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STUDY OF QUIET TURBOFAN STOL AIRCRAFT
FOR
SHORT-HAUL TRANSPORTATION

FINAL REPORT

VOLUME VI

SYSTEMS ANALYSIS

JUNE 1973

Prepared Under Contract No. NAS2-6994

for

ADVANCED CONCEPTS AND MISSIONS DIVISION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MOFFETT FIELD, CALIFORNIA 94035

Douglas Aircraft Company - Long Beach

FOREWORD

This document is one of six volumes which comprises the final report of a contract study performed for NASA, "Study of Quiet Turbofan STOL Aircraft for Short-Haul Transportation," by the Douglas Aircraft Company, McDonnell Douglas Corporation.

The NASA technical monitor for the study was R. C. Savin, Advanced Concepts and Missions Division, Ames Research Center, California.

The Douglas program manager for the study was L. S. Rochte. He was assisted by study managers who prepared the analyses contained in the technical volumes shown below.

Volume I	Summary	
Volume II	Aircraft	L. V. Malthan
Volume III	Airports	J. K. Moore
Volume IV	Markets	G. R. Morrissey
Volume V	Economics	M. M. Platte
Volume VI	Systems Analysis	J. Seif

The participation of the airline subcontractors, (Air California, Allegheny, American and United), throughout the study was coordinated by J. A. Stern.

The one year study, initiated in May 1972, was divided into two phases. The final report covers both phases.

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SUMMARY

The primary approach in Phase I was to develop and apply parametric analyses of candidate systems - aircraft, airport, airline and operational. These analyses were performed in the framework of a 1980 scenario for three representative regions of the United States. A representative network of airport pairs was selected to serve the demand for short-haul service in each of the three representative regions. The ranges included were less than 575 statute miles (925 Km). System networks comprised representative routes for the California, Northeast, and Chicago Regions. Simulated airline operations provided a technique for evaluation and selection of STOL transportation systems including aircraft. Aircraft Analysis, starting from seven hard point designs, proceeded through a full matrix of 202 parametric aircraft from which 53 point designs were screened. Detail analysis reduced the candidates to 20 aircraft that were subjected to the systems analysis phase of the study. Methodologies were developed by Airport Analysis to define requirements for airports. Emphasis was placed on assessing requirements for community acceptance of STOL service. Selected airports were analyzed for suitability in the regional networks. Market Analysis had the basic task of developing patronage levels for the 1980/1985 time period. These data, expressed as a baseline demand for STOL air travel, quantified the simulation of an airline operation to serve the markets in the three representative regions. Economics Analysis established a basic set of acquisition and operational cost data. From these, evaluations were made of potential economic viability of STOL systems concepts. Operations Analysis designed representative systems concepts to effect airline realism.

The results of the studies and analyses of the five discipline areas were synthesized to develop the selection process for the recommendation of aircraft and transportation systems to be studied during Phase II. Systems evaluation of candidate parametric aircraft resulted in the selection of eight aircraft configurations. Various STOL aircraft concepts were investigated and performance characteristics derived. Point design of aircraft permitted computation of economic characteristics for each system concept. The preliminary costs estimates were used in selection of candidate concepts for Phase II study. Networks were selected as combinations of contemporary air-carrier airports, secondary general aviation sites, and new dedicated STOLports. Major carrier sites were considered both with dedicated STOL runways and terminals and with co-mingling of STOL and CTOL traffic where feasible.

Methodologies were refined in Phase I and expanded in Phase II to simulate system operational basing, and maintenance concepts. Evaluation of fleet planning and system activity results in each region revealed a need for expanding the regional studies. Both the magnitude of networks and the complexity of airport types in the network required this expansion to provide the evaluation base for STOL concepts. The expansion resulted in revisions to each of the three Phase I regions and the addition of four more, including Hawaii, which was studied analytically.

During the course of Phase II analyses, a detailed examination was made of system performance in meeting a system objective of major airport congestion relief. A target was selected of 20 percent removal of aircraft movements from air carrier airports which are predicted to have a saturated congestion status in 1985 and shift of short-haul to STOL at constrained airports. Five major airports were examined with flight operations results from the initial set of travel demand data from the market analysis. Relief was not sufficient to satisfy the objective of significant reductions for all cases. The allocation and distribution of travelers from the baseline travel demand market was changed to extend the original baseline regional networks and also to include low-density routes. Results of the reevaluation of these changes were to expand the total estimate of STOL aircraft needed in the U.S. domestic market and to achieve a more satisfactory relief of congestion of the selected major air carrier airports.

Evaluation of regional simulations with the expanded/extended network demand allocation showed a minimum need for a total U.S. domestic fleet of 426 STOL aircraft of 150 seat capacity. Estimates were made for the 100 and 200 passenger capacity aircraft as alternate sizes using the same Baseline Market Demand. Fleet numbers for the 1985 traffic level are 643 (100 seat) or 324 (200 seat) aircraft. It was revealed in the study that use of the 150 passenger aircraft resulted in the most desirable operations in all of the regions.

The market analysis evaluation of demand for STOL aircraft is based upon the high-density routes (300,000 or more annual O and D travelers annually). A top-down aircraft estimate shows 240 aircraft required in 1985 of the 150 passenger size. This estimate is derived from the demand data in annual passenger miles and aircraft productivity in seat miles per year.

It was not the intention of the study to evaluate which of the various propulsive-lift concepts was the best. However, the Externally Blown Flap, the Augmentor Wing, and Upper Surface Blowing showed capabilities of efficiently achieving short-field performance. The economics of each concept was shown to be sufficiently competitive with projected conventional aircraft (to 1985) to warrant serious STOL aircraft developmental effort.

All of the candidate aircraft were subjected to a number of iterations to refine their weights and performance. The aircraft were then given detailed economic, market, systems analyses, and airport compatibility studies. Aircraft trade studies were performed on noise level, performance trade-offs, landing ground rules, avionics, ride quality, alternate missions, effects of composite materials, and feasibility of military/commercial commonality. A number of final baseline aircraft emerged that had sideline noise levels of 96-98 EPNdB, but were much lighter in takeoff gross weight and were greatly superior in DOC.

These studies showed that a major impact on the aircraft designs was the noise goal of 95 EPNdB. Another important design consideration was field length as determined by the landing ground rules and ground effects. Aircraft tended toward being landing critical with light wing loadings which decreased their ride qualities. It was found that a STOL short-haul aircraft could be modified to fly extended ranges with no significant penalty to its basic short range economics.

Military/Commercial commonality studies showed that such an approach is economically feasible and could produce a viable short-haul STOL aircraft.

One objective of the study was to determine critical technology areas where research and development should be emphasized. Aircraft and airport research and development areas are highlighted in Volumes II and III respectively. Major R and D areas in Operations are oriented toward evaluating the impact (favorable/unfavorable) of STOL operations on the community and contemporary CTOL systems. Integration of STOL with CTOL (interconnect) and with ground access and community transportation systems is another area for future research. Details of Operations R and D are presented in Section 6.2.

Four airlines - Air California, Allegheny, American and United - cooperated in the study by offering valuable assistance in providing airline operations realism. Collectively and singly, the airline participants have reviewed the scenario approach and methodology and contributed to the fleet planning elements in the study.

INTRODUCTION

The Systems Analysis role in the NASA sponsored "Study of Quiet Turbofan Aircraft for Short-Haul Transportation" was to integrate the representative data generated by aircraft, market, and economic analyses. The integration format is schematically diagramed in Figure 6.0-1, System Analysis. Phase I activities of the study were to develop the approach and to refine the methodologies for analytic, tradeoff and sensitivity studies of selected propulsive lift conceptual aircraft and their performance in simulated regional airlines. Phase II activities integrated these methodologies in the selection, development and evaluation of appropriate simulated airlines in each of six geographic regions of the United States. The offshore domestic regions were not originally included, but were later evaluated to provide a complete domestic evaluation of the STOL concept applicability.

The basic study approach, consistent with the activity flow expressed in Figure 6.0-1, was divided into five (5) discipline areas. The role of each is summarized briefly.

- Market Analysis - provide estimates of the demand for short-haul air travel in the 1980-1990 period.
- Airport Analysis - select and evaluate the suitability of strategically located airports from which regional airline operations may be simulated.
- Aircraft Analysis - determine the characteristics of candidate STOL aircraft using the various propulsive lift concepts.

- Economic Analysis - evaluate cost and profitability of each aircraft concept.
- Systems Analysis - create the framework and methodology to integrate the study.
    - Operations Analysis - integrate aircraft and airports into simulated regional airlines with travel demand providing quantification.

SYMBOLS AND ABBREVIATIONS

ACFT	Aircraft
ADAP	Airport and Airway Development Program
ADV	Advanced
AMST	Advanced Medium STOL Transport
AOPM	Airline Operations Planning Model
ARINC	Aeronautical Radio, Inc.
ARTCC	Air Route Traffic Control Centers
ASDE	Airport Surface Detection Equipment
ATA	Air Transport Association
ATC	Air Traffic Control
ATCRBS	ATC Radar Beacon Systems
ATSD	Airborne Traffic Situation Display
AW	Augmentor Wing
BLC	Boundary Layer Control
CAB	Civil Aeronautic Board
CBD	Central Business District
CONUS	Continental United States
CTOL	Conventional Takeoff and Landing
DABS	Discrete Address Beacon System
DEP	Departure
DMC	Direct Maintenance Cost
DME	Distance Measuring Equipment
DOC	Direct Operating Cost
DOT	Department of Transportation
EBF	Externally Blown Flap
E7LS	Fleet Planning and Schedule Evaluation Model
EPNdB	Effective Perceived Noise Level, (dB)
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
F_B	Block Fuel
FL	Field Length
FLIR	Forward Looking Infra-Red
FLT	Flights
FREQ	Frequency
FT	Feet

GHE	Ground Handling Equipment
GNP	Gross National Product
GSE	Ground Support Equipment
HR	Hour
IBF	Internally Blown Flap
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INS	Inertial Navigation System
IOC	Indirect Operating Costs
IPC	Intermittent Positive Control
KG	Kilogram
KM	Kilometers
KPH	Kilometers per Hour
L	Liters
LB	Pound
M	Meter(s)
MF	Mechanical Flap
MC	Maintenance Check
MDC	McDonnell Douglas Corporation
M/HR	Man-Hours
MIN	Minutes
MLGS	Microwave Landing Guidance System (Also MLS)
MODILS	Modular Instrument Landing System
MPH	Miles per Hour
NASA	National Aeronautics and Space Administration
N	Newtons (Force)
N.M.(N.MI.)	Nautical Miles
NEF	Noise Exposure Factor
NO	Number
O & D	Origin and Destination
OH	Overhaul
OPT	Optimum
PNdB	Perceived Noise in dB
PROP	Propeller
PSGR	Passenger
R & D	Research and Development

R-NAV	Area Navigation System
SAE ARP	Society of Automotive Engineers, Aerospace Recommended Practices
SC	Service Check
SCHED	Schedule(d)
ST. MI.	Statute Miles (Also S MI)
STOL	Short Takeoff and Landing
TALAR	Tactical Landing Approach Radar
T_B	Block Time
TPF	Terminating Preflight
USB	Upper Surface Blowing
USG	U. S. Gallons
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VOR	VHF Omni Range
VOR TAC	VOR plus Tactical Air Navigation
VHF	Very High Frequency
W	Weight
- MLW	Maximum Landing Weight
- MRW	Maximum Ramp Weight
- MTOGW	Maximum Takeoff Gross Weight
- MWE	Manufacturer's Weight Empty
- MZFW	Mission Zero Fuel Weight
- OEW	Operator's Empty Weight
YR	Year

Airplane Designations -

In this and other volumes of the report, the following designations are used to denote study aircraft.

E.150 .3000 .70 A

E = EBF
I = IBF
A = AW
U = USB
M = MF
C = CTOL

150: Passenger Payload

.3000: Field Length (Feet)

.70: Cruise Mach Number

A = Allison
G = General Electric

STOL AIRPORTS

CODE	AIRPORT	CITY
ABE	Allentown	Allentown, Penna.
ABQ	Albuquerque Sunport	Albuquerque, N. M.
ACV	Arcata	Eureka, Calif.
AGC	Allegheny County	Pittsburgh, Penna
ALB	Albany County	Albany, N. Y.
ALO	Waterloo	Waterloo, Iowa
AMA	Amarillo Air Terminal	Amarillo, Texas
ASE	Aspen-Pitkin Co.	Aspen, Colo.
AUS	Robert Mueller Municipal	Austin, Texas
AVL	Asheville Municipal	Asheville, No. Car.
AVP	W-B Scranton	Wilkes-Barre/Scranton, Penna.
BDR	Bridgeport	Bridgeport, Conn.
BED	Hanscom Field	Boston, Mass.
BEL	Beltsville	Baltimore, Md.
BFL	Meadows Field	Bakersfield, Calif.
BGM	Broome County	Binghampton, N. Y.
BGR	Bangor International	Bangor, Maine
BHM	Birmingham Municipal	Birmingham, Ala.
BIL	Logan Field	Billings, Mont.
BIS	Bismarck	Bismarck, No. Dak.
BKL	Burke Lakefront	Cleveland, Ohio
BMT	Beaumont	Beaumont, Texas
BNA	Nashville Metropolitan	Nashville, Tenn.
BOI	Boise Air Terminal	Boise, Idaho
BTR	Ryan Field	Baton Rouge, La.
BTV	Burlington International	Burlington, Vt.
BUF	Greater Buffalo	Buffalo, N. Y.
CAE	Columbia Metropolitan	Columbia, S. C.
CAK	Akron/Canton	Akron/Canton, Ohio
CGX	Meigs Field	Chicago, Ill.
CHA	Lovell Field	Chattanooga, Tennessee
CHS	Charleston Municipal	Charleston, S. C.
CID	Cedar Rapids	Cedar Rapids, Iowa
CLT	Douglas Municipal	Charlotte, N. C.
CMH	Port Columbus	Columbus, Ohio

CODE	AIRPORT	CITY
CMI	U of Ill.-Willard	Champaign, Ill.
COS	Peterson Field	Colorado Springs, Colo.
CPR	Casper Air Terminal	Casper, Wyo.
CPS	Bi-State Parks	St. Louis, Mo.
CRP	Corpus Christi Int'l	Corpus Christi, Texas
CVG	Greater Cincinnati	Cincinnati, Ohio
DAB	Daytona Beach Regional	Daytona Beach, Fla.
DAL	Dallas Love Field	Dallas, Texas
DAY	J. M. Cox	Dayton, Ohio
DCA	Washington National	Washington, D. C.
DEC	Decatur	Decatur, Ill.
DEN	Stapleton International	Denver, Colo.
DET	Detroit City	Detroit, Mich.
DLH	Duluth International	Duluth, Minn.
DSM	Des Moines Municipal	Des Moines, Iowa
DYS	Dyess AFB	Abilene, Texas
ELM	Chemung County	Elmira, N. Y.
ELP	El Paso International	El Paso, Texas
EMT	El Monte	El Monte, Calif.
ERI	Erie International	Erie, Penna.
EUG	Mahlon Sweet Field	Eugene, Ore.
EVV	Dress Memorial	Evansville, Ind.
EWN	Simmons-Nott	New Bern, No. Car.
FAR	Hector Field	Fargo, No. Dak.
FAT	Fresno Air Terminal	Fresno, Calif.
FAY	Grannis	Fayetteville, No. Car.
FLL	Hollywood International	Ft. Lauderdale, Fla.
FNT	Bishop	Flint, Mich.
FSD	Foss Field	Sioux Falls, So. Dak.
FTY	Fulton County	Atlanta, Ga.
FWA	Baer Field	Ft. Wayne, Ind.
GDS	Gen. D. Spain	Memphis, Tenn.
GEG	Spokane International	Spokane, Wash.
GFK	Grand Forks International	Grand Forks, No. Dak.
GON	Trumbull	New London/Groton, Conn.
GPF	Gen. Patton Field	Los Angeles, Calif.

CODE	AIRPORT	CITY
GRB	Austin-Straubel	Green Bay, Wisc.
GRR	Kent Co. Cascade	Grand Rapids, Mich.
GSO	Greensboro High Pt.	Greensboro, N. C
GSP	Greenville-Spartanburg	Greenville, So. Car.
HAR	Harrisburg State	Harrisburg, Penna.
HFD	Hartford-Brainard	Hartford, Conn.
HOU	Houston Hobby	Houston, Texas
HPN	Westchester County	New York, N. Y.
HSV	Huntsville Madison Co.	Huntsville, Ala.
HVN	New Haven	New Haven, Conn.
ICT	Wichita Municipal	Wichita, Kan.
Ind	Weir Cook	Indianapolis, Ind.
ISP	Islip MacArthur	New York, N. Y.
ITH	Tompkins County	Ithaca, N. Y.
JAN	A. C. Thompson Field	Jackson, Miss.
JAX	Jacksonville International	Jacksonville, Fla.
LAN	Capital City	Lansing, Mich.
LAS	McCarran International	Las Vegas, Nev.
LBB	Lubbock Regional	Lubbock, Taxas
LEX	Blue Grass	Lexington, Ky.
LGB	Daugherty Field	Long Beach, Calif.
LIT	Adams Field	Little Rock, Ark.
LNK	Lincoln Municipal	Lincoln, Neb.
M4Q	Armory-Monroe Co.	Aberdeen, Miss.
MAF	Midland Odessa Regions	Midland Odessa, Texas
MBS	Tri City	Saginaw, Mich.
MCO	McCoy Air Force Base	Orlando, Fla.
MDW	Midway	Chicago, Ill.
MED	Medford Jackson	Medford, Oregon
MFE	Miller Field	McAllen, Texas
MGM	Dannelly Field	Montgomergy, Ala.
MHT	Manchester Municipal	Manchester, N. H.
MIC	Crystal	Minneapolis-St. Paul, Minn.
MKC	Kansas City Municipal	Kansas City, Mo.
MKE	Gen. Mitchell Field	Milwaukee, Wis.
MLI	Quad City	Moline, Ill.

CODE	AIRPORT	CITY
MLV	Monroe Municipal	Monroe, La.
MOB	Bates Field	Mobile, Ala.
MOF	Moffett Field	Mountain View, Calif.
MRY	Monterey, Pennisula	Monterey, Calif.
MSN	Truax Field	Madison, Wisc.
MYF	Montgomery Field	San Diego, Calif.
NEW	Lakefront	New Orleans, La.
OAK	North Field	Oakland, Calif.
OKC	Will Rogers World	Oklahoma City, Okla.
OMA	Eppley Field	Omaha, Neb.
OPF	Opa Locka	Miami, Fla.
ORF	Norfolk Regional	Norfolk, Va.
ORH	Worcester	Worcester, Mass.
OSH	Wittman	Oshkosh, Wisc.
OWD	Norwood	Boston, Mass.
PBI	Palm Beach International	Palm Beach, Fla.
PDK	DeKalb Peachtree	Atlanta, Ga.
PDX	Portland International	Portland, Ore.
PHF	Patrick Henry	Newport News, Va.
PHX	Phoenix Sky Harbor	Phoenix, Ariz.
PIA	Greater Peoria	Peoria, Ill.
PNE	North Philadelphia	Philadelphia, Penna.
PNS	Pensacola Municipal	Pensacola, Fla.
POI	Presque Isle Municipal	Presque Isle, Maine
PSC	Tri Cities	Pasco, Wash.
PSP	Palm Springs	Palm Springs, Calif.
PVD	Greater Providence	Providence, R. I.
PWM	International Jetport	Portland, Maine
RAP	Rapid City Regional	Rapid City, So. Dak.
RDD	Redding	Redding, Calif.
RDU	Raleigh/Durham	Raleigh Durham, N. C.
RHV	Reid Hillview	San Jose, Calif.
RIC	R. E. Byrd International	Richmond, Va.
RNO	Reno International	Reno, Nev.
ROA	Roanoke Municipal	Roanoke, Va.
ROC	Monroe County	Rochester, N. Y.
RST	Rochester Municipal	Rochester, Minn.

CODE	AIRPORT	CITY
SAL	Sacramento Executive	Sacramento, Calif.
SAT	San Antonio International	San Antonio, Texas
SAV	Savannah Municipal	Savannah, Ga.
SBA	Santa Barbara Municipal	Santa Barbara, Calif.
SBN	St. Joseph County	South Bend, Ind.
SCK	Stockton Field	Stockton, Calif.
SDF	Standiford Field	Louisville, Ky.
SEA	Seattle-Tacoma	Seattle, Wash.
SEC	Secaucus (New Jersey)	New York, N. Y.
SGF	Springfield	Springfield, Mo.
SHV	Shreveport Regional	Shreveport, La.
SLC	Salt Lake City Int'l	Salt Lake City, Utah
SNA	Orange County	Santa Ana, Calif.
SPI	Capital	Springfield, Ill.
SUX	Sioux City	Sioux City, Iowa
SYR	C. E. Hancock	Syracuse, N. Y.
TLH	Tallahassee Municipal	Tallahassee, Fla.
TOL	Toledo Express	Toledo, Ohio
TPA	Tampa International	Tampa, Fla.
TRI	Tri City	Bristol, Tenn.
TUL	Tulsa International	Tulsa, Okla.
TUS	Tucson International	Tucson, Ariz.
TYS	McGhee Tyson	Knoxville, Tenn.
UCA	Oneida County	Utica, N. Y.
VNY	Van Nuys	Van Nuys, Calif.
YKM	Yakima	Yakima, Wash.
YNG	Youngstown	Youngstown, Ohio

1.0 SYSTEM SCENARIO

The study has been conducted within guidelines established for a 1985 time frame. To provide for airline realism, each of the airline subcontractors reviewed and contributed to the development of a system scenario. The basic format of the scenario presents a national air transportation system overview, a projected view of the baseline air transportation system for the whole nation, and regional reviews of baseline transportation systems. Each of these is developed and presented in the following sequence.

National Air Transportation System Overview - 1985.
Baseline National Air Transportation System - 1985.
California Region Baseline Transportation System - 1985.
Northeast Region Baseline Transportation System - 1985.
Chicago Region Baseline Transportation System - 1985.
Northwest Region Baseline Transportation System - 1985.
Southern Region Baseline Transportation System - 1985.
Southeast Region Baseline Transportation System - 1985.

1.1 National Air Transportation System Overview - 1985

1.1.1 <u>Constraints on Growth of Air Travel</u> - A recently completed study by the Aviation Advisory Commission describes primary problem areas affecting the present aviation system in the United States. A principle constraint on growth of the present system exists in noise levels found at major hub airports, as well as some smaller airports located in sensitive community areas. Another constraint on growth exists in air and ground congestion. An illustration of the magnitude of the potential congestion problem is brought out by estimates of 1985 traffic at a level of 2.9 times as great as 1972. The greatest growth will be at those airports which currently are the busiest. Thus, a prime topic for study is the area of current and future constraints upon the air transportation system as a whole. Since the concept of STOL offers some physical characteristics not inherent in a conventional aircraft, it is of interest to evaluate the STOL concept for its effect upon a constrained system. Constraint is a generalized term which is used to describe any form of impediment to free flow of traffic over a given time period. For the purposes of this study, the term is subdivided into the following levels and meanings.

Level 1, Congestion - Physical

This is a specific form of constraint applied to the movement of people or vehicles. Congested airports are those at which movement is restricted and delays or temporary stoppages occur in the movement (flow) of aircraft, airside/airport; people and baggage, terminal; or surface vehicular traffic, groundside, entering or leaving the airport across the airport boundary. This may occur either within the airport boundaries or on the network of surface streets providing community access to the airport. The Level 1 category is applied to those airports which now or in the future projection are congested to a saturation level. In this concept, no additional operations or expansion is possible.

Level 2, Constrained - Physical

Another form of physical congestion but less severe than Level 1. Operations occasionally are interruped and delays occur at peak hours. However, there is sufficient area within the airport boundaries to permit the rearrangement or addition of facilities to restore free movement to aircraft, people or surface vehicles. One example is the airport at Dallas and Ft. Worth, Texas, which includes a separate STOL runway and terminal in its long-range master plan of development.

Level 3, Constrained - Social

A special application of the word used in a social sense wherein restrictions (physical) are placed upon the kind and level of aircraft operations permitted at the airport. Typical constraints are applied in the form of anti-noise flight profile rules, permissible exhaust emission standards, or time-of-day operations restrictions such as prohibiting jet operations between 10:00 PM and 6:00 AM.

Level 4, Congested/Constrained - Social

There are some airports in the U.S. at which there are both physical congestion arising from sheer volume of operational demands and also social constraint of Level 3 nature. Data on those congested/constrained airports included in the Baseline National Air Transportation System Overview - 1985 are included in Appendix A, Supporting Data for Development of STOL Systems Scenario - 1985.

1.1.2 General Descriptors - The series of topical items listed below summarizes a basic review of the important factors affecting the 1985 air transportation system which is projected without consideration of STOL as part of the system.

- Inflation continues into the 1980's at approximately a three percent per year rate.
- Commercial air traffic continues to grow faster than the national rate for the economy - 9.5 percent growth rate for commercial air travel versus 4.3 percent per year for the Gross National Product.
- Surface transportation systems adjust through the decade in response to continued urban population growth, a population shift from the central cores of cities to lower density suburban areas, increased

disposable income per household, and increasingly attentive local and national governments with respect to the solution of surface transportation problems. Technology advances will be found in computerized control systems, bus priority schemes, and improvements in surface commuter lines. To illustrate the relative emphasis placed on ground transportation by the various state governments, it is estimated by the Department of Transportation that about $27 billion will be spent for air transportation improvements during the next 20 years. This in contrast to about $643 billion on other (surface) transport needs. Of the $670 billion, about 84 percent is planned for highway improvements.

- Environmental restrictions will be found in a national standard for smokeless engines in all forms of transportation vehicles. A standard suggested by an airline is the SAE ARP 1179 (20 percent). In addition, invisible emissions from jet engines for aircraft will be reduced from 1972 levels as noted:
  - Hydrocarbons and carbon monoxide reduced 75 percent
  - Oxides of nitrogen by 50 percent.
- Severe pressures will be exerted to reduce noise levels below current levels. The noise issue will continue to be a major deterrent to expanded operations of the national air transportation system. Agreement on standards of measurement may emerge. Various criteria such

as Noise Exposure Factor (NEF), Community Noise Exposure (EPNdB), exposure in acre-minutes and other contemporary standards will eventually be merged into a useful standard as knowledge grows with increases in data and experience. It has been suggested that aircraft noise level of 90 PNdB may be the maximum generally tolerated by communities.

o Although there are some differences of opinion among airline operators, transportation analysts, CAB and the FAA, it seems evident that many major hub airports will suffer congested traffic, both on the runways and in surface access systems. Currently there are at least four hub airports at which congestion is a growing problem. By the 1980 decade, it is anticipated that some 20 to 30 major airports will suffer serious congestion in the absence of decisive efforts to correct the situation.

1.2 Baseline National Air Transportation System - 1985

o There will be an increasingly critical shortage of land for expansion of existing airports or creation of new ones. The new airports at Houston and the Ft. Worth/Dallas region plus the new airport at Kansas City, Missouri are likely to be among if not the last major jetports created in the United States. A new jetport in the Los Angeles area is a possibility but by no means a certainty in the 1980's. It is possible that some existing military or secondary fields will be expanded to handle new classes of traffic.

- The use of advanced technology in aircraft may result in relatively lower direct operating costs as compared with conventional Mach 0.80 commercial aircraft operating in the decade of the 1970's.
- The Air Traffic Control (ATC) system on Federal airways will have been improved as projected in the FAA National Aviation System Plan.
- The world inventory of aircraft projected to 1985 is shown in Figure 1.2-1. The world fleet is projected to grow from about 6700 aircraft in 1980 to some 7500 in 1985. The U. S. fleet was estimated at about 2700 aircraft in 1980. Note that the estimate of 300 at the head of the column represents a combination of the advanced jet and the short-haul aircraft. This reflects the view that there may be only a single new aircraft developed for the 1980's, rather than a new CTOL and a STOL. The bulk of the U. S. fleet thus will consist of aircraft being delivered in the mid 70's. These are both narrow and wide-body jets. There also may be derivations of current aircraft such as stretched DC-10s, or DC-10 Twins, B-747 and L-1011 advanced configurations.

PROJECTED FREE WORLD COMMERCIAL AIRCRAFT INVENTORY

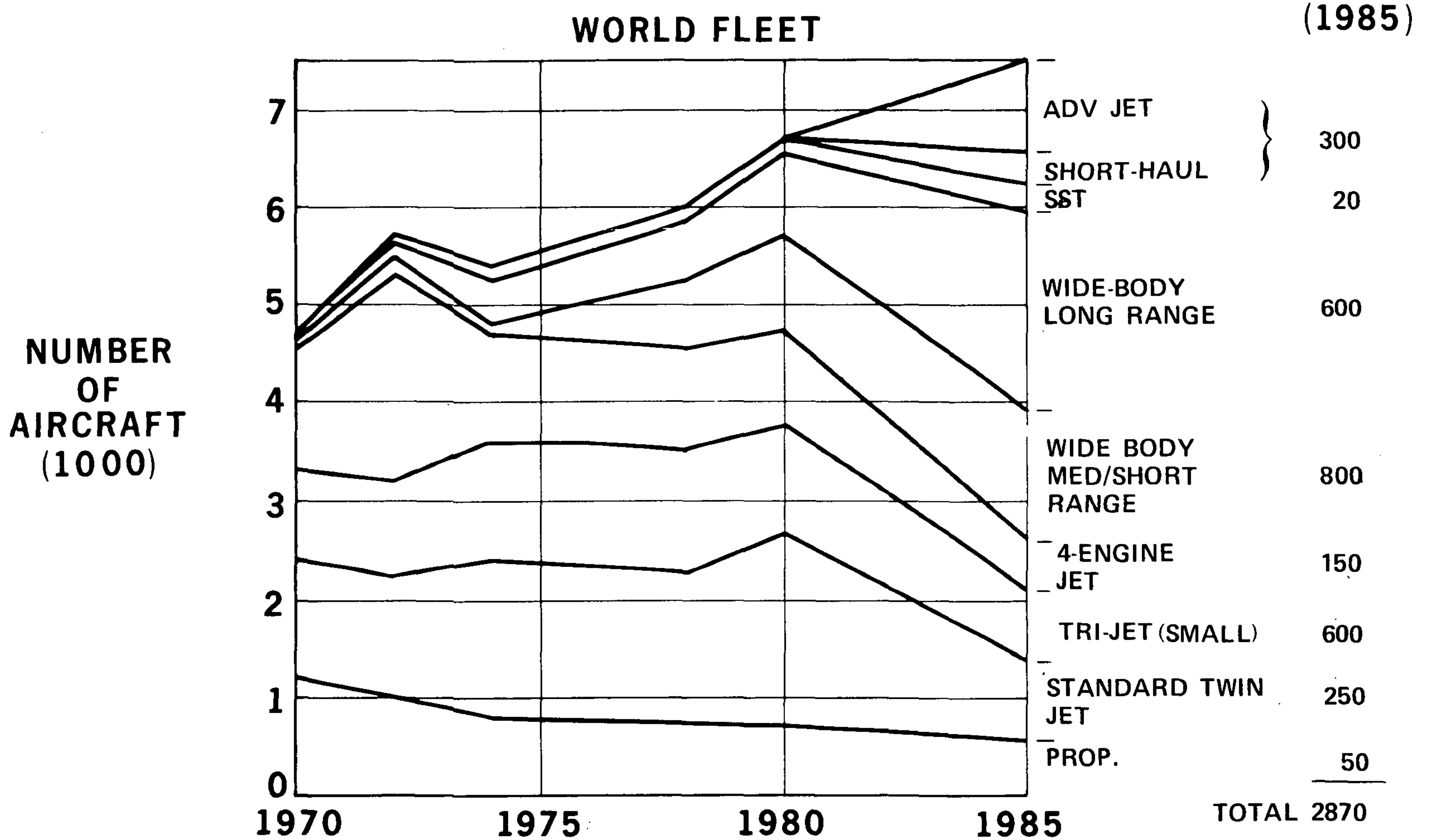


FIGURE 1.2-1

PR2-STOL-1185

1.3 Regional Baseline Transportation Systems - 1985

1.3.1 California Region - Summary descriptors are included herein which are projections from basic data included in Appendix A.

An aviation activity forecast was published by the FAA in July of 1971. Forecasts were made to the year 1982 on enplanements and geographical regions of the U.S. Included also were general economic indicators applicable to the growth trends of commercial aviation. These are summarized for the California Expanded Region and others which follow:

- Growth trends on the West Coast continue the highest in the U.S. Population increases from 10.8 percent of U.S. total in 1966 to 13.2 percent in 1985. Commensurately, personal income increases from 12.2 percent to 14.2 percent by 1985. Air traffic is predicted to grow similarly with activities in the Los Angeles area to show increases in the satellite airports greater than for Los Angeles International. Total growth in air traffic for the Los Angeles area will be much above the U.S. average of 10 percent.
- Serious congestion at airport peak traffic hours occurs at Los Angeles Internation and San Francisco International with less severe congestion at San Diego Lindbergh Field and San Jose. Included in the

Phase II expanded California region are airports at Denver, Colorado, and Las Vegas, Nevada. These, too, are in the congested/constrained category. Numbers of flights are limited to keep peak hour operations manageable. General aviation largely has been excluded. Feeder operations are significant with special terminals established to accommodate the traffic at Los Angeles and San Francisco.

- Rapid transit surface commuter systems have been established to provide good access to both San Francisco International and Oakland International Airports. In Los Angeles, mass transit depends heavily upon motor buses. Extended bus service interlinks Los Angeles, Ventura, and Orange Counties with peak hour traffic on dedicated express freeway lanes.

- Commercial aircraft in routine scheduled operations among the major metropolitan hubs in the extended California region are conventional and wide-body jet. These include DC-9's, B-727's, B-737's, at 150 seats or less, with DC-10's, L-1011's plus derivatives on the high-voulume routes. For high-volume holiday traffic, B-747's are used.

- Although an international airport is planned for Palmdale, delays in construction and development of the complex have prevented shifting any significant amount of traffic from Los Angeles International to

Palmdale. Limited supersonic aircraft operations may be conducted to accommodate overseas traffic which will not be permitted to use Los Angeles International.

- Severe noise constraints exist at several airports in the expanded region. The Federal Government has assumed responsibility for noise-control regulations. At Burbank, Long Beach, and Santa Ana (Orange County) nighttime curfews prohibit jet operations.

1.3.2 Northeast Region - The most concentrated population region of the U.S. lies along a spinal corridor from Washington, D.C., to Boston, Massachusetts. Air travel activity is high in the region. Of the busiest airports in the U.S., six (6) of the top 13 (in 1969) are in the Northeast. The New York/ Newark area has three (3) of these (J.F. Kennedy, 3rd; LaGuardia, 6th; and Newark, 12th). Logan International ranks 10th, Philadelphia International, 13th, and Washington National, 7th, to conclude this listing. Detailed discussion of the major airports is included in Appendix A. Summary descriptions which follow provide a digest of a regional scenario.

- Population in the region will approach 52 million people.
- The urbanized area will continue to grow more than the non-urbanized areas at an increase of about 1.5 million to 6.5 million non-urban dwellers.
- There will be increased highway travel as a result of expanded capacity and automated express control which will allow higher operating speeds.

- o Rail travel will be facilitated by improvements in rail and train technology.
- o Increased income levels will provide a base for a disproportional increase in demand for travel at both intra- and inter-urban levels. Commuter travel distance will increase. Pleasure and personal air travel will increase from 1972 with respect to business travel to about a 6 to 4 ratio.
- o Major traffic flows will follow a central "spinal" route from the Boston area to the Washington, D.C. area. Central Business District (CBD) travel on this route will continue to generate a high fraction of business trips (52% between CBD and another 30% originating or ending in a CBD - 1972 levels).

1.3.3 Chicago Region - As in the Northeast Region, major airports in the Chicago Expanded Region are among the nation's busiest. In the city of Chicago, O'Hare International ranked first (in 1969) in number of passenger enplanements per year. Although Chicago Midway is below its former level of enplanements, airlines have been encouraged to put as much short-haul origin and destination traffic as possible (up to about 180,000 flights per year).

Hopkins International, Cleveland, Ohio, in 1969 ranked 17th in annual U.S. passengers enplaned, Detroit Metropolitan Wayne County, 11th; Greater Pittsburgh, 16th; Stapleton International at Denver, Colorado, 15th; Lambert Field, St. Louis, 14th; and Kansas City Municipal ranked 21st to complete the list of busy airports in the Chicago expanded region. Projections of population growth and personal income in the Chicago Expanded Region are the lowest projected for the nation. Enplanement growth is above average for Minneapolis/St. Paul. Milwaukee is anticipated to benefit from Chicago congestion, and Indianapolis will show a moderate increase above the average. All other major hubs in these states are projected at lower growth rates than the U.S. average. The southern portion of the Chicago region (Iowa, Kansas, Nebraska, and Missouri) shows the nation's lowest growth rate in population and personal income. General growth in enplanements is expected to be slightly below the 10% national average. An exception is found in St. Louis which is forecasted to exceed the 10% growth rate to 1982. Detailed discussions of major hubs in this region are included in Appendix A.

- The city of Chicago continues its historic role as a nodal point in a total traffic pattern.
- Rail and bus traffic show no significant growth with the relative share about constant when compared with national trends.
- Growth rates for CTOL between city pairs range from about 4% Chicago - Milwaukee to about 10% St. Louis - Indianapolis.

1.3.4 <u>Northwest Region</u> - Although regional growth in population and personal income are projected at rates below the national average, the Seattle/Tacoma and Portland hubs are expected to enjoy above average growth rates.

- Enplanements at Seattle/Tacoma and Portland, Oregon, will grow at greater than 10% because of Transpacific and Transpolar flights.
- Rapid growth is expected in the above hubs after the mid-1970's.

- Recreational and vacation travel will continue to grow in relative importance.

- The aerospace industry, forest products exports and generally good foreign trade will contribute to growth of the two major hub metropolitan complexes.

- Spokane will enjoy moderately good growth rates reflecting a resurgence of commercial agriculture in the region.

1.3.5 Southern Region - Both population and personal income in the Southern Region are projected at a level slightly above the national average. The region's share of population will increase from 10.2% in 1966 to 10.4% in 1985 while its share of personal income will be up from 8.3% in 1966 to 8.5% in 1985.

Anticipated growth of air carrier enplanements for the Southern Region is considerably higher than that of the nation in general. Their share of tbe national hub total will increase from 8.9% in 1970 to 9.6% in 1982. Dallas/Ft. Worth and Houston are expected to be the leaders in this expansion, while only San Antonio should perform at a slower rate than the national average. Withdrawal from the Vietnam War is expected to affect San Antonio because of the significant military influence in its economy. Air carrier operations will grow in about the same manner as the national hub average.

- Business travel will increase as a reflection of above average growth of industries.

- Recreation and vacation travel will increase as a function of personal income.

- Large-scale water recreational developments will enable residential, industrial and recreational growth to exceed a national average.

1.3.6 Southeast Region - Although annual population increases for the Southeast Region are only slightly above the U.S. average of 1.3%, the growth of total personal income is expected to be substantially above the 4.6% average. The high growth for the latter series reflects both a low base and an anticipated increase in the business and industrial orientation which is expected to stimulate air carrier activity in the region.

The Southeast Region evidences the largest increase in regional share of air carrier enplanements over the forecast period (16.3% in 1970 to 17.1% in 1982). High growth rates in the region are expected at Atlanta, Ft. Lauderdale, Memphis, Charlotte, and Raleigh/Durham.

The regional share of air carrier operations (17.3% in 1970 to 18.7% in 1982) is also the largest increase of all the regions. This growth is due in part to the high passenger forecasts; however, the short-haul nature of many of the markets in this region moderates the impact of the wide-bodied aircraft which are designed to serve longer-haul markets.

- Although business growth will contribute greatly to increases in air travel, recreational travel will keep pace in the overall growth.

- Urbanization will continue at a rapid pace with most growth occurring in suburbs and communities around the major metropolitan regions.

2.0 SHORT-HAUL SYSTEM OBJECTIVES

A set of objectives for the STOL short-haul system may be created within the general objective of providing a needed or desired service to the traveling public. Figure 2.0-1 presents topical mission objectives for a STOL system. There is an interplay between needs of the public, the operating environment, and physical characteristics of the system. This interplay has a tendency to shape both the demand for service and the system which will supply that service.

Within the overall concept of a STOL aircraft, a set of operating characteristics has been derived. These characteristics are both purposeful and derivative physical attributes which may be utilized to shape and define the system objectives. These are developed in the following text.

Improved Short-Haul Service

A first detailed objective is stated to provide an improvement in short haul service not planned to be or capable of being provided by extension or expansion of the contemporary air transportation system.

Relief of CTOL Congestion

A second objective is to permit shifting of some portion of future short haul travel away from existing conventional airports to other sites. The effect is to narrow the scope of conventional air traffic at major airports to medium- and long-range service. This shifting of traffic away from existing airports will relieve a current or incipient congestion problem. At such "relieved" airports, medium to long haul traffic may resume or continue a dynamic growth into the future. It is expected relief of ground congestion is a corollary of relief of air congestion.

1985 - 1990

STOL SHORT-HAUL MISSION OBJECTIVES

- PROVIDE RELIEF OF TRAFFIC AT CONGESTED AND CONSTRAINED AIR-CARRIER AIRPORTS
- PROVIDE A QUIET AIRCRAFT TO REDUCE OVERALL NOISE
- OPERATE STOL AIRCRAFT WITHIN ACCEPTABILITY STANDARDS OF SURROUNDING COMMUNITIES
- PROVIDE IMPROVED SHORT-HAUL SERVICE

FIGURE 2.0-1

PR3-STOL-1755 A

Community Acceptance of Expanded Short-Haul Air Service

The acceptance of surrounding communities of an expanded aircraft/airport system is the third objective. Expansion of service will result in the appearance of STOL aircraft at airports currently not being served by scheduled commercial flights. Expansion also will result in increased numbers of flights at airports which currently or in the future may be relatively limited in number of permissible flights. Thus, the STOL aircraft operationally must comply with standards of acceptability established by communities.

Reduction in Air Systems Noise Impact

Another system objective is to reduce the impact of aircraft noise upon existing airport environments. The STOL aircraft is being conceived and designed to noise emission criteria at sound levels some 15 to 25 dB below 1972 contemporary jet transport aircraft. The net effect of a STOL aircraft with lower noise emission is either to reduce the average noise level where commingled with CTOL in a total expansion of activity or to stay within a tolerable noise level at an airport where commercial STOL operations are added to existing general or non-commercial aviation operations, assuming the existing business or non-commercial jet aircraft operate at an acceptable noise level.

3.0 STOL SERVICE CONCEPTS

The evaluation of proposed STOL aircraft is best conducted within a basic framework of simulated airline operations. To accomplish this, several key elements are required. Such elements include a descriptive systems scenario which establishes a qualitative framework for airline simulation. A set of mission objectives specifies the general task expected of the system. A short-haul system is conceptualized to perform the transportation task. To put dimensions on the system concept, a travel demand estimates provides the key element of numbers of people who desire to travel. Distribution of travelers within the geographic region establishes where the service needs to be provided.

The concept of providing a travel service to the public thus is predicated upon two physical elements, an organizational concept, and a numerical quantifier which provides dimensions to the system.

The first physical element is the vehicle providing the transport function. Since the study is designed to evaluate a number of propulsive lift concepts for a commercial aircraft, a variety of design configurations is presented. Based on contemporary aircraft and airline experience, a size range can be selected. This was originally specified at a passenger capacity range of 50 to 200 seats. Details of the various designs are included in Volume II - AIRCRAFT ANALYSIS.

For systems simulation and evaluation purposes, certain basic data are required to represent the aircraft. The data sets on each of the propulsive concepts are included in Section 5.1.1 with concept descriptions included in Section 3.1.

The second physical element in the simulated system is the airport. The vital function performed by the airport is to provide the interface or transition point at which the traveler switches from (or to) a surface mode to (or from) an air mode. The whole concept of the airport is designed to provide this function in an optimal manner considering all of the factors involved. General descriptions of the airport concepts are presented in Section 3.2.

The organizational concept is included in Section 3.3 The prime value of this concept is to provide the best utilization of aircraft and airports in a system of transport which best meets the mission objectives.

The final element, estimated travel demand is presented in terms of numbers of people distributed by geographic site. Tabulations of demand are detailed in Section 3.4, Passenger Travel Demand.

A systems study has certain sequential and simultaneous functions. Ideally, each separate analytic section of this study should operate on data created in final form in the preceding section. Therefore the operational concept is quantified with the best data available from each study area consistent with the schedule requirements of Phase II. Since the study was conducted in two phases, each section presented a set of results from Phase I which, in the initiation of Phase II, were updated to provide a "baseline" set of data. Simultaneous activities, for example, occurred in the Aircraft Analysis function to continually review and iterate the aircraft designs to achieve the best possible results. The Airport Analysis group similarly reviewed, iterated, and upgraded data on site selection, design and community acceptance factors. The initial travel demand data provided quantification of the "baseline" system upon which the

Operations Analysis activities in each of the regions were conducted in the initial evaluation. The Economics Analysis function initially provided aircraft prices as varying with quantity produced. Final data on prices is based upon 400 units of production as reported in Volume V. Evaluations in this Volume VI are all conducted upon "baseline", initial Phase II data except where noted.

3.1 Aircraft Concepts

The basic aircraft concept was specified as Short Take Off and Landing (STOL) with a more fundamental distinction evolving as STOL Propulsive Lift Concepts. The prime characteristics of this concept are short-field capabilities (compared with conventional commercial jet aircraft) and reduced noise levels. The latter result both from a new engine design concept and from inherent flight characteristics derived from the short-field capability. In Phase I, many possible combinations of field length, propulsive concepts, and aircraft size were studied. Certain recommendations reduced the combinations by eliminating the 50 passenger aircraft and the 1500 foot field length. Also derived from Phase I was an indication that a 150 seat aircraft should be considered. Thus the primary concepts for the aircraft were size and propulsive lift capability. Sizes selected for airline simulation were the 150 seat aircraft as the "baseline" and the 100 and 200 seat aircraft for comparative purposes. See Figure 3.1-1.

A family of aircraft was derived based on detailed weight, drag, and acoustic analyses conducted during the parametric study time period. The drag, acoustic, propulsion and weight methods used to derive these aircraft are described in Appendices B, C, D, and E, respectively of Volume II, Aircraft. The brief configuration descriptions given in this section are based upon extensive configuration studies conducted during the contract. Engineering three-view drawings of each of the eight systems analysis aircraft and the advanced CTOL aircraft are shown in Figures 3.1-2 through 3.1-9. A Mechanical Flap concept is used with the advanced CTOL for comparative analysis.

CANDIDATE AIRCRAFT
FOR SYSTEMS ANALYSIS

FIELD LENGTH	PASSENGERS		
	100	150	200
2000		AUGMENTOR WING EXTERNALLY BLOWN FLAP OVER-THE-WING	
3000	EXTERNALLY BLOWN FLAP	EXTERNALLY BLOWN FLAP MECHANICAL FLAP	EXTERNALLY BLOWN FLAP
4000		MECHANICAL FLAP	

FIGURE 3.1-1

PR3-STOL-1653

EXTERNALLY BLOWN FLAP AIRCRAFT
150 PASSENGERS - 3000 FT (914 M) FIELD LENGTH

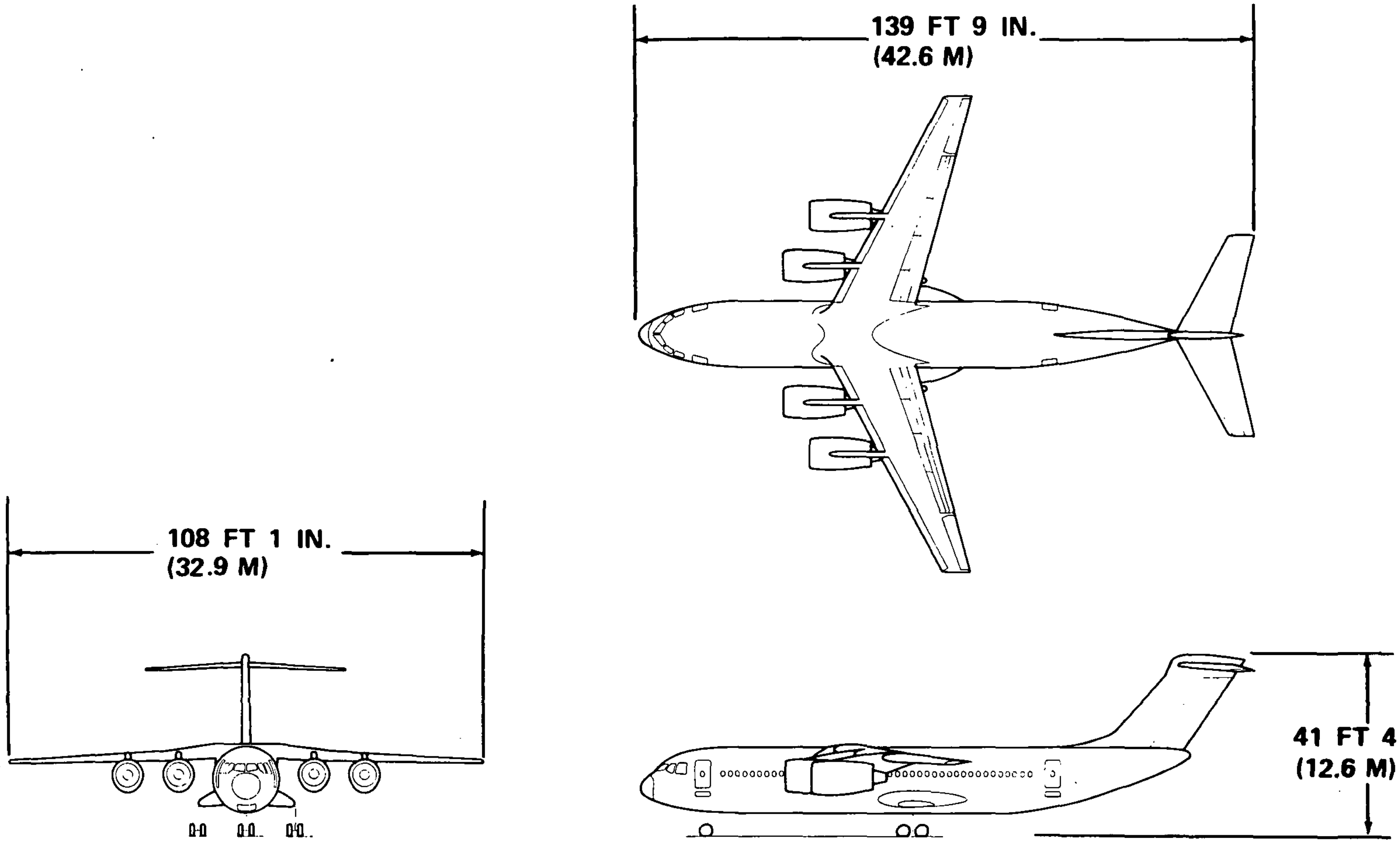


FIGURE 3.1-2

PR3-STOL-1512B

EXTERNALLY BLOWN FLAP AIRCRAFT
200 PASSENGERS - 3000FT. (914 M.) FIELD LENGTH

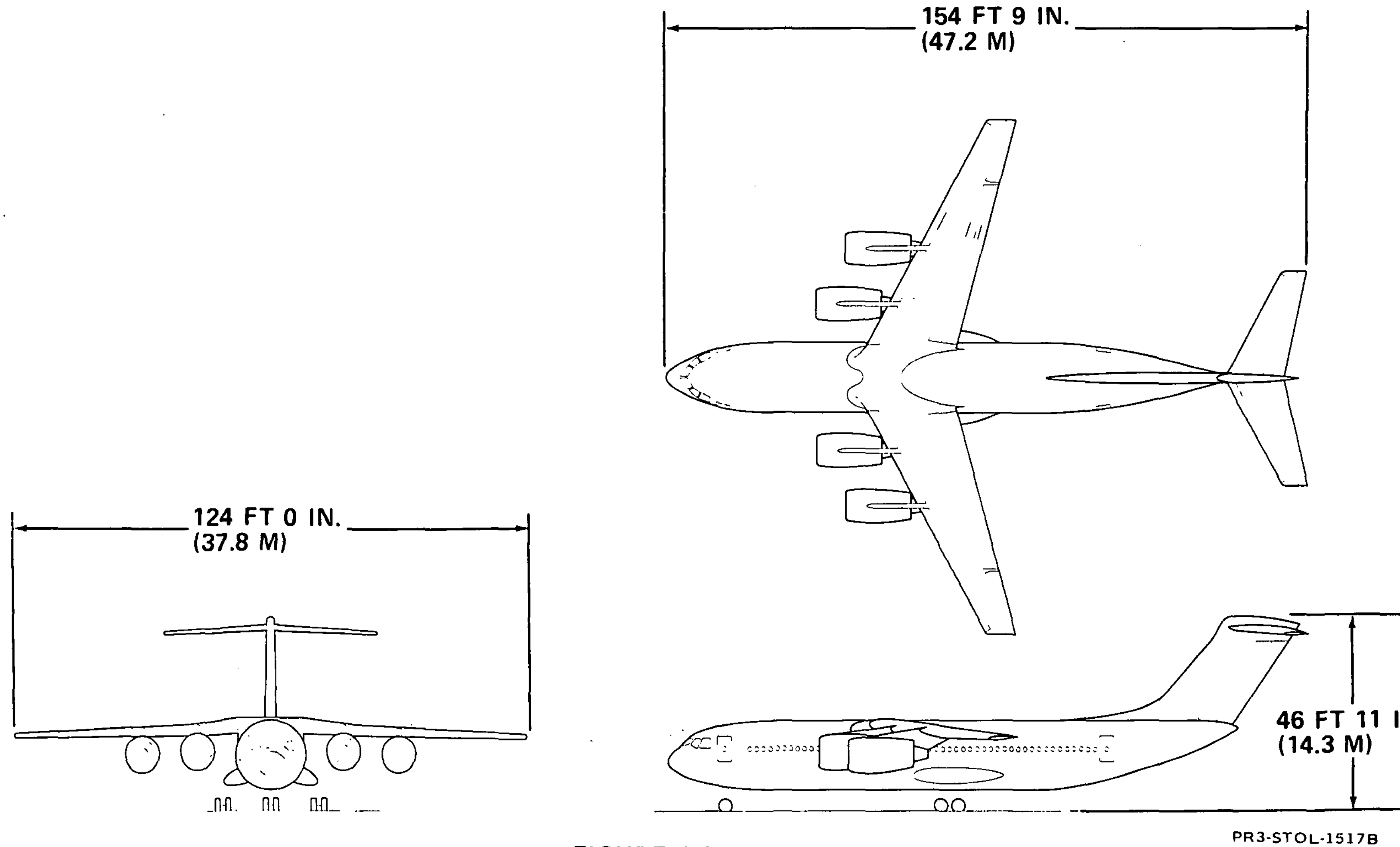


FIGURE 3.1-3

EXTERNALLY BLOWN FLAP AIRCRAFT

100PASSENGERS-3000FT. (914 M.) FIELD LENGTH

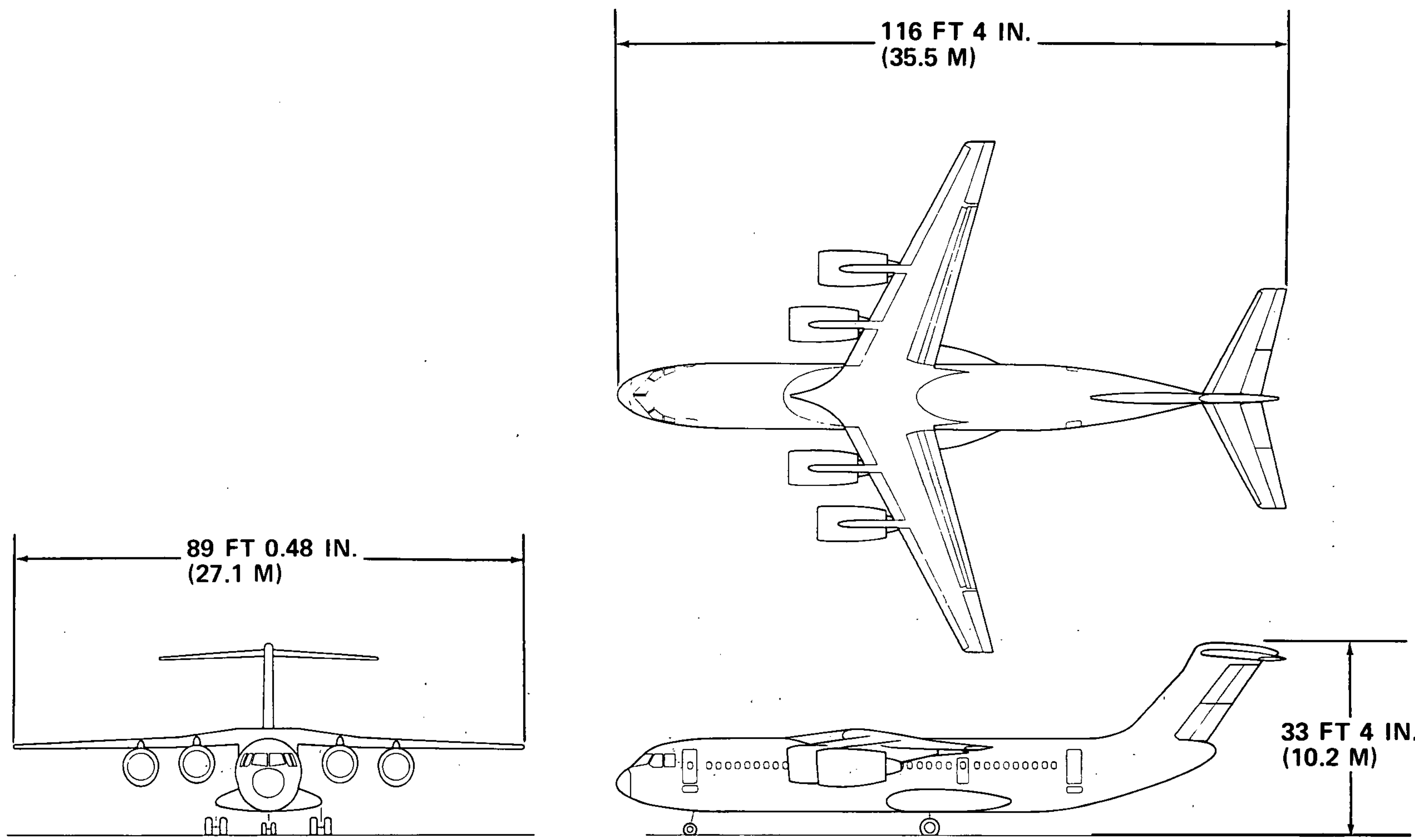


FIGURE 3.1-4

EXTERNALLY BLOWN FLAP AIRCRAFT

150 PASSENGERS - 2000 FT. (610M.) FIELD LENGTH

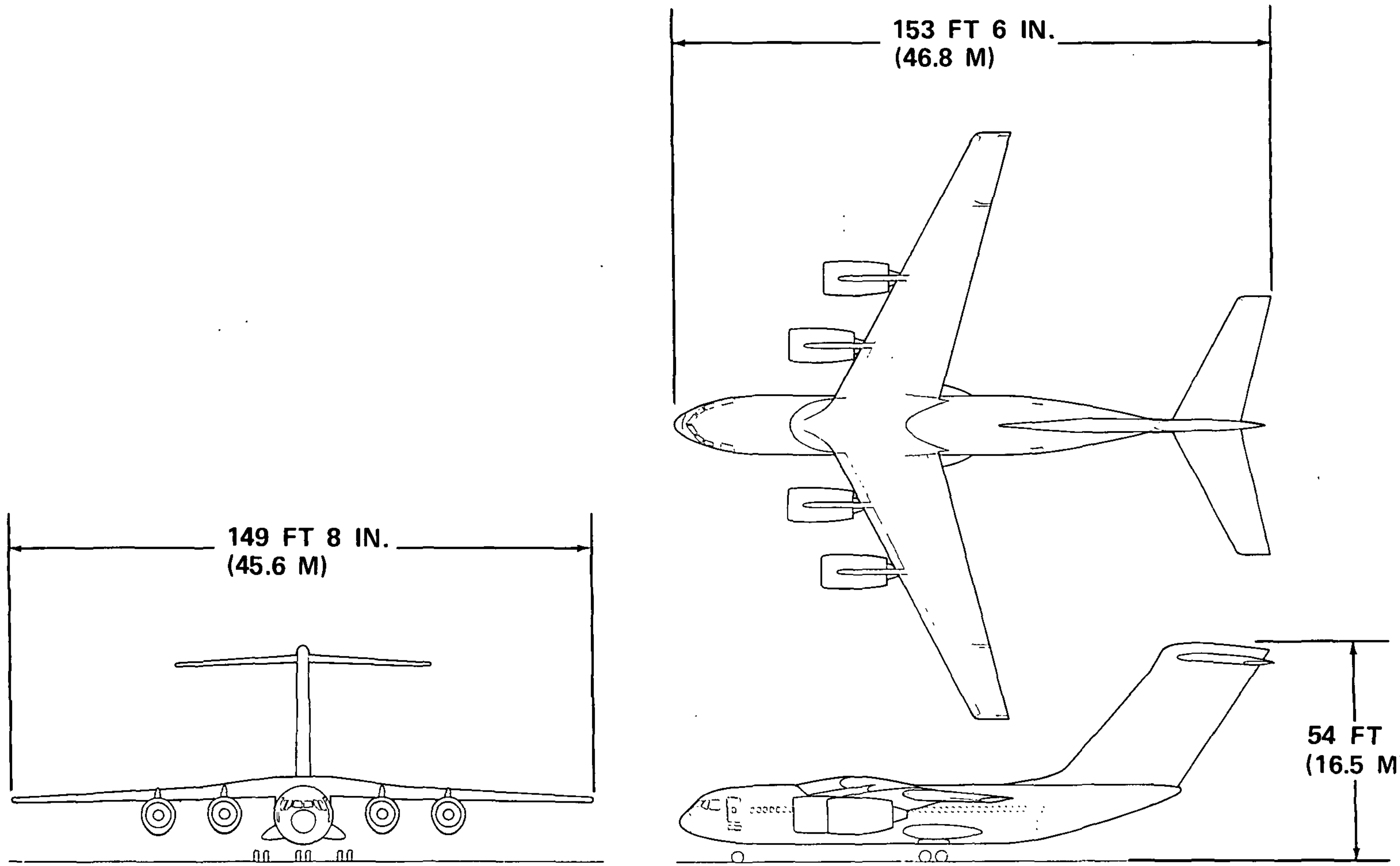


FIGURE 3.1-5

UPPER SURFACE BLOWN AIRCRAFT

150 PASSENGERS - 2000 FT (610 M) FIELD LENGTH

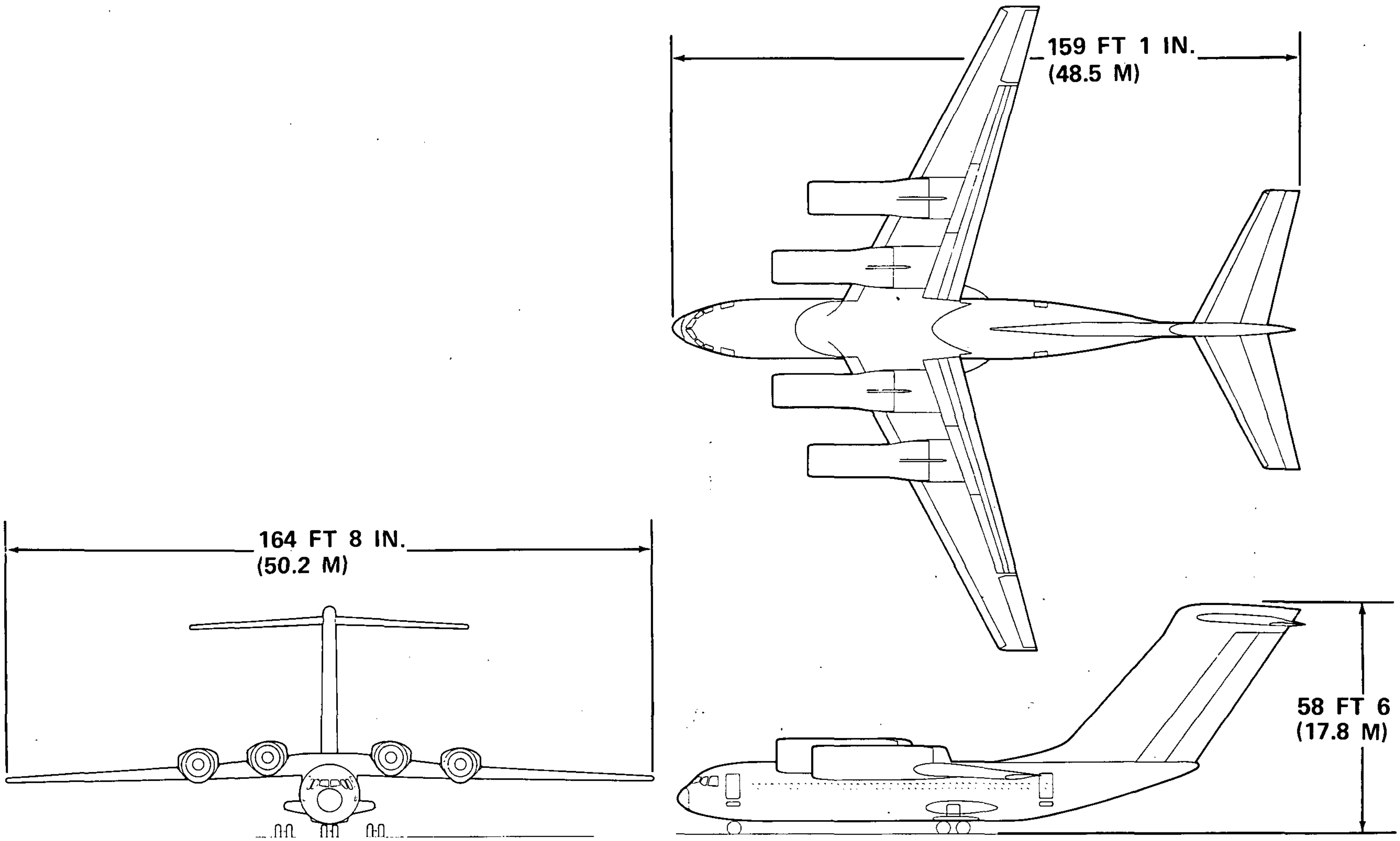


FIGURE 3.1-6

PR3-STOL-1646B

AUGMENTOR WING AIRCRAFT

150 PASSENGERS - 2000 FT (610 M) FIELD LENGTH

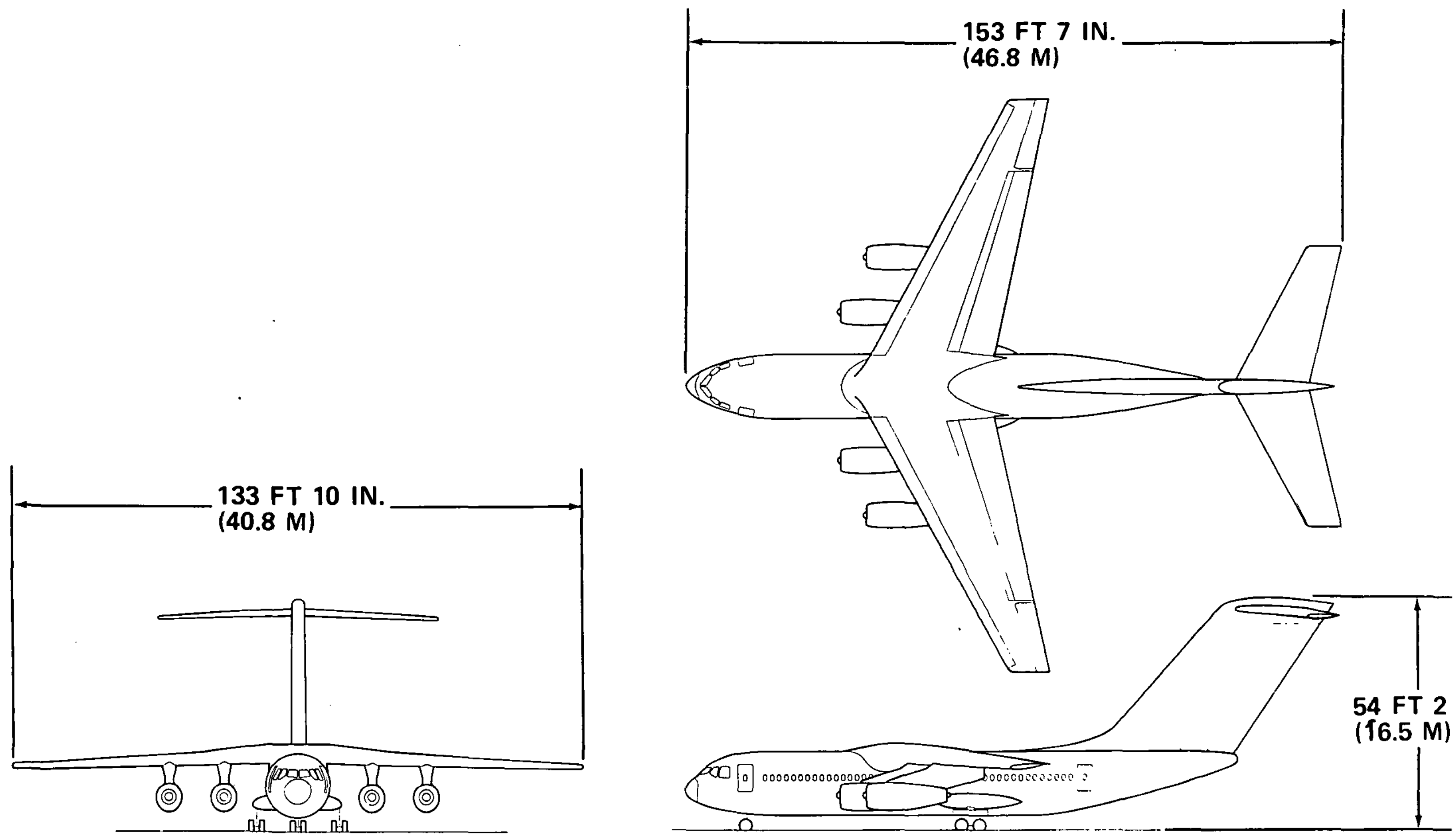


FIGURE 3.1-7

PR3-STOL-1458 B

MECHANICAL FLAP AIRCRAFT

150 PASSENGERS • 3000 FT (914 M) FIELD LENGTH

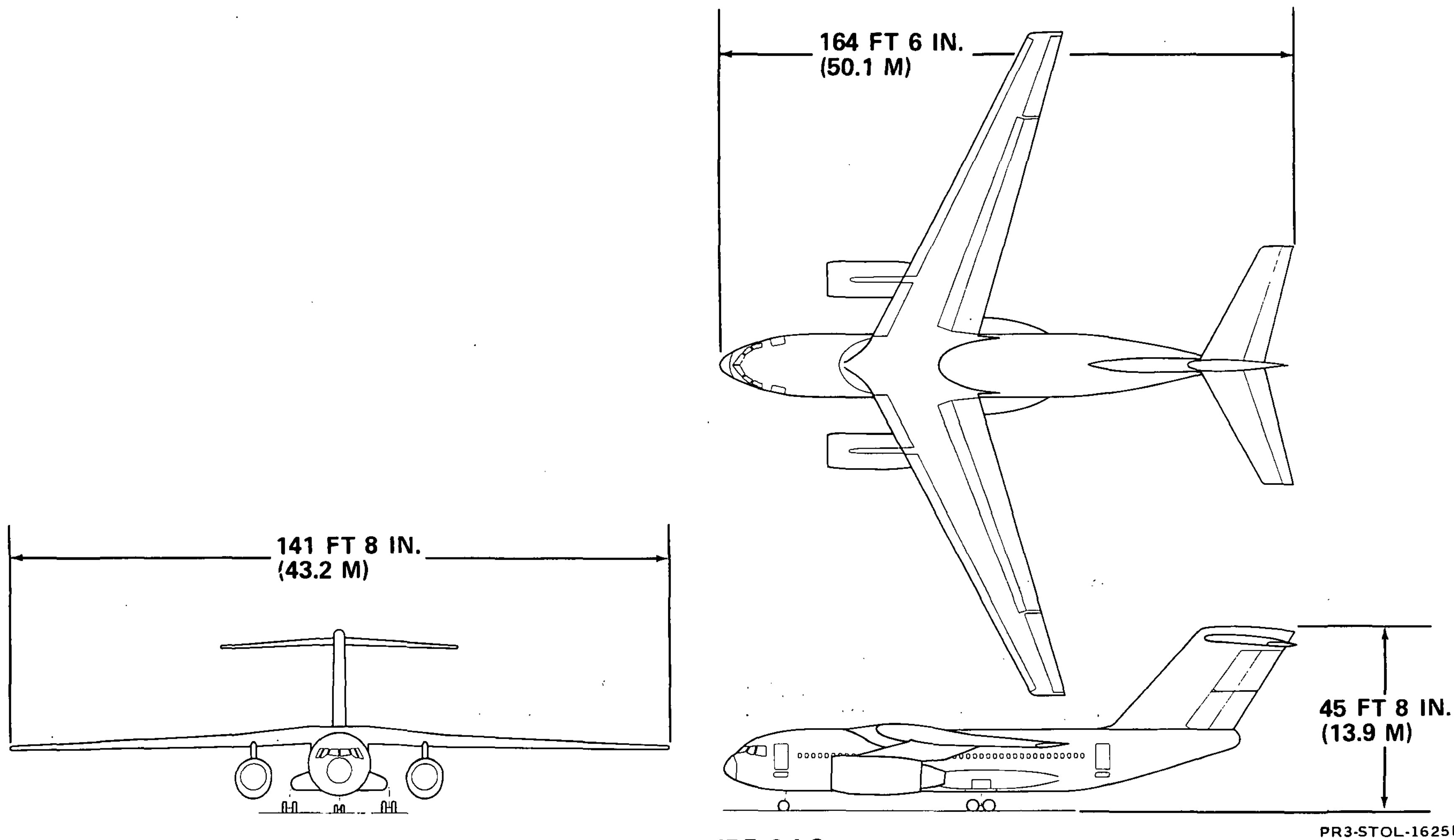


FIGURE 3.1-8

MECHANICAL FLAP AIRCRAFT
150 PASSENGERS 4000 FT (1220 M) FIELD LENGTH

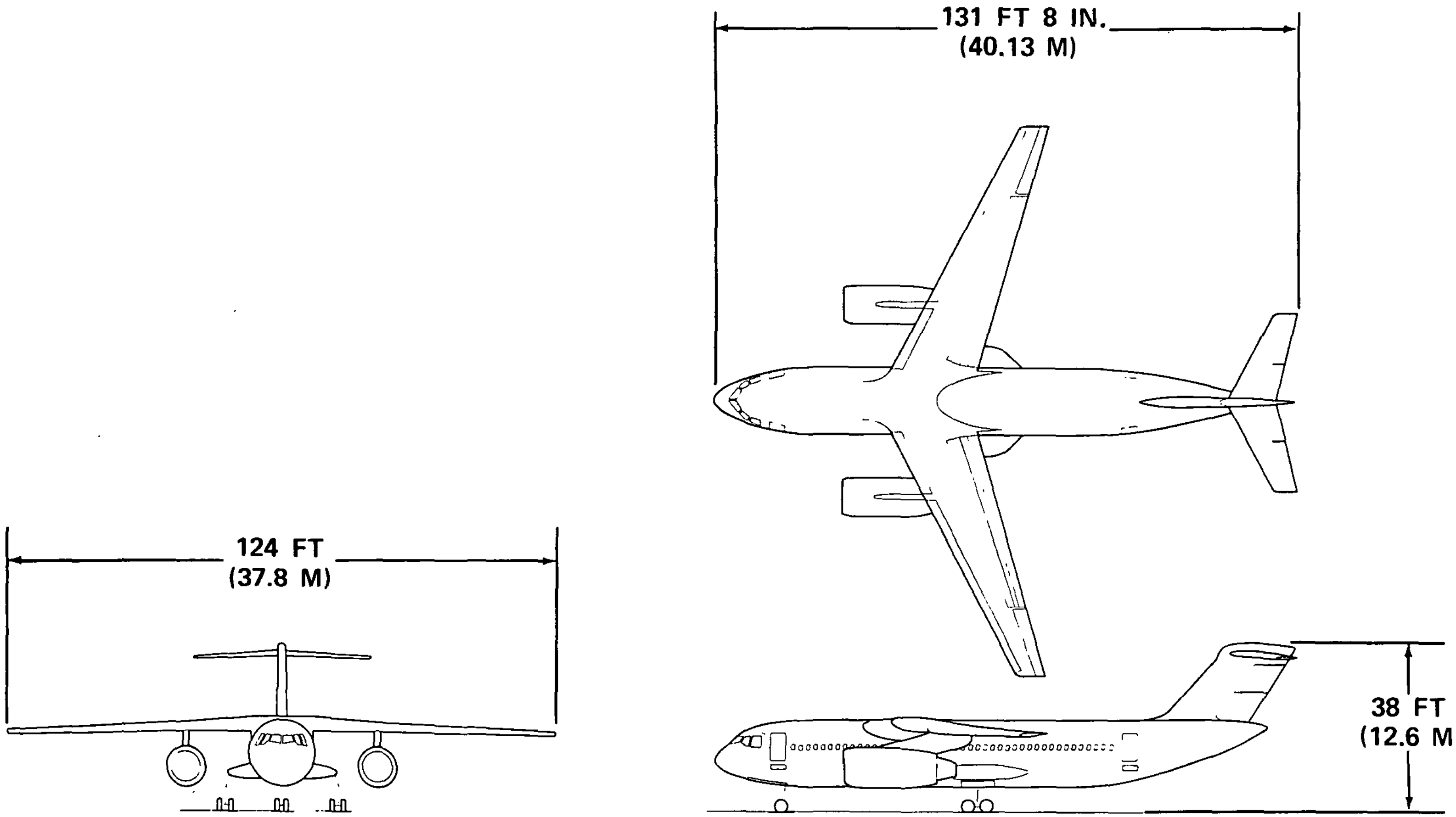


FIGURE 3.1-8A

PR3-STOL-1676 B

CTOL AIRCRAFT

150 PASSENGERS - 7500 FT. (2286 M.) FIELD LENGTH

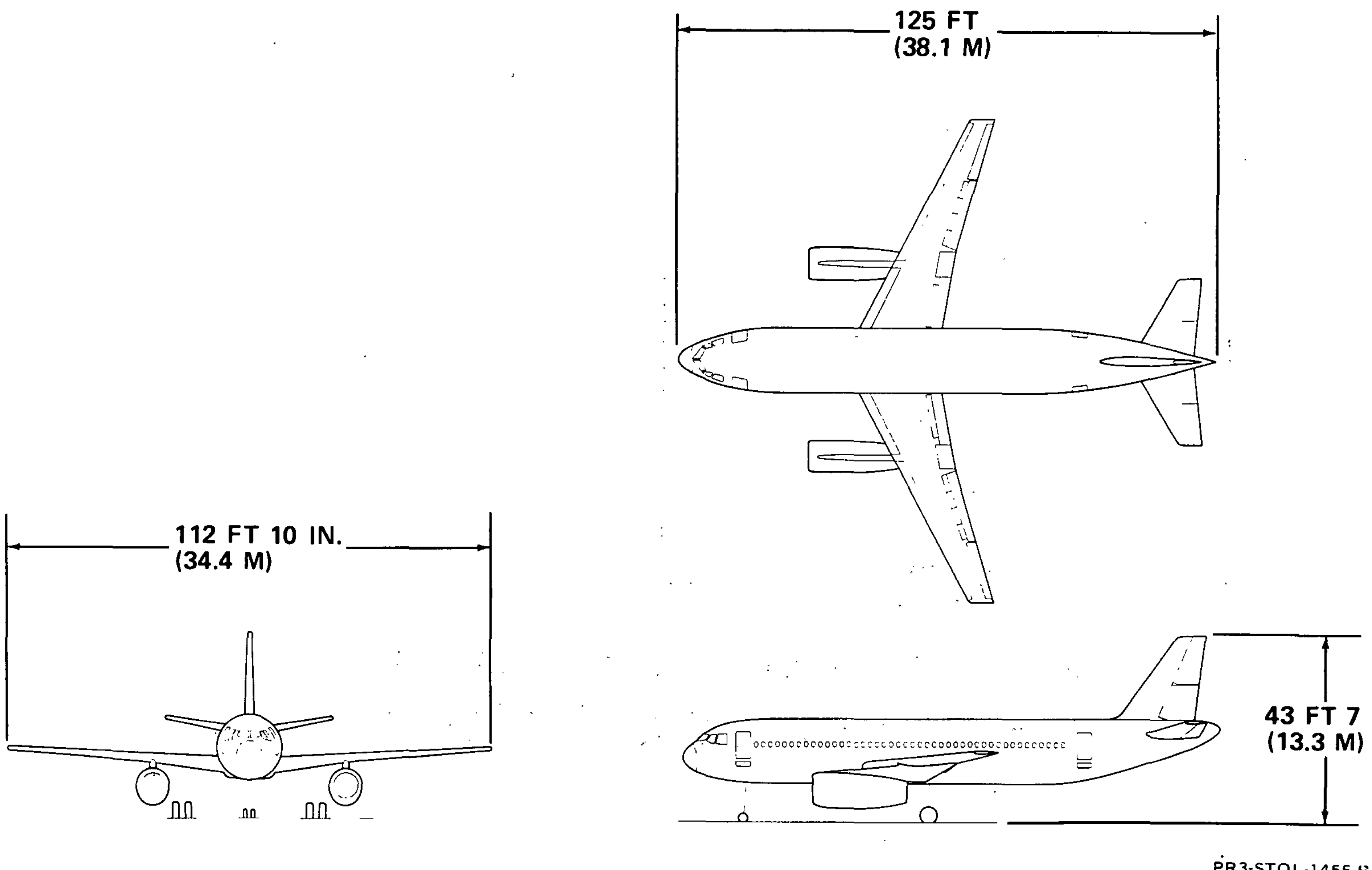


FIGURE 3.1-9

High Lift Systems

Externally Blown Flap - The EBF airplane has flaps extending from the fuselage side to 75 percent of the wing semi-span and occupy 35 percent of the wing chord when retracted. Each flap has two segments hinged independently to give a large chord-wise expansion when operated and results in 3 percent chord gaps between segments. Spoilers are used for direct lift control and flare for the approach mode and are normally drooped for takeoff. Leading edge flaps are used behind the engines and leading edge slats outboard. The engines are located well inboard to reduce engine-out asymmetric effects. The location of the outboard engine at 50 percent of the wing semi-span allows sufficient spacing to avoid significant interference drag penalties. The engine fan exits are located at approximately 110 percent of the wing chord forward of the wing leading edge and are positioned as high as possible for high turning efficiency without the fan exhaust impinging on the deflected leading edge flaps or introducing significant scrubbing losses in cruise flight.

Upper Surface Blowing - The flaps aft of the USB configuration engines are similar to the EBF flaps except that the components are arranged to provide a continous smooth relatively large radius coanda surface without slots. Outboard of the engines the flap is similar to the EBF flap except that the flap gaps are only 2 percent of the wing chord because it is unblown. The engine exhaust is ejected parallel to and close to the wing upper surface, separated from it by a vented insulating layer which tapers to zero thickness at the spoiler hinge line.

Augmentor Wing - For the augmentor wing configuration, all of the fan airflow is diverted to independent plenums in the wing which feed discreet high aspect ratio flap nozzles and secondary aileron BLC plenums. The augmentor flap technology presented in Volume II was used in selecting the ejector and nozzle geometries. The engines are mounted on pylons to permit the use of an uninterrupted leading edge slat and to minimize cruise interference drag.

Mechanical Flap - The mechanical flap high lift system uses a large chord ratio two segment flap similar to that of the EBF except that the gaps are smaller. The engines are mounted low enough to avoid exhaust impingement on the flaps at takeoff setting. The leading edge has full span slats similar to those used on the DC-10 airplane.

CTOL - Hinged expanding double slotted flaps are used similar to DC-10 flaps and occupy 28 percent of the wing chord when retracted. An inboard aileron behind the engine serves as a gate to avoid exhaust impingement on the flap. Leading edge slats are interrupted only by the engine pylon and are otherwise continous. A reduction in $C_{L_{max}}$ requirements with the longer field length results in less adverse ground effects and permits the use of a conventional low wing configuration.

Engine Arrangements - Four engines are used with all propulsive lift systems and are positioned to avoid significant interference drag. On the EBF aircraft, the outboard engine is limited to 50 percent of the semi-span for safe control with one engine out and on the augmentor wing is limited to 45 percent of the semi-span due to duct size limitations.

Only two engines are required for the mechanical flap and CTOL configurations. The use of two engines in lieu of three or four has significant economic advantages.

3.2 Airport Concepts

The STOLport concept is a vital part of the service concept. Functionally, the airport is designed to provide an optimum operating environment for the aircraft. Accomplishing this, the airport also must provide the most possible convenience to the traveling public. Safety of air travel and the least environmental impact on the community are additional requisites. Airport noise is a prime irritant to nearby inhabitants, thus the STOLport must be conceived to permit operations with a tolerable, acceptable noise impact. The STOLport also should be located where it will relieve congestion suffered by a major metropolitan airport. Relief is in the form of shifting short-haul operations away from conventional CTOL to the STOL system. A final factor is to include good ground access to all proposed STOLports.

The various types of short-haul airports considered were classified according to the configuration categories listed below to insure that all possible situations were considered. Air carrier airports were classified by FAA National Airports System Plan (NASP) criteria.

A. Existing primary system air carrier airports.

B. Existing secondary system air carrier airports.

C. Existing feeder system air carrier airports.

D. Existing general aviation airports.

E. Existing military airports.

F. Existing joint-use (military/civil) airports.

G. New urban CBD (Central Business District) STOLports.

H. New suburban STOLports.

I. New elevated STOLports.

J. New offshore (or floating) STOLports.

The baseline network composition includes a complete cross-section of airports ranging from large and medium hub carrier airports to general aviation airports without existing scheduled carrier operations. Also included are two new STOLport sites - General Patton Field (California Region) and Secaucus, New Jersey (Northeast Region). A summary of the baseline airports selected for detailed evaluation is included as Table 3.2-1. Three basic categories are Primary, Secondary, and Feeder.

These airports are a representative sample of the Baseline System for which an airport-pair route structure was used in the detailed regional analyses. In the operations analysis activity, 504 aiport pairs were used in the Fleet Baseline Analysis (medium and high density routes) for the six mainland regions. In Hawaii, seven airports were interconnected with six routes. In the Extended Region and Low Density evaluation, more airports and routes were added, and traffic reallocated to achieve a greater degree of airport congestion relief. For detailed airport analysis, the baseline list of 94 airports provided the basic sample as reported in Airport Analysis, Volume III.

In extension to the low density routes, an additional 77 airports brought the total number of mainland STOL airports to 171. This number included 10 airports in the extended baseline network plus 67 airports in the low-density network.

TABLE 3.2-1

SUMMARY: NETWORK COMPOSITION OF THE NATIONAL SHORT-HAUL SYSTEM

Total Number of Airports	94
Number of Existing Air Carrier (Mode I) Airports	72
Number of Existing General Aviation (Mode II) Airports	20
Number of New (Mode III) STOLports	2
Number of NASP Primary System Airports (Cover one million annual passengers - 1970 traffic)	29
High Density (more than 350,000 operations)	4
Medium Density (250,000 to 350,000 operations)	4
Low Density (less than 250,000 operations)	21
Number of NASP Secondary System Airports	41
High Density (more than 250,000 operations)	4
Medium Density (100,000 to 250,000 operations)	3
Low Density (less than 100,000 operations)	34
Number of NASP Feeder System Airports	2
High Dense (more than 100,000 operations)	1
Medium Dense (20,000 to 100,000 operations)	1
Low Dense (less than 20,000 operations)	0

In the original concepts for selecting sites and determining general physical requirements, certain performance factors are critical. These apply to the airport/aircraft/airline/traveler interface. For example, flight delays and cancellations mean revenue lost to competitors and other surface media. Hence, an airline must attempt to schedule and perform its operations to maximize revenue passenger miles.

The importance of time to an airline is illustrated in Figure 3.2-1. This importance is measured as a function of delay time versus direct operating cost. A similar effect is presented in Figure 3.2-2, the effect of variations in turnaround time in which the penalties or savings in DOC are normalized at 30 minutes. The number of flights delayed more than 30 minutes, for example, came to an alarming total of 106,000 in 1969, but by 1970, the number had fallen to 72,000, and in 1971 dropped even further to 34,000. Some of this reduction in delays was probably due to the 1970-71 decrease in flight activity and the initiation of traffic rationing at five of our busiest airports. The first six months of 1972 showed a reversal of the trend with 20,400 delays. Moreover, the mechanism for producing substantially more delays is still very much in operation. Unless significant improvements are made to the system, the outlook, as early as 1978, is for average peak hour delays per operation at typical high-density airports, of anywhere from an hour and three quarters to three and a half hours. Delay cost to the air carriers amounted to roughly $160 million a year in 1969. By 1981, delay costs are estimated to increase tenfold, reaching a rate of more than $1 billion per year.

To illustrate expected problems in congestion at major airports in the Chicago Region, FAA data and analysis by the Mitre Corporation provided a

AIRPORT DELAYS vs DOC

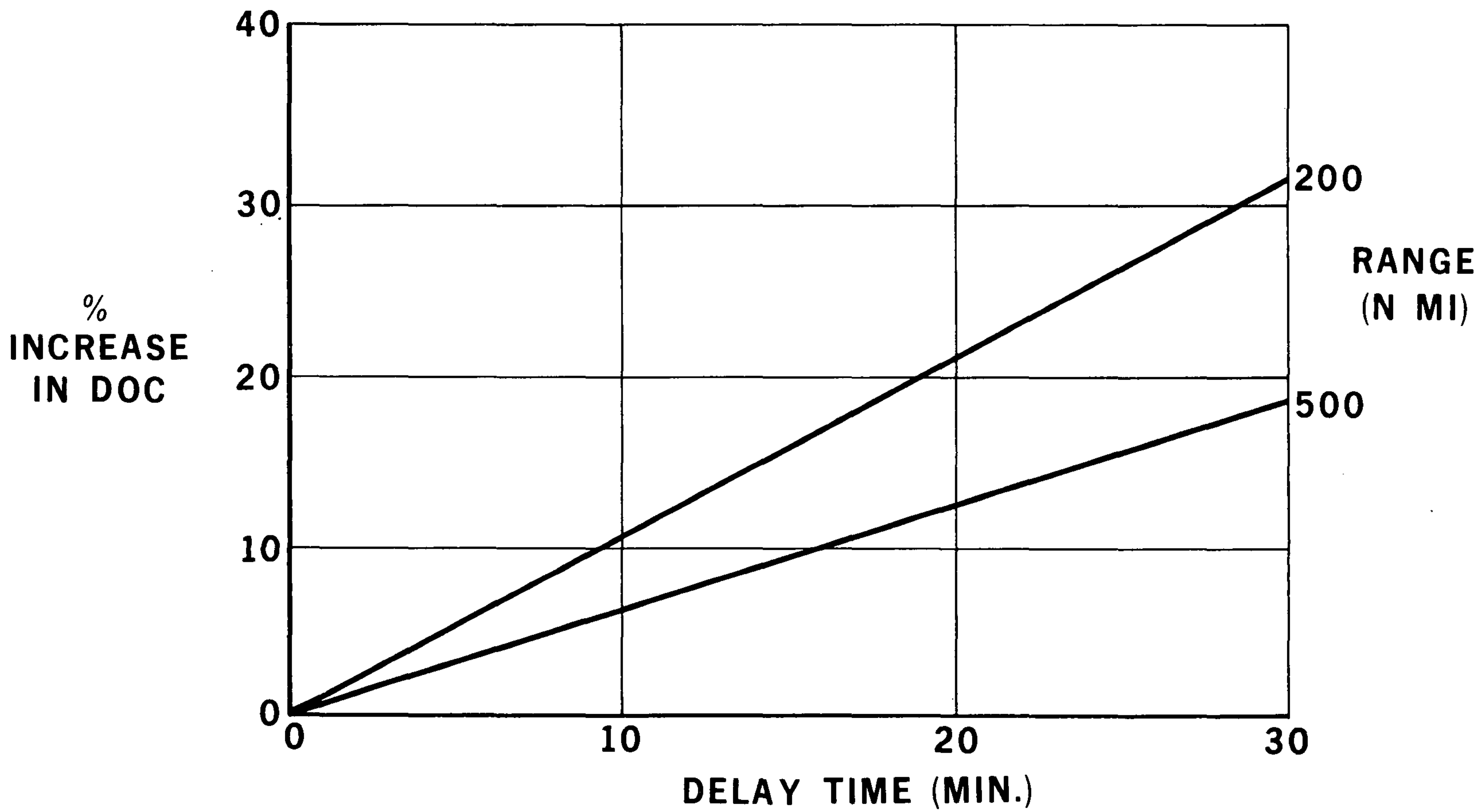


FIGURE 3.2-1

PR2-STOL-9892

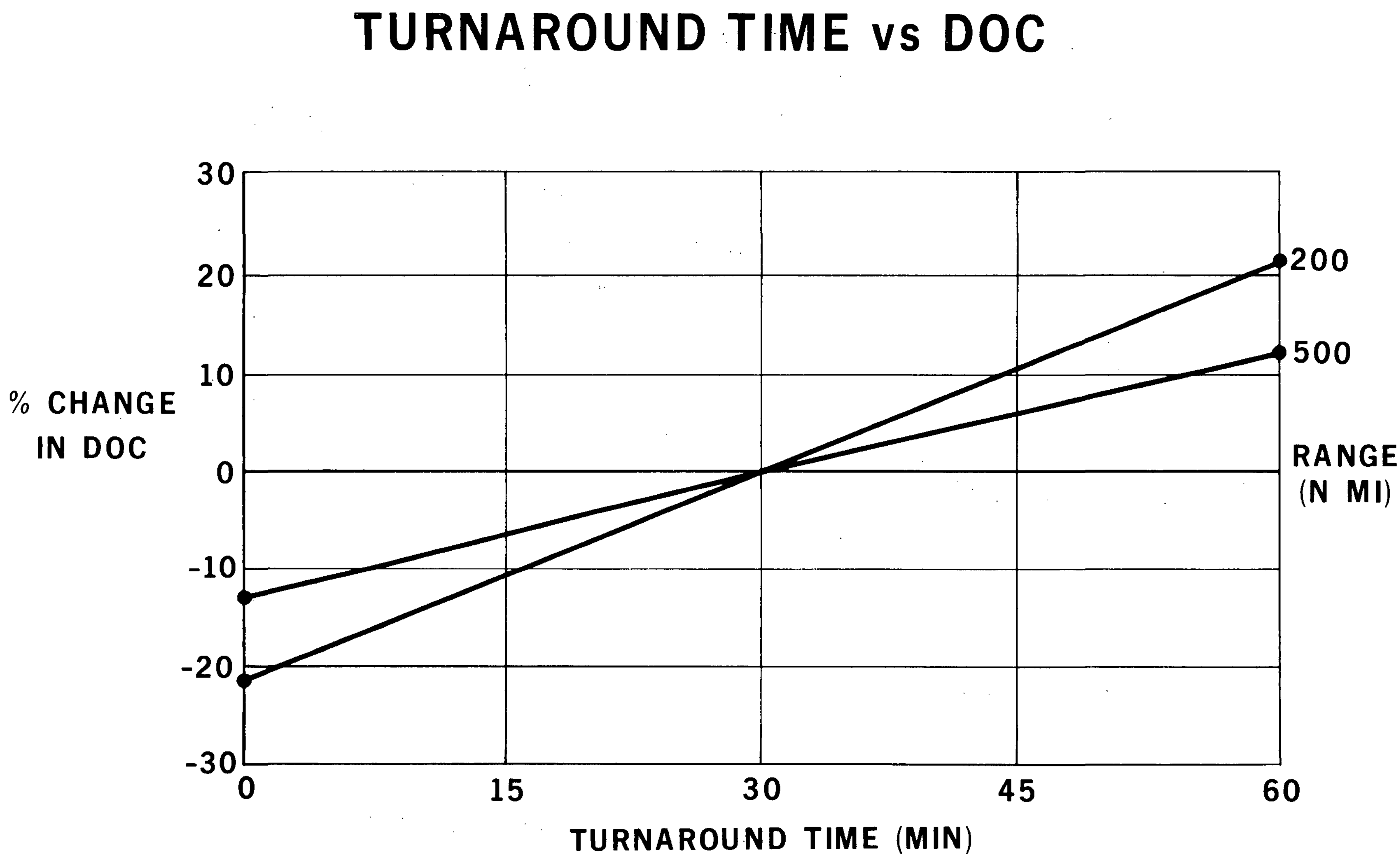

TURNAROUND TIME vs DOC
30
20
10
0
-10
-20
-30
% CHANGE
IN DOC
0
15
30
45
60
TURNAROUND TIME (MIN)
200
500
RANGE
(N MI)
PR2-STOL-9871

FIGURE 3.2-2

reference point of departure. In Table 3.2-2 projected airport capacity improvement is shown. By 1975, a predicted improvement is shown of 20% in airport handling capacity for aircraft over the predicted annual capacity. With achievement of the six improvement areas shown, an expected improvement of 70% is extimated by 1985.

With a 70 percent improvement rate, Table 3.2-3 shows the possible achievement in airport operations capacity by 1985. Note that the 70 percent factor has been applied to 1970 actual operations data. Assuming that 1970 operations exceeded those for 1969 (the Mitre base), the 1985 levels would be somewhat in excess of those predicted by Mitre. On the same chart, unconstrained growth is shown forecasted at 1985 levels. During the course of the study, analysis of congestion relief provided insight into expansion and clarification of airport concepts. For example, in the Chicago regional analysis, some of the short-haul traffic was shifted from major airports at Pittsburgh, Cleveland, Detroit, Chicago, Milwaukee, Minneapolis, and St. Louis. STOLports were provided in each city to receive this short-haul traffic. The impact of this shift in traffic is illustrated in Table 3.2-4. For instance, at the major Pittsburgh airport, about 11,000 annual short-haul operations were shifted to a STOL runway at Allegheny County Airport. This amounted to about 3 percent of the forecasted unconstrained growth. About 8,000 CTOL short-haul operations remained at Pittsburgh.

TABLE 3.2-2

FAA'S INCREASED AIRCRAFT HANDLING CAPACITY AIRPORT PROGRAM

PROGRAM ELEMENT	PERCENT CAPACITY INCREASE BY 1975	BY 1985
1. CONSTRUCTION AND EFFECTIVE USE OF HIGH-SPEED EXITS AND ENTRANCES	0	5
2. SEPARATION OF AIRCRAFT BY PERFORMANCE	10	10
3. TWO MILE LONGITUDINAL SEPARATION	0	30
4. COMPUTER AIDED SPACING	10	10
5. GROUND GUIDANCE AND CONTROL	0	5
6. HIGHER LEVELS OF AUTOMATION	0	10
TOTAL INCREASE OVER 1969 AIRCRAFT HANDLING CAPACITY	20%	70%

PR2-STOL-1206

TABLE 3.2-3

RUNWAY CAPACITY vs AIRCRAFT OPERATIONS

CHICAGO REGION

AIRPORT	AIRCRAFT OPERATIONS FORECAST 1985 (ANNUAL 000)	AIRCRAFT OPERATIONS CAPACITY 1985 (ASSUME 70 PERCENT IMPROVEMENT OVER 1970) (ANNUAL 000)
PITTSBURGH	368	257
CLEVELAND	348	222
DETROIT	444	346
CHICAGO	1,206	1,020
MILWAUKEE	236	126
MINNEAPOLIS/ST. PAUL	270	216
ST. LOUIS	330	317
DENVER	317	296
BUFFALO	206	122
ROCHESTER	178	92
CINCINNATI	245	158

PR2-STOL-1165A

TABLE 3.2-4

1985

RUNWAY CAPACITY IMPROVEMENT

CHICAGO REGION

AIRPORT	AIRCRAFT SHORT HAUL O&D OPERATIONS SHIFTED (ANNUAL 000)	PERCENT MOVEMENTS REDUCED	AIRCRAFT SHORT HAUL O&D OPERATIONS REMAINING (ANNUAL 000)
PITTSBURGH	11	3	8
CLEVELAND	13	4	10
DETROIT	31	7	16
CHICAGO	90	8	43
MILWAUKEE	5	2	3
MINN/ST. PAUL	24	9	10
ST LOUIS	27	9	13
DENVER	5	2	2
BUFFALO	3	1	3
ROCHESTER	3	2	2
CINCINNATI	7	3	5

PR2-STOL-1199A

Highway congestion contiguous to the airport is another area where the results of doing too little could exact a formidable penalty. If the private automobile and taxi continue to be the favorite means of getting to and from airports--73-85 percent of all passengers use this means at JFK, San Francisco, Washington National, and Los Angeles--some monumental traffic jams with their attendant delays, much worse than anything we have seen yet, are inevitable. The highways leading into Los Angeles International, for example, will be capable of handling only 40 million people per year by 1975 if all planned highways are completed, but double that number are expected to be using, or trying to use, the airport by 1985.

As for aircraft congestion at the airports, both in the air and on the ground, the Air Traffic Control Advisory Committee has concluded that unless substantial improvements are made, the four airports now under restricted operation will jump to twenty or thirty by 1980, and double that by 1995. Using only the 1980 date, the value of the time lost by passengers would amount to $370 million from congestion in the air and $1.7 billion from congestion on the ground. These conclusions are based on the existing capacity of our airports. Existing capacity, however, is being diminished at an accelerating rate by curfews and restricted runway operations. In some cases the airport operator has been unable even to repave existing runways. Use of these runways must be restricted or they may ultimately have to be closed for safety reasons. At the same time, airport development in the nation has been brought to a virtual standstill. Unless this situation is changed, concerns over highway and airport congestions will become purely academic.

In 1972, the Presidential Aviation Advisory Commission assigned one of its contractors the job of determining the length of time that planned improvements could stave off traffic saturation at our major airports--i.e., the point at which delays to the average passenger would regularly negate the advantages of air travel. The contractor was asked to assume the anticipated airline shift to larger capacity airplanes, and all of the FAA's ten-year improvement plans for airspace, as well as the planned enlargement of the airports themselves. The study concluded that even with all contemplated improvements, 23 out of 27 of the country's busiest airports would become saturated at various times between now and the year 2000.

The significance of these projections becomes clear when one considers that, though the U.S. has about 4,000 airports capable of accommodating some kind of reliable, scheduled air transportation, and 653 are actually doing so, a full 70 percent of all enplanements is handled by the top 27. What happens to that handful can have an enormous impact on air travel.

With respect to the airport congestion problems, the Commission considered, among other things:

- The separation of short-haul traffic from long-haul traffic to separate runways within the same airport.
- The removal of short-haul O & D traffic from large airports to suburban and military airports.
- The increased use of high-speed rail service to supplement air service.

Short-haul is divided into two kinds of traffic, inter-connecting, and true origin and destination (O&D). The ideal arrangement is to have both interconnecting short-haul and long-haul within any given airport. From the standpoint of the aircraft involved, long-haul airliners require long, space-consuming runways while short-haul transports can be designed to operate from shorter runways. Where an airport is being hard pressed to keep up with traffic demands today, and promises to reach the saturation point in the predictable future, some sorting out of short-haul and long-haul traffic is essential. Shifting of short-haul traffic to STOLports can clearly result in a significant decrease in congestion, since many airports either already possess or can accommodate simultaneously-usable runways to which the short-haul traffic can be diverted.

The airports for most communities in low-density areas will undoubtedly evolve in the future much as they have in the past--with multipurpose airports and general aviation airports accommodating the necessary service.

Ground access, the final element considered in airport concepts, is the most intractable of all. Neglect of ground access consideration can nullify everything done to improve the system from the air side. The older, closer-in airports have been enveloped by residential communities, so expanded road networks or new rights-of-way are often blocked by insupportable social and economic costs. A mass transit line serving the newer, more remote airports would have little or no non-airport patronage to offset its construction and operating costs. Road networks beyond the airport boundaries are under town, county, state, or municipal control and are designed, maintained, and regulated primarily to serve needs of their immediate constituencies rather than those of the airport.

Continuation of recent trends, if unconstrained, means that an average of almost 600 thousand people will be arriving and departing at New York's three major airports every day by 1985; on a typical day, Chicago will have to accommodate 396,000; Los Angeles, 472,000; San Francisco, 293,000; Washington, 227,000. Expressed in terms of the facilities which will then be required, three cities--New York, Chicago, and Los Angeles will have to have 10 to 16 lanes of additional freeway and two additional tracks of rail rapid transit; four cities, San Francisco, Washington, Boston and Miami, will need five to ten new lanes of freeway and two new tracks of rail rapid transit, while 23 other cities will require five additional freeway lanes and one or two new rail tracks

To summarize some considerations entering into the evaulation of airport concepts, Table 3.2-5 has been prepared to compare advantages and disadvantages of three types of airport concepts used in construction of a representative national short-haul transportation system.

TABLE 3.2-5

STOL AIRPORT EVALUATION

AIRPORT TYPE	ADVANTAGE	DISADVANTAGE
	o INTERCONNECTING PASSENGERS	o INCREASED GROUND CONGESTION
AIR CARRIER	o ENVIRONMENTAL APPROVAL EASIER	o NOT OPTIMIZED FOR STOL
	o COMPATIBLE ATC FACILITIES	o LOWER PRIORITY OF FACILITIES
	o SHORTEST TIME TO IMPLEMENT	o MODERATE ATC EXPENSE
	o MANY FACILITIES EXIST	
	o AVIATION PRECEDENT	o QUESTIONABLE ENVIRONMENTAL APPROVAL
GENERAL AVIATION	o GOOD GROUND ACCESS	o NEED MANY NEW FACILITIES
	o BASIC FACILITIES EXIST	o LONGER TIME TO IMPLEMENT
	o FEW ATC FACILITIES	o NOT OPTIMIZED FOR STOL
		o EXTENSIVE ATC EXPENSE
	o CONVENIENT TO POPULATION CENTER	o DOUBTFULL ENVIRONMENTAL APPROVAL
NEW SITE	o GOOD GROUND ACCESS	o LONGEST TIME TO IMPLEMENT
(GROUND LEVEL)	o OPTIMIZED FOR STOL	o HIGH COST-LAND SCARCITY
		o MAXIMUM ATC EXPENSE

3.3 Operational Concepts

A STOL airline operational concept is generated for each region analyzed. These concepts cover the following items:

- o Maintenance Concept/Policy
- o Crew Domicile Policy
- o Aircraft Flight Schedules
- o Baggage Handling Concepts
- o Food Service
- o Passenger Service (Ticketing)

Maintenance Concepts - The locations of the maintenance bases were studied to determine which location is the most effective in terms of fleet operations. From an economic standpoint, it is not feasible to have maintenance in manpower and resources available at every station in the airline network. For example, one large domestic trunk carrier services over 90 cities, but has maintenance capability at only 20 of these cities. When new schedules and/or equipment are proposed, the maintenance capability at specific stations may be adequate, inadequate or excessive. Trade off studies relative to the compatibility of proposed fleet size, schedules, maintenance concepts and base allocation are performed for each region.

Location of Crew Domicile - It was assumed that each flight crew's last flight of the day terminated at the origin of the first flight of the day. This eliminated the need for per diem and hotel costs which could have a significant impact on IOC.

Aircraft Flight Schedules - One of the basic measurements of the effectiveness of an airline is its ability to meet the schedule. Generally, the carrier attempts to optimize its schedule toward the goal of maximizing profit and/or maintaining a desirable competitive posture. Unfortunately, these "optimized systems" many times do not reflect the effects of system constraints; constraints such as schedule/unscheduled maintenance requrements and fleet size restrictions. These various constraints will determine the most cost effective approach for alternative basing and schedule configurations.

In addition, a practical phased maintenance policy as well as the performance reliability evaluation of the aircraft will be considered in determing the frequency of maintenance checks which will reduce the length of time for the out-of-service status. The maintenance concept will include the determination of a scheduled maintenance concept to optimize fleet size and schedule as well as locating the most economical and effective maintenance base system.

Baggage Handling Concepts - The baseline scenario for the STOL aircraft baggage handling concept is carry-on luggage to be placed in forward and aft locations near the forward and rear exits. Baggage transfer to other airlines will be provided. Other concepts to be reviewed will be the use of universal containers and automated baggage systems or combinations of both. Another consideration will be the use of overhead storage. The airline subcontractors agree that the current system of stowing standard size briefcases beneath the seats should be continued.

Food and Beverage Service - Service is limited to beverages.

Passenger Service (Ticketing) - The value of automated ticketing may be significant, but is not unique to STOL. Savings to STOL may arise in simplification of ticket types, use of cash register receipt or ticket stub, or simplified on-board procedures.

3.4 Passenger Travel Demand

The initial data base included all city-pairs projected to have 50,000 annual O and D travelers per year. The datum year of 1970 provided the starting list of city-pairs. Traffic was predicted on a specific city-pair list to 1985. Total travel in the defined network for STOL was about 145,000,000 travelers on 497 city-pair routes. Of this total, about 124,000,000 passengers were allocated to STOL routes at annual, low-density levels from 50,000 travelers per year through medium density at 130,000 to a high density level of 300,000 travelers per year or more. Table 3.4-1 contains the initial high-density traffic allocations by regions. Details by city-pair and region are included as Table 3.4-2, pages 1 through 7 which includes all city-pairs contained in the baseline market demand.

These baseline data provide the point of departure for specific analysis in each region. Network traffic is considered in determining fleet and aircraft sizes. In each network, the flow of traffic is found to be through currently or potentially congested/constrained airports in the large cities. Thus, the principal impact of a new short-haul system, such as STOL, must be analyzed for its effect on the major airports (and cities) to be served. Considering STOL as an evolutionary approach to short-haul air systems, its earliest impact on congestion relief would be 1980 or such later date as aircraft are certified and introduced to service. To resolve current and near-future congestion, short-haul operations, as feasible, must be shifted to less busy or under-utilized sites.

In the evaluation of systems performance for the Chicago and Northeast Regions, the allocation of travelers to STOL did not provide congestion relief to a number of key airports in major cities. Thus each region was expanded to include analysis of added routes with short-haul traffic in excess of 50,000 annually. This resulted in a network of some 596 city-pairs. Detailed statistics by region are shown in Table 3.4-3, pages 1 through 10, Baseline City-Pair Annual STOL O&D Traffic by Regions. For this baseline analysis, annual short-haul traffic of 130,000 and more was used to determine a flight schedule and fleet size with attendant number of operations between each airport pair.

Air Travel Demand

Patronage levels for 1985 are determined as follows:

- The top 1000 city-pairs in the U.S. are ranked in descending order of CAB data on air traveler origins and destinations (O&D); a further ranking is made of city-pairs into ranges of 600 statute miles or less. Short-haul for this study is defined as 600 miles and less.
- Projection of this traffic is made with 12 year traffic data for each city-pair to 1985.

TABLE 3.4-1

1985

CITY PAIR MARKET ANALYSIS

HIGHER DENSITY

SUMMARY

REGION	NO. CITY PAIRS	TOTAL O&D TRAFFIC ≥ 300,000	NUMBER CITY PAIRS	STOL O&D TRAFFIC MODAL SPLIT ≥ 300,000	% STOL ALLOCATION REGION	% STOL ALLOCATION PERCENT
CHICAGO	20	13,199	11	7,015	CHICAGO	53.2
NORTHEAST	28	33,755	14	15,938	NORTHEAST	47.2
CALIFORNIA	13	25,725	8	11,775	CALIFORNIA	45.8
SOUTHEAST	16	7,738	4	1,781	SOUTHEAST	23.0
SOTTHERN	9	4,536	4	1,576	SOUTHERN	34.7
NORTHWEST	2	782	0	0	NORTHWEST	0
HAWAII	4	3,797	3	1,678	HAWAII	44.2
TOTAL	92	89,082	44	39,763		

TABLE 3.4-2

1985

CHICAGO REGION

CITY PAIR MARKET ANALYSIS

HIGHER DENSITY

CITY PAIR	ANNUAL TOTAL O & D TRAFFIC $\geq$300,000	STOL O&D TRAFFIC MODAL SPLIT $\geq$300,000
Buffalo-Chicago	312,249	------
Chicago-Cleveland	968,940	618,000
Chicago-Columbus	480,830	324,000
Chicago-Cincinnati	541,012	350,000
Chicago-Dayton	339,171	------
Chicago-Des Moines	352,393	------
Chicago-Detroit	1,651,370	1,138,000
Chicago-Indiana	538,212	359,000
Chicago-Kansas City	887,797	603,000
Chicago-Minneapolis	1,876,763	1,362,000
Chicago-Omaha	324,412	------
Chicago-Pittsburgh	796,667	535,000
Chicago-St. Louis	1,540,859	1,118,000
Cleveland-Detroit	407,967	304,000
Kenver-Kansas City	394,916	------
Detroit-Minneapolis	334,726	------
Detroit-Pittsburgh	325,334	------
Detroit-St. Louis	422,559	304,000
Milwaukee-Minneapolis	345,273	------
Kansas City-St. Louis	357,259	------
TOTAL	13,198,709	7,015,000
(20 City Pairs)		(11 City Pairs)

Table 3.4-2

1985

NORTHEAST REGION

CITY PAIR MARKET ANALYSIS

HIGHER DENSITY

CITY PAIR	ANNUAL TOTAL O & D TRAFFIC ≥300,000	STOL O&D TRAFFIC MODAL SPLIT ≥300,000
Baltimore-Boston	370,899	---------
Baltimore-New York City	599,817	--------
Hartford-Washington	386,331	--------
Boston-Buffalo	309,845	---------
Boston-Cleveland	421,332	---------
Boston-New York City	6,907,105	4,094,000
Boston-Philadelphia	1,707,300	1,200,000
Boston-Pittsburgh	404,980	---------
Boston-Washington	2,453,000	1,751,000
Buffalo-New York City	1,227,913	544,000
Buffalo-Philadelphia	316,676	----- ---
Cleveland-New York City	1,522,841	688,000
Cleveland-Philadelphia	473,335	---------
Cleveland-Washington	428,466	---------
Columbus-New York City	624,804	310,000
Cincinnati-New York City	602,122	--------
Dayton-New York City	411,354	---------
Detroit-New York City	2,076,400	1,001,000
Detroit-Philadelphia	655,940	386,000
Detroit-Washington	611,733	350,000
New York City-Norfolk	463,601	---------
New York City-Pittsburgh	1,725,380	874,000
New York City-Providence	328,167	---------
New York City-Rochester	1,119,154	613,000
New York City-Syracuse	840,229	409,000
New York City-Washington	5,473,051	3,182,000
Philadelphia-Pittsburgh	941,578	536,000
Pittsburgh-Washington	414,864	---------
TOTAL (28 City Pairs)	33,755,217	5,938,000 (14 City Pairs)

Table 3.4-2

1985

CALIFORNIA REGION

CITY PAIR MARKET ANALYSIS

HIGHER DENSITY

CITY PAIR	ANNUAL TOTAL O & D TRAFFIC ≧300,000	STOL O&D TRAFFIC MODAL SPLIT ≧300,000
Fresno-Los Angeles	444,000	---------
Fresno-San Francisco	362,000	--------
Las Vegas-Los Angeles	3,078,439	2,177,000
Las Vegas-San Francisco	551,750	--------
Los Angeles-Monterey	472,715	--------
Los Angeles-Phoenix	1,362,133	791,000
Los Angeles-San Diego	2,248,000	992,000
Los Angeles-San Francisco	12,613,000	5,713,000
Los Angeles-Sacramento	1,435,000	627,000
Los Angeles-Tucson	480,051	301,000
Portland-San Francisco	863,453	535,000
Reno-San Francisco	375,241	---------
San Diego-San Francisco	1,439,000	639,000
TOTAL	25,724,782	11,775,000,000

(13 City Pairs) (8 City Pairs)

Table 3.4-2

1985

SOUTHEAST REGION

CITY PAIR MARKET ANALYSIS

HIGHER DENSITY

Page 4

CITY PAIR	ANNUAL TOTAL O&D TRAFFIC ≥300,000	STOL O&D TRAFFIC MODAL SPLIT ≥300,000
Atlanta-Nashville	306,485	-------
Atlanta-Chicago	778,460	509,000
Atlanta-Jacksonville	400,738	-------
Atlanta-Memphis	417,277	-------
Atlanta-Miami	791,473	483,000
Atlanta-New Orleans	388,519	-------
Atlanta-Savannah	336,176	-------
Atlanta-Tampa	441,310	-------
Atlanta-Washington	594,920	378,000
Chicago-Memphis	464,401	-------
Chicago-Louisville	417,013	-------
Charlotte-New York City	572,060	-------
Greensboro-New York City	497,703	-------
Miami-Tampa	399,011	-------
New York City-Richmond	309,188	-------
New York City-Raleigh	623,757	411,000
TOTAL	7,738,491	1,781,000
(16 City Pairs)		(4 City Pairs)

Table 3.4-2
1985
SOUTHERN REGION
CITY PAIR MARKET ANALYSIS
HIGHER DENSITY

CITY PAIR	ANNUAL TOTAL O&D TRAFFIC $\geqq$300,000	STOL O&D TRAFFIC MODAL SPLIT $\geqq$300,000
Austin-Dallas	370,785	-------
Dallas-Houston	945,267	483,000
Dallas-Lubbock	357,891	-------
Dallas-Kansas City	356,629	-------
Dallas-New Orleans	489,430	307,000
Dallas-Oklahoma	394,414	-------
Dallas-San Antonio	542,988	346,000
Dallas-St. Louis	368,753	-------
Houston-New Orleans	710,135	440,000
TOTAL	4,536,292	1,576,000
(9 City Pairs)		(4 City Pairs)

Table 3.4-2
1985
NORTHWEST REGION
CITY PAIR MARKET ANALYSIS
HIGHER DENSITY

CITY PAIR		ANNUAL TOTAL O&D TRAFFIC ≧300,000	STOL O&D TRAFFIC MODAL SPLIT ≧300,000
Spokane-Seattle		451,404	----
Portland-Seattle		330,454	----
	TOTAL	781,858	0
(2 City Pairs)			(Ø City Pairs)

Table 3.4-2

1985

HAWAII REGION

CITY PAIR MARKET ANALYSIS

HIGHER DENSITY

CITY PAIR		ANNUAL O&D TRAFFIC 300,000	STOL O&D TRAFFIC 300,000
Honolulu-Hilo		977,217	563,000
Honolulu-Kona		838,451	-------
Honolulu-Kihue		1,036,790	597,000
Honolulu-Kahului		899,974	518,000
	TOTAL	3,797,432	1,678,000

(4 City Pairs) (3 City Pairs)

Restriction of STOL service only to the high-density city-pair traffic tabulated on the preceding pages appeared to offer little success in achieving congestion relief at major hub airports. Therefore, the potential travel market was expanded to include city-pairs with predicted 1985 traffic of $\geq$ 50,000 annual origin and destination travelers in the short-haul market. These data have been tabulated by market region and by city pairs. The expanded study was conducted in two phases. The first phase involved analysis of city pairs with $\geq$ 130,000 annual origin and destination travelers in the short haul market. The second phase was in extension of the market to the lower density city pairs with traffic of 50,000 to 130,000 annual origin and destination short haul travelers.

TABLE 3.4-3
1985
EXPANDED CHICAGO REGION

CITY PAIR ANNUAL STOL O & D TRAFFIC
(BASELINE)
(000)

		STOL Traffic
BETWEEN:	Chicago	
AND	Minneapolis	1,362
	St. Louis	1,118
	Detroit City	1,138
	Cleveland	618
	Kansas City	603
	Pittsburgh	535
	Cincinnati	350
	Columbus	324
	Evansville	111
	Des Moines	237
	Ft. Wayne	73
	Peoria	99
	Omaha	207
	Dayton	219
	Rochester	165
	Toledo	110
	Madison	113
	Grand Rapids	55
	Springfield, Ill.	81
	Buffalo	209
	Indianapolis	359
BETWEEN:	Minneapolis	
AND	Des Moines	105
	Milwaukee	241
	Sioux Falls	43
	Omaha	151
	Madison	76
	Duluth	23

		STOL Traffic
BETWEEN:	St. Louis	
AND	Dayton	64
	Des Moines	83
	Indianapolis	48
	Kansas City	197
	Milwaukee	86
	Omaha	66
	Pittsburgh	115
	Tulsa	69
	Columbus	68
BETWEEN:	Detroit	
AND	Columbus	88
	Grand Rapids	35
	Indianapolis	96
	Milwaukee	108
	Minneapolis	235
	Pittsburgh	219
	Rochester	114
	St. Louis	304
	Dayton	24
	Buffalo	78
BETWEEN:	Denver	
AND	Kansas City	287
	Omaha	139

Table 3.4-3

EXPANDED CHICAGO REGION

(CONTINUED)

		STOL Traffic
BETWEEN:	Des Moines	
AND:	Omaha	10
	Kansas City	47
BETWEEN:	Cincinnati	
AND:	St. Louis	121
	Cleveland	58
	Detroit	133
BETWEEN:	Pittsburgh	
AND:	Dayton	62
	Cleveland	47
	Indianapolis	77
	Cincinnati	45
	Columbus	25

		STOL Traffic
BETWEEN:	Cleveland	
AND:	Buffalo	28
	St. Louis	176
	Columbus	17
	Dayton	42
	Detroit	304
BETWEEN:	Indianapolis	
AND:	Columbus	32

Table 3.4-3

1985

EXPANDED NORTHEAST REGION

CITY PAIR ANNUAL STOL O & D TRAFFIC

(BASELINE)

(000)

		STOL Traffic
BETWEEN:	Philadelphia	
AND:	Hartford	157
	Rochester	113
	Syracuse	73
	Providence	96
	Detroit City	386
	Burke Lakefront	266
	Cincinnati	97
	Norfolk	141
	Boston	1200
	Washington	124
	Indianapolis	113
	Columbus	124
	Dayton	82
	Erie	34
BETWEEN:	Washington/Baltimore	
AND:	Hartford	350
	New York	3380
	Pittsburgh	359
	Providence	137
	Syracuse	90
	Columbus	173
	Detroit City	452
	Cleveland	313
	Indianapolis	161
	Dayton	129
	Norfolk	126
	Cincinnati	154
	Rochester	27

		STOL Traffic
BETWEEN:	Albany	
AND:	Buffalo	125
	Philadelphia	78
	Syracuse	30
	New York	105
	Rochester	56
	Cleveland	43
	Pittsburgh	42
	Detroit City	63
	Washington	105
BETWEEN:	Rochester	
AND:	Hartford	55
	Pittsburgh	46
	Boston	159
	New York	613
BETWEEN:	Hartford	
AND:	Cleveland	131
	Dayton	30
	Detroit City	152
	Pittsburgh	111
	New York	49
BETWEEN:	Cleveland	
AND:	Providence	29
	Rochester	55
	Syracuse	43
BETWEEN:	Indianapolis	
AND:	New York	277

Table 3.4-3

EXPANDED NORTHEAST REGION

CONTINUED

		STOL Traffic
BETWEEN:	Boston	
AND:	Albany	104
	New York	196
	Washington	1751
	Bangor	104
	Norfolk	124
	Cleveland	231
	Hartford	10
	Dayton	60
	Detroit City	312
	Portland	38
	Indianapolis	75
	Harrisburg	51
	Burlington	38
	Columbus	76
	Cincinnati	88
BETWEEN:	Buffalo	
AND:	Washington	164
	New York	544
	Pittsburg	26
	Syracuse	9
	Boston	174
	Philadelphia	182
	Hartford	70
BETWEEN:	Harrisburg	
AND:	New York	75
BETWEEN:	Pittsburgh	
AND:	Harrisburg	118
	Boston	227
	Philadelphia	536
	Providence	32

		STOL Traffic
BETWEEN:	New York	
AND:	Dayton	189
	Providence	83
	Columbus	310
	Pittsburgh	583
	Syracuse	409
	Detroit City	678
	Cleveland	688
	Cincinnati	261
	Philadelphia	87
	Norfolk	258
	Portland	42
	Boston	3969
	Burlington	94
	Bangor	48
	Erie	36
BETWEEN:	Syracuse	
AND:	Hartford	38
	Boston	153
	Pittsburgh	44
	Detroit City	62

Table 3.4-3
1985
EXPANDED CALIFORNIA REGION
CITY PAIR ANNUAL STOL O&D TRAFFIC
(BASELINE)
(000)

		STOL Traffic
BETWEEN:	Los Angeles	
AND:	Monterey	298
	Phoenix	791
	Reno	198
	San Diego	992
	Santa Barbara	65
	San Francisco	858
	Sacramento	627
	Tucson	301
	Las Vegas	2177
	Fresno	297
	Salt Lake City	394
	San Jose	858
	Oakland	1712
BETWEEN:	San Francisco	
AND:	Santa Ana	214
	Sacramento	90
	Monterey	46
	Portland	535
	Reno	143
	San Diego	639
	Santa Barbara	160
	Eureka	91
	Fresno	230
	Las Vegas	287
	Salt Lake City	365(1)
	Long Beach	358

(1) Total O&D Traffic

		STOL Traffic
BETWEEN:	Las Vegas	
AND:	Phoenix	162
	Reno	179
	(1) Salt Lake City	365
	Albuquerque	165
BETWEEN:	Phoenix	
AND:	(1) Salt Lake City	137
	Albuquerque	158
BETWEEN:	Denver	
AND:	Phoenix	191
	(1) Albuquerque	259
	(2) Salt Lake City	426
BETWEEN:	Long Beach	
AND:	Oakland	574
	San Jose	358
	San Francisco	358
BETWEEN:	Santa Ana	
AND:	Oakland	428
	San Jose	214
	San Francisco	214
BETWEEN:	San Diego	
AND:	Phoenix	163
	Sacramento	47
	Tucson	64
	Las Vegas	174

Table 3.4-3

1985

SOUTHEAST REGION

CITY PAIR ANNUAL STOL O & D TRAFFIC

(BASELINE)

(000)

BETWEEN: Atlanta	STOL Traffic
AND: Pittsburg	121
Baltimore	152
W. Palm Beach	89
Birmingham	61
Nashville	200
New Orleans	254
Mobile	102
Columbia	194
Montgomery	86
Cleveland	154
Memphis	281
Charlotte	109
Orlando	169
Cincinnati	112
Dayton	60
Washington	378
Greensboro	148
Indianapolis	86
Jackson	103
Jacksonville	241
Pensacola	79
Raleigh	193
Richmond	84
Louisville	150
St. Louis	162
Savannah	243
Talahassee	62
Tampa	275
Knoxville	51
Detroit	235
Charleston, S.C.	148
Ft. Lauderdale	112
BETWEEN: Birmingham	
AND: Memphis	53
New Orleans	61

BETWEEN: Charlotte	STOL Traffic
AND: Washington	85
Philadelphia	85
BETWEEN: Tampa	
AND: Ft. Lauderdale	50
W. Palm Beach	50
New Orleans	71
Tallahassee	58
BETWEEN: Louisville	
AND: Cleveland	144
Washington	111
Detroit	148
Chicago	235
Pittsburgh	50
St. Louis	90
Philadelphia	80
BETWEEN: Memphis	
AND: Chicago	289
Jackson	56
St. Louis	152
Nashville	113
BETWEEN: Miami	
AND: Tallahassee	120
Atlanta	483
Orlando	57
Tampa	122
Jacksonville	144
BETWEEN: Norfolk	
AND: Charleston (CHS)	70
Atlanta	97

Table 3.4-3

SOUTHEAST REGION

(CONTINUED)

		STOL Traffic
BETWEEN:	Washington	
AND:	Columbia	89
	Raleigh	144
	Charleston	94
	Greensboro	100
	Charlotte	85
	Charleston, W. V.	59
	Knoxville	145
	Louisville	112
	Nashville	89
	Roanoke	57
BETWEEN:	Chicago	
AND:	Atlanta	509
	Charlotte	75
	Richmond	94
	Nashville	141
BETWEEN:	New York	
AND:	Charlotte	291
	Newport News	74
	Raleigh	411
	Richmond	150
	Greensboro	292
BETWEEN:	Baltimore	
AND:	Norfolk	78
BETWEEN:	New Orleans	
AND:	St. Louis	106
	Memphis	139

Table 3.4-3

1985

SOUTHERN REGION

CITY PAIR ANNUAL STOL O & D TRAFFIC

(BASELINE)
(000)

BETWEEN: Dallas		STOL Traffic
AND:	Abilene	41
	Albuquerque	138
	Austin	239
	El Paso	172
	Houston	483
	Lubbock	233
	Little Rock	117
	Midland/Odessa	154
	Memphis	168
	Kansas City	221
	New Orleans	307
	Oaklahoma City	247
	San Antonio	346
	St. Louis	234
	Tulsa	181
	Amarillo	130
	Corpus Christi	125
	Wichita	73

BETWEEN: Denver		
AND:	Oklahoma City	92
	Wichita	95

BETWEEN: El Paso		
AND:	San Antonio	59

BETWEEN: Houston		
AND:	New Orleans	440
	San Antonio	88
	Shreveport	61
	Tulsa	141
	Oklahoma City	104
	Kansas City	91
	Midland Odessa	90

BETWEEN: Wichita		STOL Traffic
AND:	Kansas City	13
	Tulsa	26

BETWEEN: Memphis		
AND:	Houston	93
	Kansas City	67
	New Orleans	139
	St. Louis	153
	Jackson, Miss.	56

BETWEEN: New Orleans		
AND:	Monroe	42
	Jackson	23
	Shreveport	109

BETWEEN: St. Louis		
AND:	Tulsa	59
	Little Rock	58

BETWEEN: Albuquerque		
AND:	Denver	173
	El Paso	88

Table 3.4-3

1985

NORTHWEST REGION

CITY PAIR ANNUAL STOL O&D TRAFFIC

(BASELINE)

(000)

		STOL Traffic
BETWEEN:	Seattle	
AND:	Boise	77
	Spokane	245
	Portland	84
	Reno	83
	Pasco	90
	Yakima	41
BETWEEN:	Portland	
AND:	Spokane	128
	Reno	79

		STOL Traffic
BETWEEN:	Boise	
AND:	Portland	88
	San Francisco	76
	Salt Lake City	60
BETWEEN:	Eugene	
AND:	San Francisco	146

Table 3.4-3

1985

HAWAII REGION

CITY PAIR ANNUAL STOL O&D TRAFFIC
(BASELINE) (000)

		STOL Traffic
BETWEEN:	Honolulu	
AND	Hilo	563
	Kono	220
	Lihue	597
	Molokai	96
	Kahului	518
	Kamuela	80
BETWEEN:	Hilo	
AND	Kahului	32

4.0 OPERATIONAL ASSUMPTIONS

The Operations Analysis activity is based upon a set of assumptions and guidelines which create the framework for the regional fleet studies. This framework is established in an Operations Scenario which is developed in Section 4.1. The scenario describes the economic pattern anticipated for the 1980-1990 period with the midyear 1985 as a reference planning point. Population growth trends and changes establish geographic patterns for O&D traffic descriptors. Existing transport routes form a network within which a STOL transport system is to be constructed and studied. Quantification of assumptions results in numerical guidelines for development of operations concepts involving the market and the physical elements of a short-haul air transport system.

For convenience of analysis, the U.S. domestic market is divided into six mainland and one offshore region— Hawaii. In phase I, three simplified regions were studied. These were the California, Chicago, and Northeast Regions. In Phase II, these regions were enlarged in scope with a greater travel potential sample. Additional mainland regions were developed in the Southern, Southeast and Northwest Regions. The Hawaii Region was studied with both O&D and interconnect traffic allocated to a STOL system. No details were developed for a Hawaiian scenario. However, with Honolulu projected as both congested and constrained, it appeared logical to consider all of the island short-haul traffic on STOL.

4.1 Operations Scenario

The operations scenario was initiated in Phase I of the study and expanded to cover the more detailed analyses conducted through the remainder of the study. The scenario is intended to project the general environment within which a representative STOL short-haul transportation system is postulated. Operational concepts, airlines schedules, fleet composition and basing concepts are all generated within the operations scenario.

An operations scenario contains the basic ground rules and guidelines needed in the conduct of the study. Ground rules and guidelines are needed both for the basic integration of the various elements of the STOL system study and for development of the implementation plan. The latter is intended to demonstrate how STOL aircraft and networks could evolve in the total U.S. air transportation scenario of the future. Figure 1.2-1 showed an estimate of the world and U.S. domestic inventory of commercial transport aircraft exclusive of STOL. The potential number of STOL aircraft is thus bounded by replacement and/or displacement of conventional aircraft in the 1980 to 1990 period. A primary factor in the STOL system implementation is the availability and utilization of operating sites.

The operations scenario must start with a concept of how to supply a service to meet the demand for short-haul transportation. This demand arises in two ways; from increasing numbers of people who desire air transportation, and from changes in equipment and facilities inventory as the character an geographic distribution of airline systems change in response to temporal, demographic, and environmental factors. To meet this demand, the STOL service must be designed to:

- o Satisfy air travelers with transportation from desired origins to destinations with speed, comfort, safety, reliability, adequate frequency,an acceptable fare level, and convenience of location of the airport.
- o Operate within environmental constraints and limitations, the most important of which is noise.
- o Be acceptable to airline and airport operators in terms of system interface compatibilities at acceptable minimum cost of system revisions.
- o Generate sufficient revenue to be economically viable within a regulated transportation economy.
- o Provide sufficient sales opportunity for aircraft manufacturers to realize a reasonable profit on production and sales.
- o Assure continued growth of the total air travel market in meeting travel requirements by relieving actual and potential congestion at vital transportation centers.

The study includes an analysis of simulated STOL airline operations in the California, Chicago, Northeast regions expanded for Phase II. In addition, the Northwest, Southern, and Southeast regions are included for analyses. The Hawaii region is surveyed to include a total U.S. domestic market. Alaska was excluded because of insufficient traffic potential for the 1985 time period.

Operations Study Ground Rules and Assumptions

Basic ground rules are established in the list below.

1. Each region is organized geographically into representative airline networks. Where appropriate, a region may contain more than one STOL simulated airline. Each STOL airline will be assumed to be a separate operating division of an existing corporate airline.
2. Although STOL operations will be planned at all airports considered, no commingling of CTOL and STOL air traffic will be planned. Rather, separate or dedicated STOL runways are assumed. Operations will be planned for a single STOL runway unless the analysis results in a level of operations which might require a second STOL runway. The number of STOLports in the same city will be minimum consistent with air passenger demand and economic factors.
3. A STOL route network may include the following types of airports:
   - Major air carrier airports with separate STOL facilities.
   - Secondary airports with separate STOL and general aviation facilities.
   - New STOLports at market-oriented sites exclusively dedicated for STOL operations.
   - Existing civil or military airports converted exclusively to short-haul operations, or joint use of facilities by STOL and CTOL where feasible.

4. It is anticipated that some 15 to 20 major airports will be constrained or congested by 1985 at projected growth rates of conventional air carrier operations These will be in addition to some five (5) which are presently airside congested and are unable to meet the potential traffic demand. Various levels of congestion and constraints are developed in Section 1.0 System Scenario. It is proposed that a STOL system be configured to relieve congestion at all of these airports in the following ways appropriate to each level of congestion and constraint:

Level 1 - To relieve congestion at the saturation level, shift all STOL short-haul service to other available airports or sites which are located in traffic generating areas.

Level 2 - Where congestion is occasional or at a maximum level below saturation, relief may be provided by adding separate STOL facilities within the existing and reserved acreage of the airport and its environs.

Level 3 - At airports with social constraints against noise, exhaust emission at minimum levels, or low-level limits on approach, departure, or over-flights, the STOL aircraft nominally should be permissible with operating characteristics wholly within the constraint limits.

On those general aviation airports where STOL is added, the STOL should operate off a runway separate from GA activities. This is recommended for safety, since the jet wake and trailing vortices from STOL operations could leave hazardous turbulence for small aircraft.

At airports subject to Level 2 or 3 constraints, STOL should operate from separate runways where STOL operations are sufficient in number to create an incipient congestion problem if mixed with conventional commercial aircraft on a common runway. To initiate a guideline for airport and operations analysis, the separation number is five or more STOL round trip daily (10 aircraft movements) from which requirements for gate and terminal facilities may be drawn. Short-haul traffic originates in many cities now which are neither constrained nor congested at the airport, but which terminate at constrained airports. To accommodate future growth of short-haul as well as medium and long-haul traffic, new STOL runways are proposed at those airports which are limited by runway capacity with either integrated or segregated use of passenger terminals and facilities. Commingling may be considered at those airports which are not runway limited; also with joint or separate terminal facilities. The STOL operations concept in regional expanded networks will consist of service between the following types of cities:

- o Cities with congested/constrained airports where a STOL strip is placed at an existing major air carrier airport (separate terminals).
- o Cities with congested/constrained airports where short-haul traffic is shifted to a separate airport or

- o Uncongested/unconstrained airports where separate runways are used but CTOL and STOL travelers may commingle in the passenger terminals.

5. Current plans in the Airport & Airway Development Program do not provide for the allocation of any funds for the relief of surface access system congestion or constraints at airports. For the 1980-85 period, it is assumed this policy will not change. Thus, any investment in terminals (people processing and flow) or vehicle access systems (roads, parking, loading zones) will have to be funded by (local) government.

6. A STOL network will be constructed in the same manner as a conventional, short-haul network. The STOL service will be planned to:
   - o Relieve aircraft and passenger-related congestion within the jurisdictional boundaries of existing airports.
   - o Expand or maintain service within operating constraints imposed by the environment.
   - o Provide additional interconnect service both with long-haul air routes and local commuter service at CTOL airports which have a STOL runway.
   - o Operate in a city-pair linkage so that the selected STOL service network contributes to the relief of a potential constrained/congested status at one end of each link in the network.

7. Airline fleet schedules will be derived considering the following operational characteristics:

- Time-distributed peak-hour schedules for a 16 hour day, 7 days per week.
- Turnaround times of 20 minutes for 100 and 150 seat aircraft and 25 minutes for 200 seat aircraft.
- Through-stop times of 15 minutes for 100 and 150, and 20 minutes for 200 seat aircraft.
- Aircraft maneuvers with power-in, power-out to and from the terminal gate
- A total of eight (8) minutes operational maneuver time for each trip
  - Ground maneuver at flight origin (engine warm-up and taxi-out) - 3.5 minutes
  - Ground maneuver at destination (taxi-in to engine off - 1.5 minutes
  - Air maneuver at origin (takeoff and climb to 1500 feet) - 1.0 minutes
  - Air maneuver at destination (approach pattern and landing) - 2.0 minutes
- The fleet schedule may be flown with one or more sizes of aircraft. The appropriate size(s) will be selected to offer a reasonable schedule.
- A total system planning load factor of 60% will be assumed for high and medium density routes and 45% for low density routes.

o Each regional fleet size is derived from a pure scheduling methodology which assumes an average load factor, block times, and numbers of people traveling over each airport pair in the network. Schedules are assigned and iterated until the fleet balances out on a daily basis.

o. A fleet mix of more than one passenger capacity aircraft may be considered in the initial regional analyses.

8. Basing and maintenance concepts are periodic and phased maintenance both of which will be considered in fleet performance evaluation. The number and type of maintenance bases and a variable number of aircraft at appropriate bases will be analyzed to determine the effects upon scheduled departures and optimum fleet size for each region.

9. Specific requirements for labor hours and maintenance costs will be developed for each aircraft as a function of lift concept and passenger seating capacity. For the optimum fleet and maintenance basing concept, facilities costs will be estimated for each region.

10. The baseline fleet evaluation will be done with an EBF, 3000 foot field length aircraft in 100, 150, and 200 passenger capacities. Other lift concepts and field lengths will be included by analytic studies for system and operational comparisons and evaluation.

A summary of the key operational guidelines appears below:

Table 4.1.1
KEY SCENARIO GUIDELINES

- o Annual O & D Traffic

  Higher density= 300,000 and over

  Medium density= 130,000 to 300,000

  Lower density = 50,000 to 130,000

- o Flight Frequency

  Higher density = 4 round trips daily minimum

  Medium density = 2 round trips daily minimum

  Lower density = 1 round trip daily minimum

- o Load Factor - Total System

  Higher density = 60%

  Medium density = 60%

  Lower density = 45%

4.2 Regional System Description

In the baseline STOL airline simulation analysis, routes were constructed to provide service over a representative sample of medium to high density city-pair links. Included in this sample were 94 airports. These were grouped into six mainland regions. The airports are shown on the map in Figure 4.2-1.

These airports, as well as seven in the Hawaiian Islands include several major hub and satellite airports which are projected to suffer various levels of constraint and congestion by the year 1985. Definitions of these are included in Section 1.1.1 of this volume. A listing of airports at each of the levels of congestion/constraint is included as Table 4.2.1. Specific analysis of all of the 94 baseline airports is contained in Volume III, Airports.

NATIONAL SHORT HAUL NETWORK

AIRPORT BASE • 94 AIRPORTS

FIGURE 4.2-1

TABLE 4.2-1

CONGESTED/CONSTRAINED AIRPORTS - 1985

Level 1, Congested - Physical	Airport
Albany/Schenectady, New York	Albany County
Atlanta, Georgia	Atlanta Municipal
Baltimore, Maryland	Friendship International
Boston, Massachusetts	Logan International
Chicago, Illinois	O'Hare International
Cleveland, Ohio	Hopkins International
Detroit, Michigan	Detroit Metropolitan/Wayne County
Hartford, Connecticut	Bradley-Windsor Locks
Los Angeles, California	Los Angeles International
Memphis, Tennessee	Memphis International
Miami, Florida	Miami International
Minneapolis/St. Paul, Minnesota	Wold Chamberlain Field
New Orleans, Louisiana	Moissant International
New York, New York	Kennedy International
	La Guardia Field
	Newark International
Philadelphia, Pennsylvania	Philadelphia International
Pittsburgh, Pennsylvania	Greater Pittsburgh
San Diego, California	Lindbergh International
San Francisco, California	San Francisco International
San Jose, California	San Jose Municipal
St. Louis, Missouri	Lambert Field
Washington, D.C.	Washington National
Level 2, Constrained - Physcial	
Buffalo, New York	Greater Buffalo
Denver, Colorado	Stapleton International
Las Vegas, Nevada	McCarran International
Milwaukee, Wisconsin	Mitchell Field
Oakland, California	Oakland International
Providence, Rhode Island	Greater Providence
Rochester, New York	Monroe County
Seattle, Washington	Seattle/Tacoma International
Syracuse, New York	Hancock Field
Tampa, Florida	Tampa International

TABLE 4.2-1

CONGESTED/CONSTRAINED AIRPORTS - 1985

Level 3, Constrained - Social	Airport
Burbank, California	Burbank/Hollywood
Boston, Massachusetts	Logan International
Dallas, Texas	Love Field
Denver, Colorado	Stapleton International
Los Angeles, California	Los Angeles International
Long Beach, California	Daugherty Field
Miami, Florida	Miami International
Minneapolis/St. Paul, Minnesota	Wold Chamberlain Field
New York, New York	Kennedy International
Santa Ana, California	Orange County
San Diego, California	Lindbergh International
San Francisco, California	San Francisco International
San Jose, California	San Jose Municipal
St. Louis, Missouri	Lambert Field
Washington, D.C.	Washington National

Level 4, Congested/Constrained - Social	
Boston, Massachusetts	Logan International
Denver, Colorado	Stapleton International
Los Angeles, California	Los Angeles International
Miami, Florida	Miami International
Minneapolis/St. Paul	Wold Chamberlain Field
New York, New York	Kennedy International
San Diego, California	Lindbergh International
San Francisco, California	San Francisco International
San Jose, California	San Jose Municipal
St. Louis, Missouri	Lambert Field
Washington, D.C.	Washington National

5.0 OPERATIONS ANALYSIS

In this section, data from the concepts sections are organized within the framework, assumptions, and guidelines established in the Systems Scenario and the Operations Scenario. Certain simulation and analytical routines and methodologies are applied in the evaluation of aircraft operations and performance in a regional transportation assignment. The general approach duplicates the operation of an airline through all the planning, implementation, flight operations, accounting and management evaluation of system performance.

With a baseline aircraft as input, an evaluation is made of system performance of the aircraft over each flight route in a specified regional network. With a quantified, time-distributed travel demand schedule, fleet sizes are determined within operational guidelines. The operations phase of the airline is evaluated and variations in fleet size are estimated with changes in maintenance requirements and aircraft basing assignments. The interaction of the aircraft also is measured against an ATC environment postulated to exist in the 1980 to 1990 period. Results of regional operations are accumulated and merged into a total analysis of STOL as performing a short-haul mission.

An illustration of Phase I activities of this nature is shown in Table 5.0-1. These recommendations included the number and kinds of airports in each of the Phase I regions as well as the most promising range of seat capacities of the STOL aircraft. These recommendations provided the initial input to the regional analyses for Phase II.

STOL SHORT-HAUL TRANSPORTATION SYSTEMS - PHASE II

- SELECTED COMBINATIONS OF 100 - 150 - 200 PASSENGER AIRCRAFT
  - AIRFIELD LENGTH: 2000 - 3000-4000 FEET
  - DESIGN RANGE: 575 ST MI (TRADEOFF STUDIES: 1000 ST MI)

STOL RUNWAYS	REGIONS		
	CALIFORNIA	NORTHEAST	CHICAGO
• AIR CARRIER AIRPORTS	12	10	13
• GENERAL AVIATION AIRPORTS	7	7	2
• NEW/MILITARY AIRPORTS	2	3	0
• SHIFT SOME SHORT-HAUL FROM CONSTRAINED AIR CARRIER AIRPORTS	8	6	5

- FOR NATIONAL SYSTEM INCLUDE: NORTHWEST - SOUTHERN - SOUTHEAST REGIONS

FIGURE 5.0-1

PR2-STOL-1302A

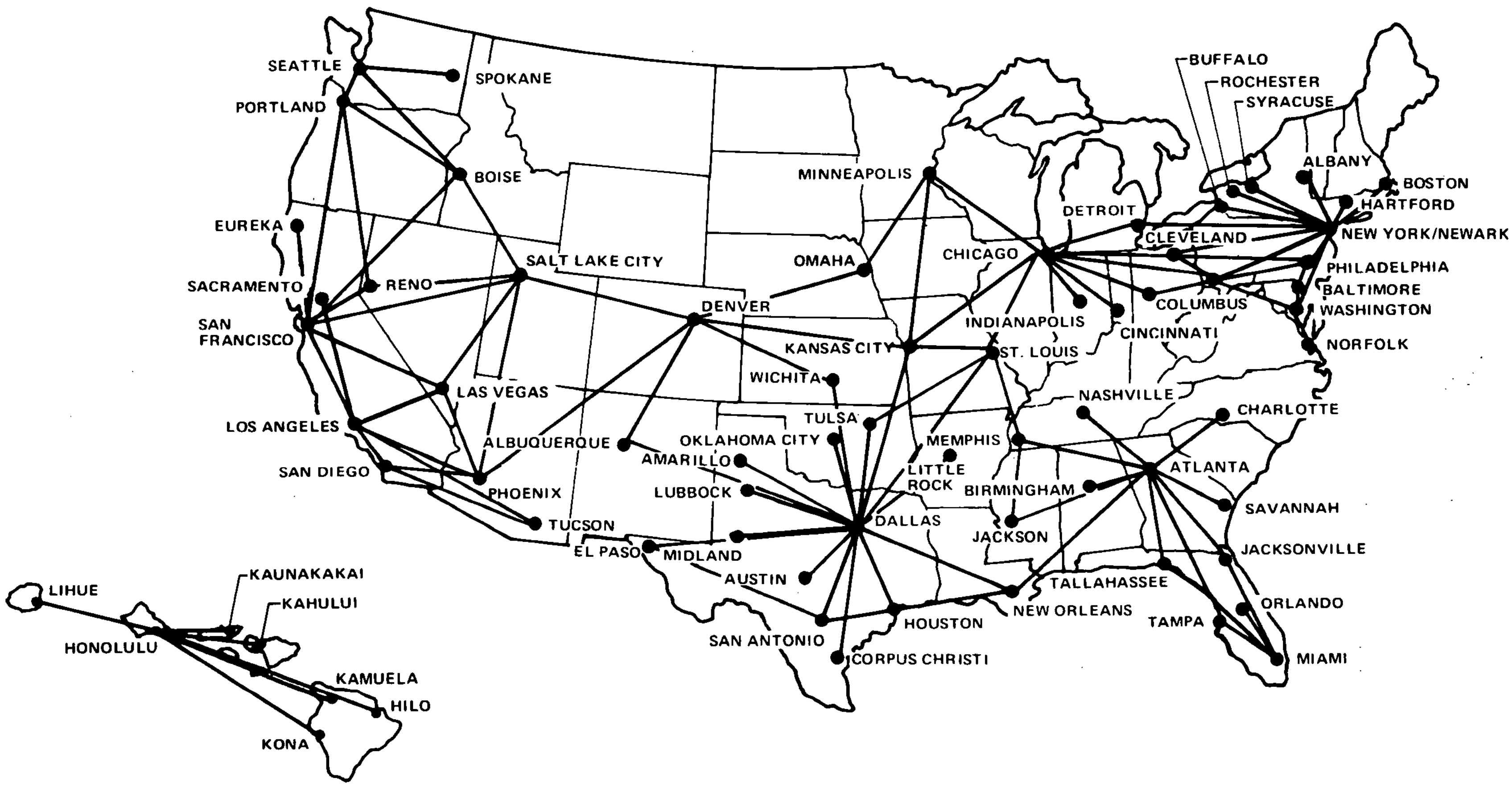
5.1 Regional Route Analysis

The approach to study propulsive lift aircraft is to consider the U.S. domestic short-haul network as it exists today. This is in terms of the cities and routes as shown in Figure 5.1-1. The total number of candidate routes is far greater than those shown. The map, however, does illustrate how the entire U.S. may be viewed as a series of short-haul market regions. Certain key network hubs are notable as the center of many spokes, e.g., Dallas, Altanta, Chicago, and New York.

It is not to be implied in viewing the entire U.S. that a short-haul aircraft would operate from Miami to Minneapolis in a series of short stages. Rather, it is that there are natural geographic groupings within which a short-haul aircraft may operate on a convenient daily schedule. At certain regional interface cities, travelers may journey to two or more regions. Examples are Denver, St. Louis, and New Orleans.

Some current statistics are of interest in quantifying some of the methodology used in the regional analyses. For example, a survey of 23 selected airports provided data on hourly arrival rates of a variety of commercial aircraft. The data are presented in Table 5.1-1. Some peaking is noted, but the pattern is not uniform as between types of aircraft. There is a slight tendency toward the larger jet aircraft arriving latest in the afternoon with the majority of flights scheduled for daylight hours. It is important in scheduling aircraft that arrivals (or departures) are suited to the desires of travelers. The data in

REPRESENTATIVE SHORT-HAUL MARKET REGIONS



PR3-STOL-1791A

FIGURE 5.1-1

TABLE 5.1-1

ARRIVAL PERCENTAGE PER HOUR

(23 Selected Airports)

HOUR	INDIVIDUAL PERCENTAGE DOMESTIC FLIGHTS							CUMULATIVE PERCENTAGE DOMESTIC FLIGHTS						
	747	DC-10 L-1011	DC-8 707	LIGHT JETS	PROP	OTHER N.A. FLIGHTS	TOTAL	747	DC-10 L-1011	DC-8 707	LIGHT JETS	PROP	OTHER N.A. FLIGHTS	TOTAL
12 - 1 AM	1.3	2.0	3.0	1.5	1.4	0.8	1.7	1.3	2.0	3.0	1.5	1.4	0.8	1.7
1 - 2	1.9	0.7	2.1	0.7	0.6	0	0.9	3.2	2.7	5.1	2.2	2.0	0.8	2.6
2 - 3	0.6	0	2.5	0.7	0.5	0.3	0.9	3.8	2.7	7.6	2.9	2.5	1.1	3.5
3 - 4	0	2.0	1.1	0.6	0.6	0	0.7	3.8	4.7	8.7	3.5	3.1	1.1	4.2
4 - 5	0.6	0.7	1.6	0.5	0.4	0.5	0.7	4.4	5.4	10.3	4.0	3.5	1.6	4.9
5 - 6	3.2	2.0	2.4	1.1	0.2	0.3	1.1	7.6	7.4	12.7	5.1	3.7	1.9	6.0
6 - 7 AM	5.7	2.0	3.2	0.7	1.2	0.3	1.3	13.3	9.4	15.9	5.8	4.9	2.2	7.3
7 - 8	1.3	2.0	2.3	2.6	5.8	2.1	3.1	14.6	11.4	18.2	8.4	10.7	4.3	10.4
8 - 9	0.6	1.4	4.6	5.0	8.7	4.0	5.5	15.2	12.8	22.8	13.4	19.4	8.3	15.9
9 - 10	1.9	5.5	2.7	5.8	5.0	1.9	4.9	17.1	18.3	25.5	19.2	24.4	10.2	20.8
10 - 11	5.1	5.5	3.8	8.5	7.0	5.4	7.3	22.2	23.8	29.3	27.7	31.4	15.6	28.1
11 - Noon	3.2	7.5	5.7	6.3	6.1	3.2	6.1	25.4	31.3	35.0	34.0	37.5	18.8	34.2
Noon - 1 PM	5.7	5.5	6.3	5.1	5.4	6.2	5.5	31.1	36.8	41.3	39.1	42.9	25.0	39.7
1 - 2	5.1	3.4	5.3	6.2	5.0	7.2	5.6	36.2	40.2	46.6	45.4	47.9	32.2	45.3
2 - 3	3.2	3.4	4.2	6.2	5.9	9.4	6.1	39.4	43.6	50.8	51.5	53.8	41.6	51.4
3 - 4	5.1	6.1	4.6	5.8	6.2	10.7	5.9	44.5	49.7	55.4	57.3	60.0	52.3	57.3
4 - 5	7.7	9.5	6.5	5.8	8.1	10.4	6.6	52.2	59.2	61.9	63.1	68.1	62.7	63.9
5 - 6	10.2	3.4	5.8	7.1	6.8	9.8	6.9	62.4	62.6	67.7	70.2	74.9	72.5	70.8
6 - 7 PM	6.4	8.2	4.4	6.0	7.8	8.3	6.2	68.8	70.8	72.1	76.2	82.7	80.8	77.0
7 - 8	9.6	9.5	6.0	6.9	5.7	5.8	6.5	78.4	80.3	78.1	83.1	88.4	86.6	83.5
8 - 9	10.8	7.5	7.8	6.2	3.9	7.2	6.1	89.2	87.8	85.9	89.3	92.3	93.8	89.6
9 - 10	6.4	2.7	6.2	4.9	3.9	2.8	4.7	95.6	90.5	92.1	94.2	96.2	96.6	94.3
10 - 11	0.6	6.8	4.4	2.7	2.5	2.1	3.0	96.2	97.3	96.5	96.9	98.7	98.7	97.3
11 - 12	3.8	2.7	3.5	3.1	1.3	1.3	2.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5.1-1 represent accumulated experience over a period of time and are presumed to reflect traveler preferences. Figure 5.1-2 contains the hourly arrival percentages in a histogram which provides a graphic view of hourly arrivals.

Total daily arrivals (survey of August 15, 1972) at the same 23 airports is summarized in Table 5.1-2. Note that some airports have a large number of arrivals. These are generally coincidental with designations of congestion noted in the listing of Appendix A.

A specific survey has been conducted of scheduled operations at Los Angeles International (LAX). Again, it is noticeable in Table 5.1-3 that the largest aircraft arrive late in the afternoon. This undoubtedly reflects early morning departures from the Central and Eastern U.S. A similar grouping of large, long-range aircraft departures is evident in the early hours. Departures and arrivals of light jets are well distributed over the daylight hours. These may be associated with shorter flight distances and reflect travel preferences of passengers in this class.

An analysis was performed to determine if geographical area influenced the time-of-day distribution. Figure 5.1-3 presents the cumulative arrival distributions for Eastern, Central and Western geographical areas. Note the very small difference between geographical areas; most of this difference is due to random variation. There was not an obvious impact due to geographical area for any of the aircraft types.

The time-of-day distribution in Table 5.1-1 may be considered

HOURLY ARRIVALS OF COMMERCIAL AIRCRAFT

23 AIRPORTS

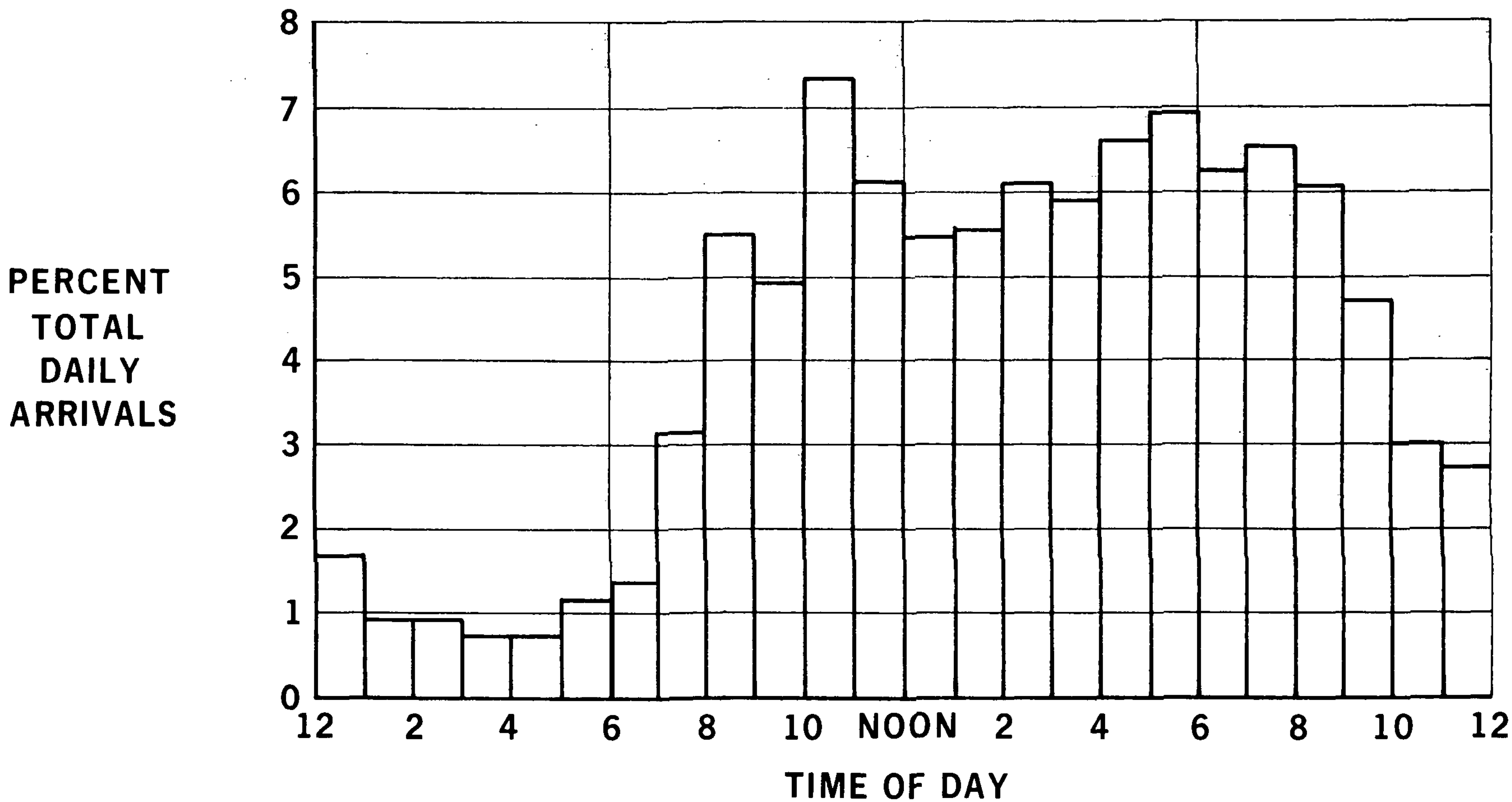


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FIGURE 5.1-2

ARRIVAL-TIME DISTRIBUTION

CONTEMPORARY JET AIRCRAFT

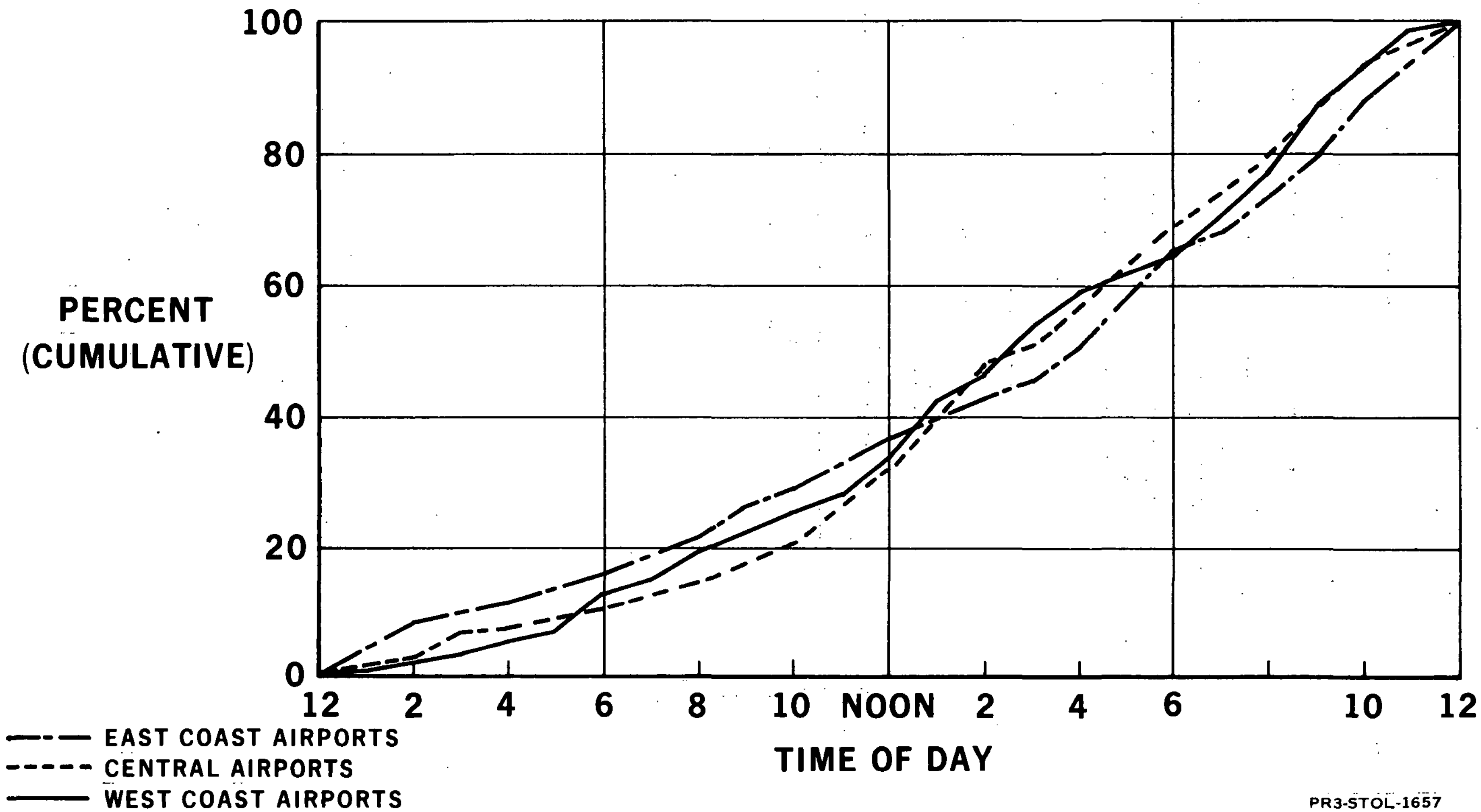

FIGURE 5.1-3

TABLE 5.1-2

SCHEDULED DAILY ARRIVALS

AIRPORTS		DOMESTIC FLIGHTS					OTHER NORTH AMERICAN FLIGHTS	TOTAL
CITY NAME	CODE	747	DC-10 L-1011	DC-8 707	LIGHT JETS	PROP		
New York City	JFK	25	12	104	126	55	130	452
New York City	LGA	0	12	0	313	39	14	378
Boston	BOS	6	3	41	212	107	25	394
Washington, D.C.	DCA	0	0	0	262	105	0	367
Washington, D.C.	IAD	3	2	32	39	8	3	87
Miami	MIA	5	10	60	165	32	85	357
Philadelphia	PHL	0	1	50	168	103	7	329
Tampa	TPA	1	1	29	104	28	2	165
Buffalo	BUF	0	2	9	75	13	18	117
Chicago	ORD	29	39	179	497	163	22	929
Atlanta	ATL	9	0	65	455	52	2	583
Dallas	DAL	5	9	65	251	72	2	404
St. Louis	STL	0	1	25	205	55	0	286
Denver	DEN	0	15	26	194	51	2	285
Houston	IAH	0	0	19	146	50	7	222
New Orleans	MSY	0	0	33	101	56	6	196
Nashville	BNA	0	0	4	60	17	0	81
Los Angeles	LAX	43	24	151	264	81	25	588
San Francisco	SFO	21	10	109	206	43	12	401
Seattle	SEA	6	3	44	95	52	14	214
Phoenix	PHX	1	2	19	74	23	1	120
San Jose	SJC	0	0	1	69	32	0	102
Santa Ana	SNA	0	0	0	33	22	0	55
TOTAL		154	146	1,065	4,114	1,259	377	7,115

TABLE 5.1-3

SCHEDULED OPERATIONS

LOS ANGELES INTERNATIONAL

HOUR	ARRIVALS							DEPARTURES						
	747	DC-10 L-1011	DC-8 707	LIGHT JETS	PROP	OTHER N.A. FLIGHTS	TOTAL	747	DC-10 L-1011	DC-8 707	LIGHT JETS	PROP	OTHER N.A. FLIGHTS	TOTAL
12 - 1 AM			1	3	1	1	6	5	2	4	4	1		16
1 - 2			2	5			7	1		1	3		2	7
2 - 3			2	2			4			1	3			4
3 - 4		1	4	2	1		9			1				1
4 - 5			4	2			6			4				4
5 - 6			8				8			1				1
6 - 7 AM	2		6	2	4		14			2	1	4	1	8
7 - 8			3	7	9		19		1	9	16	6		32
8 - 9		1	7	13	4	1	26	5	2	11	29	7	1	55
9 - 10	1	1	3	18	4		27	7	6	9	15	6	1	44
10 - 11	5	1	6	17	6	3	38	1	1	6	20	6		34
11 - Noon	3	4	10	15	8	1	41	4	2	10	19	9	2	46
Noon - 1 PM	1	1	8	18	4	2	34	5	2	10	15	4	3	39
1 - 2	1	1	6	20	2	1	31	3	4	8	16	2	1	34
2 - 3	3	3	13	15	6	1	41		1	6	21	6	2	36
3 - 4			4	16	5	1	26	1		8	14	5	1	29
4 - 5	1		5	16	6	3	31		1	8	13	3	1	26
5 - 6	5	1	4	19	4	1	34	1	1	5	19	3	1	30
6 - 7 PM	3	2	9	17	6	2	39	3		3	21	5	1	33
7 - 8	5	5	11	15	6	4	46	2		3	15	6		26
8 - 9	7		12	19	2	2	42		1	7	11	5	3	27
9 - 10	4		10	8	1		23	1	1	6	8	5		21
10 - 11		2	5	12	1	2	22	3		8	8			19
11 - 12	2	1	3	2	1		9			11	5		1	17
TOTAL	43	24	146	264	81	25	593	42	25	142	276	83	21	589

representative for all airports. The difference in the time-of-day distribution between airports is generally due to random variation. Therefore, it is reasonable to assume that the expected number of arrivals per aircraft type per hour is the daily demand multiplied by the corresponding number from Table 5.1-1 (This does not hold for an airport with a curfew and/or flow restrictions.)

Data from the Official Airline Guide have been tabulated to illustrate current practices in scheduling numbers of daily round trips up to 500 miles (805 km). For convenience, the data have been arranged to correspond generally with the regions adapted for this study. Table 5.1-4 shows the number of routes (segments) with less than four (4) daily round trips. Individual airline data are presented with the percentage of total routes in each of the regions. Note, for example, that in the Chicago region, all airlines (including those listed) schedule less than four round trips daily on 62.1 percent of their short-haul routes (500 miles or less). Similar numbers are presented for other regions.

The point to be emphasized by these data is that current practice in the short-haul market is to include scheduled flights into varying density markets. This constitutes a very substantial portion of current airline short-haul scheduling. Thus, it is reasonable to plan the STOL network and service levels in a comparable fashion.

The following sections summarize pertinent aircraft characteristics and significant performance evaluations.

TABLE 5.1-4

Regional Summaries of
OAG Data on Airline
Segments with Less than
Four Round Trips Daily
(Stage Lengths Under 500 Miles)
(805 Kilometers)

Chicago Region

Selected Airlines	No. of Segments Under 4 R/T	% of Total Network
American	66	83.5
Allegheny	23	38.3
Delta	75	72.1
Eastern	36	75.0
Northwest	34	61.8
Ozark	110	69.2
Trans World Airlines	48	66.7
United	83	70.3
All Airlines in Region	646	62.1

Northeast Region

Selected Airlines	No. of Segments Under 4 R/T	% of Total Network
American	39	72.2
Allegheny	48	44.9
Eastern	47	85.5
Mohawk	85	74.6
Northeast	25	75.8
United	23	88.5
All Airlines in Region	410	68.1

TABLE 5.1-4 (Continued

California Region

Selected Airlines	No. of Segments Under 4 R/T	% of Total Network
American	18	85.7
Pacific Southwest	14	45.2
Hughes Airwest	53	75.7
United	45	88.2
Western	19	52.8
Air California	8	53.3
All Airlines in Region	228	68.5

Southeast Region

Selected Airlines	No. of Segments Under 4 R/T	% of Total Network
American	19	86.4
Allegheny	8	47.1
Delta	130	72.6
Eastern	143	73.7
National	54	74.0
Southern	95	78.5
United	43	86.0
All Airlines in Region	722	75.8

TABLE 5.1-4 (Continued)

Southern Region

Selected Airlines	No. of Segments Under 4 R/T	% of Total Network
American	18	69.2
Braniff	34	59.6
Continental	18	45.0
Delta	41	68.3
Texas Int'l	100	71.4
All Airlines in Region	303	61.1

Northwest Region

Selected Airlines	No. of Segments Under 4 R/T	% of Total Network
Northwest	12	63.2
Hughes Airwest	45	76.3
United	27	79.4
Western	9	75.0
All Airlines in Region	99	63.5

5.1.1 Aircraft Characteristics - The basic concepts of candidate aircraft were presented in Section 3.1. Characteristic data on each aircraft are included in Tables 5.1.1-1 through 5.1.1-9. These basic data were used as aircraft descriptors in regional route analyses in the baseline analyses. An additional reexamination of the 150 passenger EBF configuration by the Aircraft Analysis section resulted in a modified aircraft with improvements in design. Data on the modified aircraft are shown in Table 5.1.1-10. Evaluation of the important improvements in the modified aircraft is included in Section 6.1, Aircraft/System Evaluation.

Table 5.1.1-1

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: E 100.3000

Item	Units			
	English		International	
Passenger Seats (No.)	100		--	
Runway Length	3,000	FT	914	M
MRW	112,200	LB	50,894	KG
MTOGW	111,700	LB	50,667	KG
MLW	111,700	LB	50,667	KG
MZFW	98,130	LB	44,512	KG
OEW	78,130	LB	35,440	KG
MWE	75,860	LB	34,410	KG
Cost Weight	66,009	LB	29,942	KG
Unit Engine Weight	2,152	LB	976	KG
Thrust Per Engine	14,520	LB	6,586	KG
Number of Engines (No.)	4		--	
Avionics Weight	1,690	LB	767	
Rolling Assembly Weight	1,243	LB	563	
Fuel Capacity	2,120	USG	8,025	L
Fuel Flow/Flying Hour - All Engines	1,000	USG	3,785	L
Wing Area	1,117	SQ FT	104.8	SQ M
Wing Loading	100	LB/SQ FT	4,788	N/SQ M
Cruise Mach at Altitude	.67/25,000	FT	.67/7620	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300		2,500	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	6.741		--	
Hull Insurance (%)	2		--	

* Production = 800 units

Table 5.1.1-2

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: E 150.3000 (Baseline)

Item	Units (English)		Units (International)	
Passenger Seats (No.)	150			
Runway Length	3,000		914	M
MRW	163,800	LB	74,300	KG
MTOGW	163,300	LB	74,073	KG
MLW	163,300	LB	74,073	KG
MZFW	143,750	LB	65,205	KG
OEW	113,750	LB	51,597	KG
MWE	110,900	LB	50,304	KG
Cost Weight	96,742	LB	43,882	KG
Unit Engine Weight	3,150	LB	1,429	KG
Thrust Per Engine	21,270	LB	9,648	KG
Number of Engines (No.)	4		--	
Avionics Weight	1,760	LB	798	KG
Rolling Assembly Weight	1,818	LB	824	KG
Fuel Capacity	3,100	USG	11,735	L
Fuel Flow/Flying Hour - All Engines	1,660	USG	6,284	L
Wing Area	1,633	SQ FT	151.7	SQ M
Wing Loading	100	LB/SQ FT	4,788	N/SQ M
Cruise Mach at Altitude	.68/25,000	FT	.68/7620	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	9,399		--	
Hull Insurance (%)	2		--	

* Production = 600 units

Table 5.1.1-3

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: E200.3000

Item	Units			
	English		International	
Passenger Seats (No.)	200		--	
Runway Length	3,000	FT	914	M
MRW	221,900	LB	100,653	KG
MTOGW	221,400	LB	100,427	KG
MLW	221,400	LB	100,427	KG
MZFW	195,640	LB	88,742	KG
OEW	155,640	LB	70,598	KG
MWE	151,880	LB	68,893	KG
Cost Weight	132,350	LB	60,034	KG
Unit Engine Weight	4,266	LB	1,935	KG
Thrust Per Engine	28,790	LB	13,059	KG
Number of Engines (No.)	4		--	
Avionics Weight	1,910	LB	866	KG
Rolling Assembly Weight	2,464	LB	1,118	KG
Fuel Capacity	4,030	USG	15,255	L
Fuel Flow/Flying Hour				
- All Engines	1,938	USG	7,336	L
Wing Area	2,214	SQ FT	205.7	SQ M
Wing Loading	100	LB/SQ FT	4,788	N SQ M
Cruise Mach at Altitude	.70/29,000	FT	.70/7620	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	9.399		--	
Hull Insurance (%)	2			

* Production = 600 units

Table 5.1.1-4

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: E 150.2000

Item	Units			
	English		International	
Passenger Seats (No.)	150		--	
Runway Length	2,000	FT	610	M
MRW	206,700	LB	93,759	KG
MTOGW	206,200	LB	93,532	KG
MLW	206,200	LB	93,532	KG
MZFW	181,900	LB	82,510	KG
OEW	151,900	LB	68,902	KG
MWE	148,900	LB	67,541	KG
Cost Weight	130,700	LLB	59,285	KG
Unit Engine Weight	3,976	LB	1,803	KG
Thrust Per Engine	26,830	LB	12,171	KG
Number of Engines (No.)	4		--	
Avionics Weight	1,760	LB	798	KG
Rolling Assembly Weight	2,295	LB	1,041	KG
Fuel Capacity	3,850	USG	14,574	L
Fuel Flow/Flying Hour - All Engines	2,100	USG	7,949	L
Wing Area	3,100	SQ FT	288	SQ M
Wing Loading	66.5	LB/SQ FT	3,184	N/SQ M
Cruise Mach at Altitude	.68/25,000	FT	.68/7620	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300			
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	13.118		--	
Hull Insurance (%)	2			

* Production = 400 units

Table 5.1.1-5

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: A 150.2000

Item	Units (English)		Units (International)	
Passenger Seats (No.)	150		--	
Runway Length	2,000	FT	610	M
MRW	211,770	LB	96,059	KG
MTOGW	211,770	LB	95,832	KG
MLW	211,270	LB	95,832	KG
MZFW	177,310	LB	80,428	KG
OEW	147,310	LB	66,820	KG
MWE	144,360	LB	65,482	KG
Cost Weight	125,915	LB	57,115	KG
Unit Engine Weight	4,023	LB	1,824	KG
Thrust Per Engine	22,200	LB	10,069	KG
Number of Engines (No.)	4		--	
Avionics Weight	1,760	LB	798	KG
Rolling Assembly Weight	2,350	LB	1,066	KG
Fuel Capacity	5,390	USG	20,403	L
Fuel Flow/Flying Hour - All Engines	2,890	USG	10,940	L
Wing Area	2,471	SQ FT	229.6	SQ M
Wing Loading	85.5	LB/SQ FT	4,094	N/SQ M
Cruise Mach at Altitude	.79/29,000	FT	.79/8839	M
Design Range	575	ST MI		
Annual Utilization (Hr.)	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million) *	13.468		--	
Hull Insurance (%)	2		--	

* Production = 400 units

Table 5.1.1-6

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: U 150.2000

Item	Units English		Units International	
Passenger Seats (No.)	150		--	
Runway Length	2,000	FT	610	M
MRW	233,340	LB	105,843	KG
MTOGW	232,840	LB	105,616	KG
MLW	232,840	LB	105,616	KG
MZFW	206,600	LB	93,713	KG
OEW	176,600	LB	80,106	KG
MWE	173,540	LB	78,717	KG
Cost Weight	155,362	LB	70,472	KG
Unit Engine Weight	3,870	LB	1,755	KG
Thrust Per Engine	27,475	LB	12,463	KG
Number of Engines (No.)	4		--	
Avionics Weight				
Rolling Assembly Weight	2,592	LB	1,175	KG
Fuel Capacity	4,100	USG	15,520	L
Fuel Flow/Flying Hour				
- All Engines	2,000	USG	7,570	L
Wing Area	3,881	SQ FT	360.5	SQ M
Wing Loading	60	LB/SQ FT	2,873	N/SQ M
Cruise Mach at Altitude	.70/30,000	FT	.70/9140	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	14.888		--	
Hull Insurance (%)	2			

* Production = 400 units

Table 5.1.1-7

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: M 150.3000

Item	Units			
	English		International	
Passenger Seats (No.)	150		--	
Runway Length	3,000	FT	914	M
MRW	160,600	LB	72,848	KG
MTOGW	160,100	LB	72,621	KG
MLW	160,100	LB	72,621	KG
MZFW	141,400	LB	64,139	KG
OEW	111,400	LB	50,531	KG
MWE	108,600	LB	49,261	KG
Cost Weight				
Unit Engine Weight	3,020	LB	1,370	KG
Thrust Per Engine	20,280	LB	9,199	KG
Number of Engines (No.)	4			
Avionics Weight	1,760	LB	798	KG
Rolling Assembly Weight	1,984	LB	900	KG
Fuel Capacity	2,960	USG	11,205	L
Fuel Flow/Flying Hour				
- All Engines	1,630	USG	6,170	L
Wing Area	2,426	SQ FT	225.4	SQ M
Wing Loading	73.5	LB/SQ FT	3,519	N/SQ M
Cruise Mach at Altitude	.71/28,000	FT	.71/8534	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million) *	9,690		--	
Hull Insurance (%)	2		--	

* Production = 600 units

Table 5.1.1-8

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: M 150.4000

Item	Units			
	English		International	
Passenger Seats (No.)	150		--	
Runway Length	4,000	FT	1,219	M
MRW	154,550	LB	70,104	KG
MTOGW	154,050	LB	69,877	KG
MLW	154,050	LB	69,877	KG
MZFW	135,290	LB	61,367	KG
OEW	105,920	LB	47,760	KG
MWE	103,070	LB	46,752	KG
Cost Weight	90,075	LB	40,858	KG
Unit Engine Weight	5,640	LB	2,558	KG
Thrust Per Engine	34,390	LB	15,599	KG
Number of Engines (No.)	4		--	
Avionics Weight	1,760	LB	798	KG
Rolling Assembly Weight	1,715	LB	778	KG
Fuel Capacity	2,880	USG	10,902	L
Fuel Flow/Flying Hour - All Engines	1,495	USG	5,659	L
Wing Area	1,525	SQ FT	141.7	SQ M
Wing Loading	101	LB/SQ FT	4,836	N/SQ M
Cruise Mach at Altitude	.76/26,000	FT	.76/ 7925	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	9.872			
Hull Insurance (%)	2		--	

* Production = 400 units

Table 5.1.1-9

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: CTOL 150.7600

Item	Units			
	English		International	
Passenger Seats (No.)	150		--	
Runway Length	7,600	FT		
MRW	160,100	LB	72,621	KG
MTOGW	159,600	LB	72,394	KG
MLW	159,600	LB	72,394	KG
MZFW	124,800	LB	56,609	KG
OEW	94,800	LB	43,001	KG
MWE	91,000	LB	41,277	KG
Cost Weight	80,844	LB	36,670	KG
Unit Engine Weight	4,190	LB	1,900	KG
Thrust Per Engine	29,350	LB	13,313	KG
Number of Engines (No.)	2			
Avionics Weight	1,760	LB	798	KG
Rolling Assembly Weight	1,776	LB	805	KG
Fuel Capacity	5,510	USG	20,857	L
Fuel Flow/Flying Hour				
- All Engines	1,440	USG	5,440	L
Wing Area	1,450	SQ FT	134.7	SQ M
Wing Loading	110	LB/SQ FT	5,267	N/SQ M
Cruise Mach at Altitude	180/32,000	FT	.80/9753	M
Design Range	1,200	ST MI	1,930	KM
Annual Utilization (Hr).	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	1		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	9.046		--	
Hull Insurance (%)	2		--	

* Production = 400 units

Table 5.1.1-10

AIRCRAFT CHARACTERISTICS DATA

Aircraft Identification: E 150.3000 (Modified)

Item	Units			
	English		International	
Passenger Seats (No.)	150		--	
Runway Length	3,000	FT	914	M
MRW	149,530	LB	67,826	KG
MTOGW	149,030	LB	67,600	KG
MLW	149,030	LB	67,600	KG
MZFW	132,610	LB	60,152	KG
OEW	102,610	LB	46,543	KG
MWE	99,770	LB	45,255	KG
Cost Weight	87,311	LB	39,604	KG
Unit Engine Weight	2,725	LB	1,236	KG
Thrust Per Engine	18,260	LB	8,282	KG
Number of Engines (No.)	4		--	
Avionics Weight	1,760	LB	798	KG
Rolling Assembly Weight	1,659	LB	752	KG
Fuel Capacity	2,600	USG	9,842	L
Fuel Flow/Flying Hour				
- All Engines	1,290	USG	4,883	L
Wing Area	1,461	SQ FT	135.7	SQ M
Wing Loading	102	LB/SQ FT	4,884	N/SQ M
Cruise Mach at Altitude	.69/26,000	FT	.69/ 7925	M
Design Range	575	ST MI	924	KM
Annual Utilization (Hr.)	3,300		--	
Flight Crew Number (No.)	3		--	
Depreciation Period (Yr.)	12		--	
Residual Value (%)	0		--	
Aircraft Price ($ Million)*	10.518		--	
Hull Insurance (%)	2			

* Production = 400 units

5.1.2 Performance Evaluation - The route analysis required performance evaluation of the candidate aircraft in each of the three regions studied. A flight profile was used on each route segment (airport-pair). A twenty minute turnaround time was used as input to the scheduling model. The block times were computed in a standard flight performance routine for airborne time. Block time for each flight in all segments included a constant eight (8) minutes of maneuver time.

Data from route analysis is used to compute aircraft trip costs on each segment. The data used are flight length, block time and fuel burned as a part of the modified ATA methodology used in other sections of the study.

The attached Exhibits 5.1.2-1, pages 1 through 44, present the results for the candidate aircraft operating in the Chicago Region. A map of the route network for the Chicago Region - Baseline system is included in Section 5.2.1 as Figure 5.2.1-1.

An analysis was performed to determine if the values for approach, takeoff and taxi maneuver times and fuels allocated to the baseline STOL aircraft were reasonable. Data were obtained for the DC-10, DC-8 and DC-9 family. Fuel flows were obtained for each maneuver, and the maneuver fuel was computed based on an estimated time for each particular maneuver. THe maneuver times and fuels are presented in Table 5.1.2-1.

Table 5.1.2-1

MANEUVER TIME AND FUEL (CTOL vs. STOL)										
	Engine Start & Taxi-Out		Takeoff & Accelerate to Climb Speed		Approach & Land		Taxi-In		Total	
	Min	Lb	Min	Lb	Min	Lb	Min	Lb	Min	Lb
DC-10										
Series-10	6	500	4	1500	4	1080	4	270	18	3350
-40	6	520	4	1700	4	1310	4	270	18	3800
-30	6	670	4	1930	4	1350	4	350	18	4300
DC-8										
Series-61	5	350	4	1800	4	770	3	230	15	3150
-62	5	350	4	1730	4	740	3	230	15	3050
-63	5	330	4	1470	4	670	3	230	15	2700
DC-9										
Series-10	4	160	4	465	4	200	2	75	12	900
-20	4	165	4	500	4	200	2	85	12	950
-30	4	170	4	520	4	220	2	90	12	1000
-40	4	170	4	560	4	230	2	90	12	1050
STOL										
EBF 150.3000	3.5	240	2	570	2	350	1.5	90	8	1250

The comparative data as presented in Table 5.1.2-1 above indicate that the time values and fuels allocated to the study STOL aircraft are reasonable.

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

AIRCRAFT MODEL: U150.2000
(Production Quantity = 400)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

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Conversion Table:
S.Mi x 1.609 = km
Lb x .4536 = kg
$/S.Mi ÷ 1.609 = $/km
¢/seat S.Mi ÷ 1.609 = ¢/seat km
DOC in Passenger Seat Miles
at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	18,000	1:01	13,009	213,202	200,443	4.14	4.60
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	18,000	1:01	12,870	211,622	199,002	4.13	4.59
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	18,000	0:48	9,882	208,950	199,318	4.76	5.29
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	18,000	0:48	9,882	208,634	199,002	4.77	5.30
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	18,000	0:47	9,564	208,032	198,718	4.87	5.41
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	18,000	0:46	9,560	208,312	199,002	4.85	5.39
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	18,000	0:55	11,508	211,382	200,124	4.38	4.87
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	18,000	0:55	11,560	210,312	199,002	4.37	4.86
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	18,000	1:07	14,296	215,272	201,226	3.98	4.42
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	18,000	1:07	14,109	212,861	199,002	3.96	4.40
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	18,000	1:08	14,549	215,322	201,023	3.91	4.34
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	18,000	1:08	14,680	213,432	199,002	3.91	4.34
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	18,000	0:47	9,617	207,895	198,528	4.82	5.36
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	18,000	0:47	9,609	208,361	199,002	4.81	5.34

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: U150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	282	FWA	138	18,000	0:51	10,604	210,884	200,530	4.57	5.08
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	18,000	0:51	10,613	209,365	199,002	4.56	5.06
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	18,000	0:54	11,349	211,339	200,240	4.41	4.89
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	18,000	0:54	11,304	211,294	199,002	4.41	4.89
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	18,000	0:43	9,031	208,067	199,286	4.96	5.52
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	18,000	0:43	8,951	207,703	199,002	4.98	5.54
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	18,000	0:40	8,345	207,160	199,065	5.23	5.81
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	18,000	0:40	8,293	207,045	199,002	5.25	5.84
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	18,000	0:38	7,153	206,537	199,634	6.28	6.98
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	18,000	0:39	7,194	205,946	199,002	6.40	7.11
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	18,000	1:01	13,046	213,239	200,443	4.12	4.58
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	18,000	1:01	12,902	211,528	198,876	4.12	4.57
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	18,000	0:49	10,125	209,193	199,318	4.69	5.22
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	18,000	0:49	10,114	208,740	198,876	4.71	5.23
CHICAGO(MEIGS)-DETROIT	238	TOL	70	18,000	0:44	9,444	207,912	198,718	4.87	5.41
DETROIT-CHICAGO(MEIGS)	238	MKE	76	18,000	0:45	9,373	207,999	198,876	4.89	5.43
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	18,000	0:55	11,343	211,217	200,124	4.42	4.91
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	18,000	0:54	11,388	210,014	198,876	4.41	4.90
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	18,000	1:08	14,574	215,550	201,226	3.95	4.39
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	18,000	1:08	14,374	213,000	198,876	3.93	4.37

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: U150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	18,000	1:08	14,385	215,158	201,023	3.93	4.36
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	18,000	1:08	14,507	213,133	198,876	3.93	4.37
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	18,000	0:47	9,619	207,897	198,528	4.83	5.36
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	18,000	0:47	9,609	208,235	198,876	4.81	5.34
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	18,000	0:51	10,507	210,787	200,530	4.59	5.10
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	18,000	0:50	10,510	209,136	198,876	4.57	5.08
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	18,000	0:55	11,556	211,285	199,979	4.36	4.85
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	18,000	0:55	11,466	210,092	198,876	4.36	4.85
CHICAGO(MEIGS)-OMAHA	429	DSM	116	18,000	1:10	15,035	214,764	199,979	3.89	4.33
OMAHA-CHICAGO(MEIGS)	429	MKE	76	18,000	1:10	14,822	213,448	198,876	3.88	4.31
CHICAGO(MEIGS)-DAYTON	223	FWA	91	18,000	0:43	8,988	208,024	199,286	5.04	5.60
DAYTON-CHICAGO(MEIGS)	223	MKE	76	18,000	0:43	8,879	207,505	198,876	5.02	5.58
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	18,000	1:21	17,552	215,609	198,307	3.69	4.10
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	18,000	1:21	17,284	215,910	198,876	3.67	4.08
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	18,000	1:14	15,705	213,762	198,307	3.80	4.22
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	18,000	1:14	15,926	214,552	198,876	3.81	4.24
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	18,000	0:38	7,235	206,619	199,634	6.25	6.94
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	18,000	0:39	7,275	205,901	198,876	6.36	7.06
MINNEAPOLIS-MILWAUKEE	307	GRR	121	18,000	0:54	11,315	211,160	200,095	4.40	4.89
MILWAUKEE-MINNEAPOLIS	307	DLH	135	18,000	0:54	11,382	211,575	200,443	4.40	4.89

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: U150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	18,000	0:52	10,845	210,574	199,979	4.49	4.99
OMAHA-MINNEAPOLIS	290	DLH	135	18,000	0:52	10,806	210,999	200,443	4.50	5.00
ST. LOUIS-KANSAS CITY	242	OMA	166	18,000	0:45	9,507	210,483	201,226	4.85	5.39
KANSAS CITY-ST. LOUIS	242	SPI	92	18,000	0:45	9,554	208,622	199,318	4.83	5.36
ST. LOUIS-INDIANAPOLIS	223	FWA	104	18,000	0:43	8,981	208,365	199,634	5.02	5.58
INDIANAPOLIS-ST. LOUIS	223	SPI	92	18,000	0:43	8,894	207,962	199,318	5.02	5.58
DETROIT-INDIANAPOLIS	251	FWA	104	18,000	0:47	9,696	209,080	199,634	4.80	5.33
INDIANAPOLIS-DETROIT	251	TOL	70	18,000	0:47	9,683	208,151	198,718	4.81	5.35
DETROIT-MILWAUKEE	251	GRR	121	18,000	0:47	9,703	209,548	200,095	4.80	5.33
MILWAUKEE-DETROIT	251	TOL	70	18,000	0:47	9,689	208,157	198,718	4.82	5.35
DETROIT-MINNEAPOLIS	547	DLH	135	18,000	1:25	18,557	218,750	200,443	3.62	4.02
MINNEAPOLIS-DETROIT	547	TOL	70	18,000	1:25	18,221	216,689	198,718	3.59	3.99
DETROIT-PITTSBURGH	214	CMH	158	18,000	0:41	8,666	209,439	201,023	5.09	5.66
PITTSBURGH-DETROIT	214	TOL	70	18,000	0:41	8,573	207,041	198,718	5.11	5.67
DETROIT-ST. LOUIS	460	SPI	92	18,000	1:14	15,980	215,048	199,318	3.82	4.24
ST. LOUIS-DETROIT	460	TOL	70	18,000	1:14	15,762	214,230	198,718	3.80	4.22
CLEVELAND-DETROIT	92	TOL	70	18,000	0:31	5,063	203,531	198,718	9.39	10.43
DETROIT-CLEVELAND	92	CMH	122	18,000	0:31	4,949	204,823	200,124	9.36	10.40
CLEVELAND-ST. LOUIS	493	SPI	92	18,000	1:18	16,948	216,016	199,318	3.73	4.15
ST. LOUIS-CLEVELAND	493	CMH	122	18,000	1:18	16,714	216,588	200,124	3.72	4.13

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: U150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	ALTERNATE				BLOCK	BLOCK	WEIGHT		D.O.C.	
	DISTANCE (S MI)	AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	TIME (HR:MIN)	FUEL (LB)	TAKEOFF (LB)	LANDING (LB)	($/S MI)	(¢/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	18,000	0:53	11,101	210,169	199,318	4.46	4.95
ST. LOUIS-CINCINNATI	298	DAY	63	18,000	0:53	11,060	209,338	198,528	4.46	4.96
CINCINNATI-DETROIT	247	TOL	70	18,000	0:47	9,577	208,045	198,718	4.85	5.39
DETROIT-CINCINNATI	247	DAY	63	18,000	0:46	9,579	207,857	198,528	4.83	5.37
DENVER-KANSAS CITY	550	OMA	166	18,000	1:22	17,985	218,961	201,226	3.50	3.89
KANSAS CITY-DENVER	550	COS	67	18,000	1:23	18,446	216,819	198,623	3.53	3.92
DENVER-OMAHA	483	DSM	116	18,000	1:14	16,035	215,764	199,979	3.63	4.03
OMAHA-DENVER	483	COS	67	18,000	1:14	16,431	214,804	198,623	3.65	4.06

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: E150.2000

(Production Quantity = 400)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

Conversion Table:
S.Mi x 1.609 km
Lb x .4536 kg
\$/S.Mi ÷ 1.609 = \$/km
¢/seat S.M. ÷ 1.609 = ¢/seat km
DOC in Passenger Seat Miles
at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	18,000	1:00	11,627	186,502	175,125	3.86	4.29
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	18,000	0:60	11,517	185,117	173,850	3.85	4.28
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	18,000	0:47	8,877	182,757	174,130	4.42	4.91
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	18,000	0:47	8,973	182,573	173,850	4.42	4.91
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	18,000	0:45	8,662	182,010	173,598	4.51	5.01
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	18,000	0:45	8,592	182,192	173,850	4.51	5.01
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	18,000	0:54	10,303	184,897	174,844	4.07	4.52
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	18,000	0:54	10,321	183,921	173,850	4.07	4.52
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	18,000	1:06	12,760	188,326	175,816	3.71	4.12
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	18,000	1:05	12,617	186,217	173,850	3.69	4.10
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	18,000	1:07	13,055	188,442	175,637	3.65	4.05
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	18,000	1:08	13,090	186,690	173,850	3.66	4.07
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	18,000	0:45	8,735	181,915	173,430	4.47	4.97
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	18,000	0:46	8,640	182,240	173,850	4.47	4.97

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	282	FWA	138	18,000	0:50	9,516	184,468	175,202	4.25	4.72
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	18,000	0:50	9,482	183,082	173,850	4.24	4.72
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	18,000	0:53	10,161	184,857	174,946	4.11	4.56
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	18,000	0:53	10,071	184,767	173,850	4.11	4.56
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	18,000	0:42	8,096	181,948	174,102	4.68	5.20
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	18,000	0:43	7,994	181,594	173,850	4.68	5.20
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	18,000	0:40	7,459	181,115	173,906	4.92	5.47
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	18,000	0:40	7,409	181,009	173,850	4.92	5.47
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	18,000	0:34	6,448	180,608	174,410	5.58	6.20
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	18,000	0:34	6,492	180,092	173,850	5.58	6.20
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	18,000	1:00	11,659	186,534	175,125	3.85	4.27
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	18,000	1:00	11,544	185,032	173,738	3.83	4.26
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	18,000	0:48	9,103	182,983	174,130	4.36	4.85
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	18,000	0:48	9,199	182,687	173,738	4.36	4.85
CHICAGO(MEIGS)-DETROIT	238	TOL	70	18,000	0:44	8,435	181,783	173,598	4.58	5.09
DETROIT-CHICAGO(MEIGS)	238	MKE	76	18,000	0:44	8,365	181,853	173,738	4.58	5.08
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	18,000	0:53	10,157	184,751	174,844	4.10	4.56
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	18,000	0:53	10,166	183,654	173,738	4.10	4.56
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	18,000	1:07	13,006	188,572	175,816	3.69	4.09
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	18,000	1:07	12,851	186,339	173,738	3.67	4.08

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	18,000	1:07	12,908	188,295	175,637	3.67	4.08
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	18,000	1:07	12,935	186,423	173,738	3.68	4.09
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	18,000	0:45	8,736	181,916	173,430	4.47	4.97
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	18,000	0:46	8,638	182,126	173,738	4.47	4.97
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	18,000	0:49	9,429	184,381	175,202	4.26	4.74
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	18,000	0:49	9,388	182,876	173,738	4.26	4.74
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	18,000	0:54	10,342	184,808	174,716	4.07	4.52
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	18,000	0:54	10,268	183,756	173,738	4.06	4.52
CHICAGO(MEIGS)-OMAHA	429	DSM	116	18,000	1:09	13,427	187,893	174,716	3.64	4.04
OMAHA-CHICAGO(MEIGS)	429	MKE	76	18,000	1:09	13,251	186,739	173,738	3.62	4.02
CHICAGO(MEIGS)-DAYTON	223	FWA	91	18,000	0:42	8,003	181,855	174,102	4.73	5.25
DAYTON-CHICAGO(MEIGS)	223	MKE	76	18,000	0:42	7,928	181,416	173,738	4.71	5.24
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	18,000	1:20	15,622	188,606	173,234	3.44	3.83
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	18,000	1:19	15,439	188,927	173,738	3.43	3.81
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	18,000	1:12	14,042	187,026	173,234	3.54	3.94
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	18,000	1:13	14,188	187,676	173,738	3.56	3.96
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	18,000	0:34	6,522	180,682	174,410	5.55	6.17
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	18,000	0:34	6,564	180,052	173,738	5.55	6.17
MINNEAPOLIS-MILWAUKEE	307	GRR	121	18,000	0:53	10,143	184,711	174,818	4.10	4.55
MILWAUKEE-MINNEAPOLIS	307	DLH	135	18,000	0:53	10,185	185,060	175,125	4.10	4.56

EXHIBIT 5.1.2-1

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	18,000	0:51	9,715	184,181	174,716	4.19	4.66
OMAHA-MINNEAPOLIS	290	DLH	135	18,000	0:51	9,701	184,576	175,125	4.19	4.66
ST. LOUIS-KANSAS CITY	242	OMA	166	18,000	0:45	8,513	184,079	175,816	4.54	5.05
KANSAS CITY-ST. LOUIS	242	SPI	92	18,000	0:45	8,525	182,405	174,130	4.54	5.05
ST. LOUIS-INDIANAPOLIS	223	FWA	104	18,000	0:42	8,040	182,200	174,410	4.72	5.25
INDIANAPOLIS-ST. LOUIS	223	SPI	92	18,000	0:42	7,940	181,820	174,130	4.72	5.25
DETROIT-INDIANAPOLIS	251	FWA	104	18,000	0:46	8,735	182,895	174,410	4.47	4.96
INDIANAPOLIS-DETROIT	251	TOL	70	18,000	0:46	8,783	182,131	173,598	4.46	4.96
DETROIT-MILWAUKEE	251	GRR	121	18,000	0:46	8,739	183,307	174,818	4.47	4.96
MILWAUKEE-DETROIT	251	TOL	70	18,000	0:46	8,787	182,135	173,598	4.47	4.96
DETROIT-MINNEAPOLIS	547	DLH	135	18,000	1:24	16,532	191,407	175,125	3.38	3.76
MINNEAPOLIS-DETROIT	547	TOL	70	18,000	1:24	16,275	189,623	173,598	3.36	3.73
DETROIT-PITTSBURGH	214	CMH	158	18,000	0:41	7,804	183,191	175,637	4.81	5.34
PITTSBURGH-DETROIT	214	TOL	70	18,000	0:41	7,660	181,008	173,598	4.80	5.34
DETROIT-ST. LOUIS	460	SPI	92	18,000	1:13	14,224	188,104	174,130	3.56	3.96
ST. LOUIS-DETROIT	460	TOL	70	18,000	1:13	14,086	187,434	173,598	3.54	3.94
CLEVELAND-DETROIT	92	TOL	70	18,000	0:25	4,580	177,928	173,598	7.84	8.71
DETROIT-CLEVELAND	92	CMH	122	18,000	0:25	4,501	179,095	174,844	7.84	8.71
CLEVELAND-ST. LOUIS	493	SPI	92	18,000	1:17	15,079	188,959	174,130	3.48	3.87
ST. LOUIS-CLEVELAND	493	CMH	122	18,000	1:17	14,932	189,526	174,844	3.47	3.85

EXHIBIT 5.1.2-1

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	18,000	0:52	9,903	183,783	174,130	4.15	4.61
ST. LOUIS-CINCINNATI	298	DAY	63	18,000	0:52	9,922	183,102	173,430	4.15	4.61
CINCINNATI-DETROIT	247	TOL	70	18,000	0:45	8,680	182,028	173,598	4.50	5.00
DETROIT-CINCINNATI	247	DAY	63	18,000	0:45	8,627	181,807	173,430	4.50	5.00
DENVER-KANSAS CITY	550	OMA	166	18,000	1:23	16,103	191,669	175,816	3.33	3.71
KANSAS CITY-DENVER	550	COS	67	18,000	1:23	16,733	189,997	173,514	3.35	3.73
DENVER-OMAHA	483	DSM	116	18,000	1:15	14,382	188,848	174,716	3.46	3.84
OMAHA-DENVER	483	COS	67	18,000	1:15	14,953	188,217	173,514	3.48	3.86

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E200.3000
(Production Quantity = 400)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

EXHIBIT 5.1.2-1

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Conversion Table

S.Mi. x 1.609 = km
Lb x .4536 = kg
$/S.Mi 1.609 = $/km
¢/Seat S.Mi. 1.609 = ¢/seat km
DOC in Passenger Seat Miles at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	24,000	0:59	11,813	195,776	184,303	3.77	3.14
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	24,000	0:59	11,700	194,290	182,930	3.76	3.14
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	24,000	0:46	9,010	191,900	183,230	4.34	3.62
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	24,000	0:46	9,125	191,715	182,930	4.34	3.62
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	24,000	0:45	8,806	191,126	182,660	4.43	3.69
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	24,000	0:45	8,717	191,307	182,930	4.43	3.69
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	24,000	0:53	10,442	194,099	183,997	3.99	3.32
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	24,000	0:53	10,471	193,061	182,930	3.99	3.32
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	24,000	1:05	12,988	197,701	185,053	3.62	3.01
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	24,000	1:04	12,838	195,428	182,930	3.61	3.01
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	24,000	1:06	13,300	197,819	184,859	3.56	2.97
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	24,000	1:06	13,327	195,917	182,930	3.57	2.97
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	24,000	0:45	8,882	191,022	182,480	4.40	3.66
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	24,000	0:45	8,767	191,357	182,930	4.40	3.66

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E200.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	282	FWA	138	24,000	0:50	9,627	193,673	184,386	4.17	3.48
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	24,000	0:50	9,607	192,197	182,930	4.17	3.47
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	24,000	0:52	10,301	194,069	184,108	4.02	3.35
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	24,000	0:52	10,330	194,098	182,930	4.02	3.35
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	24,000	0:42	8,217	191,077	183,200	4.60	3.83
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	24,000	0:42	8,100	190,690	182,930	4.60	3.83
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	24,000	0:40	7,560	190,210	182,990	4.85	4.04
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	24,000	0:40	7,493	190,083	182,930	4.85	4.04
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	24,000	0:34	6,554	189,744	183,530	5.49	4.58
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	24,000	0:34	6,635	189,225	182,930	5.50	4.58
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	24,000	0:59	11,847	195,810	184,303	3.75	3.13
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	24,000	0:59	11,729	194,199	182,810	3.75	3.12
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	24,000	0:47	9,243	192,133	183,230	4.28	3.57
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	24,000	0:47	9,360	191,830	182,810	4.28	3.57
CHICAGO(MEIGS)-DETROIT	238	TOL	70	24,000	0:44	8,571	190,891	182,660	4.50	3.75
DETROIT-CHICAGO(MEIGS)	238	MKE	76	24,000	0:44	8,484	190,954	182,810	4.50	3.75
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	24,000	0:53	10,291	193,948	183,997	4.02	3.35
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	24,000	0:53	10,312	192,782	182,810	4.02	3.35
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	24,000	1:06	13,243	197,956	185,053	3.59	2.99
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	24,000	1:06	13,082	195,552	182,810	3.58	2.98

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E200.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	24,000	1:06	13,148	197,667	184,859	3.58	2.98
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	24,000	1:06	13,167	195,637	182,810	3.58	2.99
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	24,000	0:45	8,884	191,024	182,480	4.40	3.66
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	24,000	0:45	8,765	191,235	182,810	4.40	3.66
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	24,000	0:49	9,537	193,583	184,386	4.19	3.49
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	24,000	0:49	9,511	191,981	182,810	4.18	3.49
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	24,000	0:53	10,489	194,007	183,858	3.98	3.32
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	24,000	0:53	10,409	192,879	182,810	3.98	3.32
CHICAGO(MEIGS)-OMAHA	429	DSM	116	24,000	1:08	13,677	197,195	183,858	3.54	2.95
OMAHA-CHICAGO(MEIGS)	429	MKE	76	24,000	1:08	13,498	195,968	182,810	3.53	2.94
CHICAGO(MEIGS)-DAYTON	223	FWA	91	24,000	0:42	8,120	190,980	183,200	4.65	3.88
DAYTON-CHICAGO(MEIGS)	223	MKE	76	24,000	0:42	8,032	190,502	182,810	4.64	3.87
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	24,000	1:18	15,948	197,878	182,270	3.35	2.79
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	24,000	1:18	15,776	198,246	182,810	3.34	2.78
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	24,000	1:11	14,320	196,250	182,270	3.45	2.88
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	24,000	1:11	14,465	196,935	182,810	3.46	2.89
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	24,000	0:34	6,630	189,820	183,530	5.46	4.55
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	24,000	0:34	6,709	189,179	182,810	5.46	4.55
MINNEAPOLIS-MILWAUKEE	307	GRR	121	24,000	0:53	10,276	193,905	183,969	4.02	3.35
MILWAUKEE-MINNEAPOLIS	307	DLH	135	24,000	0:53	10,324	194,287	184,303	4.02	3.35

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E200.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	24,000	0:50	9,843	193,361	183,858	4.11	3.43
OMAHA-MINNEAPOLIS	290	DLH	135	24,000	0:51	9,817	193,780	184,303	4.11	3.43
ST. LOUIS-KANSAS CITY	242	OMA	166	24,000	0:44	8,621	193,334	185,053	4.46	3.72
KANSAS CITY-ST. LOUIS	242	SPI	92	24,000	0:44	8,659	191,549	183,230	4.46	3.72
ST. LOUIS-INDIANAPOLIS	223	FWA	104	24,000	0:42	8,156	191,346	183,530	4.65	3.87
INDIANAPOLIS-ST. LOUIS	223	SPI	92	24,000	0:42	8,042	190,932	183,230	4.65	3.87
DETROIT-INDIANAPOLIS	251	FWA	104	24,000	0:46	8,861	192,051	183,530	4.39	3.66
INDIANAPOLIS-DETROIT	251	TOL	70	24,000	0:45	8,931	191,251	182,660	4.39	3.66
DETROIT-MILWAUKEE	251	GRR	121	24,000	0:46	8,862	192,491	183,969	4.39	3.66
MILWAUKEE-DETROIT	251	TOL	70	24,000	0:45	8,935	191,255	182,660	4.39	3.66
DETROIT-MINNEAPOLIS	547	DLH	135	24,000	1:22	16,898	200,861	184,303	3.28	2.73
MINNEAPOLIS-DETROIT	547	TOL	70	24,000	1:22	16,647	198,967	182,660	3.27	2.72
DETROIT-PITTSBURGH	214	CMH	158	24,000	0:41	7,901	192,420	184,859	4.73	3.94
PITTSBURGH-DETROIT	214	TOL	70	24,000	0:41	7,753	190,073	182,660	4.73	3.94
DETROIT-ST. LOUIS	460	SPI	92	24,000	1:12	14,502	197,392	183,230	3.46	2.89
ST. LOUIS-DETROIT	460	TOL	70	24,000	1:11	14,367	196,687	182,660	3.45	2.88
CLEVELAND-DETROIT	92	TOL	70	24,000	0:25	4,702	187,022	182,660	7.73	6.44
DETROIT-CLEVELAND	92	CMH	122	24,000	0:25	4,624	188,281	183,997	7.73	6.44
CLEVELAND-ST. LOUIS	493	SPI	92	24,000	1:15	15,389	198,279	183,230	3.39	2.82
ST. LOUIS-CLEVELAND	493	CMH	122	24,000	1:15	15,252	198,909	183,997	3.38	2.81

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: E200.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	ALTERNATE DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (₵/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	24,000	0:52	10,039	192,929	183,230	4.07	3.39
ST. LOUIS-CINCINNATI	298	DAY	63	24,000	0:52	10,053	192,193	182,480	4.07	3.39
CINCINNATI-DETROIT	247	TOL	70	24,000	0:45	8,824	191,144	182,660	4.42	3.68
DETROIT-CINCINNATI	247	DAY	63	24,000	0:45	8,756	190,896	182,480	4.42	3.68
DENVER-KANSAS CITY	550	OMA	166	24,000	1:22	16,473	201,186	185,053	3.24	2.70
KANSAS CITY-DENVER	550	COS	67	24,000	1:21	17,103	199,333	182,570	3.25	2.71
DENVER-OMAHA	483	DSM	116	24,000	1:14	14,678	198,196	183,858	3.37	2.81
OMAHA-DENVER	483	COS	67	24,000	1:13	15,256	197,486	182,570	3.38	2.81

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: A.150.2000

(Production Quantity = 400)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

EXHIBIT 5.1.2-1

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Conversion Table
S.Mi x 1.609 = km
Lb x .4536 = kg
$/S.Mi 1.609 = $/km
¢/seat S.Mi 1.609 = ¢/seat km
DOC in Passenger Seat Miles
at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	18,000	0:56	18,689	191,635	173,446	3.94	4.37
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	18,000	0:57	18,272	189,349	171,577	3.93	4.36
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	18,000	0:45	13,703	185,186	171,983	4.51	5.02
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	18,000	0:45	13,505	184,582	171,577	4.51	5.01
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	18,000	0:44	13,008	183,720	171,212	4.61	5.12
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	18,000	0:44	13,226	184,303	171,577	4.61	5.12
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	18,000	0:51	16,091	188,616	173,025	4.15	4.61
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	18,000	0:51	16,373	187,450	171,577	4.15	4.61
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	18,000	1:01	20,699	194,679	174,480	3.78	4.20
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	18,000	1:01	20,237	191,314	171,577	3.77	4.19
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	18,000	1:03	21,020	194,732	174,212	3.72	4.14
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	18,000	1:03	21,301	192,378	171,577	3.73	4.14
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	18,000	0:44	13,132	183,600	170,968	4.57	5.08
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	18,000	0:44	13,312	184,389	171,577	4.57	5.08

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: A.150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	282	FWA	138	18,000	0:48	14,690	187,751	173,561	4.33	4.81
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	18,000	0:48	14,890	185,967	171,577	4.33	4.81
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	18,000	0:50	16,091	188,769	173,178	4.19	4.66
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	18,000	0:51	15,730	186,807	171,577	4.18	4.65
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	18,000	0:42	12,097	183,539	171,942	4.78	5.31
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	18,000	0:41	12,218	183,295	171,577	4.78	5.31
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	18,000	0:38	11,958	183,116	171,658	5.03	5.59
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	18,000	0:39	11,660	182,737	171,577	5.03	5.59
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	18,000	0:34	9,817	181,706	172,389	5.70	6.34
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	18,000	0:34	9,548	180,625	171,577	5.70	6.34
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	18,000	0:57	18,746	191,692	173,446	3.92	4.36
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	18,000	0:57	18,321	189,236	171,415	3.91	4.35
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	18,000	0:46	14,085	185,568	171,983	4.45	4.95
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	18,000	0:46	13,871	184,786	171,415	4.45	4.94
CHICAGO(MEIGS)-DETROIT	238	TOL	70	18,000	0:43	12,641	183,353	171,212	4.68	5.20
DETROIT-CHICAGO(MEIGS)	238	MKE	76	18,000	0:43	12,842	183,757	171,415	4.68	5.20
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	18,000	0:51	15,830	188,355	173,025	4.19	4.65
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	18,000	0:51	16,098	187,013	171,415	4.19	4.65
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	18,000	1:02	21,135	195,115	174,480	3.76	4.17
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	18,000	1:02	20,655	191,570	171,415	3.74	4.16

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: A.150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	ALTERNATE DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	18,000	1:02	20,758	194,470	174,212	3.74	4.16
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	18,000	1:02	21,026	191,941	171,415	3.75	4.16
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	18,000	0:44	13,134	183,602	170,968	4.57	5.08
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	18,000	0:44	13,308	184,223	171,415	4.57	5.08
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	18,000	0:48	14,534	187,595	173,561	4.35	4.83
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	18,000	0:47	14,723	185,638	171,415	4.35	4.83
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	18,000	0:51	16,415	188,748	172,833	4.15	4.61
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	18,000	0:51	16,042	186,957	171,415	4.14	4.60
CHICAGO(MEIGS)-OMAHA	429	DSM	116	18,000	1:04	21,894	194,227	172,833	3.71	4.12
OMAHA-CHICAGO(MEIGS)	429	MKE	76	18,000	1:04	21,374	192,289	171,415	3.69	4.11
CHICAGO(MEIGS)-DAYTON	223	FWA	91	18,000	0:42	11,932	183,374	171,942	4.83	5.37
DAYTON-CHICAGO(MEIGS)	223	MKE	76	18,000	0:41	12,106	183,021	171,415	4.82	5.35
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	18,000	1:13	25,790	195,974	170,684	3.51	3.90
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	18,000	1:13	25,271	196,186	171,415	3.50	3.89
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	18,000	1:07	22,784	192,968	170,684	3.61	4.02
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	18,000	1:07	23,242	194,157	171,415	3.63	4.03
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	18,000	0:34	9,936	181,825	172,389	5.67	6.30
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	18,000	0:34	9,657	180,572	171,415	5.67	6.30
MINNEAPOLIS-MILWAUKEE	307	GRR	121	18,000	0:51	15,816	188,302	172,986	4.18	4.65
MILWAUKEE-MINNEAPOLIS	307	DLH	135	18,000	0:50	16,132	189,078	173,446	4.19	4.65

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: A.150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	18,000	0:49	15,309	187,642	172,833	4.28	4.75
OMAHA-MINNEAPOLIS	290	DLH	135	18,000	0:49	15,031	187,977	173,446	4.28	4.75
ST. LOUIS-KANSAS CITY	242	OMA	166	18,000	0:43	13,072	187,052	174,480	4.64	5.16
KANSAS CITY-ST. LOUIS	242	SPI	92	18,000	0:44	12,779	184,262	171,983	4.64	5.15
ST. LOUIS-INDIANAPOLIS	223	FWA	104	18,000	0:42	11,998	183,887	172,389	4.83	5.37
INDIANAPOLIS-ST. LOUIS	223	SPI	92	18,000	0:41	12,116	183,599	171,983	4.83	5.36
DETROIT-INDIANAPOLIS	251	FWA	104	18,000	0:44	13,467	185,356	172,389	4.56	5.07
INDIANAPOLIS-DETROIT	251	TOL	70	18,000	0:45	13,204	183,916	171,212	4.56	5.06
DETROIT-MILWAUKEE	251	GRR	121	18,000	0:44	13,468	185,954	172,986	4.56	5.07
MILWAUKEE-DETROIT	251	TOL	70	18,000	0:45	13,211	183,923	171,212	4.56	5.06
DETROIT-MINNEAPOLIS	547	DLH	135	18,000	1:17	27,420	200,366	173,446	3.44	3.83
MINNEAPOLIS-DETROIT	547	TOL	70	18,000	1:17	26,776	197,488	171,212	3.43	3.81
DETROIT-PITTSBURGH	214	CMH	158	18,000	0:40	11,615	185,327	174,212	4.92	5.47
PITTSBURGH-DETROIT	214	TOL	70	18,000	0:40	11,652	182,364	171,212	4.91	5.45
DETROIT-ST. LOUIS	460	SPI	92	18,000	1:07	23,298	194,781	171,983	3.63	4.03
ST. LOUIS-DETROIT	460	TOL	70	18,000	1:08	22,853	193,565	171,212	3.62	4.02
CLEVELAND-DETROIT	92	TOL	70	18,000	0:23	8,184	178,896	171,212	8.00	8.89
DETROIT-CLEVELAND	92	CMH	122	18,000	0:24	7,852	180,377	173,025	7.97	8.85
CLEVELAND-ST. LOUIS	493	SPI	92	18,000	1:11	24,820	196,303	171,983	3.55	3.94
ST. LOUIS-CLEVELAND	493	CMH	122	18,000	1:11	24,355	196,880	173,025	3.54	3.93

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: A.150.2000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	18,000	0:50	15,631	187,114	171,983	4.23	4.71
ST. LOUIS-CINCINNATI	298	DAY	63	18,000	0:50	15,420	185,888	170,968	4.23	4.70
CINCINNATI-DETROIT	247	TOL	70	18,000	0:44	13,038	183,750	171,212	4.60	5.11
DETROIT-CINCINNATI	247	DAY	63	18,000	0:44	13,294	183,762	170,968	4.60	5.11
DENVER-KANSAS CITY	550	OMA	166	18,000	1:17	26,560	200,540	174,480	3.40	3.78
KANSAS CITY-DENVER	550	COS	67	18,000	1:16	27,897	198,487	171,090	3.42	3.80
DENVER-OMAHA	483	DSM	116	18,000	1:10	23,503	195,836	172,833	3.53	3.92
OMAHA-DENVER	483	COS	67	18,000	1:09	24,731	195,321	171,090	3.55	3.94

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: E150.3000
(Production Quantity = 600)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

Conversion Table:
S Mi x 1.609 = km
Lb x .4536 = kg
\$/S Mi ÷ 1.609 = \$/km
¢/seat S.Mi ÷ 1.609 = ¢/seat km

DOC in Passenger Seat Miles at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. (\$/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	18,000	0:60	8,938	143,935	135,247	2.97	3.30
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	18,000	0:60	8,371	142,833	134,212	2.97	3.30
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	18,000	0:46	6,811	140,999	134,438	3.41	3.79
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	18,000	0:46	6,883	140,845	134,212	3.41	3.79
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	18,000	0:45	6,644	140,403	134,009	3.48	3.87
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	18,000	0:45	6,591	140,553	134,212	3.48	3.87
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	18,000	0:54	7,930	142,696	135,016	3.14	3.49
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	18,000	0:54	7,932	141,894	134,212	3.14	3.49
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	18,000	1:05	9,813	145,377	135,814	2.85	3.17
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	18,000	1:05	9,724	143,686	134,212	2.85	3.17
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	18,000	1:07	10,065	145,482	135,667	2.81	3.13
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	18,000	1:07	10,068	144,030	134,212	2.81	3.13
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	18,000	0:45	6,701	140,324	133,873	3.45	3.84
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	18,000	0:45	6,629	140,591	134,212	3.45	3.84

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E150.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	282	FWA	138	18,000	0:49	7,447	142,507	135,310	3.28	3.64
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	18,000	0:50	7,349	141,311	134,212	3.27	3.64
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	18,000	0:53	7,807	142,657	135,100	3.17	3.52
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	18,000	0:53	7,757	141,969	134,212	3.17	3.52
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	18,000	0:42	6,204	140,369	134,415	3.62	4.02
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	18,000	0:42	6,129	140,091	134,212	3.62	4.02
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	18,000	0:39	5,958	139,965	134,257	3.81	4.23
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	18,000	0:39	6,045	140,007	134,212	3.81	4.23
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	18,000	0:34	4,931	139,345	134,664	4.30	4.78
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	16,000	0:34	4,985	138,947	134,212	4.30	4.78
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	18,000	0:60	9,110	144,107	135,247	2.96	3.29
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	18,000	0:60	9,192	143,064	134,122	2.96	3.29
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	18,000	0:47	6,985	141,173	134,438	3.37	3.74
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	18,000	0:47	7,058	140,930	134,122	3.37	3.74
CHICAGO(MEIGS)-DETROIT	238	TOL	70	18,000	0:44	6,468	140,227	134,009	3.53	3.93
DETROIT-CHICAGO(MEIGS)	238	MKE	76	18,000	0:44	6,416	140,288	134,122	3.53	3.93
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	18,000	0:53	7,997	142,763	135,016	3.17	3.52
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	18,000	0:53	7,901	141,773	134,122	3.17	3.52
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	18,000	1:06	10,003	145,567	135,814	2.83	3.15
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	18,000	1:06	9,905	143,777	134,122	2.83	3.14

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: E150.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	18,000	1:06	9,952	145,369	135,667	2.83	3.15
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	18,000	1:06	9,948	143,820	134,122	2.83	3.14
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	18,000	0:45	6,703	140,326	133,873	3.45	3.84
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	18,000	0:45	6,627	140,499	134,122	3.45	3.84
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	18,000	0:49	7,372	142,432	135,310	3.29	3.66
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	18,000	0:49	7,273	141,145	134,122	3.29	3.65
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	18,000	0:54	7,947	142,608	134,911	3.14	3.49
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	18,000	0:54	7,902	141,774	134,122	3.14	3.49
CHICAGO(MEIGS)-OMAHA	429	DSM	116	18,000	1:08	10,328	144,989	134,911	2.80	3.11
OMAHA-CHICAGO(MEIGS)	429	MKE	76	18,000	1:08	10,215	144,087	134,122	2.79	3.10
CHICAGO(MEIGS)-DAYTON	223	FWA	91	18,000	0:42	6,132	140,297	134,415	3.65	4.06
DAYTON-CHICAGO(MEIGS)	223	MKE	76	18,000	0:42	6,078	139,950	134,122	3.64	4.05
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	18,000	1:19	12,024	145,489	133,715	2.64	2.94
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	18,000	1:19	11,914	145,786	134,122	2.64	2.93
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	18,000	1:12	10,828	144,293	133,715	2.73	3.03
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	18,000	1:12	10,916	144,788	134,122	2.74	3.04
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	18,000	0:34	4,988	139,402	134,664	4.28	4.76
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	18,000	0:34	5,040	138,912	134,122	4.28	4.76
MINNEAPOLIS-MILWAUKEE	307	GRR	121	18,000	0:53	7,806	142,551	134,995	3.17	3.52
MILWAUKEE-MINNEAPOLIS	307	DLH	135	18,000	0:53	7,825	142,822	135,247	3.17	3.52

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E150.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	18,000	0:51	7,463	142,124	134,911	3.23	3.59
OMAHA-MINNEAPOLIS	290	DLH	135	18,000	0:51	7,463	142,460	135,247	3.24	3.60
ST. LOUIS-KANSAS CITY	242	OMA	166	18,000	0:45	6,522	142,086	135,814	3.51	3.90
KANSAS CITY-ST. LOUIS	242	SPI	92	18,000	0:44	6,535	140,723	134,438	3.50	3.89
ST. LOUIS-INDIANAPOLIS	223	FWA	104	18,000	0:42	6,158	140,572	134,664	3.65	4.05
INDIANAPOLIS-ST. LOUIS	223	SPI	92	18,000	0:42	6,086	140,274	134,438	3.65	4.05
DETROIT-INDIANAPOLIS	251	FWA	104	18,000	0:46	6,699	141,113	134,664	3.45	3.83
INDIANAPOLIS-DETROIT	251	TOL	70	18,000	0:46	6,738	140,497	134,009	3.45	3.83
DETROIT-MILWAUKEE	251	GRR	121	18,000	0:46	6,701	141,446	134,995	3.45	3.83
MILWAUKEE-DETROIT	251	TOL	70	18,000	0:46	6,760	140,769	134,009	3.45	3.83
DETROIT-MINNEAPOLIS	547	DLH	135	18,000	1:23	12,733	147,730	135,247	2.59	2.88
MINNEAPOLIS-DETROIT	547	TOL	70	18,000	1:23	12,564	146,323	134,009	2.59	2.87
DETROIT-PITTSBURGH	214	CMH	158	18,000	0:41	5,968	141,385	135,667	3.71	4.13
PITTSBURGH-DETROIT	214	TOL	70	18,000	0:41	5,869	139,628	134,009	3.71	4.12
DETROIT-ST. LOUIS	460	SPI	92	18,000	1:12	10,944	145,132	134,438	2.74	3.04
ST. LOUIS-DETROIT	460	TOL	70	18,000	1:12	10,862	144,621	134,009	2.73	3.03
CLEVELAND-DETROIT	92	TOL	70	18,000	0:25	3,532	137,291	134,009	6.03	6.70
DETROIT-CLEVELAND	92	CMH	122	18,000	0:25	3,474	138,240	135,016	6.04	6.71
CLEVELAND-ST. LOUIS	493	SPI	92	18,000	1:16	11,605	145,793	134,438	2.67	2.97
ST. LOUIS-CLEVELAND	493	CMH	122	18,000	1:16	11,522	146,288	135,016	2.67	2.97

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E150.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	ALTERNATE DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	18,000	0:52	7,688	141,876	134,438	3.20	3.56
ST. LOUIS-CINCINNATI	298	DAY	63	18,000	0:51	7,799	141,422	133,873	3.20	3.56
CINCINNATI-DETROIT	247	TOL	70	18,000	0:45	6,658	140,417	134,009	3.47	3.86
DETROIT-CINCINNATI	247	DAY	63	18,000	0:45	6,620	140,243	133,873	3.47	3.86
DENVER-KANSAS CITY	550	OMA	166	18,000	1:23	12,433	147,997	135,814	2.57	2.85
KANSAS CITY-DENVER	550	COS	67	18,000	1:22	12,881	146,572	133,941	2.57	2.86
DENVER-OMAHA	483	DSM	116	18,000	1:14	11,097	145,758	134,911	2.66	2.96
OMAHA-DENVER	483	COS	67	18,000	1:14	11,504	145,195	133,941	2.67	2.97

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: CTOL150.80G
(Production Quantity = 400)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

Conversion Table:
S.Mi x 1.609 = km
Lb x .4536 = kg
$/S.Mi ÷ 1.609 = $/km
¢/seat S.Mi ÷ 1.609 = ¢/seat km
DOC in Passenger Seat Miles at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO-PITTSBURGH	412	CMH	145	18,000	1:11	9,827	126,479	117,002	2.70	3.00
PITTSBURGH-CHICAGO	412	MKE	67	18,000	1:11	9,810	125,092	115,632	2.70	3.00
CHICAGO-CLEVELAND	313	CMH	112	18,000	0:60	8,134	124,208	116,424	3.05	3.39
CLEVELAND-CHICAGO	313	MKE	67	18,000	0:60	8,172	123,454	115,632	3.05	3.39
CHICAGO-BUFFALO	472	ROC	55	18,000	1:18	10,876	125,955	115,429	2.56	2.84
BUFFALO-CHICAGO	472	MKE	67	18,000	1:18	10,954	125,236	115,632	2.55	2.84
CHICAGO-COLUMBUS	295	FWA	138	18,000	0:58	7,764	124,297	116,883	3.14	3.48
COLUMBUS-CHICAGO	295	MKE	67	18,000	0:58	7,789	123,071	115,632	3.13	3.48
CHICAGO-ST. LOUIS	258	SPI	83	18,000	0:53	7,364	122,931	115,917	3.35	3.73
ST. LOUIS-CHICAGO	258	MKE	67	18,000	0:53	7,536	122,818	115,632	3.38	3.75
CHICAGO-CINCINNATI	264	DAY	63	18,000	0:54	7,669	122,890	115,571	3.33	3.70
CINCINNATI-CHICAGO	264	MKE	67	18,000	0:54	7,471	122,753	115,632	3.31	3.68
CHICAGO-DAYTON	239	FWA	91	18,000	0:51	7,079	122,788	116,059	3.50	3.89
DAYTON-CHICAGO	239	MKE	67	18,000	0:51	6,910	122,192	115,632	3.49	3.88

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: CTOL150.80G

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO-DETROIT	234	TOL	49	18,000	0:50	6,934	121,912	115,328	3.54	3.93
DETROIT-CHICAGO	234	MKE	67	18,000	0:50	6,914	122,096	115,632	3.53	3.92
CHICAGO-DES MOINES	298	OMA	116	18,000	0:58	7,880	124,035	116,505	3.12	3.46
DES MOINES-CHICAGO	298	MKE	67	18,000	0:58	7,794	123,076	115,632	3.12	3.47
CHICAGO-INDIANAPOLIS	177	FWA	104	18,000	0:42	5,903	121,835	116,282	4.04	4.49
INDIANAPOLIS-CHICAGO	177	MKE	67	18,000	0:42	5,809	121,091	115,632	4.06	4.51
CHICAGO-MINN.-ST. PAUL	334	DLH	144	18,000	1:02	8,626	125,259	116,983	2.96	3.28
MINN.-ST. PAUL-CHICAGO	334	MKE	67	18,000	1:02	8,531	123,813	115,632	2.96	3.28
CHICAGO-KANSAS CITY	404	OMA	166	18,000	1:11	9,744	126,755	117,361	2.74	3.04
KANSAS CITY-CHICAGO	404	MKE	67	18,000	1:11	9,661	124,943	115,632	2.73	3.04
CHICAGO-OMAHA	416	DSM	116	18,000	1:12	9,935	126,090	116,505	2.69	2.99
OMAHA-CHICAGO	415	MKE	67	18,000	1:12	9,843	125,125	115,632	2.69	2.99
CHICAGO-ROCHESTER	526	BUF	55	18,000	1:24	11,845	126,924	115,429	2.45	2.72
ROCHESTER-CHICAGO	526	MKE	67	18,000	1:24	11,961	127,243	115,632	2.45	2.73
CHICAGO-TOLEDO	213	FWA	83	18,000	0:48	6,431	121,998	115,917	3.71	4.13
TOLEDO-CHICAGO	213	MKE	67	18,000	0:48	6,339	121,621	115,632	3.71	4.13
DETROIT-PITTSBURGH	201	CMH	145	18,000	0:46	6,158	122,810	117,002	3.82	4.25
PITTSBURGH-DETROIT	201	TOL	49	18,000	0:47	6,026	121,004	115,328	3.84	4.26
DETROIT-CLEVELAND	94	CMH	112	18,000	0:31	4,037	120,111	116,424	5.98	6.64
CLEVELAND-DETROIT	94	TOL	49	18,000	0:31	4,021	118,999	115,328	5.99	6.65

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: CTOL150.80G

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
DETROIT-ST. LOUIS	439	SPI	83	18,000	1:14	10,357	125,924	115,917	2.64	2.93
ST. LOUIS-DETROIT	439	TOL	49	18,000	1:15	10,288	125,266	115,328	2.64	2.93
DETROIT-CINCINNATI	228	DAY	63	18,000	0:49	6,680	121,901	115,571	3.57	3.97
CINCINNATI-DETROIT	228	TOL	49	18,000	0:50	6,773	121,751	115,328	3.58	3.98
DETROIT-INDIANAPOLIS	229	FWA	104	18,000	0:50	6,714	122,646	116,282	3.57	3.96
INDIANAPOLIS-DETROIT	229	TOL	49	18,000	0:50	6,810	121,788	115,328	3.58	3.98
DETROIT-MINN.-ST. PAUL	526	DLH	144	18,000	1:24	11,972	128,605	116,983	2.45	2.73
MINN.-ST. PAUL-DETROIT	526	TOL	49	18,000	1:24	11,823	126,801	115,328	2.45	2.72
DETROIT-MILWAUKEE	236	GRR	121	18,000	0:50	6,876	123,110	116,584	3.51	3.90
MILWAUKEE-DETROIT	236	TOL	49	18,000	0:51	6,986	121,964	115,328	3.53	3.92
ST. LOUIS-CLEVELAND	486	CMH	112	18,000	1:20	11,147	127,221	116,424	2.53	2.81
CLEVELAND-ST. LOUIS	486	SPI	83	18,000	1:20	11,206	126,773	115,917	2.53	2.81
ST. LOUIS-CINCINNATI	306	DAY	63	18,000	0:59	7,989	123,210	115,571	3.08	3.42
CINCINNATI-ST. LOUIS	306	SPI	83	18,000	0:59	8,024	123,591	115,917	3.08	3.42
ST. LOUIS-INDIANAPOLIS	228	FWA	104	18,000	0:50	6,807	122,739	116,282	3.59	3.99
INDIANAPOLIS-ST. LOUIS	228	SPI	83	18,000	0:50	6,671	122,238	115,917	3.58	3.98
ST. LOUIS-KANSAS CITY	228	OMA	166	18,000	0:50	6,704	123,715	117,361	3.58	3.98
KANSAS CITY-ST. LOUIS	223	SPI	83	18,000	0:50	6,790	122,357	115,917	3.59	3.99
MINN.-ST. PAUL-MILWAUKEE	296	GRR	121	18,000	0:58	8,289	124,001	116,584	3.16	3.51
MILWAUKEE-MINN.-ST. PAUL	296	DLH	144	18,000	0:58	7,834	124,467	116,983	3.13	3.48

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: CTOL150.80G

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINN.-ST. PAUL-OMAHA	282	DSM	116	18,000	0:55	7,902	124,057	116,505	3.20	3.55
OMAHA-MINN.-ST. PAUL	282	DLH	144	18,000	0:56	8,102	124,735	116,983	3.23	3.59
KANSAS CITY-DENVER	549	COS	67	18,000	1:24	12,253	127,535	115,632	2.35	2.61
DENVER-KANSAS CITY	549	OMA	166	18,000	1:26	11,801	128,812	117,361	2.38	2.65
OMAHA-DENVER	483	COS	135	18,000	1:17	11,051	127,524	116,823	2.47	2.74
DENVER-OMAHA	483	DSM	116	18,000	1:19	10,615	126,770	116,505	2.50	2.78

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: M150.3000

(Production Quantity = 600)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

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Conversion Table:
S.Mi x 1.609 = km
Lb x .4536 = kg
$/S.Mi ÷ 1.609 = $/km
¢/seat S.M. ÷ 1.609 = ¢/seat km
DOC in Passenger Seat Miles at 60% Load Factor

ROUTE	ALTERNATE DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	18,000	1:00	10,456	160,090	149,954	3.02	3.36
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	18,000	1:00	10,397	158,971	148,894	3.02	3.36
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	18,000	0:47	8,090	156,896	149,126	3.49	3.88
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	18,000	0:47	8,154	156,728	148,894	3.49	3.88
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	18,000	0:45	8,279	156,644	148,685	3.56	3.95
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	18,000	0:45	8,418	156,992	148,894	3.55	3.94
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	18,000	0:54	9,506	158,904	149,718	3.20	3.56
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	18,000	0:54	9,429	158,003	148,894	3.20	3.56
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	18,000	1:05	11,416	161,628	150,532	2.90	3.22
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	18,000	1:05	11,339	159,913	148,894	2.90	3.22
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	18,000	1:07	11,719	161,781	150,382	2.86	3.17
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	18,000	1:07	11,694	160,268	148,894	2.85	3.17
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	18,000	0:45	8,356	156,582	148,546	3.53	3.92
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	18,000	0:45	8,469	157,043	148,894	3.52	3.91

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS
Table (Cont'd)

AIRCRAFT MODEL: M150.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	282	FWA	138	18,000	0:50	8,770	158,468	150,018	3.35	3.72
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	18,000	0:50	8,683	157,257	148,894	3.35	3.72
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	18,000	0:53	9,286	158,770	149,804	3.23	3.59
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	18,000	0:53	9,385	158,869	148,894	3.23	3.59
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	18,000	0:42	7,736	156,519	149,103	3.69	4.10
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	18,000	0:42	7,823	156,397	148,894	3.68	4.09
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	18,000	0:40	7,122	155,742	148,940	3.88	4.31
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	18,000	0:39	7,229	155,803	148,894	3.88	4.31
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	18,000	0:35	5,968	155,006	149,358	4.40	4.89
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	18,000	0:34	6,038	154,612	148,894	4.40	4.89
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	18,000	1:00	10,484	160,118	149,954	3.01	3.35
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	18,000	1:00	10,420	158,901	148,801	3.01	3.35
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	18,000	0:48	8,281	157,087	149,126	3.45	3.83
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	18,000	0:48	8,347	156,828	148,801	3.44	3.82
CHICAGO(MEIGS)-DETROIT	238	TOL	70	18,000	0:44	8,061	156,426	148,685	3.61	4.01
DETROIT-CHICAGO(MEIGS)	238	MKE	76	18,000	0:44	8,192	156,673	148,801	3.61	4.01
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	18,000	0:53	9,369	158,767	149,718	3.23	3.59
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	18,000	0:53	9,292	157,773	148,801	3.23	3.59
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	18,000	1:07	11,625	161,837	150,532	2.88	3.20
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	18,000	1:07	11,540	160,021	148,801	2.87	3.19

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: M150.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	18,000	1:05	11,594	161,656	150,382	2.87	3.19
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	18,000	1:06	11,563	160,044	148,801	2.87	3.19
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	18,000	0:45	8,357	156,583	148,546	3.53	3.92
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	18,000	0:45	8,468	156,949	148,801	3.52	3.91
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	18,000	0:50	8,689	158,385	150,018	3.36	3.73
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	18,000	0:50	8,600	157,081	148,801	3.36	3.73
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	18,000	0:54	9,450	158,741	149,611	3.20	3.56
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	18,000	0:54	9,481	157,962	148,801	3.20	3.55
CHICAGO(MEIGS)-OMAHA	429	DSM	116	18,000	1:08	11,988	161,279	149,611	2.84	3.15
OMAHA-CHICAGO(MEIGS)	429	MKE	76	18,000	1:09	11,881	160,362	148,801	2.83	3.15
CHICAGO(MEIGS)-DAYTON	223	FWA	91	18,000	0:42	7,631	156,414	149,103	3.73	4.14
DAYTON-CHICAGO(MEIGS)	223	MKE	76	18,000	0:42	7,757	156,238	148,801	3.71	4.13
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	18,000	1:19	13,849	161,913	148,384	2.67	2.97
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	18,000	1:19	13,756	162,237	148,801	2.67	2.97
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	18,000	1:12	12,561	160,625	148,384	2.77	3.07
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	18,000	1:12	12,630	161,111	148,801	2.77	3.08
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	18,000	0:35	6,032	155,070	149,358	4.38	4.87
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	18,000	0:35	6,100	154,581	148,801	4.37	4.85
MINNEAPOLIS-MILWAUKEE	307	GRR	121	18,000	0:53	9,359	158,736	149,697	3.22	3.58
MILWAUKEE-MINNEAPOLIS	307	DLH	135	18,000	0:53	9,305	158,939	149,954	3.23	3.59

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: M150.3000

PHASE: II
MODE: STOL
SYSTEM: **CHICAGO REGION**

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	18,000	0:51	8,892	158,183	149,611	3.30	3.67
OMAHA-MINNEAPOLIS	290	DLH	135	18,000	0:51	8,946	158,580	149,954	3.30	3.67
ST. LOUIS-KANSAS CITY	242	OMA	166	18,000	0:44	8,314	158,526	150,532	3.57	3.97
KANSAS CITY-ST. LOUIS	242	SPI	92	18,000	0:44	8,137	156,943	149,126	3.58	3.98
ST. LOUIS-INDIANAPOLIS	223	FWA	104	13,000	0:42	7,673	156,711	149,358	3.72	4.14
INDIANAPOLIS-ST. LOUIS	223	SPI	92	13,000	0:42	7,758	156,564	149,126	3.72	4.13
DETROIT-INDIANAPOLIS	251	FWA	104	18,000	0:45	8,558	157,596	149,358	3.51	3.90
INDIANAPOLIS-DETROIT	251	TOL	70	13,000	0:46	8,396	156,761	148,685	3.52	3.91
DETROIT-MILWAUKEE	251	GRR	121	18,000	0:45	8,555	157,932	149,697	3.51	3.90
MILWAUKEE-DETROIT	251	TOL	70	13,000	0:46	8,400	156,765	148,685	3.52	3.91
DETROIT-MINNEAPOLIS	547	DLH	135	13,000	1:23	14,645	164,279	149,954	2.62	2.91
MINNEAPOLIS-DETROIT	547	TOL	70	18,000	1:23	14,471	162,836	148,685	2.61	2.90
DETROIT-PITTSBURGH	214	CMH	158	18,000	0:41	7,441	157,503	150,382	3.79	4.21
PITTSBURGH-DETROIT	214	TOL	70	12,000	0:41	7,491	155,856	148,685	3.78	4.20
DETROIT-ST. LOUIS	460	SPI	92	18,000	1:12	12,658	161,464	149,126	2.77	3.08
ST. LOUIS-DETROIT	460	TOL	70	18,000	1:12	12,598	160,963	148,685	2.77	3.07
CLEVELAND-DETROIT	92	TOL	70	18,000	0:24	4,535	152,900	148,685	6.14	6.82
DETROIT-CLEVELAND	92	CMH	122	18,000	0:25	4,430	153,828	149,718	6.15	6.84
CLEVELAND-ST. LOUIS	493	SPI	92	18,000	1:16	13,386	162,192	149,126	2.71	3.01
ST. LOUIS-CLEVELAND	493	CMH	122	18,000	1:16	13,320	162,718	149,718	2.70	3.00

EXHIBIT 5.1.2-1

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: M150.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	18,000	0:52	9,053	157,859	149,126	3.27	3.63
ST. LOUIS-CINCINNATI	298	DAY	63	18,000	0:52	9,162	157,388	148,546	3.27	3.63
CINCINNATI-DETROIT	247	TOL	70	18,000	0:45	8,297	156,662	148,685	3.55	3.94
DETROIT-CINCINNATI	247	DAY	63	18,000	0:45	8,464	156,690	148,546	3.54	3.94
DENVER-KANSAS CITY	550	OMA	166	18,000	1:23	14,298	164,510	150,532	2.59	2.88
KANSAS CITY-DENVER	550	COS	67	18,000	1:22	14,864	163,160	148,616	2.60	2.89
DENVER-OMAHA	483	DSM	116	18,000	1:14	12,832	162,123	149,611	2.70	3.00
OMAHA-DENVER	483	COS	67	18,000	1:14	13,342	161,638	148,616	2.70	3.00

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: M150.4000
(Production Quantity = 400

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

Conversion Table:
S.Mi x 1.609 = km
Lb x .4536 = kg
\$/S.Mi ÷ 1.609 = \$/km
¢/seat S.Mi ÷ 1.609 = ¢/seat km
DOC in Passenger Seat Miles at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. (\$/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	18,000	0:59	9,539	136,521	127,302	2.72	3.02
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	18,000	0:59	9,438	135,436	126,318	2.72	3.02
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	18,000	0:46	7,380	133,592	126,532	3.14	3.49
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	18,000	0:46	7,475	133,473	126,318	3.14	3.49
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	18,000	0:45	7,227	133,032	126,125	3.21	3.57
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	18,000	0:45	7,153	133,151	126,318	3.22	3.57
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	18,000	0:54	8,451	135,212	127,081	2.89	3.21
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	18,000	0:53	8,489	134,487	126,318	2.88	3.20
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	18,000	1:04	10,451	137,975	127,844	2.60	2.89
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	18,000	1:04	10,331	136,329	126,318	2.60	2.89
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	18,000	1:05	10,689	138,073	127,704	2.56	2.85
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	18,000	1:05	10,714	136,712	126,318	2.56	2.85
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	18,000	0:45	7,289	132,966	125,997	3.18	3.54
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	18,000	0:45	7,193	133,191	126,318	3.19	3.54

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: M150.4000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	232	FWA	138	18,000	0:50	7,816	134,858	127,362	3.03	3.36
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	18,000	0:50	7,816	133,814	126,318	3.02	3.35
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	18,000	0:52	8,363	135,204	127,161	2.91	3.24
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	18,000	0:52	8,313	134,631	126,318	2.91	3.24
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	18,000	0:43	6,770	132,961	126,511	3.34	3.71
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	18,000	0:43	6,671	132,669	126,318	3.35	3.72
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	18,000	0:39	6,614	132,655	126,361	3.49	3.88
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	18,000	0:38	6,745	132,743	126,318	3.48	3.86
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	18,000	0:34	5,530	131,956	126,746	3.96	4.40
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	18,000	0:33	5,623	131,621	126,318	3.95	4.39
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	18,000	0:59	9,565	136,547	127,302	2.71	3.01
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	18,000	0:59	9,461	135,373	126,232	2.71	3.01
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	18,000	0:47	7,562	133,774	126,532	3.10	3.45
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	18,000	0:47	7,659	133,571	126,232	3.10	3.44
CHICAGO(MEIGS)-DETROIT	238	TOL	70	18,000	0:44	7,044	132,849	126,125	3.26	3.62
DETROIT-CHICAGO(MEIGS)	238	MKE	76	18,000	0:44	6,971	132,883	126,232	3.27	3.63
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	18,000	0:53	8,332	135,093	127,081	2.92	3.24
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	18,000	0:53	8,365	134,277	126,232	2.91	3.23
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	18,000	1:05	10,649	138,173	127,844	2.58	2.87
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	18,000	1:05	10,522	136,434	126,232	2.58	2.87

EXHIBIT 5.1.2-1

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: M150.4000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	18,000	1:05	10,570	137,954	127,704	2.58	2.87
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	18,000	1:05	10,590	136,502	126,232	2.57	2.86
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	18,000	0:45	7,290	132,967	125,997	3.18	3.54
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	18,000	0:45	7,191	133,103	126,232	3.19	3.54
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	18,000	0:49	7,987	135,029	127,362	3.02	3.36
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	18,000	0:49	7,866	133,778	126,232	3.03	3.36
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	18,000	0:53	8,510	135,170	126,980	2.83	3.20
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	18,000	0:53	8,425	134,337	126,232	2.88	3.21
CHICAGO(MEIGS)-OMAHA	429	DSM	116	18,000	1:06	10,990	137,650	126,980	2.54	2.83
OMAHA-CHICAGO(MEIGS)	429	MKE	76	18,000	1:07	10,846	136,758	126,232	2.54	2.82
CHICAGO(MEIGS)-DAYTON	223	FWA	91	18,000	0:41	7,094	133,285	126,511	3.35	3.72
DAYTON-CHICAGO(MEIGS)	223	MKE	76	18,000	0:41	7,244	133,156	126,232	3.33	3.70
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	18,000	1:16	12,751	138,278	125,847	2.39	2.66
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	18,000	1:16	12,619	138,531	126,232	2.39	2.66
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	18,000	1:10	11,489	137,016	125,847	2.48	2.76
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	18,000	1:10	11,598	137,510	126,232	2.48	2.76
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	18,000	0:34	5,590	132,016	126,746	3.94	4.38
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	18,000	0:34	5,682	131,594	126,232	3.93	4.36
MINNEAPOLIS-MILWAUKEE	307	GRR	121	18,000	0:53	8,324	135,064	127,060	2.91	3.24
MILWAUKEE-MINNEAPOLIS	307	DLH	135	18,000	0:53	8,381	135,363	127,302	2.91	3.23

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

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AIRCRAFT MODEL: M150.4000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	18,000	0:51	8,007	134,667	126,980	2.98	3.31
OMAHA-MINNEAPOLIS	290	DLH	135	18,000	0:51	7,966	134,948	127,302	2.99	3.32
ST. LOUIS-KANSAS CITY	242	OMA	166	18,000	0:45	7,080	134,604	127,844	3.24	3.60
KANSAS CITY-ST. LOUIS	242	SPI	92	18,000	0:44	7,110	133,322	126,532	3.23	3.59
ST. LOUIS-INDIANAPOLIS	223	FWA	104	18,000	0:42	6,720	133,146	126,746	3.37	3.75
INDIANAPOLIS-ST. LOUIS	223	SPI	92	18,000	0:43	6,623	132,835	126,532	3.38	3.75
DETROIT-INDIANAPOLIS	251	FWA	104	18,000	0:46	7,268	133,694	126,746	3.18	3.53
INDIANAPOLIS-DETROIT	251	TOL	70	18,000	0:45	7,325	133,130	126,125	3.18	3.53
DETROIT-MILWAUKEE	251	GRR	121	18,000	0:46	7,268	134,008	127,060	3.18	3.54
MILWAUKEE-DETROIT	251	TOL	70	18,000	0:45	7,328	133,133	126,125	3.18	3.53
DETROIT-MINNEAPOLIS	547	DLH	135	18,000	1:20	13,494	140,475	127,302	2.34	2.60
MINNEAPOLIS-DETROIT	547	TOL	70	18,000	1:20	13,300	139,105	126,125	2.34	2.60
DETROIT-PITTSBURGH	214	CMH	158	18,000	0:40	6,916	134,300	127,704	3.41	3.79
PITTSBURGH-DETROIT	214	TOL	70	18,000	0:39	6,993	132,798	126,125	3.39	3.77
DETROIT-ST. LOUIS	460	SPI	92	18,000	1:10	11,624	137,836	126,532	2.48	2.76
ST. LOUIS-DETROIT	460	TOL	70	18,000	1:10	11,522	137,327	126,125	2.48	2.76
CLEVELAND-DETROIT	92	TOL	70	18,000	0:24	4,299	130,104	126,125	5.52	6.14
DETROIT-CLEVELAND	92	CMH	122	18,000	0:24	4,163	130,924	127,031	5.52	6.14
CLEVELAND-ST. LOUIS	493	SPI	92	18,000	1:14	12,314	138,526	126,532	2.42	2.69
ST. LOUIS-CLEVELAND	493	CMH	122	18,000	1:14	12,205	138,966	127,081	2.42	2.69

EXHIBIT 5.1.2-1

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: M150.4000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	18,000	0:52	8,151	134,363	126,532	2.95	3.27
ST. LOUIS-CINCINNATI	298	DAY	63	18,000	0:52	8,147	133,824	125,997	2.95	3.28
CINCINNATI-DETROIT	247	TOL	70	18,000	0:45	7,241	133,046	126,125	3.20	3.56
DETROIT-CINCINNATI	247	DAY	63	18,000	0:45	7,187	132,864	125,997	3.21	3.56
DENVER-KANSAS CITY	550	OMA	166	18,000	1:20	13,167	140,691	127,844	2.32	2.58
KANSAS CITY-DENVER	550	COS	67	18,000	1:19	13,702	139,443	126,061	2.32	2.58
DENVER-OMAHA	483	DSM	116	18,000	1:12	11,774	138,434	126,980	2.42	2.68
OMAHA-DENVER	483	COS	67	18,000	1:11	12,266	138,007	126,061	2.42	2.69

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: E100.3000
(Production Quantity = 800)

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

Conversion Table:
S.Mi x 1.609 = km
Lb x .4536 = kg
$/S.Mi ÷ 1.609 = $/km
¢/seat S.Mi ÷ 1.609 = ¢/seat km
DOC in Passenger Seat Miles
at 60% Load Factor

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-MINNEAPOLIS	361	DLH	135	12,000	0:60	6,313	99,290	93,142	2.34	3.90
MINNEAPOLIS-CHICAGO(MIDWAY)	361	MKE	81	12,000	0:60	6,281	98,533	92,422	2.34	3.89
CHICAGO(MIDWAY)-ST. LOUIS	257	SPI	92	12,000	0:47	4,824	97,232	92,578	2.68	4.46
ST. LOUIS-CHICAGO(MIDWAY)	257	MKE	81	12,000	0:47	4,868	97,120	92,422	2.68	4.45
CHICAGO(MIDWAY)-DETROIT	246	TOL	70	12,000	0:45	4,701	96,813	92,282	2.73	4.55
DETROIT-CHICAGO(MIDWAY)	246	MKE	81	12,000	0:45	4,673	96,925	92,422	2.73	4.55
CHICAGO(MIDWAY)-CLEVELAND	313	CMH	122	12,000	0:54	5,636	98,445	92,979	2.47	4.12
CLEVELAND-CHICAGO(MIDWAY)	313	MKE	81	12,000	0:54	5,620	97,872	92,422	2.47	4.11
CHICAGO(MIDWAY)-KANSAS CITY	404	OMA	166	12,000	1:05	6,927	100,298	93,541	2.25	3.75
KANSAS CITY-CHICAGO(MIDWAY)	404	MKE	81	12,000	1:05	6,975	99,127	92,422	2.24	3.74
CHICAGO(MIDWAY)-PITTSBURGH	419	CMH	158	12,000	1:07	7,117	100,395	93,433	2.22	3.70
PITTSBURGH-CHICAGO(MIDWAY)	419	MKE	81	12,000	1:07	7,088	99,340	92,422	2.21	3.69
CHICAGO(MIDWAY)-CINCINNATI	249	DAY	63	12,000	0:45	4,740	96,758	92,108	2.71	4.52
CINCINNATI-CHICAGO(MIDWAY)	249	MKE	81	12,000	0:46	4,696	96,948	92,422	2.71	4.52

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: E100.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MIDWAY)-COLUMBUS	282	FWA	138	12,000	0:50	5,256	98,272	93,186	2.57	4.29
COLUMBUS-CHICAGO(MIDWAY)	282	MKE	81	12,000	0:50	5,193	97,445	92,422	2.57	4.28
CHICAGO(MIDWAY)-DES MOINES	306	OMA	127	12,000	0:53	5,536	98,404	93,038	2.49	4.15
DES MOINES-CHICAGO(MIDWAY)	306	MKE	81	12,000	0:53	5,486	97,908	92,422	2.49	4.15
CHICAGO(MIDWAY)-DAYTON	226	FWA	91	12,000	0:43	4,398	96,790	92,562	2.83	4.72
DAYTON-CHICAGO(MIDWAY)	226	MKE	81	12,000	0:43	4,350	96,602	92,422	2.83	4.72
CHICAGO(MIDWAY)-TOLEDO	204	FWA	83	12,000	0:40	4,207	96,490	92,453	2.98	4.97
TOLEDO-CHICAGO(MIDWAY)	204	MKE	81	12,000	0:39	4,263	96,515	92,422	2.98	4.97
CHICAGO(MIDWAY)-INDIANAPOLIS	161	FWA	104	12,000	0:34	3,499	96,063	92,734	3.37	5.61
INDIANAPOLIS-CHICAGO(MIDWAY)	161	MKE	81	12,000	0:34	3,531	95,783	92,422	3.37	5.61
CHICAGO(MEIGS)-MINNEAPOLIS	363	DLH	135	12,000	1:00	6,413	99,385	93,142	2.33	3.88
MINNEAPOLIS-CHICAGO(MEIGS)	363	MKE	76	12,000	0:60	6,454	98,644	92,360	2.33	3.88
CHICAGO(MEIGS)-ST. LOUIS	265	SPI	92	12,000	0:48	4,945	97,353	92,578	2.64	4.40
ST. LOUIS-CHICAGO(MEIGS)	265	MKE	76	12,000	0:48	4,989	97,179	92,360	2.64	4.40
CHICAGO(MEIGS)-DETROIT	238	TOL	70	12,000	0:44	4,580	96,692	92,282	2.77	4.62
DETROIT-CHICAGO(MEIGS)	238	MKE	76	12,000	0:44	4,552	96,742	92,360	2.77	4.62
CHICAGO(MEIGS)-CLEVELAND	307	CMH	122	12,000	0:53	5,634	98,443	92,979	2.49	4.15
CLEVELAND-CHICAGO(MEIGS)	307	MKE	76	12,000	0:53	5,576	97,766	92,360	2.49	4.14
CHICAGO(MEIGS)-KANSAS CITY	413	OMA	166	12,000	1:07	7,058	100,429	93,541	2.23	3.72
KANSAS CITY-CHICAGO(MEIGS)	413	MKE	76	12,000	1:07	7,000	99,190	92,360	2.23	3.71

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: E100.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	ALTERNATE DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CHICAGO(MEIGS)-PITTSBURGH	413	CMH	158	12,000	1:07	7,039	100,307	93,438	2.23	3.72
PITTSBURGH-CHICAGO(MEIGS)	413	MKE	76	12,000	1:06	7,005	99,195	92,360	2.23	3.71
CHICAGO(MEIGS)-CINCINNATI	249	DAY	63	12,000	0:45	4,741	96,759	92,188	2.71	4.52
CINCINNATI-CHICAGO(MEIGS)	249	MKE	76	12,000	0:46	4,694	96,884	92,360	2.71	4.52
CHICAGO(MEIGS)-COLUMBUS	279	FWA	138	12,000	0:49	5,204	98,220	93,186	2.58	4.31
COLUMBUS-CHICAGO(MEIGS)	279	MKE	76	12,000	0:49	5,140	97,330	92,360	2.58	4.30
CHICAGO(MEIGS)-DES MOINES	313	OMA	116	12,000	0:54	5,633	98,368	92,905	2.47	4.11
DES MOINES-CHICAGO(MEIGS)	313	MKE	76	12,000	0:54	5,611	97,801	92,360	2.47	4.11
CHICAGO(MEIGS)-OMAHA	429	DSM	116	12,000	1:09	7,279	100,014	92,905	2.20	3.67
OMAHA-CHICAGO(MEIGS)	429	MKE	76	12,000	1:09	7,212	99,402	92,360	2.20	3.66
CHICAGO(MEIGS)-DAYTON	223	FWA	91	12,000	0:42	4,348	96,740	92,562	2.86	4.77
DAYTON-CHICAGO(MEIGS)	223	MKE	76	12,000	0:42	4,314	96,504	92,360	2.86	4.76
CHICAGO(MEIGS)-ROCHESTER	513	BUF	55	12,000	1:19	8,447	100,356	92,079	2.08	3.47
ROCHESTER-CHICAGO(MEIGS)	513	MKE	76	12,000	1:19	8,393	100,583	92,360	2.08	3.47
CHICAGO(MEIGS)-BUFFALO	459	ROC	55	12,000	1:12	7,640	99,549	92,079	2.15	3.59
BUFFALO-CHICAGO(MEIGS)	459	MKE	76	12,000	1:12	7,681	99,871	92,360	2.15	3.59
CHICAGO(MEIGS)-INDIANAPOLIS	163	FWA	104	12,000	0:34	3,539	96,103	92,734	3.35	5.58
INDIANAPOLIS-CHICAGO(MEIGS)	163	MKE	76	12,000	0:34	3,569	95,759	92,360	3.34	5.57
MINNEAPOLIS-MILWAUKEE	307	GRR	121	12,000	0:53	5,547	98,341	92,964	2.49	4.15
MILWAUKEE-MINNEAPOLIS	307	DLH	135	12,000	0:53	5,548	98,520	93,142	2.49	4.14

NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

EXHIBIT 5.1.2-1

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AIRCRAFT MODEL: E100.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	ALTERNATE DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
MINNEAPOLIS-OMAHA	290	DSM	116	12,000	0:51	5,323	98,058	92,905	2.54	4.24
OMAHA-MINNEAPOLIS	290	DLH	135	12,000	0:51	5,363	98,335	93,142	2.54	4.24
ST. LOUIS-KANSAS CITY	242	OMA	166	12,000	0:45	4,630	98,001	93,541	2.75	4.59
KANSAS CITY-ST. LOUIS	242	SPI	92	12,000	0:45	4,624	97,032	92,578	2.75	4.58
ST. LOUIS-INDIANAPOLIS	223	FWA	104	12,000	0:42	4,369	96,933	92,734	2.86	4.77
INDIANAPOLIS-ST. LOUIS	223	SPI	92	12,000	0:42	4,323	96,731	92,578	2.86	4.77
DETROIT-INDIANAPOLIS	251	FWA	104	12,000	0:46	4,748	97,312	92,734	2.71	4.51
INDIANAPOLIS-DETROIT	251	TOL	70	12,000	0:46	4,763	96,875	92,282	2.70	4.50
DETROIT-MILWAUKEE	251	GRR	121	12,000	0:46	4,749	97,543	92,964	2.71	4.51
MILWAUKEE-DETROIT	251	TOL	70	12,000	0:46	4,766	96,878	92,282	2.71	4.51
DETROIT-MINNEAPOLIS	547	DLH	135	12,000	1:23	8,946	101,918	93,142	2.05	3.41
MINNEAPOLIS-DETROIT	547	TOL	70	12,000	1:23	8,839	100,951	92,282	2.04	3.40
DETROIT-PITTSBURGH	214	CMH	158	12,000	0:41	4,400	97,668	93,438	2.91	4.85
PITTSBURGH-DETROIT	214	TOL	70	12,000	0:41	4,418	96,530	92,282	2.91	4.85
DETROIT-ST. LOUIS	460	SPI	92	12,000	1:13	7,704	100,112	92,578	2.16	3.59
ST. LOUIS-DETROIT	460	TOL	70	12,000	1:13	7,667	99,779	92,282	2.15	3.59
CLEVELAND-DETROIT	92	TOL	70	12,000	0:25	2,623	94,735	92,282	4.72	7.86
DETROIT-CLEVELAND	92	CMH	122	12,000	0:25	2,565	95,374	92,979	4.72	7.86
CLEVELAND-ST. LOUIS	493	SPI	92	12,000	1:17	8,162	100,570	92,578	2.11	3.52
ST. LOUIS-CLEVELAND	493	CMH	122	12,000	1:17	8,127	100,936	92,979	2.11	3.51

EXHIBIT 5.1.2-1

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NASA STOL SYSTEM STUDY
ROUTE ANALYSIS

AIRCRAFT MODEL: E100.3000

PHASE: II
MODE: STOL
SYSTEM: CHICAGO REGION

ROUTE	DISTANCE (S MI)	ALTERNATE AIRPORT	DISTANCE (S MI)	PAYLOAD (LB)	BLOCK TIME (HR:MIN)	BLOCK FUEL (LB)	WEIGHT TAKEOFF (LB)	WEIGHT LANDING (LB)	D.O.C. ($/S MI)	D.O.C. (¢/SEAT S MI)
CINCINNATI-ST. LOUIS	298	SPI	92	12,000	0:52	5,427	97,835	92,578	2.51	4.19
ST. LOUIS-CINCINNATI	298	DAY	63	12,000	0:52	5,500	97,518	92,188	2.52	4.19
CINCINNATI-DETROIT	247	TOL	70	12,000	0:45	4,707	96,819	92,282	2.72	4.54
DETROIT-CINCINNATI	247	DAY	63	12,000	0:45	4,692	96,710	92,188	2.72	4.54
DENVER-KANSAS CITY	550	OMA	166	12,000	1:23	8,706	102,077	93,541	2.03	3.38
KANSAS CITY-DENVER	550	COS	67	12,000	1:23	9,046	101,111	92,235	2.03	3.38
DENVER-OMAHA	483	DSM	116	12,000	1:15	7,779	100,514	92,905	2.10	3.50
OMAHA-DENVER	483	COS	67	12,000	1:14	8,089	100,154	92,235	2.10	3.51

5.2 Airline Fleet Planning

Simulation of a STOL airline operation results in derivation of a fleet schedule, a fleet size, and detailed statistics of flights per day, aircraft utilization, average system and route load factors and similar operational data. Input to these analyses is provided by the estimated traffic over each city-pair or airport pair. Route performance data is provided by route analysis and performance data.

In the sub sections which follow, airline operations were simulated in each of the study regions. Each region is complete, with results summarized and tabulated in Section 5.5, Airline Operations Summary. A simulation model accepted data from route analyses as presented in the preceding Section 5.1.2. Numbers of travelers were input for each route. An iterative process was used to adjust aircraft base assignment, departure times, and aircraft flight itineraries to arrive at a balanced fleet at a load factor closely approximating the target load factor. Fleet planning results indicate appropriate fleet sizes as a function of aircraft passenger capacity with the derived load factor approximating the target of 60 percent.

5.2.1 Chicago Region - A map of the Chicago Region network is included as Figure 5.2.1-1. Note that the cities are indicated congested, constrained or unconstrained with an appropriate legend. A congested notation indicates that the major airport in the city is predicted to be completely saturated in 1985 if all short-haul O and D traffic were to remain. For each of these cities, STOL short-haul traffic is shifted to a separate airport. A constrained designation indicates that less severe physical congestion or a social constraint may be alleviated by STOL operations on the major airport

1985
CHICAGO REGION - PHASE II

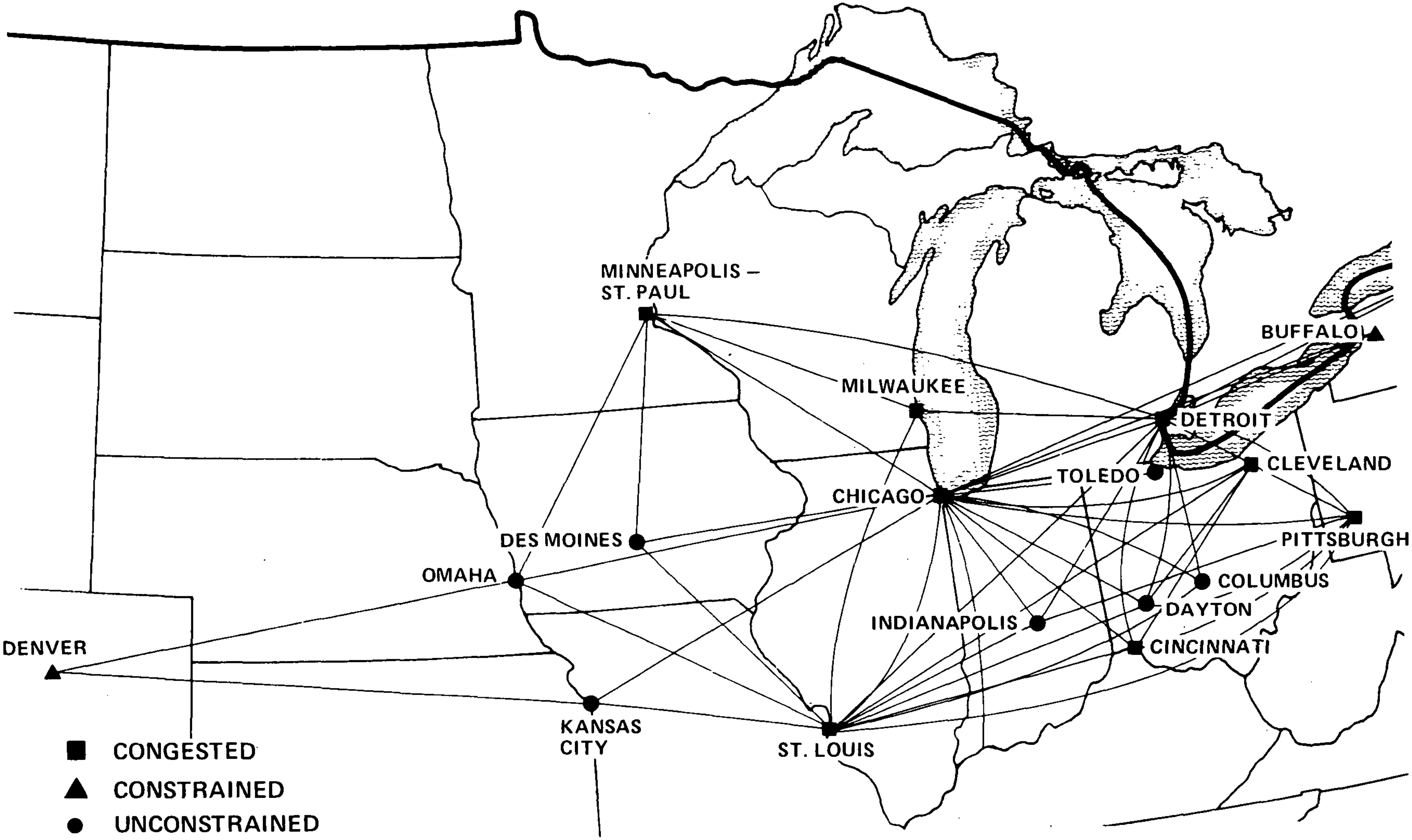


FIGURE 5.2.1-1

PR2-STOL-1187B

but from separate facilities. The unconstrained status denotes commingling or joint use with some separation of CTOL and STOL facilities where safety and traffic levels warrant separation.

In Table 5.2.1-1 each of the baseline cities is listed with the airport used for STOL service. Detailed exposition of airport characteristics for each of these is found in Volume III, Airports.

The baseline allocation of traffic was provided by the Market Analysis function. Details of the total market and the CTOL/STOL modal split are included in Section 3.4, Passenger Travel Demand. For the high density route analysis (O and D annual travelers over 300,000 per route), data are found in Tables 3.4-1 and 3.4-2 for all regions. With a 150 passenger aircraft, network activities were analyzed in terms of round trip per day and airport operations with results shown in Figure 5.2.1-2. Relief of congestion was insufficient at certain key cities such as Chicago and Detroit. Thus, the travel demand data was revised to include all routes with numbers of travelers in excess of 130,000. This was then defined as the Baseline System for the Expanded Chicago Region with STOL/CTOL split defined by Market Analysis.

Results of airline fleet planning and schedule evaluation are summarized in Table 5.2.1-2 which includes the three aircraft sizes. Each fleet is derived independently as a solution to travel demand and fleet numbers which are not additive. In other words, each fleet solution contains only one size of aircraft. The aircraft performance data reflected use of EBF configurations for all baseline cases.

To estimate the size of facilities, (gates, terminal space and costs) as needed to accommodate the aircraft movements the following were developed

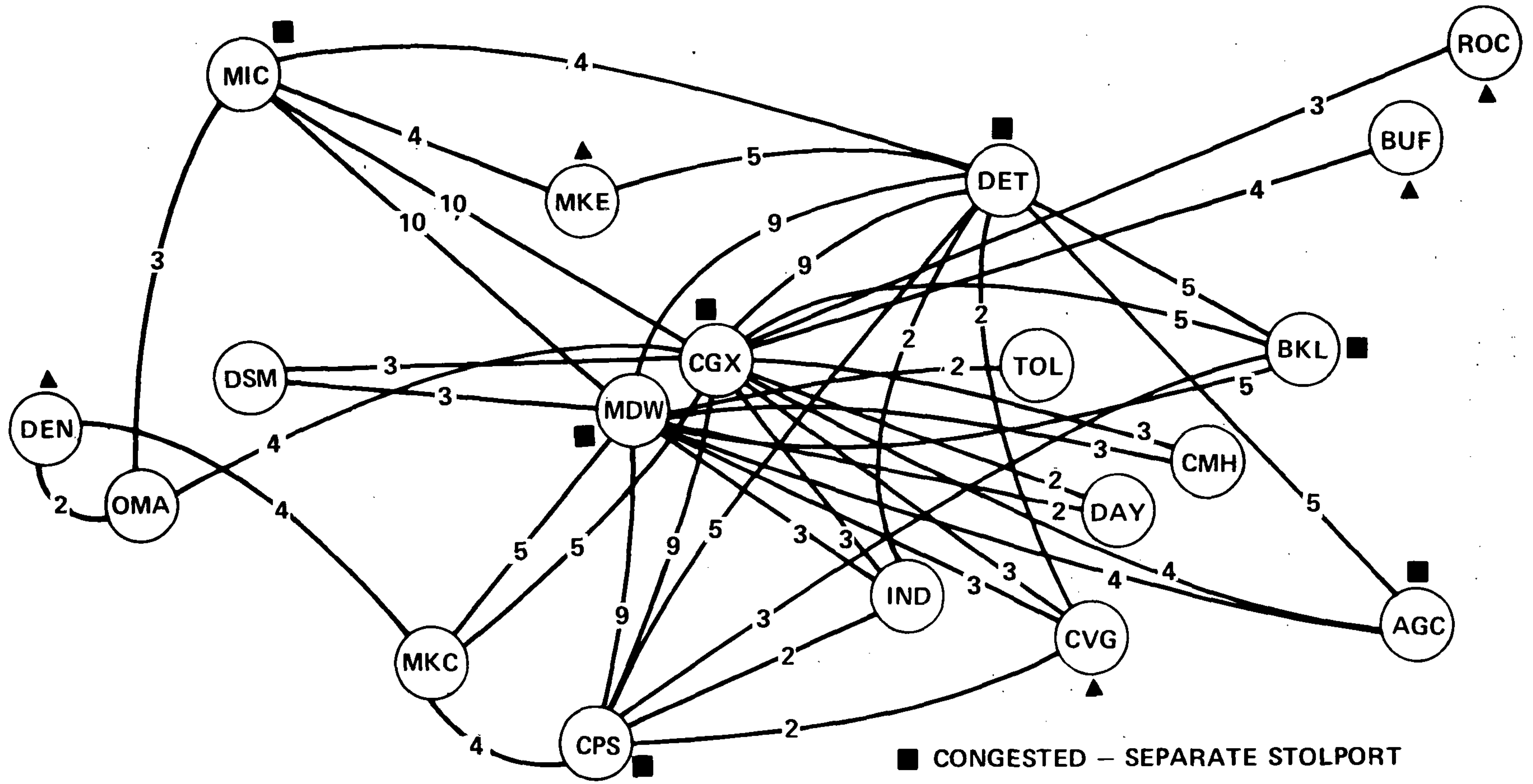
TABLE 5.2.1-1

AIRPORT IDENTIFICATION BY CITY AND CODE

CHICAGO REGION

CITY	AIRPORT	CODE
Buffalo	Greater Buffalo	BUF
Chicago	Meigs Field	CGX
Chicago	Midway	MDW
Cincinnati	Greater Cincinnati	CVG
Cleveland	Burke Lakefront	BKL
Columbus	Port Columbus	CMH
Dayton	J. M. Cox	DAY
Denver	Stapleton Int'l	DEN
Des Moines	Des Moines Municipal	DSM
Detroit	Detroit City	DET
Indianapolis	Weir Cook	IND
Kansas City	Kansas City Municipal	MKC
Milwaukee	Gen. Mitchell Field	MKE
Minneapolis and St. Paul	Crystal Field	MIC
Omaha	Eppley Field	OMA
Pittsburgh	Allegheny County	AGC
Rochester	Monroe County	ROC
St. Louis	Bi State Parks	CPS
Toledo	Toledo	TOL

1985
CHICAGO REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY



■ CONGESTED – SEPARATE STOLPORT

▲ CONSTRAINED – SEPARATE STOL RUNWAY

PR2-STOL-1272 B

FIGURE 5.2.1-2

TABLE 5.2.1-2

1985
CHICAGO REGION - PHASE II
(BASELINE)
WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH MILES (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED MPH (KPH)	DAILY UTILIZ. (HR.)	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR %
EBF-100	53	315.8 (508.1)	3,324	351.3 (565.2)	9.0	3,696	116,735 (187,827)	70,890 (114,062)	60.7
EBF-150	35	315.8 (508.1)	2,215	351.3 (565.2)	9.0	2,464	116,735 (187,827)	70,890 (114,062)	60.7
EBF-200	26	315.8 (508.1)	1,662	351.3 (565.2)	9.1	1,848	116,800 (187,931)	70,890 (114,062)	60.7

for each station:

1. Peak hour passengers (embarking and debarking)
2. Embarking and debarking passengers by time of day
3. Peak day passengers
4. Peak daily number of aircraft movements
5. Peak daily number of aircraft on ground at any one time
6. Number of flights per day arriving and departing
7. Utilization of aircraft

The following Exhibit 5.2.1-1 presents the weekly airport activity delineating the above. For each airport, numbers of passengers arriving and departing are indicated by hour of day. The total numbers of passengers and flights is representative of weekly activities. The data and results are for the baseline fleet.

A summary of daily round trip activities has been shown for the baseline system in the Expanded Chicago Region. Trip activity in the metropolitan Chicago Area at Meigs and Midway may be equated to short-haul aircraft movements shifted from O'Hare to the STOL system. It is of specific interest to examine O'Hare and other hub airports to ascertain the degree of congestion relief afforded by the STOL system. Since O'Hare International is a congested (Level 1) airport, it was the first hub to be examined in terms of the degree of relief provided by evaluating the effect of operating a STOL service from Meigs Field and Midway Airport with STOL short-haul shifted to these fields.

The baseline passenger O & D data developed by Market Analysis have been recapped for the city of Chicago in the form of city-pair data between O'Hare International Airport (ORD) and various cities in the Chicago and adjacent study regions. The data are presented as allocated to either a STOL city-pair route or a CTOL route. These data are presented in Table 5.2.1-3 which also includes routes with O and D travelers from 50,000 per year and greater.

1985
EXPANDED CHICAGO REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

Exhibit 5.2.1-1
Page 1

ALLEGHENY COUNTY (AGC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	825
825	7	8.00- 8.59	7	924
1607	14	9.00- 9.59	7	485
		10.00-10.59	7	618
618	7	11.00-11.59	7	519
903	14	12.00-12.59		
		13.00-13.59	14	982
618	7	14.00-14.59	7	519
519	7	15.00-15.59		
384	7	16.00-16.59	14	1472
824	7	17.00-17.59	7	923
923	7	18.00-18.59		
512	7	19.00-19.59		
		20.00-20.59	7	485
383	7	21.00-21.59		
		22.00-22.59	7	364

MEIGS (CGX)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
2119	21	7.00- 7.59	56	5168
2137	21	8.00- 8.59	28	3434
6447	56	9.00- 9.59	21	2477
1856	21	10.00-10.59	63	4677
2736	35	11.00-11.59	21	1495
3466	49	12.00-12.59	28	1779
873	14	13.00-13.59	42	3072
2062	28	14.00-14.59	21	1577
4016	56	15.00-15.59	35	2820
1147	14	16.00-16.59	49	5294
3972	35	17.00-17.59	28	3260
5144	42	18.00-18.59	21	2535
2023	21	19.00-19.59	35	3463
3166	35	20.00-20.59	7	531
1009	14	21.00-21.59	14	996
405	7	22.0-22.59		

GEN. MITCHELL FIELD (MKE)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
720	7	7.00- 7.59		
		8.00- ,8.59	7	830
709	7	10.00-10.59	7	519
1072	14	12.00-12.59	14	985
1070	14	14.00-14.59		
		15.00-15.59	14	985
1429	14	17.00-17.59	14	1754
539	7	21.00-21.59		
		22.00-22.59	7	466

GREATER CINCINNATI (CVG)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
707	7	7.00- ,7.59	7	707
		3.00- ,8.59	7	758
1284	14	10.00-10.59	7	634
583	7	11.00-11.59	14	1072
529	7	12.00-12.59	7	,426
582	7	15.00-15.59		
		16.00-16.59	7	706
706	7	17.00-17.59	7	758
1466	14	19.00-19.59	14	1573
,777	7	20.00-20.59		

1985
EXPANDED CHICAGO REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

DETROIT CITY (DET)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
708	7	7.00- 7.59	35	3469
2834	28	8.00- 8.59	21	2431
2659	21	9.00- 9.59	21	2500
2286	28	10.00-10.59	35	2527
1705	21	11.00-11.59	14	1055
1595	21	12.00-12.59	14	895
2312	35	13.00-13.59	28	1969
496	7	14.00-14.59	28	2088
1602	21	15.00-15.59	14	895
1819	21	16.00-16.59	21	2316
2158	21	17.00-17.59	28	3589
3683	28	18.00-18.59	14	1649
		19.00-19.59	14	1200
3264	35	20.00-20.59	7	466
531	7	21.00-21.59	21	1433
364	7	22.00-22.59		
466	7	23.00-23.59		

BI STATE PARKS (CPS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
642	7	7.00- 7.59	28	2801
2279	21	8.00- 8.59	14	1605
2533	21	9.00- 9.59	14	1468
1064	14	10.00-10.59	28	2043
1485	21	11.00-11.59	7	495
957	14	12.00-12.59	21	1351
973	14	13.00-13.59	14	958
913	14	14.00-14.59	21	1696
1422	21	15.00-15.59	14	1107
1852	21	16.00-16.59	21	2208
847	7	17.00-17.59	14	1604
3311	28	18.00-18.59	14	1550
1420	14	18.00-19.59	21	1985
726	7	20.00-20.59	7	495
942	14	21.00-21.59		

WEIRCOOK (IND)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1571	14	7.00- 7.59	7	759
		8.00- 8.59	7	985
850	7	9.00- 9.59		
571	7	10.00-10.59	7	571
519	7	11.00-11.59	14	1087
477	7	13.00-13.59		
		14.00-14.59	7	571
659	7	15.00-15.59	7	553
571	7	16.00-16.59	7	692
1455	14	19.00-19.59	14	1455

STAPLETON INT'L (DEN)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		8.00- 8.59	7	911
759	7	11.00-11.59	7	505
569	7	13.00-13.59	7	512
601	7	14.00-14.59	7	512
759	7	16.00-16.59		
759	7	17.00-17.59	7	911
		18.00-18.59	7	899
803	7	20.00-20.59		

1985
EXPANDED CHICAGO REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

MIDWAY (MDW)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1380	14	7.00- 7.59	63	6294
1439	14	8.00- 8.59	14	1815
6134	49	9.00- 9.59	28	3113
2132	28	10.00-10.59	35	2668
1661	21	11.00-11.59	35	2512
2554	35	12.00-12.59	14	1048
1818	28	13.00-13.59	35	2668
1615	21	14.00-14.59	28	1957
3579	49	15.00-15.59	14	939
2083	21	16.00-16.59	56	5821
908	7	17.00-17.59	21	2547
7622	63	18.00-18.59	21	2126
718	7	19.00-19.59	35	3474
1311	14	20.00-20.59	7	539
2567	35	21.00-21.59		

CRYSTAL (MIC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
719	7	7.00- 7.59	21	1944
1307	14	8.00- 8.59	14	1585
2523	21	9.00- 9.59	14	1635
539	7	10.00-10.59	14	1059
1499	21	11.00-11.59	14	1071
1417	21	12.00-12.59	21	1387
1058	14	13.00-13.59	14	1059
520	7	14.00-14.59	14	1070
2036	28	15.00-15.59	14	1146
719	7	16.00-16.59	21	2354
1565	14	17.00-17.59	7	959
3626	28	18.00-18.59	14	1634
718	7	19.00-19.59	21	2038
695	7	20.00-20.59	7	539
1059	14	21.00-21.59	7	520

EPPLEY FIELD (OMA)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
530	7	7.00- 7.59		
671	7	8.00- 8.59	14	1454
502	7	11.00-11.59	7	358
505	7	12.00-12.59		
397	7	13.00-13.59	14	1060
502	7	14.00-14.59	7	459
671	7	16.00-16.59	7	639
708	7	18.00-18.59		
899	7	19.00-19.59	14	1415

PORT COLUMBUS (CMH)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
661	7	8.00- 8.59		
		8.00- 9.59	7	616
371	7	13.00-13.59		
411	7	14.00-14.59	7	461
		15.00-15.59	7	411
732	7	17.00-17.59		
660	7	18.00-18.59	14	1347
549	7	19.00-19.59	7	549

1985
EXPANDED CHICAGO REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

BURKE LAKE FRONT (BKL)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
1505	14	7.00- 7.59	21	2150
		8.00- 8.59	7	950
904	7	9.00- 9.59	7	724
1312	14	10.00-10.59	7	534
508	7	11.00-11.59	7	575
1094	14	12.00-12.59	14	1036
		13.00-13.59	7	533
1083	14	14.00-14.59	7	575
542	7	15.00-15.59	14	1200
737	7	16.00-16.59		
1927	14	17.00-17.59	7	950
		18.00-18.59	14	1990
737	7	19.00-19.59		
1401	14	20.00-20.59	7	533

KANSAS CITY MUNI (MKC)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
1428	14	8.00- 8.59	14	1744
1635	14	9.00- 9.59	14	1343
1070	14	11.00-11.59	14	980
		12.00-12.59	7	569
406	7	13.00-13.59	7	437
1070	14	14.00-14.59	14	978
512	7	15.00-15.59	7	759
512	7	16.00-16.59	7	759
2875	28	17.00-17.59	14	1744
911	7	18.00-18.59	14	1556
1428	14	20.00-20.59	14	978

MONROE COUNTY (ROC)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
549	7	8.00- 8.59	7	732
411	7	13.00-13.59	7	411
732	7	18.00-18.59		
		19.00-19.59	7	549

DES MOINES MUNI (DSM)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
1190	14	7.00- 7.59		
		8.00- 8.59	14	1278
890	14	12.00-12.59	14	716
1190	14	17.00-17.59	14	1276

1985
EXPANDED CHICAGO REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

TOLEDO (TOL)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
788	7	9.00- 9.59		
		10.00-10.59	7	527
443	7	15.00-15.59		
		16.00-16.59	7	704

J.M. COX (DAY)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1408	14	10.00-10.59	14	1232
1054	14	14.00-14.59		
		15.00-15.59	14	1230

GREATER BUFFALO (BUF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
600	7	8.00- 8.59	7	720
450	7	11.00-11.59	7	405
600	7	17.00-17.59	7	720
600	7	20.00-20.59		
		21.00-21.59	7	405

TABLE 5.2.1-3
CHICAGO REGION - RECAP OF SHORT-HAUL
PASSENGER O&D STATISTICS - 1985
(IN THOUSANDS ANNUALLY)

BETWEEN: CHICAGO (ORD) AND:	ALLOCATION BY MARKET ANALYSIS STOL	CTOL	TOTAL
MINNEAPOLIS	1,362	515	1,877
ST. LOUIS	1,118	423	1,541
DETROIT	1,138	513	1,651
CLEVELAND	618	351	969
KANSAS CITY	603	285	888
PITTSBURGH	535	262	797
CINCINNATI	350	191	541
COLUMBUS	324	157	481
EVANSVILLE	111	54	165
DES MOINES	237	115	352
FT. WAYNE	73	36	109
PEORIA	99	45	144
OMAHA	207	117	324
DAYTON	219	120	339
ROCHESTER, N.Y.	165	71	236
TOLEDO	110	60	170
MADISON	113	47	160
GRAND RAPIDS	55	68	123
SPRINGFIELD, ILL.	81	45	126
BUFFALO	209	103	312
INDIANAPOLIS	359	179	538
ATLANTA	509	269	778
CHARLOTTE, N.C.	75	62	137
NASHVILLE	141	101	242
RICHMOND	52	42	94
LOUISVILLE	235	182	417
MEMPHIS	---	175	175
TOTAL	9,098	4,588	13,686

The baseline data on airport activity at Chicago have been reduced to flight schedules and numbers of airport movements. Summary tabulations are included as Table 5.2.1-4, STOL Relief of Congestion at Chicago O'Hare.

TABLE 5.2.1-4
1985
STOL RELIEF OF CONGESTION AT CHICAGO O'HARE
ANALYSIS OF MARKET FORECAST

Route Density Annual O & D Passengers (000)	O & D Passengers on STOL (000)	STOL Aircraft Movements (000)	STOL % of Annual Airport Movements (*)	O & D Passengers Remaining CTOL
≥ 300	6,916	77	7.0	6,770
≥ 130	8,329	93	7.7	5,357
> 50	9,098	101	8.4	4,588

* Unconstrained total air carrier movements forecasted at 1,206,000 for 1985 at O'Hare from Federal Aviation Administration data.

Scheduled traffic operations are presented as a percentage of forecasted total airport movements in 1985. The data is organized as O & D traffic from Chicago over city-pair routes which are projected at 50,000 and greater, 130,000 and greater, and 300,000 and greater numbers of travelers. STOL operations were conducted from Meigs and Midway airports. Numbers of flights at each of these act to relieve the same amount of short-haul traffic at O'Hare. For convenience, the number of flights are assumed equivalent in each case.

With short-haul traffic on the routes determined by Market Analysis to have 300,000 or more O and D travelers, a total of 77,000 STOL operations are generated in 1985. Total O'Hare traffic is projected from contemporary operations to an estimated 1,206,000 in 1985. With STOL relieving 77,000 operations, this results in relief of about 7.0 percent of total movements. Judged against a STOL systems objective of about 20 percent relief of operations at major congested airports, 7.0 percent is inadequate.

Revision of the sample to include city-pair data at levels of 130,000 and more travelers results in STOL operations reaching 93,000 per year. This results in a relief of about 7.7 percent. Again extending routes by adding city-pairs at a minimum of 50,000 travelers results in increasing operations to 101,000 or some 8.4 percent of the forecasted operations level at O'Hare.

This degree of relief is not of satisfactory magnitude. Therefore, the entire sample network in the Chicago Region was subjected to re-examination. The total traffic data was reallocated by airport pairs. The Airline Planning and Scheduling Group with the assistance of an Airline Sub-contract Representative reevaluated all airport pairs with traffic levels at a minimum of 130,000 O and D passengers in 1985. The resulting operations are summarized in Table 5.2.1-5. Note that total STOL traffic relieving O'Hare is estimated at 92,000 annual movements, or about 7.6 percent for the first level of reallocated traffic. Evaluation of the region again was extended to include airport pairs not originally included in the basic sample network. This resulted in the addition of about 25,000 flights by STOL in relief of O'Hare or about 9.7 percent. A similar reallocation by Airport Planning to the low-density airport pairs of traffic levels 50,000 and greater brought total STOL flights relieving O'Hare to about 141,000 annually or, some 11.7 percent.

TABLE 5.2.1-5
1985
REEVALUATION OF STOL RELIEF
OF CONGESTION AT CHICAGO O'HARE
(REALLOCATION OF TRAFFIC)

Route Density Annual O & D Passengers (000)	O & D Passengers on STOL (000)	STOL Aircraft Movements (000)	STOL % of Annual Airport Movements	O & D Passengers Remaining CTOL
≥130 (Baseline)	8,273	92	7.6	5,413
≥130 (Extended Region)	10,575	117	9.7	3,111
≥ 50 (Extended to low Density)	12,700	141	11.7	986

This result indicated an allocation and evaluation methodology to be applied in analyzing the other regions included in the study.

Two other cities in the Chicago Region have been analyzed in a similar fashion to evaluate the degree of relief of the major hub airport. These cities are Detroit (Detroit Metro/Wayne Co.) and St. Louis (Lambert Field). Also analyzed for relief of congestion are Philadelphia in the Northeast Region and Atlanta in the Southeast Region. Details of each of these hub airport examinations are presented in the regional sub-sections which follow.

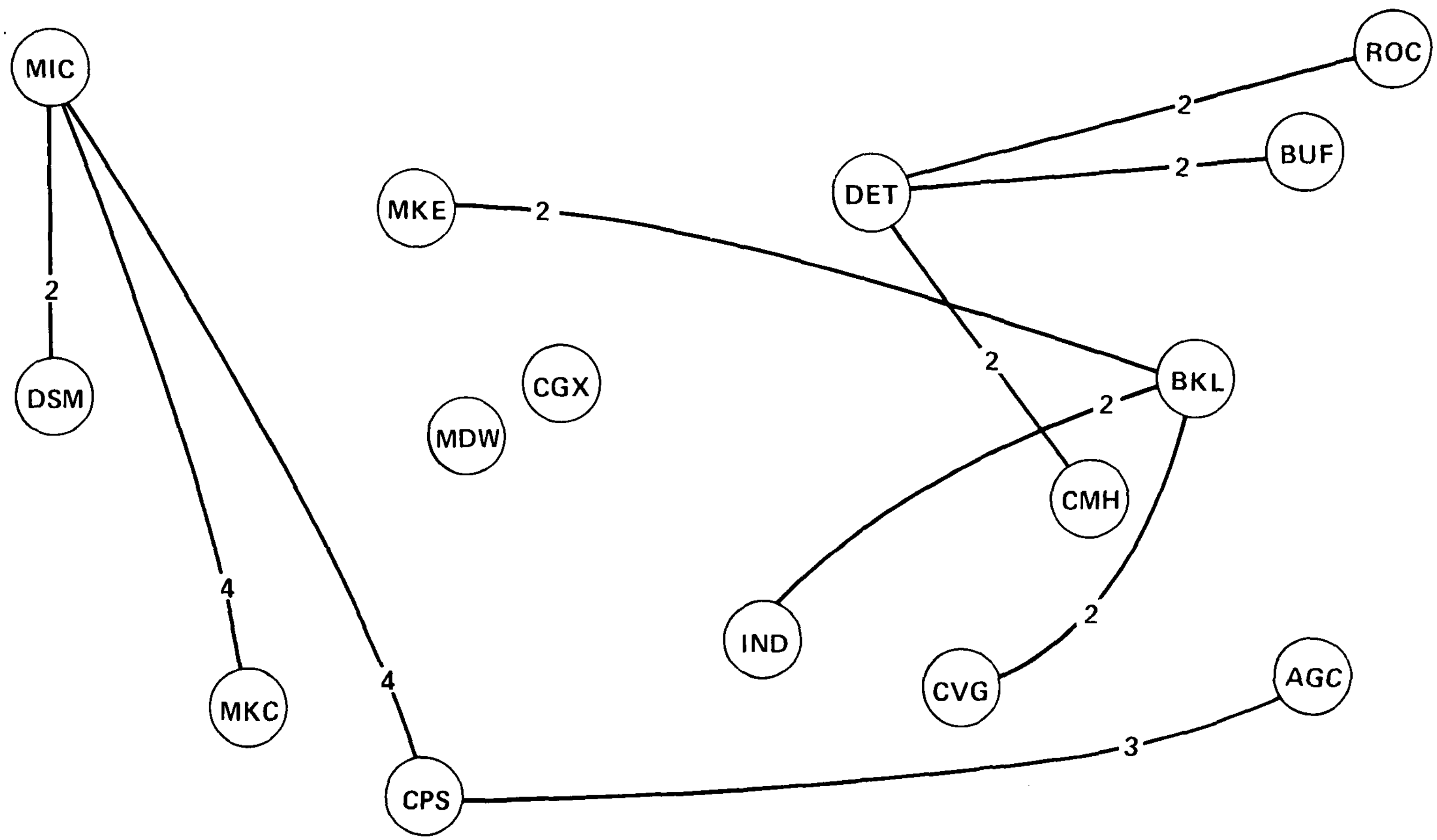
Figure 5.2.1-3 illustrates the effect of reallocating the Chicago Region Baseline traffic in a manner different from the modal split method. Where STOL traffic originated in a city with a congested Level 1 hub airport, and went to other major cities, short-haul traffic was assigned to STOL for routes of 130,000 annual O & D or more. The number of routes increased with the incremental round-trip activity shown in Figure 5.2.1-3. This incremental traffic occurred between cities included in the baseline network.

The next step in traffic analysis and congestion relief was to extend the network to more cities in the Chicago Region. Table 5.2.1-6 contains the added cities and traffic levels associated with them. Network activity resulting from this extension is detailed in Figure 5.2.1-4. Round-trips on this network occur between baseline cities (Minneapolis, Chicago, Cincinnati, and Cleveland) and added cities such as Washington (DCA), Birmingham (BHM), and Philadelphia (PNE), all of which are within 600 miles (966 km) of at least one of the baseline cities.

Including the low density routes with O & D traffic between 50,000 and 130,000 involves the addition of routes as shown in Table 5.2.1-7. The incremental fleet activities derived from this network extension are shown in three activity summaries, Figures 5.2.1-5, 5.2.1-6, and 5.2.1-7. The first details traffic from baseline cities of Chicago and Minneapolis, the second from Detroit, Cleveland, and Pittsburgh, with St. Louis being the third partial network summary.

Weekly fleet operations results for the reallocation of traffic and baseline extended network analysis are included as Table 5.2.1-8. Note that the Fleet Size column represents incremental numbers added to the baseline fleet. Departures and seat mile figures also are incremental to the baseline. The next set of data in Table 5.2.1-9 is generated with the low-density traffic data. These data also are incremental to the baseline. Selected operations data from each of these incremental analyses provided the input to the congestion relief analysis of Chicago O'Hare (Table 5.2.1-5).

1985
CHICAGO REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY
REVISED BASELINE TRAFFIC



PR3-STOL-1522

FIGURE 5.2.1-3

TABLE 5.2.1-6
1985
EXTENDED CHICAGO REGION
CITY PAIR ANNUAL STOL O & D TRAFFIC
REVISED BASELINE AND EXTENDED TRAFFIC
(≥130,000 PASSENGERS)

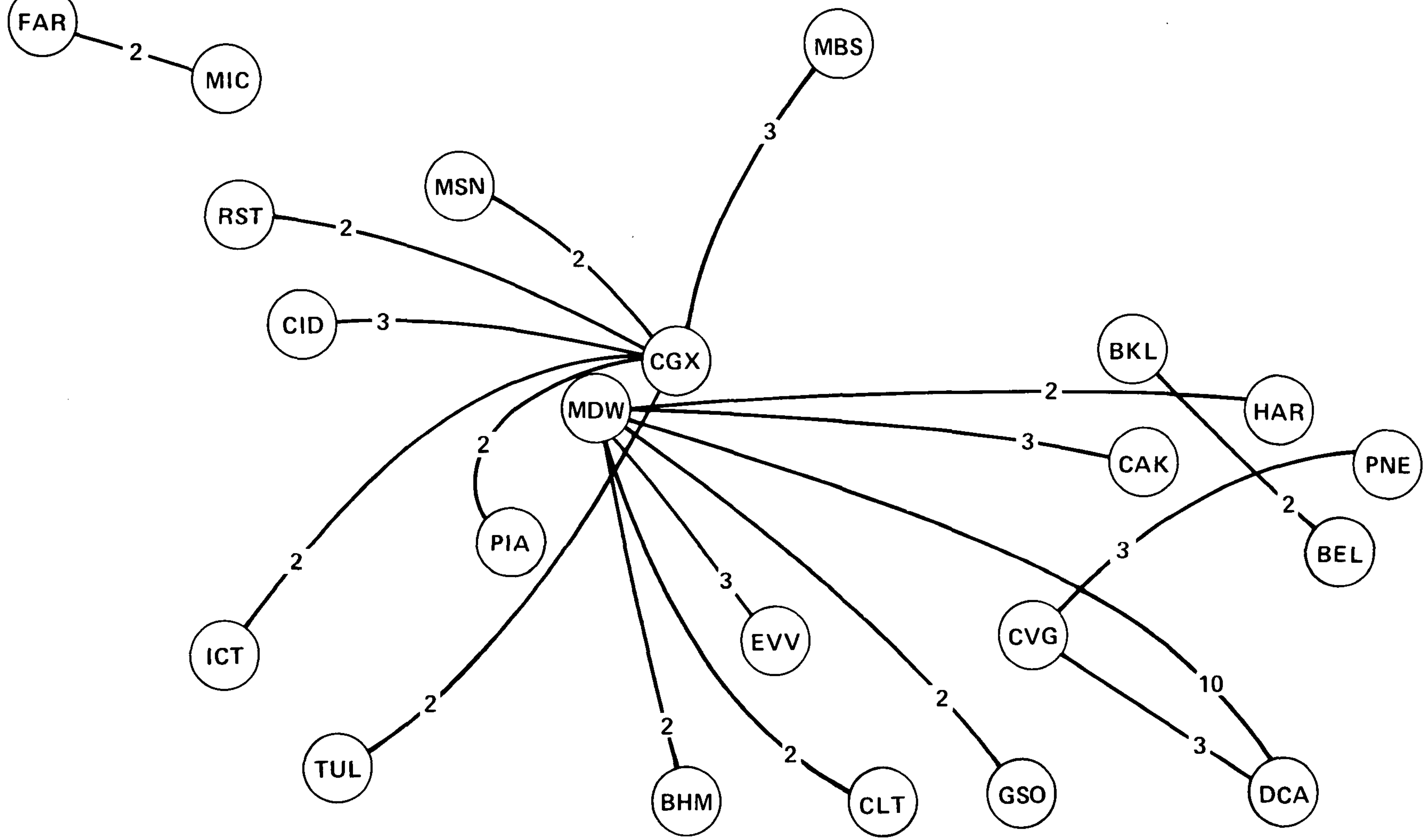
		STOL Traffic
BETWEEN:	Chicago	
AND:	Washington	1240
	Wichita	136
	Tulsa	154
	Saginaw	164
	Rochester, Minn	156
	Cedar Rapids	174
	Peoria	144
	Evansville	166
	Madison	160
	Akron	178
	Greensboro	136
	Harrisburg	134
	Birmingham	138
	Charlotte	138
BETWEEN:	Detroit	
AND:	Columbus	130
	Buffalo	150
	Rochester, N. Y.	160
BETWEEN:	Minneapolis	
AND:	Fargo	154
	Kansas City	254
	Des Moines	150

		STOL Traffic
BETWEEN:	Cincinnati	
AND:	Washington	208
	Philadelphia	178
BETWEEN:	St. Louis	
AND:	Minneapolis	284
	Pittsburgh	166
BETWEEN:	Cleveland	
AND:	Indianapolis	158
	Milwaukee	156
	Baltimore	150
	Cincinnati	130

1985

CHICAGO REGION - PHASE II

SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY EXTENDED NETWORK TRAFFIC



PR3-STOL-1525

FIGURE 5.2.1-4

TABLE 5.2.1-7

1985

EXTENDED CHICAGO REGION

CITY PAIR ANNUAL STOL O & D TRAFFIC

REALLOCATED BASELINE AND EXTENDED TRAFFIC IN THOUSANDS

(50,000 to 130,000 PASSENGERS)

BETWEEN:	Chicago	STOL Traffic
AND:	Chattanooga	69
	Champaign	111
	Decatur	50
	Duluth	94
	Flint	114
	Sioux Falls	63
	Ft. Wayne	109
	Green Bay	104
	Grand Rapids	123
	Lansing	119
	Lexington Ky.	76
	Little Rock	107
	Lincoln	82
	Milwaukee	94
	Moline	105
	Oshkosh	58
	South Bend	93
BETWEEN:	Minneapolis	
AND:	Cincinnati	63
	Duluth	57
	Sioux Falls	78
	Grand Forks	89
	Green Bay	62
	Moline	65
	Madison	106
	Bismark	57
	Cedar Rapids	67
	Indianapolis	81

BETWEEN:	Chicago	STOL Traffic
AND:	Springfield, Ill.	126
	Springfield, Mo.	60
	Sioux City	82
	Knoxville	94
	Youngstown	110
	Waterloo	82
	Kalamazoo	74
BETWEEN:	Detroit City	
AND:	Nashville	74
	Charlotte	70
	Dayton	60
	Grand Rapids	54
	Norfolk	72
	Syracuse	110
	Cleveland	70
BETWEEN:	Pittsburgh	
AND:	Allentown	116
	Scranton	61
	Nashville	56
	Buffalo	101
	Charlotte	68
	Columbus	63
	Cincinnati	86
	Dayton	95
	Indianapolis	114
	Norfolk	84

TABLE 5.2.1-7

EXTENDED CHICAGO REGION

(CONTINUED)
(000)

		STOL Traffic			STOL Traffic
BETWEEN:	Cleveland		BETWEEN:	St. Louis	
AND:	Allentown	58	AND:	Nashville	102
	Albany	78		Columbus	97
	Nashville	87		Cincinnati	86
	Buffalo	62		Dayton	95
	Charlotte	66		Des Moines	117
	Dayton	94		Little Rock	96
	Norfolk	55		Moline	57
	Pittsburgh	97		Oklahoma City	110
	Providence	53		Omaha	98
	Rochester	94		Peoria	53
	Louisville	118		Springfield, Mo.	72
	Syracuse	81			
BETWEEN:	Kansas City				
AND:	Milwaukee	86			

1985
CHICAGO REGION - PHASE II
EXTENSION TO LOW DENSITY
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY
CHICAGO - MINNEAPOLIS HUBS

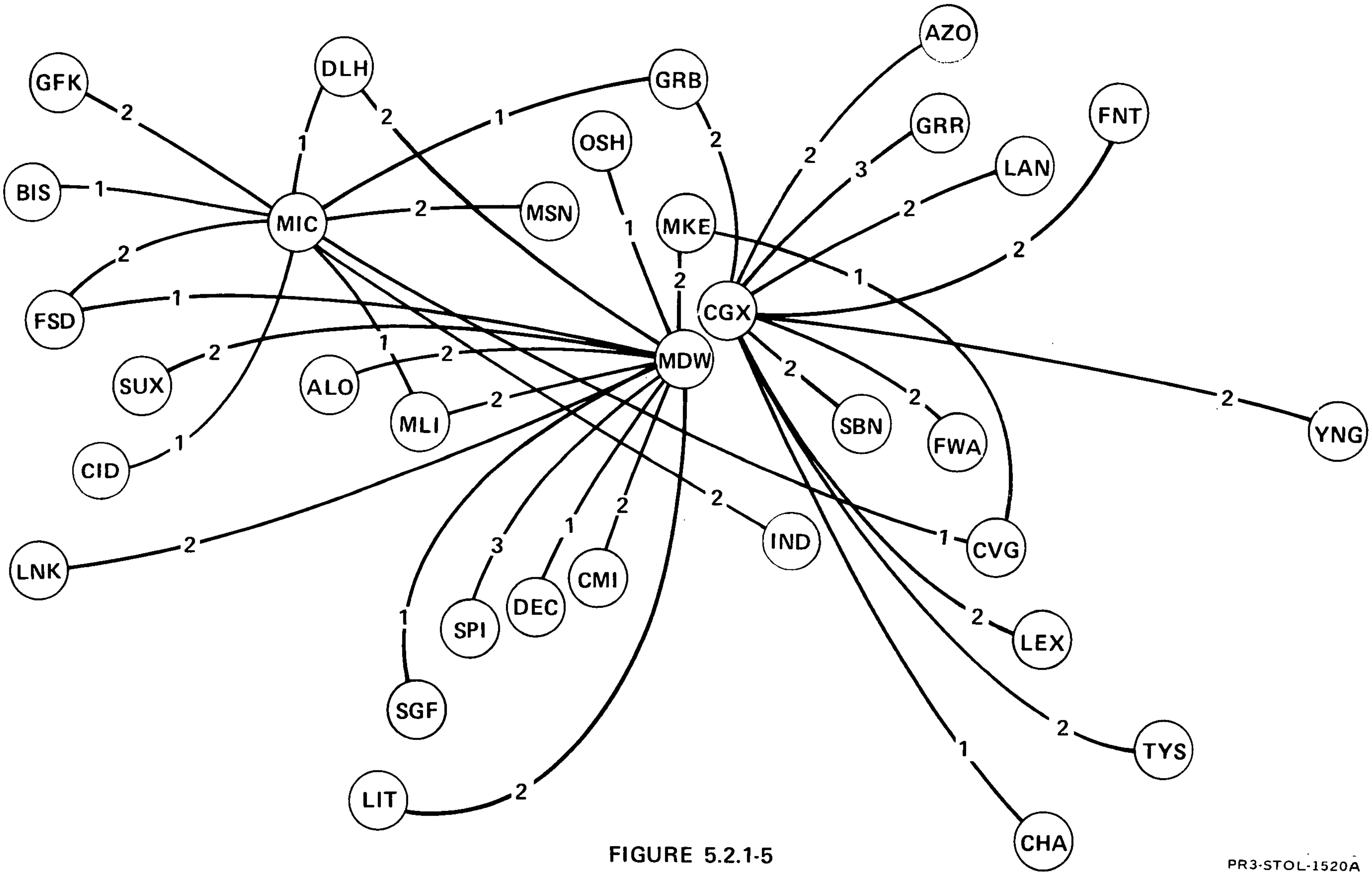


FIGURE 5.2.1-5

PR3-STOL-1520A

1985
CHICAGO REGION - PHASE II
EXTENSION TO LOW DENSITY
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY
DETROIT - CLEVELAND - PITTSBURGH HUBS

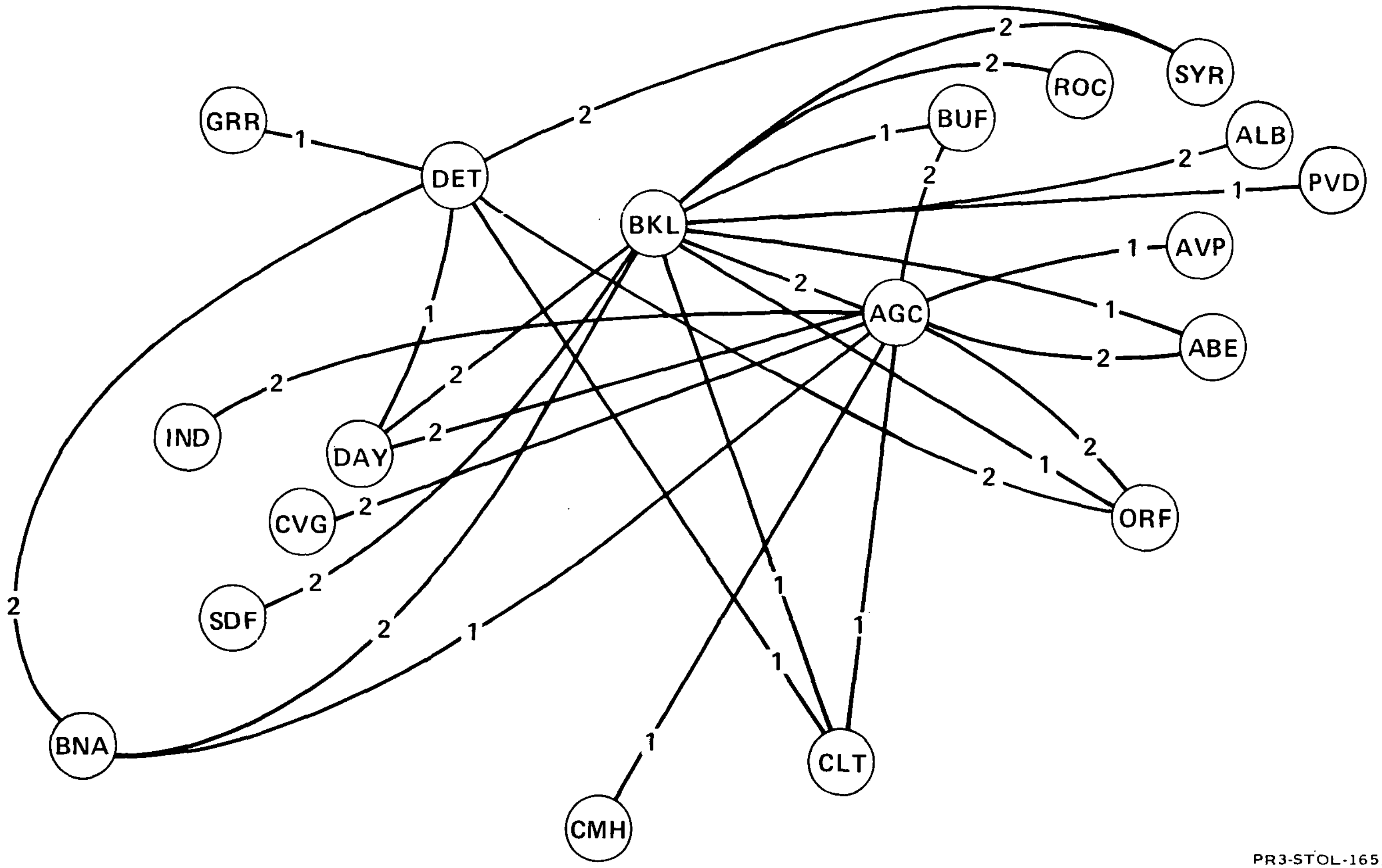


FIGURE 5.2.1-6

1985
CHICAGO REGION - PHASE II
EXTENSION TO LOW DENSITY
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY
ST. LOUIS HUB

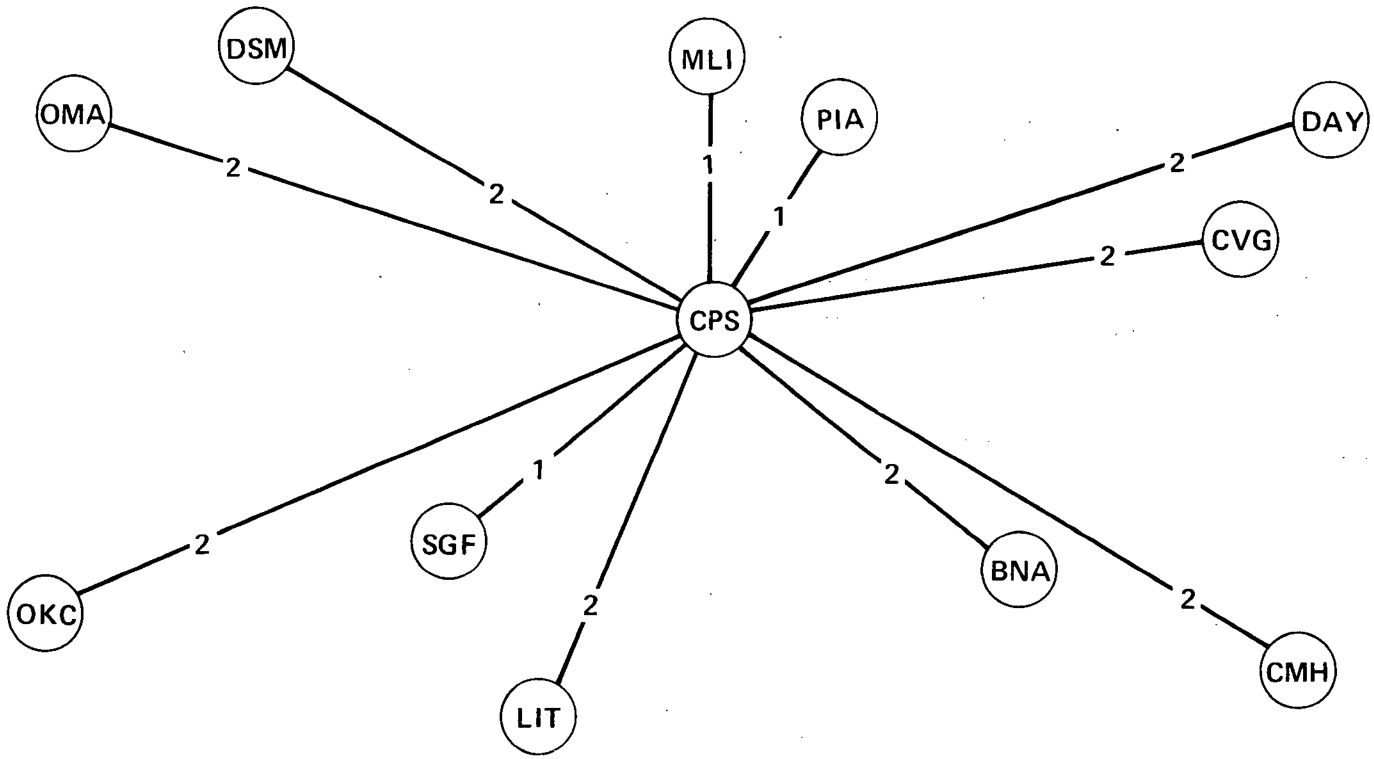


FIGURE 5.2.1-7

PR3-STOL-1524

TABLE 5.2.1-8

1985

CHICAGO REGION - PHASE II
REALLOCATED BASELINE TRAFFIC
AND EXTENDED NETWORK
INCREMENTAL TRAFFIC

Weekly Fleet Operations Results

Aircraft Type	Fleet Size	Average Stage Length Miles (KM)	Block Hours	Average Block Speed MPH (KPH)	Daily Utiliz. Hr	Total Depart	Aircraft Seat Miles (KM) (000)	Passenger Seat Miles (KM) (000)	System Load Factor %
EBF-100	33	349.3 (562)	2058	355.7 (572.3)	9.0	1786	74,712 (120,212)	45,099 (72,564)	60.6
EBF-150	22	349.3 (562)	1373	355.7 (572.3)	9.0	1190	74,712 (120,212)	45,099 (72,564)	60.6
EBF-200	17	349.3 (562)	2058	355.7 (572.3)	9.0	893	74,647 (120,107)	45,099 (72,564)	60.6

TABLE 5.2.1-9

1985

CHICAGO REGION - PHASE II

LOW-DENSITY NETWORK

INCREMENTAL TRAFFIC

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH MILES (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED MPH (KPH)	DAILY UTILIZ. HR.	TOTAL DEPART.	AIRCFT SEAT MI. (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR %
EBF-100	42	418 (673.5)	2216	363.0 (584.1)	7.5	2646	76,802 (122,357)	35,485 (57,095)	45.0
EBF-150	28	418.6 (673.5)	1477	363.0 (584.1)	8.8	1764	76,802 (122,357)	35,485 (57,095)	45.0
EBF-200	21	418.6 (673.5)	1108	363.0 (584.1)	7.5	1323	76,802 (122,357)	35,485 (57,095)	45.0

Detroit Hub

A similar evaluation of congestion relief of the Detroit Metropolitan/ Wayne County airport is presented in the following tabulations of data. The Detroit traffic data for routes in excess of 50,000 annual O & D travelers. is displayed in Table 5.2.1-10. Total annual forecasted air carrier movements are 444,000 for 1985. Congestion relief afforded with movements based on the CTOL/STOL modal split is shown in Table 5.2.1-11. Note that about 14 percent of air carrier movements are relieved if low-density markets are served. In contrast, with a reallocation of the market by Airline Planning and Scheduling, congestion relief is increased to about 16.3 percent of 1985 air carrier movements. This relief by reallocation is stated in Table 5.2.1-12.

TABLE 5.2.1-10

CHICAGO REGION - RECAP OF SHORT-HAUL

PASSENGER O&D STATISTICS - 1985

(IN THOUSANDS ANNUALLY)

BETWEEN: DETROIT (DTW)

AND:

	ALLOCATION BY MARKET ANALYSIS STOL	CTOL	TOTAL
CHICAGO	1,138	513	1,651
INDIANAPOLIS	96	89	185
MILWAUKEE	108	116	224
MINNEAPOLIS	235	100	335
PITTSBURGH	219	106	325
ROCHESTER, N.Y.	114	47	161
ST. LOUIS	304	119	423
DAYTON	24	36	60
BUFFALO	78	73	151
GRAND RAPIDS	35	19	54
CLEVELAND	304	104	408
CINCINNATI	133	72	205
COLUMBUS	88	42	130
NORFOLK	46	26	72
PHILADELPHIA	386	270	656
WASHINGTON NATIONAL	350	262	612
HARTFORD	152	90	242
BOSTON	312	223	535
NEW YORK CITY	1,001	1,075	2,076
ALBANY	63	44	107
BALTIMORE	102	90	192
PROVIDENCE	36	26	62
SYRACUSE	62	48	110
ATLANTA	235	120	355
TOTAL	5,519	3,710	9,229

TABLE 5.2.1-11

1985

STOL RELIEF OF CONGESTION AT DETROIT

ANALYSIS OF MARKET FORECAST

ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL (000)
$\geqslant$ 300	3,795	42	9.5	5,434
$\geqslant$ 130	4,769	53	12.0	4,460
$\geqslant$ 50	5,519	62	14.0	3,710

TABLE 5.2.1-12

1985

REEVALUATION OF STOL RELIEF

OF CONGESTION AT DETROIT

(REALLOCATION OF TRAFFIC)

ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL
$\geqslant$130 (Baseline)	5,672	63	14.3	3,557
$\geqslant$130 (Extended Region)	6,112	68	15.3	3.117
$\geqslant$ 50 (Extended to Low Density)	6,552	73	16.3	2,677

St. Louis Hub

Analysis similar to that performed for Detroit has been generated for the St. Louis hub. The forecasted traffic data for Lambert Field are presented as STOL/CTOL numbers in Table 5.2.1-13. Total annual forecasted air carrier movements are 330,000 for 1985. The baseline modal split STOL carrier movements generate a relief of congestion to the total extent of about 11.8 percent as indicated in Table 5.2.1-14. With reallocation of traffic, a corresponding number from Table 5.2.1-15 reveals a relief level of about 16.4 percent by including all the potential STOL traffic.

TABLE 5.2.1-13

CHICAGO REGION - RECAP OF SHORT-HAUL

PASSENGER O&D STATISTICS - 1985

(IN THOUSANDS ANNUALLY)

BETWEEN: ST. LOUIS		ALLOCATION BY MARKET ANALYSIS		
AND:		STOL	CTOL	TOTAL
DALLAS		234	135	369
LITTLE ROCK		58	38	96
MEMPHIS		153	83	236
WICHITA		48	165	213
ATLANTA		162	81	243
LOUISVILLE		90	59	149
MEMPHIS		152	84	236
NEW ORLEANS		106	65	171
CHICAGO		1,118	423	1,541
DAYTON		64	30	94
DES MOINES		83	34	117
INDIANAPOLIS		48	165	213
KANSAS CITY		197	160	357
MILWAUKEE		86	37	123
OMAHA		66	32	98
PITTSBURGH		115	50	165
TULSA		69	29	98
DETROIT		304	119	423
CLEVELAND		176	75	251
CINCINNATI		121	55	176
COLUMBUS		68	29	97
	TOTAL	3,518	1,948	5,466

TABLE 5.2.1-14

1985

STOL RELIEF OF CONGESTION AT ST. LOUIS

ANALYSIS OF MARKET FORECAST

ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL
$\geqslant$ 300	1,422	16	4.9	4,044
$\geqslant$ 130	2,496	28	8.5	2,970
$\geqslant$ 50	3,518	39	11.8	1,948

TABLE 5.2.1-15

1985

REEVALUATION OF STOL RELIEF OF CONGESTION AT ST. LOUIS

ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL
$\geqslant$130 (Baseline)	3,394	39	11.8	2,072
$\geqslant$130 (Extended Region)	3,844	43	13.1	1,622
$\geqslant$50 (Extended to Low Density)	4,827	54	16.4	639

5.2.2 Northeast Region - The same procedures are followed in analyzing each of the regions. In the Northeast Region a baseline system was analyzed with modal split traffic data followed by reallocation and extension to low-density routes. A map of the Northeast regional network is included as Figure 5.2.2-1. For each of the cities in this network, the STOL airports are identified in Table 5.2.2-1. The baseline traffic data is contained in Table 3.4-2 Page 2, High density O & D and in Table 3.4-3 Pages 3 and 4, extension to low-density. Following the same schedule simulation as in the Chicago region, results are summarized in Figure 5.2.2-2 with the route distribution of daily round trips for the EBF 150 aircraft. The baseline fleet and total weekly operating statistics for each of three sizes of aircraft are gathered into Table 5.2.2-2.

1985
NORTHEAST REGION-PHASE II

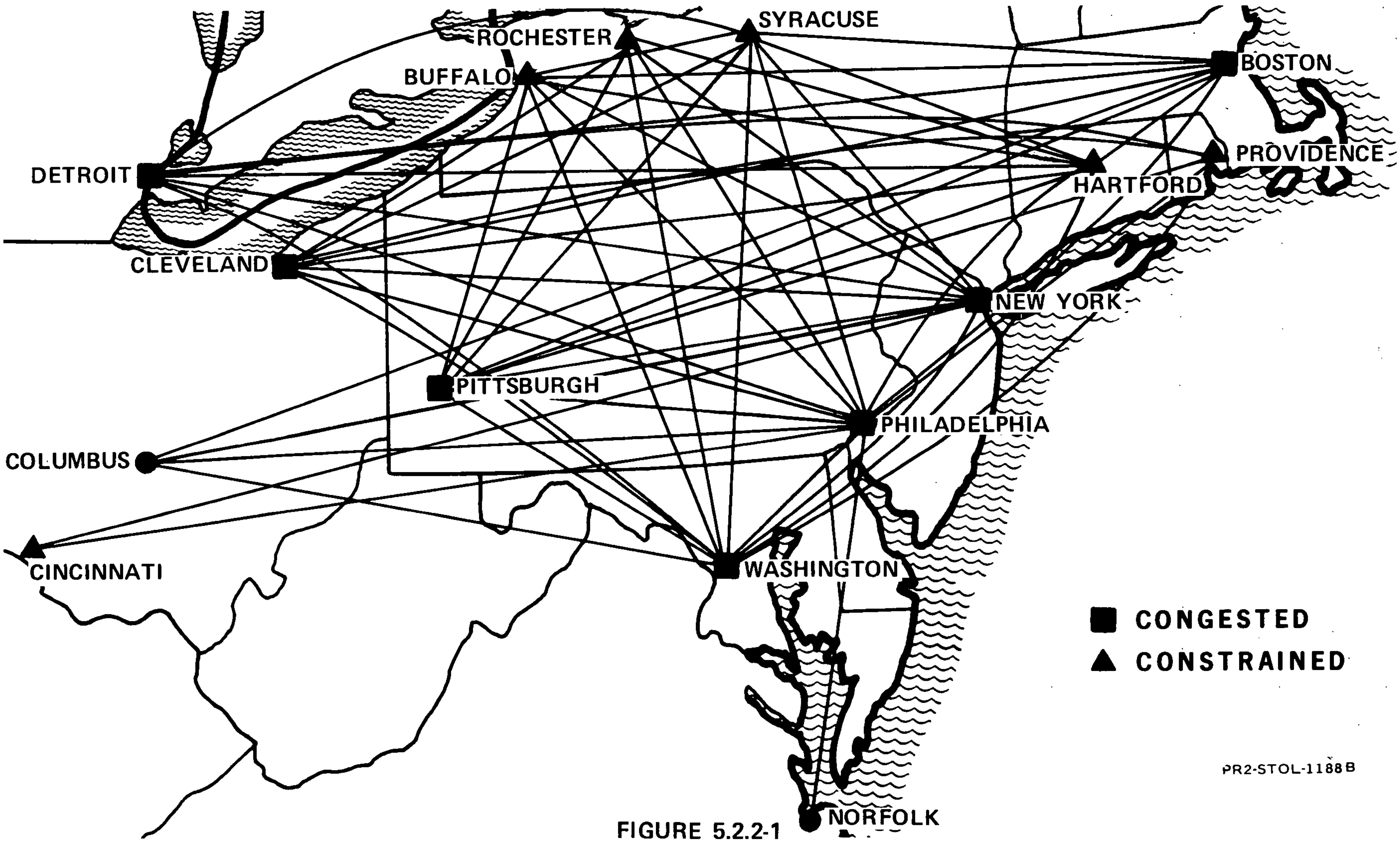


FIGURE 5.2.2-1

TABLE 5.2.2-1

AIRPORT IDENTIFICATION BY CITY AND CODE

NORTHEAST REGION

CITY	AIRPORT	CODE
Boston	Hanscom Field	BED
Boston	Norwood	OWD
Buffalo	Greater Buffalo	BUF
Cincinnati	Greater Cincinnati	CVG
Cleveland	Burke Lakefront	BKL
Columbus	Port Columbus	CMH
Detroit	Detroit City	DET
Hartford	Hartford-Brainard	HFD
New York	Westchester County	HPN
New York	Islip MacArthur	ISP
New York	Secaucus	SEC
Norfolk	Norfolk Regional	ORF
Pitssburgh	Allegheny County	AGC
Philadelphia	No. Philadelphia	PNE
Providence	Gr. Providence	PVD
Rochester	Monroe County	ROC
Syracuse	C. E. Hancock	SYR
Washington	Washington National	DCA
Baltimore	Beltsville	BEL

1985
NORTHEAST REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS
EBF 150 PASSENGER CAPACITY

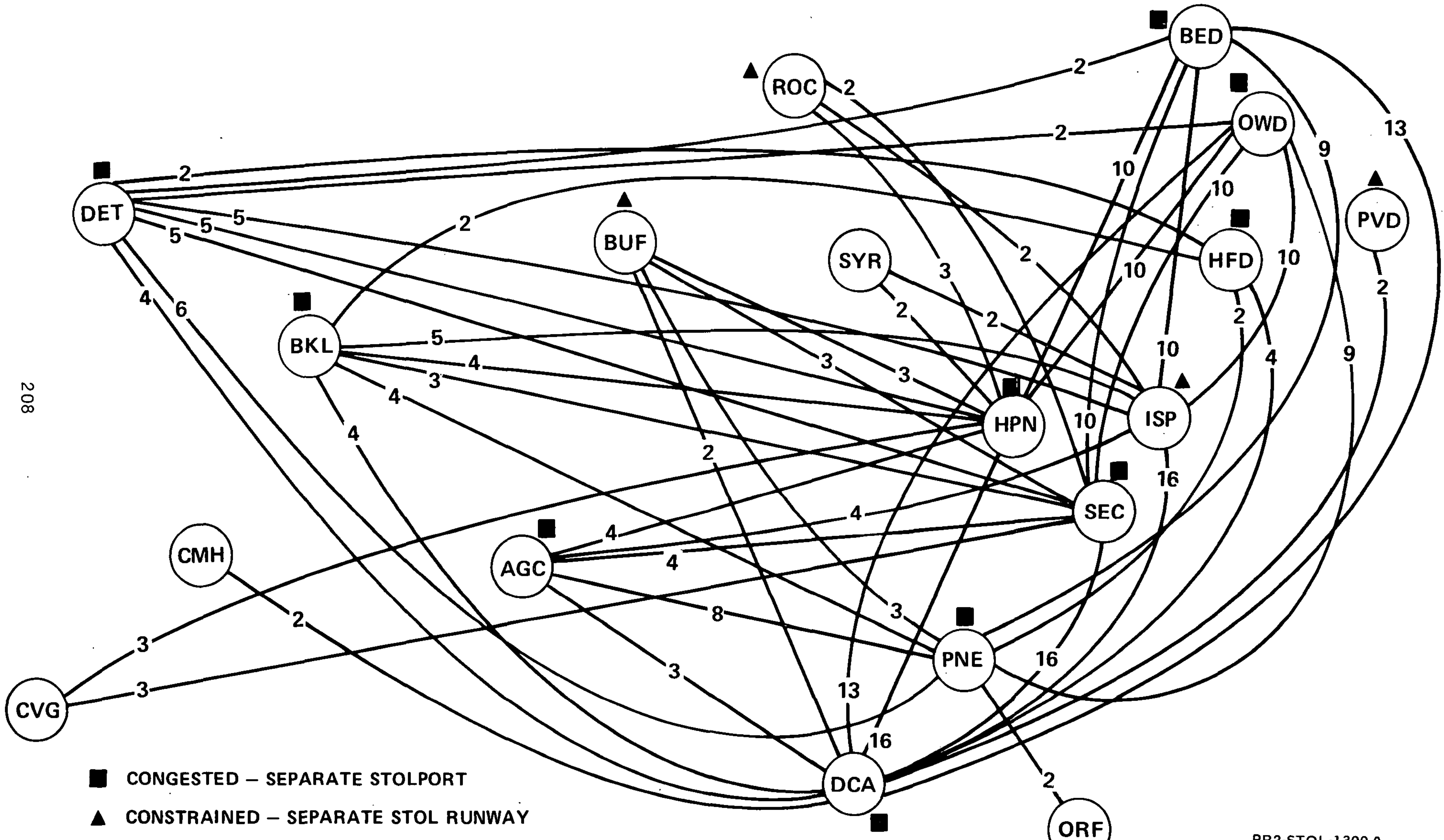


FIGURE 5.2.2-2

TABLE 5.2.2-2

1985
NORTHEAST REGION - PHASE II
(BASELINE)
WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH MILES (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED MPH (KPH)	DAILY UTILIZ.	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR %
EBF-100	78	288.2 (463.7)	4,744	343.2 (552.2)	8.7	5,649	162,000 (261,950)	98,908 (159,143)	60.8
EBF-150	52	288.2 (463.7)	3,163	342.9 (551.7)	8.7	3,766	162,708 (261,800)	98,988 (159,272)	60.8
EBF-200	39	288.2 (463.7)	2,372	343.2 (552.2)	8.7	2,824	162,800 (261,950)	98,908 (159,143)	60.8

Statistics from which airport facility requirements are derived are contained in Exhibit 5.2.2-1, Expanded Northeast Region, Weekly Airport Activity for 150 passenger aircraft. Baseline modal split traffic at Philadelphia is shown in Table 5.2.2-3. This provides the data for evaluation of congestion relief by shifting short-haul operations to a STOL airport.

The degree of air congestion relief provided in the baseline analysis for Philadelphia is presented in Table 5.2.2-4. Maximum relief is about 11.3 percent of commercial air carrier operations from the International Airport in 1985. Extension of the network and reallocation of traffic results in greater relief to the extent of about 15.2% as revealed in Table 5.2.2-5. The extended network is presented in Figure 5.2.2-3. The traffic increment in the Northeast Region is contained in Table 5.2.2-6. Incremental daily round trip activity arising in the extended network is detailed in Figure 5.2.2-4. The resulting additions of aircraft derived by including routes with 50,000 to 130,000 annual O & D travelers are summarized in Table 5.2.2-7. Fleet sizes for the Northeast region are included in Section 5 Airline Operations Summary.

1985
EXPANDED NORTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

HANSCOM FIELD (BED)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
2537	28	7.00- 7.59	35	3269
3953	35	8.00- 8.59	35	4359
3425	28	9.00- 9.59	28	3248
1440	21	10.00-10.59	21	1495
1522	21	11.00-11.59	28	1972
2475	35	12.00-12.59	14	954
1854	28	13.00-13.59	28	1972
1470	21	14.00-14.59	42	2968
1996	28	15.00-15.59	14	954
1951	21	16.00-16.59	28	2631
2431	21	17.00-17.59	28	3510
3425	28	18.00-18.59	14	1698
2536	28	19.00-19.59	28	2686
2712	28	20.00-20.59	28	2429
1060	14	21.00-21.59	7	642

ALLEGHENY COUNTY (AGC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	28	2940
3767	28	9.00- 9.59		
521	7	10.00-10.59	28	2324
608	7	11.00-11.59	7	545
1567	21	12.00-12.59	7	549
		13.00-13.59	21	1688
549	7	14.00-14.59		
1022	14	15.00-15.59	7	669
1332	14	16.00-16.59	14	1768
		17.00-17.59	14	1888
1820	14	18.00-18.59		
2156	21	19.00-19.59	14	1576
812	7	20.00-20.59	21	1822
545	7	21.00-21.59		
1070	14	22.00-22.59		

GREATER PROVIDENCE (PVD)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
560	7	7.00- 7.59		
		8.00- 8.59	7	748
748	7	18.00-18.59		
		19.00-19.59	7	560

1985
EXPANDED NORTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

WASHINGTON NATIONAL (DCA)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
2609	28	7.00- 7.59	42	3891
3768	35	8.00- 8.59	49	5945
5974	49	9.00- 9.59	28	3269
3979	49	10.00-10.59	70	5107
3543	49	11.00-11.59	56	4038
4042	56	12.00-12.59	28	1956
1502	21	13.00-13.59	63	4311
3032	42	14.00-14.59	35	2494
5557	77	15.00-15.59	42	3422
3323	35	16.00-16.59	56	6071
6575	56	17.00-17.59	49	5960
5382	42	18.00-18.59	56	6105
3047	28	19.00-19.59	21	2006
4617	49	20.00-20.59	42	3413
2018	28	21.00-21.59	21	1487
995	14	22.00-22.59	7	488

NORWOOD (OWD)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
2711	28	7.00- 7.59	35	3294
1611	14	8.00- 8.59	35	4395
3607	28	9.00- 9.59	7	839
1713	21	10.00-10.59	35	2501
1756	21	11.00-11.59	21	1467
2054	28	12.00-12.59	14	1044
2546	35	13.00-13.59	42	2973
1033	14	14.00-14.59	28	1966
2545	35	15.00-15.59	14	960
3636	42	16.00-16.59	35	3383
2715	21	17.00-17.59	42	5354
2731	21	18.00-18.59	14	1707
3367	35	19.00-19.59	28	2686
657	7	20.00-20.59	21	1662
1020	14	21.00-21.59		
1028	14	22.00-22.59	7	499

HANCOCK (SYR)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
560	7	7.00- 7.59		
		8.00- 8.59	7	748
654	7	11.00-11.59	7	560
654	7	15.00-15.59		
		16.00-16.59	7	748
748	7	18.00-18.59		
		19.00-19.59	7	560

1985
EXPANDED NORTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

BURKE LAKEFRONT (BKL)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
3391	35	7.00- 7.59	42	4106
1717	14	8.00- 8.59	35	4380
2619	21	9.00- 9.59	14	1715
3358	42	10.00-10.59	21	1502
965	14	11.00-11.59	28	2028
995	14	12.00-12.59	28	2032
2540	35	13.00-13.59	14	995
1487	21	14.00-14.59	35	2460
3455	42	15.00-15.59	28	2221
2760	28	16.00-16.59	35	3401
1816	14	17.00-17.59	28	3565
3335	28	18.00-18.59	7	868
2885	28	19.00-19.59	28	2713
1288	14	20.00-20.59	35	2787
995	14	21.00-21.59	7	488
1741	21	22.00-22.59	7	488
402	7	23.00-23.59	14	1308

GREATER BUFFALO (BUF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
3238	35	7.00- 7.59	21	1917
4282	42	8.00- 8.59	42	4852
3150	28	9.00- 9.59	35	4006
1955	28	10.00-10.59	28	2042
1828	28	11.00-11.59	28	2057
2885	42	12.00-12.59	28	1865
954	14	13.00-13.59	28	1911
1872	28	14.00-14.59	35	2219
1442	21	15.00-15.59	28	2166
3639	42	16.00-16.59	21	2135
3326	28	17.00-17.59	35	4162
4887	42	18.00-18.59	35	3625
1524	14	19.00-19.59	28	2484
3634	28	20.00-20.59	14	1105
		21.00-21.59	14	1070

PORT COLUMBUS (CMH)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
484	7	11.00-11.59		
		12.00-12.59	7	484
862	7	17.00-17.59		
		18.00-18.59	7	862

1985
EXPANDED NORTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

DETROIT CITY (DET)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	28	2773
2118	21	8.00- 8.59		
785	7	9.00- 9.59	21	2180
2395	21	10.00-10.59	7	750
		11.00-11.59	21	1493
1587	21	12.00-12.59		
1601	21	13.00-13.59	21	1634
2021	28	14.00-14.59	21	1578
		15.00-15.59	28	2359
1114	14	16.00-16.59		
1418	14	17.00-17.59	14	1772
2830	21	18.00-18.59	14	1816
589	7	19.00-19.59	21	2145
1417	14	20.00-20.59		
526	7	21.00-21.59	14	1108
1793	21	22.00-22.59	7	586

NORTH PHILADELPHIA (PNE)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
2060	21	7.00- 7.59	35	3544
1539	14	8.00- 8.59	28	3565
2549	21	9.00- 9.59	7	757
2866	35	10.00-10.59	21	1445
583	7	11.00-11.59	35	2548
2112	28	12.00-12.59	7	530
1544	21	13.00-13.59	28	2012
1131	14	14.00-14.59	14	1013
2018	28	15.00-15.59	21	1684
1918	21	16.00-16.59	28	2685
971	7	17.00-17.59	21	2664
3410	28	18.00-18.59	7	927
1330	14	19.00-19.59	23	2635
728	7	20.00-20.59	7	514
1128	14	21.00-21.59	7	521
1085	14	22.00-22.59	7	514
586	7	23.00-23.59		

MONROE COUNTY (ROC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
766	7	8.00- 8.59		
1613	14	9.00- 9.59	7	766
		10.00-10.59	14	1010
430	7	13.00-13.59	7	430
430	7	15.00-15.59		
634	7	16.00-16.59	7	849
766	7	17.00-17.59	7	948
766	7	18.00-18.59	7	766
		19.00-19.59	7	636

1985
EXPANDED NORTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

ISLIP (ISP)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1265	14	7.00- 7.59	42	3883
3170	28	8.00- 8.59	21	2723
2567	21	9.00- 9.59	28	3168
2433	28	10.00-10.59	14	1026
1919	28	11.00-11.59	28	1972
1964	28	12.00-12.59	21	1534
1021	14	13.00-13.59	42	3022
3599	49	14.00-14.59	14	1026
957	14	15.00-15.59	49	3596
2282	28	16.00-16.59	7	519
4265	35	17.00-17.59	28	3584
3600	28	18.00-18.59	42	4821
1424	14	19.00-19.59	28	2622
1921	21	20.00-20.59	7	507
1610	21	21.00-21.59	7	549
1062	14	22.00-22.59	7	507

HARTFORD-BRAINARD (HFD)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
858	7	7.00- 7.59	7	600
731	7	8.00- 8.59	7	960
720	7	9.00- 9.59	7	836
		10.00-10.59	7	540
450	7	11.00-11.59		
		12.00-12.59	7	535
405	7	14.00-14.59		
642	7	15.00-15.59	7	450
		16.00-16.59	7	600
1520	14	18.00-18.59		
		19.00-19.59	14	1315
731	7	20.00-20.59		
405	7	21.00-21.59	7	626

GREATER CINCINNATI (CVG)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	536
662	7	8.00- 8.59		
646	7	9.00- 9.59	7	536
		10.00-10.59	7	402
363	7	15.00-15.59		
496	7	16.00-16.59	7	716
		17.00-17.59	7	716
645	7	18.00-18.59		
496	7	21.00-21.59		
		22.00-22.59	7	402

TABLE 5.2.2-3

NORTHEAST REGION - RECAP OF SHORT-HAUL

PASSENGER O&D STATISTICS - 1985

(IN THOUSANDS ANNUALLY)

BETWEEN: PHILADELPHIA (PHL) AND:	ALLOCATION BY MARKET ANALYSIS		
	STOL	CTOL	TOTAL
HARTFORD	157	93	250
ROCHESTER	113	74	187
SYRACUSE	73	58	131
PROVIDENCE	96	66	162
NORFOLK	141	78	219
BOSTON	1,200	507	1,707
WASHINGTON	124	167	291
ALBANY	78	55	133
BUFFALO	182	135	317
COLUMBUS	124	93	217
DAYTON	82	71	153
ERIE	34	32	66
BALTIMORE	106	87	193
NEWARK	29	30	59
NEW YORK	58	91	149
DETROIT	386	270	656
CLEVELAND	266	207	473
CINCINNATI	97	81	178
INDIANAPOLIS	133	82	195
PITTSBURGH	536	406	942
CHARLOTTE	85	67	152
LOUISVILLE	80	59	139
TOTAL	4,160	2,809	6,969

TABLE 5.2.2-4

1985

STOL RELIEF OF CONGESTION AT PHILADELPHIA

ANALYSIS OF MARKET FORECAST

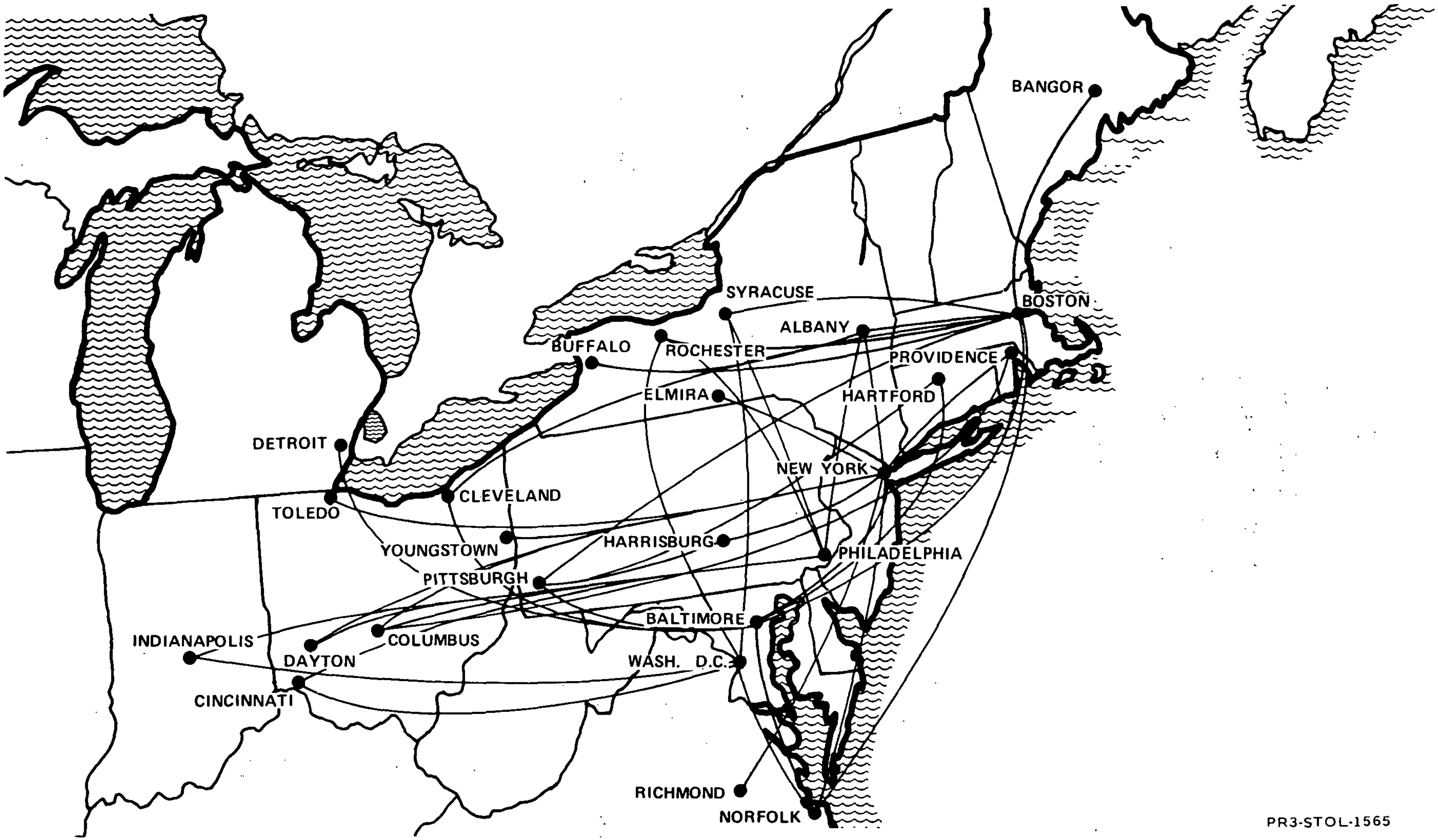
ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL
⩾ 300	2,122	24	5.9	4,847
⩾ 130	2,868	32	7.8	4,101
⩾ 50	4,160	46	11.3	2,809

TABLE 5.2.2-5

REEVALUATION OF STOL RELIEF OF CONGESTION AT PHILADELPHIA

ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL
$\geqslant$130 (Baseline)	3,158	35	8.6	3,811
$\geqslant$130 (Extended Region)	5,206	58	14.2	1,763
$\geqslant$50 (Extended to Low Density)	5,605	62	15.2	1,364

1985
NORTHEAST REGION - PHASE II - EXTENDED NETWORK



PR3-STOL-1565

FIGURE 5.2.2-3

TABLE 5.2.2-6

1985

EXTENDED NORTHEAST REGION

CITY PAIR ANNUAL STOL O & D TRAFFIC

REVISED BASELINE AND EXTENDED TRAFFIC

(≥130,000 PASSENGERS)

BETWEEN:	New York	STOL Traffic
AND:		192
	Dayton	412
	Harrisburg	150
	Philadelphia	208
	Richmond	288
	Youngstown	162
	Columbus	624
	Elmira	130
	Norfolk	264
	Providence	336
	Toledo	150

BETWEEN:	Washington	
AND:	Hartford	196
	Boston	370
	Detroit City	192
	New York	300
	Norfolk	334
	Philadelphia	194
	Pittsburgh	236
	Cincinnati	360
	Cleveland	152
	Rochester	194
	Syracuse	164
	Indianapolis	226
	Dayton	224

BETWEEN:	Cleveland	
AND:	Hartford	214

BETWEEN:	Boston	STOL Traffic
AND:	Bangor	180
	Buffalo	312
	Cleveland	420
	Norfolk	190
	Pittsburg	404
	Syracuse	276
	Rochester	264

BETWEEN:	Philadelphia	
AND:	Dayton	154
	Columbus	216
	Indianapolis	156
	Rochester	188
	Syracuse	132
	Providence	162
	Washington	290
	Cincinnati	176

BETWEEN:	Albany	
AND:	Buffalo	220
	New York	298
	Boston	180
	Philadelphia	132
	Washington	194

BETWEEN:	Pittsburgh	
AND	Harrisburg	208
	Hartford	184

TABLE 5.2.2-6 (Cont.)

1985

EXTENDED NORTHEAST REGION

CITY PAIR ANNUAL STOL O & D TRAFFIC

REVISED BASELINE EXTENDED TRAFFIC

(50,000 to 130,000 PASSENGERS)

BETWEEN:	New York	STOL Traffic
AND:	Asheville	64
	Binghamton	91
	Bangor	83
	Charleston	112
	Erie	86
	Flint	53
	Ft. Wayne	101
	Ithaca	113
	Jackson, Miss.	81
	Lansing	59
	Lexington	97
	Saginaw	87
	Manchester	73
	Worcester	51
	Portland	109
	Roanoke	100
	Bristol, Tenn	75
	Utica	117

BETWEEN:	Pittsburgh	
AND:	Milwaukee	73
	Providence	58
	Rochester, N. Y.	78
	Louisville	89
	Syracuse	79
	Cincinnati	51
	Wilkes Barre	61

BETWEEN:	Philadelphia	STOL Traffic
AND:	Greensboro	86
	Newport News	64
	Raleigh	77
	Toledo	55
	Youngstown	51
	Erie	66

BETWEEN:	Washington/Baltimore	
AND:	Buffalo	66
	Cincinnati	87
	Detroit	63
	Pittsburgh	112
	Bridgeport	66
	Charleston	110
	New Bern	52
	New London	85
	White Plains	56
	New Haven	71
	Lexington	72
	Portland, Me	53

BETWEEN:	Boston	
AND	Burlington	68
	Harrisburg	87
	Presque Isle	57
	Portland	84
	Bridgeport	68

EXTENDED NORTHEAST REGION
(50,000 to 130,000 PASSENGERS)
(CONTINUED)

		STOL Traffic			STOL Traffic
BETWEEN:	Providence		BETWEEN:	Hartford	
AND:	Norfolk	71	AND:	Rochester	89
				Syracuse	64
BETWEEN:	Albany				
AND:	Pittsburgh	76	BETWEEN:	Milwaukee	
	Rochester	56	AND:	Cincinnati	51
	Syracuse	56			

1985 NORTHEAST REGION - PHASE II

SUMMARY OF DAILY ROUND TRIPS - EBF 150 PASSENGER CAPACITY
EXTENDED NETWORK INCREMENTAL TRAFFIC

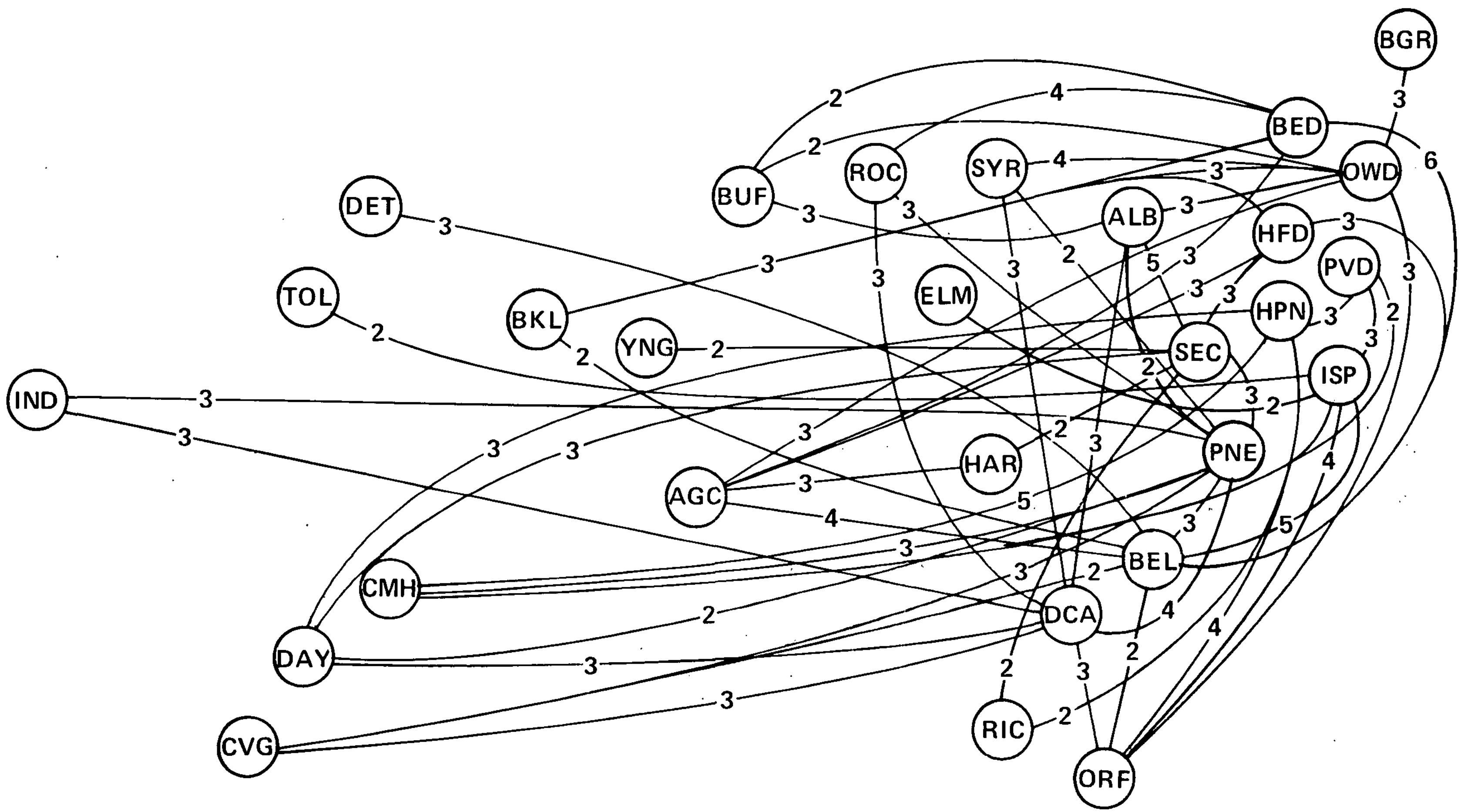


FIGURE 5.2.2-4

PR3-STOL-1675A

TABLE 5.2.2-7

1985

NORTHEAST REGION - PHASE II
EXTENDED NETWORK
INCREMENTAL TRAFFIC

Weekly Fleet Operations Results

Aircraft Type	Fleet Size	Average Stage Length Miles (km)	Block Hours	Average Block Speed MPH (KPH)	Daily Utiliz. Hr	Total Depart	Aircraft Seat Miles (km) (000)	Passenger Seat Miles (km) (000)	System Load Factor %
EBF-100	65	321.4 (517.1)	3408	352.6 (567.3)	7.5	1869	N/A	N/A	N/A
EBF-150	36	321.4 (517.1)	2272	352.6 (567.3)	8.8	2492	120,104 (143,247)	73,285 (117,916)	61.0
EBF-200	32	321.4 (517.1)	1704	352.6 (567.3)	7.5	3738	N/A	N/A	N/A

5.2.3 California Region - The analysis in the California Region is conducted and presented in the same manner as preceding analyses. The expansion of the network to Denver and Portland was made to provide an interface between the Chicago and Northwest Regions. The cities and network are depicted in Figure 5.2.3-1. Airports used for STOL service are identified in Table 5.2.3-1. The baseline traffic from Section 3.4 was used to compute schedules and fleet sizes. Daily round trip activities for the baseline 150 passenger EBF aircraft are included as Figure 5.2.3-2. Weekly summaries of operational activities are included as Table 5.2.3-2 for the baseline evaluation with STOL/CTOL modal split. Details of airport activity are assembled in Exhibit 5.2.3-1. Baseline traffic on California Region city-pair routes is compiled in Table 5.2.3-3. Fleet planning results and summaries of operating statistics are included as incremental statistics in Table 5.2.3-4.

Analysis of the California Region is the last of three regional analyses originated in Phase I of the study. During these three analyses, the Phase II methodology for Systems Analysis was refined and expanded. Firmer guidelines were adopted for allocation of short-haul travel to STOL. In the analysis of the Southeast Region, this refined methodology is followed. Similar attention is paid to baseline and reallocation statistics to facilitate analysis of congestion.

1985
CALIFORNIA REGION - PHASE II

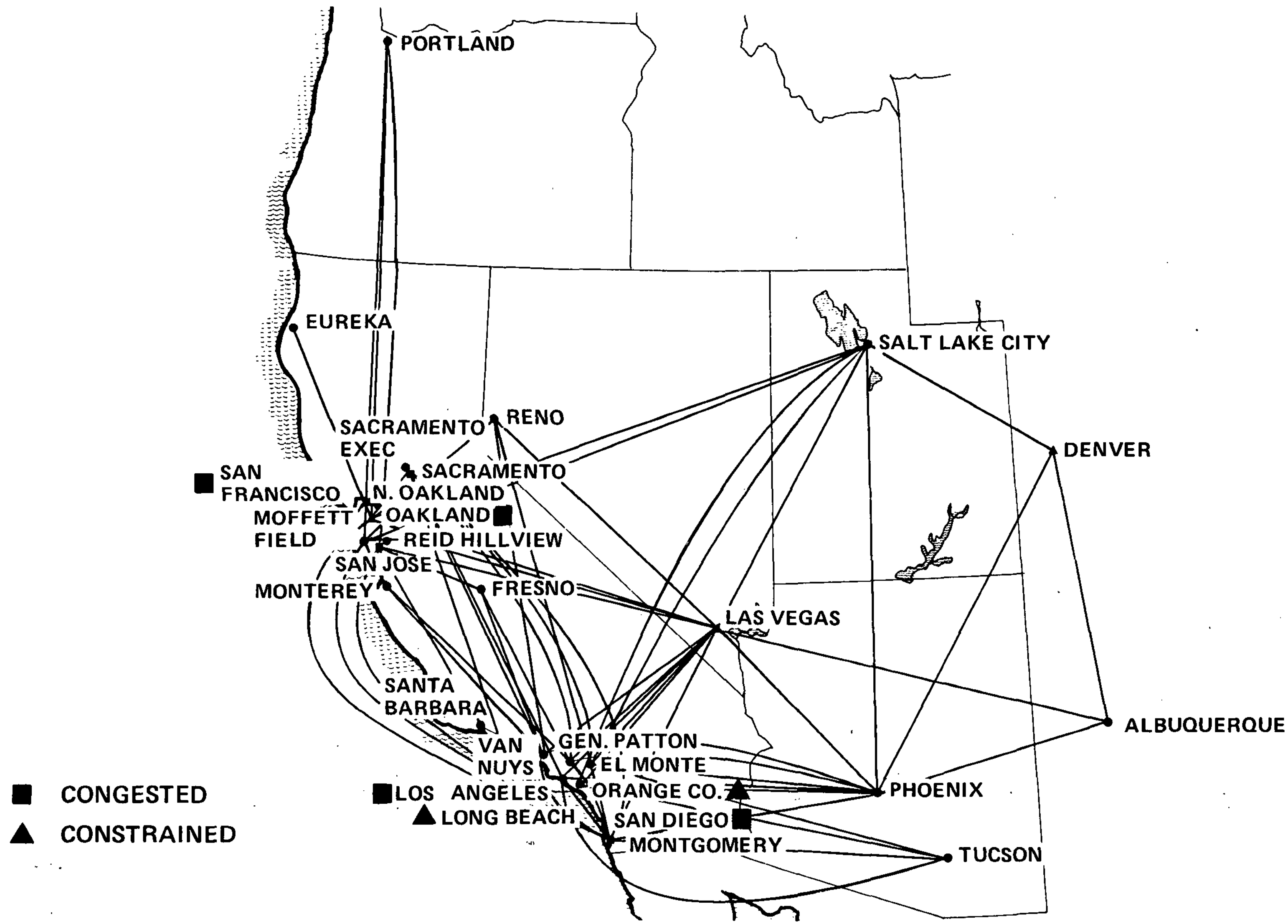


FIGURE 5.2.3-1

PR2-STOL-1234 B

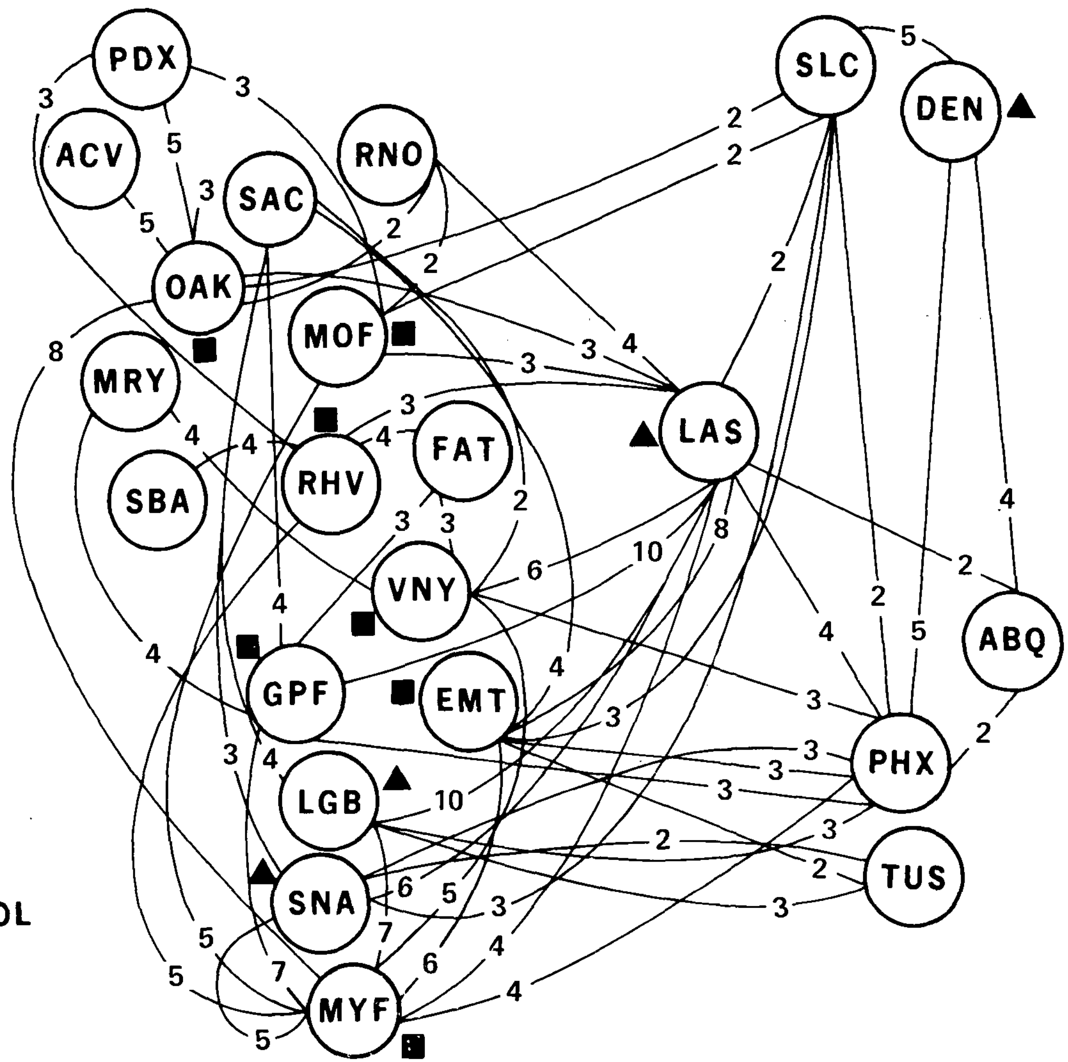
TABLE 5.2.3-1

AIRPORT IDENTIFICATION BY CITY AND CODE

CALIFORNIA REGION

CITY	AIRPORT	CODE
Albuquerque	Albuquerque Sunport	ABQ
Denver	Stapleton Int'l	DEN
El Monte	El Monte	EMT
Eureka	Arcata	ACV
Fresno	Fresno Air Terminal	FAT
Las Vegas	McCarran Int'l	LAS
Long Beach	Daugherty Field	LGB
Los Angeles	Gen. Patton Field	GPF
Monterey	Monterey Peninsula	MRY
Mountain View	Moffett Field	MOF
Oakland	North Field	OAK
Phoenix	Phoenix Sky Harbor	PHX
Portland	Portland Int'l	PDX
Reno	Reno Int'l	RNO
Sacramento	Sacramento Exec	SAC
Salt Lake City	Salt Lake City Int'l	SLC
San Diego	Montgomery Field	MYF
San Jose	Reid Hillview	RHV
Santa Ana	Orange County	SNA
Santa Barbara	Santa Barbara Municipal	SBA
Tucson	Tucson Int'l	TUS
Van Nuys	Van Nuys	VNY

1985
CALIFORNIA REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY



■ CONGESTED SEPARATE STOL PORT

▲ CONSTRAINED SEPARATE STOL RUNWAY

FIGURE 5.2.3-2

PR3-STOL-1650

TABLE 5.2.3-2

1985
CALIFORNIA REGION - PHASE II
(BASELINE)

WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED (KPH)	DAILY UTILIZ. (HR.)	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR
EBF-100	71	305.4 (491.4)	4,260	346.2 (557.0)	8.6	4,830	147,515 (237,352)	89,506 (144,015)	60.7
EBF-150	47	305.4 (491.4)	2,839	346.4 (557.4)	8.6	3,220	147,515 (237,352)	89,506 (144,015)	60.7
EBF-200	35	305.2 (491.1)	2,129	346.2 (557.0)	8.7	2,415	147,515 (237,352)	89,506 (144,015)	60.7

Exhibit 5.2.3-1
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EXPANDED CALIFORNIA REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

FRESNO AIR TERMINAL (FAT)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
699	7	7.00- 7.59	7	715
667	7	8.00- 8.59	14	1773
699	7	10.00-10.59	7	535
500	7	12.00-12.59		
		13.00-13.59	7	472
1046	14	14.00-14.59		
		15.00-15.59	14	1058
667	7	16.00-16.59		
932	7	17.00-17.59	7	841
932	7	18.00-18.59	7	699
666	7	19.00-19.59	7	715

MOFFETT FIELD (MOF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	21	1985
894	7	9.00- 9.59	7	681
1332	14	10.00-10.59	7	531
		11.00-11.59	7	450
1542	21	12.00-12.59	7	510
		13.00-13.59	14	1044
1092	14	15.00-15.59	7	681
1179	14	16.00-16.59	7	685
		17.00-17.59	14	1624
1694	14	18.00-18.59	7	909
816	7	19.00-19.59	7	708
670	7	20.00-20.59		
589	7	22.00-22.59		

GEN. PATTON FIELD (GPF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1918	21	7.00- 7.59	21	1950
784	7	8.00- 8.59	14	1628
3359	28	9.00- 9.59	14	1465
		10.00-10.59	21	1404
441	7	11.00-11.59		
1460	21	12.00-12.59	7	430
1423	21	13.00-13.59	14	1007
510	7	14.00-14.59	28	1923
1473	21	15.00-15.59	7	484
951	14	16.00-16.59	21	1825
3397	28	17.00-17.59	7	930
784	7	18.00-18.59	42	4802
1966	21	19.00-19.59		
603	7	20.00-20.59	14	1221
		21.00-21.59	7	451
451	7	22.00-22.59		

SANTA BARBARA MUNI (SBA)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
720	7	7.00- 7.59		
		8.00- 8.59	7	807
540	7	10.00-10.59		
		11.00-11.59	7	453
539	7	13.00-13.59		
		14.00-14.59	7	453
720	7	16.00-16.59		
		17.00-17.59	7	806

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EXPANDED CALIFORNIA REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

SALT LAKE CITY INT'L (SLC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	21	1901
1980	21	9.00- 9.59	7	825
1365	14	10.00-10.59	14	1230
560	7	11.00-11.59	21	1649
984	14	12.00-12.59		
		13.00-13.59	14	967
519	7	14.00-14.59		
876	14	15.00-15.59		
565	7	16.00-16.59	21	2216
748	7	17.00-17.59	7	816
1570	14	18.00-18.59	7	838
1640	14	19.00-19.59	7	617
1482	14	20.00-20.59	7	509
		21.00-21.59	7	721

PHOENIX SKY HARBOR (PHX)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	35	3526
1445	14	8.00- 8.59		
3524	35	9.00- 9.59	21	2181
		10.00-10.59	21	1614
560	7	11.00-11.59		
2790	35	12.00-12.59	21	1592
523	7	13.00-13.59	28	2056
1685	21	14.00-14.59	7	484
1028	14	15.00-15.59	21	1611
1487	21	16.00-16.59	14	1347
697	7	17.00-17.59	21	2578
865	7	18.00-18.59	7	899
1689	14	19.00-19.59	7	868
2367	21	20.00-20.59	7	658
1318	14	21.00-21.59	14	1106
542	7	22.00-22.59		

MONTEREY PENINSULA (MRY)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
603	7	7.00- 7.59		
		8.00- 8.59	7	803
1054	14	10.00-10.59		
		11.00-11.59	14	945
451	7	12.00-12.59		
		13.00-13.59	7	494
451	7	15.00-15.59		
		16.00-16.59	7	660
1606	14	18.00-18.59		
		19.00-19.59	14	1263
451	7	21.00-21.59		
		22.00-22.59	7	451

TUCSON INT'L (TUS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	535
1128	14	9.00- 9.59	7	792
		10.00-10.59	7	611
539	7	12.00-12.59		
		13.00-13.59	7	611
539	7	15.00-15.59		
		16.00-16.59	7	715
1675	14	19.00-19.59	7	816
792	7	20.00-20.59	7	593

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EXPANDED CALIFORNIA REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

ALBUQUERQUE (ABQ)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	648
1652	14	9.00- 9.59	7	1010
651	7	10.00-10.59	7	485
		11.00-11.59	7	760
485	7	12.00-12.59		
		13.00-13.59	7	485
485	7	15.00-15.59		
		17.00-17.59	7	863
1516	14	19.00-19.59		
788	7	20.00-20.59	7	759
		21.00-21.59	7	567

STAPLETON INT'L (DEN)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
648	7	7.00- 7.59	7	697
679	7	8.00- 8.59	14	1608
1132	14	10.00-10.59		
994	14	11.00-11.59	21	1426
		12.00-12.59	7	523
485	7	13.00-13.59		
993	14	14.00-14.59	14	903
484	7	15.00-15.59	7	522
		16.00-16.59	7	697
1542	14	17.00-17.59	7	745
862	7	18.00-18.59	7	648
		19.00-19.59	7	559
509	7	21.00-21.59		

ARCATA (ACV)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
645	7	7.00- 7.59		
		8.00- 8.59	7	804
644	7	10.00-10.59	7	452
483	7	12.00-12.59		
		13.00-13.59	7	452
483	7	15.00-15.59	7	603
860	7	17.00-17.59		
		18.00-18.59	7	804

EL MONTE (EMT)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
673	7	6.00- 6.59		
1820	21	7.00- 7.59	35	3211
828	7	8.00- 8.59	14	1601
2336	21	9.00- 9.59	7	796
		10.00-10.59	21	1515
442	7	11.00-11.59		
425	7	12.00-12.59	7	475
900	14	13.00-13.59	7	566
442	7	14.00-14.59	14	1040
505	7	15.00-15.59	7	475
1054	14	16.00-16.59	14	1426
2543	21	17.00-17.59	7	847
2331	21	18.00-18.59	28	2774
621	7	19.00-19.59	7	635
593	7	20.00-20.59	7	596
891	14	21.00-21.59	7	447

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EXPANDED CALIFORNIA REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

VAN NUYS (VNY)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
657	7	7.00- 7.59	35	3460
2825	21	8.00- 8.59		
803	7	9.00- 9.59	28	3091
551	7	10.00-10.59		
1459	21	11.00-11.59	14	1012
514	7	12.00-12.59	7	451
1556	21	13.00-13.59	21	1555
1044	14	14.00-14.59	14	1013
513	7	15.00-15.59	7	451
1183	14	16.00-16.59	14	1341
		17.00-17.59	14	1735
804	7	18.00-18.59		
1359	14	19.00-19.59	7	696
2079	21	20.00-20.59	7	542

ORANGE COUNTY (SNA)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
2469	28	7.00- 7.59	7	535
		8.00- 8.59	21	2370
1733	14	9.00- 9.59		
1104	14	10.00-10.59	28	2012
980	14	11.00-11.59		
451	7	12.00-12.59	7	550
479	7	13.00-13.59	14	1002
469	7	14.00-14.59	14	917
991	14	15.00-15.59	7	438
2158	21	16.00-16.59	7	550
2490	21	17.00-17.59	28	3162
		18.00-18.59	14	1749
696	7	19.00-19.59		
		20.00-20.59	7	735

REID HILLVIEW (RHV)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
715	7	7.00- 7.59	28	2785
1498	14	9.00- 9.59		
611	7	10.00-10.59	14	1106
923	14	11.00-11.59	14	1066
1751	21	12.00-12.59	14	1048
		13.00-13.59	14	1105
458	7	14.00-14.59		
1637	21	15.00-15.59	7	565
		16.00-16.59	21	2030
866	7	17.00-17.59	7	1008
2312	21	18.00-18.59	7	666
		19.00-19.59	7	756
715	7	20.00-20.59		
649	7	21.00-21.59		

PORTLAND INT'L (PDX)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	626
1440	14	8.00- 8.59	7	611
		9.00- 9.59	7	611
626	7	10.00-10.59		
469	7	11.00-11.59	7	468
566	7	12.00-12.59	7	469
		13.00-13.59	7	458
982	14	14.00-14.59		
468	7	15.00-15.59	14	926
565	7	16.00-16.59	7	834
685	7	17.00-17.59	7	816
834	7	18.00-18.59	7	816

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EXPANDED CALIFORNIA REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

McCARRAN INT'L (LAS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
746	7	6.00- 6.59		
2475	28	7.00- 7.59	49	4579
5336	49	8.00- 8.59	49	5630
4223	35	9.00- 9.59	28	2821
1529	21	10.00-10.59	42	2821
1436	21	11.00-11.59	21	1473
3941	56	12.00-12.59	21	1500
1440	21	13.00-13.59	49	3279
1925	28	14.00-14.59	28	1968
2507	35	15.00-15.59	35	2554
2665	35	16.00-16.59	28	2731
4617	42	17.00-17.59	42	4713
2378	21	18.00-18.59	28	3201
1826	21	19.00-19.59	21	1833
2041	21	20.00-20.59		
1126	14	21.00-21.59	14	1108

DAUGHERTY FIELD (LGB)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
801	7	6.00- 6.59		
623	7	7.00- 7.59	28	2659
1728	14	8.00- 8.59	7	832
995	7	9.00- 9.59	14	1454
1738	21	10.00-10.59	21	1579
467	7	11.00-11.59	7	467
2130	28	12.00-12.59	7	467
1078	14	13.00-13.59	35	2531
503	7	14.00-14.59	7	467
1625	21	15.00-15.59	14	934
970	14	16.00-16.59	14	1696
1728	14	17.00-17.59	14	1792
832	7	18.00-18.59	14	1596
816	7	19.00-19.59		
		20.00-20.59	7	622
1062	14	21.00-21.59		

SACRAMENTO EXECUTIVE (SAC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1384	14	7.00- 7.59	7	721
2116	21	8.00- 8.59	35	4289
1209	14	10.00-10.59	7	451
1591	21	11.00-11.59	28	1959
1638	21	14.00-14.59	14	1099
540	7	15.00-15.59	7	522
		16.00-16.59	7	803
2246	21	17.00-17.59	14	1561
		18.00-18.59	7	698
2364	21	19.00-19.59	7	720
720	7	20.00-20.59	14	985

RENO INT'L (RNO)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	759
924	7	9.00- 9.59	7	535
900	14	11.00-11.59	7	568
		12.00-12.59	7	450
519	7	13.00-13.59		
		14.00-14.59	7	568
692	7	16.00-16.59		
800	7	17.00-17.59	7	715
800	7	18.00-18.59	7	800
		19.00-19.59	7	759
519	7	22.00-22.59		

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EXPANDED CALIFORNIA REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

MONTGOMERY FIELD (MYF)					NORTH FIELD (OAK)				
ARRIVAL			DEPARTURE		ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR	PSGR	FREQ		FREQ	PSGR
1319	14	7.00- 7.59	35	3307	721	7	7.00- 7.59	28	2789
4627	42	8.00- 8.59	35	4496	626	7	8.00- 8.59		
3530	28	9.00- 9.59	21	2353	2394	21	9.00- 9.59	14	1270
2125	28	10.00-10.59	28	2121	1210	14	10.00-10.59	21	1454
1568	21	11.00-11.59	42	3248	1679	21	11.00-11.59	14	1066
2154	28	12.00-12.59	14	1053	973	14	12.00-12.59	14	1002
2550	35	13.00-13.59	21	1576	469	7	13.00-13.59	14	1003
1585	21	14.00-14.59	42	3219	1886	28	14.00-14.59	21	1486
2033	28	15.00-15.59	14	1032	505	7	15.00-15.59	14	1070
2546	28	16.00-16.59	35	3238	1071	14	16.00-16.59	7	715
1511	14	17.00-17.59	35	4279	2239	21	17.00-17.59	14	1694
3260	28	18.00-18.59			899	7	18.00-18.59	21	2438
2320	21	19.00-19.59	35	3414	1524	14	19.00-19.59	7	715
4071	42	20.00-20.59	28	2392			20.00-20.59	7	720
994	14	21.00-21.59	7	465	1226	14	21.00-21.59		

TABLE 5.2.3-3

1985

EXPANDED CALIFORNIA REGION

CITY PAIR ANNUAL STOL O&D TRAFFIC

(BASELINE)

(000)

		STOL Traffic
BETWEEN:	Los Angeles	
AND:	Monterey	298
	Phoenix	791
	Reno	198
	San Diego	992
	Santa Barbara	65
	San Francisco	858
	Sacramento	627
	Tucson	301
	Las Vegas	2177
	Fresno	297
	Salt Lake City	394
	San Jose	858
	Oakland	1712
BETWEEN:	San Francisco	
AND:	Santa Ana	214
	Sacramento	90
	Monterey	46
	Portland	535
	Reno	143
	San Diego	639
	Santa Barbara	160
	Eureka	91
	Fresno	230
	Las Vegas	287
	Salt Lake City	365
	Long Beach	358

		STOL Traffic
BETWEEN:	San Diego	
AND:	Phoenix	163
	Sacramento	47
	Tucson	64
	Las Vegas	174
BETWEEN:	Las Vegas	
AND:	Phoenix	162
	Reno	179
	Salt Lake City	365
	Albuquerque	165
BETWEEN:	Phoenix	
AND:	Salt Lake City	137
	Albequerque	158
BETWEEN:	Denver	
AND:	Phoenix	191
	Albuquerque	259
	Salt Lake City	426
BETWEEN:	Long Beach	
AND:	Oakland	574
	San Jose	358
	San Francisco	358
BETWEEN:	Santa Ana	
AND	Oakland	428
	San Jose	214
	San Francisco	214

TABLE 5.2.3-4

1985

CALIFORNIA/NORTHWEST REGIONS

CITY PAIR ANNUAL STOL O&D TRAFFIC

REVISED EXTENDED TRAFFIC

(50,000 TO 130,000 PASSENGERS)

		STOL Traffic
BETWEEN:	Los Angeles	
AND:	Palm Springs	90
	Santa Barbara	107
	Stockton	55
	Bakersfield	65
BETWEEN:	San Francisco	
AND:	Bakersfield	80
	Medford	93
	Monterey	107
	Palm Springs	81
	Redding	61
BETWEEN:	San Diego	
AND:	Sacramento	108
	Tucson	100
BETWEEN:	Denver	
AND:	Billings	102
	Colorado Springs	81
	Casper	97
	Sioux Falls	59
	Lincoln	70
	Rapid City	57
	Tulsa	121
	Aspen	60
BETWEEN:	Seattle	
AND:	Pasco	89
	Yakima	72
BETWEEN:	Boise	
AND:	Spokane	78
	Salt Lake City	107
BETWEEN:	Portland	
AND:	Medford	77
	Sacramento	61
BETWEEN:	Phoenix	
AND:	Tucson	58
BETWEEN:	Salt Lake City	
AND:	Reno	66

TABLE 5.2.3-5

CALIFORNIA REGION - PHASE II
LOW-DENSITY NETWORK
INCREMENTAL WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH-MI (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED-MPH (KPH)	DAILY UTILIZ. (HR.)	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR (%)
EBF-150	4	250 (402)	209	334,9 (539.0)	7.5	280	10,500 (16,900)	5,006 (8,140)	45.0

5.2.4 Southeast Region - The Southeast Region provided an opportunity to examine a large volume of traffic. Some peculiarities are also notable. On the network map, Figure 5.2.4-1, the congestion potential is immediately evident at Atlanta. The region also is provided an overlapping interface between the Chicago and Northeast Regions. A lesser interface arises by including Memphis and New Orleans which appear in the Southern regional network in the next study section. City and airport identities are included as Table 5.2.4-1. Fleet planning and scheduling activity was applied to baseline traffic data on routes with travel demand at 130,000 or more. Round trip statistics which resulted are shown in Figure 5.2.4-2. Derived fleet sizes and weekly operations are detailed in Table 5.2.4-2. Airport activity levels are included as Exhibit 5.2.4-1.

To permit evaluation of relief of congestion, data in Table 5.2.4-3 were compiled for activity at Atlanta. These numbers reflect the baseline modal split between STOL and CTOL. By computing equivalent numbers of short-haul movements shifted from Atlanta International to nearby DeKalb Peachtree and Fulton County Airports, at which STOL traffic is proportioned about equally. The relief generated by shifting of short-haul movements away from International is tabulated in Table 5.2.4-4. These results are all based upon the modal split methodology developed in the Market Analysis Volume.

1985
SOUTHEAST REGION - PHASE II

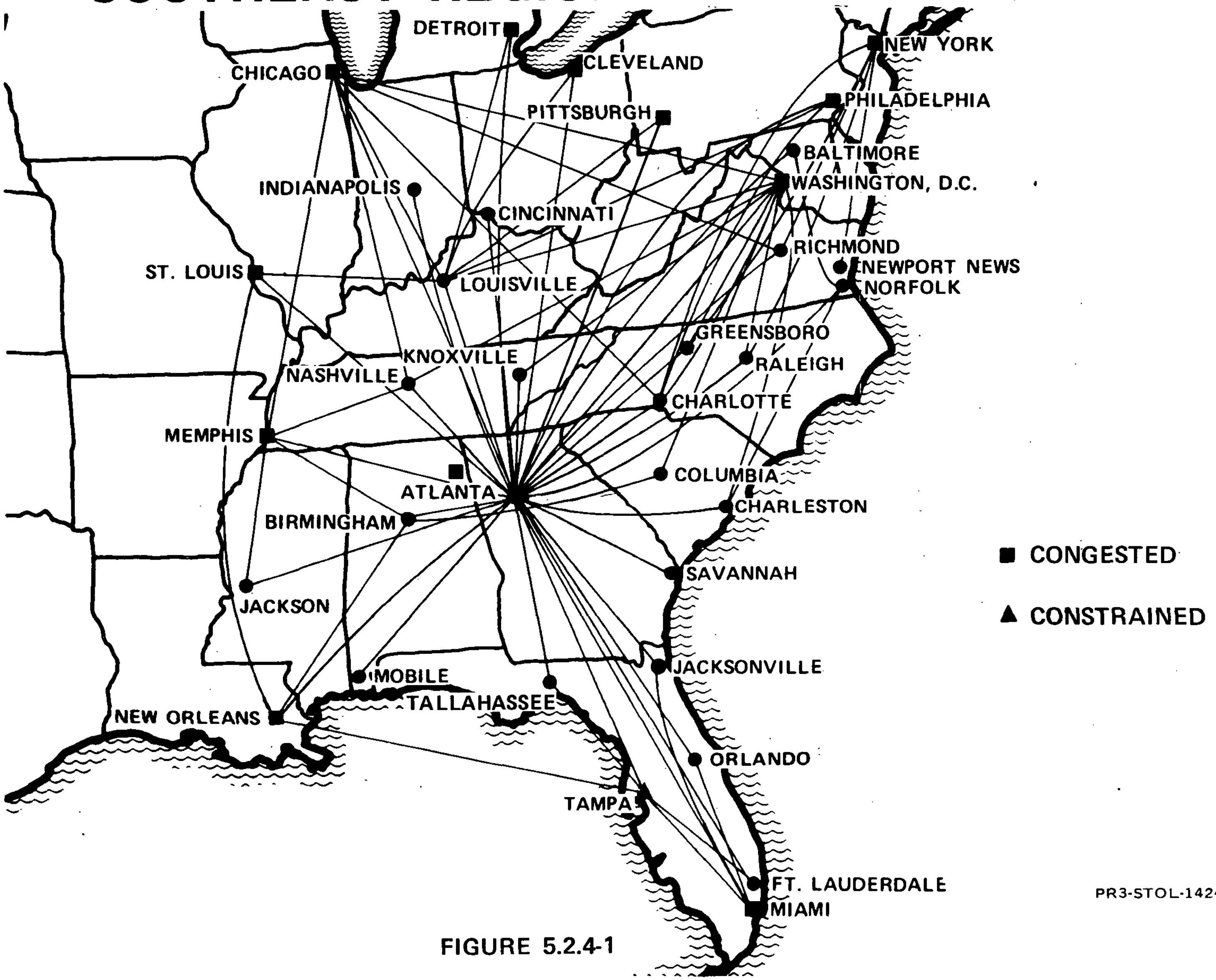

FIGURE 5.2.4-1

PR3-STOL-1424 B

TABLE 5.2.4-1

AIRPORT IDENTIFICATION BY CITY AND CODE

SOUTHEAST

REGION

CITY	AIRPORT	CODE
Atlanta	DeKalb Peachtree	PDK
Atlanta	Fulton County	FTY
Baltimore	Beltsville	BEL
Birmingham	Birmingham Municipal	BHM
Charleston	Charleston Municipal	CHS
Charlotte	Douglas Municipal	CLT
Chicago	Meigs	CGX
Cincinnati	Greater Cincinnati	CVG
Cleveland	Burke Lakefront	BKL
Columbia	Columbia Metropolitan	CAE
Detroit	Detroit City	DET
Ft. Lauderdale	Hollywood International	FLL
Greensboro	Greensboro High Pt.	GSO
Indianapolis	Weir Cook	IND
Jackson	A.C. Thompson Field	JAN
Jacksonville	Jacksonville Int'l	JAX
Knoxville	McGhee Tyson	TYS
Louisville	Standiford Field	SDF
Memphis	Gen. D. Spain	GDS
Miami	Opa Locka	OPF
Mobile	Bates Field	MOB
Nashville	Nashville Metropolitan	BNA
New Orleans	Lakefront	NEW
New York	Islip MacArthur	ISP
New York	Secaucus	SEC
Newport News	Patrick Henry	PHF

TABLE 5.2.4-1

SOUTHEAST REGION (CONTINUED)

CITY	AIRPORT	CODE
Norfolk	Norfolk Regional	ORF
Orlando	McCoy Air Force Base	MCO
Philadelphia	No. Philadelphia	PNE
Pittsburgh	Allegheny County	AGC
Raleigh Durham	Raleigh/Durham	RDU
Richmond	R. E. Byrd International	RIC
Savannah	Savannah Municipal	SAV
Tallahassee	Tallahassee Municipal	TLH
Tampa	Tampa International	TPA

1985
SOUTHEAST REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS
EBF 150 PASSENGER CAPACITY

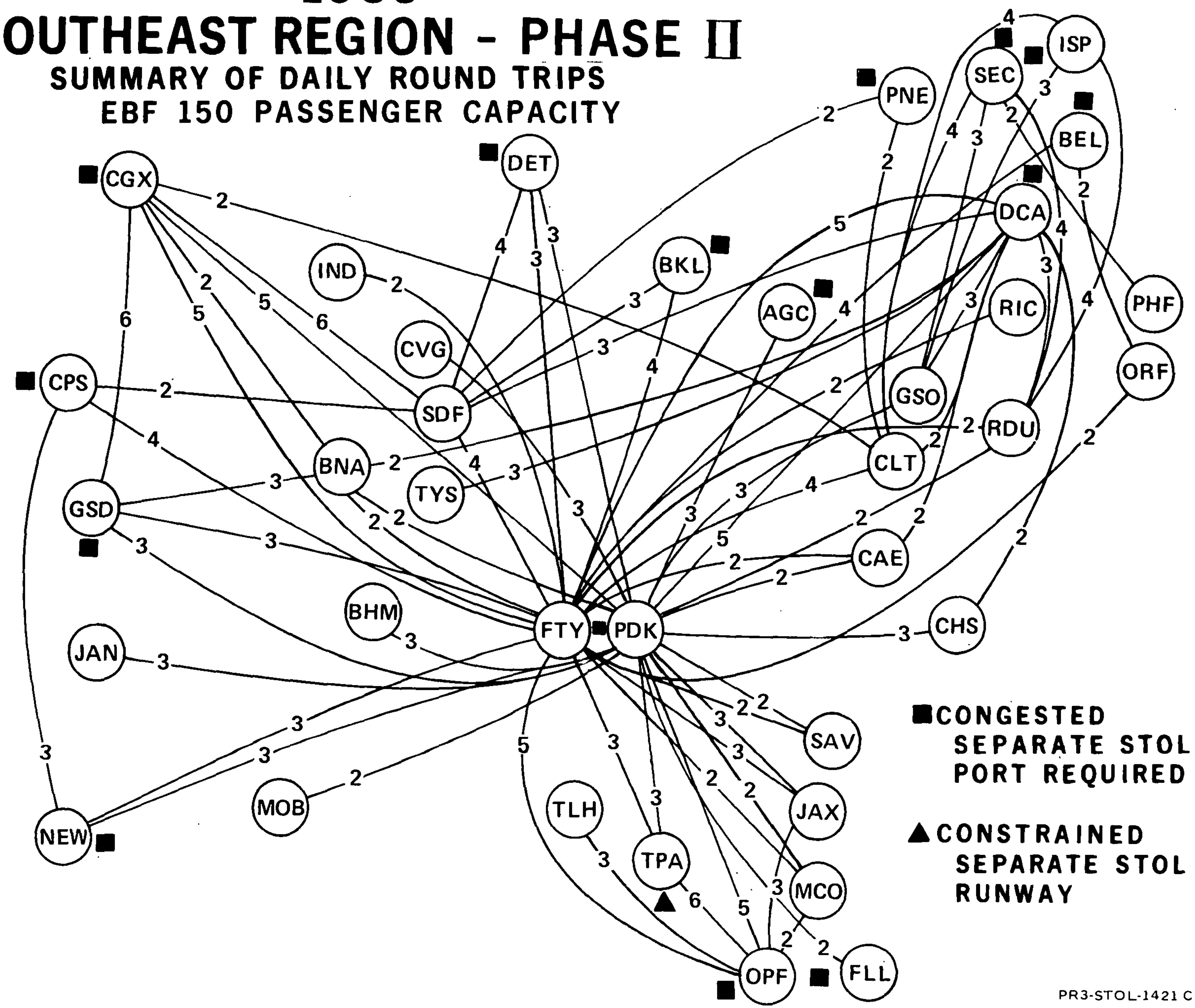

FIGURE 5.2.4-2

TABLE 5.2.4-2

1985
SOUTHEAST REGION - PHASE II
(BASELINE)

WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH MILES (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED MPH (KPH)	DAILY UTILIZ. HR.	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR %
EBF-100	81	407.0 (654.8)	5,166	373.9 (601.6)	9.1	4,746	193,200 (310,859)	114,595 (184,383)	59.3
EBF-150	54	407.0 (654.8)	3,444	373.9 (601.6)	9.1	3,164	193,153 (310,783)	114,595 (184,383)	59.3
EBF-200	40	407.0 (654.8)	2,583	373.9 (601.6)	9.1	2,373	193,200 (310,859)	114,595 (184,383)	59.3

1985
SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

FULTON COUNTY (FTY)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	63	5937
3102	35	8.00- 8.59	14	1357
4905	56	9.00- 9.59	28	2539
1766	21	10.00-10.59	49	3880
1505	21	11.00-11.59	21	1407
4639	56	12.00-12.59	28	1900
2023	28	13.00-13.59	42	2909
1350	21	14.00-14.59	42	2906
4231	56	15.00-15.59	14	1182
3381	42	16.00-16.59	70	7094
1342	14	17.00-17.59	28	3414
3339	28	18.00-18.59	14	1619
5480	49	19.00-19.59	28	2407
675	7	20.00-20.59	14	1290
1089	14	21.00-21.59	7	468
1980	21	22.00-22.59	7	498

CHARLESTON MUNI (CHS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
801	7	7.00- 7.59		
		8.00- 8.59	7	780
585	7	10.00-10.59		
		11.00-11.59	7	600
600	7	13.00-13.59	7	599
599	7	15.00-15.59		
		16.00-16.59	7	585
780	7	18.00-18.59		
		19.00-19.59	7	801

NASHVILLE METRO (BNA)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
847	7	7.00- 7.59	7	847
1632	14	8.00- 8.59	7	815
847	7	9.00- 9.59	7	634
561	7	10.00-10.59	14	1194
1301	14	13.00-13.59	14	1092
1055	14	15.00-15.59	7	458
740	7	16.00-16.59	7	847
749	7	17.00-17.59	14	1845

DEKALB PEACHTREE (PDK)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1308	14	7.00- 7.59	63	5960
4027	42	8.00- 8.59	14	1619
3513	35	9.00- 9.59	56	5687
2283	28	10.00-10.59	21	1653
1865	21	11.00-11.59	28	2016
3508	49	12.00-12.59	35	2784
1084	14	13.00-13.59	28	1792
2556	35	14.00-14.59	28	2011
2259	35	15.00-15.59	42	3495
2125	28	16.00-16.59	21	2031
3895	35	17.00-17.59	28	3180
5178	42	18.00-18.59	35	3355
2057	21	19.00-19.59	35	2976
2583	28	20.00-20.59		
1449	21	21.00-21.59	7	468
		22.00-22.59	7	663

1985
SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

RALEIGH/DURHAM (RDU)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	14	1421
658	7	8.00- 8.59	7	823
877	7	9.00- 9.59		
568	7	10.00-10.59	7	492
1689	21	11.00-11.59	21	1712
		12.00-12.59	7	462
492	7	13.00-13.59	7	492
1120	14	15.00-15.59	7	617
1251	14	16.00-16.59	7	762
		17.00-17.59	14	1727
877	7	18.00-18.59		
658	7	19.00-19.59	7	617
1598	14	20.00-20.59		
		21.00-21.59	7	663

BI STATE PARKS (CPS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	21	1972
709	7	9.00- 9.59		
602	7	10.00-10.59	7	459
519	7	11.00-11.59		
		12.00-12.59	7	402
398	7	13.00-13.59	7	618
		14.00-14.59	7	459
451	7	15.00-15.59		
708	7	16.00-16.59	7	716
923	7	17.00-17.59	7	816
601	7	19.00-19.59		
531	7	20.00-20.59		

BELTSVILLE (BEL)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	592
726	7	9.00- 9.59	7	635
649	7	10.00-10.59	7	444
486	7	13.00-13.59		
		14.00-14.59	7	443
648	7	17.00-17.59		
		18.00-18.59	7	790
543	7	19.00-19.59	7	634
486	7	21.00-21.59		

SECAUCUS (SEC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	624
1386	14	8.00- 8.59	7	877
832	7	9.00- 9.59	7	617
		10.00-10.59	7	673
1038	14	11.00-11.59		
1218	14	12.00-12.59	14	955
		13.00-13.59	7	467
492	7	14.00-14.59		
546	7	15.00-15.59	14	954
467	7	16.00-16.59	7	823
		17.00-17.59	7	832
877	7	18.00-18.59	7	658
624	7	19.00-19.59		
		20.00-20.59	7	673
673	7	23.00-23.59		

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SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

WASHINGTON NATIONAL (DC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
763	7	7.00- 7.59	28	2890
617	7	8.00- 8.59	14	1440
3119	28	9.00- 9.59	21	1779
1826	21	10.00-10.59	14	1148
463	7	11.00-11.59	14	1010
1674	21	12.00-12.59	14	809
886	14	13.00-13.59	14	1139
1366	21	14.00-14.59	7	505
		15.00-15.59	21	1638
1396	14	16.00-16.59	7	692
1145	14	17.00-17.59	28	2990
3258	28	18.00-18.59		
1397	14	19.00-19.59	28	2806
936	14	22.00-22.59		

LAKEFRONT (NEW)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1210	14	7.00- 7.59	14	1164
536	7	8.00- 8.59		
		9.00- 9.59	7	602
855	14	13.00-13.59		
453	7	14.00-14.59	21	1463
807	7	16.00-16.59		
1523	14	17.00-17.59	7	807
		18.00-18.59	14	1348

SAVANNAH MUNI (SAV)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1171	14	7.00- 7.59		
		8.00- 8.59	14	739
484	7	11.00-11.59	7	788
392	7	13.00-13.59	7	392
484	7	14.00-14.59		
		15.00-15.59	7	787
699	7	18.00-18.59		
		19.00-19.59	7	524

OPA LOCKA (OPF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		6.00- 6.59	7	654
660	7	7.00- 7.59	21	2017
1472	14	8.00- 8.59	7	867
1679	14	9.00- 9.59	14	1344
592	7	10.00-10.59	14	1189
1188	14	11.00-11.59	7	548
1597	21	12.00-12.59	21	1452
		13.00-13.59	14	1006
1903	28	14.00-14.59		
		15.00-15.59	28	2392
2933	28	16.00-16.59		
		17.00-17.59	28	3457
791	7	18.00-18.59		
2175	21	19.00-19.59	7	651
587	7	21.00-21.59		

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SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

DOUGLAS MUNI (CLT)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
637	7	7.00- 7.59	21	1922
728	7	8.00- 8.59	7	847
836	7	9.00- 9.59	7	617
1915	21	10.00-10.59	14	1013
		11.00-11.59	14	1008
1024	14	12.00-12.59		
463	7	13.00-13.59	14	928
546	7	14.00-14.59	7	546
478	7	15.00-15.59	14	1101
1645	21	16.00-16.59		
823	7	17.00-17.59	21	2418
847	7	18.00-18.59	7	831
626	7	19.00-19.59		
663	7	20.00-20.59		

BURKE LAKEFRONT (BKL)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	14	1182
660	7	8.00- 8.59		
		9.00- 9.59	7	566
519	7	11.00-11.59		
494	7	12.00-12.59	7	463
		13.00-13.59	7	423
1187	14	16.00-16.59		
		17.00-17.59	14	1578
692	7	19.00-19.59		
660	7	20.00-20.59		

COLUMBIA METRO (CAE)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
759	7	7.00- 7.59	7	759
		8.00- 8.59	7	748
560	7	10.00-10.59		
		11.00-11.59	7	568
664	7	12.00-12.59		
		13.00-13.59	7	568
568	7	15.00-15.59		
		16.00-16.59	7	560
748	7	18.00-18.59		
		19.00-19.59	7	759
663	7	22.00-22.59		

MEIGS (CGX)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
568	7	7.00- 7.59	28	3034
2459	21	8.00- 8.59	21	2142
906	7	9.00- 9.59	14	1416
997	14	10.00-10.59		
2068	28	11.00-11.59	14	988
		12.00-12.59	28	2170
1009	14	13.00-13.59	7	517
1505	21	14.00-14.59	14	1170
500	7	15.00-15.59	21	2046
2313	21	17.00-17.59		
2772	21	18.00-18.59	21	2371
		19.00-19.59	14	1088
1347	14	20.00-20.59		
498	7	22.00-22.59		

SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

ISLIP MACARTHUR (ISP)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	14	1386
770	7	8.00- 8.59	7	624
823	7	9.00- 9.59		
617	7	10.00-10.59	7	492
577	7	11.00-11.59	7	546
463	7	12.00-12.59		
462	7	13.00-13.59	14	1013
462	7	14.00-14.59	7	492
		15.00-15.59	7	545
1193	14	16.00-16.59		
		17.00-17.59	14	1709
823	7	18.00-18.59		
617	7	20.00-20.59		

HOLLYWOOD INT'L (FLL)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	549
616	7	10.00-10.59		
		11.00-11.59	7	411
461	7	15.00-15.59		
		16.00-16.59	7	732
615	7	19.00-19.59		

A. C. THOMPSON FIELD (JAN)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
574	7	6.00- 6.59		
		7.00- 7.59	7	631
430	7	12.00-12.59		
		13.00-13.59	7	473
573	7	18.00-18.59		
		19.00-19.59	7	473

STANDIFORD FIELD (SDF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
617	7	7.00- 7.59	14	1387
1513	14	8.00- 8.59	7	906
824	7	9.00- 9.59	14	1682
1362	14	10.00-10.59	14	982
1155	14	11.00-11.59	21	1513
467	7	12.00-12.59		
2015	28	13.00-13.59	14	946
618	7	14.00-14.59	21	1570
984	14	15.00-15.59	7	436
572	7	16.00-16.59	14	1275
1504	14	17.00-17.59	14	1786
824	7	18.00-18.59	7	824
1683	14	19.00-19.59	7	692
617	7	20.00-20.59	14	1328
572	7	22.00-22.59		

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SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

TAMPA INT'L (TPA)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	660
867	7	8.00- 8.59		
		9.00- 9.59	7	880
658	7	10.00-10.59	7	479
955	14	11.00-11.59	7	494
		12.00-12.59	7	468
980	14	13.00-13.59		
468	7	14.00-14.59	21	1440
487	7	15.00-15.59		
		16.00-16.59	7	659
1490	14	17.00-17.59	7	851
867	7	18.00-18.59	14	1492
651	7	20.00-20.59		

BIRMINGHAM MUNI (BHM)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
616	7	7.00- 7.59		
		8.00- 8.59	7	677
461	7	15.00-15.59		
		16.00-16.59	7	508
615	7	19.00-19.59		
		20.00-20.59	7	507

GREATER CINCINNATI (CVG)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	549
732	7	9.00- 9.59		
		10.00-10.59	7	411
411	7	16.00-16.59		
		17.00-17.59	7	732
549	7	19.00-19.59		

DETROIT CITY (DET)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	616
616	7	8.00- 8.59		
		9.00- 9.59	7	549
549	7	10.00-10.59		
485	7	11.00-11.59	7	461
461	7	12.00-12.59	7	573
485	7	14.00-14.59	7	411
411	7	15.00-15.59	7	572
		16.00-16.59	7	615
1478	14	17.00-17.59		
		18.00-18.59	14	1496
732	7	19.00-19.59		
648	7	20.00-20.59		
		21.00-21.59	7	572

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SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

GEN. D. SPAIN (GDS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
808	7	6.00- 6.59		
		7.00- 7.59	14	1320
2412	21	9.00- 9.59	7	561
		10.00-10.59	14	991
1050	14	12.00-12.59	7	500
443	7	13.00-13.59	7	491
458	7	14.00-14.59	14	921
1048	14	15.00-15.59		
1050	14	16.00-16.59	21	2290
		17.00-17.59	7	874
605	7	18.00-18.59		
1395	14	19.00-19.59	14	1321

ALLEGHENY COUNTY (AGC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	739
598	7	10.00-10.59		
		11.00-11.59	7	554
449	7	14.00-14.59		
		15.00-15.59	7	553
799	7	18.00-18.59		

R. E. BYRD INT'L (RIC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
551	7	8.00- 8.59	7	644
737	7	17.00-17.59		
		18.00-18.59	7	644

WEIR COOK (IND)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
548	7	11.00-11.59	7	640
731	7	20.00-20.59		
		21.00-21.59	7	639

PATRICK HENRY (PHF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
673	7	11.00-11.59		
		12.00-12.59	7	673
673	7	21.00-21.59		
		22.00-22.59	7	673

1985
SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

GREENSBORO HIGH PT. (GSO)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
846	7	7.00- 7.59	7	770
1240	14	8.00- 8.59	14	1658
		9.00- 9.59	7	574
624	7	10.00-10.59	7	577
981	14	13.00-13.59		
934	14	14.00-14.59	14	894
		15.00-15.59	14	1043
634	7	16.00-16.59		
		17.00-17.59	7	825
2279	21	18.00-18.59	14	1197

MC COY AIR FORCE BASE (MCO)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
2012	21	10.00-10.59	7	470
		11.00-11.59	14	1071
702	7	15.00-15.59		
653	7	16.00-16.59	7	803
653	7	17.00-17.59	14	1676

NORFOLK REGIONAL (ORF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
581	7	8.00- 8.59	7	726
635	7	10.00-10.59	7	678
775	7	18.00-18.59	7	543
634	7	20.00-20.59	7	678

BATES FIELD (MOB)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
985	7	9.00- 9.59		
		10.00-10.59	7	659
553	7	14.00-14.59		
		15.00-15.59	7	879

MC GHEE TYSON (TYS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
693	7	8.00- 8.59	7	744
519	7	11.00-11.59		
		12.00-12.59	7	417
692	7	17.00-17.59	7	743

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SOUTHEAST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

JACKSONVILLE INT'L (JAX)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1193	14	7.00- 7.59		
		8.00- 8.59	14	1569
708	7	9.00- 9.59		
		10.00-10.59	7	545
846	14	12.00-12.59		
445	7	13.00-13.59	14	994
		14.00-14.59	7	433
799	7	17.00-17.59		
		18.00-18.59	7	598
1125	14	19.00-19.59		
		20.00-20.59	14	977

NORTH PHILADELPHIA (PNE)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1396	14	8.00- 8.59	7	836
		9.00- 9.59	7	673
576	7	15.00-15.59		
		16.00-16.59	7	673
836	7	18.00-18.59	7	626

TALLAHASSEE MUNI (THM)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
731	7	8.00- 8.59		
		9.00- 9.59	7	592
548	7	12.00-12.59		
		13.00-13.59	7	444
548	7	16.00-16.59		
		17.00-17.59	7	791

TABLE 5.2.4-3

SOUTHEAST REGION - RECAP OF SHORT-HAUL

PASSENGER O&D STATISTICS - 1985

(IN THOUSANDS ANNUALLY)

BETWEEN:	ATLANTA (ATL)	ALLOCATION BY MARKET ANALYSIS		
		STOL	CTOL	TOTAL
AND:	CHARLESTON, S.C.	148	59	207
	FT. LAUDERDALE	112	62	174
	MIAMI	483	308	791
	RICHMOND	85	48	133
	W. PALM BEACH	89	39	128
	BIRMINGHAM	61	113	174
	NASHVILLE	200	106	306
	MOBILE	102	57	159
	COLUMBIA, S.C.	194	82	276
	MONTGOMERY	86	40	126
	CHARLOTTE, N.C.	109	120	229
	ORLANDO, FLA.	169	101	270
	GREENSBORO, N.C.	148	70	218
	JACKSON, MISS.	103	58	161
	JACKSONVILLE, FLA.	241	160	401
	PENSACOLA, FLA.	79	30	109
	RALEIGH, N.C.	193	82	275
	LOUISVILLE, KY.	150	81	231
	SAVANNAH, GA.	243	93	336
	TALLAHASSEE, FLA.	62	27	89
	TAMPA, FLA.	275	166	441
	KNOXVILLE, TENN.	51	57	108
	PITTSBURGH	121	71	192
	CHICAGO	509	269	778
	DETROIT	235	120	355
	CLEVELAND	154	84	238
	CINCINNATI	112	63	175
	DAYTON	60	36	96
	INDIANAPOLIS	86	47	133
	ST. LOUIS	162	81	243
	NORFOLK, VA.	97	44	141
	BALTIMORE	152	87	239
	WASHINGTON, D.C.	378	217	595
	NEW ORLEANS	254	135	389
	MEMPHIS	281	136	417

Table 5.2.4-4

1985

STOL RELIEF OF CONGESTION AT ATLANTA

ANALYSIS OF MARKET FORECAST

ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL
$\geqslant$ 300	2,362	26	3.6	9,276
$\geqslant$ 130	5,944	58	8.0	5,694
$\geqslant$ 50	7,471	74	10.2	4,167

The same rationale for evaluation of congestion for the Atlanta International Airport leads to a reallocation of short-haul traffic. Table 5.2.4-5 summarizes results of a reallocation of medium to high-density traffic over baseline routes. This reallocation results in congestion relief of about 12.7 percent of commercial carrier movements at International. Drawing a larger sample of city pairs, the network is extended to include greater traffic on routes above the 130,000 level. Relief is increased to about 13.1 percent. By including low-density service routes from Atlanta, total relief is increased to about 14.8 percent of air carrier movements in 1985. The names and city-pair traffic levels for the extended Southeast Region are contained in Table 5.2.4-6.

TABLE 5.2.4-5

1985

REEVALUATION OF STOL RELIEF OF CONGESTION AT ATLANTA (REALLOCATION OF TRAFFIC)

ROUTE DENSITY ANNUAL O&D PASSENGERS (000)	O&D PASSENGERS ON STOL (000)	STOL AIRCRAFT MOVEMENTS (000)	STOL % OF ANNUAL AIRPORT MOVEMENTS	O&D PASSENGERS REMAINING CTOL
$\geqslant$130 (Baseline)	8,372	92	12.7	3,266
$\geqslant$130 (Extended Region)	8,570	95	13.1	3,068
$\geqslant$50 (Extended to Low Density)	9,605	107	14.8	2,033

TABLE 5.2.4-6
1985
SOUTHEAST REGION
CITY PAIR ANNUAL STOL O&D TRAFFIC
REVISED EXTENDED TRAFFIC
(50,000 TO 130,000 PASSENGERS)
(000)

		STOL Traffic
BETWEEN:	Atlanta	
AND:	Aberdeen	58
	Asheville	55
	Charlotte	117
	Daytona Bch.	65
	Dayton	96
	Fayetteville	65
	Huntsville	83
	Pensacola	109
	Tallahassee	90
	Montgomery	126
	Bristol	63
	Knoxville	108
BETWEEN:	Birmingham	
AND:	Memphis	85
	Mobile	82
	New Orleans	103
BETWEEN:	Nashville	
AND:	Cincinnati	52
	New Orleans	71
	Louisville	52
BETWEEN:	Charleston	
AND:	Miami	70
	Norfolk	94
	Philadelphia	94
BETWEEN:	Chattanooga	
AND:	Memphis	54
BETWEEN:	Charlottesville	
AND:	New York	66
BETWEEN:	Columbia	
AND:	Miami	83
	Philadelphia	78
BETWEEN:	Memphis	
AND:	Cincinnati	64
	Indianapolis	66
	Jackson, Miss.	88
	Kansas City	109
	Louisville	98
	Knoxville	92
BETWEEN:	Jacksonville	
AND:	Norfolk	59
BETWEEN:	New Orleans	
AND:	Monroe	69
	Mobile	66
	Tampa	118
	Tulsa	64
	Jacksonville	67

TABLE 5.2.4-6

SOUTHEAST REGION

(CONTINUED)
(000)

		STOL Traffic
BETWEEN:	Tampa	
AND:	Ft. Lauderdale	86
	Palm Beach	78
	Pensacola	51
BETWEEN:	Washington, D.C.	
AND:	Richmond	62
	Roanoke	101
	Greenville	65

		STOL Traffic
BETWEEN:	Huntsville	
AND:	Orlando	51
BETWEEN:	Kansas City	
AND:	Louisville	51
BETWEEN:	Richmond	
AND:	Roanoke	51

5.2.5 Southern Region - Continuation of regional analyses leads to the Southern Region. Because population density is low compared to the other regions, the network is simple, even though the geographic area is extensive. Predicted 1985 traffic levels from Section 3.4 indicated a pattern of routes radiating from Dallas/Ft. Worth with a few peripheral routes. The cities and routes comprising the network are shown in Figure 5.2.5-1. A list of cities, airports and identifier codes is included in Table 5.2.5-1. Traffic statistics are shown in Figure 5.2.5-2, Summary of Daily Round Trips, EBF 150 Passenger Capacity and Table 5.2.5-2, Weekly Fleet Operations Results. Details of airport activities are shown in Exhibit 5.2.5-1. Shown traffic levels on routes between 50,000 and 130,000 travelers in 1985 are included as Table 5.2.5-3.

1985
SOUTHERN REGION - PHASE II

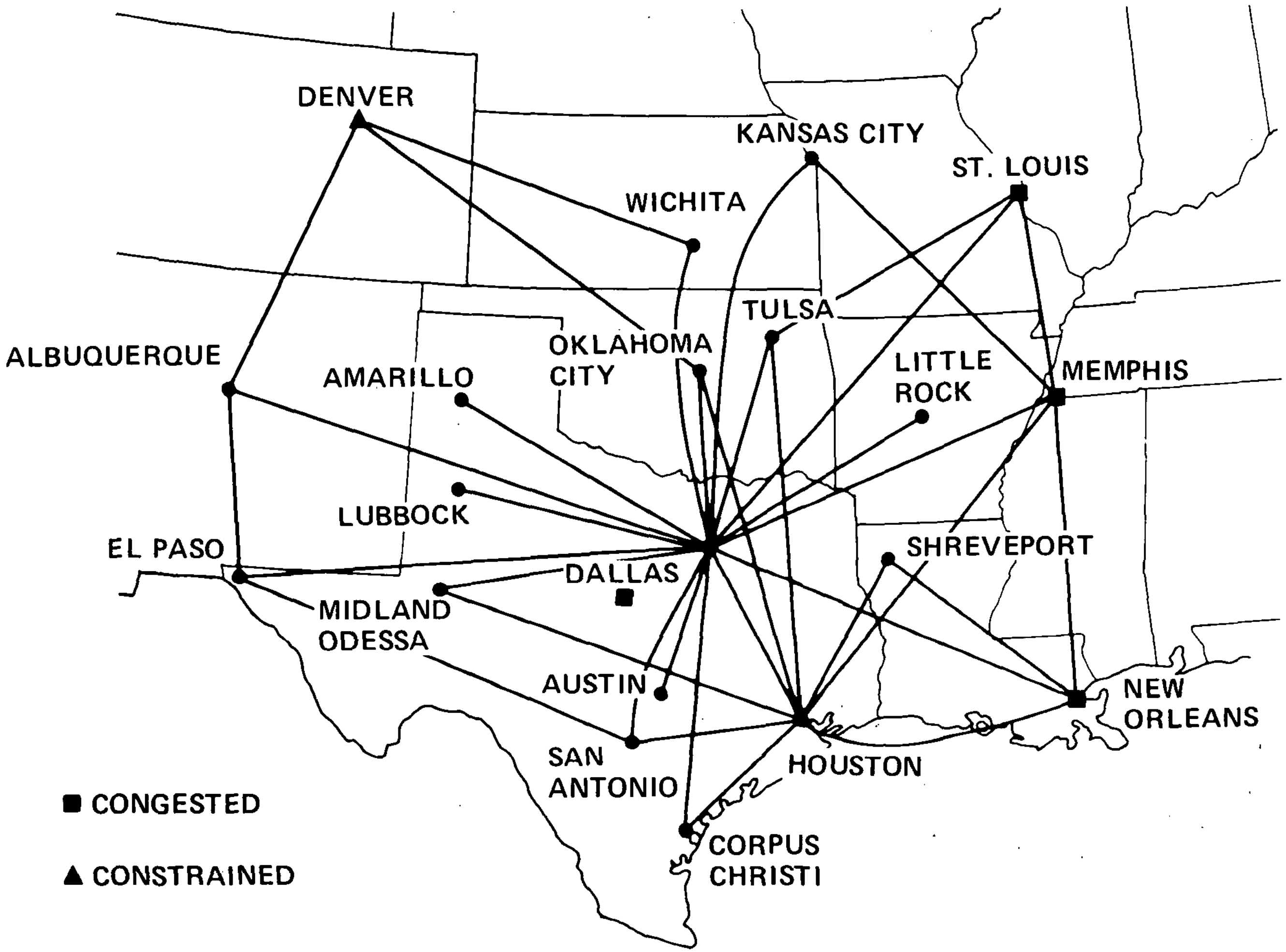

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FIGURE 5.2.5-1

TABLE 5.2.5-1

AIRPORT IDENTIFICATION BY CITY AND CODE

SOUTHERN REGION

CITY	AIRPORT	CODE
Albuquerque	Albuquerque Sunport	ABQ
Amarillo	Amarillo Air Terminal	AMA
Austin	Robert Mueller Municipal	AUS
Corpus Christi	Corpus Christi Int'l	CRP
Dallas	Dallas Love Field	DAL
Denver	Stapleton Int'l	DEN
El Paso	El Paso Int'l	ELP
Houston	Houston Hobby	HOU
Kansas City	Kansas City Municipal	MKC
Little Rock	Adams Field	LIT
Lubbock	Lubbock Regional	LBB
Memphis	Gen. D. Spain	GDS
Midland/Odessa	Midland/Odessa Regional	MAF
New Orleans	Lakefront	NEW
Oklahoma City	Will Rogers World	OKC
St. Louis	Bi State Parks	CPS
San Antonio	San Antonio Int'l	SAT
Shreveport	Shreveport Regional	SHV
Tulsa	Tulsa Int'l	TUL
Wichita	Wichita Municipal	ICT

1985
SOUTHERN REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY

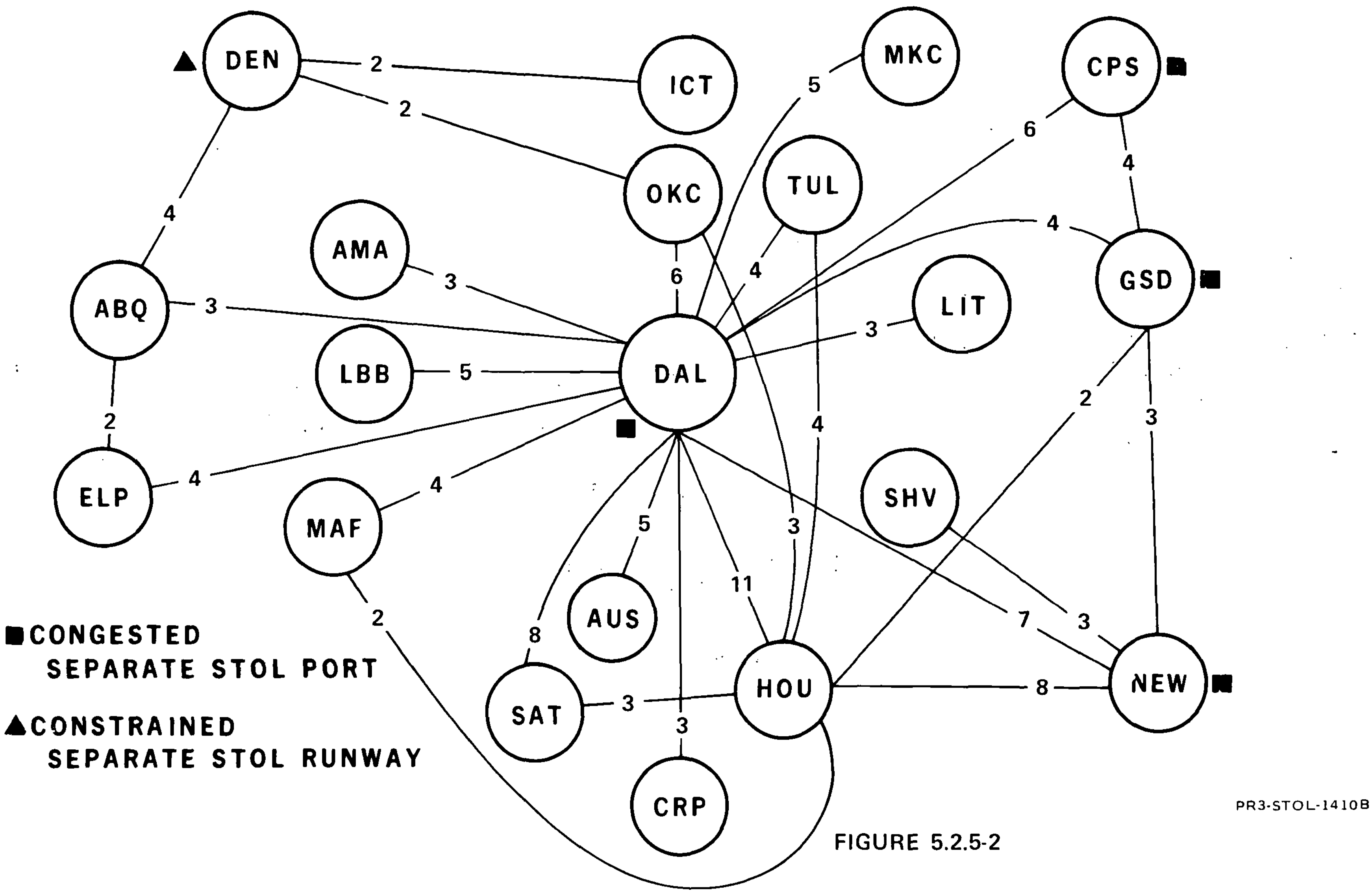

FIGURE 5.2.5-2

TABLE 5.2.5-2

1985
SOUTHERN REGION - PHASE II
(BASELINE)
WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH MILES (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED MPH (KPH)	DAILY UTILIZ. HR.	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR %
EBF-100	31	341.9 (550.1)	2,447	361.0 (580.8)	11.1	2,583	88,300 (142,075)	54,005 (86,894)	61.1
EBF-150	21	341.9 (550.1)	1,631	361.0 (580.8)	11.1	1,722	88,322 (142,110)	54,005 (86,894)	61.1
EBF-200	16	341.9 (550.1)	1,223	361.0 (580.8)	11.1	1,292	88,400 (142,236)	54,005 (86,894)	61.1

Exhibit 5.2.5-1
Page 1

1985
SOUTHERN REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

TULSA INT'L (TUL)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
560	7	0.00- 0.59	7	228
748	7	7.00- 7.59		
643	7	8.00- 8.59	14	1907
560	7	13.00-13.59	7	641
482	7	14.00-14.59	7	431
643	7	17.00-17.59	7	766
997	7	18.00-18.59		
		19.00-19.59	7	855
482	7	23.00-23.59	7	287

SHREVEPORT REGIONAL (SHV)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
555	7	7.00- 7.59		
		8.00- 8.59	7	669
416	7	12.00-12.59		
		13.00-13.59	7	375
741	7	17.00-17.59		
		18.00-18.59	7	668

EL PASO INT'L (ELP)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
678	7	7.00- 7.59	7	508
508	7	10.00-10.59		
552	7	11.00-11.59	14	970
507	7	14.00-14.59	7	678
736	7	16.00-16.59		
903	7	17.00-17.59	7	825
		18.00-18.59	7	903

LUBBOCK REGIONAL (LBB)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
934	7	8.00- 8.59		
		9.00- 9.59	7	712
525	7	11.00-11.59	7	534
525	7	13.00-13.59		
		14.00-14.59	7	534
525	7	16.00-16.59	7	950
933	7	18.00-18.59		
		19.00-19.59	7	712

1985
SOUTHERN REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

GEN. D. SPAIN (GDS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	601
1800	14	9.00- 9.59	7	677
803	7	10.00-10.59	14	1197
1486	21	12.00-12.59	7	507
		13.00-13.59	14	1195
475	7	14.00-14.59		
1010	14	15.00-15.59	14	1244
		16.00-16.59	7	839
845	7	17.00-17.59		
813	7	18.00-18.59	14	1480
601	7	21.00-21.59	7	567
474	7	23.00-23.59		

AMARILLO AIR TERMINAL (AMA)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
899	7	9.00- 9.59		
		10.00-10.59	7	693
505	7	14.00-14.59	7	692
673	7	20.00-20.59		
		21.00-21.59	7	692

MIDLAND ODESSA REGIONAL (MAF)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
682	7	10.00-10.59	7	551
609	7	11.0-11.59	7	712
511	7	15.00-15.59	7	734
1495	14	20.00-20.59	14	1261
511	7	22.00-22.59		
		23.00-23.59	7	550

WILL ROGERS WORLD (OKC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
454	7	1.00- 1.59		
		7.00- 7.59	7	679
854	7	8.00- 8.59		
770	7	9.00- 9.59	14	1469
1344	14	12.00-12.59	7	509
		13.00-13.59	7	445
480	7	14.00-14.59	7	508
432	7	15.00-15.59		
480	7	16.00-16.59	14	1500
854	7	18.00-18.59	7	679
640	7	20.00-20.59	7	508
480	7	22.00-22.59	7	491

1985
SOUTHERN REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

BI STATE PARKS (CPS)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
668	7	8.00- 8.59	7	678
1068	14	11.00-11.59	7	475
		12.00-12.59	7	508
567	7	13.00-13.59		
		14.00-14.59	7	475
500	7	15.00-15.59	7	678
567	7	16.00-16.59	7	845
890	7	18.00-18.59		
		19.00-19.59	7	678
1567	21	22.00-22.59	21	1490

HOUSTON HOBBY (HOU)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
876	14	0.00- 0.59		
		7.00- 7.59	21	1923
1257	14	8.00- 8.59	21	2447
2391	21	9.00- 9.59	7	787
1873	21	10.00-10.59	21	1690
1080	14	11.00-11.59	14	924
712	7	12.00-12.59	14	958
913	14	13.00-13.59	14	973
936	14	14.00-14.59	14	1021
1512	21	15.00-15.59	14	1278
1443	14	16.00-16.59	14	1299
595	7	17.00-17.59	14	1706
2390	21	18.00-18.59	7	656
1459	14	19.00-19.59	21	2202
1443	14	20.00-20.59	14	1246
1300	14	21.00-21.59		
590	7	22.00-22.59	144	1071
		23.00-23.59	7	589

LAKEFRONT (NEW)

ARRIVAL			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
954	14	0.00- 0.59		
		7.00- 7.59	14	1268
732	7	8.00- 8.59	7	987
1644	14	9.00- 9.59	7	787
1416	14	10.00-10.59	14	1123
590	7	11.00-11.59	7	555
549	7	12.00-12.59	7	416
628	7	13.00-13.59	7	534
375	7	14.00-14.59	14	1144
1137	14	15.00-15.59	7	787
1626	14	16.00-16.59	7	713
		17.00-17.59	14	1692
975	7	18.00-18.59		
668	7	19.00-19.59	14	1500
787	7	20.00-20.59	7	589
1138	14	21.00-21.59		
589	7	22.00-22.59	14	1124
		23.00-23.59	7	589

ALBUQUERQUE SUNPORT (ABQ)

			DEPARTURE	
PSGR	FREQ		FREQ	PSGR
		7.00- 7.59	7	598
1262	14	10.00-10.59	7	552
		11.00-11.59	7	535
463	7	12.00-12.59	7	449
523	7	13.00-13.59	7	535
1077	14	15.00-15.59		
		16.00-16.59	14	1451
825	7	17.00-17.59		
931	7	18.00-18.59	14	1514
553	7	21.00-21.59		

1985
SOUTHERN REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

DALLAS LOVE FIELD (DAL)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
2068	28	0.00- 0.59		
430	14	1.00- 1.59		
1440	14	7.00- 7.59	49	4790
4165	35	8.00- 8.59	49	6325
2185	21	9.00- 9.59	28	3090
3827	42	10.00-10.59	35	2555
3348	42	11.00-11.59	35	2555
1105	14	12.00-12.59	21	1495
3024	42	13.00-13.59	35	2532
3086	42	14.00-14.59	42	3044
2796	35	15.00-15.59	42	3336
2067	21	16.00-16.59	14	1372
7499	63	17.00-17.59	56	7028
1825	14	18.00-18.59	35	4488
4250	42	19.00-19.59	14	1321
5983	56	20.00-20.59	49	4059
1058	14	21.00-21.59	28	2012
1771	21	22.00-22.59	14	1048
534	7	23.00-23.59	21	1411

WICHITA MUNI (ICT)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
825	7	9.00- 9.59	7	923
617	7	22.00-22.59	7	519

ADAMS FIELD (LIT)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
592	7	7.00- 7.59		
		8.00- 8.59	7	713
444	7	12.00-12.59		
		13.00-13.59	7	401
791	7	17.00-17.59		
		18.00-18.59	7	713

STAPLETON INT'L (DEN)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE FREQ
		7.00- 7.59	7	825
1797	14	9.00- 9.59	7	911
		10.00-10.59	7	523
535	7	12.00-12.59	7	523
535	7	14.00-14.59		
		15.00-15.59	7	523
715	7	17.00-17.59	7	931
715	7	19.00-19.59		
		20.00-20.59	7	617
1010	14	22.00-22.59		
		23.00-23.59	7	454

1985
SOUTHERN REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

SAN ANTONIO INT'L (SAT)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
486	7	0.00- 0.59	7	202
		7.00- 7.59	7	761
624	7	8.00- 8.59	7	751
946	7	9.00- 9.59	7	761
531	7	11.00-11.59		
467	7	12.00-12.59	7	571
		13.00-13.59	7	422
531	7	14.00-14.59	7	571
709	7	16.00-16.59		
832	7	17.00-17.59	7	1015
		18.00-18.59	7	750
946	7	19.00-19.59	7	761
531	7	21.00-21.59		
532	7	22.00-22.59	7	570

CORPUS CHRISTI INT'L (CRP)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
770	7	10.00-10.59		
		11.00-11.59	7	509
577	7	15.00-15.59		
		16.00-16.59	7	905
576	7	21.00-21.59		
		22.00-22.59	7	509

ROBERT MUELLER MUNI (AUS)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
716	7	7.00- 7.59		
		8.00- 8.59	7	894
537	7	12.00-12.59	7	502
716	7	16.00-16.59		
		17.00-17.59	7	894
956	7	18.00-18.59		
		19.00-19.59	7	670
537	7	23.00-23.59	7	502

KANSAS CITY MUNI (MKC)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	761
929	7	9.00- 9.59		
		10.00-10.59	7	570
522	7	12.00-12.59		
		13.00-13.59	7	570
522	7	15.00-15.59		
		16.00-16.59	7	761
928	7	18.00-18.59		
		19.00-19.59	7	761
522	7	21.00-21.59		

TABLE 5.2.5-3
1985
SOUTHERN REGION
CITY PAIR ANNUAL STOL O&D TRAFFIC
REVISED EXTENDED TRAFFIC
(50,000 TO 130,000 PASSENGERS)

		STOL Traffic
BETWEEN:	Dallas	
AND:	Abilene	65
	Birmingham	93
	Beaumont	87
	Baton Rouge	80
	Wichita	119
	Jackson, Miss.	104
	Omaha	70
BETWEEN:	Houston	
AND:	Amarillo	69
	Birmingham	64
	Baton Rouge	104
	Shreveport	99
	Lubbock	96
	McAllen	64
BETWEEN:	Little Rock	
AND:	Houston	69
	Kansas City	55
BETWEEN:	Oklahoma	
AND:	Kansas City	128
	San Antonio	73
BETWEEN:	Corpus Christi	
AND:	Houston	85
BETWEEN:	El Paso	
AND:	Denver	96
	Phoenix	89
	San Antonio	93
BETWEEN:	San Antonio	
AND:	New Orleans	87
BETWEEN:	Birmingham	
AND:	Shreveport	67
BETWEEN:	Tulsa	
AND:	Kansas City	63
	St. Louis	98
BETWEEN:	Kansas City	
AND:	Lincoln	59
	Milwaukee	57
	Omaha	126
	Springfield, Mo.	69
	Indianapolis	84
	Wichita	68
	Cincinnati	66

5.2.6 Northwest Region - Since there are but eleven cities in the Northwest Region, the network is quite simple, as shown in Figure 5.2.6-1. Cities and airports are identified in Table 5.2.6-1. With the baseline allocation of traffic shown in Table 5.2.6-2, analysis of fleet requirements and derivation tion of operations statistics is reported in Table 5.2.6-3. Detailed weekly airport activities are shown in Exhibit 5.2.6-1.

In extending the network to include more cities with at least 50,000 travelers, a list of cities has been compiled as Table 5.2.6-4. This includes both California and Northwest Region traffic data. These data have been used in computation of the "Extended" total market for STOL aircraft as presented in Section 5.5 which is at the end of Section 5.0.

1985
NORTHWEST REGION - PHASE II

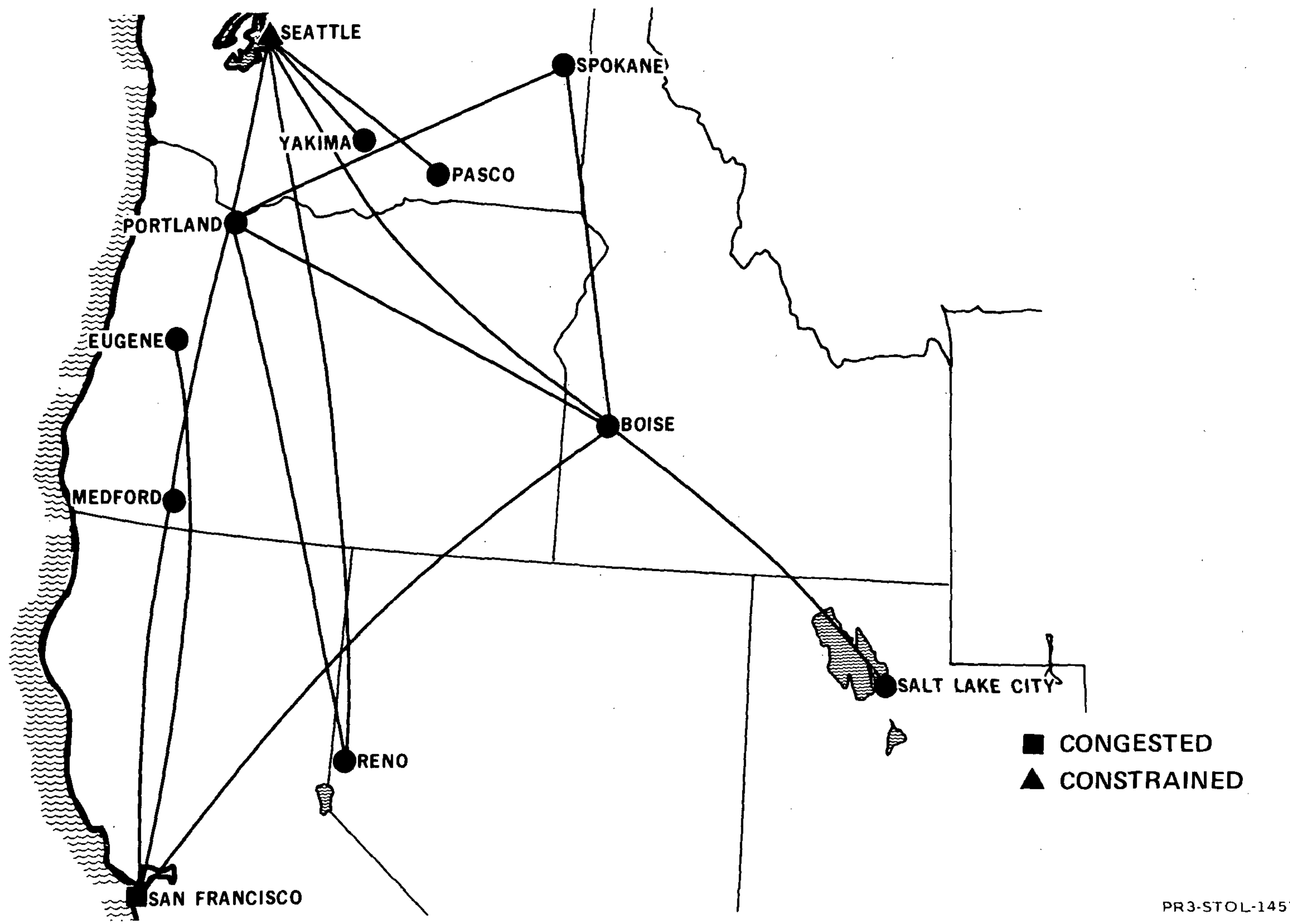

FIGURE 5.2.6-1

TABLE 5.2.6-1

AIRPORT IDENTIFICATION BY CITY AND CODE
NORTHWEST
REGION

CITY	AIRPORT	CODE
Boise	Boise Air Terminal	BOI
Eugene	Mahlon Sweet Field	EUG
Oakland	North Field	OAK
Portland	Portland International	PDX
Reno	Reno International	RNO
Seattle	Seattle-Tacoma	SEA
Spokane	Spokane International	GEG

TABLE 5.2.6-2

1985

NORTHWEST REGION

CITY PAIR ANNUAL STOL O&D TRAFFIC

(BASELINE)
(000)

		STOL Traffic
BETWEEN:	Seattle	
AND:	Boise	77
	Spokane	245
	Portland	84
	Reno	84
	Pasco	90
	Yakima	41
BETWEEN:	Eugene	
AND:	San Francisco	146

		STOL Traffic
BETWEEN:	Portland	
AND:	Spokane	128
	Reno	79
BETWEEN:	Boise	
AND:	Portland	88
	San Francisco	76
	Salt Lake City	60

1985
NORTHWEST REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY

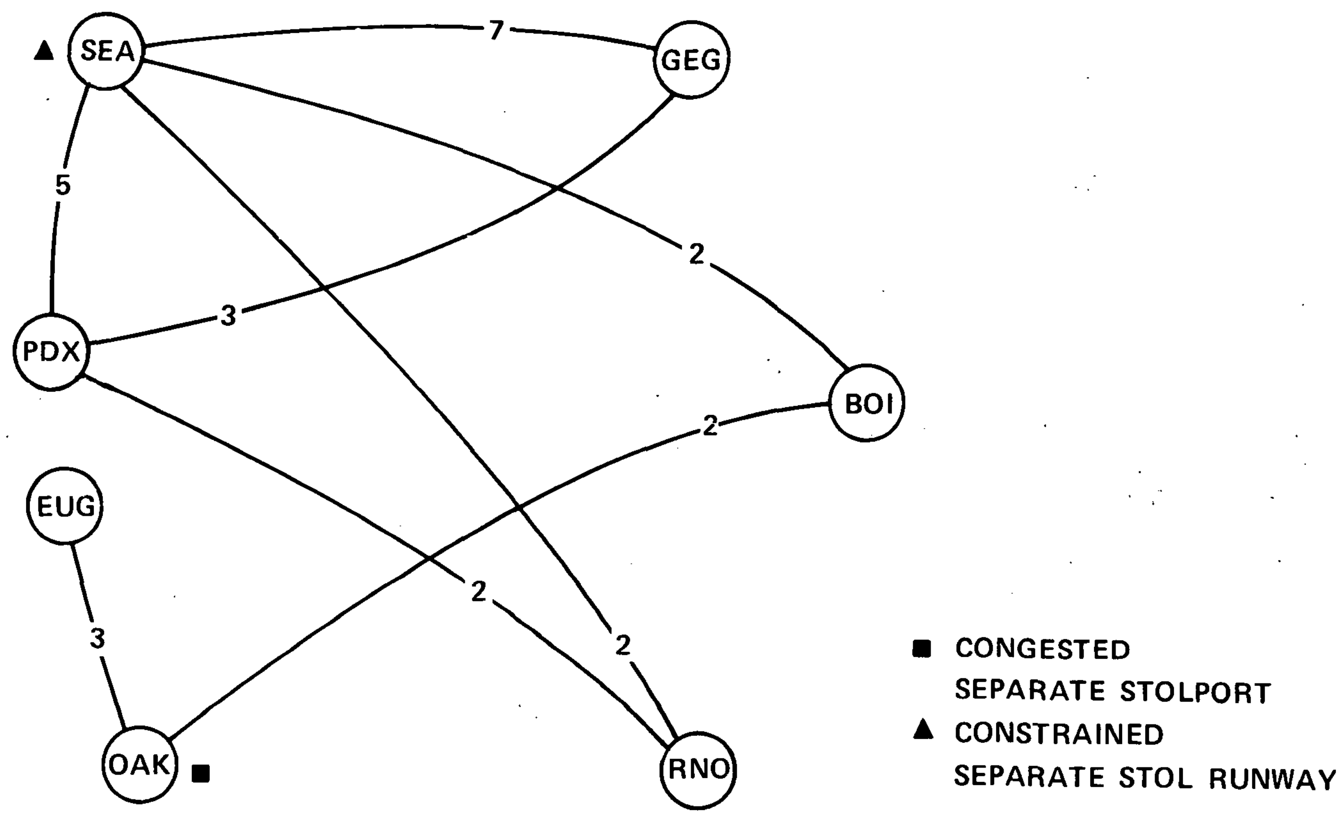

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FIGURE 5.2.6-2

TABLE 5.2.6-3

1985
NORTHWEST REGION - PHASE II
(BASELINE)

WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH MILES (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED MPH (KPH)	DAILY UTILIZ. HR.	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR %
EBF-100	9	317.6 (511.0)	532	351.7 (565.9)	7.8	588	18,678 (30,053)	11,648 (18,742)	62.4
EBF-150	6	317.6 (511.0)	354	351.7 (565.9)	7.8	392	18,678 (30,053)	11,648 (18,742)	62.4
EBF-200	5	317.6 (511.0)	266	351.7 (565.9)	7.8	294	18,678 (30,053)	11,648 (18,742)	62.4

1985
NORTHWEST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

SEATTLE-TACOMA (SEA)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	14	1365
918	7	8.00- 8.59		
		9.00- 9.59	7	700
1639	21	10.00-10.59		
517	7	11.00-11.59	14	1165
510	7	12.00-12.59	7	525
516	7	13.00-13.59	7	510
510	7	14.00-14.59	7	525
		15.00-15.59	7	510
516	7	16.00-16.59	7	663
		17.00-17.59	7	934
1666	14	18.00-18.59		
1440	14	19.00-19.59	7	654
		20.00-20.59	7	681

PORTLAND INT'L (PDX)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	14	1346
857	7	8.00- 8.59		
625	7	9.00- 9.59	7	721
		10.00-10.59	7	511
1030	14	11.00-11.59		
		12.00-12.59	14	1050
510	7	13.00-13.59		
481	7	14.00-14.59	7	510
510	7	15.00-15.59	7	721
		16.00-16.59	7	625
923	7	17.00-17.59		
625	7	18.00-18.59	7	720
		19.00-19.59	7	681
1324	14	20.00-20.59		

RENO INT'L (RNO)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1289	14	8.00- 8.59	7	625
		9.00- 9.59	7	568
1288	14	17.00-17.59	7	625
		18.00-18.59	7	759

NORTH FIELD (OAK)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
737	7	7.00- 7.59	14	1375
668	7	10.00-10.59		
		11.00-11.59	7	617
500	7	14.00-14.59		
551	7	15.00-15.59	14	1354
890	7	18.00-18.59		

1985
NORTHWEST REGION
WEEKLY AIRPORT ACTIVITY
(150 PASSENGER STOL AIRCRAFT)

SPOKANE INT'L (GEG)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
1422	14	7.00- 7.59		
		8.00- 8.59	14	1775
700	7	10.00-10.59	7	517
525	7	12.00-12.59		
540	7	13.00-13.59	14	997
525	7	15.00-15.59	7	516
934	7	17.00-17.59		
		18.00-18.59	7	918
720	7	19.00-19.59	7	643

BOISE AIR TERMINAL (BOI)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
		7.00- 7.59	7	737
551	7	10.00-10.59	7	560
721	7	11.00-11.59		
		12.00-12.59	7	519
654	7	13.00-13.59		
		15.00-15.59	7	551
721	7	17.00-17.59		
737	7	18.00-18.59	14	1671
654	7	21.00-21.59		

MAHLON SWEET FIELD (EUG)

ARRIVAL PSGR	ARRIVAL FREQ		DEPARTURE FREQ	DEPARTURE PSGR
824	7	8.00- 8.59		
		9.00- 9.59	7	668
617	7	12.00-12.59		
		13.00-13.59	7	500
617	7	16.00-16.59		
		17.00-17.59	7	890

TABLE 5.2.6-4

1985
CALIFORNIA/NORTHWEST REGIONS
CITY PAIR ANNUAL STOL O&D TRAFFIC
REVISED EXTENDED TRAFFIC
(50,000 TO 130,000 PASSENGERS)

		STOL Traffic
BETWEEN:	Los Angeles	
AND:	Palm Springs	90
	Santa Barbara	107
	Stockton	55
	Bakersfield	65
BETWEEN:	San Francisco	
AND:	Bakersfield	80
	Medford	93
	Monterey	107
	Palm Springs	81
	Redding	61
BETWEEN:	San Diego	
AND:	Sacramento	108
	Tucson	100
BETWEEN:	Denver	
AND:	Billings	102
	Colorado Springs	81
	Casper	97
	Sioux Falls	59
	Lincoln	70
	Rapid City	57
	Tulsa	121
	Aspen	60

		STOL Traffic
BETWEEN:	Seattle	
AND:	Pasco	89
	Yakima	72
BETWEEN:	Boise	
AND:	Spokane	78
	Salt Lake City	107
BETWEEN:	Portland	
AND:	Medford	77
	Sacramento	61
BETWEEN:	Phoenix	
AND:	Tucson	58
BETWEEN:	Salt Lake City	
AND:	Reno	66

5.2.7 Hawaii Region - The Hawaii Region was evaluated analytically. No performance evaluation or scheduling of aircraft were performed. In this region it was operationally both practical and feasible to include the inter-connecting passengers in the STOL system. These were treated in the extended network and the fleet requirements are included in Section 5.5, Airline Operations Summary.

Data shown in the pages following include a regional map, Figure 5.2.7-1, cities and airport identifiers, Table,5.2.7-1, a summary of daily round trips for the baseline O & D traffic only, Figure 5.2.7-2 and weekly fleet activities in Table 5.2.7-2.

1985
HAWAII REGION-PHASE II

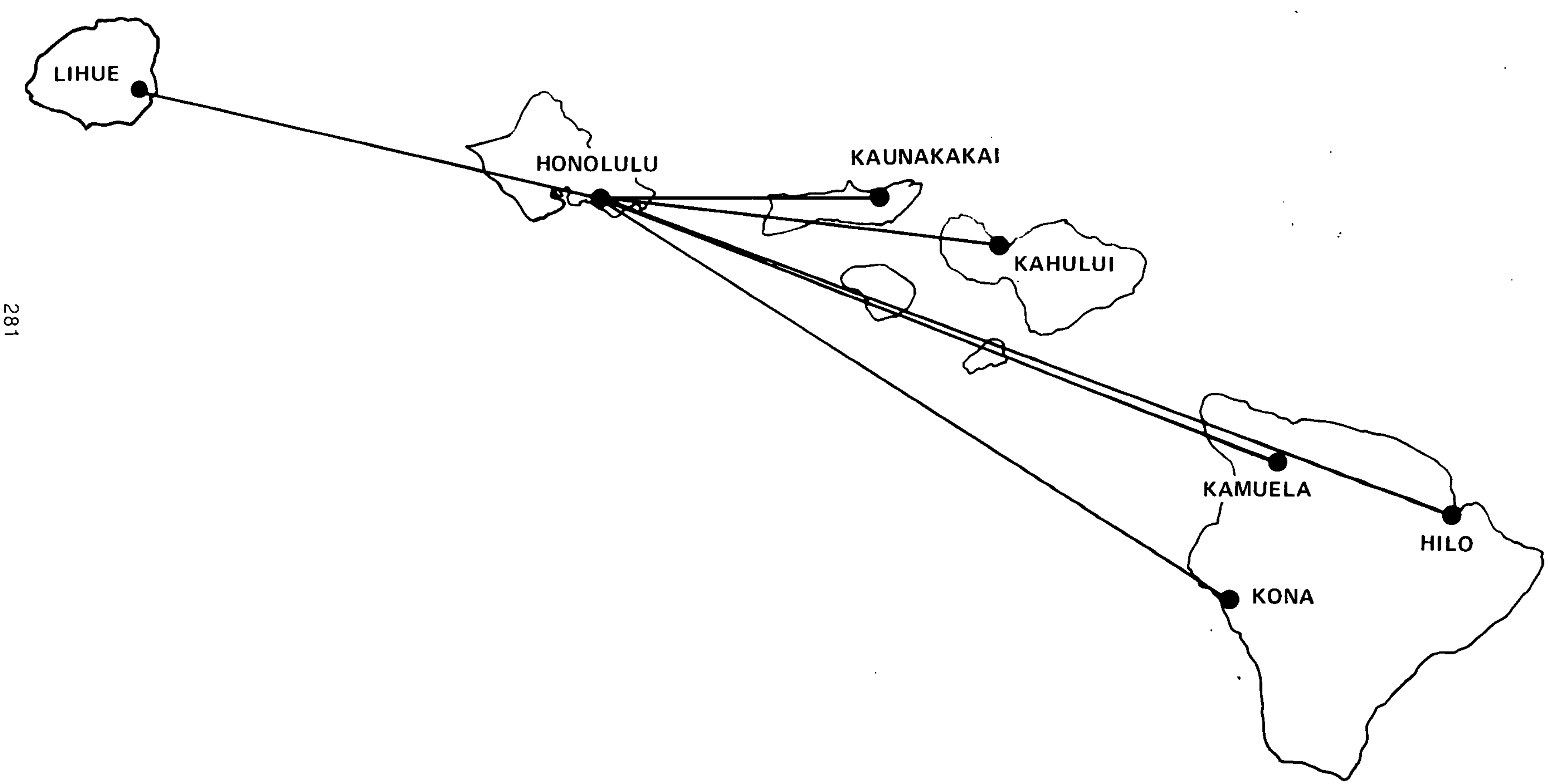
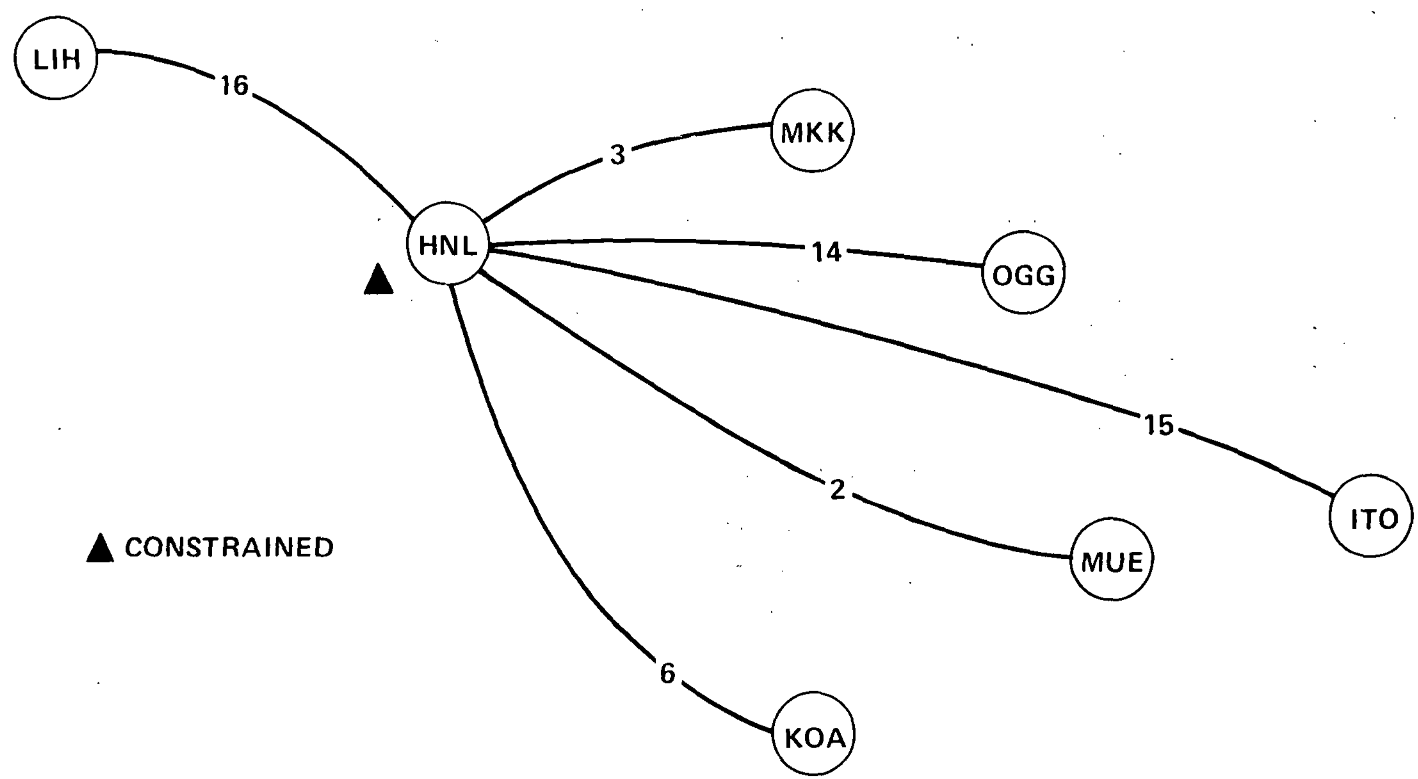


FIGURE 5.2.7-1

TABLE 5.2.7-1
AIRPORT INDENTIFICATION BY CITY AND CODE
HAWAII REGION

CITY	AIRPORT	CODE
Hilo	General Lyman Field	ITO
Honolulu	Honolulu Int'l	HNL
Kahului	Kahului	OGG
Kailua-Kona	Ke-Ahole	KOA
Kamuela	Waimez-Kohala	MUE
KaunaKaKai	Molokai	MKK
Lihue	Lihue	LIH

1985
HAWAII REGION - PHASE II
SUMMARY OF DAILY ROUND TRIPS EBF 150 PASSENGER CAPACITY



PR3-STOL-1523

FIGURE 5.2.7-2

TABLE 5.2.7-2

1985
HAWAII REGION - PHASE II
(BASELINE)
WEEKLY FLEET OPERATIONS RESULTS

AIRCRAFT TYPE	FLEET SIZE	AVERAGE STAGE LENGTH MILES (KM)	BLOCK HOURS	AVERAGE BLOCK SPEED MPH (KPH)	DAILY UTILIZ.	TOTAL DEPART.	AIRCRAFT SEAT MILES (KM) (000)	PASSENGER SEAT MILES (KM) (000)	SYSTEM LOAD FACTOR
EBF-100	10	139.1 (223.8)	610	267.9 (431.0)	8.3	1,176	164 (263.9)	16,358 (26,320)	59.2
EBF-150	7	139.1 (223.8)	407	267.9 (431.0)	8.3	784	109 (175.4)	16,358 (26,320)	59.2
EBF-200	5	139.1 (223.8)	305	267.9 (431.0)	8.3	588	82 (131.9)	16,358 (26,320)	59.2

5.3 Airline Operations

5.3.1 <u>Maintenance Concept for the STOL Aircraft</u> - The maintainability of the STOL aircraft must be a major consideration from initial design through development and testing to eliminate long periods of downtime to accomplish block overhauls and substitute condition monitoring, area checks and scheduled inspections of operational and structurally significant items.

The STOL maintenance concept developed in this study is based on the same philosophy as that used on the DC-10, which is to eliminate or minimize "Hard-Time" items with the object of allowing components to operate to the end of their useful life. This is accomplished by adequate system redundancy and built-in fault isolation equipment so that most components will operate under "Condition Monitoring" or "On-Condition" type of maintenance.

The DC-10-10 maintenance concept has been approved by the FAA and is being employed by the airline operators. This concept has; less than one percent of all items classified for scheduled overhaul; 68 percent are classified "Condition Monitor"; and slightly less than 32 percent are classified "On-Condition". A similar distribution is anticipated for the STOL aircraft.

A scheduled maintenance program has been developed for each of the eight STOL plus the one CTOL configurations and is basically the same as that developed for the DC-10-10 aircraft. Exhibit 5.3.1-1 shows the scheduled maintenance program which consists of a Service Check, an "A" Check, a "C" check and a Structural Inspection Program.

The Service Check is to be performed prior to each flight and is for the purpose of refueling the aircraft, routine replacement of expendable fluid and gases, serving of potable water, lavatory and galley systems, and walk around inspection for obvious damage or discrepancy.

STOL SCHEDULED MAINTENANCE PROGRAM - EBF 150.3000(MODIFIED)

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	.5	2	.25	
A	35 FLT HRS	7	2	3.5	
C	650 FLT HRS	*(270)	(34)	(7.95)	
		90	12	7.5	* Divide the "C" check into 3 visits of 8 hours each.
		90	12	7.5	
		90	12	7.5	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	56	7	8.0	
	5000 FLT HRS	35	5	7.0	
	7500 FLT HRS	30	4	7.5	
	10,000 FLT HRS	16	2	8.0	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	16	2	8.0	* Schedule sample inspections between 6000 and 10,000 hours.
1/6 OR 17% OF FLEET	10,000 FLT HRS	51	7	7.28	
1/7 OR 14% OF FLEET	10,000 FLT HRS	70	9	7.8	
1/12 OR 8% OF FLEET	10,000 FLT HRS	47	6	7.82	

STOL SCHEDULED MAINTENANCE PROGRAM - EBF 150.3000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	0.5	2	0.25	
A	35 FLT HRS	7	2	3.5	
C	650 FLT HRS	*(290)	(37)	(7.85)	
		96.66	13	7.43	* Divide the "C" check into 3 visits of 8 hours each.
		96.66	13	7.43	
		96.66	13	7.43	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	61	8	7.62	
	5000 FLT HRS	39	5	7.80	
	7500 FLT HRS	33	5	6.60	
	10,000 FLT HRS	17	3	5.67	
INTERNAL*(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	17	3	5.67	* Schedule sample inspections between 6000 and 10,000 hours.
1/6 OR 17% OF FLEET	10,000 FLT HRS	56	7	8.00	
1/7 OR 14% OF FLEET	10,000 FLT HRS	76	10	7.60	
1/12 OR 8% OF FLEET	10,000 FLT HRS	50	7	7.14	

EXHIBIT 5.3.1-1

Page 3 of 10

STOL SCHEDULED MAINTENANCE PROGRAM - EBF 100.3000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	0.5	2	0.25	
A	35 FLT HRS	5	2	2.50	
C	650 FLT HRS	*(210)	(27)	(7.78)	
		112	14	8.00	*Divide the "C" check into 2 visits of 8 hours each.
		98	14	7.00	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	44	6	7.33	
	5000 FLT HRS	27	4	6.75	
	7500 FLT HRS	24	3	8.00	
	10,000 FLT HRS	12	2	6.00	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	12	2	6.00	* Schedule sample inspections between 6000 and 10,000 hours.
1/6 OR 17% OF FLEET	10,000 FLT HRS	40	5	8.00	
1/7 OR 14% OF FLEET	10,000 FLT HRS	55	7	7.71	
1/12 OR 8% OF FLEET	10,000 FLT HRS	36	5	7.20	

STOL SCHEDULED MAINTENANCE PROGRAM - EBF 200.3000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	0.5	2	.25	
A	35 FLT HRS	10	2	5.00	
C	650 FLT HRS	*(408)	(51)	(8.00)	
		102	13	7.85	*Divide the "C" check into 4 visits of 8 hours each.
		102	13	7.85	
		102	13	7.85	
		102	13	7.84	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	85	11	7.72	
	5000 FLT HRS	53	7	7.58	
	7500 FLT HRS	46	6	7.68	
	10,000 FLT HRS	24	3	8.00	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	24	3	8.00	* Schedule sample inspections between 6000 and 10,000 hours.
1/6 OR 17% OF FLEET	10,000 FLT HRS	78	10	7.80	
1/7 OR 14% OF FLEET	10,000 FLT HRS	106	14	7.58	
1/12 OR 8% OF FLEET	10,000 FLT HRS	71	9	7.90	

STOL SCHEDULED MAINTENANCE PROGRAM - A150.2000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	0.5	2	.25	
A	35 FLT HRS	10	2	5	
C	650 FLT HRS	(430)	(54)	(7.95)	
		110	14	7.86	* Divide the "C" check into 4 visits of 8 hours each.
		110	14	7.86	
		110	14	7.86	
		100	13	7.70	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	90	12	7.50	
	5000 FLT HRS	56	7	8.00	
	7500 FLT HRS	48	6	8.00	
	10,000 FLT HRS	25	4	6.25	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	25	4	6.35	* Schedule sample inspections between 6000 and 10,000 hrs.
1/6 OR 17% OF FLEET	10,000 FLT HRS	83	11	7.55	
1/7 OR 14% OF FLEET	10,000 FLT HRS	111	14	7.95	
1/12 OR 8% OF FLEET	10,000 FLT HRS	75	10	7.50	

STOL SCHEDULED MAINTENANCE PROGRAM U 150.2000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	.75	3	.25	
A	35 FLT HRS	12	5	2.40	
C	650 FLT HRS	*(501)	(64)	(7.83)	
		126	16	7.88	* Divide the "C" check into 4 visits each of 8 hours each.
		125	16	7.81	
		125	16	7.81	
		125	16	7.81	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	105	14	7.50	
	5000 FLT HRS	65	9	7.20	
	7500 FLT HRS	57	8	7.10	
	10,000 FLT HRS	30	4	7.50	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	30	4	7.50	* Schedule sample inspections between 7500 and 10,000 hours.
1/6 OR 17% OF FLEET	10,000 FLT HRS	96	12	8.00	
1/7 OR 14% OF FLEET	10,000 FLT HRS	131	17	7.71	
1/12 OR 8% OF FLEET	10,000 FLT HRS	87	11	7.91	

STOL SCHEDULED MAINTENANCE PROGRAM - M 150.3000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	0.5	2	0.25	
A	35 FLT HRS	8	2	4	
C	650 FLT HRS	*(335)	(42)	(7.96)	
		85	11	7.73	* Divide the "C" check into 4 visits of 8 hours each.
		85	11	7.73	
		85	11	7.73	
		80	10	8 00	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	70	9	7.70	
	5000 FLT HRS	44	6	7.35	
	7500 FLT HRS	38	5	7.60	
	10,000 FLT HRS	20	3	6.68	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	20	3	6.68	* Schedule sample inspection between 6000 and 10,000 hours
1/6 OR 17% OF FLEET	10,000 FLT HRS	64	8	8.00	
1/7 OR 14% OF FLEET	10,000 FLT HRS	88	11	8.00	
1/12 OR 8% OF FLEET	10,000 FLT HRS	58	8	7.25	

STOL SCHEDULED MAINTENANCE PROGRAM - M 150.4000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	0.5	2	0.25	
A	35 FLT HRS	7	(35)		
C	650 FLT HRS	*(276)	(12)	(7,90)	
		92	12	7.67	* Divide the "C" check into 3 visits of 8 hours each.
		92	12	7.67	
		92	12	7.67	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	58	8	7.25	
	5000 FLT HRS	36	5	7.20	
	7500 FLT HRS	31	4	7.75	
	10,000 FLT HRS	16	2	8.00	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	16	2	8.00	* Schedule sample inspections between 6000 and 10,000 hours
1/6 OR 17% OF FLEET	10,000 FLT HRS	53	7	7.58	
1/7 OR 14% OF FLEET	10,000 FLT HRS	72	9	8.00	
1/12 OR 8% OF FLEET	10,000 FLT HRS	48	6	8.00	

STOL SCHEDULED MAINTENANCE PROGRAM - EBF 150.2000

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREELIGHT OR DAILY	0.5	2	0.25	
A	35 FLT HRS	10	2	5	
C	650 FLT HRS	*(400)	(50)	(8.0)	
		100	13	7.70	* Divide the "C" check into 4 visits of 8 hours each.
		100	13	7.70	
		100	13	7.70	
		100	13	7.70	
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	2500 FLT HRS	84	11	7.62	
	5000 FLT HRS	54	7	7.72	
	7500 FLT HRS	46	6	7.67	
	10,000 FLT HRS	24	3	8.00	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	10,000 FLT HRS	24	3	8.00	* Schedule sample inspections between 6000 and 10,000 hours.
1/6 OR 17% OF FLEET	10,000 FLT HRS	78	10	7.80	
1/7 OR 14% OF FLEET	10,000 FLT HRS	105	14	7.50	
1/12 OR 8% OF FLEET	10,000 FLT HRS	69	9	7.62	

STOL SCHEDULED MAINTENANCE PROGRAM - CTOL 150.7600

CHECK	FREQ/HRS	M/HRS	NO. MEN	ELAPSED TIME/HRS	REMARKS
SERVICE CHECK	PREFLIGHT OR DAILY	0.5	2	.25	
A	45 FLT HRS	6	2	3.0	
C	850 FLT HRS	(245) 125 120	(31) 16 15	(7.91) 7.81 8.00	* Divide the "C" check into two visits of 8 hours each.
STRUCTURAL PROGRAM					
EXTERNAL (100% OF FLEET)					
	3500 FLT HRS	51	7	7.30	
	7000 FLT HRS	32	4	8.00	
	10,500 FLT HRS	28	4	7.00	
	14,000 FLT HRS	15	2	7.50	
INTERNAL *(FLEET SAMPLE)					
1/5 OR 20% OF FLEET	14,000 FLT HRS	15	2	7.50	* Schedule sample inspection between 10,000 and 14,000 hrs.
1/6 OR 17% OF FLEET	14,000 FLT HRS	47	6	7.85	
1/7 OR 14% OF FLEET	14,000 FLT HRS	64	8	8.00	
1/12 OR 8% OF FLEET	14,000 FLT HRS	43	6	7.15	

The "A" Check (walk around) is performed each 35 hours for each of the STOL and 45 hours for the CTOL. This check is a general visual inspection for for condition of the entire exterior/interior of the aircraft with spoilers, flaps, and slats and main landing gear door open. The interior aspect includes a visual inspection of the cockpit, cabin, galley, and cargo area.

The "C" Check (area check) is performed each 650 hours for each of the STOL and 850 for the CTOL and consists of a visual inspection of the entire aircraft by specific area and is made to locate discrepancies such as damage, leaks, hose connections, corrosion and abrasion which are visible without removal of equipment or access doors except those listed on the work cards. This inspection includes the interior of all equipment compartments and the engines with cowling door opened in addition to the flight controls, hydraulic systems and service panels. Control cables will be inspected at multiples of this inspection. Radiographic engine inspection will be accomplished on one of the engines.

Based upon a 100 percent improvement in the "A" and "C" Check frequencies on the DC-10-10 after 18 months of operation, a similar improvement in the STOL inspection frequencies is also anticipated after STOL has been in operation for a period of time.

The Structural Inspection Program is performed at the intervals indicated for each of the STOL configurations and consists of an "Internal and "External" inspection to assure the structural integrity of the airframe. One hundred percent of the fleet will receive an external inspection of those items of structure which are designated by the manufacturer to be significant. The external inspection also supports the internal sampling by providing some probability of the adjacent internal items condition.

The internal inspection of the structure provides structural integrity at an economical cost through fleet sampling. Only those items of internal structure designated by the manufacturer will be inspected. The size of the sampling is also established by the manufacturer and is determined by the significance of the item to be inspected, i.e., the more significant the item, based on fatigue, corrosion, crack propagation, redundancy, the larger the sample size.

All of the inspection frequencies were basically derived from the ratio between the STOL designed flight cycle and the designed flight cycle for the DC-10-10 with some conservatism being considered due to the complexity of the STOL systems. The CTOL is considered to be the same complexity as the DC-10, but the frequencies of inspection were increased slightly to account for the more frequent landing cycles.

The man-hours and number of men were derived basically from the ratio between the Manufacturer's Empty Weight (MEW) for each STOL configuration and the MEW for the DC-10-10. The only exception was the augmentor wing. Here the man-hours, except the Service Check, were increased 10 percent due to the anticipated complexity of the propulsive lift system, which will require additional time for inspecting and testing.

The Unscheduled Maintenance will consist primarily of removing, replacing or repairing those discrepancies discovered during flight or scheduled maintenance periods. The man-hours required for unscheduled maintenance will be kept to a minimum by the use of Built-In Test Equipment (BITE), and Flight Environment Fault Indication/Turnaround Fault Identification (FEFI/TAFI) which is a concept for fault identification and isolation and will isolate the problems to a Line Replaceable Unit (LRU) and then verify the repair after the failed LRU is removed and replaced by a known good spare. This concept of removal and replacement of LRU's will allow maximum aircraft availability and permit the shops to accomplish repair of the faulty LRU at a more convenient time.

The maintenance tasks for the STOL aircraft will be consistent with the airlines present organizational structure. The Service Check and "A" Check plus removal and replacement of LRU that cannot be deferred can be accomplished at any field that has turnaround capabilities. These maintenance functions can generally be accomplished by maintenance personnel of lower skill levels.

The "C" Checks, structural inspection program and replacement of deferred LRU will be accomplished at a maintenance base, which will have shop level capability and skilled mechanics.

The estimated direct maintenance cost, which includes both scheduled and unscheduled maintenance, was estimated as a part of the Direct Operating Costs (DOC) using the 1967 ATA formula, escalated to 1972 dollars and factored by 75 percent. The DOC's were provided to Economics Analysis for incorporation in their related evaluation. A graph of the Scheduled Maintenance Costs is included as Figure 5.3.1-1.

SCHEDULED MAINTENANCE COSTS

SYSTEM STUDY CONFIGURATIONS

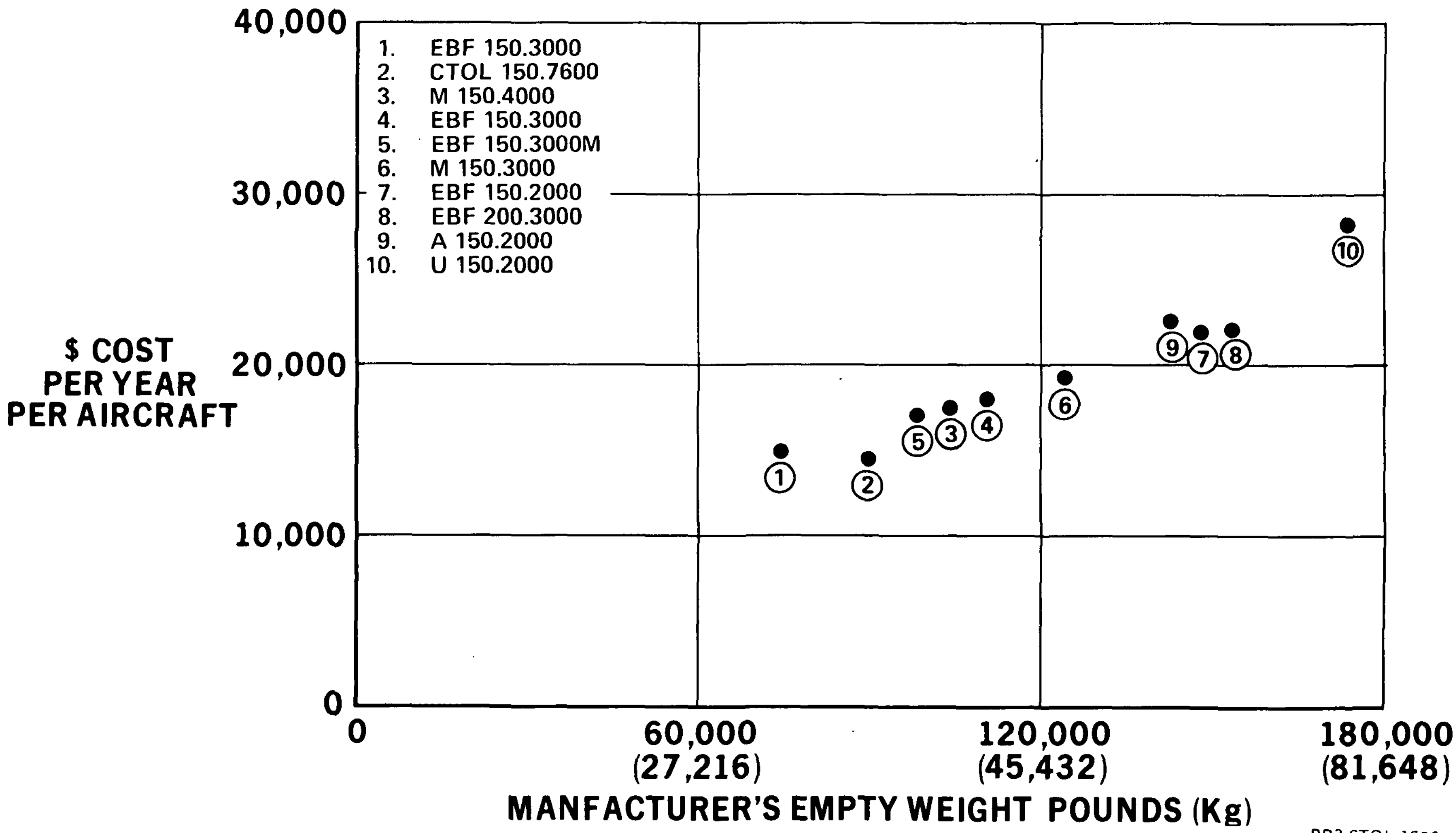


FIGURE 5.3.1-1

5.3.2 Maintenance Evaluation - Concepts and policies were established for operations, delay, cancellation, maintenance and aircraft substitutions. Analysis was performed for the Baseline EBF 150.3000 STOL aircraft operations in each region to measure the compatibility and productivity of the STOL aircraft compared with the results of the Airline Scheduling Group's pure schedule. The results of these analyses were applied to the baseline schedule and adjustments were made to reflect the maintenance requirements and are summarized in the expanded network results. The result of the operational maintenance concept of the baseline aircraft was assumed to be a standard, to be applied to the other aircraft (100 and 200 passenger) that were evaluated analytically by the Airline Scheduling Group.

5.3.2.1 Maintenance Basing Concepts

Schedule Maintenance - The maintenance schedules developed by the Product Support Group, described in the text above, established the bases for the analyses performed. Operation assumption included the following: (1) Turn-around station time at 20 minutes, (2) thru-stop station time at 15 minutes, (3) all stations have fueling capability, (4) periodic maintenance up to and including "A" checks at limited maintenance bases, (5) phased maintenance to include maintenance and structural checks, both external and internal and (6) maximum of one (1) hour for delay.

Unscheduled Maintenance - The assumption for unscheduled maintenance requires that two (2) percent of the departures will require unscheduled maintenance as follows:

Probability of Occurence	Out of Service Elapsed Time (Hours)
.015 P .02	1
.005 P .015	2
.001 P .005	4

The following Exhibit 5.3.2.1-1 present the results of the Airline Operations Simulation Model detailing various cases applied and the optimum configuration selected for the basing concepts. Included are: (1) location of the full and limited maintenance bases, (2) number of substitutions, (3) aircraft utilization, (4) percent of on-time departures, delay, substitutions and cancellation times, and (5) fleet size requirements.

Details of the baseline, test cases and the various replications performed are presented in the Appendix B.

Each regional tabulation includes a selection of an optimum maintenance base location(s) and placement of additional aircraft in the regional network. The additional aircraft are those added to the regional fleet developed in the original fleet scheduling program. It is necessary to expand the original fleet to allow for delays caused by scheduled and unscheduled maintenance.

The test cases and optimum configuration selected were based upon 100 hour airline operations simulation and each replication represented five runs of 100 hours each. Sensitivity analyses were performed of simulating operations up to 5000 hours with no significant changes compared with the 100 hour operation used in the study.

EXHIBIT 5.3.2.1-1
Page 1

MAINTENANCE CONCEPT ANALYSIS
EBF 150 . 3000
CHICAGO REGION
SUMMARY

CASE TYPE	CONFIGURATION				DEPARTURES			NO. FLTS CANCEL	NO. ACFT SWITCH	NO. DELAYS	DELAYS			BLOCK HOURS UTILIZATION
	FLEET SIZE	MAINT STAT	TYPE MAINT	ACFT ALLOC	SCHED	ACTUAL	%				DELAY HOURS	RATE %	FLT HOURS	HR/DAY/ACFT
BASE	35	MDW CPS DET	** * *	-- -- --	1408	1274	90.5	134	54	76	53.70	5.96	1140	7.81
#1	36	MDW CPS DET	** * *	1 -- --	1408	1295	91.9	113	47	67	39.10	5.17	1161	7.73
#2	38	MDW CPS DET	** * *	1 1 1	1408	1318	93.5	90	46	61	39.58	4.60	1176	7.43
#3	38	MDW CPS DET	** -- *	1 1 1	1408	1339	95.1	69	46	64	45.62	4.77	1194	7.53
#4	40	MDW CPS DET CGX DEN	** -- * -- --	1 1 1 1 1	1408	1374	97.5	34	53	64	38.45	4.60	1238	7.42
OPT (1)	38	MDW CPS DET CGX DEN	** * * -- --	1 -- -- 1 1	1408	1329	94.3	79	60	56	33.88	4.21	1203	7.59

** - Full Maintenance Base
* - Limited Maintenance Base
(1) - Selected Configuration

MAINTENANCE CONCEPT ANALYSIS
CHICAGO REGION
AIRPORT FLEET ALLOCATION
(start-of-day)

AIRPORT	NUMBER OF AIRCRAFT
MDW	10
MIC	3
CGX	9
CPS	4
BKL	2
DET	5
MKC	1
AGC	1
CVG	1
TOL	0
CMH	0
DSM	0
DAY	0
IND	0
ROC	0
BUF	0
OMA	0
MKE	0
DEN	2

MAINTENANCE CONCEPT ANALYSIS
EBF 150 . 3000
NORTHEAST REGION

CASE TYPE	CONFIGURATION: FLEET SIZE	MAINT STAT	TYPE MAINT	ACFT ALLOC	DEPARTURES: SCHED	ACTUAL	%	NO. FLTS CANCEL	ACFT SWITCH	DELAYS: NO. DELAYS	DELAY HOURS	RATE %	TOT FLT HOURS	BLOCK HOURS UTILIZATION HR/DAY/ACFT
BASE	52	HPN OWD DET DCA	** * * --	-- -- -- --	2152	1963	91.2	189	97	141	87.95	7.18	1654	7.63
#1	56	HPN OWD DET DCA	** * * --	1 1 1 1	2152	2012	93.5	140	98	121	78.83	6.01	1697	7.27
#2	57	HPN OWD DET DCA SEC	** * * * --	1 1 1 1 1	2152	2030	94.3	122	101	124	73.15	6.10	1708	7.19
#3	57	HPN OWD DET DCA SEC	** * * -- --	1 1 1 1 1	2152	2039	94.7	113	114	179	110.42	8.77	1719	7.23
#4	57	HPN OWD DET DCA SEC	** * * ** --	1 1 1 1 1	2152	2027	94.2	125	99	129	77.73	6.06	1708	7.19
#5	58	HPN OWD DET DCA SEC BED	** * * * -- --	1 1 1 1 1 1	2152	2090	97.1	62	90	121	70.92	5.74	1756	7.26

NORTHEAST REGION (CONT'D)

CASE TYPE	CONFIGURATION				DEPARTURES			NO. FLTS CANCEL	ACFT SWITCH	DELAYS			TOT FLT HOURS	BLOCK HOURS UTILIZATION HR/DAY/ACFT
	FLEET SIZE	MAINT STAT	TYPE MAINT	ACFT ALLOC	SCHED	ACTUAL	%			NO. DELAYS	DELAY HOURS	RATE %		
#6	55	HPN OWD DET	** * *	1 1 1	2152	2029	94.2	123	108	152	98.19	7.49	1711	7.46
OPT (1)	57	HPN OWD DET DCA BED	** * * * --	1 1 1 1 1	2152	2072	96.2	100	106	115	72.96	5.55	1728	7.26

** - Full Maintenance Base
* - Limited Maintenance Base
(1) - Selected Configuration

MAINTENANCE CONCEPT ANALYSIS

NORTHEAST REGION

AIRPORT FLEET ALLOCATION
(start-of-day)

E 150 3000

AIRPORT	NUMBER OF AIRCRAFT
BED	6
DCA	9
ISP	6
PNE	5
SEC	3
HPN	7
AGC	4
OWD	6
BUF	2
BKL	2
HFD	1
CMH	0
DET	5
ROC	0
ORF	0
CVG	1
SYR	0
PVD	0

MAINTENANCE CONCEPT ANALYSIS
EBF 150 . 3000
CALIFORNIA REGION

CASE TYPE	FLEET SIZE	CONFIGURATION MAINT STAT	CONFIGURATION TYPE MAINT	CONFIGURATION ACFT ALLOC	DEPARTURES SCHED	DEPARTURES ACTUAL	DEPARTURES %	NO. FLTS CANCEL	NO. ACFT SWITCH	DELAYS NO. DELAYS	DELAYS DELAY HOURS	DELAYS RATE %	TOT FLT HOURS	BLOCK HOURS UTILIZATION HR/DAY/ACFT
BASE	47	LAS	**	--	1840	1682	91.4	158	70	109	82.83	6.48	1500	7.63
		MYF	*	--										
		OAK	*	--										
#1	50	LAS	**	1	1840	1727	93.9	113	66	98	70.13	5.67	1510	7.24
		MYF	*	1										
		OAK	*	--										
		PHX	--	1										
#2	51	LAS	**	1	1840	1742	94.7	98	73	105	72.55	6.02	1550	7.29
		MYF	*	1										
		OAK	*	1										
		PHX	--	1										
#3	51	LAS	**	1	1840	1746	94.9	94	73	111	77.40	6.36	1544	7.26
		MYF	*	1										
		OAK	*	--										
		PHX	--	1										
		GPF	--	1										
#4	51	LAS	**	1	1840	1743	94.7	97	85	115	78.00	6.59	1541	7.25
		MYF	*	1										
		OAK	*	1										
		LGB	*	1										
OPT (1)	52	LAS	**	1	1840	1741	95.0	99	81	69	46.47	3.96	1548	7.18
		MYF	*	1										
		OAK	*	1										
		PHX	--	1										
		LGB	*	1										

** - Full Maintenance Base
* - Limited Maintenance Base
(1) - Selected Configuration

MAINTENANCE CONCEPT ANALYSIS
CALIFORNIA REGION

AIRPORT FLEET ALLOCATION
(start-of-day)

E 150 3000

AIRPORT	NUMBER OF AIRCRAFT
ABQ	1
DEN	1
LAS	7
RHV	3
SNA	0
GPF	2
MYF	6
VNY	4
EMT	3
OAK	4
SAC	1
PHX	6
SLC	3
LGB	4
MRT	0
PDX	1
ACV	0
TUS	1
MOF	3
RNO	1
FAT	1
SBA	0

MAINTENANCE CONCEPT ANALYSIS
EBF 150 . 3000
SOUTHEAST REGION

CASE TYPE	CONFIGURATION FLEET SIZE	MAINT STAT	TYPE MAINT	ACFT ALLOC	DEPARTURES SCHED	ACTUAL	%	NO. FLT CANCEL	NO. ACFT SWITCH	DELAYS NO. DELAYS	DELAY HOURS	RATE %	TOT FLT HOURS	BLOCK HOURS UTILIZATION HR/DAY/ACFT
BASE	54	PDK OPF DCA CPS DET	** * * * *	-- -- -- -- --	1808	1605	88.8	203	59	98	71.15	6.11	1757	7.80
#1	57	PDK OPF DCA CPS DET	** * * * *	1 1 1 -- --	1808	1676	92.7	132	67	106	80.82	6.33	1826	7.68
#2	59	PDK OPF DCA CPS DET CGX	** * * * *	1 1 1 -- 1 1	1808	1705	94.3	103	48	85	60.62	4.92	1867	7.59
OPT	58	PDK OPF DCA CPS DET CGX	** * * * * --	1 1 1 -- -- 1	1808	1757	97.2	51	50	88	62.60	5.01	1920	7.94

** - Full Maintenance Base
* - Limited Maintenance Base

MAINTENANCE CONCEPT ANALYSIS
SOUTHEAST REGION
AIRPORT FLEET ALLOCATION
(start-of-day)
E 150 3000

AIRPORT	NUMBER OF AIRCRAFT
AGC	1
PDK	10
BEL	1
FTY	9
ORF	0
OPF	5
JAX	0
SDF	2
MCO	0
BHM	0
BNA	0
CGX	5
BKL	2
DCA	5
GSD	1
CAE	1
CLT	3
ISP	2
CHS	0
PNE	0
SEC	1
CPS	3
NEW	0
CVG	1
RDU	2
GSO	1
DET	1
TYS	0
FLL	1
IND	0
RIC	0
SAV	0
TPA	1
PHF	0
MOB	0
JAN	0
TLH	0

MAINTENANCE CONCEPT ANALYSIS
EBF 150.3000
SOUTHERN REGION

CASE TYPE	FLEET SIZE	CONFIGURATION MAINT STAT	TYPE MAINT	ACFT ALLOC	DEPARTURES SCHED	ACTUAL	%	NO. FLTS CANCEL	NO. ACFT SWITCH	DELAYS NO. DELAYS	DELAY HOURS	RATE %	TOTAL FLT HOURS	BLOCK HOURS UTILIZATION HR/DAY/ACFT
BASE	21	DAL HOU CPS NEW	** * * *	-- -- -- --	986	865	87.7	121	36	56	39.33	6.47	845	9.65
#1	23	DAL HOU CPS NEW	** * * *	1 -- -- 1	986	901	91.3	85	45	69	42.18	7.65	893	9.31
#2	24	DAL HOU CPS NEW OKC	** * * * --	1 -- -- 1 1	986	902	91.5	84	41	55	39.18	6.10	892	8.91
#3	24	DAL HOU NEW OKC	** * * --	1 -- 1 1	986	925	93.9	61	45	69	42.13	7.46	914	9.13

** - Full Maintenance Base
* - Limited Maintenance Base
(1) - Selected Congiguration

MAINTENANCE CONCEPT ANALYSIS

SOUTHERN REGION

AIRPORT FLEET ALLOCATION

(start-of-day)

E 150 3000

AIRPORT	NUMBER OF AIRCRAFT
DAL	10
HOU	5
SAT	1
ELP	0
CPS	0
MKC	1
ABQ	1
DEN	1
ICT	0
OKC	1
NEW	3
GDS	1
SHV	0
TUL	0
MAF	0
AUS	0
AMG	0
CRP	0
LBB	0
LIT	0

MAINTENANCE CONCEPT ANALYSIS
EBF 150.3000
SOUTHERN REGION

CASE TYPE	FLEET SIZE	CONFIGURATION			DEPARTURES			NO. FLTS CANCEL	NO. ACFT SWITCH	DELAYS			TOTAL FLT HOURS	BLOCK HOURS UTILIZATION
		MAINT STAT	TYPE MAINT	ACFT ALLOC	SCHED	ACTUAL	%			NO. DELAYS	DELAY HOURS	RATE %		HR/DAY/ACFT
#4	24	DAL HOU CPS NEW	** * * *	1 -- -- 2	986	925	93.8	61	43	74	46.38	8.00	915	9.13
OPT (1)	24	DAL HOU CPS NEW	** * * *	1 1 -- 1	986	921	93.4	65	35	56	36.52	6.08	909	9.08

** - Full Maintenance Base
* - Limited Maintenance Base
(1) - Selected Configuration

MAINTENANCE CONCEPT ANALYSIS
EBF 150.3000
NORTHWEST REGION

CASE TYPE	FLEET SIZE	CONFIGURATION MAINT STAT	CONFIGURATION TYPE MAINT	CONFIGURATION ACFT ALLOC	DEPARTURES SCHED	DEPARTURES ACTUAL	DEPARTURES %	NO. FLTS CANCEL	ACFT SWITCH	DELAYS NO. DELAYS	DELAYS DELAY HOURS	DELAYS RATE %	TOTAL FLT HOURS	BLOCK HOURS UTILIZATION HR/DAY/ACFT
BASE	6	SEA OAK	** *	-- --	200	154	77.0	46	14	10	5.57	6.49	145	5.80
#1.	8	SEA OAK PDX	** * --	1 -- 1	200	186	92.9	.4	8	1	0.80	0.54	175	5.26
#2	8	SEA OAK PDX GEG	** * -- --	-- -- 1 1	200	188	94.1	12	12	6	3.33	3.18	177	5.31
OPT (1)	7	SEA OAK PDX	** * --	-- -- 1	200	180	90.0	20	13	9	5.0	5.0	171	5.86

** - Full Maintenance Base

* - Limited Maintenance Base

(1)- Selected Configuration

MAINTENANCE CONCEPT ANALYSIS

NORTHWEST REGION
AIRPORT FLEET ALLOCATION
(start-of-day)

E 150 3000

AIRPORT	NUMBER OF AIRCRAFT
BOI	1
OAK	1
SEA	2
PDX	3
GEG	0
EUG	0
RNO	0

MAINTENANCE CONCEPT ANALYSIS
CTOL 150 PASSENGER AIRCRAFT
CHICAGO REGION

CASE TYPE	FLEET SIZE	CONFIGURATION MAINT STAT	CONFIGURATION TYPE MAINT	CONFIGURATION ACFT ALLOC	DEPARTURES SCHED	DEPARTURES ACTUAL	DEPARTURES %	NO. FLTS CANCEL	NO. ACFT SWITCH	DELAYS NO. DELAYS	DELAYS DELAY HOURS	DELAYS RATE %	TOTAL FLT HOURS	BLOCK HOURS UTILIZATION HR/DAY/ACFT
BASE	10	ORD DTW STL	** * *	-- -- --	388	321	82.8	67	12	40	29.73	12.47	305	7.31
#1	11	ORD DTW STL	** * *	1 -- --	388	351	90.5	37	9	28	20.92	7.97	329	7.17
#2	12	ORD DTW STL	** * *	1 1 --	388	347	89.4	41	13	27	19.92	7.78	325	6.50
#3	13	ORD DTW STL MSP	** * * --	1 1 -- 1	388	334	86.1	54	16	36	26.17	10.78	314	5.81
OPT (1)	12	ORD DTW STL MSP	** * * --	1 -- -- 1	388	373	96.2	15	9	23	16.65	6.17	353	7.05

** - Full Maintenance Base
* - Limited Maintenance Base
(1) - Selected Configuration

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION
AIRPORT FLEET ALLOCATION
(start-of-day)

CTOL 150 7600

AIRPORT	NUMBER OF AIRCRAFT
CLE	1
ORD	3
CMH	1
CVG	1
DTW	1
IND	1
STL	0
MKC	2
MSP	2
PIT	0

5.3.3 Operational Maintenance Costs - The ground support and overhaul equipment requirements were based upon the EBF 150.3000 aircraft. The estimated cost of the required equipment is itemized by ATA chapters as shown in Exhibit 5.3.3-1, detailed into costs per Main base (full maintenance) and per Turnaround Station. The costs for a Limited Base (Limited maintenance) will approximate those for a Turnaround Station. The peculiar and common equipment list is based upon the simulated airline aircraft operating out of a jet airport that has aircraft of similar or larger size also operating out of the same airport. Thus commingling of assets will be possible and the cost of equipment can be estimated. The Exhibit 5.3.3-1 also reflects the costs for engine overhaul and shop equipment required to overhaul avionics, instruments, electrical, and other aircraft components.

GROUND SUPPORT EQUIPMENT COST - EBF 150.3000
(A FLEET OF 35-55 AIRCRAFT)

ATA Chapter	Subject	Main Base Peculiar	Main Base Common	Main Base Total	Turnaround Station Peculiar	Turnaround Station Common	Turnaround Station Total
7	Lifting	$ 76,000	$ 16,000	$ 92,000	$ 2,000	$ 2,000	$ 4,000
8	Leveling & Weighing	--	78,000	78,000	--	--	--
9	Towing	6,600	75,000	81,600	2,200	25,000	27,200
10	Parking & Mooring	18,850	--	18,850	584	--	584
12	Servicing	--	10,180	10,180	--	3,342	3,342
20	Airframe	--	10,500	10,500	--	--	--
21	Air Conditioning	--	150	150	--	--	--
24	Electrical Power	40,050	--	40,050	--	--	--
25	Equipment & Furnishings	800	630	1,430	--	--	--
26	Fire Protection	200	--	200	--	--	--
27	Flight Controls	45,425	--	45,425	--	--	--
28	Fuel	1,350	--	1,350	200	--	200
29	Hydraulics	1,635	62,150	63,785	--	--	--
30	Windshield	8,000	--	8,000	--	--	--
31	Instrumentation	5,300	3,300	8,600	--	--	--
32	Landing Gear	36,955	4,700	41,655	1,722	--	1,722
36	Pneumatic	3,500	2,410	5,910	--	--	--
49	APU	10,135	--	10,135	--	--	--
51	Structures	304,875	92,200	397,075	101	16,796	16,897
52	Doors	1,695	--	1,695	--	--	--
53	Fuselage	3,000	--	3,000	--	--	--

ATA Chapter	Subject	Main Base			Turnaround Station		
		Peculiar	Common	Total	Peculiar	Common	Total
56	Windows	$ 10,430	$ --	$ 10,430	$ --	$ --	$ --
57	Wings	2,125	315	2,440	--	--	--
71	Power Plants	295,660	--	295,660	650	--	650
76	Engine Controls	250	--	250	--	--	--
78	Exhaust	3,640	--	3,640	--	--	--
80	Air Starters	--	60,000	60,000	--	11,368	11,368
	TOTAL	$876,475	$415,535	$1,292,010	$ 7,457	$ 58,506	$ 65,963

Maintenance
Engine Overhaul

Tools and Equipment	$ 255,000
Engine Test Cell	750,000
Total	$1,005,000

Maintenance
Shop Equipment

Nondestructive Test Equip.	$ 5,700
Avionics/Instrument	500,000
Electronic Shop	
CSD & Generator	125,000
Air Driven Tunnel	75,000
Digital Test Equip.	28,000
Total	$733,700

Through Stop Station

Peculiar	Common	Total
$ 5,500	$19,200	$24,700

5.3.3.1 Estimate of Basic Costs for Airport Elements - Analysis of airport costs related to a simulated airline operation were performed for each region as a functional portion of total systems costs. The application of these costs is described in Section V, Economics. The elements of the costs applied in estimating the associated airport operational costs include the Ground Support Equipment requirements from the preceding section. The estimated cost details applied for Ground Handling Equipment are delineated in Section III, Airports.

For STOL operations on air carrier airports it was assumed that the parent airline would also be operating at the site and only peculiar STOL Ground Support Equipment would be required and only those costs have been assessed to the simulated airline. For limited maintenance bases on airports providing STOL service to other regions it was assumed that the Ground Handling Equipment could be co-shared. The costs for full maintenance base hangars were estimated at $20 per square foot with a capacity for nine (9) STOL aircraft which would provide for future growth as well as for intra-regional interface. The limited maintenance bases were costed at the same rate, but with capacity requirements for five (5) STOL aircraft. Exhibits 5.3.3.1-1 through 5.3.3.1-6 summarize the operational maintenance facilities cost for each simulated airline operating in the study regions.

EXHIBIT 5.3.3.1-1
SIMULATED AIRLINE
OPERATIONAL AIRPORT COSTS
CHICAGO REGION

OPERATIONAL REQUIREMENTS	ESTIMATED COSTS (1)
Ground Support Equipment (GSE) costs for 19 airports, one (1) full maintenance base and two (2) limited maintenance bases.	$1,268,000
Ground Handling Equipment (GHE) costs for 48 gates for the 19 airports.	$2,704,000
Hangar costs for one (1) full maintenance base and two (2) limited maintenance bases.	$7,600,000
Maintenance and overhaul shop costs at the full maintenance base.	$2,000,000
Shop Equipment Costs	$ 734,000
Engine test cell cost at the full maintenance base.	$ 750,000
Engine test cell tools and equipment.	$ 255,000

(1) 1972 Dollars

EXHIBIT 5.3.3.1-2
SIMULATED AIRLINE
OPERATIONAL AIRPORT COSTS
NORTHEAST REGION

OPERATIONAL REQUIREMENTS	ESTIMATED COSTS (1)
Ground Support Equipment (GSE) costs for one (1) full maintenance base and three (3) limited maintenance bases.	$1,550,369
Ground Handling Equipment (GHE) costs for 66 gates for the 18 airports.	$3,616,000
Hangar costs for one (1) full maintenance base and two (2) limited maintenance bases. The cost for third limited base, Detroit City has been accounted for in the Chicago region.	$7,600,000
Maintenance and overhaul shop costs at the full maintenance base.	$2,000,000
Shop equipment costs	$ 734,000
Engine test cell costs at the full maintenance base	$ 750,000
Engine test cell tests and equipment	$ 255,000

(1) 1972 Dollars

EXHIBIT 5.3.3.1-3

SIMULATED AIRLINE

OPERATIONAL AIRPORT COSTS

CALFIORNIA REGION

OPERATIONAL REQUIREMENTS	ESTIMATED COSTS (1)
Ground Support Equipment (GSE) costs for the 22 airports and one (1) full maintenace base and three (3) limited maintenance bases.	$1,530,948
Ground Handling Equipment (GHE) costs for 73 gates for the 22 airports.	$3,767,000
Hangar costs for one (1) full maintenance base and three (3) limited maintenance bases.	$9,600,000
Maintenance and overhaul shop costs at full maintenance base.	$2,000,000
Shop equipment costs	$ 734,000
Engine test cell costs at the full maintenance base.	$ 750,000
Engine test cell tests and equipment	$ 255,000

(1) 1972 Dollars

EXHIBIT 5.3.3.1-4

SIMULATED AIRLINE

OPERATIONAL AIRPORT COSTS

SOUTHEAST REGION

OPERATIONAL REQUIREMENTS	ESTIMATED COSTS (1)
Ground Support Equipment (GSE) costs for the 37 airports and one (1) full maintenance base and four (4) limited maintenance bases.	$1,927,876
Ground Handling Equipment (GHE) costs for 85 gates for the 37 airports	$4,850,000
Hangar costs for one (1) full maintenance base and two (2) limited maintenance bases. The costs for two additional limited maintenance bases are accounted for in the Chicago and Northeast Regions.	$7,600,000
Maintenance and overhaul shop costs at full maintenance base	$2,000,000
Shop equipment costs	$ 734,000
Engine test cell costs at the full maintenance base	$ 750,000
Engine test cell tools and equipment	$ 255,000

(1) 1972 Dollars

EXHIBIT 5.3.3.1-5

SIMULATED AIRLINE

OPERATIONAL AIRPORT COSTS

SOUTHERN REGION

OPERATIONAL REQUIREMENTS	ESTIMATED COSTS (1)
Ground Support Equipment (GSE) costs for the 20 airports and one (1) full maintenance base and three (3) limited maintenance bases.	$1,282,010
Ground Handling Equipment (GHE) costs for 45 gates for the 20 airports	$2,142,000
Hangar costs for one (1) full maintenance base and three (3) limited maintenance bases	$9,600,000
Maintenance and overhaul shop costs at full maintenance base	$2,000,000
Shop equipment costs	$ 734,000
Engine test cell costs at the full maintenance base	$ 750,000
Engine test cell tests and equipment	$ 255,000

(1) 1972 Dollars

EXHIBIT 5.3.3.1-6
SIMULATED AIRLINE
OPERATIONAL AIRPORT COSTS
NORTHWEST REGION

OPERATIONAL REQUIREMENTS	ESTIMATED COSTS (1)
Ground Support Equipment (GSE) costs for the 7 airports and one (1) full maintenance base and one (1) limited maintenance base.	$ 928,674
Ground Handling Equipment (GHE) costs for 12 gates for the 7 airports.	$ 764,600
Hangar costs for one (1) full maintenance base. The limited maintenance base is accounted for in the California Region.	$1,800,000
Maintenance and overhaul shop costs at full maintenance base.	$2,000,000
Shop equipment costs	$ 734,000
Engine test cell costs at the full maintenance base	$ 750,000
Engine test cell tests and equipment	$ 255,000

(1) 1972 Dollars

5.3.4 Passenger, Baggage and Other Payload Handling Techniques. -

AIRPORT PASSENGER HANDLING

The activities carried out at an airport in a single day can be categorized into several hundred separate areas; but, the real function of an airport is the bringing together and servicing of aircraft and passenger (or cargo). If this action does not take place, or takes place only after delay and inconvenience, the airport's function has been seriously impared. The growth and complexity of today's jetports, mainly brought about by the increased number of passengers, has caused intra-airport transport and handling to become of major concern to airport operators and airlines. The advent of the wide-bodied jet, with its huge carrying capability has further emphasized the need to process the passenger from the time of airport arrival to the time of aircraft boarding (or from deboarding to airport exit) as quickly and as efficiently as possible. A further complication exists in that each airport (and more often than not, each airline or terminal) has its own problems which cannot always be resolved by applying a generally-accepted or proven system. Therefore equipment and systems to better process the passenger through all areas of the airport are being developed at an increasing rate, while existing systems are continually being modified.

A review of what is being done to enhance passenger movement within the airport and what can be accomplished in the future, provides an overall look at the passenger handling situation.

PASSENGER TRANSIT SYSTEMS

Sponsors and airlines are now concentrating a three-pronged attack on reducing the distance a passenger must walk when at the airport. One, mainly concerning the originating or final destination passenger, is to and from the parking area and terminal; another, mainly concerning the interconnecting passenger, is from terminal to terminal; the third, concerning all passengers, is within the terminal itself.

The problem of excessive distance is emphasized at airports such as Chicago's O'Hare, Los Angeles' International and New York's JFK, where passengers may have to walk over a mile. Once at the terminal in Chicago or Atlanta, for example, a passenger may still have to trudge an additional 1,700 feet before reaching the boarding gate. There are all too many examples of passenger frustration in connection with airport parking, particularly if one departs on one airline and returns on another.

Now that these problems have been magnified by the numbers of passengers using the airports, new complexes, such as Kansas City International, Seattle-Tacoma, Tampa, Houston and Dallas/Ft. Worth have designed-in facilities or systems with the idea of keeping walking distances to a minimum. Other airports, with modernization plans further off, are making provisions for transit systems that will use, in part, the experience gained by observing the operations of existing systems. Most of these airports Newark, Pittsburgh, New Orleans, Palmdale, Oakland, just to name a few, are hoping to link the intra-airport system with a rapid transit system that connects with the city center. Existing airports often find it difficult or prohibitively costly to redesign built-in passenger handling deficiencies, but even here a full-scale attempt is being mustered to circumvent the problems or at least to alleviate it.

Several of the nation's large hub airports are including rapid transit systems between airport and city center in future improvement plans. (Cleveland Hopkins International has this country's only direct link from airport to downtown area.) If these systems become a reality, additional intra-airport transit systems will be needed to convey passengers from station to a terminal, boarding area, or to a point where transportation within the airport exists. Included in this group are Boston, Kennedy, Los Angeles, New Orleans, Oakland and Palmdale.

Use of the bus for transfer of passengers from remote parking lots, or off-airport parking, has the advantage of providing a comparatively simple way of reaching the terminal proper with baggage and without car. The interconnecting traveler, without auto and often without baggage, is not anchored to an area. His chief concern is time. The originating passenger, with auto and baggage, is tied to the area in which he must park. His chief concern is distance. Checking his baggage curbside at the terminal before parking, does little good since he must return to park his car. Free parking lot to terminal bus service enables the arriving passenger to park his car in the less expensive long-term lot, board a shuttle with baggage, and be transported to his terminal . . . making his first trip to the terminal his only one. As more automated transit systems come into being and are linked with the remote parking areas, the bus will be less desirable. However because installation and wide-spread use of these systems at large airports is still several years in the future, the use of buses for this purpose will in all probability gain in popularity before waning. Use at smaller airports should continue at increased levels through the decade.

Less prominent use of the bus, at least in the U.S., is for transporting passengers to and from the terminal and remotely parked aircraft. Instead of elaborate terminal boarding areas and loading bridges necessary when an aircraft is brought to the terminal, advocates of this method propose the use of a bus to transport passengers to the airplane. This has been successful in Europe. Buses for this purpose usually fall into three categories. For light aircraft loads, a mini-bus is used. Usually a rather austere conveyance, its saving grace is that the duration of the trip and the number of fellow passengers is at a minimum. For larger aircraft a single high capacity bus (up to 130 passengers seated and standing) may be used, or for greater loads, several units coupled in tandum to a powered unit enables one driver to handle over 150 passengers. There are several various models of buses manufactured for this purpose affording varying degrees of comfort. Some could be termed luxurious. While these vehicles have their place; indeed at some airports and in some circumstances, it would be hard to imagine a more convenient and adequate service within the bounds of economics, they all have in common the necessity for the passenger to deboard the bus once at the aircraft only to board the aircraft. This extra step, or two, and the possibility of being exposed to the elements, apparently have caused service-oriented, time-conscience airlines to lean to new systems that provide linkage directly with the aircraft door. These systems, in the form of mobile lounges and more recently, bus transporters/passenger loaders are described in the following section.

PASSENGER LOADING SYSTEMS

While there is only one airport in the United States, Dulles International, that extensively employs the mobile lounge concept to ferry passengers between the airport terminal and aircraft parked on the apron for loading and unloading, there are indications that this system is gaining more favor. There are several obvious benefits with off-terminal loading including the elimination of expensive terminal boarding gate facilities and expensive construction in an already congested terminal area. For the passenger it can mean the elimination of waiting on the apron for a particular airline gate to become available. The cumbersome task of parking aircraft adjacent to the terminal no longer exists. An added degree of flexibility is attained by the ability to park the aircraft at a remote location, such as the cargo area, and have the mobile lounge come to the aircraft. At airports whose terminal expansion possibilities are limited, it may provide the only alternative.

Tending to counteract these features are several factors, the key among them being cost. Over a multi-year period, the cost of purchasing, maintaining and replacing the mobile lounges is far greater compared to the construction and maintenance cost of the terminal on a comparatively same utilization basis. The mobile lounge vs. fixed gate facility comparison fares better when an airport is specifically designed for the remote aircraft loading. At existing airports, remote aircraft loading places the aircraft out of reach of fixed servicing facilities that may be located at terminal gates, such as fuel, auxiliary power, interior cleansing equipment, etc., thus creating more use of and need for mobile ground support equipment. Distance from the terminal also can add to the problem of baggage handling and service area lighting.

Excepting Dulles International the newly-constructed airports have not been designed around the mobile lounge concept. Practically all airports being build or in the planning stage, are of the main terminal(s)/satellite terminal type. Passenger connection between the main terminal where passengers are processed and the satellite or cluster where passengers are boarded is by the now common enclosed elevated fingers (some equipped with moving sidewalks) or by automated shuttle systems (both underground and overhead to the apron).

This is not to say that the mobile lounge concept is in disfavor, only that present thinking, at least at major airports, has apparently turned to the use of gate-arrival design or terminal-to-satellite transit systems as the expedient answer to passenger boarding and deboarding. For future airport design much will depend on how effective such concepts and shuttle systems prove in actual operation. On the other hand, use of the mobile lounge at Dulles has proved satisfactory and more airlines are experimenting with its use at other airports. Favorable results will certainly effect long range thinking on the part of both the airlines and airport sponsors. Over the next several years increased use of the mobile lounge is foreseen; however only as an adjunct to the present forms of passenger loading.

AIRPORT BAGGAGE HANDLING

The problem of airport baggage handling is one of excessiveness for both the passenger and the airline and results in too much loss, too much damage, and too much time. For the passenger a lost or delayed bag represents inconvenience at best and at the worst, negates the purpose of the trip. A damaged bag or a claim area wait of some 30 minutes produces a frustrated passenger, hostile to the airline he had selected to fly. For the airlines, a lost or damaged bag represents money in the form of payments on claims. Non-rapid movement of baggage from aircraft to claim area represents lost aircraft turnaround time, vital to economical scheduling.

In 1969, five airlines alone (American, Eastern, Pan American, TWA and United) paid out over $15.5 million in lost/damage baggage claims. At large hub airports airlines are not making their aircraft turnaround schedules about 20 percent of the time, due mainly to baggage handling delay.

Baggage volume has increased about 300 percent over the last ten years and some forecast an increase of another 300 percent by 1980. Even projections on the conservative side show upwards of a doubling of the present volume. A study by McDonnell Douglas Corporation showed that at Los Angeles International in order to satisfy both airline and passenger demands, baggage systems should have handled about 11,000 pieces an hour in 1970 and predicted that it would fall short about 2,750 pieces per hour. The airport should process, according to the study, 19,500 bags per hour by 1975 and 32,500 by 1980 in order to adequately keep up with the requirements. It projects that unless capability is increased, requirements will exceed capacity by 150 percent in 1980. Although these figures may be dramatic when compared to similar statistics at a medium hub carrier airport, they can logically serve to point out the ever increasing baggage demands across-the-board.

Improved baggage processing may be the desire of the passenger, but it is the necessity of the airline.

5.4 Air Traffic Control

5.4.1 En Route Air Traffic Control - An examination of the FAA's National Airspace System Plan for 1973/82 shows that the planned growth capacity for enroute and terminal ATC will permit a 33% increase in air carrier operations and a 200% increase in general aviation operations during the next decade. Additional facilities and equipment specifically for STOL enroute ATC are therefore not considered necessary in this time period and the present systems and those planned for future installation are considered adequate to meet the anticipated additional traffic.

The existing and planned long-range radars and communications equipment providing surveillance and separation control are part of the FAA's nationwide Air Route Traffic Control Centers (ARTCC) for monitoring the enroute movement of aircraft. These ARTCC can also provide enroute air traffic control for STOL aircraft because they enable 100% radar coverage to be maintained within the urban areas that the STOL city-pairs are planned to operate. The procedural impact of STOL aircraft operations on the enroute ATC is being examined by the FAA in order to achieve a smooth intermingling of the STOL aircraft with CTOL movements. STOL aircraft operating enroute will have a cruise speed of 0.68 Mach at 20,000 feet altitude and FAA procedures are required to handle the problems of relative speeds (with CTOL aircraft), separation, overtaking and vertical and horizontal spacing within assigned corridors. It is anticipated that an additional air traffic controller will be required at each ARTCC in the city pair control areas to take care of the special procedures the FAA may develop for STOL aircraft enroute monitoring and control.

5.4.1.2 High Altitude Routes. Using Area Navigation (R-NAV) in the en route area, R-NAV's greatest advantage is in the ability to fly direct routes between city-pairs and to provide multiple lanes for busy STOL and CTOL trunk routes. In order to exercise proper control over the en route corridors the FAA is considering mandatory requirements for the carriage of R-NAV equipment in Positive Control Airspace. Eventual lowering of the floor of Positive Control Airspace to 14,500 feet by the 1980/85 time period is under study by the FAA.

The STOL aircraft mission profile predicates en route flight above 18,000 feet for 70% of average flight time between city-pairs. It is possible therefore that area navigation equipment will be a mandatory requirement for STOL in 1980/85 in order to fly the planned mission profile in the en route airspace.

5.4.2 ATC/Aircraft Compatibility Evaluation

5.4.2.1 The Air Traffic Control Environment for STOL Aircraft

The Air Traffic Control System environment in which the STOL aircraft will be operating in the 1980/85 time period (both en-route and terminal), will be an upgraded Third Generation Phase II system. Table 5.4.2.1-1 shows the basic third generation system now being deployed followed by the Phase I and Phase II upgraded systems scheduled for deployment in the years 1976 - 1982. Table 5.4.2.1-2 gives in greater detail the generation of ATC systems scheduled for future deployment. The Phase II configuration will include Metering and Spacing Automation, Intermittent Positive Control (IPC), ATC Data Link Services, Discrete Address Beacon System (DABS), the application of Area Navigation to ATC and the Microwave Landing Guidance System (MLS). The role of automation in both ATC and the delivery of flight services will be greatly expanded to assure system safety while increasing both airport and control system capacities.

The overall system configuration is illustrated in Figure 5.4.2.1-1 shows the integration of available airspace with the various types of Air Traffic Control and Flight Service Stations, air/ground sites for surveillance, data link, and voice radio communications, and the navaids used to provide en-route, terminal, landing and airport surface guidance. Typical on-line control and control support positions are shown for representative ATC facilities. The major groups of subsystems comprising the Upgraded Third Generation ATC are:

Surveillance and Air-Ground Communications.

Ground - Ground Communications.

TABLE 5.4.2.1-1

AIR TRAFFIC CONTROL SYSTEM DEPLOYMENT

SYSTEM \ DATE	FY 72-73	FY 74-75	FY 76-78	FY 78-82
THIRD GENERATION	Deploy, shake down, and commission NAS Stage A and ARTS III			
UPGRADED 3rd - PHASE I	Develop and test Phase I, ATC capabilities	Start deployment of Phase I capabilities	Complete deployment of Phase I capabilities	
UPGRADED 3rd - PHASE II	Develop and test new subsystems (DABS, MLS); Develop ATC and IPC automation capabilities		Test bed experimentation with Phase II automation	Start deployment of Phase II capabilities

TABLE 5.4.2.1-2

ATC SYSTEM GENERATIONS*

SYSTEM \ GENERATION	THIRD	UPGRADED THIRD PHASE I	UPGRADED THIRD PHASE II
DEPLOYMENT YEARS	1971-1975	1976-1978	1979-1985
NAVIGATION & LANDING SYSTEMS			
AIRBORNE	POINT-TO-POINT PLUS SOME AREA NAVIGATION	MORE AREA NAVIGATION APPLICATIONS	SAME
GROUND STATIONS	VOR/DME/TACAN PLUS MORE ACCUR-ATE VOR	SAME	OPTIONS INCLUDE WIDE AREA MLS, PVOR, OR HIGHER CAPACITY DME (PRESENT OR ONE-WAY)
LANDING AND TERMINAL	VHF/ILS PLUS LIM-ITED CATEGORY II AND III PLUS INTERIM V/STOL	SAME PLUS INITIAL MLS	INCREASED NUMBERS OF MLS RUNWAYS
AIRPORTS			
RUNWAY OPERATIONS	PARALLEL ILS (5000 FT/1524M)	DUAL LANE RUNWAYS	PRECISION MLS APPROACHES TO CLOSED-SPACED PAR-ALLEL RUNWAYS (2500 FT/762M)
GROUND GUIDANCE AND CONTROL	INITIAL AUTOMATED AIRPORT GROUND TRAFFIC CONTROL (AGTC)	IMPROVED AUTOMATED AGTC	COMPREHENSIVE AUTO-MATED AGTC
SURVEILLANCE			
MAIN SURVEILLANCE	BEACON (4096 CODE FOR ALTITUDE AND IDENTITY)	SAME	DISCRETE ADDRESS BEACON SYSTEM (DABS) INTRODUCED
BACKUP SURVEILLANCE	RADAR	SAME	SAME
AIR-GROUND COMMUNICATIONS			
MAIN COMMUNICATIONS	VHF/UHF VOICE	SAME	DABS DATA LINK AND VHF/UHF VOICE
BACKUP COMMUNICA-TIONS			
GROUND	BACKUP EMERGENCY COMMUNICATIONS (BUEC)	SAME	SAME
AIRBORNE	EMERGENCY BEACON CODE	SAME	UHF/VHF VOICE
DATA PROCESSING AND CONTROL			
FLOW CONTROL	CENTRALIZED-MANUAL	CENTRALIZED-AUTOMATED	CENTRALIZED-AUTOMATED
CLEARANCE PROCESSING	SIMPLIFIED MANUAL PROCEDURE	AUTOMATIC COORDINA-TION AND GENERATION	AUTOMATIC DELIVERY VIA OPTIONAL DATA LINK
SEPARATION & SEQUENCING	AUTOMATED AIDS TO CONTROLLER	AUTOMATED CONFLICT DETECTION & RESOLUTION	AUTOMATIC SAFETY COMMANDS VIA DATA LINK: IPC TO VFR ATC TO IFR
METERING & SPACING (PRECISE TIME SCHEDULING)	MANUAL, WHEN PERFORMED	AUTOMATED-VOICE CONTROL	AUTOMATED - DATA LINK CONTROL

ATC SYSTEM GENERATIONS (Continued)*

GENERATION / SYSTEM	THIRD	UPGRADED THIRD	
		PHASE I	PHASE II
DEPLOYMENT YEARS	1971-1975	1976-1978	1979-1985
GROUND-GROUND COMMUNICATIONS	AUTOMATED LINE AND MESSAGE SWITCHING	SAME	SAME
INTRAFACILITY	VIA CONTROLLER DISPLAY OR VOICE	SAME	SAME
INTERFACILITY	DIGITAL + VOICE	SAME	SAME
OCEANIC NAV & ATC			
SURVEILLANCE	PILOT REPORTS - VOICE	SAME PLUS SOME AUTOMATIC REPORTS	AUTOMATIC REPORTS VIA DATA LINK/ SATELLITE SURVEILLANCE
COMMUNICATIONS	HF VOICE (NON-ATC) PLUS SOME DEDICATED VHF	SAME	SAME PLUS "L" BAND DATA LINK AND VOICE VIA SATELLITE
CONTROL	MANUAL-SOME COMPUTER AIDS	MORE COMPUTER AIDS TO CONTROLLER	SAME
NAVIGATION	INERTIAL PLUS LORAN/OMEGA	SAME	SAME
FLIGHT SERVICES	MANUAL - RECONFIGURED	AUTOMATED AIDS TO FSS SPECIALISTS	PILOT SELF-SERVICE AUTOMATION (FLIGHT PLAN FILING & BRIEFING)

* Source: FAA-ED-01-1A
Upgraded Third Generation
ATC System.
MITRE Corp. MTR-6152, Rev. 1

UPGRADED THIRD GENERATION CONUS ATC FINAL BASELINE SYSTEM *

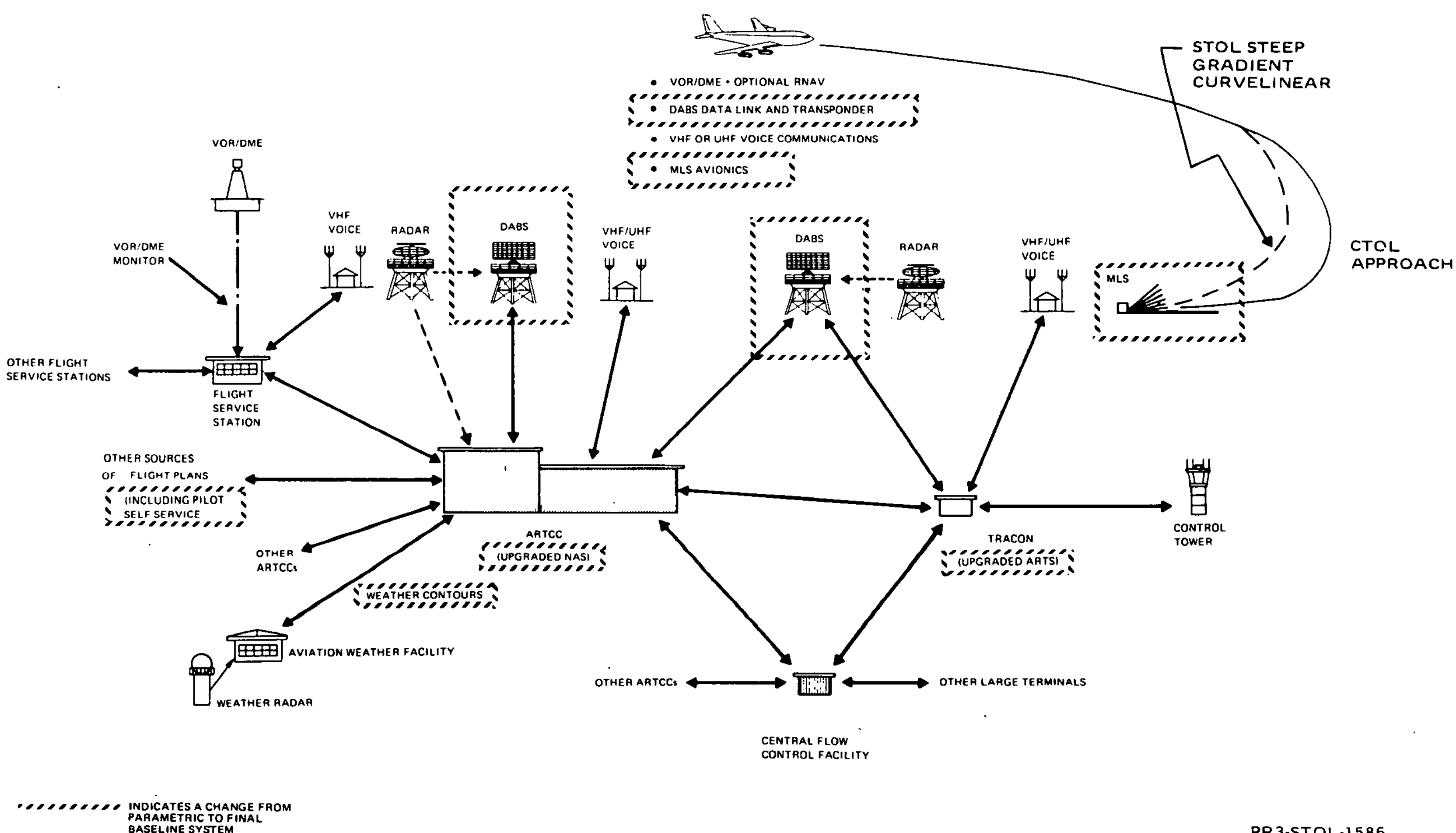


FIGURE 5.4.2.1-1

* Source: FAA-ED-01-1A
Upgraded Third Generation
ATC System
MITRE Corp. MTR-6152, Rev. 1

Traffic Control and Coordination.
Flight Plan Entry and Data Processing.
Flight Services System.

The concepts for assuring reliability of service and safety of STOL flight within the ATC system are presented below.

5.4.2.2 Surveillance and Air-Ground Communication

The prime link with STOL and CTOL aircraft for essential air-ground digital data communications and position determination will be provided by the DABS-ATC system as follows:

A DABS site can serve several ATC facilities. Inputs from several DABS sites can be accepted by a single ATC facility. Radar correlation will be performed by the DABS site processor, where required or in larger terminal areas where procedural solutions to transponder failures are inadequate to maintain safety, or where the risk of unauthorized penetration by non-beacon intruders is high.

Micro-wave Landing System derived 3-space position data which is reported via the DABS down-link during precision approaches will be correlated and confidence checked against DABS derived slant range and mode C altitude reports.

DABS data link may be used to provide clearance and advisory services to equipped STOL and CTOL users. The FAA will define message type formats, priorities, aircraft address assignments and other procedures related to all ATC applications of the data link.

5.4.2.3

Ground-Ground Communications

The present system will be improved to meet the requirements of the upgraded Third Generation ATC system as follows:

VHF/UHF air-ground voice channels with remote control from both ATC and FSS positions. Teletype networks for the collection and distribution of weather data and flight movements data with networks having computer store-and-foreward and/or network switching and high speed transfer capabilities. Dedicated computer-to-computer and to remote terminal lines for the entry and forwarding of digitized flight plans and flight control data. Dedicated radar site to ATC facility land-lines and microwave links for transfer of digitized and broad-band radar/beacon data.

Modernization of the Flight Services System will facilitate the transmittal of flight plans from various sources to their point of entry into the automated ATC system. The teletype networks and terminals will be reconfigured and the data rates increased to handle the forecast demand for flight movements data, changing network traffic (additional flow control data) and the need to efficiently accommodate on-line computers.

Electronic circuit switching systems are being developed to implement a nation-wide switched aviation voice communications network that will also carry digital data. The system will provide local and long distance communications for both the air traffic control and administrative functions and for primary air/ground radio for ATC. It is planned that this capability will be expanded to provide automatic control of the nation-wide voice network in which failed lines are removed from service and maintenance personnel are automatically notified. The traffic discipline of the entire network will be managed on a real-time basis.

5.4.2.4- Traffic Control and Coordination

The workload associated with real-time traffic control and coordination will be off loaded onto the automated system whenever operationally desirable and technically feasible. Routine STOL and CTOL ATC clearances and real-time control commands will be generated automatically and relayed to the aircraft via data link. The traffic controller increasingly will become a manager and a monitor of the automatic planning and control process with his attention directed toward monitoring the displayed air traffic situation and planning data and to interacting with the automated system. The automated control system is made up of data entry and display systems which interface the controllers with the network of computer systems to process and exchange data automatically on controller request. Transfer of control procedures for STOL aircraft will be routinely handled via the display system in Third Generation automation.

Existing facility communications networks for voice and digital data are in process of being upgraded to meet the requirement of the Upgraded Third Generation ATC System.

5.4.2.5- Flight Plan Entry and Data Processing

The processing and distribution of flight plans for STOL will evolve from the design principles established in the Third Generation ATC System design. Flight plans will enter the active ATC data base through the originating Air Route Traffic Control Center for error and legality checking and correction. The flight plan sources will be:

Bulk stored flight plans for scheduled air carrier flights.

Remote on-line sources such as Flight Services Stations, military base operations offices and airline offices.

Pilot self-service automation on-line to the Air Route Traffic Control Center.

Sometime prior to a STOL aircraft departure, its flight plan will be automatically read into the Air Route Traffic Control Center (ARTCC) main core storage, modified if necessary to conform with current procedures, preferred routes and restrictions known to the program and then digitized and transmitted to the originating Terminal Radar Approach Control (TRACON) or airport tower.

Upon departure of the STOL aircraft, automatic updating of the flight plan will commence based on DABS or controller inputs. The flight plan will be augmented with current control information (clearances and commands) and tailored to eliminate expired portions of the route. Current data on outbound flights will be automatically forwarded to the next ATC facility down the route of flight.

5.4.2.6- Flight Services System

The flight services system will provide a variety of STOL pilot services including preflight weather and notices to airmen briefings, arrival reservations, flight plan filing, in-flight advisories and aids to overdue flights. The expected configuration of the 1980/85 upgraded system with regard to automation and communications is shown in Figure 5.4.2.6-1.

FLIGHT SERVICES SYSTEM

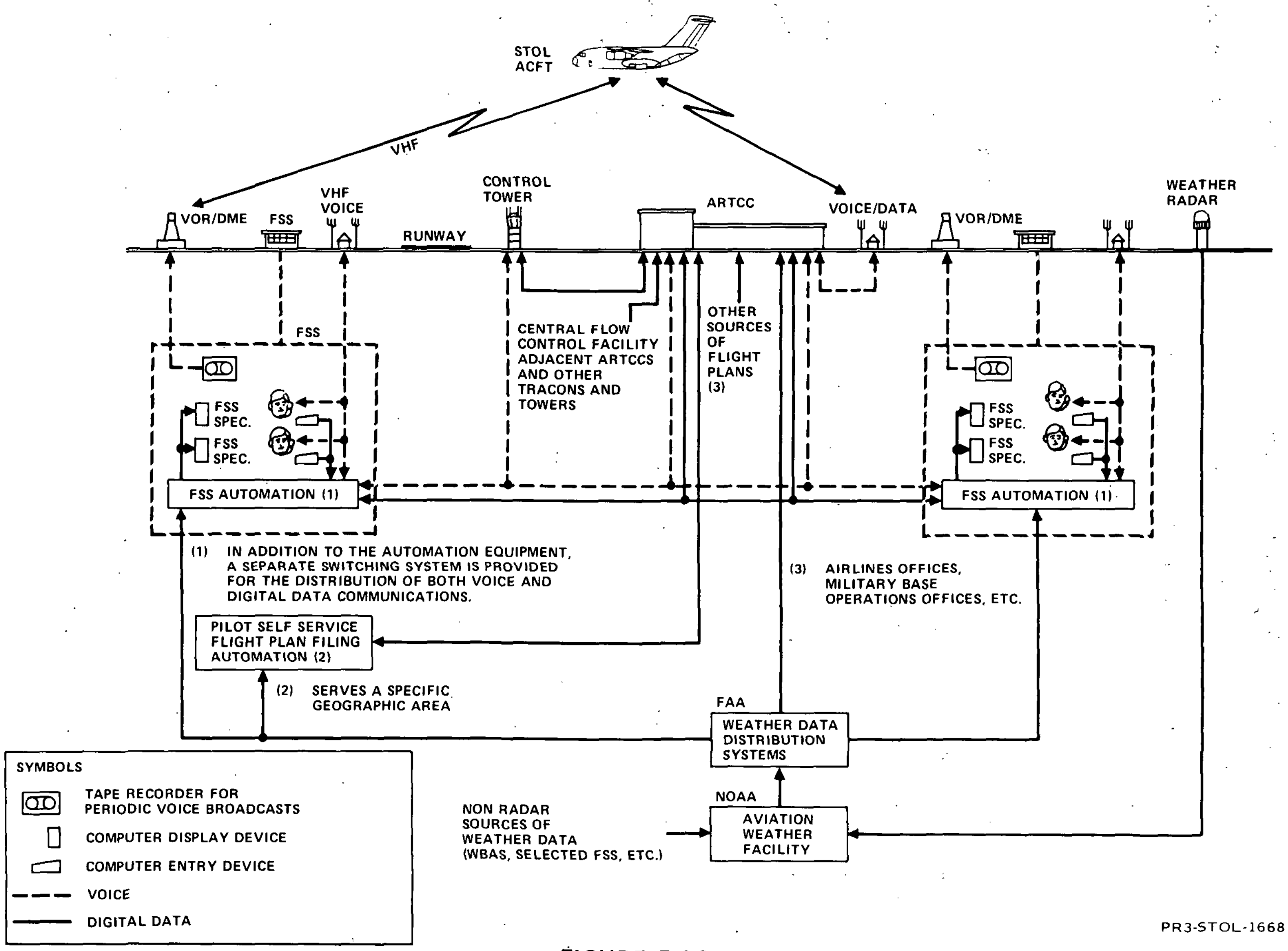
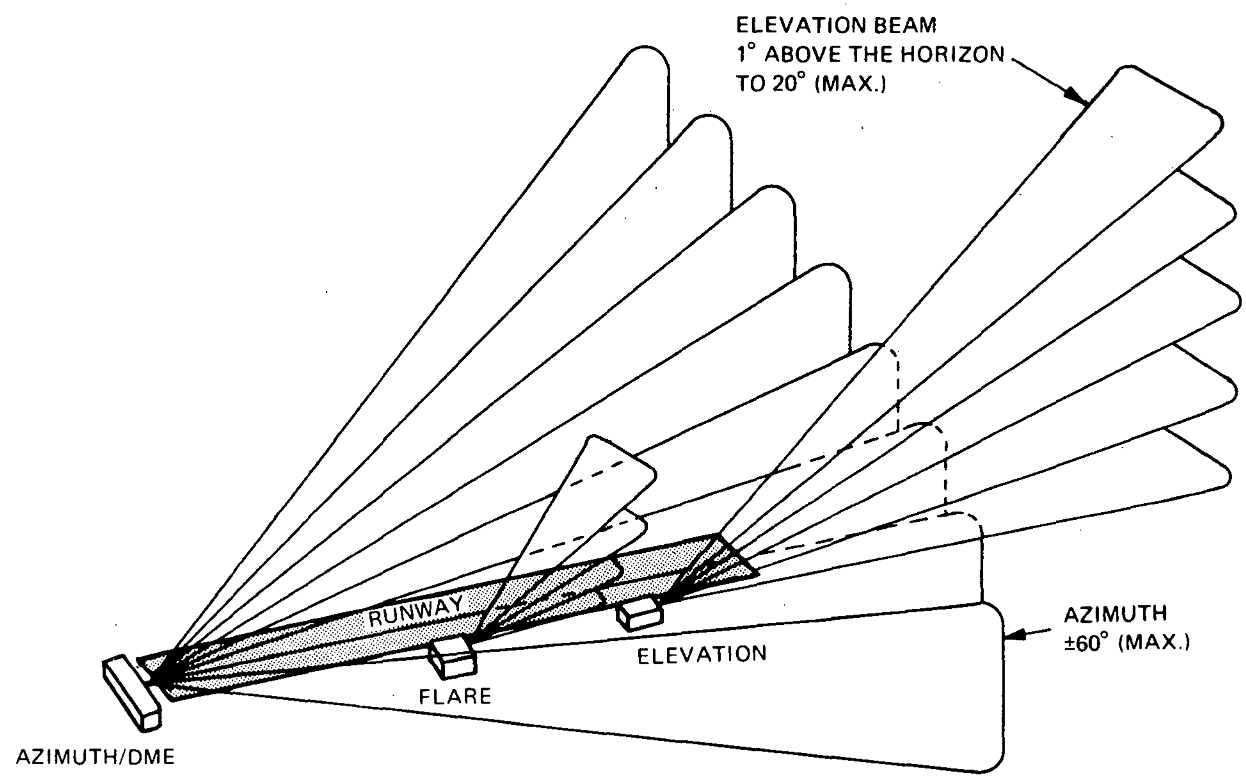


FIGURE 5.4.2.6-1

5.4.3 Major Potential Air Traffic Control Improvements by 1980/85. - The major potential air traffic control improvements in the next decade are defined in the FAA's National Aviation System Plan. The improvements having the greatest benefit for STOL aircraft operations will be; (1) The microwave landing guidance system for terminal area approach and departure guidance; (2) four dimensional area navigation, adding a time factor to latitude, longitude and altitude to provide more accurate waypoints in space and (3) air-ground-air data links for automatic uplink and downlink transmission of ATC messages, clearance and holding reports, automatic terminal service reports, altimeter settings and load control messages. In addition, methods of aircraft collision avoidance will be adapted and put into operation and also various means of meeting the FAA's community noise abatement requirements in airport terminal areas will be developed.

5.4.3.1 Microwave Landing Guidance System. The Microwave Landing System (MLS) will provide a high integrity precise signal in space insensitive to dense airport environments and terrain independant for the formation of its beams. It will permit all weather operations with a high degree of safety and provide the capability for generating curved approaches to runways as a means for increasing airport capacity and for STOL operations. It will also permit reduced separation between parallel IFR runways down to 2,500 feet and fulfill the operational needs of STOL aircraft for approach and landing services by providing a flexible glideslope beam in accordance with R.T.C.A. (SC 117) recommendations against the fixed 3° beam of the present VHF/UHF Instrument Landing System. The M.L.S. antenna patterns shown in Figure 5.4.3.1-1 are representative of the encoded narrow horizontal and vertical beams which coupled with distance measuring equipment (DME)

SCANNING - BEAM MLS ANTENNA RADIATION PATTERNS



NOTE: SCANNING BEAMS IN AZIMUTH & ELEVATION PERMIT THE DEFINITION OF PILOT-SELECTABLE 3-DIMENSIONAL APPROACH PATHS TO THE RUNWAY.

PR3-STOL-1587

FIGURE 5.4.3.1-1

will provide three dimensional guidance information throughout the STOL aircraft's approach and flare to touchdown.

5.4.3.2 Area Navigation (R-NAV). The use of area navigation for STOL aircraft in 1980/85 will lead to greater flexibility in the definition of route structures and to more efficient utilization of airspace. These improvements derive from the capability to navigate along routes not coincident with VOR radials, the capability to navigate along defined as parallel to another specified route, and the capability to, where VOR/DME locations permit, navigate with reduced cross course errors. By 1980, although R-NAV will be a user option, STOL aircraft so equipped can expect to receive priority ATC service in both en-route and high density terminal areas.

The ability of an R-NAV equipped STOL aircraft to navigate precise vertical profiles provided a number of potential benefits; the use of a two segment final approach for noise abatement, the reduction of landing minimums for non-instrument runways, and the ability to navigate optional flight profiles within ATC constraints with the reduction of STOL pilot work load. Three and four dimensional area navigation will also allow safe approaches to unequipped runways although at a somewhat higher landing minima.

5.4.3.3 Area Navigation Metering and Spacing. When traffic levels and the degree of R-NAV warrant it, an automated ground based metering and spacing system can schedule and control arriving STOL aircraft into an airport so that they are precisely and appropriately spaced upon arriving at their assigned runways. Figure 5.4.3.3-1 depicts what can be realized with STOL or CTOL aircraft using four dimensional area navigation (ED.R-NAV) in conjunction

TIME-SYNCHRONIZED TERMINAL AREA NAVIGATION

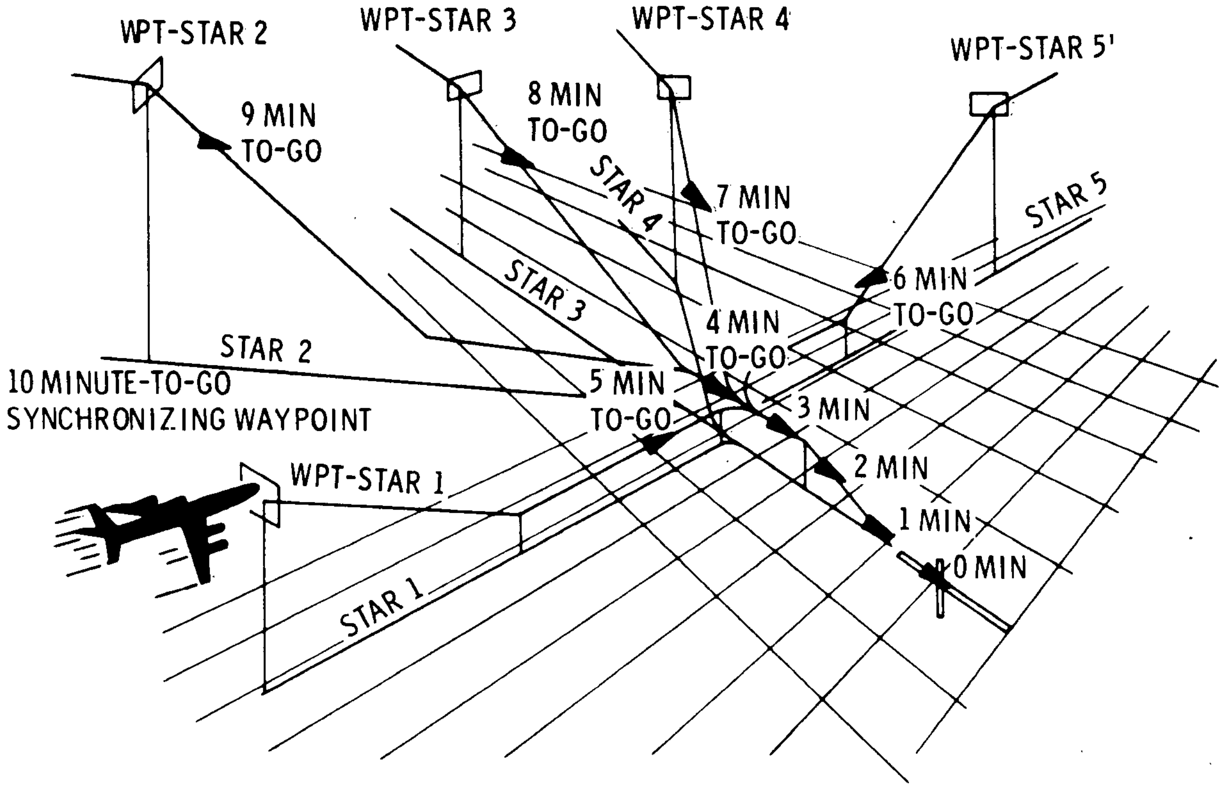


FIGURE 5.4.3.3-1

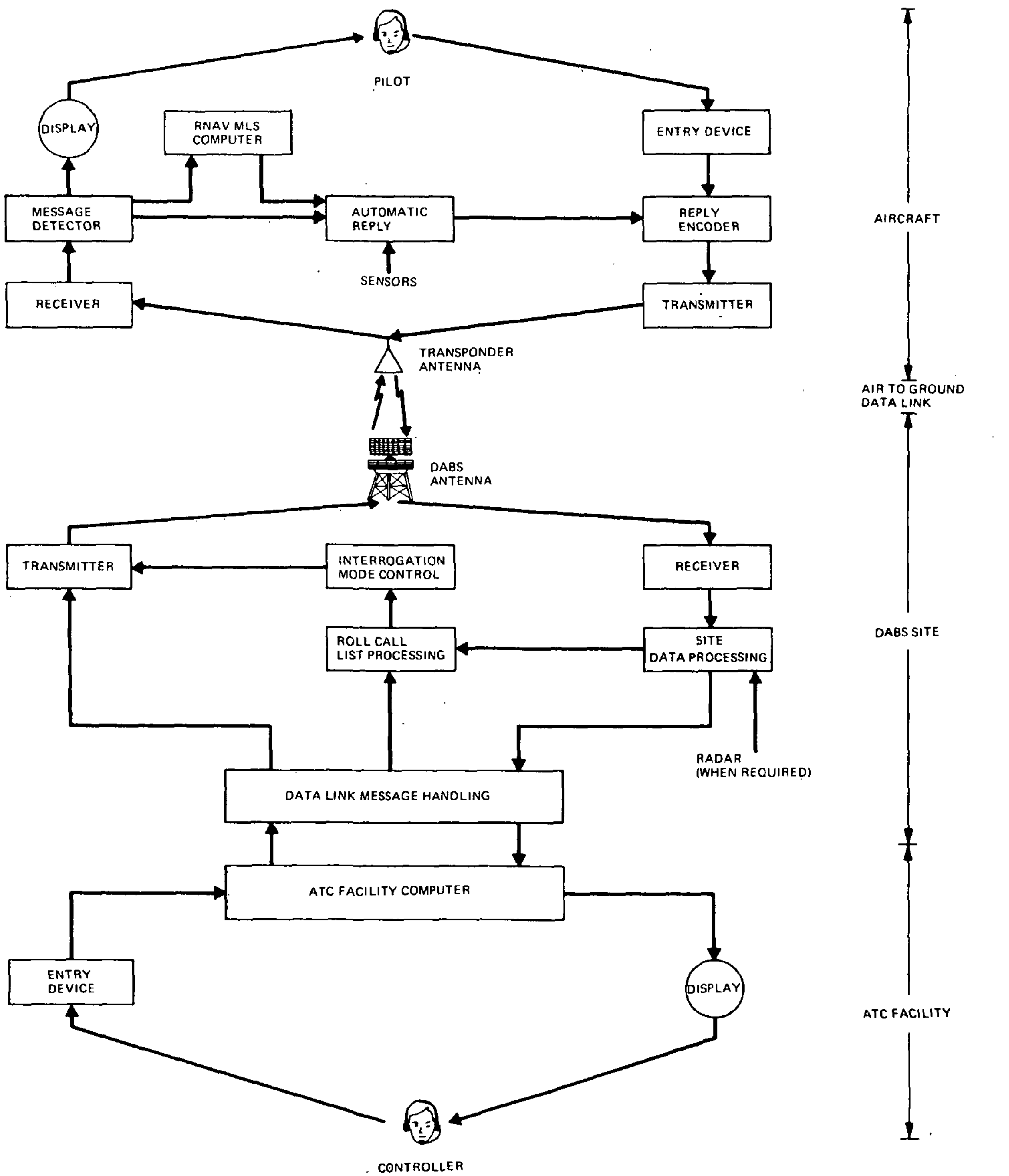
PR3-STOL-1590

with air traffic control at an airport at which aircraft arrive continuously from different directions. Each aircraft as it arrives in the greater terminal area contacts approach control and is given a specific time to land say at intervals of one minute or less. Also it will be given a standard terminal arrival route (STAR) to follow. On each of these arrival routes will be a waypoint designated as a sychronizing waypoint to be arrived at say precisely ten minutes before the assigned landing time. Beginning at this point, the position of the aircraft will be controlled as a function of time all the way to touchdown. Figure 5.4.3.3-1 shows the aircraft at intervals of one minute backed up along the final approach and then fanning out. On each one of the standard terminal arrival routes, one or more aircraft are synchronized to join the final approach path at one minute intervals or less behind the preceding aircraft. The approach controller's radar will monitor the position of individual STOL and CTOL aircraft to make sure that safe separation is maintained.

5.4.3.4 Air-Ground-Air Data Link. The Discrete Address Beacon System (DABS) which the FAA plan to have fully operational by 1980/85 makes possible the realization of a low cost high capacity air-ground-air data link. The DABS marks an important advance in surveillance and communications capabilities for air traffic control as it resolves problems inherent in the present ATC Beacon Systems (ATCRBS) and adds the significant feature that human intervention is not required to establish and maintain either surveillance or communications.

The basic DABS system is shown in Figure 5.4.3.4-1 which also illustrates the major aircraft and ATC data link components required to provide one up-link frequency for all site interrogators and one down-link frequency for all down-link transfonders. Frequency switching is therefore not required for either surveillance or communications on the ground or in the STOL aircraft.

BASIC DISCRETE ADDRESS BEACON SYSTEM



NOTE: HIGHEST AVIONICS LEVEL IS ILLUSTRATED.

PR3-STOL-1585

FIGURE 5.4.3.4-1

Each aircraft in a roll call is individually addressed and the up-link can be used to transmit short messages to the STOL aircraft as well as interrogate for down-link replies. Transmission of ATC messages, clearances and holding reports, automatic terminal service reports, altimeter settings and load control messages are some of the data that can be transmitted between STOL and the ground station by the two-way data link, supplementing the voice communications equipment now in use.

5.4.3.5 - Collision Avoidance Systems (C.A.S.). A reliable collision avoidance system for 1980/85 STOL aircraft operations is highly desirable because the increased volume of air traffic and the added complexity of arrival and departure routing together with noise abatement procedures in high density terminal areas tend to divert the pilot's attention from maintaining visual separation. Estimates have been made indicating that mid-air collision risk grows as the square of the rate of traffic growth giving a prediction of ten collisions per year involving air carrier aircraft by 1980 if no collision avoidance system is established.

Presently the FAA considers its ground based system adequately able to provide pilot warning indication by 1975 for terminal area operations using the ARTS III (Automated Radar Tracking System). The ARTS III uses an associative type processor to correlate radar returns and simultaneously track air traffic converging on a terminal area, it will detect potential conflicts and call them to the attention of the air traffic controller who then alerts the pilots of the aircraft concerned. It is most probable that the FAA will recommend the use of ARTS III for this purpose when the system becomes fully operational instead of the airborne collision avoidance systems now being developed by equipment manufacturers in conjunction with the airlines.

For all aircraft, even if the FAA's computerized conflict prediction methods prove feasible, the airlines feel that some form of airborne CAS will still be necessary as a backup to cover segments of the flight profile that are not covered or where the surveillance system is not operating.

The existing radar beacon system coverage for terminal areas will be examined with the deployment of DABS by 1985 to include aircraft conflict prediction and collision avoidance warning. Hazard warnings to aircraft concerned will be provided by DABS data-link under the FAA plan.

Airborne CAS methods have one major deficiency; they are cooperative systems. A CAS equipped aircraft is only protected from collision with a similarly equipped aircraft and a major problem is to develop inexpensive equipment for all classes of aircraft. As an approach to this, the FAA have proposed a synchro-DABS for the 1980's which would allow transponder measurements on other aircraft. DABS replies to ATC interrogations. This is similar to the existing time frequency CAS which are now available from manufacturers of airborne collision avoidance systems.

The FAA, Defense Department, and NASA have been asked by the U.S. Congress to evaluate and recommend a suitable airborne CAS by 30 March 1974 for use in the 1980's.

5.5 System Operations Summary

The following section summarizes the pertinent system operations result as they relate to an airline operating a STOL system in the expanded and extended representative regions or the U.S. Table 5.5-1, Baseline Regional Network Data, presents the weekly operational activities of the baseline study aircraft. Delineated are the number of airports making up the network for each region, the airport pairs comprising each network, the number of weekly flights required to serve each regional system and the total O&D passenger by region.

Note that many of the airports appear in network statistics for more than one region. However, the listing in Table 5.5-1 includes each airport only once. Thus, the total of 101 airports is the baseline count of 94 without overlap, but including the seven (7) airports in the Hawaii Region. Airport pair numbers are also a true count without overlap. However, it should be noted that a single airport may appear as one end of a route in as many as three different regions.

The extension of the baseline regional systems to include more traffic routes increases the airport and route statistics. By enlarging the market to include low-density city-pairs, the total number of airports is increased to 178 with ten (10) added by extension of the medium-density sample and sixty-seven (67) added in the low-density networks in all six mainland regions.

Table 5.5-2, Regional STOL Fleet Requirements, compares the passenger capacity versus size of aircraft between the baseline system and that of the expanded system. Table 5.5-3, Revised Regional STOL Fleet Requirements, details the fleet requirements with the maintenance concept applied.

TABLE 5.5-1
1985
BASELINE REGIONAL NETWORK DATA
WEEKLY ACTIVITIES
(150 PASSENGER AIRCRAFT)

Region	Number of Airports	Airport Pairs	Number of Flights	O & D Passengers
Chicago	17	82	2,464	224,430
Northeast	14	96	3,766	343,428
California	20	114	3,220	292,198
Southeast	22	146	3,164	282,378
Southern	16	58	1,722	158,152
Northwest	5	18	392	32,502
Hawaii	7	12	784	69,346
	101	526		

TABLE 5.5-2

REGIONAL STOL FLEET REQUIREMENTS

NUMBER OF AIRCRAFT AND PASSENGER CAPACITY

	PASSENGER CAPACITY					
	100		150		200	
REGION	BASE(1)	EXPANDED(2)	BASE	EXPANDED	BASE	EXPANDED
Chicago	53	145	35	98	26	73
Northeast	78	183	52	125	39	92
California	71	87	47	57	35	44
Southeast	81	122	54	76	40	61
Southern	31	65	21	39	16	33
Northwest	9	17	6	13	5	9
Hawaii	10	24	7	18	5	12
Totals	333	643	222	426	166	324

(1) Partial city pair network submitted by Market and Airport Analysis. Used ≥130,000 annual O&D passengers. No scheduled maintenance or basing concepts applied.

(2) Extended city pair network for ≥130,000 annual O&D passengers extended to include ≥50,000 annual O&D passengers. Scheduled maintenance and maintenance basing concepts applied.

TABLE 5.5-3

REVISED REGIONAL STOL FLEET REQUIREMENTS
WITH APPLICATION OF MAINTENANCE CONCEPT ANALYSIS TO
REGIONAL BASELINE FLEETS

REGION	PASSENGER CAPACITY		
	100	150	200
Chicago	58	38	29
Northeast	86	57	43
California	78	52	39
Southeast	87	58	44
Southern	34	24	18
Northwest	10	8	6
Hawaii	11	8	6
Totals	364	245	185

6.0 SYSTEMS ANALYSIS

Construction of a realistic set of evaluation and selection criteria for any proposed transportation system is facilitated by an overall understanding of study areas or disciplines. A tabulation of the interactivity among each of the study disciplines is shown in Table 6.0-1. Each of the active disciplines is described qualitatively. Each discipline in turn is listed as a column heading of reactive disciplines. Note that the Aircraft, Airport, and Market are the major quantifiable and active functions in the study. For example, if the aircraft role is dominant, the first row of entries outlines the response of each of the study areas to the aircraft. The area of Economics in the study provides an evaluative function of dollar costs, income and profitability. The Operations discipline serves as an integrating function to construct a transportation systems response (service) to a demand expressed by the Market area. The measure of success in the Operations area of integrating the aircraft and airports (a transport system) is evaluated in the Economics area as a return on investment or some other expression of economic benefit.

A set of general criteria for evaluation and selection of systems includes the following:

- Services Provided to the Traveler:
  - Minimum door-to-door travel time enhanced by the aircraft speed and site accessibility of the airport.
  - Competitive fare levels with respect to CTOL and advanced surface systems.
  - Acceptable comfort levels.
  - Convenient departure/arrival schedules.

- o Community Acceptance of the Service at Existing and New Sites:
  - ° Tolerable noise and exhaust emission levels.
  - ° Acceptable total and peak hour distributions of air traffic.
- o Acceptable increases in the flow and location of surface vehicles

Since a broad assumption is made a priori that any new short-haul air system is to evolve from current technology and practices, it follows that the evolution generally must be compatible with the existing air transportation system.

In past design of commercial aircraft, the manufacturer and the airline generally have produced a vehicle to satisfy a mission requirement. Contemporary and future designs are being subjected to environmental and ecological pressures. Consequently, future aircraft, such as a proposed STOL, must be designed to fit the airport and the community environment. This design also must be economically practical so that competitive fare levels will generate sufficient revenue to allow both the manufacturer and airline an acceptable earnings pattern. System compatibility studies have been done with respect to airport complexes, the planned future Air Traffic Control system and conventional airline equipment and practices. In all cases, the degree of change required to accommodate STOL aircraft is insignificant in quality. Costs associated with systems adaptation are typical of those associated with introduction of any new aircraft to existing systems (airlines and airports). The magnitudes of costs are included in previous sections and in the Airport Analysis, Volume III.

The analytic activities from each study area have been presented in preceding volumes. Each may be read independently to obtain the points of view expressed in the interactivity matrix of Table 6.0-1. Exchange of data permitted each study area to proceed in generally parallel fashion. In addition, there is an integrating function provided by Systems Analysis. Figure 6.0-1 shows this integration activity in schematic form.

Environmental constraints not only exercise restraints on how systems operate in the contemporary scene, they are dominant considerations in planning and designing future air transportation systems. Thus, short-haul mission objectives must be specified within the environment of the time period. A service concept reflects supply and demand balancing in creating a system of airports, aircraft, and an operations scheme to provide travelers with satisfactory service. Putting these various concepts together in a simulated regional airline permits evaluation of how the parts interact, how changes could improve the operating, and quantitative output describing the performance of the system.

A benefit analysis of the quantitative data permits a realistic assessment of the aircraft concept and numbers required. From this, estimates of profitability to the manufacturer are possible. With the addition of facilities and supporting equipment, airline profitability may be estimated. If all of these evaluations are positive, the system is evaluated against the original mission objectives- to determine satisfactory performance. Although not shown in Figure 6.0-1, iteration at any step in the systems study facilitates changes in assumptions or input data to improve the system.

TABLE 6.0-1

TRANSPORTATION SYSTEM EVALUATION AND SELECTION OVERVIEW

ACTIVE DISCIPLINES	REACTIVE DISCIPLINES: AIRCRAFT	AIRPORT	MARKET	ECONOMICS	OPERATIONS
AIRCRAFT Vehicle config-uration and Performance		o Size & Weight affect operating surface & gates. o Operating profile affects air & ground maneuver zones. o Service & maintenance requirements deter-mine ground equipment & facilities. o ATC/Aircraft tradeoffs exist for terminal & en-route control. o Flight profile affects noise & intrusion buffer zones around airport.	o Comfort level, ride & safety qualities determine acceptability. o Potential passengers attracted from CTOL, private auto & ground systems. o Performance determines maximum block times & resultant market share of travelers.	o Configuration & level of technology determine acquisition & operations costs. o Design for maintainability & support influences level of spares & support equipment. o RDT & E requirements for funds are a func-tion of technology & level of effort.	o STOL expands operational modes & control requirements. o Short STOL design range requires proli-feration of support & maintenance. o Baggage provisions influence syste design. o Maintainability concept allows tradeoffs between aircraft & ground equipment. o ATC compatibility allows tradeoff be-tween aircraft & ground.
AIRPORT Air/Ground Inter-face for Traveler	o Available runways specify performance requirements. o Site location forces aircraft to meet community acceptability standards. o Flight profiles must meet airport opera-tional requirements.		o Site location strong determinant of traveler attraction. o Runway acceptance rates limit flight frequencies. o Local surface access limits patronage. o Aircraft & passenger flow rates are limited by available gate positions.	o Airports generate jobs & market for materials and services plus revenue tax base. o Airport may require added public safety services. o Expanded facilities require financing. o Airline costs reflect airport fees & charges.	o New operating sites require expanded operations & personnel levels. o Surface access, feeder access, & people flow set upper limit for aircraft operations.
MARKET Total Travel Affected by Modal Preferences (Fare, Amenities, & Travel Time)	o Daily traffic distribution influences size of vehicle. o Total demand determines number of vehicles produces. o Competitive fare levels influence size of vehicle.	o Geographic pattern of demand important factor in site selection of airport. o Terminal design reflects environmental preferences of travelers.		o Fares & patronage determine revenue.	o Flight frequencies & route structure adjusted to distribution of demand. o Operations concept must consider inter-face with other air modes as well as surface modes. o Patronage responsive to savings in com-competitive trip times.
ECONOMICS Cost, Revenue & Profitability	o High-technology configurations costly to produce. o DOC & Unit cost per seat inversely proportional to vehicle size & runway length. o Noise control techniques impose high costs on aircraft & operations.	o Construction bonds face community opposition. o Requirements for new & expanded sites increase total system cost.	o Systems costs organized as DOC & IOC. o Operating revenue & costs determine profitability.		o System costs increase adversely with proliferation of network & service. o Groundside traffic increases may require costly expansion of public access systems.
OPERATIONS Provision of Transportation Service	o Contemporary CTOL operating concepts influence STOL Configurations. o Maint. & basing concepts set general re-quirements for equipment configuration. o Community acceptance of flight profiles affects configuration & performance. o Regulatory control & flight rules influence vehicle design and operations.	o Expansion of flight schedule increases people & vehicle flow groundside, airside & on community surface. o Operating policies influence number of system personnel & accommodating facilities. o Ground handling methods impose design requirements on airport.	o Service offered must be either complemen-tary and/or competitive with other air and ground modes. o Patronage directly influenced by route structure & termianl locations. o Patronage responsive to passenger pro-cessing, comfort, & environment of terminals & vehicles.	o Proliferation of network increases total airport acquisition & support costs. o Basing concept influences maintenance costs. o All weather capability is costly. o Community restraints may adversely affect revenue opportunities. o Operating & basing concepts influence support costs of flight personnel.	

STOL SYSTEMS STUDY INTEGRATION

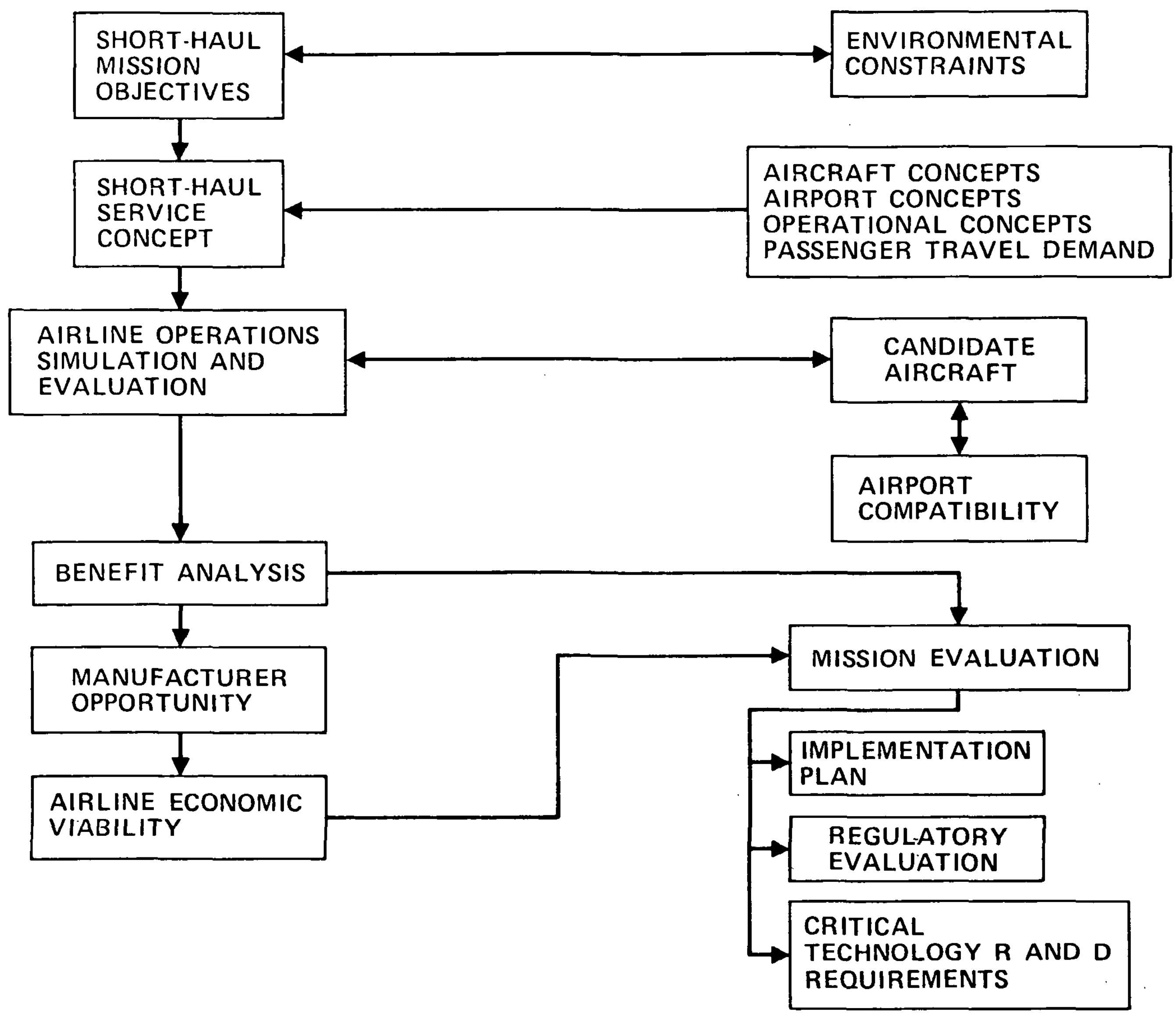


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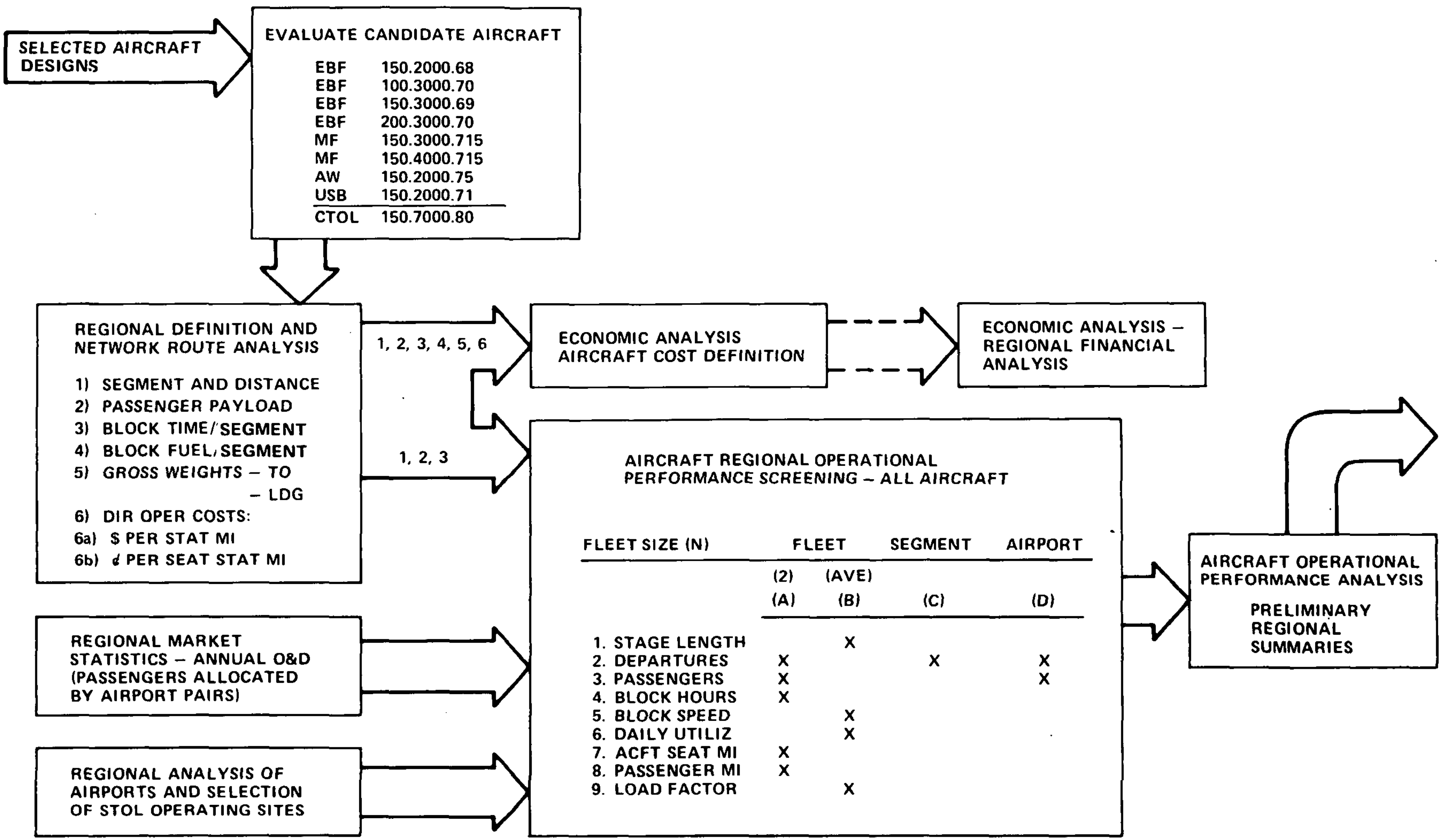
FIGURE 6.0-1

With a satisfactory system, remaining steps are to develop a technical, social, and political implementation plan and to illuminate any research and development areas needing special attention.

A detailed outline of the manner of accomplishing the above procedure is presented in Figure 6.0-2 STOL Aircraft/System Evaluation. The flow is self-explanatory, the primary function being to show specific parameters used in this system design and analysis. Environmental and other external data are established as noise and pollution limits, airport locations with respect to a quantified travel demand, existing dimensions of the airports and routes between them, and trend variations of travel demand with time.

Derived data consist of the aircraft characteristics, changes to airports, and output data describing the performance of the system. Each of these is indicated in appropriate boxes in Figure 6.0-2

STOL AIRCRAFT/SYSTEM EVALUATION



FLEET SIZE (N)	FLEET (2) (A)	FLEET (AVE) (B)	SEGMENT (C)	AIRPORT (D)
1. STAGE LENGTH		X		
2. DEPARTURES	X		X	X
3. PASSENGERS	X			X
4. BLOCK HOURS	X			
5. BLOCK SPEED		X		
6. DAILY UTILIZ		X		
7. ACFT SEAT MI	X			
8. PASSENGER MI	X			
9. LOAD FACTOR		X		

FIGURE 6.0-2

PR3-STOL-1592 A

STOL AIRCRAFT/SYSTEM EVALUATION
(CONTINUED)

AIRLINE OPERATIONS SIMULATION AND EVALUATION

- o SELECT APPROPRIATE SEAT CAPACITY
- o PERFORM DETAILED SCHEDULING BY SEGMENT AND TOTAL FLEET

– O&D DEMAND TABULATION

– AIRPORT PAIR DETAILED TRAFFIC FLOW ANALYSIS

- o FLIGHT NO.
- o DEPARTURE TIME
- o FREQUENCY
- o EN ROUTE HOURS
- o DISTANCE FLOWN
- o PASSENGERS ALLOCATED/FLIGHT
- o PASSENGER MILES
- o ROUND TRIPS
- o TOTAL SEGMENT PASSENGERS

– PASSENGER FLIGHT SCHEDULE ANALYSIS BY FLIGHT NO. AND SEGMENT

- o DEPARTURE/ARRIVAL TIME
- o BLOCK MILES/TIME
- o ORIGINATING PASSENGERS
- o REV PSGR MILES
- o LOAD FACTOR

– DAILY AND WEEKLY REGION SUMMARY

- o ACFT DEPARTURES
- o ACFT MILES
- o AVERAGE STAGE LENGTH
- o BLOCK HOURS
- o AVERAGE BLOCK SPEED
- o AVERAGE UTILIZATION
- o FLEET SIZE
- o SEAT MILES
- o PASSENGERS ORIGINATING
- o PASSENGER MILES
- o AVER PASS. CARRIED
- o SYSTEM LOAD FACTOR

– DAILY AND WEEKLY SEGMENT SUMMARY

– AIRPORT ACTIVITY – TIME OF DAY AND FREQUENCY, AIRCRAFT AND PASSENGER MOVEMENTS

– SEGMENT AND DEPARTURE TIME SCHEDULE BY AIRPORT PAIR

SYSTEMS ANALYSIS
PROPULSIVE LIFT CONCEPT
EVALUATION

COMMUNITY ACCEPTANCE

ECONOMIC ANALYSIS –
REGIONAL FINANCIAL
ANALYSIS AND AIRLINE
PROFITABILITY

AIRPORT/AIRCRAFT
COMPATIBILITY EVALUATION

OPERATIONS ANALYSIS
– REGIONAL FLEET SUMMARY

CONGESTION RELIEF

STOL
MISSION OBJECTIVE AND
SERVICE CONCEPT
EVALUATION

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FIGURE 6.0-2 (CONT)

6.1 Aircraft/System Evaluation

The performance of STOL aircraft operating in the Northwest, California, Chicago, South, Southeast and Northeast regions of the United States were investigated. Externally blown flap (EBF), augmentor wing (AW), mechanical flap (MF), and upper surface blown flap (USB) STOL configurations designed for takeoff field lengths of 2000, 3000 and 4000 feet were evaluated. The criteria used for evaluating the performance of the various STOL aircraft configurations were payload-range capability, block time (T_B), block fuel (F_B), and direct operating cost (DOC). All aircraft investigated are capable of carrying a 60% load factor of passengers on all routes considered without performance penalties.

T_B, F_B and DOC were explored for the EBF, AW and USBF with a designed takeoff field length of 2000 feet. The EBF configured STOL aircraft appears to be the better aircraft. The EBF configuration has a 5-11% slower T_B than the AW, but burns 60-70% less fuel. Also the AW has approximately a 3% higher DOC than the EBF. Although the OW is approximately 4% faster than the EBF, it burns 11% more fuel and has a DOC that is 4% higher.

In exploring the differences in T_B, F_B and DOC between STOL configurations designed for a takeoff field of 3000 feet, the EBF and MF were considered. The EBF appears to be the better of the two configurations, burning approximately 16% less fuel; the differences in T_B and DOC are approximately 1%.

The effect on T_B, F_B and DOC by varying the designed takeoff field length for the EBF and MF were investigated. In changing the design field length from 2000 feet to 3000 feet for the EBF configuration results in a 28% savings in F_B, a 22% reduction in DOC and there is no appreciable effect on block time. Changing the designed takeoff field length for the MF from 3000 feet to 4000 feet results in a 6%, 3% and 11% reduction in T_B, F_B and DOC respectively.

The results of more detailed aircraft analysis and redesign of the baseline EBF 150, 3000 configuration reduced the F_B, T_B and DOC by 15%, 1% and 6% respectively.

Table 6.1-1, Chicago Region-Phase II Candidate Aircraft Comparison presents the systems operations results for all of the configurations which were evaluated in the Chicago Region. Airport pairs were selected to represent minimum, maximum and midpoint stage lengths of the region. Production runs have been adjusted to 400 units in all cases for consistency. The total aircraft prices that are listed are those that were established when the aircraft was introduced into the system and are reflected in the DOC's. Included in the table for each representative city pair are comparisons of blockfuel, blocktime, maintenance labor costs and footprint area.

TABLE 6.1-1

1985

CHICAGO REGION - PHASE II
CANDIDATE AIRCRAFT COMPARISON

Direct Operating Cost

1. ¢/Psgr Statute Miles (km)
Production Quantity @ 400 acft.

Airport Pair	Statute Miles (km) Route	Alter.	E150 2000 .68	A150 2000 .79	U150 2000 .70	M150 3000 .71	Baseline E150 3000 .68	Modified E150 3000 .69	E200 3000 .69	E100 3000 .67	M150 4000 .76	C150 7600 .80
Cleveland-Detroit	92 (148)	70 (113)	8.66 (5.38)	8.89 (5.52)	8.61 (6.48)	7.12 (4.42)	7.29 (4.53)	6.82 (4.24)	6.44 (4.00)	8.79 (5.46)	6.53 (4.06)	6.64 (4.13)
Chicago-Cleveland	313 (504)	122 (196)	4.46 (2.77)	4.61 (2.86)	4.32 (3.03)	3.76 (2.34)	3.78 (2.35)	3.51 (2.18)	3.32 (2.06)	4.63 (2.88)	3.44 (2.14)	3.39 (2.11)
Denver-Kansas City	550 (885)	166 (267)	3.64 (2.26)	3.78 (2.35)	3.57 (2.42)	3.06 (1.90)	3.09 (1.92)	2.86 (1.78)	2.58 (1.60)	3.78 (2.35)	2.74 (1.70)	2.61 (1.62)

2. Block Fuel-Lb/(Kg)/Block Time (Hr:Min)

Airport Pair	Route	Alter.	E150 2000	A150 2000	U150 2000	M150 3000	Baseline E150 3000	Modified E150 3000	E200 3000	E100 3000	M150 4000	C150 7600
Cleveland-Detroit	92 (148)	70 (113)	4580/:25 (2077)	8184/:23 (3712)	4068/:23 (2297)	4535/:21 (2057)	3532/:25 (1602)	3133/:25 (1421)	4702/:25 (2133)	2623/:25 (1190)	4299/:24 (1950)	4037/:31 (1831)
Chicago-Cleveland	313 (504)	122 (196)	10303/:54 (4673)	16091/:51 (7299)	10453/:47 (5220)	9506/:54 (4312)	7930/:52 (3597)	7281/:52 (3303)	10442/:53 (4736)	5636/:54 (2556)	8451/:54 (3833)	8134/:60 (3690)
Denver-Kansas City	550 (885)	166 (267)	16103/1:23 (7304)	26560/1:17 (12048)	16930/1:14 (8158)	14298/1:23 (6485)	12433/1:23 (5640)	11528/1:20 (5229)	13167/1:20 (5972)	8706/1:23 (3949)	16473/1:22 (7472)	12253/1:24 (5558)

Presented are the impacts resulting from the re-sizing of the baseline EBF 150.3000 STOL aircraft.

The performance characteristics of the two aircraft were evaluated in the Chicago Region. From this network, three airport pairs in the route structure were compared. Airport pairs were selected to represent minimum, maximum and midpoint stage lengths of the region. Results are tabulated below and same have been plotted and are attached.

WEIGHT COMPARISON - EBF 150.3000

STAGE LENGTH STATUTE MILES (City Pair)	BASELINE TAKEOFF (Lb.)	BASELINE LANDING (Lb.)	MODIFIED TAKEOFF (Lb.)	MODIFIED LANDING (Lb.)
92 (Cleveland-Detroit)	137,291	134,009	126,075	123,251
313 (Chicago-Cleveland)	142,696	135,016	130,442	123,424
550 (Denver-Kansas City)	147,977	135,814	135,656	124,770

BLOCK FUEL COMPARISON - EBF 150.3000

STAGE LENGTH STATUTE MILES (City Pairs)	BASELINE BLOCK FUEL (Lb)	MODIFIED BLOCK FUEL (Lb)
92 (Cleveland-Detroit)	3,532	3,133
313 (Chicago-Cleveland)	7,930	7,281
550 (Denver-Kansas City)	12,881	11,528

NOTE: Both fuel and weight data include requirements for alternate airports and differ for each airport pair.

DOC COMPARISON* - EBF 150.3000

STAGE LENGTH STATUTE MILES (City Pairs)	BASELINE (¢/ ASM)	MODIFIED (¢/ ASM)
92 (Cleveland-Detroit)	4.82	4.42
313 (Chicago-Cleveland)	2.51	2.30
550 (Denver-Kansas City)	2.11	1.93

* Based on economic design point data, 400 production run, 2500 hours utilization, 8 min. maneuver time, 25% engine spares and max. cert. TOGW.

The impact on block time on the total system was negligible as the only improvements realized were in the stage lengths over 500 statute miles of which there were only four airport pairs out of a total of forty-one. A comparison of the annual scheduled maintenance man-hour requirements showed a savings of $500 per aircraft per year for the EBF 150 STOL aircraft, modified. A price reduction of $805,000 per unit cost was realized in the case of the modified aircraft.

Noise footprint area comparison revealed an increase of 20%, or 96 acres, in footprint area as a result of the modifications to the baseline EBF 150.3000 STOL aircraft applying relaxed noise design criteria.

Any assumption that the changes delineated above would be applicable to the other study configurations is doubtful based on comparison of the DOC changes ranging from a low of .9% for the A 150.2000 to a high of 10.3% for the EBF 200.3000 STOL aircraft.

The propulsive lift concepts studied were shown to have sufficient potential to be considered for further research.

Within the scope of the study, the 3000 foot field (915 m) length design concepts are preferred in comparison with the 2000 foot (6.10 m) concepts considering direct operating cost, fuel consumption and maintenance. For example, achieving a 2000 foot (610 m) field length capability, in comparison with 3000 foot (915 m) field length, results in a penalty to the EBF design of 39 percent in fuel burned and 28 percent in DOC. The 150 passenger capacity aircraft is the best compromise of the four sizes studied (50, 100, 150, and 200).

Over 200 airports throughout the U.S. were initially surveyed. The baseline representative system included 72 existing air carrier airports, 20 general aviation airports, and two new STOLports. The airport locations selected are considered to be representative of the type applicable for a STOL short-haul system. There is an adequate number of airports to support a STOL short-haul system for the 1985 period.

Introducing a STOL system in high density markets will provide noise relief and should result in relatively few community acceptance problems. However, introducing a STOL system at existing general aviation airports will in most instances result in community objections due to: (1) increased operational levels; (2) increased ground traffic and congestion; (3) inconvenience to general aviation activities; and (4) potential displacement of general aviation. While the introduction of a STOL system into a non-aviation precedent area will most likely face strong community opposition, the implementation of a STOL system is dependent on incorporation of the necessary airport, ATC, runway, terminal, and access improvements on a timely basis. The basic technical capabilities to be developed in the FAA's currently planned R&D program in support of air traffic control for CTOL operations are considered adequate to support STOL operations. Microwave ILS is the only mandatory equipment needed to support STOL operations in addition to normal CTOL ATC equipment.

Achievement of a 3000 foot (915 m) field length capability for the EBF 150 passenger aircraft results in a system direct operating costs of about 2.08 cents per seat statute mile for 575 statute miles (925 km) stage length. At CAB jet coach fare levels for the short-haul ranges, regional STOL systems are estimated to generate a representative return on investment (ROI) of about 10 to 12 percent.

With estimated 1985 requirements of some 420 domestic and 320 foreign potential aircraft, the market potential may be considered as interesting to one or more aircraft producers when projected to 1990 market levels.

The study revealed no significant technical aircraft problems nor any outstanding system facilities or operating problems that could not be solved within the time frame prior to the 1980-1985 implementation period.

6.1.1 Airline Comments - The following is a compilation of the comments made by the airline subcontractors during the course of the study.

Aircraft Selection

- Aircraft for a STOL short-haul system must be 100 seats or larger with the appropriate size determined by flight frequencies and load factors.
- Range greater than 600 miles (966 km) is desirable for extensive interconnect traffic at two or three percent delta weight.
- Two-man crew is desirable.
- Contemporary "wide body" configuration is desirable for passenger appeal.

Operational Costs

- Unit operational costs are inversely proportional to range flown.
- IOC levels may be reduced with a simplified airline organizational structure.
- Fare levels for short range are not proportional to costs.
- Category III-A is not expected to be cost-efficient.
- Cost of short-haul operations relatively high with little hope for lower IOC costs even with fewer ground personnel or by a separate STOL operations system (Division).
- Contemporary short-haul costs are high because long-range aircraft are used for short-haul.
- Allocation methodology as applied to general and administrative costs and high levels of ground personnel per passenger carried as well as excessive ticketing costs, contribute to the high operating costs.

- DOC is a function of aircraft cost and performance characteristics.
- Control of IOC is dependent upon the number of ground personnel and indirect and overhead expenses per passenger carried.
- Automated/mechanized ticketing, passenger and baggage handling may reduce ground costs in STOL operations.
- Frills and extras in passenger service are costly and should be avoided in STOL operations.

Airport Congestion

- Airport congestion will spread from four airports in 1973 to an estimated 20 to 30 major airports by 1985. However, the impact of congestion is overrated.
- By 1980, there will be 10 to 12 congested major airports.
- Congestion impact at major hubs could be moderated by larger aircraft, higher load factors, peak spreading, and the use of reliever airports.
- STOL short-haul system could relieve airport congestion by reducing ground and air delays by diverting O & D travelers away from major hubs.

Operations Noise Impact

- Noise, critical to the introduction of new STOL service, 95 PNdB at 500 feet ground-level sideline, is not realistic. 100 to 105 PNdB sideline is satisfactory for existing air carrier airports. For operations at general aviation sites, 95 PNdB might be acceptable. However, for "close-in" neighborhood sites, less than 95 PNdB may be required.

- o Reduction from contemporary current noise level is mandatory for any new aircraft. Community noise impact requires further study and analysis.

<u>Operations Concepts</u>

- o Higher density routes require four to six round trips per day. For the medium density routes, from the hub airport in the network, four round trips per day with a reasonable load factor is desirable. Two round trips per day is an attractive route to develop for the lower density routes.
- o Separate STOL and CTOL terminals will relieve local congestion. Shared facilities should be considered for lower traffic levels.
- o Customer acceptance requires smooth transition for interconnect at direct or remote STOL facilities.
- o Aircraft gate operations should be power-in and power-out. Passenger boarding should be by airstairs. Provisions should be made for compatibility with the existing DC-9 and 727 jetways.
- o STOL operations should not compete with CTOL or a second STOL airline in the same route structure. Airlines may operate STOL and CTOL separately, but with common corporate management and support.
- o Short-haul operations should not exceed 14 hours per day.
- o The STOL fleet should contain one size of aircraft (seat capacity).
- o Scheduling should include through-stops.

- o Flight frequencies should be provided so that each origin airport generates four or more round trips per day.
- o Cargo is not of interest in proposed STOL operating concepts.
- o A separate STOL operating division is feasible but subject to all existing CTOL union contracts and CAB regulation.
- o Growth rate for short-haul traffic may be higher on "off-corridor" routes than on present corridors.
- o Extended ranges desirable for interconnect and through-stop service.
- o STOL efficiency in turnaround, air and ground maneuvers may be offset by delays in ground handling times.
- o STOL should be compatible with planned ATC for CTOL.

System Implementation

- o Existing airports should be considered in developing a STOL system as a new site may not be feasible because of high costs of land acquisition and new facility requirements.
- o STOL aircraft should operate with a minimum of ground support equipment.
- o Interface study and analysis will be required before implementing joint use of general aviation airports.
- o STOL operations separate from CTOL will require special treatment for interface with the interconnecting traffic.
- o Shifting of short-haul to separate STOLports will assure continued CTOL growth at certain congested airports.

6.2 Government R&D System Requirements

To assure that short-haul transportation systems, including aircraft and facilities, as described in this study, will be implemented on a timely basis it is recommended that the following in-depth R&D programs be initiated:

1. Cost benefits/disbenefits analysis related to the impact on the community by the conversion of general aviation airports to a STOL facility.
2. Determine and develop the approach and landing system required of the STOL aircraft.
3. Evaluate the impact of a STOL system in traffic reduction or increase on medium and long-haul service.
4. Changes in environmental impact at large and medium hubs as a result of the STOL system.
5. A study of route realignment and alterations to established travel patterns resulting from the introduction of new short-haul transportation system.
6. Impact of realignment of interconnecting service by diversion from major hubs.
7. Optimization of landing strip length by tradeoff studies between candidate STOL aircraft economics, noise criteria, and take-off requirements.
8. The feasibility of providing a STOL through-stop-network service during off-peak hours, to small

communities for needed and/or improved service.

9. Development of a plan to integrate the STOL service with existing and planned surface transportation systems for both general aviation and air carrier airports.

6.3 STOL System Implementation Plan

The nation's economic stability is linked directly to its transportation system. A highly developed, productive and expanded transportation system is a priority requirement to support the two and one-quarter trillion dollar economy forecasted for 1985. This growth is dependent upon a technologically advanced and integrated transportation system. A short-haul air transportation system must be considered as an integral mode of the required transportation system expansion.

Conventional aircraft operations are constrained today due to congestion and noise at the major hub airports particularly during peak hour activity. If there is no new short-haul independent transportation system by 1985, it is doubtful that the airports and airways will be able to provide the service that will be required to serve the traffic growth that is now being forecasted.

More conventional air carrier airports, as a means of increasing the capacity of the nation's air transportation system, will require huge expenditures of money, vast areas of land, environmental clearances and many years from the planning stage to actual construction and operation. In addition, environmental clearances and plans for developing the access connecting the new airport to the local ground transportation network will add more years before the total system could be implemented.

As an alternate way of expanding the capabilities of air transportation, a new independent short-haul system will prolong the life of existing conventional airports as well as increasing operational efficiency of the total air system.

The timely implementation of the proposed short-haul transportation system is directly dependent on two pacing development areas— the airport and the engine technology. To date, both government agencies and private industry are participating in an integrated plan for the development of a STOL system. NASA is taking a leading role in the development of the needed STOL technology. The DOT is participating in system requirements. The FAA's role in airport development is well defined. However, for industry to commit large expenditures required to implement such a system the expansion of the government's role in sponsoring technological development will have to be accelerated.

Figure 6.3-1 presents a STOL implementation development schedule with production deliveries commencing in the latter part of 1981. Assuming that NASA proceeds in mid-1973 with the research and development of a quiet-clean engine, the program should provide design data leading to the production of commercial STOL engines in the 1979-80 period. This would permit the development of STOL aircraft to commence in the 1977-78 period. Environmental approval could be initiated in 1974 for the necessary airports. Construction and activation would occur during the period beginning with 1979. These elements brought together in the proper timing sequence could lead to initiation of STOL service in the 1982-83 time period.

STOL IMPLEMENTATION DEVELOPMENT SCHEDULE

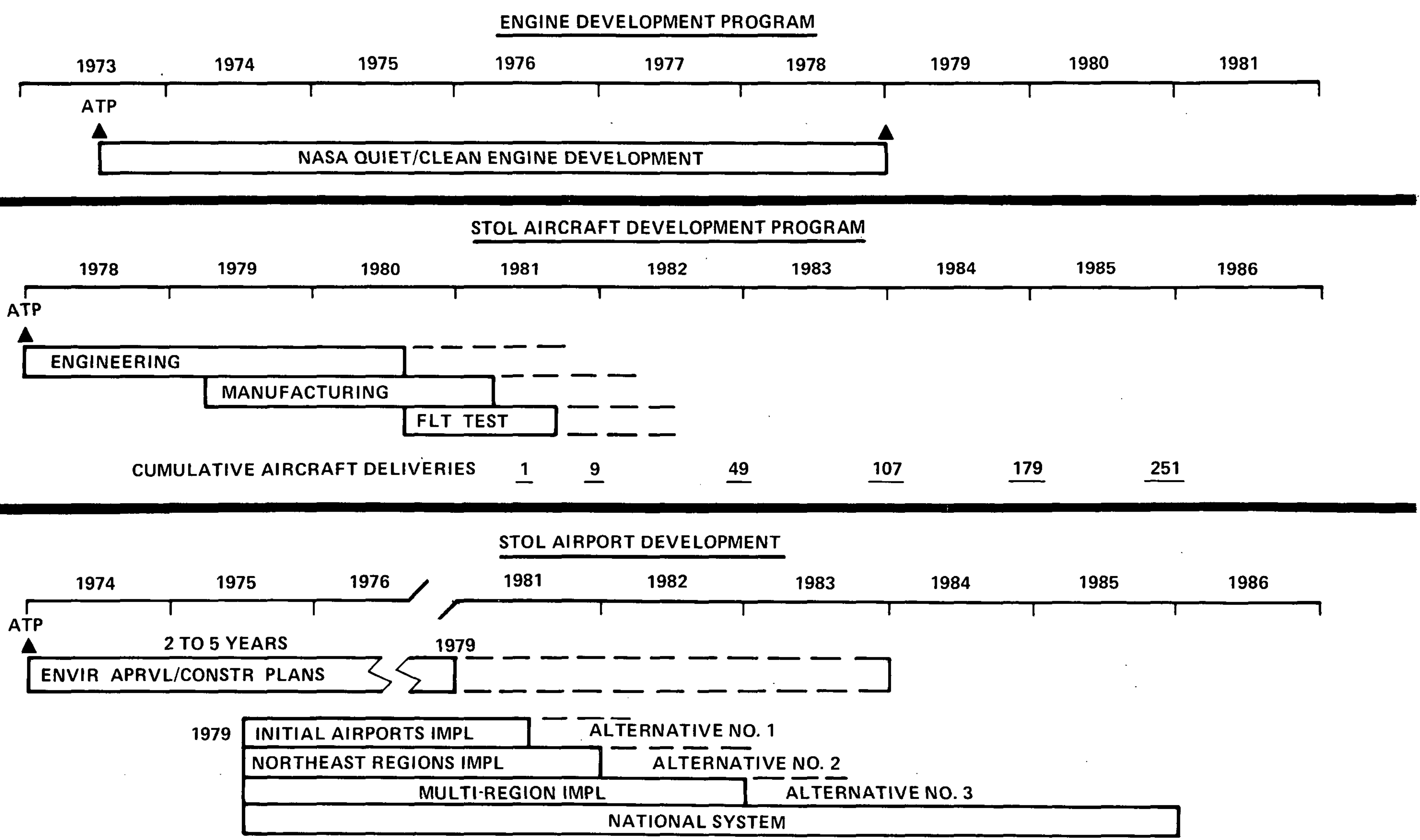


FIGURE 6.3-1

PR3-STOL-1776

The following presents three concepts for implementing a STOL system:

Implementation Operation - Alternative No. 1 - Figure 6.3-2 depicts an implementation plan considering the earliest use of STOL aircraft in a demonstration program sponsored by a joint agency composed of DOT, FAA, NASA and CAB representatives. An integrated development program for the engine, aircraft and selected key airports could result in a flight service demonstration program by 1981 at the earliest. Key cities are picked because of projected severe congestion. STOL airports in Chicago and Atlanta plus Washington National provide the initial basis with demonstration flights to other conventional airports in each region.

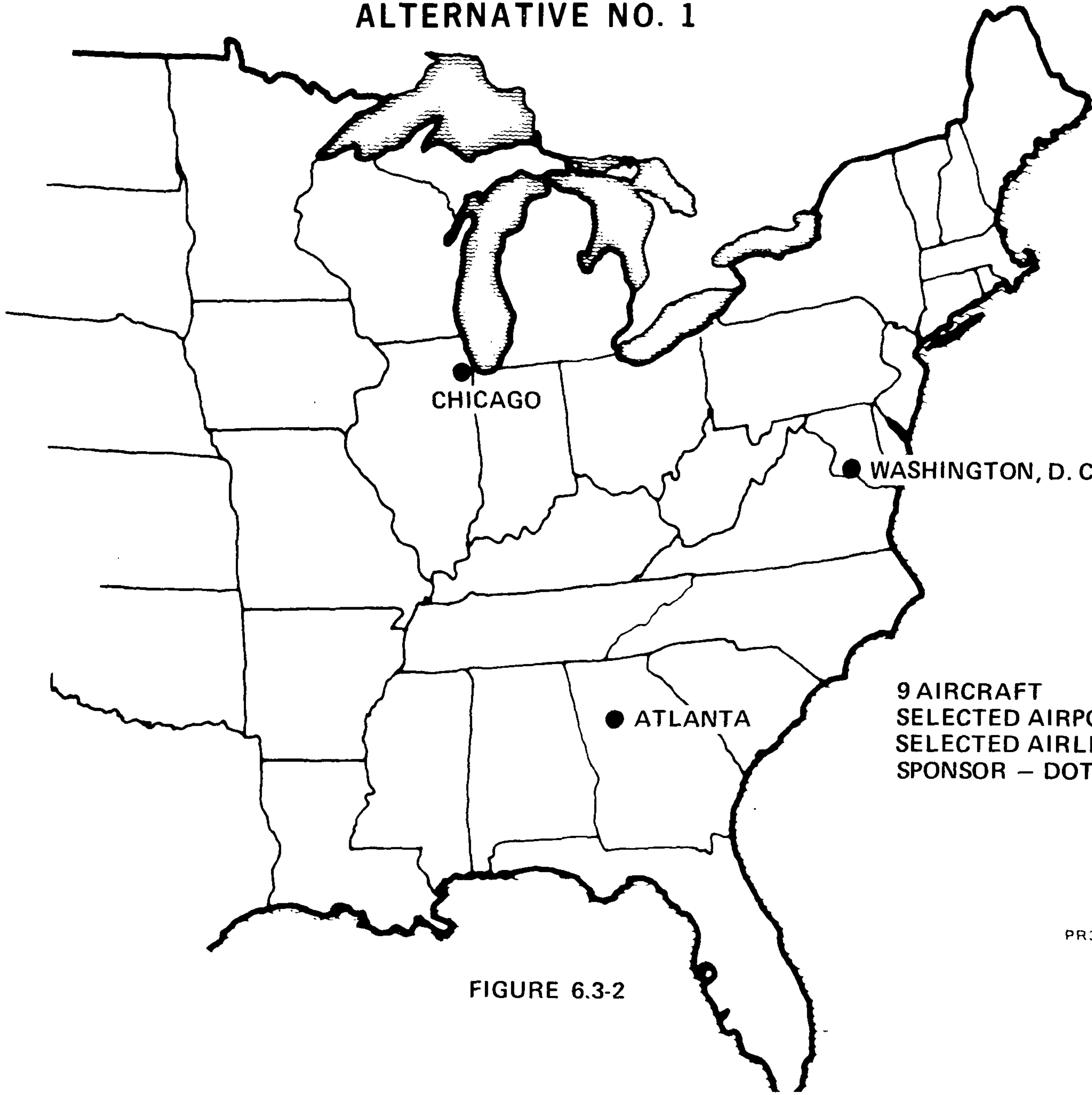
Implementation Operation - Alternative No. 2 - An alternative to a STOL demonstration of service at selected key sites is to start with deliveries to a few airlines. One potential area for this is the Northeast Region as shown in Figure 6.3-2. In 1982, about 49 aircraft could be delivered by a single manufacturer. Service from and between each of the airports shown could provide initial commercial STOL service.

Implementation Operation - Alternative No. 3 - Perhaps the most realistic way that STOL service could be implemented is to provide service in key cities in several regions as shown. By the end of 1982, 49 aircraft could be delivered by a single manufacturer. Deliveries to at least five (5) airlines during 1981-1982 permits the orderly training and

INITIAL OPERATION

1981 IMPLEMENTATION OPERATION

ALTERNATIVE NO. 1

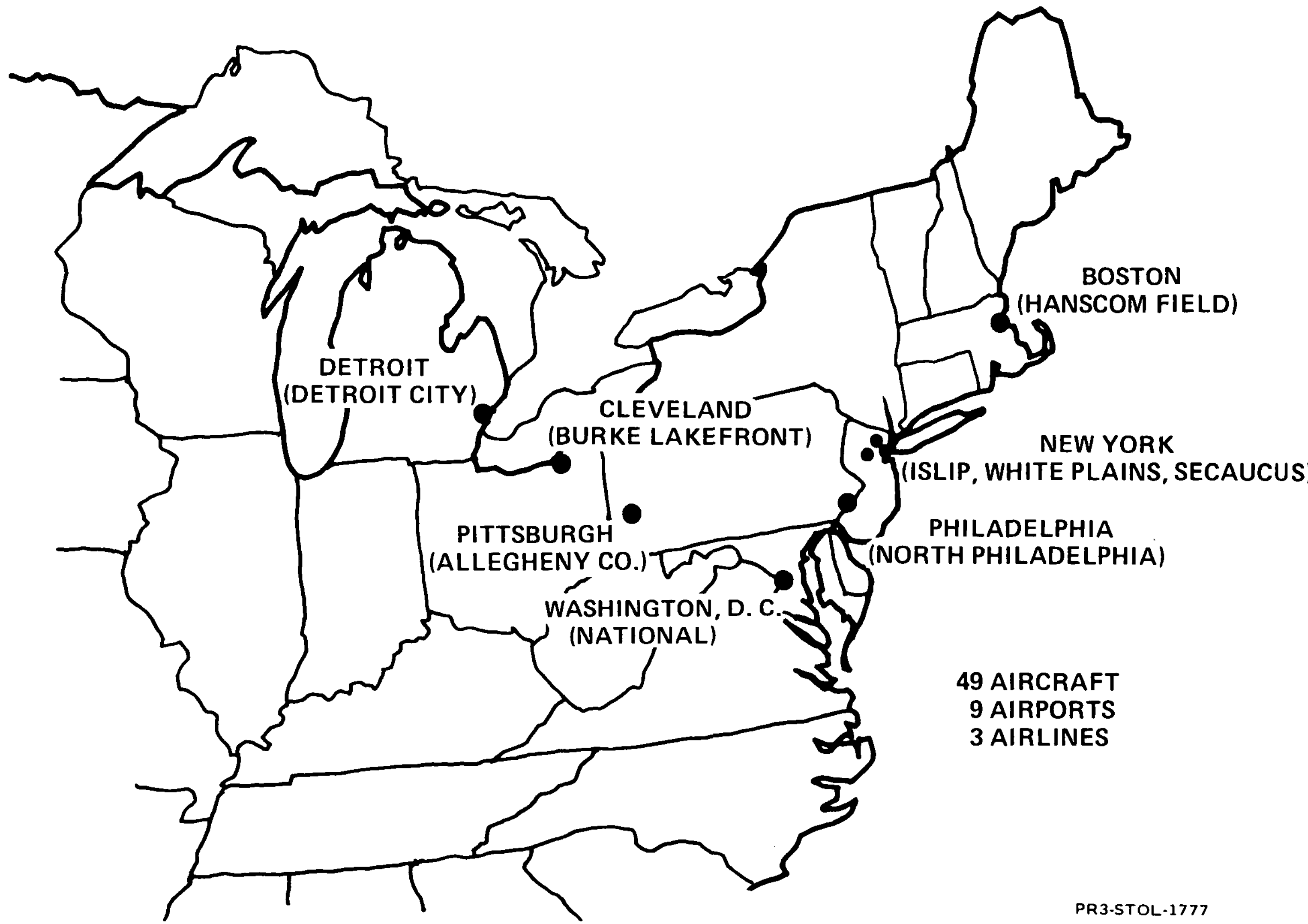


9 AIRCRAFT
SELECTED AIRPORTS
SELECTED AIRLINE
SPONSOR – DOT/FAA/NASA/CAB

PR3-STOL-1780 A

FIGURE 6.3-2

NORTHEAST REGION
1982 IMPLEMENTATION OPERATION
ALTERNATIVE NO. 2



PR3-STOL-1777

FIGURE 6.3-3

MULTI-REGION

1982 IMPLEMENTATION OPERATION

ALTERNATIVE NO. 3

FIGURE 6.3-4

familiarization programs normally used by airlines in introducing new aircraft. The key factor is the availability of airports. This requires a national policy, plan and program to be implemented jointly by the federal government, local agencies, and the airlines.

One approach of this study to relieve congestion was by diverting short-haul O&D service to secondary airports. Study results indicate that significant numbers of short-haul travelers are interconnect. If the congestion relief objective is to be accomplished, then a program should be initiated to study the feasibility of rescheduling of interconnecting traffic at major congested airports to air carrier airports where a CTOL and STOL service is established. Table 6.3-1 reflects the potential.

The following programs should be initiated to assure the timely implementation of a short-haul transportation system:

- o The airport noise and congestion problem has become serious. The development of early solutions with a new independent short-haul transportation system should be made a national goal and receive vigorous government leadership and funding.
- o Commercial STOL engine technology development should be accelerated.
- o Airport development toward a short-haul transportation system be initiated immediately.
- o Full cooperation of all federal agencies in expediting the processing of environmental impact statements for proposed STOL airports.

TABLE 6.3-1

1971 SHORT-HAUL PASSENGER MOVEMENTS

(In Millions of Passengers Enplaned and Deplaned)

City (Ranked by Number of Passengers)	O&D Short-Haul Passengers Local	Interline Connecting	Total
1. New York/Newark	8.4	1.1	9.5
2. Los Angeles	8.2	.9	9.1
3. Chicago	4.9	3.8	8.7
4. San Francisco	6.9	.6	7.5
5. Washington	4.2	1.7	5.9
6. Atlanta	2.0	2.4	4.4
7. Boston	3.5	0.5	4.0
8. Detroit	2.8	1.1	3.9
9. Pittsburgh	2.3	1.0	3.3
10. Dallas	1.7	1.6	3.3
11. Cleveland	2.1	0.6	2.7
12. St. Louis	1.6	1.1	2.7
13. Philadelphia	2.0	0.5	2.5
14. Minneapolis	1.3	0.7	2.0
15. Kansas City	1.1	0.7	1.8
16. Honolulu	1.2	.5	1.7
17. Houston	1.1	0.5	1.6
18. Denver	.6	0.7	1.3
19. Seattle	.5	0.1	.6
20. Miami	.5	0.1	.6
TOTAL	56.9	20.2	77.1

- A coordinated planned public education program, including demonstrations, on part of the government, manufacturers, airlines, and airport sponsors to make the public aware of the environmental and economic benefits of the proposed short-haul air transportation system.

6.4 Regulatory

6.4.1 Policy, Regulatory Requirements - New policies, changes in Federal regulations and special attention to Federal financial participation will be required to implement an efficient STOL short-haul transport system. A national policy must be adopted to establish an integrated short-haul system which meets specific objectives and time-oriented milestones.

The Federal Government has the statutory leadership role in the development of a STOL short-haul air transportation system. Effective national leadership cannot arise from local, regional or state levels, even though all are involved in the planning and implementation of a new system. To implement the short-haul system on a timely basis, the following actions are recommended:

Policy

- o The most effective solution to leadership is the centralization of the planning and executive functions for the STOL short-haul transportation system by Executive Order with appropriate support and funding.
- o An overall policy expressed by Congress and the Administration to encourage and support the development of the STOL short-haul transportation service to meet the needs of the public is necessary to effect the needed regulatory changes.
- o Multi-agency coordination is required to assure highway and transit ground access links to the new STOL facilities as well as for STOL facilities located on conventional air carrier airports.

- The development of new quiet engines for the STOL concept should be implemented immediately as a National goal to benefit the public sector and should be Federally financed.

Regulatory

- Federal Aviation Regulations must be simplified as they are amended and made applicable to STOL aircraft adopting certification procedures and regulations to permit effective utilization of their characteristics consistent with safety, operational requirements and environmental factors.
- Route awards and route realignment changes must be compatible with establishment of STOL operations away from congested hub airports to new locations.

6.4.2 Financial - New approaches to system financing should be investigated which include the Government, airlines. aircraft manufacturers and the financial community. The following financial considerations are presented as means of assuring the implementation of a STOL short-haul transportation system on a timely basis.

- The Federal Government should assume a financial share for STOL short-haul airport development for approved STOL airport development projects.
- To expedite the development of engine and STOL technology, consideration should be given to Federal guarantees on loans, both to guarantee availability and repayment of funding.
- Implementation of a STOL system may require Federal aid sponsored research and development and provision of FAA landing aids and an expanded ATC system.

- STOL service to the lower density markets should carry with it grant-subsidy eligibility for financial aid.
- Federal financial participation in a loan program for existing and potential STOL sites should be considered in the acquisition of land for future implementation of the STOL airport development.
- Federal financial participation in a land bank program should be considered to provide for future new STOL airport sites.
- Federal financial participation and coordination with STOL airport sponsor should be considered to assure that access facilities will be adequate for STOL service implementation.

SYSTEMS ANALYSIS
7.0 CONCLUSIONS

1. There is a market for STOL short-haul aircraft.
2. STOL aircraft can provide improved short-haul service.
3. The establishment of a short-haul transportation system can alleviate trends towards congestion in the air and on the ground with its attendent delays and cost penalties at the major hub airports.
4. Frequent STOL operations on constrained hub airports should be independent from conventional air carrier operations. Passenger terminal operations need not necessarily be independent.
5. Regular STOL operations on general aviation airports will require facilities independent from general aviation activities.
6. The 150 passenger capacity aircraft is the best compromise of the four sizes studied (50, 100, 150, 200 passengers).
7. Within the scope of the study, the 3000 foot field length design concepts are preferred in comparison with the 2000 foot concepts considering direct operating cost, fuel consumption and maintenance. For example, achieving a 2000 foot field length capability, in comparison with 3000 foot field length, results in a penalty to the EBF design of 39 percent in fuel burned and 28 percent in DOC.
8. Variations in study cruise Mach number (Mach 0.68 to 0.79) have no appreciable impact on system operations in the short-haul route networks in all the representative regions.
9. Propulsive-lift concepts studied were shown to have sufficient potential to be considered for future research, except the IBF.

10. For the noise goal condition of 95EPNdB at 500 foot sideline, and for 3000 foot field length, the mechanical flap concept has a lower community noise footprint area (90EPNdB) than the EBF concept (31 percent less) at comparable DOC's. This mechanical flap concept will have somewhat poorer ride quality than the EBF design (wing loading of 74 lb/sq. feet versus 100 lb/sq feet) and may require a gust alleviation system.

11. The STOL system should be designed for reliable service, simplified reservation, automatic ticketing, snack and beverage provisions, carry-on baggage provision and fast efficient ground handling of aircraft, passenger and related supportive activities.

12. The STOL system should include high, medium, and eventually lower density markets serving both intra-and inter-regional networks.

13. The introduction of STOL service into the National Transportation System will be evolutionary.

14. The implementation of STOL service may require certain institutional changes including:

    o The establishment by Executive Order of a National Short-Haul Transportation Plan as part of a total National Aviation Plan.

    o Centralization of the planning and executive functions for the STOL short-haul transportation system.

    o Establishment of STOL route awards and route alignment changes away from congested hub airports.

15. STOL short-haul service could be introduced in the 1982-1983 period assuming the following conditions:

- The development and test of a military STOL transport prototype by 1976.
- The development of a NASA quiet, clean engine by 1976 followed by an intensive flight test program.
- The early initiation of a national ATC facilities program for a STOL short-haul system.
- The initiation of commercial STOL engine and aircraft production during 1978.
- The early initiation of a national airport plan for a STOL short-haul transportation system.

16. The pacing factor in the achievement of a national STOL short-haul transportation system is the airport network. To activate a STOL facility:

- On a conventional air carrier airport will require approximately nine years.
- On a general aviation airport will require approximately ten years.
- At a new airport location will require a minimum of eleven years.

17. The time required to prepare and process an Environmental Impact Statement is excessive and should be included in the early planning phases of the system implementation.

8.0 APPENDICES

Appendix A	Supporting Data for System Scenario
Appendix B	Maintenance Concept Analysis Replications
Bibliography	

System Analysis Study Team

The following McDonnell Douglas Corporation personnel participated as members of the System Analysis Team and contributed to the study effort as indicated:

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M. J. Mooney	Airline Planning
S. C. Nelson	Systems Analysis
R. G. O'Brien	Fleet Operations Concepts
P. J. Rose	Fleet Operations Concepts
W. A. White	Maintenance and Support Concepts

APPENDIX A

Supporting Data for Development of the STOL Systems Scenario - 1985

AIRPORTS

A number of sources have been used to construct a listing of congested airports. These sources include Douglas Aircraft Company internal studies and various documents listed in the Bibliography. The data has been organized into a list of cities and airports which are projected to suffer congestion or constraints by 1985. Constraint is a generalized term which is used to describe any form of impediment to free flow of traffic over a given time period. For the purposes of this study, the term is subdivided into the following levels and meanings.

Level 1, Congestion - Physical

This is a specific form of constraint applied to the movement of people or vehicles. Congested airports are those at which movement is restricted and delays or temporary stoppages occur in the movement (flow) of aircraft, airside/airport; people and baggage, terminal; or surface vehicular traffic, groundside, entering or leaving the airport across the airport boundary. This may occur either within the airport boundaries or on the network of surface streets providing community access to the airport. The Level 1 category is applied to those airports which now or in the future projection are congested to a saturation level. In this concept, no additional operations or expansion is possible.

Level 2, Constrained - Physical

Another form of physical congestion is less severe than Level 1. Operations are occasionally interrupted and delays occur at peak hours. However, there is sufficient area within the airport boundaries to permit the rearrangement or addition of facilities to restore free movement to aircraft, people, or surface vehicles. One example is the airport at Dallas and Ft. Worth, Texas, which includes a separate STOL runway and terminal in its long-range master plan of development.

Level 3, Constrained - Social

A special application of the word used in a social sense wherein restrictions (physical) are placed upon the kind and level of aircraft operations permitted at the airport. Typical constraints are applied in the form of anti-noise flight profile rules, permissible exhaust emission standards, or time-of-day operations restrictions such as prohibiting jet operations between 10:00 PM and 6:00 AM.

Level 4, Congested/Constrained

There are some airports in the U.S. at which there are both physical congestion arising from sheer volume of operational demands and also social constraint of Level 3 nature.

Level 1, Congested - Physical	Airport
Albany/Schenectady, New.York	Albany County
Atlanta, Georgia	Atlanta Municipal
Baltimore, Maryland	Friendship International
Boston, Massachusetts	Logan International
Chicago, Illinois	O'Hare International
Cleveland, Ohio	Hopkins International
Detroit, Michigan	Detroit Metropolitan/Wayne County
Hartford, Connecticut	Bradley-Windsor Locks
Los Angles, California	Los Angeles International
Memphis, Tennessee	Memphis International
Miami, Florida	Miami International
Minneapolis/St. Paul, Minnesota	Wold Chamberlain Field
New Orleans, Louisiana	Moissant International
New York, New York	Kennedy International
	LaGuardia Field
	Newark International
Philadelphia, Pennsylvania	Philadelphia International
Pittsburgh, Pennsylvania	Greater Pittsburgh
San Diego, California	Lindbergh International
San Francisco, California	San Francisco International
San Jose, California	San Jose Municipal
St. Louis, Missouri	Lambert Field
Washington, D.C.	Washingon National
Level 2, Constrained - Physical	
Buffalo, New York	Greater Buffalo
Denver, Colorado	Stapleton International
Las Vegas, Nevada	McCarran International
Milwaukee, Wisconsin	Mitchell Field
Oakland, California	Oakland International
Providence, Rhode Island	Greater Providence
Rochester, New York	Monroe County
Seattle, Washington	Seattle/Tacoma International
Syracuse, New York	Hancock Field
Tampa, Florida	Tampa International

Level 3, Constrained - Social	Airport
Burbank, California	Burbank/Hollywood
Boston, Massachusetts	Logan International
Dallas, Texas	Love Field
Denver, Colorado	Stapleton International
Los Angeles, California	Los Angeles International
Long Beach, California	Daugherty Field
Miami, Florida	Miami International
Minneapolis/St. Paul	Wold Chamberlain Field
New York, New York	Kennedy International
Santa Ana, California	Orange County
San Diego, California	Lindbergh International
San Francisco, California	San Francisco International
San Jose, California	San Jose Municipal
St. Louis, Missouri	Lambert Field
Washington, D.C.	Washington National

Level 4 Congested/Constrained - Social	
Boston, Massachusetts	Logan International
Denver, Colorado	Stapleton International
Los Angeles, California	Los Angeles International
Miami, Florida	Miami International
Minneapolis/St. Paul	Wold Charberlain Field
New York, New York	Kennedy International
San Diego, California	Lindbergh International
San Francisco, California	San Francisco.International
San Jose, California	San Jose Municipal
St. Louis, Missouri	Lambert Field
Washington, D.C.	Washington National

LOS ANGELES INTERNATIONAL

Secondary Airports, Long Beach, Orange County (Santa Ana); Van Nuys (Los Angeles) General Aviation with ATC tower; El Monte (El Monte)

International anchors the Los Angeles Hub, a vast and growing complex of airports which are among the nation's leaders in both air carrier and general aviation operations each year. LAX, ranking second only to Chicago's O'Hare in order of number of enplaned passengers, has annual operations distributed as follows: air carrier, 72.2%; general aviation, 26.2%, and military, 0.5%. Over the past decade, air carrier percentage of operations have remained relatively stable. Ten years ago the figures were: air carrier, 74.2%; general aviation, 17.2%, and military, 8.6%. Traffic at LAX presently numbers about 640,000 annually and is expected to jump over the 800,000 mark by 1975. Helicopter operations account for about 10% of this total and is expected to increase substantially over the next five-year period.

Traffic at other Hub area airports is huge, with the satellite airports and major relievers accounting for over three million total operations per year. In addition these airports handle about 100,000 air carrier operations annually. A breakout of major Hub airports and their approximate total operations is as follows:

Burbank	250,000
Hawthorne	300,000
Long Beach	550,000
Ontario	180,000
Palmdale	140,000
Santa Ana	550,000
Santa Monica	360,000
Torrance	415,000
Van Nuys	530,000

Modifications and improvements recently contracted for at the El Monte reliever airport include construction, marking and installation of medium intensity runway and taxiway lighting for Runway 3/21, 4,050 ft. by 75 ft., parallel, connecting and exit taxiways; construction of parking apron, and landing aids at a cost of over $350,000.

The size of the Los Angeles Hub can be measured by its top or near top ranking in key aircraft activity categories. General aviation flying is greater than in any other area in the country. Air carrier operations at LAX are the second highest of any other airport in the nation, as are total operations and enplanements. However, for these and other reasons, LAX also ranks among the highest in ground and air congestion. Key factors causing congestion listed by the FAA included

- Runway saturation
- Layout of several taxiways inefficient with respect to runway and ramp areas
- Lack of aircraft gates
- Insufficient aircraft holding areas
- Restriction imposed by noise abatement procedures

In addition, it is pointed out that the saturation of one area (i.e., the airfield) has an affect on other areas, such as terminals and parking, particularly at LAX. The congestion problem is not new, nor is it one of insufficient planning. In the mid-sixties, the L.A. Department of Airports, in anticipation of the tremendous passenger growth (estimated to total 50,000,000 in 1975), conducted a study to determine the needs through 1975 of LAX and the Hub's satellite and reliever airports. From this evolved a three-phase improvement program which called for 1) maximum utilization of LAX, 2) development and integration of V/STOL "metroports" and 3) a network of satellite airports. Allocation of funds to accomplish the program were, at that time, estimated to be:

	1967-1971	1971-1975	Total 67-75
Airfield	$ 87,723,624	$ 23,553,067	$111,276,691
Terminal	168,582,878	138,299,000	306,881,878
Roadways/ Parking	56,458,000	12,400,000	68,858,000
Other	14,692,000	2,270,000	16,962,000
	$327,456,502	$176,522,067	$503,978,569

The progress of this ambitious master plan can be assessed by detailing current projects and plans in key areas.

Roadways/Parking/Access

The capacity factor in this area is deemed crucial since it is the one that will limit the number of passengers that can be handled at LAX. In other words, if enough time and money is spent, the capacities of airspace, airfield and terminal facilities could be increased to handle up to an estimated 80 million passengers which would extend LAX maximum capacity sometime beyond the 1980 period. However, the present access facilities (both externally and internally) have an estimated capacity of 50 million passengers thus limiting maximum capacity to the 1975-76 period. The access factor's importance becomes evident when it is realized that over 90% of LAX passengers employ private auto to go to and from the airport.

Initial plans called for some large scale improvements to alleviate the auto congestion problem but will have to be weighed against cost and newer developments. They were additional entrance road construction to increase capacity to permit some 50 million annual passenger traffic; increase capacity within the airport by double-decking airport roadways and providing six separate entrances/exits, and increase parking to accommodate 30,000 cars by multi-level facilities over the present parking areas.

Terminal

Additional terminal improvements and indeed, additional terminal buildings, constitute a pressing need at LAX. The need for more gate positions, particularly to accommodate the wide-body jets, and possibly in due time the supersonic transports, is equally acute. The satellite terminal arrangements at LAX, with most of the major airlines occupying an individual terminal, creates of necessity an "exclusive" gate use policy, which simply means that an unoccupied "company" gate cannot be used by another airline. Terminal 6, which is shared by several airlines, has a non-exclusive gate policy; however, because of the volume created by the several airlines, there are seldom enough gates to accommodate aircraft during peak hours, resulting in delays daily. However, if the present pace of expansion and new construction by both the sponsor and airlines is maintained, terminal facilities should be adequate to meet forecasted demands through the 1980 period.

Two new terminals were scheduled and due for completion in 1972-73. Satellite Terminal 1 will provide an additional 28 gates, about half of which will accommodate the wide-bodied jets. Cost is estimated at $275 million. West Terminal, at a cost of $165 million will add another 32 gates, all of which will handle the wide-bodies.

The airport, in order to reduce the congestion caused by the mingling together of the short haul passenger with the long-hauler, has centralized the commuter carriers in a new terminal on the airport periphery. This enables the airlines and passenger to take advantage of quick turn-around and rapid loading and unloading processes. When original plans are carried out, the commuter terminal will have 20 gate positions, an adjacent parking garage, rooftop heliport serving the outlying metroports, and a passenger access system to the airport center. Towards the end of the decade the airport plans to construct a giant terminal structure which will house three smaller terminals.

An estimated $44 million was spent in 1969 on field improvements, terminal expansion, and hangar construction at LAX. The airlines are spending approximately $15 million for new construction and expansion, mainly to accommodate wide-bodied jets and eventually the SST. Estimates run as high as $170 million for the amount to be spent by airlines by 1975 for LAX improvements. TWA and American construction programs in the L.A. area are expected to total over $85 million during the next five years.

Current and planned projects at LAX being carried out by the airlines include:

American - 15,000 sq. ft. terminal expansion, three additional gates and passenger lounges, new baggage system - $4.15 million. Completion of five-story 247,500 sq. ft. "super bay" maintenance hangar - $18 million.

Continental & Delta - 30,000 sq. ft. terminal expansion jointly undertaken (both use the same terminal) to accommodate two 747's or six conventional jets, baggage handling systems - $10 million est.

Pan American - two new 747 gate positions in International Satellite Terminal, additional terminal improvements - $7 million. Planned maintenance faciltiy - $60 million.

TWA - 6,000 ft. terminal expansion, gate modification to handle 747's - $2 million. Completion of 115 foot high, 75,000 sq. ft. maintenance hangar - $9 million.

United - 23,000 sq. ft. terminal expansion -$2.5 million. Planned maintenance facility - $30 million.

Airfield

Current airfield improvements center around strengthening existing runways, widening taxiways and fillets to accommodate the wide-bodied jets. Reconstruction was recommended for Runway 6R/24L as is the extension of Runway 6L/24R following work on both 7/25 runways. Additional holding areas to relieve gate positions are also planned. Work on a new North/South parallel access taxiway, including overpass, will permit four-way N/S taxiing and reduce delays caused by traffic crossing on the existing N/S taxiways.

Satellite/Regional Airports

Palmdale: In mid-70, DOT approved Palmdale as the site of a major new airport to serve the Los Angeles area. The location is adjacent to Air Force Plant No. 42 which includes an operating airport now jointly used by the military and commercial air carriers. As planned, Palmdale will be a sprawling 17,000 acre complex, operational by 1980, at a cost of 1 billion dollars. Initial design calls for four 14,000 foot runways and a pair of 3,000 foot STOL runways. Site selection was based on the fact that Palmdale is outside the congested and environmentally unsound L.A. Basin.

Palmdale is scheduled to receive about $12 million from the government under the Department of Housing and Urban Developments Advance Acquisition of Land program. At present, in addition to the Air Force facilities at Palmdale, a $500,000 temporary terminal has been constructed. Additional automobile parking and aircraft ramps are also scheduled, in order that more use can be made of the facility by scheduled carriers.

Long Beach and Orange County - Both these satellite airports' development plans have undergone civic objection resulting in expansion limitations. Applications by Calfironia's two intrastate airlines (Air California, PSA) to serve the airport were left up in the air, following disagreement in the Long Beach City Council. Voters, in November, 1970 elections, voted down an amendment which would have permitted an airport expansion project, indicating further growth limitations. At Santa Ana's Orange County Airport, noise restrictions have imposed a limitation on the number of flights conducted, type of aircraft flown and nighttime operations. Future growth at these airports will be subjected to civic attitudes and political pressures.

SAN DIEGO INTERNATIONAL/LINDBERGH FIELD

San Diego presents rather a unique problem due to the substantial operations of Pacific Southwest Airlines out of the field. Since PSA's operations are not counted in official CAB data, the reported 1970 operations figure is 44,000 for the year, while in fact there were some 78,000 commercial operations at the field. This discrepancy has led to considerable difficulty in the forecasting of future operations at Lindbergh, since little is known about PSA and its plans.

San Diego is officially classified as a medium hub, but again, with the addition of PSA's traffic it actually qualifies as a large hub airport. Traffic at the field is very heavily short-haul in nature and as of March 1972, more than 85% of all operations were for flight stage lengths of 500 miles or less. San Diego also has the highest percentage of general aviation activity as a percent of total, as of fiscal year 1970 (57.9%). This is the highest percentage of any airport covered in this study. Two-engine turbofan type aircraft or smaller accounted for 30.4% of all operations in March 1972, while the 727 types accounted for another 38%. The remaining operations were performed by large four-engine jet aircraft.

For fiscal year 1983 the FAA has projected 120,000 operations. On the other hand, a study currently underway for the County of San Diego projects total commercial operations at Lindbergh at 171,000 for the year 1985. This results in a 100% difference in the high and low projections.

When faced with such diversity, it is the practice to lean towards the higher projection, if only to present the possible worst case for evaluation by aviation planners. Accordingly, 155,000 operations are included in the analysis, which falls in line between the FAA 1983 projection and the County's 1985 projection.

It is anticipated that by 1985 there will be 747 service into San Diego, if only to provide through service via Los Angeles. On the other hand, the DC-10/1011 types will form an important segment of total operations (30%), particularly in view of the fact that the major portion of PSA's fleet will be made up of these types by 1985. The stretched 727 will also be an important aircraft through the study period, while the four-engine turbofans and two-engine turbofans will assume less importance.

The potential for land use conversion in the airport area is severly limited by factors of geography, community stability and institutional land holdings. Some land acquisition has been carried out to eliminate safety hazards along flight paths. The density of residential development complicates acquisition by forcing the purchase of many small parcels. To the west of the airport the well developed, economically stable Loma Portal community maintains a posture of strong objection to aircraft noise and continued support of single-family residential use of the land. This is in accord with plans for the retention of residential uses for the entire Point Loma land area, which includes some of the most desired residential real estate in metropolitan San Diego.

Intensification of land uses north of the city's central business district may provide some opportunity for land use conversion east of the airport. The area is presently characterized by a variety of uses including industrial, rail and highway right-of-way, residential and recreational uses. The principal land use is residential, and the strong sense of ethnic solidarity in this area would raise difficult political problems if proposals for conversion of neighborhood land were made. The Centre City Plan, which provides for a conversion of this area to a "downtown" mix of uses, may result in replacement of some of the least stable residential areas with airport compatible uses (office - commercial), but it also provides for construction of apartment buildings which would probably result in a net increase in the area's population.

Complaint statistics are accurately maintained by the Port of San Diego, the airport operator. However, one important element of community reaction to noise has not been included. Marine Corps and Naval Training facilities are located on land immediately to the west of the airport, thereby placing residential, recreational, religious, medical and educational land uses in a high noise impact zone. The U.S. Naval Hospital in Balboa Park to the east also lies partially within the 40 NEF area.

The military impact on the noise environment around Lindbergh Field is further emphasized by the use of North Island Naval Air station across from San Diego Bay. The principal runway for North Island runs north/south, thereby creating flight patterns which cross the Loma Portal area. Future analysis of the noise environment for this section of San Diego should consider the impact of noise on military populations as well as the contribution to environmental noise made by military aircraft.

SAN FRANCISCO INTERNATIONAL

Secondary Airports, Reid-Hillview (San Jose); San Carlos, San Jose Municipal.

San Francisco International, ranking fifth in the nation in order of number of enplaned passengers, anchors the growing area's hub airports. In the distribution of operations at S.F. International, air carrier accounts for 78.4%; general aviation, 20.1%, and military, 1.5%. Over the past decade, these percentages represent a steady increase in air carrier operations (from 59.4%), and a decline in military and general aviation flying, although the latter has remained about the same over the last five years.

Traffic at the area's three air carrier airports (SFO, Oakland, San Jose) is currently over 1 million operations per year. This is expected to climb over the 2 million level by 1975. Estimated breakout of annual operations at the three airports is: San Francisco - 400,000; Oakland - 370,000, San Jose - 240,000.

Air carrier operations at the three airports is presently nearing the 500,000 annual level and will probably total close to 1 million in 1975. Helicopter operations at San Francisco represent about 6% of total traffic, while at Oakland, helicopters register about 4.6% and San Jose less than 2%.

Reid-Hillview constructed and marked parallel Runway 13R/31L (3,100 x 75 ft.), including connecting taxiways at an estimated cost of $85,000.

According to a study conducted by Systems Analysis and Research Corporation for the Association of San Francisco Bay Area Governments, enplanements in the nine-county bay area will total 82 million in 1985. This compares to a current 18 million passengers. If these forecasts prove accurate, much work is required to expand and modernize the Hub's airports with most of the burden of accommodating the predicted more than four-fold passenger increase falling on the three air carrier airports now serving the area.

San Francisco International

In the past, S.F. International has been bothered by several problems that have greatly added to congestion. Although some of these are inherent and cannot be effectively alleviated, other problems will be reasonably solved when a $140 million expansion/improvement program, now underway, is completed. Chief causes of congestion at S.F., according to the FAA, are:

- Inadequate runway length and exits
- Noise restrictions on runway use
- Continual need for maintenance/repair of runways and taxiways
- Inadequate number of taxiway lights and markers
- Inadequate apron space and gate positions

Noise restrictions and runway length limitations impose special problems at San Francisco. About two-thirds of the time, landings are made on the parallel 28 Runways and takeoffs on the parallel 1 Runways. At other times, noise abatement procedures require that departures be made on the 10 Runways and landings on the 19 Runways. Thus, for about 75% of the time, take-off and landings are forced to use runways that intersect each other at almost their mid-points. In addition, heavy jet aircraft do not usually use the primary departure Runway 1R, but prefer to use the longer (by 1100 ft.) Runway 28L -- normally a landing runway. The effect of this is a reduction in runway capacity.

Part of this problem was alleviated with Runway 28R extended to a total length of 11,870. Completion of the extension cost $3.7 million. Associated taxiways additions and widening of taxiway turnoff cost about $500,000.

Rehabilitation of runways and taxiways continues, with work being completed on Runway 1R/19L and the northern 2,000 ft. of Runway 1L/19R. Tentative plans also call for the extension of Runway 19L by 2,000 ft. to enable large aircraft to employ Runway 1R for departure. The cost of this project would be in the $8 million range. New runways under consideration for use by the 1975 time period include a parallel 2,000 by 75 ft. east/west general aviation/STOL runway. Located in the Bay, it would require extensive fill and taxiway system, and probably cost about $5 million. An additional parallel runway 10/28, 10,500 x 150 ft., has been proposed. It too, would be located in the Bay and require extensive site preparation with costs estimated to be $45 million. Centerline taxiway lights are being added, as are taxiway signs in the terminal area.

The new North Terminal building provides for 23 new gate positions, bringing the total to 77. Expansion of the north terminal apron is completed. Total gate requirement is expected to total 95 by 1975. Thus, further expansion is planned to meet the post 1972 period requirement. Gates are used exclusively by the particular airline except at the International finger where mutual use is made.

In mid-1970, the Public Utilities Commission issued a $10 million contract for the construction of a roadway network providing more rapid and improved access to the terminal facilities. It was the largest contract for an individual project in S.F. International's history. Following completion of TWA's terminal expansion in 1970, American and United have begun construction projects that will cost in excess of $16 million, under authorization of the Public Utilities Commission.

Creation of a separate airport commission has replaced the PCU. The new commission is responsible for all of the hub area's airports formerly operated by the PCU. New baggage handling systems at the International facility will greatly speed up customs processing and enable handling of double the present amount of international arriving passengers.

Oakland International

Oakland International airport was created in 1962 with the completion of a $20 million expansion program in the existing general aviation facility. Some 1,400 acres of San Francisco Bay were reclaimed and a new air carrier airport established about a mile into the Bay. Thus, International is actually two airports in one, sharing a single tower.

The "old airport" or North Field is a three-runway complex used primarily by general aviation aircraft. Two parallel east/west Runways 27L/9R and 27R/9L are 6,210 ft. and 5,452 ft., respectively. Crosswind Runway 15/33 is 3,400 ft. The newer air carrier airport, which is linked to North Field by a roadway and taxiway, has a single 10,000 ft. Runway 11/29.

The expansion program, in addition to the control tower, included a terminal building with full passenger handling, conveniences and services facilities; terminal apron with 10 gate positions; parking facilities which have since been expanded to accommodate 3,200 cars, in addition to a short-term parking lot; service buildings; cargo facilities, and, perhaps most important, room for further expansion.

Since the first full year of operation, 1963, passenger traffic has risen from 425,000 to about 2,000,000 at present; operations from 54,000 to about 370,000 of which some 80,000 are air carrier.

In anticipation of further passenger and cargo growth, recent projects called for extension of Runway 11/29 2,500 ft. to 12,500 ft. at a cost of about $2.5 million and construction of an air cargo center, including two new buildings with a total area of 64,300 sq. ft. and terminal area expansion. The cost of this project was placed at $900,000.

The Port of Oakland, through revenue bonds, has earmarked $1.6 million for construction of additional terminal expansion that would initially increase gate positions to 17. Another $15 million will provide for additional gate expansion to 30 positions and the provision of new customs facilities. Rapid growth of activity will, of course, necessitate further expansion throughout the decade of the 1970's. Expansion of terminal and terminal area facilities, cargo and maintenance areas, and parking areas will all be required. However, of prime importance will be the addition of a new parallel 11/29 runway which would cost about $23 million to construct, including a required dike. The need for the new runway could require its completion by 1967, but this is highly dependent upon the rate of increase in airport activity.

Perhaps the key to the extent of Oakland's growth rests in the ability of passengers (or potential passengers) to get to and from the airport conveniently and rapidly. Most residents of six of the nine counties now served by San Francisco Hub are closer to Oakland International than they are to San Francisco International. Assuming that flight service and scheduling would follow demand, many passengers would prefer to originate from Oakland and would do so if access to the airport was at least competitive to any other.

From this point of view, Oakland seems to be making progress. The airport is close enough to link up with the new Bay Area Rapid Transit (BART) system now under construction. The Department of Transportation has already approved a $60,000 grant for a technical study, and Kaiser Engineers is under contract to determine the optimum airport-transit link. If the airport is tied in with the BART system, a trip from downtown Oakland to International would take about 10 minutes as opposed to 17 minutes by car and 30 minutes by bus. A trip from airport to San Francisco would take from 20 to 25 minutes, competitive with the trip from S.F. International. Additionally, Oakland International would eventually be linked with downtown San Francisco via the Southern Crossing which will traverse the Bay. When completed, the airport passenger will be able to drive 10 miles to the airport almost exclusively by throughway.

At the North Field, Oakland has constructed and lighted dual taxiways between Runways 9R/27L and 9L/27R and build a single taxiway between Runway 9L/27R and the terminal apron, including a holding apron. This $120,000 project will greatly alleviate congestion by improving acceptance rate, permitting use of 27L intersection takeoffs, and decreasing taxiing time.

Location of the control tower at the air carrier terminal places it almost a mile from parallel Runways 9/27 and is a source of congestion at the North Field. Controllers are reluctant to conduct simultaneous operations on the runways because they cannot visually determine aircraft positions relative to the respective runway. This is further compounded by the high volume of student pilot operations. An additional tower to serve the general aviation facility is under considerations. Two tower operation at an airport is generally regarded as impractical, however, the two airport configuration of Oakland -- each with its own ILS and approach lighting system, traffic patterns, approaches, runway and taxiway systems -- may lend itself to dual tower arrangement. Growth of general aviation activity at North Field is on a par with the growth at the air carrier sector. Operations have nearly quadrupled since 1962 and based aircraft increased to about 500, more than double the number located there in 1962. Although some leveling off of general aviation traffic is expected at such time when air carrier operations (and overall airport demand) substantially increase, North Field figures to be one of the most complete and healthiest of the nation's major general aviation facility.

San Jose Municipal

Primarily a general aviation facility, Municipal is constantly assuming more air carrier traffic. At present, air carrier traffic accounts for about 25% of all operations. Located in rapidly growing Santa Clara County, Municipal has the potential of serving the populous southern Bay area which accounts for some 30% of all airline passengers in the San Francisco Hub.

To gear up for the expected increase of air carrier operations and overall demand on the airport's facilities, the City of San Jose instituted a series of improvement and expansion projects. Several of the major sources of congestion have been remedied. The primary air carrier Runway 30L/12R has a displaced threshold and a by-pass carrier aircraft forcing use of a taxiway that was also employed by general aviation traffic for access to Runway 30R. This mixing of general aviation and air carrier aircraft resulted in delays. With the strengthening, marking and rehabilitating of approximately 1,450 by 150 feet of the runway (the displaced threshold portion) and taxiways, this problem has been eliminated. San Jose has a high percentage of touch-and-go operations which were adding to congestion. A separate parallel runway, 3,000 ft. x 100 ft., has been built exclusively for touch-and-go operations. It is expected that the addition of this runway will add 25% to Municipal's practical annual capacity.

The terminal's south concourse and apron area at the satellite finger has been expanded to provide an additional eight gate positions, bringing to 12 the total number of gates. Planned terminal expansion called for four more gates and apron expansion to the north side. Eventually, Municipal will have a total of 48 gates. As growth potential is realized at Municipal, general aviation and training traffic will conflict more and more with air carrier operations. There are over 500 based aircraft at Municipal. Nearby Reid-Hillview cannot offer much relief since is already has over 400 based aircraft. Under consideration is a new reliever airport that would siphon off much of the general aviation traffic now located at Municipal and would act as a reliever to Municipal's air carrier traffic. The cost of the proposed airport is estimated at $2.5 to $3 million. Another alternative proposed is the construction of a new Regional airport since there are eventual limitations to expansion at Municipal. However, the cost is high ($280 million, est.) and little action has been taken.

MC CARRAN INTERNATIONAL, LAS VEGAS, NEVADA

McCarran International is the focal point of the Las Vegas Hub. In order of number of enplaned passengers, it ranks last of the nation's large hub airports. Operations are dominated by general aviation activity totaling 57%. Air carriers account for 36.8% and military flying 6.2%. While the distribution of operations for general aviation has remained relatively close to that percentage of ten years ago (61.1%, air carriers have risen from 27.3% and military has dropped from 11.6%.

Traffic at McCarran presently numbers about 250,000 operations annually and is expected to rise to some 270,000 operations by 1975.

Primary reliever airport to McCarran is North Las Vegas (some 9 miles distant), a privately-owned airport with 260 based aircraft. McCarran has about 160 based aircraft.

The increased traffic at McCarran has already been felt in varying degrees with gate congestion (especially at peak hours), taxiway tie-up, and runway inadequacy. Naturally this situation will worsen as operations increase during subsequent years. Specific factors causing congestion, described by the FAA, included the necessity of aircraft, departing Runway 25, to taxi past the intersection formed by the taxiways of Runway 25/7 and Runway 14/32 which is the normal turnoff point for aircraft landing on Runway 25. Since, at this point, there is room for only a single aircraft, one-way traffic results in delaying taxiing of other airports.

The condition of Runway 14/32 was such that only light aircraft could be permitted to use it. The limited length of runway 1/19 requires that the majority of jet operations use Runway 25/7, thus creating virtually a one-runway air-carrier operation.

Specific recommendations for improvements at McCarran, according to an FAA Task Force, included:

- Construct general aviation runway parallel to Runway 1/19 (5,000' x 60'), with taxiways
- Convert Runway 14/32 to full-strength taxiway, link with Runway 7/25 and provide taxiway to terminal
- High-speed exits on Runway 7/25
- Extend Runway 1/19 to 9,753
- Improve apron

Clark County has spent over $300,000 to construct Runway 1/19 (5,000' x 75') including lighting and connecting taxiways.

Expansion and improvement of McCarran was set in motion, with Clark County officials negotiating a $23 million bond issue. Plans called for a first phase program, involving $10 million, to provide runway extensions and other related construction. A second phase would provide for land acquisition and terminal expansion.

SEATTLE-TACOMA INTERNATIONAL AIRPORT

Seattle-Tacoma International, the principal air carrier airport in the Seattle Hub, ranks 19th in the nation in order of number of enplaned passengers. Distribution of operations at the airport breaks out to air carrier, with 65.2%; general aviation 33.7%, and military 1.1%. The relatively high percentage of general aviation operations is due mainly to the use of the airport by aircraft based at either Boeing Field or Renton because of the lack of customs facilities at the latter two airports. The use of Seattle-Tacoma by non-scheduled flights, air taxis, and other general aviation traffic accounts for about one-third of the total operations. Air carrier traffic at Seattle-Tacoma is currently about 115,000, but is expected to dramatically increase over the next five years to close to 200,000. A $200 million all-airport modernization program of Seattle-Tacoma International will result in one of the most advanced facilities in the nation when completed. Passenger enplanements, now numbering about 5,000,000 annually, are expected to increase to 20 million by 1980.

In late 1968, work was begun on the initial phase of an overall expansion program which required $174 million in revenue bonds. The master plan called for the incorporation of the existing terminal building with new buildings, salvaging as many of the facilities as possible and reduce walking distances in all areas. The varied projects are being completed in stages; in detail they encompass:

Terminal

The new terminal building expansion, at a cost of $23.5 million, will add 835,000 sq. ft. to the existing facility to provide over 1,000,000 sq. ft. The terminal features an eight-level parking garage, expanded ticketing facilities, a baggage claim area with 16 carousels, escalators connecting arrival and departure facilities, and the intra-terminal transit system.

In layout, the main terminal and plaza is V-shaped with the multi-story parking garage located within the apex of the "V" and the North and South terminals along the wings of the "V". Extending airside from the "V" are two dog-leg concourses, which will provide 10 gates each, including 747 gates at the end of each finger. Two satellite terminals or "islands" are located beyond the concourses connected to the main terminal only by an underground transit link. Extension of the concourses at a cost in excess of $2.8 million has been completed and will increase gate positions to a total of 35.

Satellite Transit System

An underground shuttle system was supplied by Westinghouse Electric Company under a $5.5 million contract. The automatic system operates via tunnels around two loops connecting six major points: the North and South terminal, the two concourses and the two satellites. The vehicles are lightweight, rubber-tired, electrically-powered, air conditioned, and are guided by a beam located along the running surface. Operation is under constant computer check out. Initially, nine vehicles will be provided, with each capable of holding 106 passengers. During peak traffic hours, it is expected that the shuttle will take about five minutes to complete a loop, including boarding and deboarding. Plans call for an eventual total of 25 vehicles with a capacity of over 500 passengers per minute. During light traffic periods, the shuttle system will operate between stations on an "on-call" basis.

Parking

The terminal parking garage, an eight-level structure, will eventually have the capacity to accommodate 9,200 autos. When completed (scheduled by 1978), the facility will be one of the largest of its kind in the world. Initially, accommodations for 4,800 cars are being provided at a cost of about $20 million. General Automated Systems, Santa Monica, California has a $467,000 contract to supply and maintain (for two years) a system that will provide for automated check-in/check-out of vehicles and fee control validation as well as determining parking space availability for the entire facility.

Baggage Handling

A unique automated baggage handling system is provided by the Mathews Conveyor Division of Rex Chainbelt, Inc. under a $5 million contract covering development and installation, and an additional $700,000 for two year maintenance.

The system, consisting of over 1,000 carts (4.5 x 3.2 ft.), is self-propelled over a track network connecting the main North and South Terminals and the concourse terminals. The carts, each with one large or two standard-size suitcase capacity, can be directed to selected terminal destinations automatically within 15 minutes.

Additionally, passengers arriving by car are able to check their baggage within the parking terminal. This is to be accomplished by locating areas, designated by particular airline, where passengers can park curbside and with assistance, deposit baggage for conveyance to the proper destination prior to parking their cars.

Cargo Facilities

Planning has begun to develop an extensive area on the northeast side of the airport devoted to a cargo terminal building, maintenance facilities, airmail and cargo handling, service areas, and access roads. Combined, this area is expected to encompass 72 acres.

Northwest Orient Airlines has a 60,000 sq. ft. air freight facility costing $8 million, including a service hangar for jumbo jet aircraft and a new flight kitchen. United Air Lines has a 30,000 sq. ft. cargo building costing $1 million.

Runways

In addition to terminal access roads, new apron areas and airport service roads, Seattle-Tacoma has added a new 9,500 ft. parallel N/S Runway 16R/34L at a cost of $16 million, with associated lighting and taxiways. This addition, coupled with the existing parallel Runway 16L/34R (11,900 ft.) and the diagonal general aviation Runway 2/20 (3,000 ft.), should satisfy 1980 projected demands as far as runway capacity is concerned. A new N/S general aviation runway, 3,800 ft. in length, has been recommended to permit use of the existing general aviation strip as a taxiway.

There are some inherent drawbacks at International that may show effects on operations. Seattle has always been faced with poor weather conditions, such as fog, that will back up traffic during those periods and cause varying degrees of airport congestion. Because of this, landing aids and runway lighting are a requirement far greater than at most other airports. Eventually, limitations to expansion will be felt because the available land is mainly topographically unsuitable to airport use. However, landing aids and runway lighting improvements are being made and more will be installed in the future. To some degree, land limitations can be controlled through the use of reliever airports to accommodate as much traffic as possible of the type that does not need the facilities of a large international airport.

In summary, Seattle-Tacoma ranks at the top of the list of large hub airports in meeting the requirements projected by 1980.

PORTLAND INTERNATIONAL, PORTLAND, OREGON

Portland International is a major regional airport on the Pacific Coast, the center of aviation activity for the State of Oregon, and an important intermediate station for coastal air traffic. In addition, it is beginning to receive more international and overwater services.

In March 1972 just over half of all operations at Portland were for stage lengths of less than 500 miles, while more than 90% were for less than 1,000 miles. The 727 class of equipment, both standard and stretched, was the dominant class of aircraft operating into and out of the airport, accounting for approximately 50% of all commercial operations. The large four-engine type aircraft was also well represented with the remainder (22%) being a accounted for by two-engine turbofans or smaller type aircraft.

Forecasts of operations present some range of diversity, although not an insurmountable one. For fiscal year 1983 the FAA projects 117,000 commercial operations. The airport itself anticipates a range of between 150,000 and 208,000 operations for the year 1985. It should be noted however, that third level and feeder type operations which may well utilize turboprop or piston type aircraft could swell the total commercial operations figure.

For fiscal year 1970, some 40.3% of all operations at Portland were accounted for by general aviation type aircraft, while 11.7% were military operations. In any event, with planned expansion by the airport, the facility should be capable of handling the demands placed upon it through the 1985 time period.

The passenger projections range from the FAA's fiscal 1983 projection of approximately 7,400,000 to the airport's "high" projection of 8,900,000.

Because of its location in the flood plain of the Columbia River, this airport has an affected population which is relatively small compared to many other major commercial airports. The area has been virtually untouched by urban development in the City of Portland which occupies the area to the south and west. In fact, the majority of the complaints relating to airport noise have originated in areas of Vancouver, Washington, which is located on a ridge across the river and affected only by a crosswind (north/south) runway used five percent of the time.

There has been little need for land acquisition and conversion to compatible uses until recently, when plans to develop and expand the airport have generated concern for area wide planning and general interest in land development.

The Port of Portland Commission operates the airport and is a major land holder along the river. Traditionally, the Port has had to deal only with Multnomah County when planning airport facilities. Recently, however, the City of Portland annexed a piece of river-side land to the west of the airport (and just outside the study area). This area, called Faloma-Bridgewater, has residential areas where lot-and-house values may reach $100,000 because of the river-front locations that are available, even in close proximity to farm dwellings and houseboat communities. Land owners with agricultural land in severe noise impact areas opposed Port of Porland efforts to persuade the City Council to hold zoning at agricultural or conservation density levels because they had anticipated speculative gains from more intense residential development. The Port of Portland Commission has worked closely with Multnomah County planners in an effort to persuade the City of Portland to adopt elements of a master plan which would favor recreational rather than residential use of the undeveloped areas surrounding the airpot. It is also proposed that some commercially zoned development would be retained along the Faloma-Bridgewater shoreline.

The Port is undertaking a land acquisttion program east of the airport where 300 acres of basically agricultural land will be purchased. The Port does not, however, want to continue to purchase land to ensure compatible development along its boundaries.

The airport expansion plan, which has been in the public eye since 1968, calls for realignment of the runways by seven and one-half degrees to a more directly east/west heading. This realignment would reduce the number of people exposed to aircraft noise, according to NEF studies prepared for the Port.

At present, noise-abatement concerns have been removed from "stage center" by the public interest in the effect of the runway realignment on the hydrology of the area. The government of the State of Oregon is very sensitive to ecological issues, and plans which do not meet all the criteria for low environmental impact will have a poor chance of success. Failure by the Port to obtain state approval of the proposed runway realignment will mean that the present zones of both 30 and 40 NEF will extend over areas now in the process of residential develoomemt.

The Port has kept all noise-related data a matter of public record, and planning activities conducted by the Port have included inter-governmental representatives as well as citizens' committees. The Port staff is concerned that the general purpose governments with which they deal are not sensitive enough to the issue of aircraft noise to reliably support proper development controls. They feel they continually may be forced to buy land to achieve protection, an approach they doubt will be satisfactory.

STAPLETON INTERNATIONAL, DENVER, COLORADO

At the center of the Denver Hub is Stapleton International, which ranks 15th in the nation in order of number of enplaned passengers. Of the total aircraft operations at Stapleton, 53.7% are classified as general aviation, with air carriers accounting for 45.9% and the military, 0.3%. This reflects an increase in air carrier operations over the decade of more than 11%. Ten years ago the general aviation share of operations was 58.5% and military flying, 7%.

Traffic at Stapleton, presently numbering about 450,000 operations per year, is roughly divided into three categories with air carriers flying about 200,000 operations, air carrier training flights numbering 150,000 operations, and other general aviation operations totaling 100,000. (It should be noted that air carrier training flights are considered under the general aviation category.) Traffic at Denver is expected to rise to 480,000 by 1975.

Denver is one of the largest air carrier training centers in the nation, accounting for over 30% of all operations. Predominant use of Stapleton for training purposes is made by United Air Lines. Training flights consist of touch-and-go's, low approaches, and simulated IFR operations.

According to the FAA, Stapleton suffers, to a minor degree, by inefficient taxiway systems, limited IFT capability, inadequate runup pads, and congestion of gates and apron area. Other factors leading to congestion are at a minimum at Denver. There are no flow control restrictions that affect Denver traffic, helicopter operations are not presently an adverse consideration to fixed-wing flying, and the airport is currently operating within its estimated Practical Annual Capacity (PANCAP).

Two factors remain, however, that do present significant disruptions to smooth operations in the Denver Hub. The noise problem (particularly on training flights) is acute, resulting in many lawsuits and has led to strict noise abatement procedures, including a preferential runway system, which affects the flexibility of the entire operation. The second factor, the high ratio of general aviation flying including air carrier training flights conducted at Stapleton compared with scheduled carrier operations will become more of a problem in the future. Growth of both segments are forecasted over the next decade will result in airport operations exceeding capacity.

This has led to the obvious recommendation that more improvements and developments of reliever airports in the Denver Hub be of prime consideration. An FAA Task Force believes that if a large part of air carrier training operations and general aviation flying were situated at another field, Stapleton could adequately operate within the forecasted requirements demanded for several years to come. A second recommendation, that of lifting certain noise abatement procedures, is a difficult problem but may be assisted by the elimination of the most serious cause of noise -- air carrier training flights -- at Stapleton. Authorities are now at work on a combination immediate long-range program of improvement and modernization at Stapleton. Phase one improvements included extension of the short 8L/26R Runway, repair of Runway 8R/26L and the construction of a new 11,500 ft. Runway (17/35). In addition, a new concourse has been constructed which adds an additional 24 gate positions. Other terminal expansion provided 10 more gates.

The second phase envisions an entirely new terminal complex, addition of a third N/S runway, and two new E/W runways. However, this plan depends on acquisition of additional land. Under consideration is a 6,500 acre parcel abutting the airport. There are several pros and cons to this expansion and the project has been deferred for further study.

At present, it seems that the more practical solution to meeting the increased traffic forecasted over the decade in the Denver Hub is the provision of increased facilities at reliever airports as well as continuation of improvements at Stapleton.

WOLD-CHAMBERLAIN INTERNATIONAL AIRPORT

MINNEAPOLIS/ST. PAUL

Minneapolis-St. Paul International is the hub's main airport, ranking 18th in the nation in order of number of enplaned passengers. Distribution of aircraft operations is: air carrier - 48.5 percent; general aviation - 39.8 percent, and military - 11.8 percent. The figures are interesting in that they demonstrate that Wold-Chamberlain accounts for more military flying (on a percentage basis) than any other large hub airport in the country.

Traffic at Wold is currently about 310,000 annually and is expected to rise to 350,000 by 1975.

Two major problems confronting operations at Wold are noise abatement restrictions, and the large volume of general aviation activity. Because of noise, Runways 11R and 22 are not used unless wind conditions make use of other runways impracticable. This overburdens runways and creates saturation that would not normally occur.

General aviation operations constitute about 40 percent of all traffic despite the lack of adequate facilities. The use of certain gate areas by general aviation aircraft compounds the already inadequate number of gate positions available for air carrier use.

To remedy this situation, the Metropolitan Airports Commission developed a plan covering both air carrier and general aviation airports in 1970-1980 time frame. Essentially, the proposed system would create a new major air carrier airport before 1980. Officials felt that with the ever increasing traffic and the advent of 747 service, Wold would reach its saturation point some time in 1977.

Additionally, the plan calls for the development of three satellite airports within a 25-mile radius of the downtown area, while upgrading existing general aviation facilities. Wold would be retained, probably as a primary general aviation airport and reliever to the new air carrier airport.

A $20 million bond issue has been floated for improvements at Wold. It would include the expansion of Northwest Orient's main base facilities, provisions of more terminal space and parking area enlargement. Under the new FAA Airport Development Aid Program, Wold will spend $280,000 for landing area pavement improvements.

O'HARE INTERNATIONAL
MIDWAY

Secondary Airport, Merrill C. Meigs, General Aviation with ATC tower;

The Chicago Hub is served by two air carrier airports: O'Hare International, the nation's leading airport in terms of number of enplaned passengers per year, and to a lesser degree, Midway. Air Carriers presently account for 93.4% of aircraft operations at O'Hare, while general aviation accounts for 6.1% and military flying, 0.5%. A decade ago, before O'Hare took away "the world's busiest airport" title from Midway, general aviation accounted for 40.6% of all operations compared with only 35.1% for air carriers. Military operations were at that time registering 24.3%.

Traffic at O'Hare totals about 700,000 operations per year. It is expected to rise to 895,000 in 1975. Operations at Midway totaled some 290,000 in mid-1970 but is rising rapidly as more use of the field is fostered. Air carrier operations numbered only 28,000 in early 1970 but by the end of the year this figure had jumped to about 45,000. If the city has its way, carriers will be flying 160,000 operations per year, nearly the maximum 182,000 air carrier flights that can be handled annually according to airport officials. Prime reliever Merrill C. Meigs Field has about 100,000 operations a year of which 25,000 are air carrier. Improvements at Meigs include installation of taxiway and apron lights and construction of an additional apron at a cost of over $210,000.

The congestion problem at O'Hare is acute, with only New York's JFK accounting for more airline delays. The FAA listed the most important airport factors causing congestion as:

- Saturation of runways and taxiways
- Inadequate gate space
- Inefficient taxiway layout
- Insufficient number of holding areas (ground)
- Inadequate cargo area

An FAA Task Force recommendation of specific improvements to be considered in airport development at O'Hare included:

- High speed exits (Runway 9R/27L; 14L/32R)
- Strengthen Runway 14R/32L at point of new turnoffs
- Apron expansion
- Construct Runway 4R/22L (with taxiway system)
- Construct Runway 9L/27R (with taxiway system)
- Widen Fillets
- Full ILS on 9R and 27L
- New 14/32 Runway
- Construct Runway 4L/22R
- STOL general aviation runways
- Access taxiways to apron (from parallel taxiway 9R/27L)
- Construct holding areas

The construction of Runway 4L/22R has begun with $1 million being provided for site preparation of the runway, parallel taxiway turnoff, and connection taxiways. The funds will also be used to install emergency standby power.

The huge traffic activity at O'Hare magnifies even a single cause of congestion to a point where it can affect the entire operation. Recognizing this, the city is in the midst of a $350 million expansion program which included extension of concourse buildings, two new finger extensions, runway grooving and installation of a people moving system. However, keeping pace with the projected increased volume should prove next to impossible beyond

1975. To relieve the existing problem and that forecasted over the decade, City officials began promoting Midway as a second major air carrier airport and studied development of a third jetport. The site under consideration was a 10 square-mile area which would be claimed from Lake Michigan. However, this plan was met by opposition, particularly from the standpoints of excessive cost and impact on the environment. The Open Lands Project, a Chicago conservation group, published a comprehensive study in which the projected costs of building the airport on Lake Michigan polder were compared with building it on a land site favored by the FAA (east of the village of Frankfort):

Lake Airport

Site	$ 413,000,000
Improvements	400,000,000
Principal costs	$ 813,000,000
Annual debt service (x40)	52,945,000
Total costs	$2,117,800,000

Land Airport

Site	$ 211,800,000
Improvements	400,000,000
Principal costs	$ 611,800,000
Annual debt service (x40)	39,767,000
Total costs	$1,590,680,000

Studies of land sites, other than that favored by the FAA, projected costs as low as less than half those projected for the Lake site. In the wake of the controversy over the new jetport location, City officials have apparently made little progress. The current emphasis seems to be centered on increasing air carrier operations at Midway. The City has already spent over $11 million to revitalize the Midway facility.

Postage stamp-sized Midway (600 acres compared with O'Hare's 6,000) is virtually an island surrounded by a sea of residences. Its runways are too short (6,500 ft. max.) to accommodate the large four-engine jets and cannot be extended because of the lack of land. It can handle the medium and short-range jets, but diverting this type of aircraft traffic to Midway while limiting O'Hare to long-range, large jet operations is impractical. For many passengers arriving Chicago, that City being the largest inter-connecting flight center, it would mean debarking at one airport and traveling to the other to catch a connecting flight. Besides the inconvenience, most passengers would resent the time and money spent. Add to this the restricted airspace and noise problems accompanying the use of Midway, and it is evident why airlines are reluctant to establish operations and costly facilities and services there. Still, with FAA prodding and not wishing to incur the City's disfavor which could affect, to some degree, operations and facilities at the more profitable O'Hare field, the airlines are returning to Midway and scheduled flights are on the increase. With CAB approval, the airlines will try to effect more efficient operations by coordinated scheduling. Also, Midway will be promoted for its convenience to those passengers originating at Chicago and those making flight connections not involving the larger jets.

The increased use of Midway as a second major air carrier airport would result in increased helicopter operations and require the addition of two and possibly three vertiports devoted exclusively to the handling of this type of traffic.

LAMBERT - ST. LOUIS MUNICIPAL

Secondary Airport, Bi-State Parks (East St. Louis, Ill.)

Lambert Field, center of the St. Louis Hub, ranks 14th in the nation in order of number of enplaned passengers. Currently, distribution of operations are: air carrier - 56%; general aviation 39.2%, and military 4.8%. These figures are significant when it is considered that St. Louis, from a distributional percentage, has more general aviation and military operations and less air carrier traffic than any of the 13 large hub airports that rank higher than it is passenger volume.

Traffic at Lambert currently numbers about 350,000 operations annually. This is expected to rise to 375,000 operations by 1975.

At the reliever airport, Bi-State Parks, about $375,000 was spent to construct, light, and mark a parallel taxiway to Runway 4/22; a parallel and connecting taxiway to the east end of Runway 12/30, and a new connecting N/S taxiway between Runway 12/30 and the existing taxiway. Also, as part of the airport's improvement program, 22 new "T-type" hangars are being installed. A new 5,500 ft. runway, capable of being extended to 7,000 ft. with full instrument landing capabilities, will be built to accommodate executive jet aircraft.

The growth of air carrier operations, combined with the high volume of general aviation and flight training activity, have placed the $250 million, 2,300 acre Lambert Field facility in the inadequate category. Runway saturation, inefficient runway and taxiway layout, lack of aircraft gate positions and apron areas have been the main factors leading to increased congestion at the airport. The lack of suitable reliever airports to siphon off the general aviation traffic at Lambert, and restrictions on large-scale future expansion due to the unavailability of land, also contribute to the overall problem in St. Louis. In order to adequately serve forecasted traffic demands by the 1980 time frame, there seems no other alternative to the construction of a new air carrier jetport at another site.

Although improvements at Lambert Field and additional general aviation facilities are necessary and will provide some congestion relief, it seems likely that a new air carrier airport will be built. Airport officials representing St. Louis and Illinois have developed a plan providing for a new $350 million jetport that has met approval by the FAA, Department of Transportation, and the airlines now servicing Lambert. Scheduled to be located in Illinois, the proposed airport would serve the St. Louis Hub and be under the authority of a joint City - State Commission.

KANSAS CITY INTERNATIONAL, KANSAS CITY, MISSOURI

Secondary Airport, Municipal (to revert to General Aviation with ATC tower)

Kansas City International (KCI),opened for scheduled air carrier operations about mid-1972, forms the center of the Kansas City Hub, replacing Municipal (MKC), which is expected to be operated as a general aviation airport and prime reliever. The first full year of operations -- including air carrier -- is expected to be 325,000. Operations in 1975 are projected to number of 350,000.

Distribution of operations at Kansas City Municipal are presently running at 57.9% for air carrier, 41.6% for general aviation and 0.4% military. Traffic at Municipal is in excess of 255,000 of which 130,000 - 140,000 are air carrier operations. This, of course, will drastically change when the present eight airlines serving Kansas City move to the new International. In order of number of enplaned passengers, Municipal ranked 21st in the nation in 1969.

The new International airport is on a site eventually planned to encompass 5,000 acres situated some 15 miles northwest of downtown Kansas City, and at an overall development expenditure of about $220 million. As planned, the facility will meet the requirements forecasted for it beyond the 1980 period.

Unlike the typical airport (except for several of the newer ones), KCI was designed with the passenger in mind. Specifically, once the passenger is in the airport, his land-based trip should basically be finished. The concept at KCI is termed "gate arrival" and simply means that a passenger need only walk an average distance of 175 feet to board his plane from where he has parked his car or left his public transportation. This is accomplished by decentralized terminal design and advanced notification of the flight's gate position.

Terminals are 80-degree circular-shaped (picture a horseshoe), 1,000 feet in diameter measured to the outer or airside wall or 940 feet in diameter measured to the inner or landside wall. Within the near-circle formed by the terminal building, there are provisions for parking 1,000 cars. Access to the inner parking area is from the main airport entrance, through the open portion of the circle via the particular terminal loop road. Additional parking is provided adjacent to the terminal module. Remotely operated signs, displaying flight numbers and gate positions, will inform motorists or public transportation passengers where to park or debark at a point closest to his destination.

The terminal building, 60 feet in width, measures 2,300 feet in length from the start of the loop to the end. Terminal design will allow future addition of a mezzanine along the outer 30 feet of the building and around its entire length. Each of the terminal modules will provide for 15 200-ft. gate positions and each will house the following:

- Ticketing facilities (at every other gate)
- Baggage claim area
- Passenger lounges
- Two Restaurants and cocktail lounges
- Two snack bars
- Barber shop
- Ten rest rooms
- Three ground transportation centers
- Airline administrative offices
- Concession and other public services

Three of the four terminal modules planned will be open when the airport begins operation, thus 45 gate positions are available. The terminals are in semi-circular formation around the central mall, similar to the petals of a flower, which houses the airport administrative offices and tower. Additional parking adjacent to the terminals combined with the in-terminal parking raises the total spaces available to 5,000.

Two main runways will be operational for air carrier scheduled service: a 10,800 ft. N/S runway (which can be extended to 15,000 ft.) and a 9,500 ft. E/W runway (which can be extended to 11,600 ft.). A 4,000 ft. parallel general aviation runway is also scheduled.

Other facilities and areas planned or available breakout as follows:

. Cargo facilities (including 28 gates) - 90 acres
. Maintenance hangars - 40 acres
. Post office facilities (direct mail loading) - 10 acres
. General aviation facilities - 30 acres
. Fuel storage area - 3 acres
. Operations & Maintenance (emergency facilities) - 5 acres
. Car rental storage - 8 acres
. In-flight food kitchens - 4 acres

The eight airlines serving the Kansas City area have made substantial investment plans for various facilities at the new airport. Not surprisingly, TWA, headquarted at KC, has planned expansion of major proportions. Now underway is TWA's 2.2 million sq. ft. Maintenance and Overhaul Center (with 747 capability) being built at a cost of some $45 million. Another $20 million is going into a new administrative and pilot training center due for completion in 1974. Other plans call for a $2.5 million cargo building and a $600,000 flight service kitchen.

Planned expenditures by other airlines included: Braniff - Hangar facilities, $3.5 million and Cargo building, $500,000; Continental - Hangar, $2.5 million; Frontier - Hangar, $1 million; and a $1 million cargo facility to be used jointly by Delta, United, Ozark, North Central and Frontier. All eight airlines will use the $2.8 million underground fueling system.

KC International's beginnings came in early 1950's when the city purchased land and constructed a 6,000 ft. funway and some other facilities. TWA installed its base overhaul facilities at the then called Mid-Continent Airport (and later Mid-Continent International). For several years traffic at the airport consisted to TWA aircraft due for overhaul, general aviation pilot training and, during bad weather, overflow traffic from Municipal. When TWA began using the field extensively for training flights, officials began to regard the field as a possible supplemental air carrier airport. By 1963, however, the jet age had caught up with Municipal and it was evident that the facility no longer was adequate. Air carriers had only one 7,000 ft. runway on which to land at Municipal, obstructions marred landing patterns, and many restrictions were placed on operations. Improvement and expansion at Municipal was not feasible because of the lack of space.

Plans were set in motion to create a modern jetport out of the new landing field and transfer the prime air carrier role from Municipal. A $150 million revenue bond issue passed the voters and was sold, with the assurance that the airlines would accept the move to KCI.

With the new airport's present capacity, the improvements planned over the next decade, and the availability of "designed-in" expansion, KCI should comfortably meet the demands forecasted of it into the 1980's. Ironically, TWA which has been a prime stimulant to the airport's development, may also be the cause of traffic congestion. TWA presently conducts extensive training flights at KCI, accounting for about half of all present traffic. If this pattern continues and annual operations total 300,000, the FAA figures that an additional 6,500 hours of annual delay would result. In all probability, at such time when training flights do cause delays, a portion of this type of activity will have to be moved to another airport such as Municipal. There is a restriction against touch-and-go operations (which constitute a large portion of training activities) at Municipal, but with the absence of scheduled air carrier traffic, this ban may be lifted.

General aviation traffic will be kept to a minimum at KCI with airport officials preferring to base that traffic at relievers.

Over the next decade additional runways will be constructed. Around 1976, plans call for a 12,000 ft. parallel N/S runway to be built at a cost of about $10 million. Beyond that, a parallel E/W runway (6,000 ft.) will probably be added. Towards the end of the forecast period, the addition of elevated parking garages, which will be about double the present ground-level parking capacity, is a distinct possibility.

Addition of the fourth terminal building will be made sometime after 1975. To be similar in design to the present three other modular units, it will be built at a cost of some $10 million. When completed it will provide, in addition to ticketing, baggage claim, passenger hold, operations and other passenger/airline space, parking for 1700 more autos, another 3,000 ft. terminal ramp, and 15 more gate positions.

CLEVELAND HOPKINS INTERNATIONAL

Secondary Airport, Burke Lakefront, General Aviation with ATC tower;

Center of the Cleveland Hub is Cleveland Hopkins International Airport which ranks 17th in the U.S. in order of enplaned passengers per year. Currently, air carriers account for 45.2% of all operations each year while general aviation accounts for 54.5%; the .03% balance is attributable to military flying. The figures reflect a near 10% growth in general aviation traffic over the decade, while the percentage of air carrier operations have declined similarly.

Traffic at Hopkins totals about 330,000 operations each year and is expected to rise to over 400,000 by 1975. Traffic at the prime reliever Burke Lakefront totals slightly more than 110,000, with air carrier operations accounting for only a minuscule portion.

Recently completed expansion at Cleveland includes a new south concourse which provides for an additional 18 gate positions, some of which are capable of handling the wide-bodied jets. It was built at a cost of $8 million. A new 2,300 car parking garage also has been completed.

The aircraft congestion problem at Cleveland Hopkins is not serious when compared to other major airports but if airport officials projections of handling in excess of 12 million passengers by 1980 are correct, expansion on all fronts must take place. The FAA has cited runway limitations as one of the most important factors causing congestion. These include high demand, lack of adequate exit taxiways, and insufficient lateral spacing of parallel runways. It was also pointed out that insufficient holding areas and access taxiways contributed to inefficient operations.

Among an FAA Task Force listing of improvements, Runway 5R/23L was recommended to include high-speed exits and a holding area on the northeast end. Conversion of a taxiway (K) to an E/W parallel runway was considered to provide greatly improved airport capacity with operations to the west.

With funds of some $400,000, the City has enlarged the fillet from Runway 5R/23L to taxiway K, overlaid taxiway L, and constructed the taxiway turnoff serving Runway 5R/23L.

Cleveland Hopkins boasts the only rapid transit link directly between city center and airport terminal in the U.S. Opened in late 1968, the four-mile, double-track extension was financed in part by the U.S. Department of Housing and Urban Development ($18 million), Cuyahoga County ($5.1 million) and the City of Cleveland ($1.2 million). The Pullman-Standard "Airporter" cars, costing about $185,000 each, are air-conditioned, wide-seated, equipped with luggage racks and have 80-passenger capacity. It is estimated that 2,000 airline passengers use the rail system daily to go to and from the airport. In addition to providing the Cleveland passenger with a convenient, safe, relatively comfortable and inexpensive access between downtown and the outlying airport, the system serves as an example to other large hub airports of how and what can be done to aid the neglected airport traveler.

In late 1969, plans for a $65 million improvement program were announced for Cleveland Hopkins. The terminal expansion program is in two phases. The $40 million first phase was to be financed through bonds while using rental revenues to subsequently retire the issues. The following improvements were scheduled:

West Concourse - Redesign existing structure from one to two stories to permit passenger boarding from upper level. Include passenger lounges, various passenger facilities, and connection with main terminal.

East Concourse - This new concourse includes boarding areas and various passenger facilities. In addition, passenger handling facilities, such as automated baggage systems are provided. Related field improvements (new apron, lighting, taxiways) will also be made.

The second phase of the expansion program which is scheduled following completion of Phase I, calls for construction of a second parking garage with capacity for 3,000 vehicles, along with various access roads and passenger/rental car facilities.

The substantial amount of general aviation traffic at Cleveland including training activity, currently does not constitute a major problem but will in the future. To prevent this potential capacity/delay problem more improvements to existing reliever airports will have to be undertaken to attract general aviation flying away from Hopkins. Development of additional reliever airports will have to be undertaken to meet the forecasted increase in traffic during the next decade.

DETROIT METROPOLITAN WAYNE COUNTY

Secondary Airport, Detroit City, General Aviation with ATC tower;

Metropolitan Wayne County serves as the key airport in the Detroit Hub. The Willow Run airport is designated an air carrier airport and serves as a reliever to Metropolitan along with prime relievers City and Pontiac Municipal. Distribution of operations at Metropolitan, which ranks eleventh in the country in order of number of enplaned passengers, places air carriers at 69.6% (in contrast to 75.3 10 years ago) general aviation at 28.3% (21.2%), and military at 2% (3.5%).

Traffic at Metropolitan totals about 320,000 flights per year. This is expected to climb to approximately 360,000 operations annually over the next five years. Detroit City's annual operations number in excess of 250,000.

In many ways the Detroit Hub enjoys operations that are just not the case with several of the large hub airports. Foremost is the fact that Metropolitan is operating within its practical annual capacity (PANCAP) and is projected by the FAA to remain so into 1973. When the addition of two new runways is completed, the airport will be able to handle the forecasted demand over the decade. Noise does not present a current problem and there are no special noise abatement procedures nor any preferential runway system. Flow control restrictions (imposed by both New York and Chicago) are of an acceptable level. Helicopter operations are at a minimum and are not expected to increase significantly to cause interference with fixed-wing operations. Training operations, too, are minimal.

An FAA Task Force recommendation of future improvements at Metropolitan included:

- Construction of third parallel Runway 3RR/21LL
- Construction of high-speed exits on Runway 3R, 3L and 21L
- Partial parallel taxiway east of 3R/21L
- REIL and/or VASI on 21L
- Construct parallel 9R/27L
- Expand apron

Under the new Airport Development Aid Program (ADAP), Detroit Metropolitan was approved funding of $2,235,000 for landing area pavement improvements. This grant was matched by Wayne County, for a total improvement project of over $4 million.

Having completed a new terminal, apron and runway improvements, and multi-level parking garage, Metropolitan airport authorities have scheduled construction of the third parallel 3/21 runway (including taxiways, lighting, etc.), which will permit simultaneous IFR operations. Completion is estimated to cost about $8 million.

Additional improvement at reliever airports would go a long way towards maintaining Metropolitan's comparatively favorable operations position.

A possible source of disruption to operations on both existing 21 runways exists in an ordinance of the Dearborn community which states that no aircraft may overfly it at less than 5,000 feet. If this were to be enforced (it has not been thus far), or if it could be legally, landing on both 21 runways would be impossible since they dictate a final approach which puts incoming aircraft below altitude over the town. Should this noise-oriented situation worsen, it is likely that the airport will install runway end identity lights or visual approach slope indicators, or both.

GREATER PITTSBURGH AIRPORT, PITTSBURGH, PENNA.

Secondary Airport, Allegheny County, General Aviation with ATC tower;

Heart of the Pittsburgh Hub is the Greater Pittsburgh Airport, ranking 16th in the nation in order of annual enplaned passengers. Distribution of operations at the airport are as follows: air carrier - 59.9%; general aviation - 30.8%, and military - 9.3%. Over the decade, distribution has been marked by a doubling of general aviation operations, a reduction by half of military flying, and a lesser reduction in air carrier flights.

Traffic at Greater Pittsburgh totals about 310,000 operations annually and is projected to climb to over 350,000 by 1975. Traffic at the major reliever airport, Allegheny County, numbers over 200,000 yearly. Runway capacity at Allegheny will be substantially increased with the completion of a 1,000 foot, $6.6 million dollar extension to Runway 9/27.

Since Greater Pittsburgh was opened in 1962, the airport has experienced an extraordinary rate of growth in passenger enplanements (500%) and air freight (700%). This has imposed burdens on airport facilities which were rapidly approaching the inadequate classification. This growth has signalled the start of the major role the airport will play in international passenger and cargo operations, and justifies the long-range, high-cost improvement and expansion programs now underway and planned for the facility well beyond the 1980 period. Greater Pitt has some inherent advantages that make it operationally attractive. Land to expand is available; the airport is now in the process of tripling its acreage to about 9,000 acres. Noise does not present a major problem. Flow control restrictions imposed by other facilities do not contribute to congestion.

Also, located between the Chicago and New York hubs, Greater Pitt with expanded schedules, could serve much of the international traffic (both passenger and freight) now employing those airports as points of embarkation.

The ambitious overall plan for airport expansion, which is underway with legislative approval of a $225 million general obligation bond issue, is aimed at a capability of processing from 25 to 30 million passengers by the end of the century. Expansion in progress and planned encompasses all aspects of the airport's facilities and is detailed as follows:

Terminal

A new terminal and apron area is planned to be completed by 1975. It will be located between the existing parallel Runways 10/28. Because of the terrain, the aircraft parking area is at ground level but the point at which the terminal is to be located, is in a deep depression. Taking into account, the terminal's design plans call for a seven story building, six of which will be below ground level. This will result in a savings of some $8 million that would otherwise be spent on land fill. The six below-ground levels will provide parking for 2,300 automobiles, baggage claim, and handling areas. The single ground level will provide baggage check-in points, ticketing, and public services and conveniences. Departing and arriving passengers will travel between the main terminal and aircraft boarding gate lounges located on the apron via an automated dual-track subway transit system. The apron boarding gate lounges are really extensions of the familiar main terminal gate positions, only they will be linked by shuttle rather than a concourse. By 1975, the airport plans to have six such lounge buildings providing about 56 gate position. Expansion by 1980, to three rows of lounges each could increase gate positions to 108.

Meanwhile, additions to the existing terminal area are being hastened to completion to meet current demands: International Passenger Center - Completed in mid-1971, the center adds 25,000 sq. ft. to the West Wing at a cost of $1.3 million.

TWA - Expansion added 600 ft. to the West Wing providing for an additional three gates.

Allegheny - Expansion added 600 ft. to the South Wing.

United - Expansion added 600 ft. to the East Wing.

Combined, these expansions add 14 gates to bring the total to 39. When the new terminal is ready in 1975, the existing facility will be converted to office space, restaurants, and other services.

Terminal Apron: Expansion of the terminal apron and taxiway system has been completed (at a cost over $2 million) to provide for the foregoing terminal extensions projects. Aircraft hold positions have been increased to eight and allow for two-way taxiing.

Cargo Building: Two cargo buildings have been completed at a cost of $6 million and add an additional 72,000 st. ft. to the existing 38,000 sq. ft. of cargo facilities.

Parking

In addition to the 2,300 space enclosed terminal parking to be ready by 1975, an outdoor parking area with 10,000 spaces available will be constructed west of the terminal. It will be linked to the terminal by a transit system, provide for remote baggage handling, and be able to be expanded to accommodate an additional 7,000 autos. In the interim, a 2,350 space parking lot has recently been constructed bringing the present capacity to over 4,500.

Runway

Recently completed runway and taxiway improvement projects are the extension, by 2,000 feet of taxiway N-1 which parallels Runway LOL/28R at a cost of $600,000 including the widening of taxiway fillets on three turnoffs, and the addition of a high-speed turnoff on Runway 28L/10R and 2,500 ft. of taxiway strengthening at a cost of $366,000.

Runway 14/32 has been extended to 8,000 feet at a cost of $1.7 million. Plans call for the extensions of the existing parallel east/west Runways 10/28 to 12,000 ft. and 12,500 ft.

A third east/west parallel runway of 12,000 ft. ($18 million) is also in future plans, as is an STOL strip.

LOGAN INTERNATIONAL

Secondary Airports, L. G. Hanscom (Bedford), General Aviation with ATC tower; Memorial (Norwood);

The Boston Hub is pivoted by Logan International which ranks tenth in the U.S. in order of number of enplaned passengers per year. In the distribution of aircraft operations, air carriers account for 67.8%; general aviation, 31.9%, and military operations, 0.3%. Over the decade, the 9% rise in air carrier operations and the near 4% increase in general aviation reflects a significant drop of 13% in military use.

Traffic at Logan currently totals about 315,000 flights annually and is projected to rise to 410,000 in 1975. Not included in this figure is the substantial helicopter operations -- numbering about 40,000 per year -- flying from approximately 50 sites (half of which are private) in the Hub area. L. G. Hanscom field, prime reliever for Logan, operates at about 10% less than the level of Logan, or some 285,000 operations annually, but the military facility limits civil activity to about 30% of this total. Use of Hanscom by air carriers is less than 800 operations annually. Norwood Memorial airport, with over 50,000 operations annually, was considered to be a potential major reliever for Logan since it had the possibility of parallel runway, but it lacked an operational ATC tower. This has now been remedied by a new Port-A-Con tower purchased by the Massachusetts Aeronautics Commission. Staffed by FAA operators, traffic has substantially increased and may exceed its normal annual operations by more than three-fold if current rates hold true.

Activity at Logan is centered around a $250 million expansion and improvement program which includes aprons, runways, multi-level parking facilities and terminal buildings. Recent terminal activity includes:

Southwest Terminal - Built at a cost of more than $18 million for the Massachusetts Port Authority, the four-level concrete structure features parking for 1,000 autos, two satellite boarding areas -- each with six loading bridges -- curbside baggage conveyor system and carousel-type baggage claims area. Plans are in being for a third satellite providing an additional 10 gate positions. Eastern Airlines is the terminal's primary lessee.

South Terminal - The MPA is financing $14.6 million in short-term notes for work on the new South Terminal and a new control tower, runway, and taxiway improvements. The terminal is scheduled for completion in 1973 when it will be occupied by American, National, Allegheny and Mohawk Airlines. Total cost of the terminal is estimated at $65 million. Meanwhile, American is renovating its Pier E and D passenger facilities to serve as an interim terminal and adaptation to the 747. Cost of the project is placed at $2.5 million.

North Terminal - Upper level boarding areas, in the process of being completed atop North Terminal's Piers B and C are to facilitate passenger movement from second story ticketing areas, to hold areas, to aircraft boarding via enclosed jetways. Cost of the addition estimated at $7.4 million and will be used by Northeast, Pan American, Trans World and United.

International Arrivals Terminal - Construction was scheduled to begin in 1970 with completion set for 1973.

Several problems exist in the Boston Hub area which cause inefficient operations that appear difficult to overcome even with large scale improvements at Logan. The FAA cited some of the key causes leading to over capacity:

- Runway capacity exceeded by demand
- Operation restrictions imposed by noise
- Inadequate taxiways
- Inadequate runway turnoffs
- Lack of adequate holding aprons

Specific improvements at Logan recommended by an FAA task force included:

- Remove noise restriction Runway 4L/22R
- Improve exits from Runway 4L/22R
- Holding apron or bypass taxiway for Runway 9
- Apron expansion (South)
- New Runway 15L/33R (10,000 ft. x 150 ft.)
- Develop permanent STOL/general aviation area
- REIL on 22L, VASI on 15R, REIL on 9, ALS ("in runway") on 4L/22R

With $724,000, the MPA will construct the south apron taxiway, including marking, lighting, and drainage, and construct an isolated fillet.

Despite the largescale improvement and modernization program underway at Logan, and that projected over the decade, it appears that another major air carrier airport will have to be built if the Boston Hub area requirements are to be met in the future.

Noise abatement procedures at Logan have limited the use of runways on both take-off and landing, thus creating a restrictive preferential runway policy. Some 10% of all operations in Boston are helicopter and its operational effect on smooth traffic flow at Logan is heightened by inadequate facilities and equipment at reliever airports necessary to sift off a portion of the load. Logan is also subjected to flow control restrictions brought about by congestion in the New York Hub.

The Air Transportation Association uses, as a general rule, a seven-to-ten year period to obtain a new airport -- from plans to first flight. If this be the case, it seems unlikely that a major new air carrier airport will be built in the Boston Hub in the 1970-1980 period. Instead, more emphasis will be placed on reliever airports. It is thought that more air carrier operations will be conducted at Hanscom Field. Norwood Memorial, now that a tower is operating,will see increased use.

INTERNATIONAL AIRPORT, PHILADELPHIA, PENNA.

Secondary Airport, North Philadelphia, General Aviation with ATC tower;

International centers the Philadelphia Hub with North Philadelphia the major general aviation facility. In order of number of enplaned passengers, International ranks 13th in the nation. Operations are distributed among air carrier with 67.8%, general aviation with 31% and military, with 1.1%. While the percentage of general aviation flying has remained about the same over the past ten-year period, air carrier distribution has increased, and military has declined more than 9%. Traffic at International numbers about 300,000 flights annually. This is expected to climb to 380,000 by 1975. Operations at North Philadelphia currently number about 170,000 yearly.

Philadelphia currently experiences severe delays in both aircraft departure and arrival. Primarily this is caused by runway saturation, inadequate taxiways, and lack of gate positions, holding areas, and runup pads. Congestion occurs when air carrier and general aviation use the same landing approach areas. International is also subject to flow control restrictions and airspace crowding because of its location between New York and Washington, D.C.

A series of airport improvement projects will alleviate several key problem areas. A new 10,500 ft. by 150 ft. parallel Runway 9R/27L and associated taxiways and holding apron has been constructed at a cost of over $10 million. Runway 9L/27R will undergo rehabilitation. It is presently being extended 6,000 ft. at a cost of $2.5 million. When both runways are fully operational, and additional holding areas and runup pads provided, the practical annual capacity will be increased from 265,000 to 365,000 operations.

Although this represents a considerable operational boost, further runway addition will be needed in the post-1975 period to match operations which are projected to increase sharply from the 380,000 expected by 1975.

Expansion of the terminal facilities is being completed with provisions for a total of 41 gate positions. Future expansion of satellite flight pavilions will result in an additional 25 gates. A new $50 million cargo facility has been completed. Plans also include additional parking structures to house a total of 12,000 vehicles. Upgrading of landing equipment at North Philadelphia would increase that airport's role as primary reliever to International.

DULLES INTERNATIONAL
NATIONAL
FRIENDSHIP INTERNATIONAL (BALTIMORE, MD.)*

The Washington, D.C. Hub is served by three major air carrier airports, Baltimore's Friendship, National and Dulles, the latter two under the authority of the FAA. In order of number of enplaned passengers, Washington National ranks seventh in the U.S. Air carrier accounts for 65.8% of total operations at National, while general aviation accounts for 33.3% and military, 0.9%. Over the past decade, general aviation distribution of operations has doubled, while air carrier has declined almost 14% and military flying has fallen off 2.5%. Currently, total operations at the three airports number over 800,000, of which about 420,000 are air carrier traffic with a total passenger volume of close to 16 million. A breakout of these figures by airport is:

	Operations	Air Carrier	Enplanements
National	337,000	221,000	10,500,000
Baltimore	240,000	135,000	3,200,000
Dulles	224,000	64,000	2,200,000

More use of the Hub area's general aviation fields by that type of traffic now located at the three air carrier airports is expected, as passenger volume increases in subsequent years. National is already tightening up its policy on use by general aviation.

* Friendship-Baltimore, is classified as a separate large hub; however, it is included within the Washington, D.C. Hub because of its close inter-relationship and geographical location.

Originally, Dulles was not planned with any large amount of general aviation activity in mind; however, it now attributes about 34% of its total operations to general aviation despite its ban on student pilot training flights. It is expected that saturation will be reached in a few years, forcing general aviation aircraft owners to find other bases. Baltimore, which is expected to account for the largest gain in percentage of the hub area's enplanements by 1980, now has the largest percentage (38.7%)of general aviation traffic of the three airports.

It is obvious that more and more general aviation traffic will be forced to other fields over the decade, if Friendship is to accommodate the projected passenger volume.

Facility development and overall growth is probably more interrelated with the three major airports serving the Washington, D.C. Hub than it is with any other of the nation's multi-air carrier hubs. The reason for this, basically, is the fact that not only do all three serve the same general area and share the same general airspace, but two are under control of the FAA and the third, Friendship, is directly affected by the activity of the Washington airport complex.

Through the decade, according to FAA projections, there will be a continued leveling off of the number of passengers processed by each airport, until 1981 when the distribution of enplanements will be essentially equal. If this forecast proves true, and at present there is no reason to believe that it will not, since the FAA to a large degree can influence the projection, it will mean that more emphasis will be placed on further development of Dulles and Baltimore than on National.

Of the nearly 16 million passengers presently using the three airports, National accommodates by far the largest segment -- 66%. Baltimore is next with 20.1%, followed by Dulles with 13.8%. By 1980, the FAA expects that a total of over 43 million passengers will use the three airports, with National accounting for 16.4 million passengers, Baltimore, 15 million, and Dulles, 11.8 million. Although National will still process the largest number of passengers, its share of the two-city area market will have dropped to 37.9% -- a decrease of 28.1% -- while Baltimore will have increased 14.6% and Dulles, 13.5%. Assuming that these figures approximate the actual, a dramatic and wide-scale improvement program will be instituted at Baltimore by the Friendship International Airport Authority.

Opened in 1962, the northern Virginia Dulles complex was surrounded by controversy with some criticizing the airport as being too remote (40 - 50 minutes by car from downtown Washington), and too large (encompassing 10,000 acres) to justify the burden on taxpayers, while others cited it as an example of proper future planning. During its first year of operation, Dulles handled only about 700,000 passengers. Subsequent years proved not much better and critics became more vocal with "under-utilization" the key word. With current enplanements at 2.2 million and congestion experienced at peak hours, Dulles has come of age. With passenger traffic expected at 5.5 million by 1975, Dulles sometime in 1974, should reach the growth for which it was originally designed. First phase of a planned expansion program was sought by the FAA in FY 71. It called for enlargement of the main terminal from the present 600 ft. length to 920 ft. which would provide an additional 115,000 sq. ft. for concourse, lounge and ticketing space.

Depending upon Federal appropriations, an alternative plan would increase the main terminal by 150 feet.

Dulles is the only airport in the U.S. that exclusively employs mobile lounges to transport passengers to and from the main terminal and the aircraft parked on the apron. The number of lounge vehicles currently totals between 35 and 40. Lounge gate positions total 60. Eventually, more lounges and gate positions will be needed, including those located at the base of the control tower which is located directly in front of the terminal.

More recent improvements, have been the addition of a second cargo terminal, bringing total freight terminal area to over 50,000 sq. ft., and the expansion of parking and service facilities to accommodate car rentals.

Another boost in passenger volume may be realized with the completion of Route 66, which would then link the airport directly to downtown Washington and reduce driving time to about 20-25 minutes, or about half the time it now takes. National, on the other hand, despite such recent additions as a separate air commuter terminal, and the new TWA/Northwest $7 million joint terminal and other general improvements, has experienced operational limitations. Included in this category: the restriction on IFR operations of a maximum of 60 operations an hour, and all jets during normal sleeping hours (after 11 p.m.). In addition, more government-operated aircraft are destined to relocate from National to Dulles, including those of the FAA and Department of Transportation.

Rumors have persisted that National will eventually be closed to airline traffic. Fuel is being added to this fire by a number of senators who have tried, unsuccessfully to date, for just such a ban, and the fact that Dulles must be regarded as the FAA's example of a modern airport keeping pace with the requirements of the 70's while preparing for the demands of the 80's.

J. F. KENNEDY INTERNATIONAL (N.Y.C.)
LA GUARDIA (N.Y.C.)
NEWARK (N.J.)
MAC ARTHUR FIELD (ISLIP, N.Y.)
WESTCHESTER COUNTY (WHITE PLAINS, N.Y.)

Secondary Airports, Teterboro (N.J.) General Aviation with ATC tower;
Stewart AFB, Newburgh, N.Y.

JFK International, Los Angeles and Chicago's O'Hare comprise the country's "big three" airports. While JFK ranks third in the nation in order of annual number of enplaned passengers, LaGuardia accounts for sixth place and Newark ranks 12th. Significantly, the three airports are within a 15-mile radius of each other. In addition, the area is served by two other air carrier airports. Thus, the combined New York/Newark hub is one of the most complex in the world. Current distribution of aircraft operations at the area's three major airports are as follows:

	Air Carrier	General Aviation	Military
JFK	86.3%	13.5%	0.2%
LaGuardia	78.3%	21.4%	0.3%
Newark	75.6%	24.3%	0.1%

Traffic at the area's five air carrier airports is currently over 1.6 million operations per year. This is expected to climb over the 2 million level by 1975. Teterboro, ranking in the top 15 of the nation's general aviation airports, is presently conducting about 240,000 annual operations. Estimated breakout of annual operations at the five air carrier airports is as follows:

J. F. Kennedy	450,000
LaGuardia	340,000
Newark	270,000
MacArthur	295,000
Westchester	285,000

Of the total 1 million-plus operations at the three major airports each year, air carrier traffic is currently accounting for some 850,000 flights. Air carrier traffic at these airports is expected to increase to 1.2 million annually by 1975. Helicopter operations are adding an additional 24% to the three airport combined traffic, with Newark accounting for 10%, JFK for 8% and LaGuardia, 6%. In 1970, a new general aviation airport was added to the New York Hub when the Metropolitan Transport Authority gained control of the former Stewart AFB at Newburgh, N.Y. The base, which became available when the Air Force was forced to close it due to Defense Department budget cuts, has two runways 8,200 ft. and 6,500 ft. long.

At Westchester County airport, a 5,000 ft. by 150 ft. portion of Runway 16/34 was overlayed at a cost of about $480,000. A full-range of customs, health, agriculture and inspection services is now available at the White Plains facility under an agreement with the U.S. Bureau of Customs.

Millions of dollars have been, still are, and will be, expended by sponsors, airlines and government in order that the New York area's three major airports keep pace with the ever increasing need for ground facilities imposed by the ever increasing enplanements. However, the three groups feel that expansion is approaching the point where further improvements will no longer be practical in perhaps five to eight years. Airspace limitations in the congested three-airport area may advance this date. The answer it has been felt for some time, is the addition of New York's fourth major jetport. After years of what is probably the most concentrated effort of its type, the airport authorities have considered innumerable sites and encountered strenuous opposition to all of them. Noise, congestion, pollution and safety hazards are but a few of the adverse factors put forth by opposition groups -- many of them made more adamant by previous experience with the area's existing airports. The need for another major jetport to serve the New York area is not the question .. where and when is. Even if a site were selected, approved and construction begun now, it would be unlikely that an airport of the size proposed could be operational before 1980. Meanwhile extensive improvement and modernization programs continue in varied areas at each of the major facilities.

J. F. Kennedy

Among the key causes of congestion at JFK, according to the FAA, are noise abatement procedures, airspace restrictions, runway saturation, lack of holding areas, and inadequate number of gates.

In order to lessen noise, for example, all IFR departures on 31L (the primary noise abatement runway) must make a 180 degrees turn to the left, passing south of the airport and climbing above incoming traffic. This results in a great reduction to the capacity of the runway. Procedures such as this are also imposed to cope with the congested airspace produced by New York's three major airports. Although they contribute most to the problem, little can be done to alter noise reduction and airspace traffic procedures.

Both arriving and departing aircraft experience runway saturation during fairly long periods of the day. Simultaneous approach capability (Runways 31, where spacing permits) would help this situation only to a minor degree during times of maximum landings and minimum take-offs. The FAA is presently studying the proposed extension of runways into Jamaica Bay to increase capacity and the compatibility with planned environmental restoration of the Bay area. Key consideration is extension of Runway 4R/22L some 1,600 ft. This would require a connecting taxiway between 4R and Runway 4L/22R (which already extends into the bay) and ILS/ALS on both. Cost of the project is estimated at $13 million. A new 4/22 runway, which would extend into the bay and provide simultaneous IFR capability with minimum noise affects, is under consideration but costs could run as high as $100 million.

The Port of New York Authority is spending about $1 million to relocate taxiways, widen others and widen fillets serving Runway 13L/31R.

The lack of holding areas force aircraft that are waiting for gate positions or departure clearances to use ramp space or taxiways, resulting in congestion of those areas. To alleviate the situation, inactive runways are used whenever possible. The problem was most accute at the International Arrival Building because of its heavy load. Relief should be realized with the expansion of the facility to double its former size and the provision of customs capability at individual airlines terminals, such as those innaugurated in 1970 by TWA, Pan Am and BOAC.

The problem of too few gate positions is being lessened through recently completed expansion of the airline terminal complexes.

International Arrival & Airline Wing:

Expansion by Port of New York Authority (PONYA), doubling size of previous area to over 1 million sq. ft. at estimated cost of $55 million. PONYA installing 12 three-door loading bridges at new international terminal. The three covered ramps telescope out from the main loading bridge to join with the three doors of a 747, enabling passengers to embark and disembark in minimum time. Bridges are being supplied by Dortech, Inc., Stamford, Conn.

TWA-Flight Wing One: Opened in 1970 and full operational in 1971, the wing was designed with the 747 in mind. The top level is used by arriving and departing domestic passengers. Departing international passengers also use the top level, but incoming international travelers use the bottom level which houses customs and immigration facilities. The Wing is connected to the main terminal by a 220 ft. enclosed bridge containing a moving sidewalk. The middle level is devoted to ticketing and other passenger handling services, including Soleri teleindicator information displays. Four gates can accommodate 747's, while additional gates will handle up to a total of 10 smaller aircraft.

Cost is estimated in excess of $20 million.

Pan American: New $70 million, four-level passenger terminal will be world's largest operated by a single airline. The giant terminal has six gate positions for the 747 aircraft, each with three lounges (2 economy class, 1 first class).

Ten gates are available to serve standard jet aircraft. In addition to customs facilities, the terminal has 56 check-in counters and six baggage pick-up stations.

American: A 30,000 sq. ft. extension of the east concourse has been completed. The west concourse combined with the east, provides four 747/wide-body gates and doubles facility's size.

North Terminal: New North Terminal is four times the size of the old. It is used for departures and arrivals of passengers on supplemental airlines. The old North Terminal is used for arriving passengers on domestic flights and pre-cleared incoming international passengers. PONYA spent $560,000 to improve passenger facilities at the terminal which is being run by the National Air Carrier Association.

United and Eastern: Both terminals are completing expansion to accommodate the 747/wide-bodied aircraft. Although the number of gates remain about the same as before, approximately half are altered to accept the 747 type aircraft. Eastern also added new road frontage to its terminal.

National, BOAC and Lufthansa: Each airline added new terminal facilities which became operational in 1970. National's $40 million facility, featuring separate arrivals and departure buildings, also houses Trans Caribbean Airways' terminal facility space. BOAC's $44 million terminal, also used by Air Canada, features a computerized passenger control system. Lufthansa's expansion has quadrupled the previous space. The space is shared by Irish International.

Many programs to increase the size and capability of cargo and maintenance facilities have been recently completed:

TWA has completed a 95,000 sq. ft. addition to its hangar facilities at a cost of $7 million. It will house two 747's, two SST's or three L-1011's. United has completed expansion of its cargo handling facilities at a cost of $1.5 million. Pan Am has doubled its frieght capacity with a $7 million expansion program. Eastern placed into service a $2 million air cargo facility. American, Northwest and Braniff are believed to be planning additional cargo terminals.

Terminal City, the mall around which are located the individual airline terminals, has been increased from 655 acres to 840 acres. Parking area 2-4 has been expanded while parking lot 5 has been added.

The Kennedy Airport Access Project, a group representing the Metropolitan Transportation Authority (M.T.A.), the Port of New York Authority and major airlines service JFK, is continuing its investigation into the ways and means of providing access to the airport from mid-town New York via a rail link with the Long Island Railroad. TRW's Systems Group has conducted initial systems engineering and advanced technology in planning a rail express service and baggage system between the two points under a $600,000 contract. As well as providing consultation, TRW was to develop designs and perform comparative analyses of the latest technology for moving people, baggage and goods to and from and within the airport.

One such system, put forth by Cornell Aeronautical Laboratory, Inc., envisions a train comprised of dual-mode (rail and surface) vehicles and conventional railroad cars. From the point of origination (Penn Station), airline passengers could be boarded to dual-mode cars appropriate to their specific airport destinations and their baggage processed and containerized. The railroad cars would be used for non-airline passengers (airport employees and visitors). Following the trip over the main LIRR tracks and the airport spur (estimated to be about 20 minutes), the train would arrive at the JFK station, whereupon non-airline passengers would debark. The dual-mode cars would be unhooked and driven over the road to their specified terminal destination. A further proposal foresees the dual-mode vehicle as a mobile lounge that, instead of depositing passengers at the terminal, would transport them to the proper flight for direct boarding of the aircraft. Such proposals present more logistical problems than they do technical, but seem feasible enough to warrant further consideration.

LaGuardia

Major expansion and modernization of LaGuardia has taken place over the last several years. Much of the air carrier operations (about 270,000) center about Eastern Airlines shuttle service to Boston and Washington, D.C. The high amount of total operations and air carrier operations, combined with limitations imposed by runways, aprons, noise and airspace make for a good deal of congestion at LaGuardia. Some expansion and improvement is planned. However, the airport is in short supply of space being bordered by water on three sides and a heavily-travelled parkway on the other. The increase of air carrier traffic over the years and the imposition of a minimum landing fee has substantially reduced the number of general aviation operations. In 1964, for example, general aviation accounted for 45.2% of all operations. It presently accounts for only about 20%. Much of what general aviation activity remains consists of air taxi flights and executive jet operations and in all probability would not relocate at another reliever airport, such as at Flushing.

The Port of New York Authority is considering building two new hangars and parking facilities at the west end of the airport adjacent the Marine Terminal area. Plans call for use of 133 acres of which 97 are presently under water. Additional airfield improvements will take place in the form of high-speed turnoffs, widening of access throats, additional taxiways and possibly, runway extensions. Terminal area improvements will center on multi-level parking facilities, and additional holding aprons. Passenger, baggage and cargo handling systems will be given increased emphasis.

Another program, encompassing large scale improvements such as additional runways, further land reclamation, and terminal and gate expansion, will only be considered in light of progress on development of New York area's fourth jetport.

Newark

Many of Newark's present problems will be solved upon completion of a $200 million redevelopment program. Congestion caused by the New York area's restricted airspace and problems stemming from pollution (both air and noise) will continue to place limitations on the airport's capacity, but in many respects they will be made more tolerable by the wide-scale improvements.

Major features of the program are:

- Parallel Runway 4/22 and associated taxiway system
- Extension of existing runway 4/22 and 11/29 and associated taxiway system
- High-speed turnoffs
- New holding areas
- Expansion of cargo and maintenance area
- New terminal area complex

PONYA, at a cost of about $1 million, is installing instrument and approach lighting systems and runway visual range equipment on Runway 4L and instrument landing system and runway visual range equipment on Runway 22R. This should alleviate at least a small portion of Newark's noise problem by enabling pilots to maintain a glide path high enough to reduce the effects of noise. Also PONYA is extending Runway 4F/22L from 7,000 ft. to 9,800 ft. along with high-speed taxiways.

The new terminal complex incorporates much of the latest thinking in terminal design and will incorporate many automated systems. The master plan calls for a series of three rectangular-shaped unit terminals in quarter circle arrangement, each with three circular satellite terminals at the end of enclosed fingers which extend airside from each unit terminal.

Terminal B, the center terminal, has three satellites with finger connections. Eastern will occupy one entire satellite and share a second with Allegheny Airlines. The third satellite will be used by Pan American and National. It will be different than the other two only in size, 250 foot diameter as opposed to 200 foot diameter. Each satellite will have 8 to 10 gate positions depending on the mix of standard and wide-bodied jets. Design of all three unit terminals and nine satellite terminals are basically the same, except for some alterations (mainly interior) desired by individual airlines. Terminal B, 800 ft. long by 165 ft. wide, is of split level design with three levels on the landside and two on the airside. The lowest level houses the parking area part of the 10,000 car control feasibly serving all three terminals; the second level, the baggage claim area; the third, the ticketing area. The half-level area concourse is situated between the second and third levels and will house public services and conveniences. From this point, passengers pass through the fingers to the individual satellites. The fingers are equipped to handle installation of moving sidewalks.

On the terminal's landside, a network of roadways connect with all three levels. The low-level roadway provides access and egress to the parking garage; the second-level roadway allows for pick-up by private and public conveyances of arriving passengers, while the upper level provides for drop-off by surface transportation of departing passengers. Baggage handling systems present a problem because of the various levels creating both vertical and horizontal movement of the conveyor system. Added to this is the need to have chutes linking with the conveyor at strategic locations - lower level parking area, upper level entranceway, ticket counters, etc.

The decentralized design of the unit terminal and its three satellites makes necessary the duplication of all video and audio communications. Such things as flight information displays and paging systems will be available on all levels within the terminal and in each of the satellites. In addition, these services will have to be linked with the other unit terminals when they are completed, particularly for passengers making connecting flights.

In order that passengers may get from one unit terminal to another, an automatic International Transfer (ITT) system will run outside and adjacent to the upper level of each terminal, stopping at each terminal's station to board or discharge passengers. The system could conceivably link up with the Penn Central Railroad close by (as well as other areas within the airport). A passenger could then, for example, leave New York's Penn Station, train across the river to New Jersey, and connect with the ITT to be conveyed directly to the proper terminal.

Carrying this example a step further, it may someday be possible for a passenger wishing to connect with JFK to disembark at Newark and via the ITT/Penn Central/Long Island RR links arrive at the appropriate JFK terminal -- conveniently and in comparative comfort. This, of course, has the great advantage of providing a method of getting from terminal to terminal without adding to the already congested highways. However, timing would have to be worked out to be reasonably competitive with highway transportation (car rental, bus, limousine), while the comfort factor and cost advantage would have to be considerably more attractive.

LOVE FIELD (DALLAS)
GREATER SOUTHWEST INTERNATIONAL (FT. WORTH)
DALLAS - FT. WORTH REGIONAL (UNDER CONSTRUCTION)

The major air carrier airport serving the Dallas Hub is Love Field, while Greater Southwest International aircarrier airport serves the Ft. Worth area. This will change upon completion of the new Regional airport which is being built to serve both areas. Currently, Love Field ranks eighth in the nation in order of number of enplaned passengers. Air carrier operations account for 65% of all traffic at Love, while general aviation totals 34.3% and military flying, the balance. These figures compare to those of a decade ago: air carrier - 57.7%; general aviation - 39.7% and military - 2.5%.

There are over 425,000 total operations at Love Field annually. This is projected to rise to 475,000 by 1975, however, the exact total will be subject to operations at the new Regional. Total operations at Greater Southwest are currently running over 150,000 with air carriers accounting for less than 5,000 annually.

Delays at Love Field are not considered to be significant. The few problems encountered center around slippery conditions when runways are wet, taxiing congestion due to lack of sufficient apron area, and pavement failure. However, certain measures have been taken to alleviate the situation. The parallel taxiway to Runway 31R/13L has been strengthened, Runway 31L/13R has been grooved, and Runway 31R/13L was scheduled for resurfacing.

The many passenger loading spurs and terminals that jut out onto the terminal apron have reduced the available taxiing space and limited taxiing, in most cases, to one way only. Aircraft had to be backed out from the terminal gates which further utilized the ramp area and added to taxiing congestion.

Further improvements to Love Field, and indeed all the Hub airports, are strictly dependent on the progress and completion of the new Dallas/ Ft. Worth Regional. New construction will be kept at a minimum and will have to be justified on an interim basis.

Of significant interest to airport planners is Braniff International's automated monorail system. Installed at a cost of about $2 million, the monorail became operational in April 1970. It is used to transport passengers between Braniff's satellite parking area and the aircraft boarding gates. Its operation and results will be watched to determine the feasibility and desireability of such systems.

The Dallas/Ft. Worth Regional Airport is due to be operational in 1973. Cost of the airport is estimated at $500 million.

The airport is near Arlington, Texas on two sides of a multi-lane expressway which runs between the two cities. Plans call for the terminals to be built in semi-circle design on three levels. Each of the presently planned eight terminals will contain its own ticket, baggage, and loading facilities. Feature of the design is the complex access roadways within the terminal area and the connecting links to the main expressway and other terminals.

The problem of moving passengers, baggage, and cargo between the various terminals on either side of the expressway led to the development of a circulatory system.

The Department of Transportation's Urban Mass Transportation Administration provided a $1 million-plus demonstration grant to the Dallas/Ft. Worth Airport Board for a circulatory transportation system at the new Regional. Two such systems selected for evaluation: Dashaveyor Company, Los Angeles, provided a steel-wheeled, self-propelled, automatic monorail system and Varo, Inc., Garland, Texas provided a Monocab Horizontal Elevator System which can also operate underground. Both Dashaveyor and Varo will be reimbursed for design and testing up to $350,000 by the Board.

When the new Regional becomes operational, it is believed that Love Field will operate as a general aviation airport, however, no firm decision has been made. Authorities point out that local funds may not be sufficient to support both airports. Operating Love Field as a general aviation airport would be a disproportionately expensive proposition.

INTERNATIONAL
FORT LAUDERDALE - HOLLYWOOD

Secondary Airports, Opa-Locka (Miami) General Aviation with ATC tower;
Opa-Locka West

International centers the Miami Hub airports and ranks ninth in the nation in order of number of enplaned passengers. Annual operations are distributed among air carriers with 67.6%, general aviation with 31.9%, and military, 0.5%. Over a ten year period air carrier operations have experienced the widest distributional increase, 16.4%. A decade ago, general aviation accounted for 39.1% and military, 9.7%. Traffic at International currently numbering about 570,000 annually, consists of some 30% devoted to training operations and of these about one-third are touch-and-go. Miami is one of the largest air carrier training centers in the nation. Four of Miami's hub airports have combined annual operations around the 2 million mark, making this hub second only to Los Angeles in general aviation traffic. Opa-Locka, Hollywood, and Tamiami are the major general aviation airports with approximately 580,000, 425,000 and 445,000 operations annually.

Ft. Lauderdale's 525,000 operations per year include air carrier traffic of some 40,000-plus flights.

The chief cause of congestion affecting the smooth operation at Miami is the sizeable number of air carrier training flights conducted there. These proficiency flights consist of touch-and-go, instrument check-out and emergency simulation involving large jet transports. Although the training operations are scheduled around the passenger flights, the FAA indicates that on numerous occasions it is impractical to cease the training procedure so as to enable scheduled traffic to land or take off without delay. The training activities, in addition to disruption of scheduled service, have added to Miami's other major problems, noise and overcapacity. Recognizing the need to reduce training operations at International and the upcoming requirement for a new major jetport in the area, Dade County Port Authority officials, some ten years ago, began an intensive search for a suitable location. The effort culminated, after about 20 proposed sites were rejected, in the selection of Big Cypress Swamp, a 38 square mile area, some 40 miles west of Miami and adjacent Everglades National Park. The Authority began construction of a 10,500 ft. runway as the first step in the planned multi-million dollar airport complex. Caught in the mounting tide of environmental awareness and strong objection voiced by conservation groups, the Departments of Interior and Transportation decided, in early 1969, that the site threatened the ecological balance of the Everglades. In the ensuing controversy, the runway was completed and made operational in November 1969. Following an agreement in January 1970 between local, state and government officials in which Dade County will renew the search for another jetport site, the landing strip began airline training operations. Under the agreement the Everglades training strip will be abandoned once a new airport location has been found, and a runway for pilot training built on it is made operational. Purchase of the new site will be at no cost to the Dade County Port Authority, Operation of the Everglades runway is conditional upon the adherence to environmental safeguards monitored by the Interior Department.

The operation of the Everglades strip has brought some relief to International with training flights being diverted out of the scheduled traffic. However, full potential has not been realized and probably will not be until a permanent site is operational and fully equipped. General aviation activity in the Miami Hub, although extremely large, does not seriously affect International's operations. In 1970, a new general aviation airport, Opa-Locka West, was added to the Hub and should help to maintain the balance for a few years in the face of rising general aviation flying. The 420-acre facility has two 3,000 ft. runways and will serve as a reliever to neighboring Opa-Locka Airport.

Eastern Airline plans to earmark $70.5 million for improvements at its Miami base. Expansion of its maintenance and overhaul facilities to accommodate the wide-bodied jets and terminal area modernization and Eastern's key projects, to be financed through the bond issue, marketed by the Port Authority and paid for by Eastern through long term lease arrangements.

Immediate improvements in the Hub area, including terminal expansion, cargo building, pavement strengthening, apron extension and access road improvement, are scheduled by the Port Authority.

TAMPA INTERNATIONAL, TAMPA FLORIDA

Tampa is a medium-sized hub airport located on the west coast of Central Florida. The facility is the subject of considerable interest in aviation circles due to its new terminal and aircraft boarding facilities.

In March 1972, approximately 60% of all flights were for stage lengths of 500 statute miles or less, and essentially all activity was conducted over stage lengths of less than 1,500 statute miles. Nevertheless, the airport was already receiving service by both 747 and DC-10 type equipment and substantial service from four-engine turbofans and turbojets as well as the 727 types. Only 25% of commercial operations were conducted by aircraft of twin-engine turbofan size or smaller.

The airport also had heavy use by general aviation with 47.8% of all operations falling into this category in fiscal year 1970. Military activity is nil, accounting for less than 1% of all operations in the same period.

It should be noted that in 1969 a report prepared for the airport forecast 160,000 aircraft operations for the year 1985 (and 12,000,000 passengers). Further, the Tampa region as well as Florida in general is receiving a very large boost from the opening of Disney World in Orlando. As a result, operations at Tampa increased nearly 15% in 1971, while the national trend was down. It is therefore quite possible that the 160,000 operations forecast will be achieved by this airport in the year 1985.

In terms of aircraft mix in 1985, B-747 and DC-10/1011 operations should account for nearly one-third of the total. The stretched 727 will probably be the single most predominant aircraft type, while others will assume less importance. The airport appears to be well capable of handling all demands placed upon it.

ATLANTA AIRPORT, ATLANTA, GEORGIA

Secondary Airports, DeKalb-Peachtree, General Aviation with ATC tower;
Fulton County, General Aviation with ATC tower;

The Atlanta Hub is centered about the Atlanta Airport which ranks fourth in the nation in order of number of enplaned passengers per year. The bulk of aircraft operations are accounted for by air carriers with an 83.6% distribution. General aviation distribution totals 16.5% with military operations the 0.3% balance. The near 9% increase in air carrier operations in the last decade is reflected by an almost equally-split decrease of general aviation and military flying at Atlanta.

Traffic at Atlanta presently numbers about 450,000 flights annually and is expected to rise to some 485,000 operations by 1975.

Atlanta's problems are not of the magnitude of the giant hubs (Chicago, L.A., N.Y.), but the growth of enplanements and operations projected should exceed capacity in the immediate future. Factors causing congestion, as described by the FAA, included:

- Lack of simultaneous approach capability
- Inadequate number of runways
- Slippery wet-runway condition (Runway 9R/27L)
- Inadequate runup ramps
- Inadequate number of aircraft parking gates
- Lack of well-placed high-speed turnoffs

Specific recommendations for improvements at Atlanta, according to an FAA Task Force, included:

- Groove Runway 9R/27L
- Construct South parallel Runway 9FR-27FL
- High-speed turnoffs Runways 9L and 9R
- North parallel runway 9FL/27FR, general aviation stage length & taxiway system

- Expand general aviation apron
- Parallel taxiways to Runways 9R/9FR
- Provide dual taxi capability around ramps
- Fill explanade end of Runway 9L

Under an estimated $1 million in funds (half of which provided by a Federal grant), the City has paved Runway 9R/27L (9200 ft. x 150 ft.) and constructed a portion of parallel taxiway (5900 ft. x 75 ft.), including connecting and exit taxiways.

The Atlanta Hub's main requirements to meet the increased traffic and facilities demand center on increased number of runways and runway improvements, such as wet runway operations and high-speed turnoffs. Other problems will be somewhat alleviated with the addition of a central terminal area at Atlanta and ILS at the Fulton reliever airport. The City is supporting the proposed addition of perhaps two more reliever airports in the Hub area to maintain the Air Carrier/General Aviation ratio of Atlanta Airport despite the expected increase in general aviation flying. In a study prepared by R. Dixson Speas Associates, Henry County was recommended as the optimum location for a second major airport for Atlanta.

At present, problems which disrupt operations at other large hubs, such as those caused by helicopter operations (almost non-existent at Atlanta), noise, flight training and flow control restrictions imposed by other major terminals, is at a minimum.

APPENDIX B

Appendix B presents the various replications performed during the maintenance concept analysis.

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Baseline Case)

STATION	ACFT START OF DAY	SCHED DEPTS	ACTUAL DEPTS	NO. CANCEL	NO. DELAYS	DELAY HOURS	NO. SWITCHES
** MDW	9	232	216	16	15	7.55	12
MIC	3	124	115	9	4	3.53	3
CGX	9	268	240	28	20	13.42	12
* CPS	4	136	128	8	8	4.83	9
BKL	1	68	57	11	2	1.25	2
* DET	5	180	168	12	7	5.27	11
MKC	1	72	67	5	0	0	3
AGC	1	52	51	1	2	1.77	0
CVG	1	40	37	3	0	0	1
TOL		8	7	1	0	0	0
CMH		24	22	2	3	2.58	0
DSM		24	20	4	1	0.95	0
DAY		16	14	2	2	1.73	0
IND		40	36	4	2	1.70	0
ROC		12	7	5	1	.80	0
BUF		16	14	2	4	3.77	1
OMA		36	31	5	3	2.73	0
MKE		36	24	12	2	1.82	0
DEN		24	20	4	0	0	0
TOTALS	35	1408	1274	134	76	53.70	54

** Full Maintenance Base * Limited Maintenance Base

EBF 150.3000

No. Aircraft = 35

% Schedule Departures (mean) = 90.5%

Delay Rate (mean) = 59.6%

Total Flight Hours (mean) = 1140 hrs.

Aircraft Utilization (mean) = 7.81 hrs/day

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Test Case No. 1)

STATION	SCHED DEPTS	ACTUAL DEPTS MEAN	NO. CANCEL MEAN	NO. DELAYS MEAN	DELAY HRS MEAN	NO. SWITCH MEAN
**MDW (1)	232	226	6	12	4.58	9
MIC	124	119	5	3	1.33	4
CGX	268	247	21	19	10.62	14
*CPS	136	131	5	2	0.83	7
BKL	68	58	10	1	0.73	1
*DET	180	160	20	11	4.68	7
MKC	72	57	15	1	0.60	2
AGC	52	47	5	2	1.77	1
CVG	40	38	2	0	0	0
TOL	8	8	0	0	0	0
CMH	24	23	1	1	0.68	1
DSM	24	24	0	3	3.02	0
DAY	16	15	1	1	0.67	0
IND	40	39	0	2	1.48	0
ROC	12	9	3	0	0	1
BUF	16	14	2	3	2.73	0
OMA	36	33	3	2	1.82	0
MKE	36	30	6	4	3.55	0
DEN	24	17	7	0	0	0
TOTALS	1408	1295	113	67	39.10	47

**Full Maintenance Base   *Limited Maintenance Base   (1) Additional Aircraft

<u>EBF 150.3000</u>

No. of Aircraft	= 38
% Schedule Departures (Mean)	= 91.9%
Delay Rate (Mean)	= 5.17%
Total Flight Hours (Mean)	= 1161 Hrs
Utilization (Mean)	= 7.73 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Test Case No. 2)

STATION	SCHED DEPTS	ACTUAL DEPTS MEAN	NO. CANCEL MEAN	NO. DELAYS MEAN	DELAY HRS MEAN	NO. SWITCH MEAN
**MDW (1)	232	220	12	7	2.87	8
MIC	124	112	12	3	2.18	5
CGX	268	245	23	19	10.58	8
*CPS (1)	136	131	5	2	1.18	9
BKL	68	61	7	3	1.55	2
*DET (1)	180	179	1	7	3.35	8
MKC	72	60	12	2	1.68	3
AGC	52	51	1	2	1.77	0
CVG	40	39	1	2	2.07	2
TOL	8	8	0	0	0	0
CMH	24	23	1	0	0	1
DSM	24	24	0	4	4.05	0
DAY	16	16	0	1	0.67	0
IND	40	37	3	3	2.27	0
ROC	12	9	3	0	0	0
BUF	16	15	1	1	0.72	0
OMA	36	35	1	3	2.83	0
MKE	36	34	2	2	1.82	0
DEN	24	19	5	0	0	0
TOTALS	1408	1318	90	61	39.58	46

**Full Maintenance Base   *Limited Maintenance Base   (1)Additional Aircraft

EBF 150.3000

No. of Aircraft	= 35
% Schedule Departures (Mean)	= 93.5%
Delay Rate (Mean)	= 4.60%
Total Flight Hours (Mean)	= 1176 Hrs
Utilization Hours (Mean)	= 7.43 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Test Case - No. 3)

STATION	SCHED DEPTS	ACTUAL DEPTS MEAN	NO. CANCEL MEAN	NO. DELAYS MEAN	DELAY HRS MEAN	NO. SWITCH MEAN
**MDW (1)	232	226	6	12	6.73	11
MIC	124	124	0	2	1.28	2
CGX	268	250	18	14	9.00	8
CPS (1)	136	130	6	4	2.65	5
BKL	68	64	4	5	3.75	3
*DET (1)	180	176	4	7	3.90	14
MKC	72	67	5	1	0.67	1
AGC	52	51	1	1	0.95	2
CVG	40	39	1	2	2.02	0
TOL	8	7	1	0	0	0
CMH	24	24	0	0	0	0
DSM	24	24	0	5	5.17	0
DAY	16	15	1	0	0	0
IND	40	36	4	3	2.50	0
ROC	12	5	7	0	0	0
BUF	16	12	4	3	2.68	0
OMA	36	35	1	1	0.78	0
MKE	36	34	2	4	3.53	0
DEN	24	20	4	0	0	0
TOTALS	1408	1339	69	64	45.62	46

** Full Maintenance Base   *Limited Maintenance Base   (1)Additional Aircraft

EBF 150.3000

No. of Aircraft = 38

% Schedule Departures (Mean) = 95.1%

Delay Rate (Mean) = 4.77%

Total Flight Hours (Mean) = 1194 hrs

Utilization (Mean) = 7.53 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Test Case No. 4)

STATION	SCHED DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS MEAN	SWITCH MEAN
**MDW (1)	232	226	6	15	7.33	9
MIC	124	120	4	4	2.30	4
CGX (1)	268	268	0	7	2.03	18
CPS (1)	136	128	8	5	3.88	1
BKL	68	67	1	5	3.62	1
*DET (1)	180	175	5	10	4.42	14
MKC	72	70	2	1	0.98	2
AGC	52	52	0	3	2.43	0
CVG	40	39	1	2	1.75	1
TOL	8	7	1	0	0	0
CMH	24	24	0	0	0	0
DSM	24	24	0	2	1.63	0
DAY	16	16	0	1	0.67	0
IND	40	38	2	3	2.57	1
ROC	12	12	0	1	0.70	0
BUF	16	16	0	1	0.72	0
OMA	36	36	0	1	0.78	0
MKE	36	32	4	3	2.63	2
DEN (1)	24	24	0	0	0	0
TOTALS	1408	1374	34	64	38.45	53

** Full Maintenance * Limited Maintenance (1) Aircraft Added

EBF 150.3000

No. Aircraft = 40

% Schedule Departure (mean) = 97.5%

Delay Rate (mean) = 4.60%

Total Flight Hours (mean) = 1238 hrs

Utilization (mean) = 7.42 Hrs /day

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Optimum Case - 5 Replications

STATION	SCHED DEPTS	ACTUAL DEPTS MIN	ACTUAL DEPTS MAX	ACTUAL DEPTS MEAN	% SCHED DEPTS MIN	% SCHED DEPTS MAX	% SCHED DEPTS MEAN	# CANCELLATIONS MIN	# CANCELLATIONS MAX	# CANCELLATIONS MEAN	# DELAYS MIN	# DELAYS MAX	# DELAYS MEAN
** MDW (1)	232	213	229	221.8	91.8	98.7	95.6	3	19	10.2	10	22	13,0
MIC	124	113	119	117.0	91.1	95.9	94.3	5	11	7.0	2	5	3.2
CGX (1)	268	243	264	254.2	90.6	98.5	94.8	4	25	13.8	8	22	15.8
* CPS	136	129	133	131.4	94.8	97.7	96.6	3	7	4.6	1	3	1.8
BKL	68	58	65	60.4	85.2	95.5	88.8	3	10	7.6	0	4	2.4
* DET	180	161	174	168.2	89.4	96.6	93.4	6	19	11.8	6	10	7.8
MKC	72	67	70	68.8	93.0	97.2	95.5	2	5	3.2	1	2	1.2
AGC	52	46	51	48.8	88.4	98.0	93.8	1	6	3.2	1	3	1.8
CVG	40	35	39	37.4	87.5	97.5	93.5	1	5	2.6	0	6	2.0
TOL	8	7	8	7.6	87.5	100.0	95.0	0	1	0.4	0	1	0.4
CMH	24	19	24	22.2	79.1	100.0	92.5	0	5	1.8	0	1	0.4
DSM	24	22	24	22.8	91.6	100.0	95.0	0	2	1.2	1	2	1.6
DAY	16	15	16	15.4	93.7	100.0	96.2	0	1	.6	0	1	0.6
IND	40	36	39	37.6	90.0	97.5	94.0	1	4	2.4	1	4	2.8
ROC	12	8	12	10.2	66.7	100.0	85.0	0	4	1.8	0	2	0.8
BUF	16	14	16	15.2	87.5	100.0	95.0	0	2	.8	3	4	3.8
OMA	36	32	35	34.2	88.8	97.2	95.0	1	4	1.8	1	2	1.8
MKE	36	28	33	30.4	77.7	91.6	84.4	3	8	5.6	1	2	1.6
DEN (1)	24	20	24	22.4	83.3	100.0	93.3	0	4	1.6	0	0	0
TOTALS	1408	1266	1375	1326.0	89.9	97:6	94:1	33	142	82.0	36	96	62.8

** Full Maintenance Base * Limited Maintenance Base (1) Additional Aircraft

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Optimum Case - 5 Replications)

STATION	DELAY HOURS			DELAY RATE %			# SWITCHES			TOTAL FLT HOURS			UTILIZATION		HRS/DAY
	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
**MDW (1)	3.37	13.18	6.49			5.86	6	13	9.4						
MIC	1.67	4.82	2.43			2.73	4	8	5.4						
CGX (1)	3.32	12.10	8.71			6.21	10	17	13.6						
*CPS	0.53	1.77	1.12			1.36	4	9	6.4						
BKL	0	3.55	1.84			3.97	0	1	.8						
*DET	3.35	5.78	4.39			4.63	7	12	9.4						
MKC	0.53	1.97	0.97			1.74	0	4	1.4						
AGC	0.73	2.80	1.50			3.68	0	2	1.0						
CVG	0	5.98	1.90			5.34	0	1	.4						
TOL	0	1.03	0.41			5.26	0	0	0						
CMH	0	1.03	0.40			1.80	0	1	..2						
DSM	0.95	1.98	1.58			7.01	0	1	.8						
DAY	0	0.68	0.40			3.89	0	0	0						
IND	1.03	3.17	2.31			7.44	0	1	.4						
ROC	0	1.77	0.73			7.84	0	0	0						
BUF	2.47	3.72	3.38			25.00	0	0	0						
OMA	.78	2.03	1.62			5.26	0	2	.8						
MKE	.78	2.07	1.50			5.26	0	1	.6						
DEN (1)	0	0	0			0	0	1	.2						
TOTALS	19.51	69.43	41.74	2.84	6.98	4.73	31	76	50.8	1177	1211	1194.5	7.43	7.64	7.53

** Full Maintenance Base * Limited Maintenance Base (1) Additional Aircraft

MAINTENANCE CONCEPT ANALYSIS

CHICAGO REGION

(Selected Optimum Case)

STATION	SCHED DEPTS	ACTUAL DEPTS MEAN	NO. CANCEL MEAN	DELAYS MEAN	NO. DELAYS MEAN	NO. SWITCH MEAN
**MDW (1)	232	229	3	11	4.37	13
MIC	124	113	11	4	2.48	8
CGX (1)	268	253	15	8	3.32	14
*CPS	136	131	5	3	1.77	9
BKL	68	60	8	4	3.10	1
*DET	180	163	17	10	5.78	11
MKC	72	70	2	1	0.65	1
AGC	52	48	4	2	1.27	2
CVG	40	39	1	0	0	1
TOL	8	8	0	0	0	0
CMH	24	24	0	1	1.03	0
DSM	24	24	0	2	1.98	0
DAY	16	16	0	1	.67	0
IND	40	38	2	2	1.53	0
ROC	12	10	2	0	0	0
BUF	16	16	0	4	3.67	0
OMA	36	35	1	2	1.48	0
MKE	36	28	8	1	0.78	0
DEN (1)	24	24	0	0	0	0
TOTALS	1408	1329	79	56	33.88	60

** Full Maintenance * Limited Maintenance (1) Additional Aircraft

EBF 150.3000

No. Aircraft	= 38
% Schedule Departures (Mean)	= 94.3%
Delay Rate (Mean)	= 4.21%
Total Flight Hours (Mean)	= 1203 hrs
Utilization (Mean)	= 7.59 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

CALIFORNIA REGION

(Baseline Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
ABQ	32	32	0	0	0	3
DEN	56	55	1	2	1.58	0
**LAS	260	245	15	16	8.58	18
RHV	76	68	8	3	1.77	1
SNA	88	82	6	2	1.45	2
GPF	124	98	26	5	4.35	3
*MYF	224	203	21	17	13.80	19
VNY	96	90	6	5	3.95	1
EMT	104	95	9	7	6.28	1
*OAK	112	106	6	3	1.73	6
SAC	84	71	13	11	9.32	3
PHX	128	121	7	12	8.48	4
SLC	76	74	2	4	3.70	0
LGB	108	100	8	12	10.82	4
MRT	32	24	8	3	2.37	1
PDX	44	44	0	1	0.50	0
ACV	20	20	0	0	0	0
TUS	28	24	4	1	0.53	3
MOF	60	60	0	0	0	0
RNO	32	25	7	2	1.67	0
FAT	40	29	11	2	1.72	1
SBA	16	16	0	1	0.23	0
TOTALS	1840	1682	158	109	82.83	70

<u>EBF 150.3000</u>

No. Aircraft	= 47
% Schedule Departures (Mean)	= 91.4%
Delay Rate (Mean)	= 6.48%
Total Flt.Hrs.(Mean)	= 1500 Hrs.
Utilization (Mean)	= 7.63 Hrs/Day

* Limited Maintenance Base

** Full Maintenance Base

(1) Additional Aircraft

MAINTENANCE CONCEPT ANALYSIS

NORTHEAST REGION

(Selected Optimum Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
BED (1)	220	214	6	13	8.53	6
*DCA (1)	376	362	14	25	15.17	25
ISP	220	206	14	10	5.93	9
PNE	172	161	11	11	9.38	10
SEC	240	232	8	27	16.18	17
**HPN (1)	224	220	4	15	7.77	19
AGC	92	86	6	4	2.37	4
*OWD (1)	216	205	11	6	3.22	10
BUF	44	44	0	1	1.03	1
BKL	88	84	4	0	0	0
HFD	40	38	2	1	0.98	0
CMH	8	8	0	0	0	0
*DET (1)	124	120	4	2	0.53	10
ROC	32	29	3	2	1.73	0
ORF	8	8	0	0	0	0
CVG	24	24	0	1	0.87	2
SYR	16	16	0	1	0.77	0
PVD	8	8	0	0	0	0
TOTALS	2152	2065	87	119	74.47	113

** Full Maintenance Base * Limited Maintenance Base (1) Additional Aircraft

EBF 150.000

No. Aircraft	= 57
% Schedule Departures (Mean)	= 96.0%
Delay Rate (Mean)	= 5.76%
Total Ft.Hrs.(Mean)	= 1738 hrs.
Utilization (Mean)	= 7.31 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

NORTHEAST REGION

(Baseline Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
BED	220	199	21	16	10.95	5
* DCA	376	347	29	47	25.68	30
ISP	220	200	20	6	3.52	8
PNE	172	160	12	3	2.15	4
SEC	240	210	30	31	19.42	12
** HPN	224	206	18	15	9.57	17
AGC	92	79	13	9	7.07	3
* QWD	216	205	11	6	5.27	9
BUF	44	36	8	1	1.03	0
BKL	88	79	9	1	.53	2
HFD	40	37	3	0	0	0
CMH	8	8	0	1	.50	0
* DET	124	119	5	3	.88	7
RQC	32	27	5	0	0	0
QRF	8	6	2	0	0	0
CVG	24	22	2	2	1.38	0
SYR	16	16	0	0	0	0
PVD	8	7	1	0	0	0
TOTALS	2152	1963	189	141	87.95	97

** Full Maintenance Base   * Limited Maintenance Base   (1) Additional Aircraft

EBF 150.3000

No. Aircraft	= 52
% Schedule Departures (Mean)	= 91.2%
Delay Rate (Mean)	= 7.18%
Total Flt. Hrs. (Mean)	= 1654 Hrs.
Utilization (Mean)	= 7.63 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

CALIFORNIA REGION

(Selected Optimum Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
ABQ	32	32	0	0	0	4
DEN	56	54	2	0	0	1
**LAS (1)	260	252	8	10	5.33	23
RHV	76	65	11	0	0	0
SNA	88	86	2	1	0.50	1
GPF	124	113	11	4	2.55	5
*MYF (1)	224	209	15	7	4.03	21
VNY	96	90	6	4	3.27	2
EMT	104	101	3	4	3.12	2
*OAK (1)	112	108	4	2	0.80	8
SAC	84	79	5	9	6.07	2
PHX (1)	128	127	1	9	5.63	4
SLC	76	74	2	2	1.13	0
*LGB (1)	108	102	6	6	5.52	3
MRT	32	30	2	2	1.33	1
PDX	44	43	1	1	0.85	1
ACV	20	18	2	0	0	0
TUS	28	28	0	0	0	1
MOF	60	56	4	2	1.30	2
RNO	32	31	1	4	2.97	0
FAT	40	27	13	2	2.07	0
SBA	16	16	0	0	0	0
TOTALS	1840	1741	99	69	46.47	81

** Full Maintenance Base   * Limited Maintenance Base   (1) Additional Aircraft

EBF 150.3000

No. Aircraft	= 52
% Schedule Departures (Mean)	= 95.0%
Delay Rate (mean)	= 3.96%
Total Flt. Hrs. (Mean)	= 1548 Hrs.
Utilization (Mean)	= 7.18 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS
SOUTHEAST REGION
(Baseline Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
AGC	12	11	1	0	0	0
**PDK	256	240	16	21	14.65	7
BEL	24	22	2	1	1.08	0
FTY	268	225	43	15	7.60	9
ORF	16	12	4	0	0	0
*OPF	96	85	11	5	3.37	5
JAX	36	35	1	0	0	1
SDF	96	84	12	15	14.50	3
MCO	24	23	1	0	0	0
BHM	12	12	0	0	0	0
BNA	44	43	1	1	1.03	0
CGX	104	95	9	7	4.23	2
BKL	28	21	7	0	0	0
*DCA	120	105	15	6	3.53	10
GSD	60	49	11	5	4.62	1
CAE	24	14	10	1	.98	0
CLT	72	54	18	1	.27	3
ISP	44	41	3	0	0	0
CHS	20	20	0	0	0	0
PNE	16	14	2	0	0	0
TEB	52	45	7	1	.75	2
*CPS	36	34	2	2	1.57	1
NEW	36	34	2	4	2.88	0
CVG	12	11	1	0	0	0
RDU	60	56	4	1	1.03	1
GSO	48	47	1	2	1.85	1
*DET	40	37	3	3	1.70	8
TYS	12	8	4	1	.43	0
FLL	12	10	2	0	0	2
IND	8	7	1	0	0	0
RIC	8	7	1	1	.87	0
SAV	24	22	2	2	1.62	0
TPA	48	43	5	3	2.58	2
PHF	8	8	0	0	0	0

MAINTENANCE CONCEPT ANALYSIS

SOUTHEAST REGION
(Baseline Case)

(Continued)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
MOB	8	7	1	0	0	1
JAN	12	12	0	0	0	0
TLH	12	12	0	0	0	0
TOTALS	1808	1605	203	98	71.15	59

** Full Maintenance Base * Limited Maintenance Base (1) Additional Aircraft

EBF 150.000

No. Aircraft	= 54
% Schedule Departures (Mean)	= 88.8%
Delay Rate (Mean)	= 6.11%
Total Flight Hrs. (Mean)	= 1757 hrs.
Utilization (Mean)	= 7.80 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

SOUTHEAST REGION

(Selected Optimum Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
AGC	12	12	0	1	.85	0
**PDK (1)	256	247	9	15	8.00	10
BEL	24	24	0	1	1.08	0
FTY	268	259	9	14	8.23	8
ORF	16	16	0	0	0	0
*OPF (1)	96	95	1	1	.78	5
JAX	36	35	1	0	0	0
SDF	96	96	0	16	15.77	3
MCO	24	24	0	0	0	0
BHM	12	9	3	1	.92	0
BNA	44	44	0	1	1.03	0
CGX (1)	104	102	2	6	3.53	5
BKL	28	28	0	0	0	0
*DCA (1)	120	118	2	6	2.67	10
GSD	60	57	3	8	6.37	2
CAE	24	22	2	2	1.97	0
CLT	72	71	1	2	1.02	1
ISP	44	43	1	0	0	0
CHS	20	20	0	0	0	0
PNE	16	16	0	0	0	0
TEB	52	50	2	2	1.48	3
*CPS	36	36	0	0	0	0
NEW	36	34	2	4	2.80	0
CVG	12	10	2	0	0	0
RDU	60	57	3	3	2.48	1
GSO	48	48	0	2	1.42	0
*DET	40	40	0	0	0	2
TYS	12	12	0	0	0	0
FLL	12	11	1	0	0	0
IND	8	8	0	1	.48	0
RIC	8	7	1	1	1.08	0
SAV	24	21	3	1	.63	0
TPA	48	46	2	0	0	0

MAINTENANCE CONCEPT ANALYSIS

SOUTHEAST REGION

(Selected Optimum Case)

(Continued)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
PHF	8	8	0	0	0	0
MOB	8	8	0	0	0	0
JAN	12	12	0	0	0	0
TLH	12	11	1	0	0	0
TOTALS	1808	1757	51	88	62.60	50

** Full Maintenance Base   * Limited Maintenance Base   (1) Additional Aircraft

EBF 150.3000

No. Aircraft	= 58
% Schedule Departures (Mean)	= 97.2%
Delay Rate (Mean)	= 5.01%
Total Flt. Hrs.(Mean)	= 1920 Hrs.
Utilization (Mean)	= 7.94 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

SOUTHERN REGION

(Baseline Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
**DAL	324	277	47	33	18.90	27
*HOU	132	128	4	4	4.13	5
SAT	45	43	2	0	0	0
ELP	24	17	7	3	2.22	0
*CPS	40	34	6	2	1.43	0
MKC	20	14	6	3	2.92	1
ABQ	36	32	4	0	0	0
DEN	32	26	6	0	0	1
ICT	8	4	4	0	0	0
OKC	44	35	9	3	3.10	0
*NEW	84	79	5	1	.83	0
GDS	52	51	1	1	.33	0
SHV	12	12	0	0	0	0
TUL	33	31	2	0	0	0
MAF	24	20	4	1	1.03	1
AUS	20	15	5	2	2.00	0
AMA	12	8	4	1	.68	0
CRP	12	11	1	0	0	0
LBB	20	19	1	0	0	1
LIT	12	9	3	2	1.75	0
TOTALS	986	865	121	56	39.33	36

** Full Maintenance * Limited Maintenance (1) Additional Aircraft

EBF 150.3000

No. Aircraft	= 21
% Schedule Departures (Mean)	= 87.7%
Delay Rate (Mean)	= 6.47%
Total Ft. Hrs. (Mean)	= 845 Hrs.
Utilization (Mean)	= 9.65 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

SOUTHERN REGION

(Selected Optimum Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
**DAL (1)	324	299	25	34	17.48	24
*HOU (1)	132	129	3	2	1.57	7
SAT	45	43	2	0	0	0
ELP	24	20	4	7	6.40	0
*CPS	40	39	1	2	1.58	3
MKC	20	17	3	3	2.92	0
ABQ	36	35	1	0	0	0
DEN	32	29	3	0	0	0
ICT	8	4	4	0	0	0
OKC	44	41	3	0	0	0
*NEW (1)	84	83	1	0	0	0
GDS	52	50	2	1	.93	0
SHV	12	12	0	0	0	0
TUL	33	30	3	2	1.33	0
MAF	24	22	2	1	0.95	0
AUS	20	16	4	1	0.73	0
AMA	12	10	2	2	1.73	0
CRP	12	11	1	1	.88	0
LBB	20	19	1	0	0	1
LIT	12	12	0	0	0	0
TOTALS	986	921	65	56	36.52	35

** Full Maintenance Base *Limited Maintenance Base (1) Additional Aircraft

EBF 150.000

No. Aircraft	= 24
% Schedule Departures (Mean)	= 93.4%
Delay Rate (Mean)	= 6.08%
Total Ft. Hrs. (Mean)	= 909 Hours
Utilization (Mean)	= 9.08 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

NORTHWEST REGION

(Baseline Case)

STATION	SCHED. DEPTS	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
BOI	24	21	3	2	1.60	5
*OAK	20	19	1	0	0	0
**SEA	52	43	9	6	2.20	9
PDX	44	26	18	2	1.77	0
GEG	32	24	8	0	0	0
EUG	12	12	0	0	0	0
RNO	16	9	7	0	0	0
TOTALS	200	154	46	10	5.57	14

** Full Maintenance Base * Limited Maintenance Base (1) Additional Aircraft

<u>EBF 150.000</u>

No. Aircraft	= 6
% Schedule Departures(Mean)	= 77.0%
Delay Rate (Mean)	= 6.49%
Total Ft. Hrs.(Mean)	= 145 Hrs.
Utilization (Mean)	= 5.80 Hrs/Day

MAINTENANCE CONCEPT ANALYSIS

NORTHWEST REGION

(Selected Optimum Case)

STATION	SCHED. DEPTS.	ACTUAL DEPTS MEAN	CANCEL MEAN	DELAY MEAN	DELAY HRS. MEAN	SWITCH MEAN
BOI	24	23	1	1	0.80	3
*OAK	20	19	1	0	0	0
**SEA	52	50	2	5	1.92	10
PDX (1)	44	35	9	3	2.28	0
GEG	32	26	6	0	0	0
EUG	12	12	0	0	0	0
RNO	16	15	1	0	0	0
TOTALS	200	180	20	9	5.00	13

** Full Maintenance Base * Limited Maintenance Base (1) Additional Aircraft

EBF 150.3000

No. Aircraft	= 7
% Schedule Departures (Mean)	= 90.0%
Delay Rate (Mean)	= 5.00%
Total Flt. Hrs. (Mean)	= 171 Hrs.
Utilization (Mean)	= 5.86 Hrs/Day

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