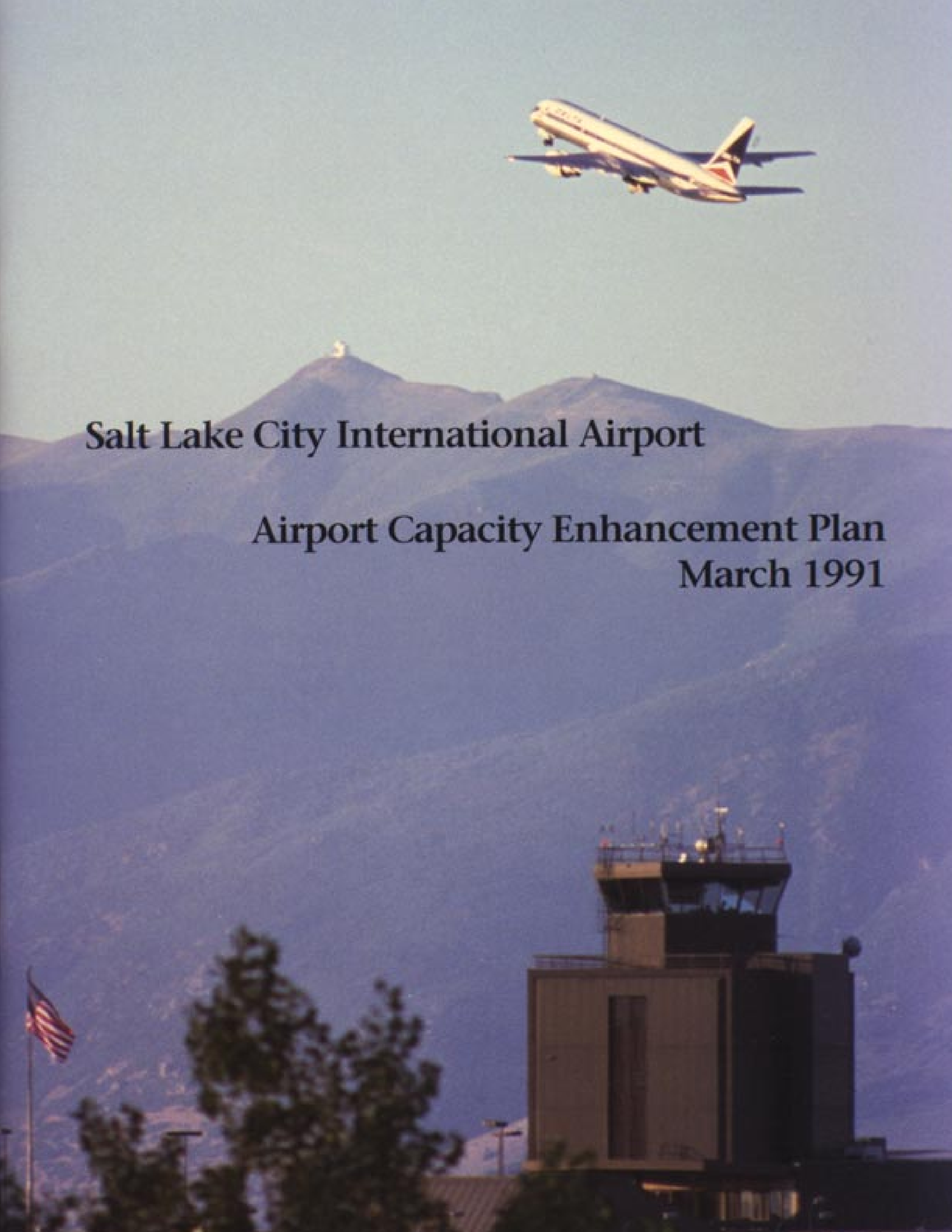

# Salt Lake City International Airport

## Airport Capacity Enhancement Plan
## March 1991

Prepared jointly by the U.S. Department of Transportation, Federal Aviation Administration, Salt Lake City Airport Authority, and Airlines and General Aviation serving Salt Lake City.

Photographs courtesy of the Salt Lake City Airport Authority.

Edited and produced by MiTech Inc.

# Executive Summary

Nearly twelve million passengers used the Salt Lake City International Airport (SLCIA) in 1989. During this same time, approximately 296,000 aircraft operations were conducted. The enclosed Design Team Study identifies options to enhance airport capacity. If implemented, these options will increase existing VFR and IFR capabilities, improve airport efficiency, and reduce aircraft delays. This will allow for continued growth in aviation activity and further development of airport facilities.

An annual traffic level of 269,600 aircraft operations was established as the "Baseline" activity level. Two future traffic levels, Future 1 and Future 2, were set at 351,000 and 418,000 annual aircraft operations, respectively. Without improvements, delays are estimated to increase dramatically, as shown below.

| Level | Total Annual Delay in Hours | Annual Delay Costs in Dollars |
|---|---|---|
| Baseline | 14,900 | $ 16,200,000.00 |
| Future 1 | 51,350 | $ 55,900,000.00 |
| Future 2 | 104,000 | $113,300,000.00 |

Considering the increasing demand, the Design Team studied several proposals for enhancing capacity and reducing delays. Many of the proposals have been recommended for implementation.

Major recommendations of this plan to meet future demands are:

- Construct a parallel runway to the west with independent IFR capability. Provide CAT III ILS on both ends of the runway.
- Terminal improvements and expansions.
- Tower relocation.
- Construct staging areas for Runway 16R/34L at runway entrances.
- Rehabilitate Taxiways X and Y.
- Install a Category III ILS on Runway 16R.
- Install a Category I ILS on Runway 34R.
- Install a Precision Runway Monitor (PRM) System.
- Install Microwave Landing Systems.
- Install Runway Visual Range equipment on Runway 34R.
- Install Airport Surface Detection Equipment.
- Install taxiway centerline lights.
- Initiate multiple changes in the terminal area airspace procedures.
- Reduce runway occupancy times.
- Improve reliever airports.
- Construct a ramp control tower for Delta Air Lines.

# FIGURE 1 Salt Lake City International Airport

# FIGURE 2 Studied Options

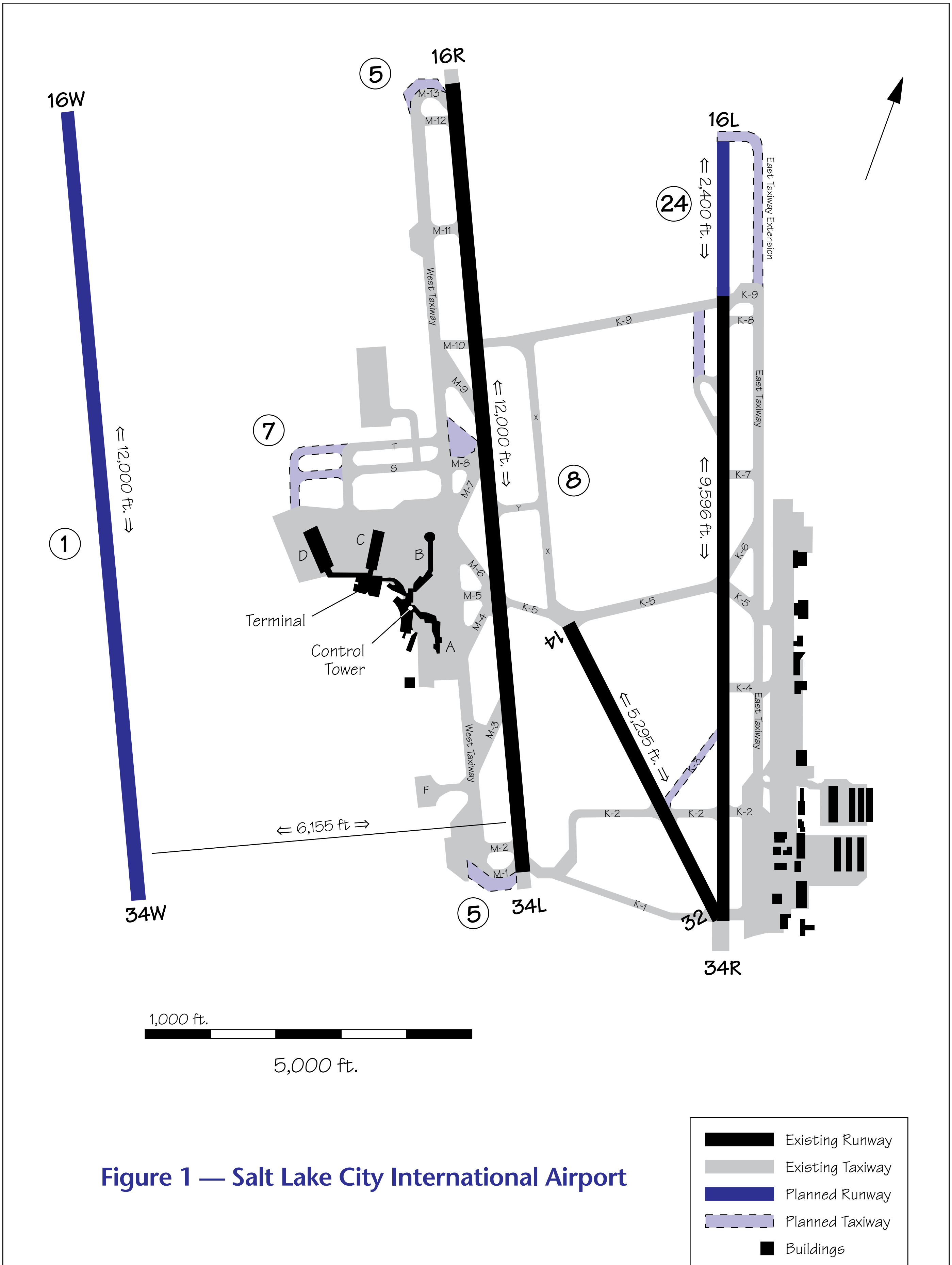


**Figure 1 — Salt Lake City International Airport**

## FIGURE 2 — Studied Options

| | Improvement | Status | Time Frame | Responsible Agency |
|---|---|---|---|---|
| **A. Recommended Improvements** | | | | |
| **Airfield Improvements** | | | | |
| 1 | Construct a parallel runway to the west with independent IFR capability (CAT III ILS on both ends) | Environmental Assessment underway | 1993-95* | SLCAA |
| 2 | Taxiway to Delta Air Lines hangar | Completed | | SLCAA |
| 3 | Relocate Tower | FAA Facilities & Equipment budget request has been made | Tied to runway construction | FAA |
| 4 | Revised taxiway exit layout | Completed | | SLCAA |
| 5 | Construct staging areas for Runway 16R/34L at runway entrances | In planning | 1991-94 | SLCAA |
| 6 | Terminal expansion | Construct on demand | Unknown | SLCAA |
| 7 | Extend Taxiways S and T to west boundary of the terminal ramp | Completed | | SLCAA |
| 8 | Rehabilitate Taxiways X & Y | In planning | 1991-94 | SLCAA |
| 9 | Improve aircraft access to cargo facilities | Completed | SLCAA | |
| **Facilities and Equipment** | | | | |
| 10 | Category I ILS on Runway 34R | Under study | 1993-95 | SLCAA / FAA |
| 11 | LDA approach to Runway 34R | ++ | | |
| 12 | Category III ILS on Runway 16R | Under grant | 1990-91 | SLCAA |
| 13 | Install Precision Runway Monitor System | Testing by FAA in progress - Raleigh Durham, NC | 1996 | FAA |
| 14 | Install Microwave Landing System | Demonstrations being conducted at JFK, MDW | Unknown | FAA |
| 15 | Install Runway Visual Range equipment on Runway 34R | In design | 1993 | FAA |
| 16 | Install Airport Surface Detection Equipment | Under study | 1993-95 | FAA |
| 17 | Install taxiway centerline lights | Ongoing | SLCAA | |

| Estimated Construction Costs in 1988 Dollars ** | Annual Savings in Hours (millions of 1988 dollars) | | | | |
|---|---|---|---|---|---|
| | Present Airfield Configuration | | | Future Airfield Configuration+ | |
| | Baseline | Future 1 | Future 2 | Future 1 | Future 2 |
| $80,700,000 | *** | 28,840 (31.4) | 61,670 (67.19) | *** | *** |
| See Narrative | | | | | |
| See Narrative | | | | | |
| $2,440,000 | 600 (0.65) | 1,770 (1.93) | 4,110 (4.50) | 210 (0.23) | 330 (0.36) |
| See Narrative | | | | | |
| $139,390,000 | *** | *** | *** | 1,430 (1.56) | 3,920 (4.26) |
| See Narrative | | | | | |
| $4,186,000 | 180 (0.19) | *** | *** | 700 (0.76) | 1,920 (2.09) |
| See Narrative | | | | | |
| $1,500,000 | 789 (0.86) | 3,021 (3.28) | 6,679 (7.27) | *** | *** |
| See Narrative | | | | | |
| $3,000,000 | 730 (0.80) | 2,800 (3.05) | 6,190 (6.80) | *** | *** |
| See Narrative | | | | | |
| See Narrative | | | | | |
| See Narrative | | | | | |
| See Narrative | | | | | |
| See Narrative | | | | | |

## FIGURE 2 — Studied Options (continued)

| | Improvement | Status | Time Frame | Responsible Agency |
|---|---|---|---|---|
| **Operational Improvements** | | | | |
| 18 | Make Bonneville routing one-way | Under study | 1991 | FAA |
| 19 | Reduce intrail arrival separation to 2.5 NM (like class aircraft only) | Initial study complete | 1990 | FAA |
| 20 | IFR independent converging approaches | Testing by FAA in progress — STL | 1996 | FAA |
| **Airport User Improvements** | | | | |
| 21 | Reduce runway occupancy times through pilot education (10%, 20%, or 30% runway occupancy time reduction) | In planning | Continuous | All |
| 22 | Improve reliever airports (reduce general aviation operations by 10%, 20%, or 30%) | In planning | Continuous | All |
| 23 | Delta Air Lines ramp control tower | Under construction | 1990-91 | SLCAA |

### B. Improvements Not Recommended

**Airfield Improvements**

24 Construct a new independent IFR capable runway north of Runway 34R/16L

25 Extend Runway 34R to 12,000 feet

26 Construct a stopway on Runway 34R

27 Crossover taxiway between and 16R at north end

28 Install centerline lights on Runway 34R

29 Angled taxiway exit from Runway 34R

**Operational Improvements**

30 Decrease Military Airspace

31 Effect of Noise Restrictions (viewed from the perspective of the current impact of the noise restrictions)

32 Implement a General Aviation reservation system

33 Uniformly distribute schedule within the hour

**Notes:**
The Task Force cannot predict with any certainty the timing of approvals necessary for these improvements.
Baseline, Future 1, and Future 2 reflect demand levels of 269,600, 351,000, and 418,000 annual aircraft operations respectively.
Both costs and savings presented here are not necessarily additive.

* Dates are consistent with 1988 SLCIA Master Plan Update

## Annual Savings in Hours (millions of 1988 dollars)

| Estimated Construction Costs in 1988 Dollars ** | Present Airfield Configuration | | | Future Airfield Configuration+ | |
|---|---|---|---|---|---|
| | Baseline | Future 1 | Future 2 | Future 1 | Future 2 |
| Not Applicable | 171 (0.19) | *** | *** | 862 (0.94) | 1,976 (2.15) |
| Not Applicable | 380 (0.41) | 1,350 (1.50) | 2,350 (2.56) | 190 (0.20) | 262 (0.28) |
| Not Available | 70 (0.08) | 390 (0.43) | 1,076 (1.17) | *** | *** |
| Not Applicable 10% | 220 (0.24) | 720 (0.79) | 1,660 (1.80) | 160 (0.18) | 250 (0.27) |
| 20% | 420 (0.45) | 1,740 (1.89) | 3,026 (3.30) | 340 (0.36) | 540 (0.58) |
| 30% | 610 (0.66) | 1,730 (1.90) | 3,980 (4.34) | 450 (0.49) | 40 (0.81) |
| Not Available 10% | 35 (0.04) | 120 (0.13) | 190 (0.20) | 150 (0.16) | 230 (0.25) |
| 20% | 260 (0.27) | 990 (1.08) | 1,860 (2.02) | 690 (0.75) | 850 (0.93) |
| 30% | 510 (0.55) | 1,450 (1.58) | 2,030 (2.21) | 1,310 (1.43) | 1,830 (1.98) |
| See Narrative | | | | | |
| $142,000,000 | *** | 1,510 (1.64) | 4,170 (4.54) | *** | *** |
| $7,125,000 | 340 (0.37) | 760 (0.83) | 1,660 (1.81) | *** | *** |
| $3,058,000 | 140 (0.15) | 550 (0.60) | 1,140 (1.24) | *** | *** |
| $3,700,000 | -[5,114 (5.57)] | *** | *** | 268(0.29) | -[632 (0.680)] |
| See Narrative | | | | | |
| $2,500,000 | 40(0.04) | *** | *** | *** | *** |
| See Narrative | | | | | |
| Not Applicable | 280 (0.31) | 450 (0.55) | 3,470 (3.80) | *** | *** |
| Not Applicable | 750 (0.82) | 2,210 (2.41) | 2,960 (3.23) | 170 (0.19) | 290 (0.31) |
| Not Applicable | 1,810 (1.97) | 4,810 (5.24) | 13,420 (14.63) | 3,430 (3.73) | 6,290 (6.85) |

** Final costs will be subject of master plan and economic studies which are beyond the scope of this effort.

*** Does not apply

+ Future airfield configuration includes the addition of the third air carrier runway

++ This item is an alternative to Improvement Nº 10 and will only be pursued if an ILS is not available


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# Table of Contents

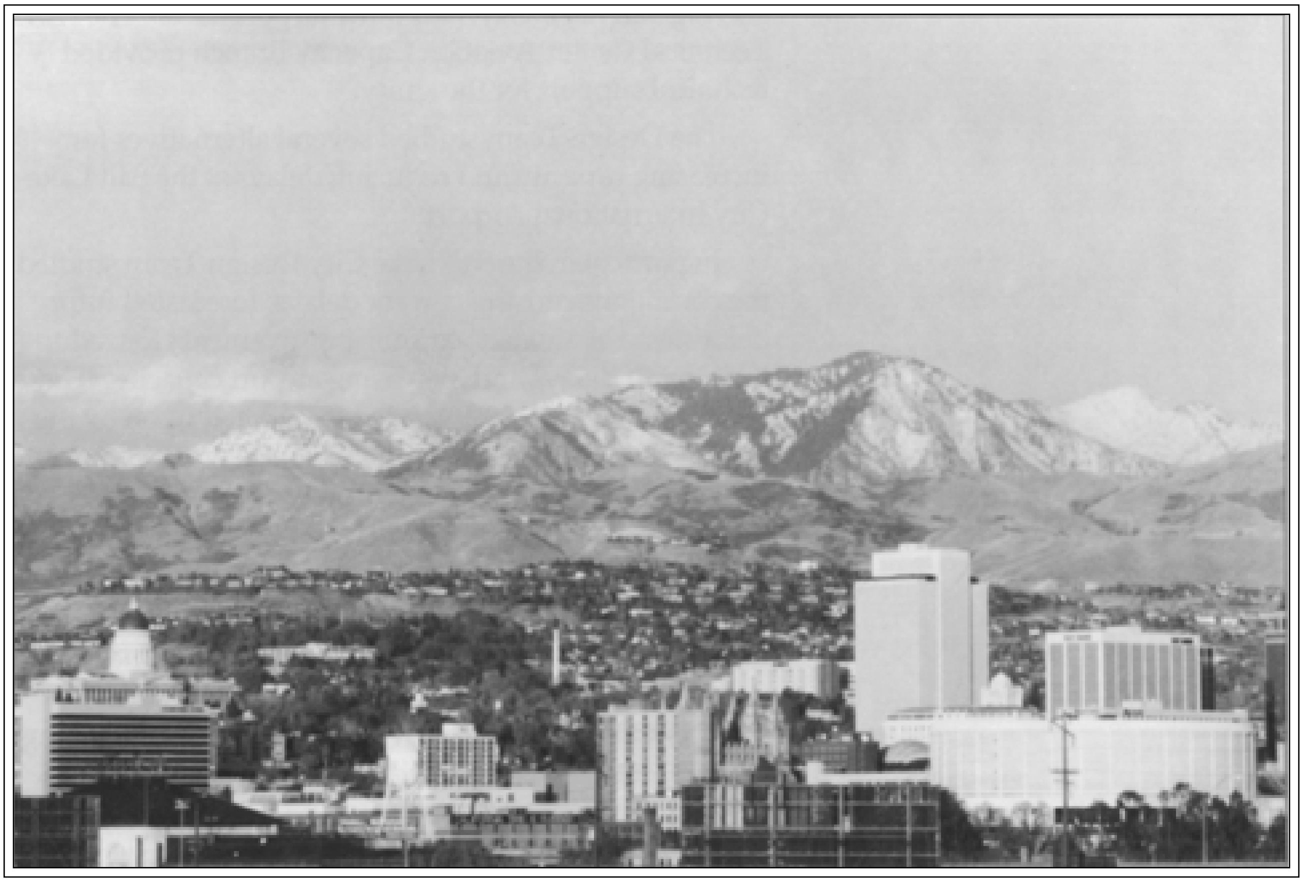
# 1.0 — Preface

This study was conducted by an airport capacity Design Team, composed of representatives of the Federal Aviation Administration, the Salt Lake City Airport Authority, the Air Transport Association, the airlines serving Salt Lake City, and other airport users. The FAA Technical Center Aviation Capacity Branch provided technical support for the study.

The Design Team studied several alternatives for increasing capacity and reducing delays at the Salt Lake City International Airport.

In particular, the Salt Lake City Design Team studied the conditions causing current delays, forecasted future delays, and evaluated various improvements for reducing aircraft delays and increasing airport capacity. These recommendations are intended to be acted upon by the appropriate agencies. Since all technical or procedural concerns may not have been fully addressed in this study, additional analysis will be required before the alternatives are implemented.

The goal of this study was to consider the technical feasibility of airport capacity projects. Environmental, political, and socio-economic consequences of the projects must be included in the airport master planning process, and other appropriate forums.



# 2.0 — Introduction

## 2.1 Background

Salt Lake City International Airport (SLCIA) is one of the fastest growing airports in the country. It provides the Intermountain Region with excellent access to the nation's air transportation network. In 1985, the FAA classified SLCIA as a large-hub airport, since it enplaned more than 1% of the nation's total enplaned passengers. 1989 showed a steady growth to nearly twelve million passengers using the airport. In that same year, over 296,000 aircraft operations in all categories of aircraft were generated. Additionally, on November 16, 1989, Salt Lake City was designated as a Terminal Control Area (TCA).

Delays at Salt Lake City increase dramatically as hourly demand increases or as weather deteriorates. The major objective of the Design Team was to identify improvements to enhance airport capacity. If implemented, these measures will increase existing VFR and IFR capabilities, improve airport efficiency, and reduce aircraft delays. Moreover, they will allow for the continued growth and development of the airport facilities to satisfy future demand.

An airport master plan develops forecasts of activity that are expected to occur at specific dates; however, this capacity analysis uses specific traffic levels without reference to the date that the traffic level might be reached. These levels are consistent with the levels identified in the SLCIA Airport Master Plan Update of 1988. In this document, these growth and activity levels are referred to as Future 1 and Future 2. Since the Master Plan and this document use the same data, they tend to retain their validity until the highest traffic levels are exceeded.

An annual traffic level of 269,600 aircraft operations was established as the "baseline" activity level. Two future traffic levels, Future 1 and Future 2, were set at 351,000 and 418,000 annual aircraft operations, respectively. Without improvements, delays are estimated to increase dramatically, as shown on the following page.

| Level | Total Annual Delay in Hours | Annual Delay Costs in Dollars |
|---|---|---|
| Baseline | 14,900 | $ 16,200,000.00 |
| Future 1 | 51,350 | $ 55,900,000.00 |
| Future 2 | 104,000 | $113,300,000.00 |

Considering the increasing demand, the Design Team studied several proposals for enhancing capacity and reducing delays. Many of the proposals have been recommended for implementation. These are identified in Figure 2 as "Recommended Improvements." Some of these improvements are currently under construction or in planning stages.

In addition, a number of items were reviewed but not recommended for implementation. These items are also discussed in the report and identified in Figure 2 as "Improvements Not Recommended."

## 2.2 Objectives

The major goal of the study was to identify improvements to increase airport capacity, improve airport efficiency, and reduce aircraft delays at SLCIA. In addition to achieving this objective, the Design Team:

- Assessed current airport capacity and associated airspace, airfield, and apron/gate area operations;
- Evaluated capacity and delay benefits of alternative air traffic control (ATC) procedures, navigational improvements, airfield development, and user improvements; and
- Examined the relationship between air traffic demand and delay for use as an aid in establishing acceptable air traffic movement levels.

## 2.3 Scope

The Salt Lake City Design Team limited its analyses to aircraft activity within the terminal area airspace and on the airfield. The Design Team considered measures which were technically and operationally feasible; it did not address environmental, economic, social, or political issues regarding airport development. These issues were beyond the scope of the Design Team and may be addressed in future airport system planning studies.

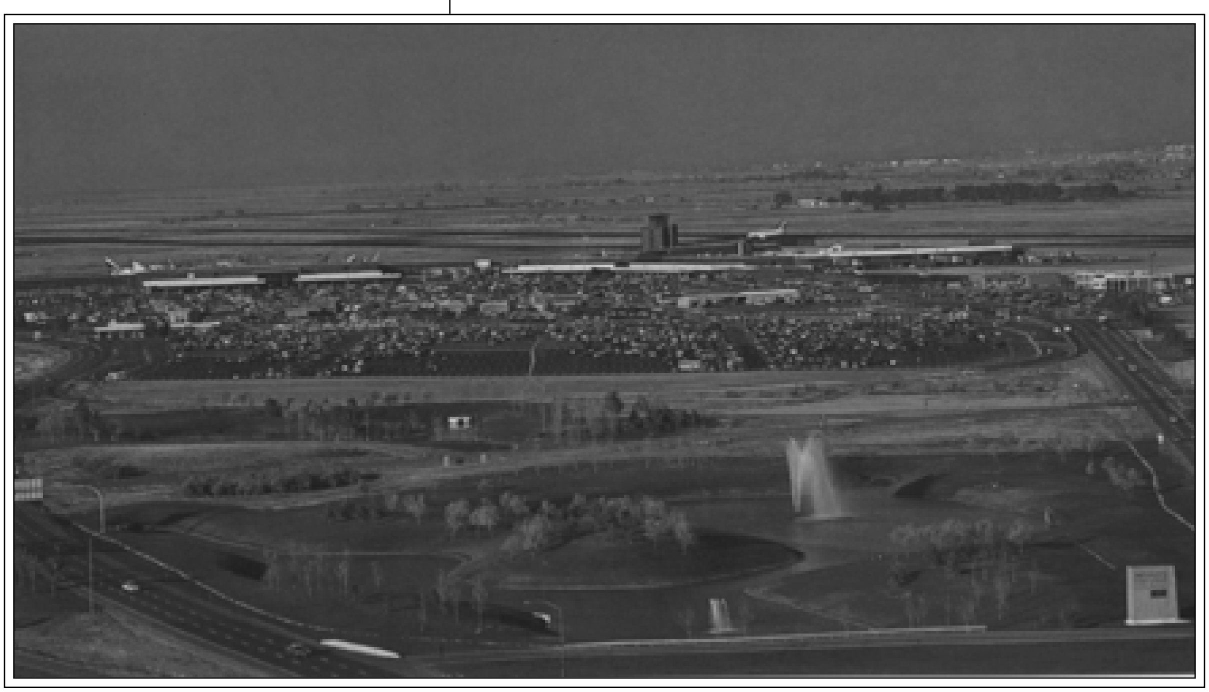
## 2.4 Methodology

The Design Team study followed a logical sequence of events with periodic review and coordination meetings. The FAA Technical Center's Aviation Capacity Branch provided expertise in performing airport simulation modeling. Design Team members contributed suggested improvement options, data, text, and capital cost estimates.

Three computer models were utilized in the analysis of the proposed improvements in relation to future demands. The models used were the Airfield Delay Simulation Model, the Runway Delay Simulation Model, and the Airport and Airspace Simulation Model. These models provide for greater detail and accuracy than the traditional advisory circular method. Appendix B provides a detailed explanation of these models.

Model experiments were designed to evaluate the suggested improvements. These experiments considered air traffic control procedures, airfield improvements, and traffic demands.

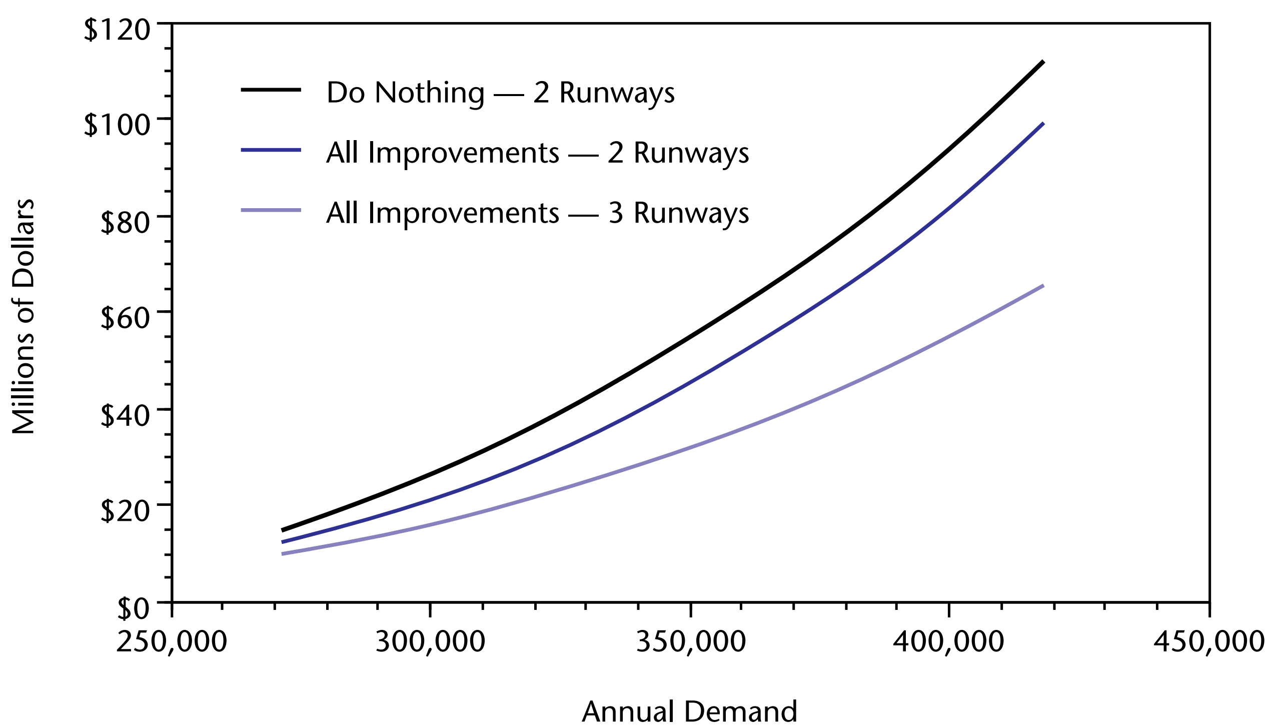
Alternative airfield configurations were prepared from present and proposed airport layout plans. Each configuration was evaluated to assess the benefit of the proposed airfield improvements. Air traffic control procedures and system improvements determined the aircraft separations to be used for the experiments under VFR and IFR.



Air traffic demand levels were derived from the *Official Airline Guide*, historical data, and SLCIA Master Plan forecasts. Aircraft volume, mix, and peaking characteristics were considered for each of the three different demand forecast levels (Baseline, Future 1, and Future 2). From this, annual delay estimates based on implementing various improvements were developed. These estimates took into account the historic variations in runway configuration, weather, and demand. The annual delay estimates for each configuration were compared. This approach allowed the identification of delay reductions resulting from each improvement. Following this evaluation, the Design Team developed a "Recommended Improvements" Plan, which is included in Figure 2.

One of the most graphic demonstrations of the delay impact at the Salt Lake City International Airport is displayed in Figure 3. The chart shows how delay will continue to grow at a substantial rate as demand increases. The chart dramatically shows that the primary improvement which substantially addresses the delay issue is the construction of an independent IFR capable runway on the west side of the terminal complex.

## FIGURE 3 AIRPORT DELAY COSTS



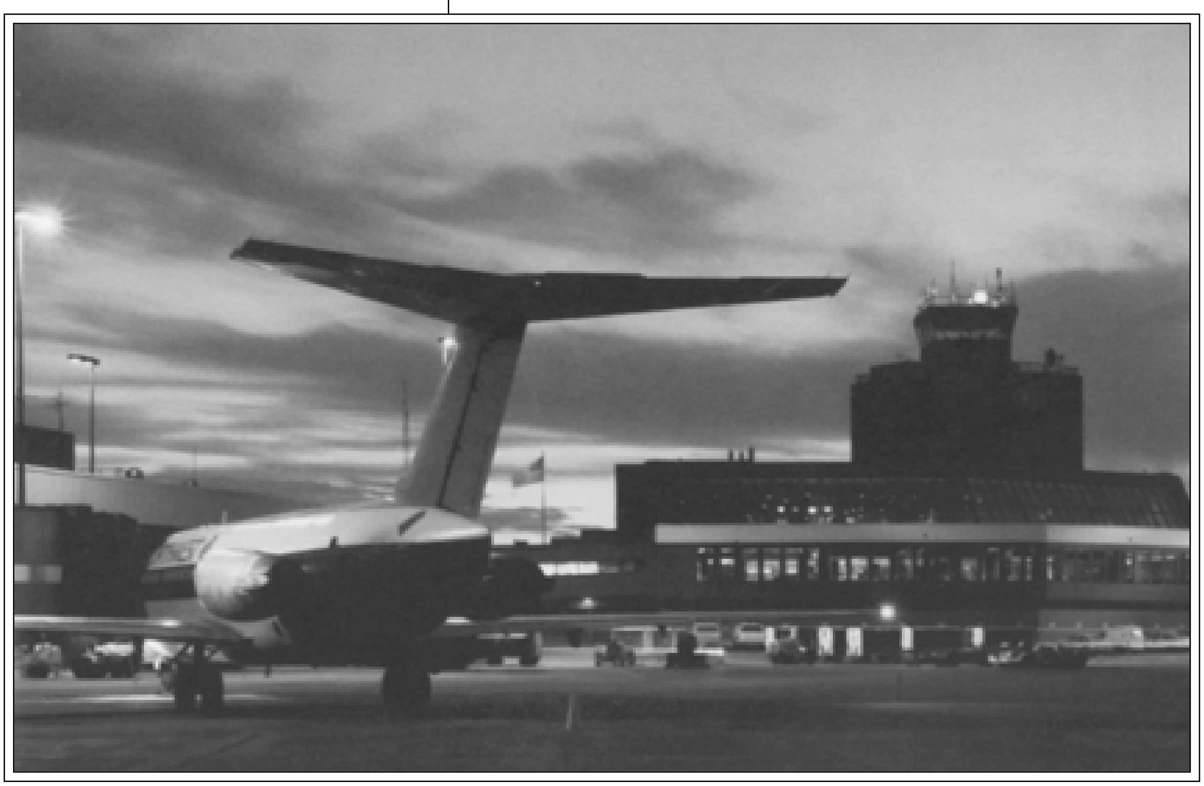
# 3.0 — Recommended Improvements

The Salt Lake City Design Team recommends the improvements listed in Figure 2. Figure 1 shows the current airport layout with the recommended airfield improvements.

Figure 2 also shows the annual delay savings in hours and dollars for those improvements modeled by the Design Team. Modeling was conducted for the Baseline, Future 1, and Future 2 periods which refer to annual aircraft operations of 269,600 (base level for 1987), 351,000 and 418,000 respectively. Several improvements were not modeled because of the inability to apply computer simulation techniques. Narratives of these improvements, however, are included in this report. Benefits of the improvements are not necessarily additive.

The proposed recommendations are categorized and discussed under the following headings:

- Airfield Improvements.
- Facilities and Equipment Improvements.
- Air Traffic Control Operational Improvements.
- Airport User Improvements.



## 3.1 Airfield Improvements

**1. Construct a Parallel Runway to the West With Independent IFR Capability (CAT III ILS on both ends).**

The benefits of a new air carrier runway, 16W/34W, with a Category III ILS at each runway end were determined by the Design Team. Two alternate concepts for runway placement were evaluated.

The first concept, Improvement Nº 1, considers a runway located west of the existing terminal facilities. This alternative assumes the runway will be a maximum of 6,300' west of and parallel to Runway 16R/34L. This is the preferred concept as documented in the original Master Plan Study (1975) and its subsequent updates (1981 and 1988). The runway development includes full length parallel taxiways east of the proposed runway with high speed runway exits and connecting taxiways.

The primary benefits of this concept are:

- Three runways available for operations;
- Two or three independent runways available for simultaneous IFR approaches;
- Direct access between the primary runways and terminals without crossing active runways;
- One of the independent runways can be assigned for departures only;
- Shorter taxiing times and distances;
- Existing Runway 16L/34R may be dedicated for general aviation use. This will segregate GA and air carrier traffic yielding a uniform aircraft mix; and
- One runway with Category III ILS will always be available when the other runway is closed for snow removal, maintenance, or major construction.

At the Future 1 activity level, this concept reduces annual delay by 28,840 hours, which results in a savings of $31.42 million per year. Given Future 2 activity levels, this runway reduces annual delays by 61,670 hours, providing a savings of $67.19 million per year.

**2. Taxiway to Delta Hangar.**

This project is complete and now allows aircraft free access to the maintenance facility. This improvement helps remove a congestion problem from the ramp area, where virtually all maintenance was conducted.

**3. Relocate Tower.**

Constructing a new runway west of existing facilities will require a new tower location and a higher tower cab to facilitate proper traffic control. The existing tower is not configured to handle traffic to the west. Additional space is also required for TRACON and cab expansions. The tower should be relocated to provide controllers with a view of future aircraft movement areas.

The estimated cost for these improvements in 1989 dollars is $13 million. The tower relocation is an essential part of Improvement N° 1, construct a parallel runway to the west with independent IFR capabilities.

**4. Revised Taxiway Exit Layout.**

Revising the exit layout to Runway 16R/34L resulted in improved runway exit times and improved runway utilization.

This improvement was completed by the Salt Lake City Airport Authority in 1988. At the current activity level, annual delay has been reduced by 600 hours saving $0.65 million per year.

**5. Construct Staging Areas for Runway 16R/34L at Runway Entrances.**

Constructing staging areas at the ends of Runways 16R and 34L will allow for resequencing of departures. This improvement will allow the local controllers to overcome some of the problems associated with enroute flow control. Additionally, they provide areas for holding aircraft which have not received takeoff data or clearance. This will permit subsequent aircraft to proceed past any aircraft experiencing a delay.

Determining the exact timing of these holding delays is not possible, therefore, modeling would not have produced meaningful results. The Task Force concluded that delays would be sufficiently reduced to warrant this improvement. The estimated cost for these improvements is $1.32 million.

**6. Terminal Expansions.**

Aviation forecasts for Salt Lake City International indicate a continued moderate increase of activity. To accommodate the increases, Concourses C & D will be lengthened to provide additional gates. A third terminal and another concourse will be developed as demand requires.

The terminal apron will be expanded to the north of Concourses B and C. This will provide pavement to hold aircraft waiting for gates. These improvements will reduce congestion in the terminal area and expedite aircraft movement.

The improvements provide the greatest benefit after the third parallel runway is complete. In conjunction with the new west runway, the terminal expansions could reduce annual delay by 1,430 hours at Future 1 activity levels, which would result in savings of $1.56 million per year. At the Future 2 activity level, this improvement reduces annual delay by 3,920 hours, saving $4.26 million per year. The estimated cost for the terminal and apron improvements in 1988 dollars is $139.4 million.

Due to model limitations in assigning aircraft to gate positions, the benefits of these improvements are underestimated. Actual savings would exceed the amounts stated above. Gate assignments change on an almost minute-by-minute basis during the heavy bank periods. Expanding concourse and apron facilities without developing a new independent runway results in increased taxiing distances for some aircraft and therefore appears to yield a slight increase in delay. Significantly greater delays would occur, however; if concourse and apron facilities are not expanded as demand increases. Higher gate demand with insufficient parking positions would require aircraft to wait until a gate becomes available for parking.

The Design Team concurs with the conclusions of the Airport Master Plan that terminal expansion is necessary to provide reasonable passenger service at Future 1 and 2 activity levels.

**7. Extend Taxiways S and T to the West Boundary of the Terminal Ramp.**

This completed project substantially improved the taxiing options available to aircraft in the vicinity of Concourses C and D. The taxiways provide the air traffic controllers greater flexibility in coordinating an ever-increasing high traffic conflict area.

**8. Rehabilitate Taxiways X and Y.**

Rehabilitating Taxiways X and Y will increase flexibility of aircraft taxiing from one side of the airport to the other. The estimated 1988 cost to complete this project is $4.2 million. Annual savings at the current demand level will be 180 hours amounting to a savings of $0.19 million.

### 9. Improve Aircraft Access to Cargo Facilities.

Additional access to the cargo terminal was needed to allow simultaneous entry to and exit from the cargo terminal. This eliminates aircraft holding on the taxiway parallel to Runway 16R/34L, while other aircraft enter or exit the cargo terminal area. This improvement was completed by the Salt Lake City Airport Authority in 1989.

## 3.2 Facilities and Equipment Improvements

### 10. Category I ILS Runway 34R.

Presently, there is not an instrument approach to Runway 34R other than an Airport Surveillance Radar approach. Under north flow IFR conditions, the airport is restricted to a single runway. When Runway 34L is closed for snow removal, all operations are stopped in IFR. Installing a Category I ILS on Runway 34R will allow air traffic to use either Runway 34L or 34R during north flow IFR conditions and will allow operations to continue while one runway is closed during IFR conditions.

The estimated construction cost in 1988 dollars is $1.3 million. At the current activity level, annual delays are reduced by 730 hours, resulting in savings of $0.80 million per year. At the Future 2 activity level, this improvement decreases annual delays by 6,200 hours, which will save $6.80 million per year.

### 11. LDA Approach on Runway 34R.

The use of a Localizer Directional Aid (LDA) would require the installation of two instrument landing system (ILS) localizer antennas with their beams radiating parallel to the localizer beam for Runway 34R. Under certain conditions of VFR and IFR weather, aircraft could approach the airport using the offset localizer beam until they break out under the cloud cover, and then the aircraft would proceed visually to land on Runway 34R. This procedure would provide dual streams that would significantly increase airport capacity under VFR 2 and IFR weather conditions.

### 12. Category III ILS on Runway 16R.

Runway 34L has Category II/III ILS approach capability. It is the only runway at SLCIA that can be used for arrivals when the weather is below Category I approach minimums. A Category II/III ILS on Runway 16R will allow arrivals to land to the south when weather conditions are below Category I approach minimums.

The estimated construction cost in 1988 dollars is $3.0 million. At the current activity level, annual delay could be reduced by 730 hours, saving $0.80 million per year. The improvement is in the design phase with scheduled completion by the fall of 1991.

**13. Install Precision Runway Monitor System (PRM).**

The airport has dependent instrument approaches to Runway 16R and 16L. If Precision Runway Monitor equipment becomes available, changes allowing triple IFR independent parallel instrument approaches may be implemented. This would benefit operations to Runways 16L and 16R. It would also benefit Runways 34 if combined with the establishment of an instrument approach to Runway 34R, such as MLS, ILS, or LDA.

**14. Install Microwave Landing System (MLS).**

The MLS technology provides positive course guidance for approaches and departures. Through its ability to curve these courses, the MLS can optimize approach and departure flight tracks. This would permit simultaneous independent operations. After construction of the third parallel runway, IFR arrivals could operate to the outside runways, with departures using the center runway. The MLS could provide final and missed approach guidance to arrivals, while providing departure course guidance to departures. All three operations could be independent of each other if the PRM equipment is available for this procedure.

**15. Install Runway Visual Range (RVR) Equipment on Runway 34R.**

Presently, Runway 34R does not have any visual navaids to provide information on runway visual range. Therefore, during instrument conditions, use of the runway is limited. Installing a transmissometer to provide runway visual range (RVR) on Runway 34R will permit increased use of that runway during IFR operations.

The estimated construction cost in 1988 dollars is $0.75 million.

**16. Install Airport Surface Detection Equipment (ASDE).**

The FAA Air Traffic Control Tower is unable to visually monitor ground movements on the ramps, runways, and taxiways during periods of low visibility. This restricts the flow of ground traffic. ASDE is a short range, high resolution radar designed to permit the monitoring and controlling of ground traffic. It tracks aircraft on the ground, providing controllers with aircraft position information. ASDE would eliminate the need to totally rely on pilot position reports when the aircraft is not visible from the tower.

The estimated construction cost in 1988 dollars is $4.5 million.

**17. Install Taxiway Centerline Lights.**

During periods of heavy fog, taxiing is encumbered by poor visibility of the pavement area. Installing taxiway centerline lights on all taxiways between Runway 16R/34L and the terminal apron will improve guidance and promote a continuous traffic flow.

The estimated construction cost in 1988 dollars is $4.44 million.

## 3.3 Operational Improvements

Various operational improvements are possible by changing air traffic control procedures. These changes reduce delays by improving traffic flow.

**18. Make Bonneville Routing One–Way.**

Under present air traffic procedures, the Bonneville route is used as a corridor for both arrivals and departures. This requires a complicated sequencing procedure to ensure proper separation between aircraft is maintained. Making Bonneville a departure route eliminates a radar sequencing point and improves traffic flow in the terminal airspace. Not all issues were reviewed in relation to this improvement, therefore, a totally definitive statement on this improvement cannot be made at this time.

At current activity levels, annual delays could be reduced by 171 hours, saving $0.19 million per year. This improvement was also modeled with the new runway to the west. At Future 1 activity levels, annual delays could be reduced by 862 hours, saving $0.94 million per year. Based on Future 2 activity levels, annual delays could be reduced by 1,976 hours, equalling savings of $2.15 million per year.

**19. Reduce Intrail Arrival Separations to 2.5 NM (like class aircraft only).**

Existing procedures require that arriving aircraft be separated by 3 NM or more. Reducing separation minimums to 2.5 NM will increase runway capacity. As of June, 1990, this concept is being tested at the Salt Lake City International Airport.

Most of the savings occur at the highest demand level during IFR conditions. If the runway exits are not visible from the tower, the 2.5 NM separation cannot be applied. However, the savings could be realized if the FAA permitted the use of an ASDE with 2.5 NM separation in IFR conditions.

At the current activity level, annual delays could be reduced by 380 hours, saving $0.41 million per year. Based on the Future 2 activity level, annual delays could be reduced by 2,350 hours, saving $2.56 million per year.

**20. IFR Independent Converging Approaches.**

Under VFR it is common to use non-intersecting converging runways for independent streams of arriving aircraft. Because of reduced visibility and ceilings associated with IFR operations, the simultaneous (independent) use of runways is currently permitted for aircraft arrivals only during relatively high weather minimums (decision heights generally 700 feet or more due to geometric constraints).

## 3.4 Airport User Improvements

Airport user improvements affect airlines and General Aviation serving Salt Lake City. These improvements are major policy change issues and require extensive coordination and cooperation between carriers and airport tenants. However, substantial benefits are feasible through implementation of these improvements.

**21. Reduce Runway Occupancy Times Through Pilot Education.**

Pilot education will result in improved aircraft movement, which will benefit all airport users.

If Runway Occupancy Times (ROC) could be reduced, the following results can be achieved.

Estimated annual savings at the Baseline level are:

- 10% Occupancy Reduction 220 hours and $0.24 million
- 20% Occupancy Reduction 420 hours and $0.45 million
- 30% Occupancy Reduction 610 hours and $0.66 million

At the Future 1 demand level, estimated annual savings with the addition of a third parallel runway are:

- 10% Occupancy Reduction 160 hours and $0.18 million
- 20% Occupancy Reduction 340 hours and $0.36 million
- 30% Occupancy Reduction 450 hours and $0.49 million

**22. Improve Reliever Airports.**

Most metropolitan area airports have plans for facility improvements. If realized, these plans will support the growth of general aviation activity. The aviation community should encourage the development of all utility airports in the areas that relieve the Salt Lake City International Airport.

Estimated annual delay savings at the Baseline activity level are:

- 10% GA Activity reduction — 40 hours and $0.04 million
- 20% GA Activity reduction — 250 hours and $0.27 million
- 30% GA Activity reduction — 510 hours and $0.55 million

At Future 1 activity levels, estimated annual delay savings with the addition of a third parallel runway are:

- 10% GA Activity reduction — 150 hours and $0.16 million
- 20% GA Activity reduction — 990 hours and $1.08 million
- 30% GA Activity reduction — 1,310 hours and $1.43 million

**23. Delta Air Lines Ramp Control Tower.**

A ramp control tower operated by Delta Air Lines will be constructed in Terminal Two. This tower will control aircraft ground operations on all ramps west of Concourse B. This will result in more efficient aircraft ground traffic flow in the apron area and reduce congestion. Savings were not calculated because of difficulty in determining the reduction in delay for each operation.

# 4.0 — Improvements Considered but not Recommended

## 4.1 Airfield Improvements

### 24. Construct a New Independent IFR Capable Runway North of Runway 34R/16L.

This concept contemplates a runway located north of Runway 16L/34R. This alternative assumes existing capital improvements on the east side will be preserved. This concept requires four parallel taxiways to provide two-way aircraft access to east and west side facilities.

This alternative creates operational restrictions due to its location based on taxi distance. It is expected that the runway would be used only under IFR conditions. Therefore, the benefits noted above would occur only under IFR conditions.

The primary benefits of this runway concept are:

- Two runways available for independent simultaneous IFR approaches;
- Direct access between the terminal and runways to avoid crossing active Runway 16R/34L;
- One runway can be assigned for departures only; and
- One runway with Category III ILS will always be available when other runways are closed for snow removal, maintenance, or major pavement reconstruction.

At Future 2 activity levels, this concept reduces annual delays by 4,170 hours, generating a savings of $4.54 million per year. The estimated construction cost in 1988 dollars is $142.0 million.

This compares to a new west runway, where at all activity levels, Improvement Nº 1 provides greater benefits than Alternative 24. For example, at Future 2 activity levels, Improvement Nº 1 saves an additional 57,500 delay hours over Alternative 24. This results in an additional savings of $62.65 million per year.

### 25. Extend Runway 34R to 12,000 Foot Length.

Runway 34R is only 9,600 feet long. Because of this shorter length, larger and heavier aircraft cannot always use this runway. Extending Runway 34R to 12,000 feet will permit larger, heavier aircraft to use this runway under any circumstance. This will eliminate the need for special sequencing when an aircraft is unable to use the shorter runway.

The estimated construction cost in 1988 dollars is $7.13 million. This improvement was modeled using the existing airfield layout. At the current activity level, annual delay could be reduced by 340 hours, saving $0.37 million per year. At the Future 2 activity level this improvement only reduces annual delays by 1,660 hours saving $1.81 million per year. However, the construction of Improvement Nº 1, the new Runway 16W/34W, essentially eliminates any benefit generated by this recommended improvement. Because the savings from this improvement would be very minimal, this improvement is not recommended.

### 26. Construct Stopway on Runway 34R.

Presently, Runway 34R does not have a stopway. This limits use of this runway by certain aircraft. A stopway on Runway 34R will allow more Class 1 and 2 aircraft to use Runway 34R for departure, increasing runway flexibility.

The estimated construction cost in 1988 dollars is $3.06 million. This improvement was modeled using the existing airfield layout. At the current activity level annual delay could be reduced by 140 hours saving $0.15 million per year. At the Future 2 activity level this improvement decreases annual delays by 1,140 hours, saving $1.24 million per year. After constructing Improvement Nº 1, the new Runway 16W/34W, the savings from this improvement would be minimal. Therefore, this improvement is not recommended.

### 27. Crossover Taxiway Between Runway 16R and 16L.

Presently aircraft taxiing between Runway 16R and 16L must cross an active runway at midfield. Constructing a new taxiway connecting the runway ends 16L and 16R would permit runway crossings to occur at the 16R threshold. This recommendation did not yield any significant benefits and therefore is not recommended.

**28. Install Centerline Lights on Runway 34R.**

During periods of heavy fog, departures on Runway 34R are limited by visibility minimums. Installing centerline lights will lower departure minimums and allow departures from this runway to occur.

The estimated construction cost in 1988 dollars is $0.5 million. Because of the low benefit/high cost ratio, the improvement is not recommended.

**29. Angled Exit off Runway 34R.**

Presently air carrier aircraft landing 34R exit to the west at the runway end; thereby increasing runway occupancy time. An angled exit to the west from Runway 34R will reduce runway occupancy times. However, with Improvement N° 1, the demand to Runway 34R will decrease. This negates much of the benefit of the angled taxiway exit.

The estimated construction cost in 1988 dollars is $2.5 million. At the current activity level, annual delay could be reduced by only 40 hours saving $0.04 million per year. Because of this low benefit/cost ratio, the improvement is not recommended.

## 4.2 Operational Improvements

**30. Decrease Military Airspace.**

The Department of Defense controls restricted airspace west of the Salt Lake City Terminal Airspace. Terminal Airspace users are frequently routed around these restricted areas. If the restricted airspace could be eliminated, a more direct routing for aircraft departing and arriving Salt Lake International Airport could be provided.

Use of this airspace by the military has decreased slightly in recent years, however, the Department of Defense has no plans to reduce the size or eliminate this airspace or use of the Utah Training and Test Range.

**31. Effect of Noise Restrictions.**

This item was modeled to determine the potential which exists as new, quieter aircraft enter the fleet. This improvement is not recommended because it is inconsistent with the airport's existing Part 150 noise abatement program. The information developed with this study should be considered in future updates of the program.

At the current activity level, noise restrictions increase delay by 280 hours costing $0.31 million per year. At the Future 1 activity level, the annual impact is 450 hours, costing $0.55 million per year.

### 32. Reduce General Aviation Activity During Peak IFR.

The savings of limiting general aviation operations during peak IFR was modeled. Since total removal is not probable, actual savings would be less than the values reported. Through pilot education, many of the general aviation users may choose to schedule around peak airline times during IFR conditions. Savings can occur for the general aviation user as well as the airlines.

At the current activity level, annual delays could be reduced by 750 hours, saving $0.82 million per year. After completing the third parallel runway, annual delays at the Future 1 activity level could be reduced by 170 hours, saving $0.19 million per year.

### 33. Uniformly Distribute Schedule Within the Hour.

More uniform distribution of scheduled operations will produce a more orderly flow of traffic consequently reducing airborne arrival delays, departure ground delays, and reduce ground congestion on airside aprons.

With the existing airfield and current air traffic control procedures, annual savings will be $2.0 million, at the baseline traffic level. Savings will increase to $5.24 million at Future 1 and $14.6 million at the Future 2 level.

However, SLCIA is an integral part of the hub and spoke operation, and a uniform distribution of traffic is not consistent with such an operation. Hubbing creates efficiencies that cannot be measured in a delay study of this type. This system provides frequent service between city pairs that could not support frequent direct service. Frequent flights provide an economic benefit to consumers, in particular the business flyer.

In order to properly evaluate the overall impact of hubbing and/or redistribution of scheduled operations, the entire system must be studied, not any one individual airport.

# 5.0 — Summary of Technical Studies

The SLCIA Design Team evaluated the operation of the existing airfield and the potential benefits of the improvements in terms of airfield capacity, airfield demand, and average aircraft delays. The Design Team used the Runway Delay Simulation Model (RDSIM) and the Airport and Airspace Simulation Model (SIMMOD) to determine aircraft delays during peak periods. Delays were calculated for current and future conditions. Daily operations corresponding to an average day in the peak month were used for each of the forecast time periods.

Daily delays were annualized to determine the potential economic benefits of the proposed improvements, including different runway use strategies. The annualized delays were then used to compare the benefits of the proposed changes.

The fleet mix at Salt Lake City International Airport has an average direct operating cost of $18.16 per minute. This figure reflects only the actual aircraft expense and does not consider lost passenger time, disruption to airline schedules, added ground personnel costs, or other factors.

The cost of a particular improvement is measured against its annual delay savings. A comparison of the costs and delay reductions associated with each improvement indicates which will be the most effective. For anticipated increases in demand, a combination of improvements can be implemented to provide maximum enhancement of airfield capacity while keeping aircraft delays within acceptable limits at a cost which can be sustained by the airport and airline community.

Figure 4 illustrates the weather conditions modelled in the study. Figure 5 illustrates the profile of daily demand levels at Salt Lake City International Airport for the Future 2 demand level of 418,000 annual operations.

## FIGURE 4

## AIRFIELD WEATHER AND RUNWAY UTILIZATION
## SALT LAKE CITY INTERNATIONAL AIRPORT

| | Visibility/Ceiling | Occurrence (%) |
|---|---|---|
| Visual Approaches (VFR 1) | Visibility greater than 3 SM and Ceiling above 2300 ft. AGL | 94 |
| VFR w/ILS Approaches (VFR 2) | Visibility greater than 3 SM and Ceiling above 1000 ft. and below 2300 ft. AGL | 1 |
| IFR Approaches ONLY (IFR) | Visibility below 3 SM and Ceiling below 1000 ft. AGL | 5 |

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| Runway Use | Percentage Use | | |
|---|---|---|---|
| **1988 Configuration** | VFR 1 | VFR 2 | IFR |
| North flow | 60% | 60% | 60% |
| South flow | 40% | 40% | 40% |
| **Future Configuration*** | VFR 1 | VFR 2 | IFR |
| North flow | 50% | 50% | 50% |
| South flow | 50% | 50% | 50% |

* New runway instrumentation allows more uniform flow in either direction

VFR – Visual Flight Rule
IFR – Instrument Flight Rule
SM – Statute Mile
AGL – Above Ground level

## 5.1 Airfield Capacity

The Salt Lake City Design Team analyzed airfield capacity for both sustained capacity and maximum throughput (maximum number of aircraft operations, landings or takeoffs, that can take place in a given time). The following conditions were considered.

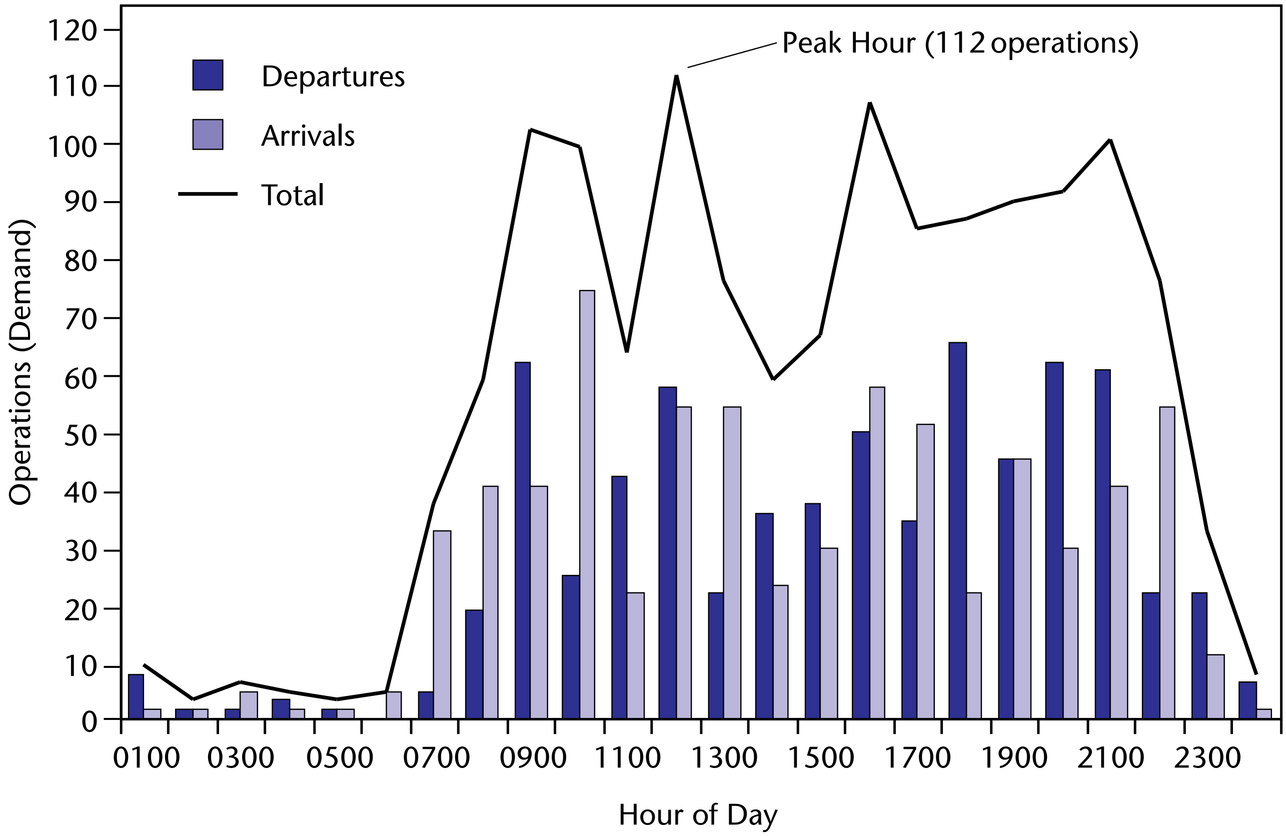
- Acceptable level of delay
- Airspace constraints
- Ceiling and visibility conditions
- Runway layout and use
- Aircraft mix
- Percent arrival demand

The Salt Lake City Design Team recognizes that airfield capacity is a very complex problem. Unfortunately, airfield capacity is not a constant value for all conditions. It varies with runway configuration, weather, aircraft fleet mix, air traffic control strategy, ratio of arrivals to departures, airspace constraints, the demand pattern and acceptable level of delay. Several measures of capacity exist. There is the maximum throughput or maximum theoretical capacity which assumes that there is always an arrival and departure available for each slot and is easily calculated for a given set of inputs. However, these values cannot be achieved in the practical situation because aircraft do not appear at the precise time required.

To circumvent this problem, some Design Teams have chosen other measures of capacity. Some have used the throughput that can be achieved with an acceptable level of average delay per operation, usually four minutes. Other Design Teams have chosen sustained capacity as a measure. This is a throughput value that can be maintained throughout the day rather than higher values which can be maintained only over short periods.

Rather than select any of these specific measures, the Design Team chose to develop a family of curves for various runway configurations, weather conditions, and ratios of arrivals to departures. The curves shown in Figures 6 through 9 were developed using the Runway Delay Simulation Model (RDSIM) which is described in Appendix B. These curves are based on the assumption that arrival and departure demand is randomly distrib-

## FIGURE 5
## PROFILE OF DAILY DEMAND
## (AVERAGE DAY, PEAK MONTH)




24 Hour Total = 1383

**FIGURE 6** **HOURLY FLOW VERSUS AVERAGE DELAY — BASELINE VFR (TWO RUNWAYS)**

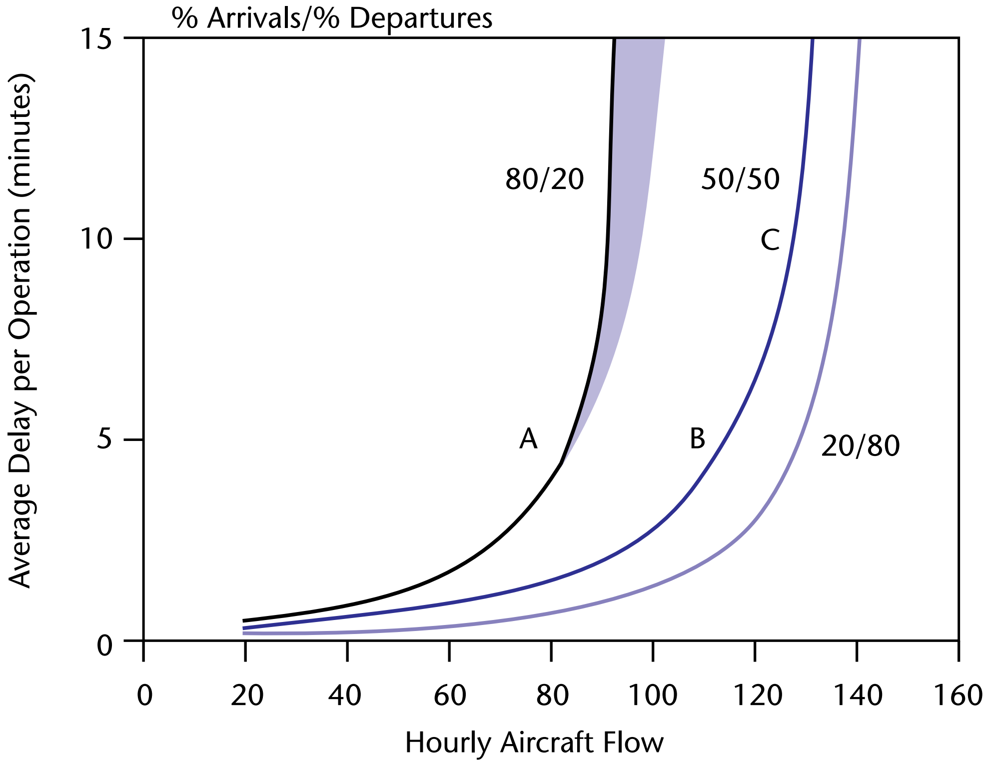
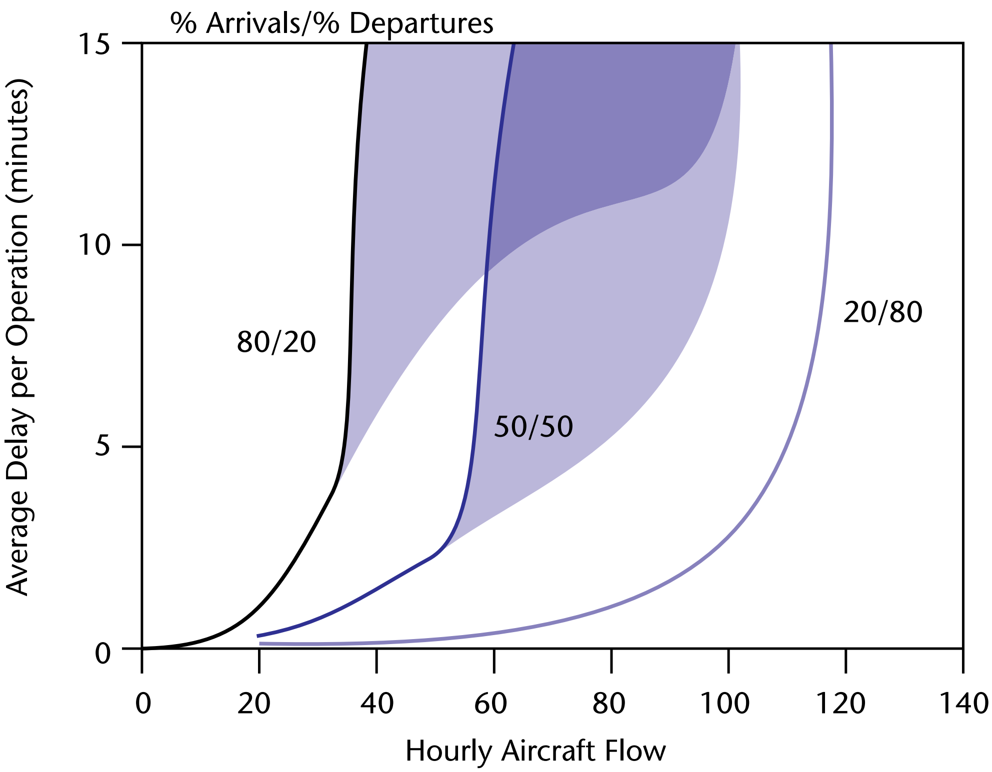
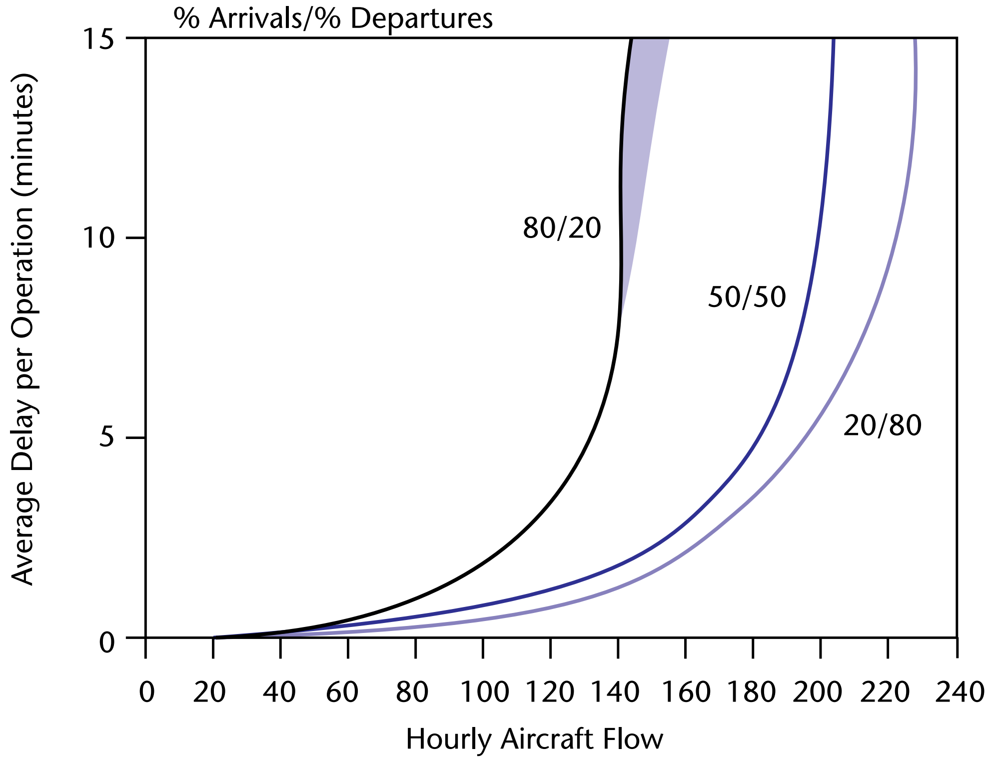



**FIGURE 7** **HOURLY FLOW VERSUS AVERAGE DELAY — BASELINE IFR (TWO RUNWAYS)**



## Figure 8 Hourly Flow versus Average Delay — Future VFR (Three Runways)

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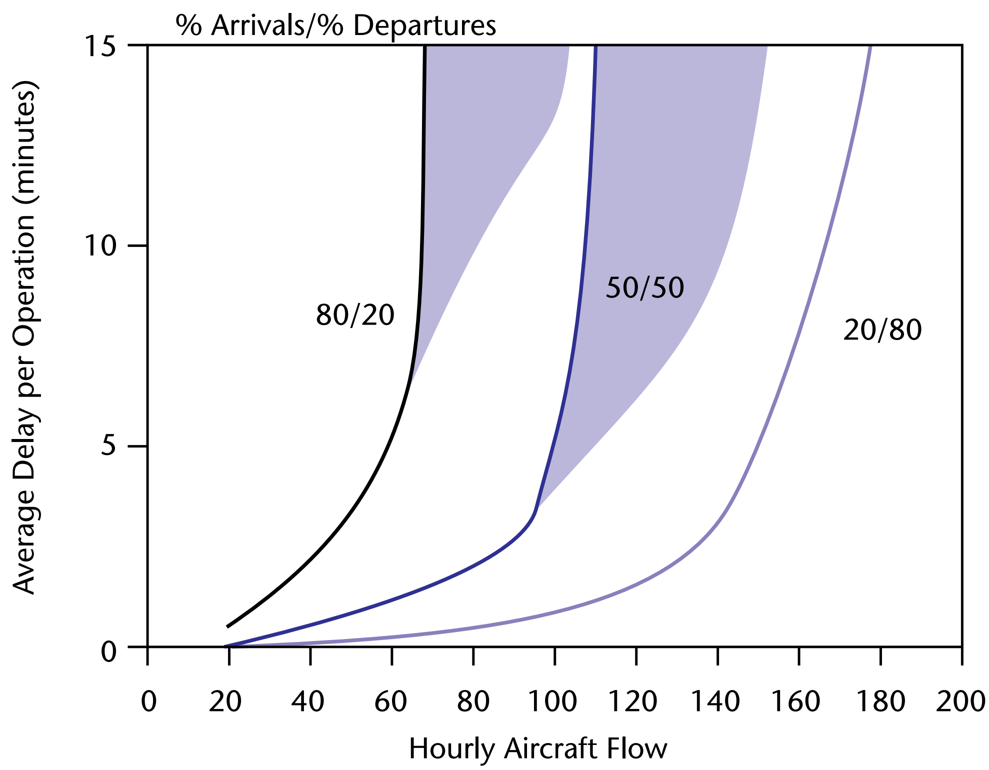
## Figure 9 Hourly Flow versus Average Delay — Future IFR (Three Runways)



uted within the hour. Other patterns of demand can alter the demand/delay relationship.

Figures 6 and 7 describe the capacity and delay for the existing baseline airport configuration with two near parallel runways. Figure 6 identifies the relationship under VFR weather conditions; whereas Figure 7 is for IFR weather conditions. Figures 8 and 9 show similar relationships for the future airport configuration having three near parallel runways.

Each of these Figures includes three capacity curves which show the different ratios of arrivals to departures. In all cases, as the operational flow increases, average delay per operation also increases. These curves can be used to determine the flow associated with a given level of delay. For example, in Figure 6, at an average delay of 5 minutes per operation with an 80/20 ratio of arrivals to departures (point A), the flow can be seen to be 83 operations per hour. For a 50/50 ratio (point B), the flow at an average delay of 5 minutes is 117 operations. Additionally, by being willing to accept a doubling of average delay to 10 minutes per operation, point C indicates that the flow rate could be increased by 10 aircraft to 127.

The maximum flow rates shown for each curve and their associated large average delay indicate the situation that would occur as the maximum theoretical capacity is approached.

The shaded area in the 80/20 case indicates that during this demand ratio of arrivals to departures there is actually a surplus departure capacity which could be used without increasing the delay to the arrivals. This in effect changes the ratio of operations achieved from that of the demand to be served. Figure 7, the baseline case with two runways in IFR, shows that there is surplus departure capacity in both the 80/20 and 50/50 cases.

By the use of this family of curves, one can interpolate between the curves to determine flow rates that can be achieved at different arrival/departure ratios than shown. It also provides a graphical depiction of the relationship between achievable flow rates and resulting delay.

By comparing the daily demand peaks in Figure 5 with the curves in Figure 7, it is possible to anticipate the times during the day when flight delays are likely to occur in IFR without airfield improvements.

## 5.2 Aircraft Delays

Aircraft delay is defined as the time above the unimpeded travel time for an aircraft to move from its origin to its destination. Aircraft delay results from interference from other aircraft in the system competing for the use of the same airspace and facilities.

The major factors influencing aircraft delays are:

- Weather
- Airfield demand
- Airfield physical characteristics
- Air traffic control procedures
- Aircraft operational characteristics

Annual delay costs, expressed in millions of dollars, for various demand levels are shown in Figures 10, 11, 12 and 13. These figures present comparisons between "Do Nothing" and:

- Airfield improvements (Figure 10)
- Facilities and Equipment and Operational improvements (Figure 11)
- Airport User related improvements (Figure 12)
- Combined effect of all improvements (Figure 13)

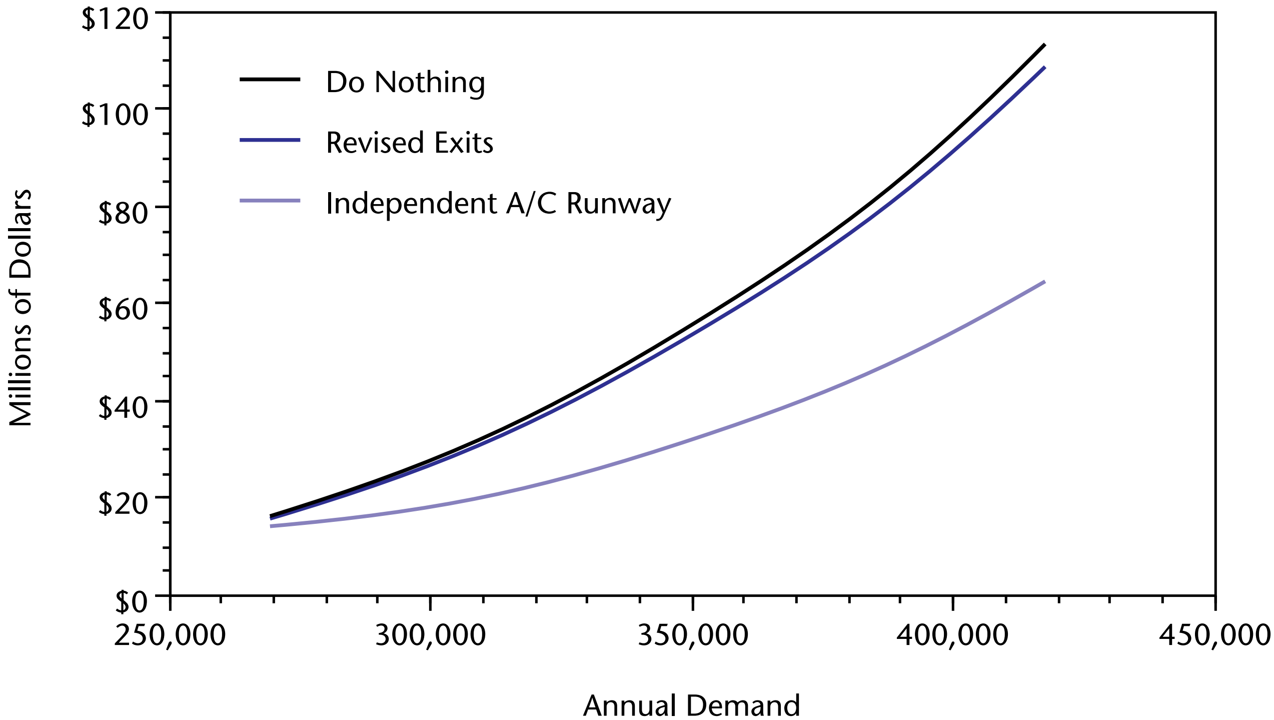
Each figure also identifies the benefit that would result from constructing a new independent air carrier runway west of existing facilities. As shown, an independent runway would reduce delays significantly greater than any other improvement.

Figure 13 reveals that the benefit of implementing all recommended improvements will not approach the benefit achieved by constructing Improvement N° 1, a new independent air carrier runway.

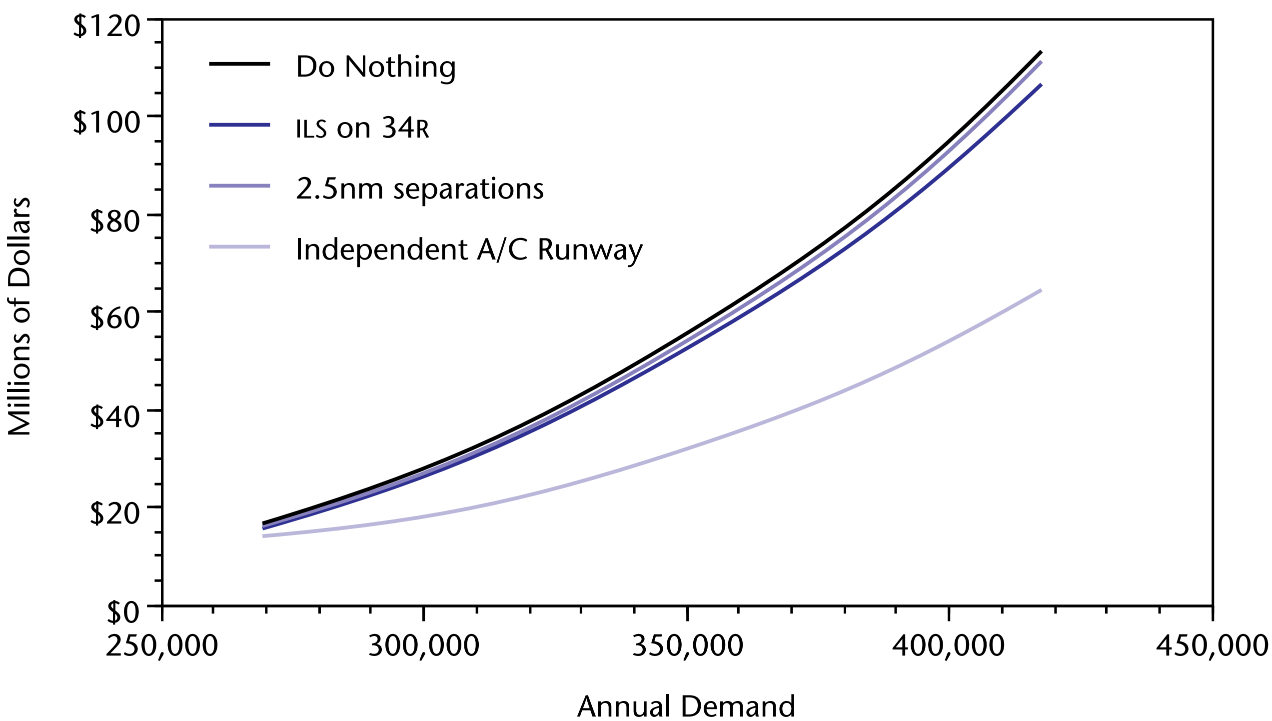
Under the "Do Nothing" situation, the annual delay cost will increase from $16.2 million in Baseline (1988) to $113.3 million by Future 2.

The average delay per operation of 1.14 minutes in Baseline will increase to the level of 4.15 minutes per operation by Future 2.

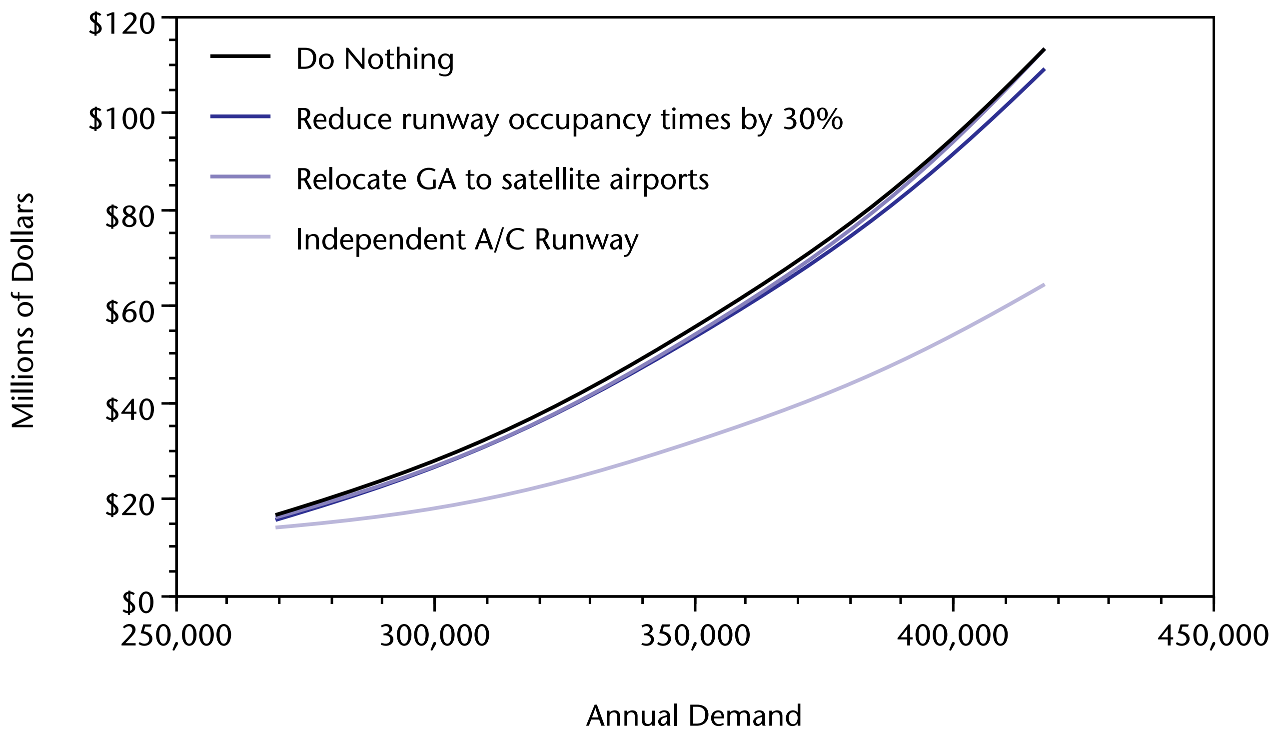
## FIGURE 10 ANNUAL DELAY COSTS — AIRFIELD IMPROVEMENTS




## FIGURE 11 ANNUAL DELAY COSTS — FACILITY & EQUIPMENT IMPROVEMENTS



## FIGURE 12 ANNUAL DELAY COSTS — USER IMPROVEMENTS

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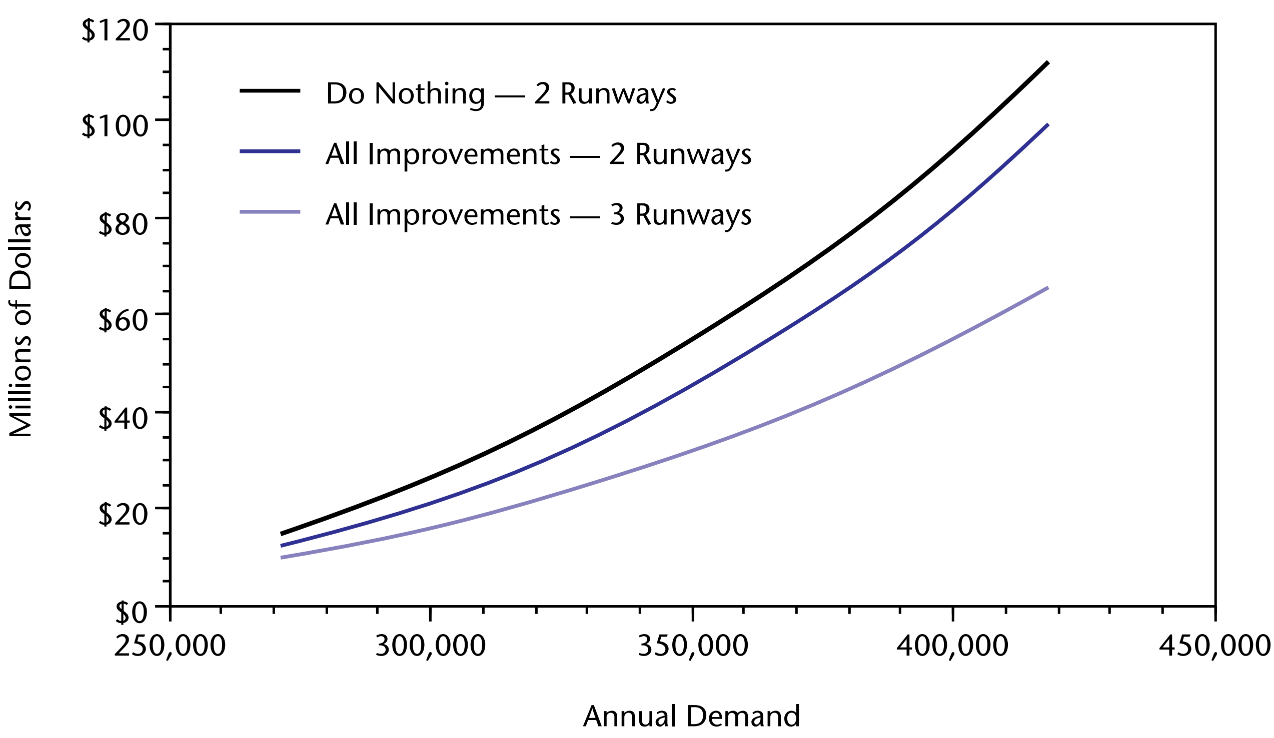
## FIGURE 13 ANNUAL DELAY COSTS — ALL IMPROVEMENTS



# Appendix A — Design Team Participants

| | |
|---|---|
| Anees Adil | FAA System Capacity and Requirements Office |
| Mike Harrison | FAA System Capacity and Requirements Office |
| Jim Smith | FAA System Capacity and Requirements Office |
| Jim McMahon | FAA System Capacity and Requirements Office |
| Philip Ashbaker | UDOT |
| Arno Bosley | SLC ARTCC |
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| Nelson Carey | FAA Technical Center |
| Dan Carr | Delta Air Lines |
| Bill Cheney | Air Line Pilots Association |
| Dennis Coombs | Wasatch Front Regional Council |
| Steve Domino | SLCAA |
| Dudley Haralson | Delta Air Lines |
| Dave Hegy | SLC FSDO |
| Robert Horsley | SLC Hub |
| Robert Holladay | FAA Technical Center |
| John McNamara | Air Transport Association |
| Major Larry Johnson | Utah Air National Guard |
| Peter Melia | Denver ADO |
| Louis E. Miller | SLCAA |
| Tim Phillips | SLCAA |
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| Donna Taylor | Airports Division, Northwest Mountain Region |
| David Tomlinson | Utah Pilots Association |
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| John Yarnish | TRA Airport Consultants |

# Appendix B — Computer Models and Methodology

The Salt Lake City Design Team studied the effects of various improvements proposed to reduce delay and enhance capacity. The options were evaluated with consideration of the anticipated increase in demand. The analysis was performed using several computer modeling techniques. A brief description of the models and the methodology employed are given below.

## Computer Models

*Airfield Delay Simulation Model (ADSIM):* This is a fast-time, discrete event model that employs stochastic processes and Monte Carlo sampling techniques. It describes significant movements of aircraft on the airport and the effects of delay in the adjacent airspace. The model was validated in 1978 at Chicago O'Hare International Airport against actual flow rates and delay data. It was calibrated for this study against field data collected at SLCIA to ensure the model was site specific.

Inputs for the simulation model were derived from empirical field data. The model repeated each experiment 10 times using Monte Carlo sampling techniques to introduce system variability. The results were averaged to produce output statistics. Total and hourly aircraft delays, travel times, and flow rates for the airport and for the individual runways were calculated.

*Runway Delay Simulation Model (RDSIM):* There are two forms of the RDSIM model. The first is a short version of the ADSIM model that simulates only the runways and runway exits. This version ignores the taxiway and gate complexes for a user-specified daily traffic demand. In the second version, the model simulates the runway and runway exits, however it creates its own demand using randomly assigned arrival and departure times. The created demand is based upon user-specified parameters. This form of the model is suitable for capacity analysis.

For a given demand, the model calculates the hourly flow rate and average delay per aircraft during the full period of airport operations. Using the same aircraft mix, computer specialists simulated different demand levels for each run to generate demand-versus-delay relationships.

*Airport and Airspace Simulation Model* (SIMMOD): SIMMOD is a fast-time, event-step, simulation model. It simulates the real-world process of aircraft flying through air-traffic-controlled enroute and terminal airspace, and arriving at and departing from airports. SIMMOD traces the movement of individual aircraft as they travel through the gate/taxiway/runway/airspace complex. It simulates air traffic control actions required to resolve potential conflicts to ensure aircraft operate within procedural rules. Aircraft travel time, delay, and traffic statistics are computed and provided as model outputs.

## Methodology

Model simulations included present and future air traffic control procedures, various airfield improvements, and traffic demands for different times. To assess the benefits of proposed airfield improvements, the FAA used different airfield configurations derived from present and projected airport layouts. The time frame for air traffic control procedures and system improvements determined the aircraft separations used for IFR and VFR weather simulations.

For the delay analysis, agency specialists developed traffic demands based on the *Official Airline Guide*, historical data, and Master Plan forecasts. Aircraft volume, mix, and peaking characteristics were developed for three demand periods (Baseline, Future 1 and Future 2). The estimated annual delays for the proposed improvement options were calculated from the experimental results. These estimates accounted for the yearly variations in runway configurations, weather, and demand based on historical data.

The potential delay reductions for each improvement were assessed by comparing the annual delay estimates.

The RDSIM model, in its capacity mode, was used to perform the capacity analysis for SLCIA. Since airfield capacity is not a constant value for all conditions, but varies with runway configurations, weather, aircraft fleet mix, air traffic control strategy, ratio of arrivals to departures, and the demand pattern, the SLCIA Capacity Design Team decided to depict capacity with a family of curves.

Capacity analysis was performed for SLCIA at three ratios of arrivals to departures for two weather conditions and two runway configurations (2 runways and 3 runways). As seen in Figures 6 through 9, a ratio of 80/20, 80% arrivals to 20% departures, was run to estimate capacity during an arrival rush, a ratio of 50/50 was run for balanced operations and 20/80 for a departure push.

The model was run with a control strategy which maintains arrival and departure flow (throughput) in the same ratio as the arrival and departure demand. It was also run with the assumption that demand is randomly distributed within the time period. The curves were generated making a number of simulation runs of multiple replications starting with low demand levels and gradually increasing demand in steps until the maximum flow rate was achieved.

# Appendix C — Glossary

| | |
|---|---|
| ASC | System Capacity and Requirements Office, FAA HQ |
| ADSIM | Airfield Delay Simulation Model |
| AFB | Air Force Base |
| AGL | Above Ground Level |
| AOPA | Aircraft Owners and Pilots Association |
| ARR | Arrival |
| ARTCC | Air Route Traffic Control Center |
| ASDE | Airport Surface Detection Equipment |
| ATA | Air Transport Association of America |
| ATC | Air Traffic Control |
| ATCT | Air Traffic Control Tower |
| DEP | Departure |
| FAA | Federal Aviation Administration |
| FSDO | Flight Standards District Office |
| IFR | Instrument Flight Rules (FAR Part 91) |
| ILS | Instrument Landing System |
| IMC | Instrument Meteorological Conditions |
| LDA | Localizer Directional Aid |
| MLS | Microwave Landing System |
| NDB | Non Directional Beacon |
| RDSIM | Runway Delay Simulation Model |
| RVR | Runway Visual Range |
| RWY | Runway |
| SIMMOD | Airport and Airspace Simulation Model |
| SLCAA | Salt Lake City Airport Authority |
| SLCIA | Salt Lake City International Airport |
| Stochastic | Random variable or random process |
| TCA | Terminal Control Area |
| TRACON | Terminal Radar Approach Control Facility |
| TWY | Taxiway |
| VFR | Visual Flight Rules (FAR Part 91) |
| VMC | Visual Meteorological Conditions |