Technical Report Documentation Pag

1. Report No. DOT/FAA/ASC/91-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle 1991-92 Aviation System Capacity Plan		5. Report Date
		6. Performing Organization Code ASC-1
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address MITRE Corporation, McLean, VA Transportation Systems Center, Cambridge, MA MiTech Incorportated, Washington, DC		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration System Capacity and Requirements Office Washington, DC 21591		13. Type of Report and Period Covered July 1990 - July 1991
		14. Sponsoring Agency Code ASC-1

15. Supplementary Notes

This report resulted from a collaborative effort by the System Capacity and Requirements Office, other FAA organizations, the MITRE Corporation, the Transportation Systems Center, and MiTech Incorportated.

16. Abstract

This is a comprehensive review of the Federal Aviation Administration's program to improve the capacity of the National Air Transportation System. The plan identifies the causes and extent of capacity and delay problems currently associated with air travel in the U.S., and outlines various planned and ongoing FAA projects that will reduce the severity of the problems in the future. The major areas of discussion are:

1)Airport Development,
2)Airport and Airspace Capacity,
3)Technology for Capacity Improvement, and
4)Marketplace Solutions.

17. Key Words Civil Aviation Airport Capacity Aviation Capacity Aviation Delay Reduction	18. Distribution Statement Document is available to the public through the National Technical Information Service Springfield, VA 22161

19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages	22. Price

Form DOT F 1700.7 (8-72) **Reproduction of completed page authoriz**

Table of Contents

Chapter 1 — Introduction 1-1
1.1 The Need for Aviation System Capacity Improvement 1-1
1.2 Level of Aviation Activity 1-2
1.2.1 Activity Statistics at Top 100 Airports 1-2
1.2.2 Traffic Volumes in the 20 Air Route Traffic Control Centers (ARTCCS) 1-4
1.3 Delay 1-9
1.3.1 Delay by Cause 1-9
1.3.2 Delay by Phase of Flight 1-11
1.3.3 Identification of Forecast Delay-Problem Airports 1-13

Chapter 2 — Airport Development 2-1
2.1 Airport Capacity Design Teams 2-1
2.1.1 Airport Capacity Design Teams — Potential Savings from Improvements 2-1
2.2 New Construction — New Airports and New and Extended Runways 2-7
2.3 Civilian Use of Military Airfield Capacity 2-14

Chapter 3 — Airport and Airspace Capacity 3-1
3.1 Instrument Approach Procedures 3-1
3.1.1 Wake Vortex Restrictions 3-2
3.1.2 Improved Longitudinal Separation on Wet Runways 3-2
3.1.3 Parallel Instrument Approaches 3-3
3.1.3.1 Independent Parallel Instrument Approaches Using a PRM 3-3
3.1.3.2 Dependent Parallel Instrument Approaches 3-5
3.1.4 Triple and Quadruple Instrument Approaches 3-6
3.1.5 Converging Approaches 3-7
3.1.5.1 Dependent Converging Instrument Approaches 3-8
3.1.5.2 Simultaneous Operations on Intersecting Runways (SOIR) 3-10
3.1.6 Expanded VFR Approach Procedures 3-10
3.1.7 Approach Procedure Applicability at the Top 100 Airports 3-11
3.2 Airspace Planning 3-16
3.2.1 Kansas City Area Airspace 3-17
3.2.2 Houston/Austin Airspace 3-18
3.2.3 Oakland Area 3-20
3.2.4 Studies in Progress 3-20

Chapter 4 — Technology for Capacity Improvement 4-1
4.1 Airport and Terminal Airspace Capacity Technology 4-2
4.1.1 Airport Surface Traffic Automation Programs 4-2
4.1.2 Terminal ATC Automation (TATCA) 4-4
4.1.2.1 Converging Runway Display Aid (CRDA) 4-4
4.1.2.2 Center-TRACON Automation System (CTAS) 4-4
4.1.3 Precision Runway Monitor (PRM) 4-5
4.1.4 Microwave Landing System (MLS) 4-6
4.1.5 Traffic Alert and Collision Avoidance System (TCAS) Applications 4-8
4.2 En Route Airspace Capacity Technology 4-8
4.2.1 Advanced Traffic Management System (ATMS) 4-9
4.2.2 Automated En Route Air Traffic Control (AERA) 4-10
4.2.3 Automatic Dependent Surveillance (ADS) and Oceanic ATC 4-12
4.3 System Planning, Integration, and Control Technology 4-13
4.3.1 National Simulation Laboratory (NSL) 4-13
4.3.2 Analysis Tools 4-14
4.3.2.1 Computer Simulation Models 4-14
4.3.2.2 Sector Design Analysis Tool (SDAT) 4-15
4.3.2.3 Terminal Airspace Visualization Tool (TAVT) 4-15
4.3.3 National Control Facility (NCF) 4-16
4.3.4 Traffic Flow Planning 4-17

Chapter 5 — Marketplace Solutions 5-1
5.1 New Hubs at Existing Airports 5-1
5.2 New Airports as Hubs 5-4
5.3 Expanded Use of Existing Commercial Service Airports 5-5
5.4 Expanded Use of Reliever Airports 5-5

Chapter 6 — Summary 6-1

Appendix A — Activity Statistics at the Top 100 Airports A-1

Appendix B — Airport Capacity Design Team Project Summaries B-1

Appendix C — New Runway Construction Projects at Major U.S. Airports C-1

Appendix D — Layouts of the Remaining Top 100 Airports D-1

Appendix E — Airport Capacity Design Teams Potential Savings from Improvements .. E-1

Appendix F — New Technology for Improving System Capacity F-1

Appendix G — Glossary G-1

List of Tables

Table 1-1. Distribution of Delay Greater Than 15 Minutes by Cause, 1984-1990 1-11
Table 1-2. Percent of Operations Delayed 1-12
Table 1-3. Average Delay by Phase of Flight 1-12
Table 1-4. Percentage of Operations Delayed 15 Minutes or More 1-14
Table 1-5. 1990 Actual and 2000 Forecast Air Carrier Delay Hours 1-15
Table 2-1. Potential Savings from Airfield Improvements Recommended by Airport Capacity Design Teams 2-3
Table 2-2. Status of Airport Capacity Design Teams 2-6
Table 2-3. New and Extended Runways Planned or Proposed 2-10
Table 3-1. Candidate Airports for Independent Parallel Approaches Using the Precision Runway Monitor (PRM) 3-4
Table 3-2. Candidate Airports for Dependent Approaches Using the Converging Runway Display Aid (CRDA) 3-9
Table 3-3. Potential Siting of New IFR Approach Procedures and Their Associated IFR Arrival Capacity 3-13
Table 3-4. Delay and Cost Savings for Lambert-St. Louis Traffic for Alternative Improvement Options 3-17
Table 3-5. Delay and Cost Savings for the New Austin Airport/Airspace System at Hub Traffic Demand Levels 3-19
Table 3-6. Delay and Cost Savings for the New Austin Airport/Airspace System at Non-Hub Traffic Demand Levels 3-19
Table 3-7. Annual Aircraft Operating Cost Savings for MCF Airspace and SJC Runway Options 3-20
Table 5-1. A Preliminary List of Airports Located Within 50 Miles of the 23 Delay-Problem Airports 5-6
Table A-1. Airport Operations and Enplanements A-2
Table A-2. Airport Enplanements, 1989 and Forecast 2000 ..... A-5
Table A-3. Total Airport Operations, 1989 and Forecast 2000 ..... A-8
Table A-4. Growth in Enplanements From 1988 to 1989 ..... A-11
Table A-5. Growth in Operations From 1989 to 1990 ..... A-14
Table A-6. Growth in Operations and Enplanements A-17

List of Figures

Figure 1-1. The Top 100 Airports by 1989 Enplanements 1-3
Figure 1-2. The 20 Continental U.S. Air Route Traffic Control Centers 1-5
Figure 1-3. Operations at Air Route Traffic Control Centers 1-6
Figure 1-4. Air Route Traffic Control Center Forecasts 1-7
Figure 1-5. Primary Cause of Delay of 15 Minutes or More in FY89 and FY90 1-10
Figure 1-6. Delays Per 1,000 Operations 1-16
Figure 1-7. Airports Exceeding 20,000 Hours of Annual Aircraft Delay in 1990 1-17
Figure 1-8. Airports Exceeding 20,000 Hours of Annual Aircraft Delay in 2000, Assuming No Capacity Improvements 1-18
Figure 2-1. Location of Airport Capacity Design Teams in the U.S. 2-4
Figure 2-2. Three Year Plan for Airport Capacity Design Teams 2-5
Figure 2-3. New Runways Planned or Proposed Among the Top 100 Airports 2-8
Figure 2-4. New Runways or Extensions Planned/Proposed Among Airports Forecasted to Exceed 20,000 Hours of Annual Aircraft Delay in 2000 2-9
Figure 5-1. Total Delay for Varying Arrival Demand at San Francisco (SFO) 5-3
Figure 5-2. Capacity Delay Curve for San Francisco (SFO) Assuming a New Connecting Hub at Sacramento (SMF) 5-3
Figure 5-3. Ten Percent of IFR Flight Tracks Within the Contiguous United States Over a 24-Hour Period 5-4