995</td>
<td>25,000</td>
<td>139,000</td>
<td>11,000</td>
<td>150,000</td>
</tr>
</tbody>
</table>

C. BASIC AIRPORT SERVICES REQUIRED BY THE FEDERAL AVIATION ADMINISTRATION: This facility will involve such building components as the tower, fuel storage, emergency equipment and hangers. Most design considerations are predetermined by strict codes and regulations issued by the FAA so only the need and location shall be given.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>NON-PRECISION RUNWAY</th>
<th>PRECISION RUNWAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DIM</td>
<td>A/2</td>
</tr>
<tr>
<td>Runway Length</td>
<td>A</td>
<td>See Figures 5, 6 and 7</td>
</tr>
<tr>
<td>Width-Runway</td>
<td>B</td>
<td>75'</td>
</tr>
<tr>
<td>-Taxiway</td>
<td>C</td>
<td>40'/3</td>
</tr>
<tr>
<td>-Runway Safety Area</td>
<td>D</td>
<td>150'</td>
</tr>
<tr>
<td>Runway Centerline to</td>
<td>E</td>
<td>200'</td>
</tr>
<tr>
<td>-Taxiway Centerline</td>
<td>F</td>
<td>275'</td>
</tr>
<tr>
<td>-Airplane Parking Area</td>
<td>G</td>
<td>As Per Current FAA Criteria</td>
</tr>
<tr>
<td>Parallel Runway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxiway Centerline to</td>
<td>H</td>
<td>75'</td>
</tr>
<tr>
<td>-Airplane Parking Area</td>
<td>I</td>
<td>50'</td>
</tr>
<tr>
<td>-Fixed or Movable Obstacle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Parallel Taxiway</td>
<td>J</td>
<td>150'</td>
</tr>
<tr>
<td>Building Restriction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line to</td>
<td>K</td>
<td>250'</td>
</tr>
<tr>
<td>-Runway Centerline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Taxiway Centerline</td>
<td>L</td>
<td>50'</td>
</tr>
</tbody>
</table>

/1 Letters are keyed to those shown as dimensions on Figure 3.

/2 Basic Transport Column A is to be used only at those low activity sites where an existing utility runway, having no anticipated need for an instrument approach procedure of any kind, is extended for business jets. For all other basic transport airports use Column B.

/3 Make straight taxiway sections 50 feet when airplanes with a wheel tread over 25 feet will use the airport. A width of 60 feet will be required for airplanes with tread over 35 feet. Make curved sections conform to Figure 8.

FIGURE 2. DIMENSIONAL STANDARDS, BASIC AND GENERAL TRANSPORT AIRPORTS
ARRIVE AT THE AIRPORT

- AT RESTAURANT
  - TICKET COUNTER
  - CHECK BAGGAGE
  - EAT AT RESTAURANT
  - WAIT IN LOUNGE FOR FLIGHT
  - CATCH FLIGHT

- FLY AIR CHARTER
  - GO TO HANGER
  - WAIT IN LOUNGE FOR PLANE PREP.
  - PREPARE FLIGHT PLAN
  - HAVE DRINK AT BAR
  - CHECK WEATHER
  - CATCH PLANE

- FLY PRIVATE OWNED PLANE
  - ATTEND CONFERENCE

Flow diagram for the use of the terminal facility.
Flow diagram for the use of the Air Cargo facility.
SITE REQUIREMENTS:

Site selection was a very important part of this project. Due to the nature of a specialized airport it is necessary to match the location with the particular airports task in mind. The proper site also had to meet the following requirements.

- It had to be relatively flat and free from obstructions.
- It had to be readily accessible from major hiway arteries.
- It was necessary for it to be close to the Indianapolis area.
- It could not interfere with the air-routes of other major airports in the area.
- There should be little if any residential build-up due to problems of noise pollution.
- Zoning had to be of a compatible nature.

The site selected is that of the Indianapolis Metropolitan Airport currently owned and operated by the Indianapolis Airport Authority. This airport is located nine miles northeast of Indianapolis in Hamilton county. It is easily accessible from Interstate hiway 69 on the east side via 96th street and 106th street and from 465 to the south via Allisonville road. It is currently classified as a "Basic Utility" airport with plans for limited expansion.
to a "General Utility" airport. The area is sparcely populated and mostly wooded which will make it necessary for tree removal to accommodate expansion of any kind.

Development of the site for this project will be to the north and the east. The central portion of the site is relatively flat and there should be no problem in building a new primary runway and parallel taxiway of approximately 5,400 feet. The present runway and taxiway can be lengthened to 3,300 feet as is currently being planned by the airport authorities. Further airport site requirements can be found in Advisory Circular 150/5300-2B published by the FAA. A Norfolk and Western railroad line penetrates the southwest corner of the site and should be given consideration for future expansion of the air cargo terminal.
CLIMATE:

1. SUN

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>April</th>
<th>July</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunrise</td>
<td>7:45</td>
<td>5:40</td>
<td>4:40</td>
<td>6:35</td>
</tr>
<tr>
<td>Sunset</td>
<td>6:15</td>
<td>8:20</td>
<td>9:25</td>
<td>6:35</td>
</tr>
<tr>
<td>Daylight</td>
<td>10.5 hrs.</td>
<td>14-75 hrs.</td>
<td>16-75 hrs.</td>
<td>11 hrs.</td>
</tr>
<tr>
<td>Angle of Sun at noon</td>
<td>28°</td>
<td>60°</td>
<td>70°</td>
<td>38°</td>
</tr>
</tbody>
</table>

2. CLOUD COVER

Clear: 30 days
Partly cloudy: 108 days
Cloudy: 177 days

3. TEMPERATURE

Average daily maximum: 59.7° F.
Average daily minimum: 40.9° F.
Degree days per year: 6,205

4. PRECIPITATION

Average precipitation per year: 35.31 inches
Greatest precipitation: June; 4.17 inches
Least precipitation: December; 2.09 inches
Average total snowfall: 30.3 inches

5. WIND

Average speed: 10.2 MPH
Prevailing direction from April through October: South-West
Prevailing direction from November through March: North-West
BUILDING REQUIREMENTS:

A. TERMINAL FACILITY

Administration

1. Charter service office 2@ 200SF= 400 SF.
2. Car rental office 200 SF.
3. Conference room 500 SF.
4. Pilot preparation 600 SF.
5. General manager 300 SF.
6. Administrative offices 2,000 SF.
7. Storage 500 SF.
8. Restrooms 500 SF.
9. Waiting area 4,000 SF.

Eating

10. Dining 6,000 SF.
11. Bar 1,000 SF.
12. Fast food 1,000 SF.
13. Food preparation 2,000 SF.
14. Dish washing 500 SF.
15. Storage 1,000 SF.
16. Employee lounge & rest rooms 1,200 SF.

Services

17. Public restrooms 1,000 SF.
18. Storage and circulation 2,000 SF.
19. Mechanical 3,800 SF.

TOTAL 28,500 SF.

B. AIR CARGO FACILITY

1. Long term warehouse 45,000 SF.
2. Short term warehouse 15,000 SF.
3. Processing 6,000 SF.
4. General offices 1,000 SF.
5. Truck dock 4,000 SF.
6. Cargo flight gate 4,000 SF.
7. Restrooms & employee lounge 1,500 SF.
8. Vending machines 800 SF.
9. Maintenance storage 1,000 SF.
10. Mechanical 6,000 SF.

TOTAL 84,300 SF.

C. AIRPORT "SERVICE" FACILITIES

1. Tower 28,500 SF.
2. Emergency equipment +84,300 SF.
3. Fuel storage
4. Hangers

Combined Total 112,800 SF.
DESIGN DEVELOPMENT
PRELIMINARY DESIGN
- DETAIL DEVELOPMENT
FINAL DESIGN
BIBLIOGRAPHY:

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INTERVIEWS:
DONALD V. MANLEY- AERONAUTICS COMMISSION OF INDIANA
CHUCK McLEAN- AIRPORT MANAGER
LAWRENCE REESE- AIRPORT OWNER
INDIANAPOLIS METROPOLITAN PLANNING COMMISSION
AIRPORT AUTHORITY - WIER COOK
PILOTS WHO'VE FLOWN THEIR OWN PLANE.
OTHER:
METROPOLITAN AIRPORT SYSTEM PLAN; 1975 Study By
Arnold Thompson Assoc.
Federal Aviation Administration ADVISORY CIRCULAR
150/5300-6
Federal Aviation Administration ADVISORY CIRCULAR
150/5300-2B

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