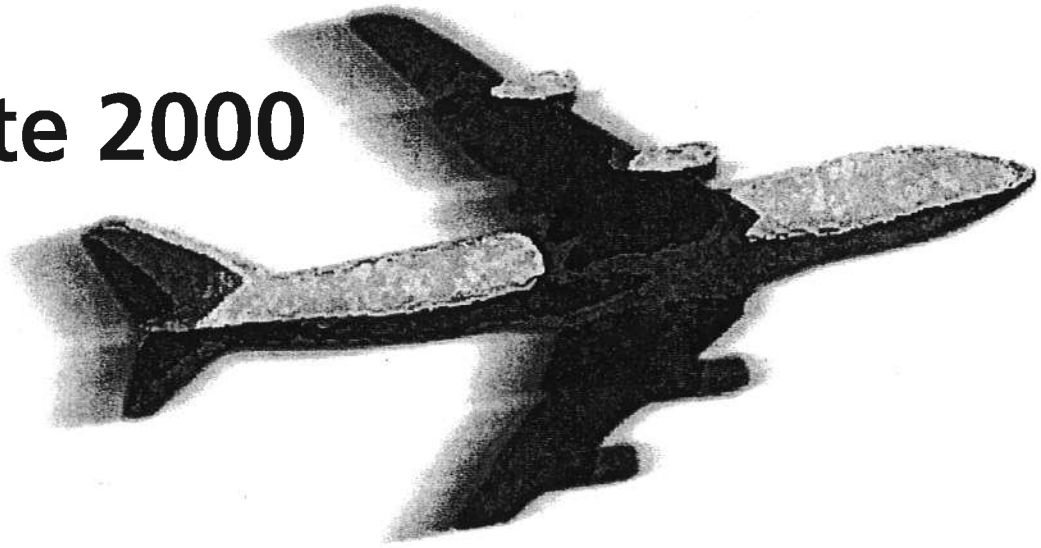
Agenda Item #9

Regional Airport System Plan

Update 2000



Final Report

Regional Airport System Plan Update 2000

Final Report

Prepared for:
Regional Airport Planning Committee

Revised September 2000

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CHAPTER 1
INTRODUCTION

As the air traffic at Bay Area airports continues to increase, the region is confronted with the potential need to increase the runway capacity at existing airports or devise new strategies to manage the capacity of the existing runways. The region must also address the potential effects of air travel growth on the region's noise environment, air quality, surface transportation system, and Bay resources. The Regional Airport Planning Committee (RAPC) is charged with developing and updating the Regional Airport System Plan, which is subsequently incorporated into the Metropolitan Transportation Commission's (MTC's) Regional Transportation Plan as the airport element of that plan. This report presents RAPC's assessment of future aviation growth, alternatives for serving this growth, and the implications for the environment.

In 1999, RAPC determined that growing air traffic and new airport planning initiatives required a review of the 1994 Regional Airport System Plan. While earlier regional airport planning exercises had determined that the region's aviation system capacity would eventually be taxed to the limits, these plans did not provide any detailed analysis of the options for addressing this condition when it occurs. This review picks up where the 1994 plan ended and responds to the central conclusion in the plan that "the defining issue for the Bay Area airport system is the adequacy of existing runways and airspace to accommodate growth in air carrier and general aviation activity."

In conducting this update of the plan, the Committee recognized that the primary audience for the analysis would be "the resource agencies and BCDC in applying the Bay Plan airport policies and in any subsequent permit applications". To provide this essential guidance, the Committee determined that the RASP update should address three primary issues:

- the need for additional airport system capacity, now, in the mid-term (10 years) and in the long term (20 years)
- regional airport system alternatives to provide this capacity
- significant environmental tradeoffs to the extent they are known (airport noise, air quality, bay fill, wetlands/habitats, etc).

To address these central issues, it was further agreed the RAPC update process would provide for the following:

- a review of aviation forecasts and update for 2010 and 2020
- a review of the capacity of the airport system for selected major runway alternatives and a sensitivity analysis addressing changes in

capacity/delay as a result of different assumptions about airport system supply and demand
- a review of some basic environmental impact data on regional runway alternatives
- recommendations for revising the RASP.

Each agency involved in the update will need to consider the conclusions and recommendation contained herein within the context of their own authority. For BCDC the authority is that of Bay fill, for MTC it is ground transportation, and for the airports and FAA it is airport master plans and projects and airspace management. Other agencies will also need to become involved in reviewing airport plans and environmental documents in terms of the projected impacts on air quality and public health, water quality, and living resources—areas which extend beyond the expertise of RAPC. Additional work will no doubt be needed to focus on these potential impacts and their possible mitigation. Chapter 8 begins to outline the various venues where these discussions can occur.

Over the last year RAPC has conducted workshops on forecasts and over flight noise, heard presentations on a wide range of topics, received and reviewed reports from staff and consultants, and provided opportunities for public input. The plan represents a collaborative effort between MTC, ABAG, BCDC, the Bay Area airports, the public and other agencies involved in airport planning issues.

The conclusions and recommendations collectively constitute an update of the *1994 Regional Airport System Plan*, a summary of which is found in Appendix A. The conclusions and recommendations are based on a number of separate reports that are listed in Appendix B.

What Is The Basis For This Plan?

Our plan starts with a realistic appraisal of the lay of the land, from the viewpoint of authority and statutes. Unlike past plans, we believe this is the proper framework in order to have relevance to future decisions. Also unlike past plans, we have made a greater effort to understand the forces and market trends that will most likely shape the growth in passengers, air cargo tonnage, and aircraft operations (takeoffs and landings) at each airport. We have avoided the concept of assigning or allocating traffic to airports, because past plans have not had any practical means to influence actual airline and airport marketing decisions. Therefore, we believe the following considerations must be given weight in the current planning process.

- The Airline Deregulation Act of 1978 gives the airlines the freedom to choose airports, routes, and fares.
- The Airport Noise and Capacity Act of 1990 defines the manner in which the FAA would consider any restrictions on aircraft operations at airports.

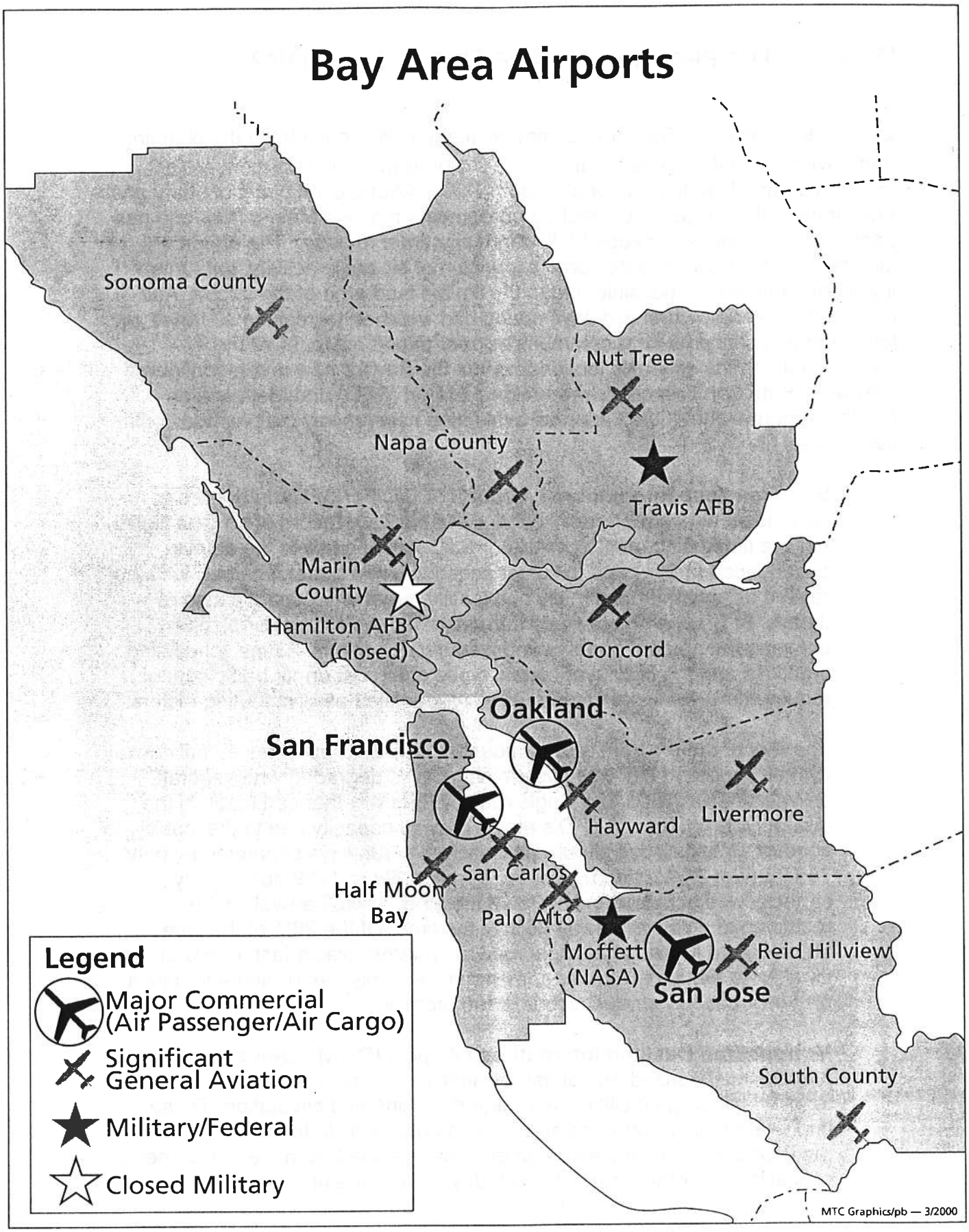
- The FAA's Airport Improvement Act defines the eligible uses of federal aviation trust funds and Passenger Facility Charges (PFCs).
- Airport master planning and project development decisions are largely vested with the airports and FAA.
- Airports are owned and operated by different local government entities.
- Airspace management decisions are made by the FAA.
- Allowable airport noise in communities near is defined by the state (California Airport Noise Standards, Code of Regulations, Title 21).
- Approval of permits for filling the Bay rests with BCDC.
- Airport pollution from aircraft rests is regulated by the EPA, and motor vehicle and on airport emissions are regulated by the California Air Resources Board.

WHAT HAVE PAST PLANS RECOMMENDED?

This plan update is neither the first, nor likely the last, contemporary review of future aviation system requirements. The original 1972 Regional Airport System Study (RASS) was developed on the heels of rapid air travel growth in the late 60's and the ensuing widespread air traffic congestion at the nation's larger airports. Because it was believed that the Bay Area would soon require major new aviation capacity, new airports were considered as well as expansion of existing airports. Concerns over the need for Bay fill were also evident in the 1972 plan, reflecting the creation of BCDC and their first Bay Plan (1968). Like today, new technology, High Speed Rail, and development of new airports at "upland" sites were advocated as viable alternatives to filling the Bay for new runways. After a reconnaissance of possible sites for a new airport, even the first plan arrived at the conclusion that projected demand could best be served at existing airports, which at that time included Hamilton Air Force Base or Napa County Airport and Travis AFB.

The key commercial, general aviation, and federal/military airports in the Bay Area are shown in Figure 1. Regional airport plans prepared after 1972 made recommendations intended to protect future options, such as the need to study a new runway at OAK, the need to preserve Hamilton Air Force Base in Marin County (subsequently closed after a court case and local opposition), and the need to protect the region's smaller "reliever" general aviation airports from closure (such as the proposed closure of Reid Hillview airport in Santa Clara County). In addition, each new plan update has reconsidered the role of federal/military airports (e.g., Moffett Federal Airfield and Travis AFB) and the possible implementation of a High Speed Rail system. In many ways the current update is plowing old ground, but in a new context.

Figure 1


Bay Area Airports
Sonoma County
Nut Tree
Napa County
Travis AFB
Marin County
Hamilton AFB (closed)
Concord
Oakland
San Francisco
Hayward
Livermore
San Carlos
Half Moon Bay
Palo Alto
Moffett (NASA)
Reid Hillview
San Jose
South County
Legend
Major Commercial (Air Passenger/Air Cargo)
Significant General Aviation
Military/Federal
Closed Military
MTC Graphics/pb — 3/2000

WHAT IS THE PROBLEM WE ARE TRYING TO SOLVE?

Since 1972, only one Bay Area commercial airport has completed the planning and environmental process required for a major runway improvement project, and that is San Jose International Airport (SJC). After eleven years of study and environmental analysis, SJC reached agreement on a new Master Plan and has begun construction on a second full-length air carrier runway. The airport will also be able to accommodate some expansion of air cargo activity, but further improvements are not possible due to the limited land area of the airport. And only now, faced with chronic delays during bad weather, increasing air travel, and long standing concerns from communities over airport noise, have the commercial airports seriously looked towards the Bay for new and reconfigured runways. Both San Francisco International Airport (SFO) and Metropolitan Oakland International (OAK) are now evaluating new runway options that could require Bay fill.

San Francisco International Airport (SFO). For SFO, delays are a paramount concern primarily because of the poor record of on time flights. For the time being, neither OAK nor SJC comes close to the delays experienced at SFO due to lighter schedules and better weather. Weather related delays, both nationally and locally, are the dominant cause of delays. At SFO, a recent study demonstrated the strong correlation between the amount of delay and weather conditions. Airline scheduling practices and the impact of certain types of aircraft on air traffic control requirements for wake turbulence were identified as contributing factors.

The root of the problem is the amount of time SFO operates at "full runway system capacity". Runway system capacity is degraded when aircraft arrivals are restricted to a single runway (bad weather can result in the loss of 50% or more of SFO's arrival runway capacity due to the inability to conduct simultaneous aircraft approaches to runways separated by only 750 ft under FAA criteria). For the period 1996 to 1999, full runway capacity was achieved only 62% of the time. Aircraft arrivals were restricted to a single runway 26% of the time. Of the 26% of the time arrivals were limited to a single runway, weather was a factor 95% of the time (Note that bad weather does not necessarily mean wind and rain; it also includes low stratus clouds in the morning).

Metropolitan Oakland International Airport (OAK). OAK's planning process has focused on necessary near-term improvements to the terminal, air cargo facilities, and airport parking and circulation. These improvements are undergoing environmental review. In the longer term, the capacity of the single air carrier runway at the South Field becomes a critical issue for the airport. Even today, OAK can approach capacity

during poor weather for short intervals. As a result, OAK has undertaken a study of runway options similar to that at SFO.

San Jose International Airport (SJC). Having recently completed a master plan, and started construction on a new runway, SJC has reached the likely extent of major improvements for a considerable length of time. The master plan includes further terminal and access development, more parking and better circulation, and additional air cargo capability. With completion of the second air carrier runway, SJC will improve its overall capacity, although the airport's capacity will be lower in poor weather than in good weather due to the close spacing of the two airline runways. Fortunately, poor weather conditions do not occur as frequently as they do at SFO.

WHAT ARE THE KEY ENVIRONMENTAL CONCERNS?

Growth in air traffic gives rise to a number of environmental concerns. To the extent that modifying airport runways requires Bay fill, protection of the Bay will need to be addressed. To the extent that more commercial flights take off and land at the three airports, there will be more flights affecting communities both near and farther away from the airport runways. And to the extent that airport demand creates more ground traffic and aircraft operations, additional emissions will be generated in the San Francisco air basin. These emissions include those that contribute to ozone (smog), small particles (generated by diesel equipment), and potential toxic compounds.

Traffic conditions will likely worsen around the airports due to increased regional travel and new air passenger and airport employee trips to the airports. Finally, because airport runways are located near active earthquake faults, there are continuing concerns about the ability of airport runways to withstand a major earthquake.

Each of these topics has been addressed in a separate report (Appendix B), and the key findings are presented in Chapter 7. Our analysis describes the potential magnitude of change in these areas, but leaves the detailed review to subsequent airport environmental documents.

CHAPTER 2

CONCLUSIONS AND RECOMMENDATIONS

WHAT ARE OUR MAJOR CONCLUSIONS AND RECOMMENDATIONS?

The regional airport plan update boils down to a few basic conclusions, supported by findings from our analysis.

1a. RAPC understands that the choices concerning runway improvements are essentially choices between:

a) Serving projected demand through system expansion;
b) Reducing the quality of service for passengers and cargo through flight restrictions that attempt to achieve a better balance between demand and available capacity, or;
c)Tolerating increasing airport delays in favor of protecting the environment beyond that which may be achieved through mitigation.
d) Demand reduction
e) Technological enhancements of capacity

1b. RAPC further understands that decisions to improve airport runways must seek to balance the economic benefits derived from these improvements and the Bay Area's quality of life.

1c. RAPC will continue to revisit these balancing issues in the plan as new information is developed.

2. Given a reasonable range of forecasting assumptions, Bay Area passenger and cargo flights are projected to increase nearly 60% by 2020. This level of activity (demand) will exceed the capacity of the existing airport runways as follows:

- **SFO**: Demand exceeds capacity during poor weather today; demand would also exceed the airport's capacity during good weather after 2010.
- **OAK**: The capacity of the airport's South Field main runway will be exceeded some time after 2010 during both good and bad weather conditions.
- **SJC**: The airport's new runway system (under construction) will have adequate capacity throughout the forecast period.

3a. After examining a range of alternatives to the construction of new runways, our analysis does not reveal a strategy, or set of strategies, that can adequately close the gap between projected demand and available runway capacity at the existing airports by 2020.

- A new North Bay airport would not provide significant air traffic relief and would not be feasible given the lack of an identified location and airport sponsor, costs, potential environmental impacts and uncertain public support.
- Absent Congressional action to change federal laws, there are no regulatory mechanisms that can be used to shift flights from one airport to another- nor would a new regional body have such authority.
- Unless airlines or airfares are regulated (see above), an airport-to-airport rapid transit connection between SFO and OAK is unlikely to make a difference in passenger preferences for airports. In addition, such a connection could exceed the cost of new runways.
- Expanding general aviation airports would not provide the necessary runway capacity to accommodate a significant share of regional air traffic.
- High Speed Rail, if approved by the state and funded by the voters, would serve only a portion of air travelers using the Bay Area airports and would not divert enough passengers to make up for the shortfall in runway capacity.
- No new Air Traffic Control (ATC) technology is available or is in the research phase that will double SFO's capacity in poor weather.

3b. The FAA and airports should continue to pursue near term measures that will help reduce delays.

- To manage its existing runways as effectively as possible, SFO should continue to define an airport access rule under FAA Part 161 that could be advanced if voluntary actions to reduce existing delays are not as effective as anticipated. The rule should consider changes in airline schedules, the size of commercial aircraft using the airport, and limits on general aviation.
- To manage the airspace as effectively as possible, FAA should implement air traffic controls tools that will improve airport capacity at SFO during poor weather as soon as practicable (these include such tools as Standard Offset Instrument Approach/Precision Runway Monitor, Center TRACON Automation System, Automatic Dependent Surveillance with wake turbulence detection, etc.).

4. Therefore, to meet reasonably expected air transportation demand and to provide more reliable air transportation during good and bad weather,

additional runway capacity is needed at SFO and OAK. A comprehensive examination of these improvements should be pursued as the most relevant course of action.

- For both airports, multiple runway system configurations are being reviewed.
- The most promising configurations need to be identified along with the criteria used for their selection.

5a. Prior to an irretrievable commitment to additional runways, all impacts on the Bay resources should be evaluated.

- In addition to the Bay impacts, potential airspace interactions between airports, potential noise shifts, and increased air pollution need to be evaluated.
- Comprehensive and effective mitigation plans need to be completed that will offset any adverse impacts on the Bay.

5b. Thus, RAPC recommends that the process proceed to complete the *full* environmental analysis of new runway options *in compliance with existing CEQA/ NEPA law without special amendment.*

- For SFO, the analysis is underway and a draft environmental report is expected in Summer 2001
- For OAK, the detailed environmental analysis will not come for some time; therefore, the ongoing runway study should analyze key capacity and environmental issues in sufficient detail to provide comparable information to the pre-environmental runway evaluation conducted by SFO

6. RAPC recommends that the plan protect future options by indicating a regional interest in civil aviation use of Travis AFB and Moffett Federal Airfield if these facilities become available in the future (These facilities are not available now, nor can their future availability be predicted). Also the plan recognizes that the commercial airports require an effective general aviation reliever airport system for small aircraft.

- Decisions that could foreclose future use of any federal, military, or general aviation airport runways should be subjected to a focused study on the effect of such a closure on local and regional aviation requirements.
- Local jurisdictions in Solano County are encouraged to apply strict land use compatibility guidelines to proposed developments around Travis AFB to protect the airport from encroachment.
- The FAA is encouraged to install advanced navigational equipment at the region's major reliever airports as soon as practicable.

7. Finally, given the inherent uncertainty when discussing the future, RAPC should continue to monitor changes in the air travel market, air traffic control technology, and laws and regulations that could affect the air transportation strategies and conclusions reached in this plan.

How Would RAPC Propose Addressing Major Environmental Concerns?

Overflight Noise. The airports should explore with RAPC the development of a regional program to "audit" overflight noise in various communities, the purpose of which would be to create a database that can be used in tracking noise trends and developing potential solutions.

Overflight Noise. The local airport noise roundtables should convene as a "Regional Roundtable" to provide a forum for discussing larger Bay Area overflight noise concerns and to apply their resources to the investigation of potential causes and solutions to overflight noise complaints.

Overflight Noise. The FAA should undertake a broader review of current aircraft arrival and departure routings to determine if any one Bay Area community or communities is experiencing an undue burden from overflights.

Overflight Noise. NASA and the FAA should develop a work program for redesigning the Bay Area airspace to take advantage of new opportunities presented by a future GPS (global positioning system) based navigational system. A redesign could address noise and airspace efficiency issues.

Air Quality. The Bay Area Air Quality Management District and California Air Resources Board should determine what resources would be needed to conduct a monitoring study of air quality around airports.

Ground Access. MTC should work with the airports and county transportation agencies to identify airport access priorities and assist in seeking necessary funding.

Ground Access. MTC should cooperate with the new Bay Area Water Transit Authority in defining effective airport ferry connections.

Bay Resources. RAPC and BCDC should fill out the Bay "Scorecard" as information becomes available.

What Issues Still Need To Be Resolved If Runways In The Bay Are To Be Considered At SFO And (/Or) OAK?

Assuming there will be a continuing review of runway proposals that could result in Bay fill, we have identified a set of outstanding issues.

Runway Design Issues

Non-Bay Fill Options at OAK. Different runway concepts would have different impacts on the Bay as discussed below.

- New Inboard Runway. An inboard runway would affect existing wetlands and may require the relocation of portions of the existing terminal complex to provide adequate setback distance. A closely spaced inboard runway (700-800 feet separation) would provide less Instrument Flight Rule (IFR) capacity compared to an outboard runway with sufficient separation for independent IFR operations.
- Increased use of the North Field. The potential for increased use of the North Field needs to be evaluated to determine the feasibility of relieving the South Field when it becomes more congested. A 1976 Settlement Agreement between the Port of Oakland, City of Alameda, and Alameda developers defines limitations on operations from the North Field runways.
- Combination North and South Field Inboard Runway. Another potential runway system concept would involve the combination of a new inboard runway and potential for increased use of the North Field as described above.

Minimum Fill with an OAK Outboard Runway.

- A new outboard runway in the Bay would provide greater capacity in both good weather and bad weather than a closely spaced inboard runway. The amount of fill needed would vary depending on the FAA's minimum runway separation criteria for simultaneous instrument aircraft arrivals in bad weather. The future use of the two runways for aircraft arrivals and departures also needs to be resolved with respect to possible airspace interactions with SFO and noise effects on nearby communities. Since any new runway would be developed beyond 10 years, advances in air traffic control technology could play a significant role in determining the minimum lateral runway separation needed for independent IFR operations.

Minimizing Fill for SFO Runways.

- ***General Design Issues***. The runway designs at SFO have been in a continuous state of refinement. At the macro level, fill amounts vary depending on the runway layout (i.e., A3, BX Refined, and F2-See Appendix D). These configurations, in turn, provide different ranges of good and bad weather capacity and different noise reduction potential. Within these general configurations there are secondary fill options related to the length of proposed runway extensions and the lateral spacing distance between parallel runways. Finally there are tertiary fill issues, affecting 10's of acres instead of 100's of acres, that relate to the fine-tuning of spacing between parallel runways and taxiways. These spacing requirements would be affected by decisions to accommodate a new class of very large aircraft.

Airport Noise

Potential shifts in overflight noise with SFO's reconfigured runways. As explained in existing SFO documents, there would be several possible changes in runway use due to the operational capabilities of the reconfigured runways. By lengthening north/south runways (Runways 1/19), it would be possible for some heavier long haul aircraft to depart over the Bay instead of through the San Bruno gap. This in turn would result in increased noise (albeit at higher altitudes, and therefore lower noise levels) on flight tracks emanating from Runway 1 and decreased noise over San Bruno, South San Francisco and Daly City from jets that must now use Runway 28. Studies underway will address this issue.

A related issue also being studied is the amount of "back blast" noise reduction that can be achieved by virtue of extending Runway 1/19 and permitting aircraft to start their departures further to the north. Back blast noise is essentially low frequency ("rumble") noise from aircraft accelerating on takeoff which is difficult to mitigate and which is experienced by Peninsula communities located behind the departure end of the runways.

Another issue concerns the extent of areawide changes in flight tracks that may be required to feed traffic to the new Runways 28L and 28R at SFO. Such changes could increase the number of flights (albeit at higher altitude) over areas in the South and East Bay that currently experience lower amounts of traffic. This issue is being evaluated by the FAA.

Potential noise impacts from new runways or increased use of existing runways at OAK. A new inboard runway could create more significant community noise impacts than an outboard runway in the Bay because aircraft would be closer to the shore of the Bay and to existing neighborhoods. With a new outboard runway, the amount of noise reduction would depend on which runways are used for arrivals and departures. Expanded use of the North Field for air carrier and general aviation operations would have significant noise implications because of flight patterns over nearby communities. As mentioned earlier, the use of the North Field runways is currently governed by the 1976 Settlement Agreement between the Port of Oakland, City of Alameda, and Alameda developers. This agreement also applies to certain types of operations associated with a possible future inboard runway.

Airspace Issues

Potential airspace conflict between SFO and a new OAK outboard runway in the Bay. Preliminary analyses conducted by SFO and OAK point to a potential airspace conflict during Southeast Plan operations (runway use based on strong winds from the Southeast) between aircraft arriving on a new outboard runway at OAK and aircraft arriving on Runway 19 at SFO. This conflict would exist for both the existing and proposed reconfigured runways at SFO. There are a variety of potential solutions that need to be evaluated with assistance from the FAA.

Potential airspace interaction between SFO and SJC. New aircraft arrival routes for SFO's proposed reconfigured runways may affect SJC aircraft operations. This issue is currently being evaluated as part of the proposed new Simultaneous Offset Instrument Approach / Precision Runway Monitor (SOIA/PRM) procedure at SFO.

CHAPTER 3
PLANNING GOALS

WHAT GOALS SHOULD GUIDE THE PLAN?

The goals of the *1994 Regional Airport System Study* have been reframed to better capture the interests and concerns of the larger public who have participated in this planning process - from the airports, to the air travelers, to the environmental community, to the individuals who have commented on various aspects of the plan.

Provide a Safe and Reliable Air Transportation System

- Safe operation of the region's airspace and airports is of paramount concern.
- A reliable air transportation system that serves air passengers and cargo shippers in good and bad weather.
- Advancing new air traffic control technology as quickly as practicable.

Seek Solutions to Long-Term Airport System Capacity Needs

- Achieve the maximum efficiency in the use of the Bay Area airspace and airport runways.
- Consider a full range of options -- from new runways to new technology to demand management.
- Options for increasing airport system capacity must be realistic in terms of the market served, authority, law, funding, and timing.
- Actions that could permanently foreclose use of any existing runways (including commercial, federal/military, or general aviation reliever airports) should be subjected to a detailed study of the local and regional consequences.
- Preserve and enhance the capability of the region's reliever general aviation airports.

- Bay fill for new runways should be the minimum required.
- Proposed mitigation plans for addressing the impact of new runways should be developed in sufficient detail to understand the long-term mitigation benefits and to ensure there are no unintended adverse impacts.
- Seek sustainable reductions in aircraft noise.
- Seek sustainable long-term reductions in airport emissions to protect Bay Area air quality.
- Protect airport facilities from a major seismic event.
- Airport environmental documents should consider both local and regional effects of increased aviation activity.

Provide Effective Surface Access to Airports

- Provide effective transit and shared ride options for air passengers and airport employees.

CHAPTER 4
FORECASTS OF AVIATION DEMAND

HOW MUCH GROWTH IN AIR PASSENGERS AND AIR CARGO IS EXPECTED IN THE FUTURE?

The starting point for any review of airport system requirements is the preparation of a baseline forecast that can be used to compare the ability of the existing airport runways to meet future needs. We have termed this the "unconstrained" demand, the accommodation of which is subject to policy and technical review. Each new forecast is largely a reflection of lessons learned during the intervening period between the last forecast, and few forecasters will assert they have the prescience to anticipate recessions, changing fuel prices, international events, or a host of other factors that could alter growth on a short or longer term basis. What has been experienced both nationally, and to an even greater extent in the Bay Area, is a fairly sustained growth in air passenger and air cargo volumes, sometimes at very high rates over short periods of time. We do not expect these very high growth rates to continue, but at the same time we do not see a leveling off of demand.

The forecasts prepared for this update are grounded in the analysis of market trends, particularly the factors which drive growth in domestic and international travel, airline service strategies which define the likely evolution of new service at each Bay Area airport, and air passenger ground origins and destinations in the Bay Area which define, in part, each airport's market share. In developing the new Bay Area aviation forecasts we have considered a number of factors, such as:

- historic trends in passenger travel to various domestic and international destinations from the Bay Area as a whole and from each airport
- existing and projected economic characteristics of 74 domestic regions served by Bay Area airlines, including jobs, population, income and tourism
- trends in airline fares, aircraft size and load factors
- industry projections of growth in international air travel
- industry projections of air cargo growth
- survey data on the location of Bay Area air passengers (both residents and visitors) using each airport
- airline route development strategies which define the types of new routes likely to be added at each Bay Area airport

We prepared a high and a low forecast for domestic and international travel, and adopted the mid-range as the most probable forecast for the subsequent analysis. The high and low forecasts can be interpreted as capturing the range of uncertainty in the future estimates. In reference to our mid-point forecast, the high/low range was plus and minus 4.7% in 2010 and plus and minus 7.3 % in 2020. For the air cargo forecasts we reviewed seven different industry forecasts and then developed a separate forecast for each airport.

What would happen to demand in the absence of any airport capacity improvements? Some combination of the various effects below might come into play.

- Fares could increase as there would be more demand for a restricted supply of aircraft seats
- Aircraft size could increase gradually over time, providing some relief in terms of available seats (aircraft are used in service for a number of years and it is not easy to change over an airline fleet in a short period); or airlines could add seats to existing aircraft.
- Load factors could reach higher levels, but more passengers could be bumped as airlines try to ensure every seat is filled.
- More flights might be scheduled in the early morning and late evenings to meet the demand.
- As a result of squeezing more flights into the day, bad weather could compound delay problems, causing more widespread flight cancellations.
- Airlines may restructure their routes to provide more point-to-point service and avoid congested hubs.
- Fewer people would be able to fly which would have broad personal and economic effects.

In summary, there are a number of reasons to believe that growth in air passenger and air cargo travel will continue, but at somewhat lower than historic growth rates (see Figures 2 and 3). The forecasts and methodologies are explained in greater detail in the Forecast Report itself (see Appendix B).

FINDINGS

- Bay Area air passengers are expected to about double between 1998 and 2020 to 111 million annual air passengers, including domestic, international, and connecting passengers using Bay Area airports to transfer between flights. It is worth noting that our latest air passenger projections for 2010 are very similar to those contained in the 1994 RASP. The current projections extend the forecast to 2020.

- Cargo tonnage (freight and mail) is expected to grow at an even higher rate, tripling in volume to 5.5 million annual tons at all three airports by 2020.

- Oakland and San Jose airports will both experience significant gains in market share in domestic air passenger markets as airlines pursue new service opportunities (see Appendix C for projected new services).

- Thus, San Francisco airport's overall share of regional air passengers would decline from 66% in 1998 to about 55% by 2020.

- SFO passengers would increase from 37.1 million passengers in 1998 to 61.1 million annual passengers in 2020, a 65% increase.

- OAK passengers would increase from 9.1 million passengers in 1998 to 24.7 million annual passengers in 2020, a 170 % increase.

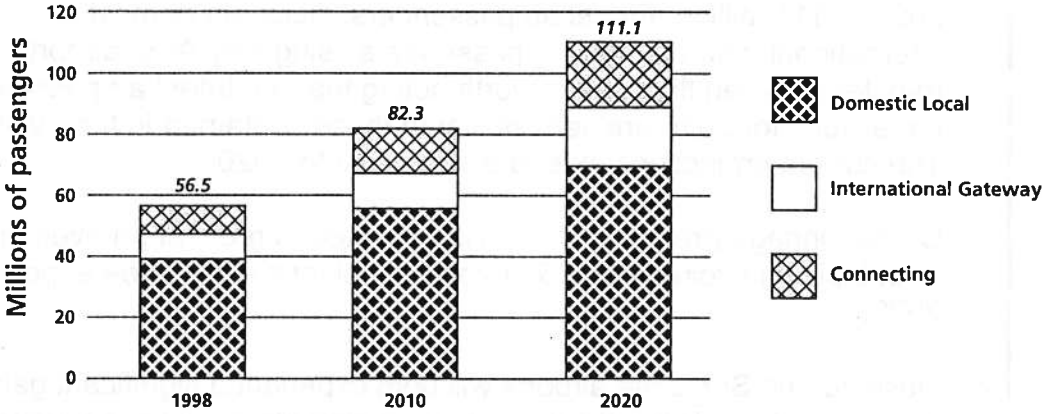
- SJC passengers would increase from 10.3 million passengers in 1998 to 25.3 million annual passengers in 2020, a 145% increase.

- This growth in air passengers and air cargo will translate into additional flights at all three airports. Overall commercial passenger flights will increase by 49% and air cargo flights by 125%.

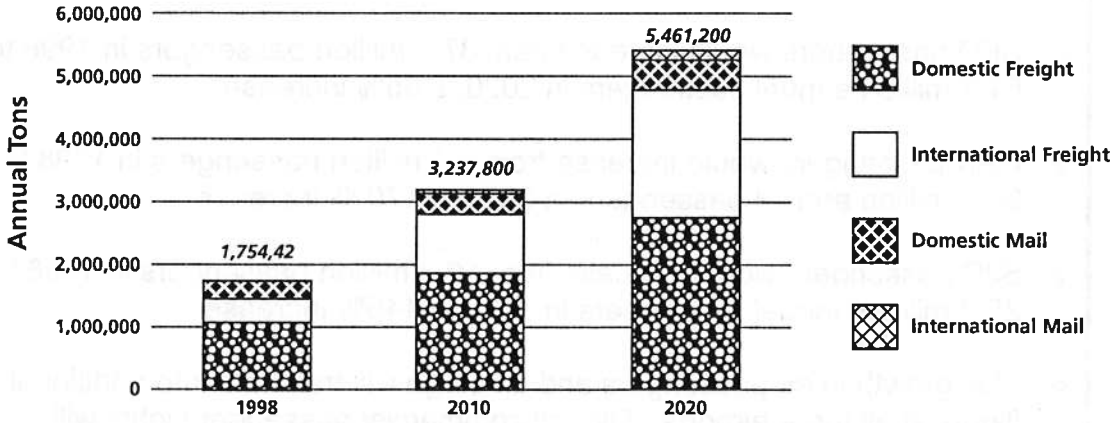
Figure 2

Bay Area Aviation Forecasts

Air passengers will double by 2020 to 111 million annual passengers



Total cargo tonnage will triple by 2020 to 5.5 million tons annually



Commercial aircraft operations will also increase at each airport

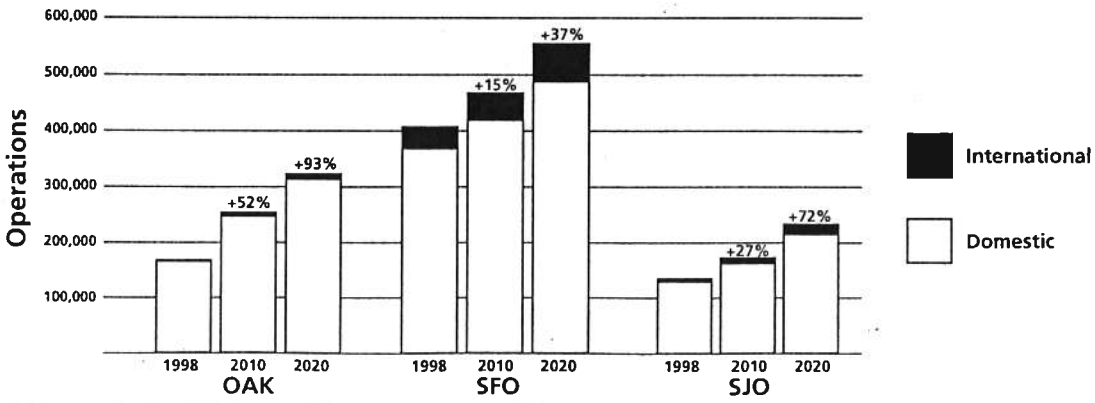
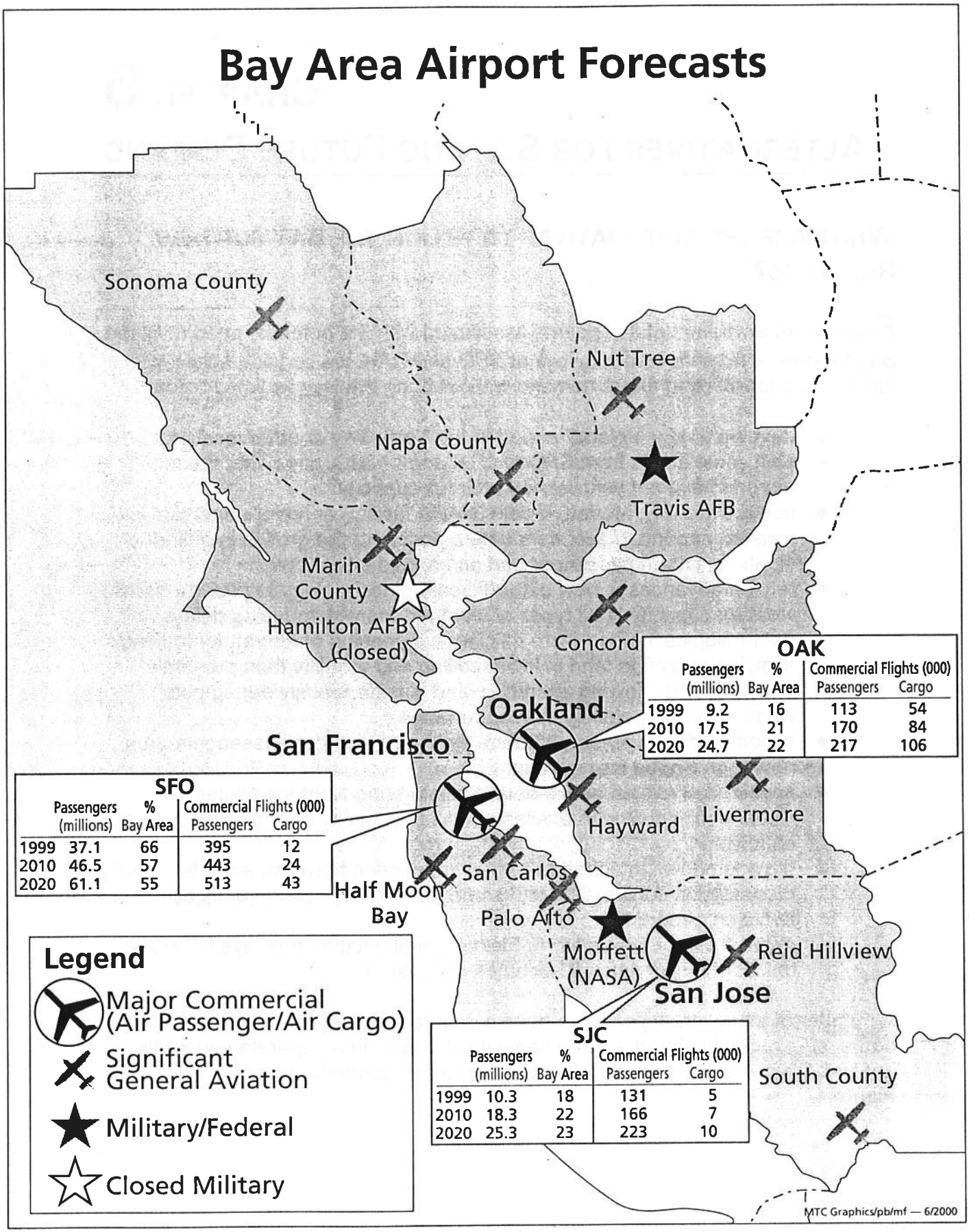


Figure 3


Bay Area Airport Forecasts
Sonoma County
Nut Tree
Napa County
Travis AFB
Marin County
Hamilton AFB (closed)
Concord
Oakland
San Francisco
Livermore
Hayward
San Carlos
Half Moon Bay
Palo Alto
Moffett (NASA)
Reid Hillview
San Jose
South County
SFO
Passengers (millions) | % Bay Area | Commercial Flights (000) Passengers | Cargo
1999 37.1 66 395 12
2010 46.5 57 443 24
2020 61.1 55 513 43
OAK
Passengers (millions) | % Bay Area | Commercial Flights (000) Passengers | Cargo
1999 9.2 16 113 54
2010 17.5 21 170 84
2020 24.7 22 217 106
SJC
Passengers (millions) | % Bay Area | Commercial Flights (000) Passengers | Cargo
1999 10.3 18 131 5
2010 18.3 22 166 7
2020 25.3 23 223 10
Legend
Major Commercial (Air Passenger/Air Cargo)
Significant General Aviation
Military/Federal
Closed Military
MTC Graphics/pb/mf — 6/2000

CHAPTER 5
ALTERNATIVES FOR SERVING FUTURE DEMAND

WHAT ARE THE ALTERNATIVES TO FILLING THE BAY FOR NEW RUNWAYS?

Because of environmental concerns associated with the potential need to fill the Bay for new or reconfigured runways at SFO and OAK, we considered a range of alternatives for meeting future demand without filling the Bay as listed below:

- develop a new "upland" airport in the North Bay or other location;
- shift some flights from SFO to OAK and/or SJC, given that these airports have not yet reached their full capacity;
- use Travis AFB, Moffett Airfield (NASA facility) or major general aviation airports to accommodate a portion of the growth in airline flights to certain passenger and air cargo destinations;
- rely on advances in new air traffic control technology to provide visual weather capacity in all types of weather, thereby reducing delays (technologies include more efficient sequencing of aircraft for landing, allowing aircraft to land in lower ceiling and visibility than presently possible, and allowing aircraft to land simultaneously during poor weather on very closely spaced runways);
- accommodate a portion of future California corridor passengers on a new High Speed Rail system;
- impose controls on airline operations to bring flight schedules into closer equilibrium with available runway capacity during all weather conditions;
- provide new high speed rail/water connection between airports (usually discussed in conjunction with some form of reallocation of flights between airports);
- expand use of OAK's North Field general aviation runways to relieve the South Field when it becomes congested

A number of these strategies have been evaluated for their effectiveness in addressing regional airport system capacity shortfalls in a separate sensitivity analysis (See Appendix B), the results of which are partially summarized in Figure 4.

Figure 4 - A
Alternatives to New Runways in the Bay

STRATEGY	EFFECTIVENESS	AUTHORITY	FUNDING	OTHER
New North Bay/ Regional Airport	Depends on location with respect to passengers and/or cargo North Bay airport might reduce SFO demand by 2% with flights to So. California and major Western cities	Unknown	FAA / Airport Operator	North Bay or other airport location would raise significant issues, e.g., • shift in impacts to new area • airline cooperation • local environmental impacts • availability of public funds • timing • proximity to markets
Shift SFO flights to Oakland	Depends on whether flights shifted from SFO are "backfilled" with flights by other air carriers	Mechanism to shift flights from SFO not defined	Implies additional costs for OAK to handle more flights Underwater rail tube connecting SFO and OAK could exceed cost of new runways	The forecasts already identify a significant shift in airline service to OAK Additional flights from SFO could shorten time when OAK runway reaches capacity
Shift SFO flights to San Jose	SJC not as centrally located for the region as OAK.	See above		SJC flights increasing on strength of own market.
Use of Travis AFB	Limited diversion of flights in California market (3-4 daily flights in 2020) Air cargo /international service speculative	Air Force approval needed. Airport sponsor unknown	FAA for public facilities (e.g., terminal, access, etc.)	Airline interest. Air cargo needs proximity to markets International service needs domestic connections

Figure 4 - B
Alternatives to New Runways in the Bay

STRATEGY	EFFECTIVENESS	AUTHORITY	FUNDING	OTHER
Shift flights to Moffett Federal Airfield	Potential future use for corporate general aviation or air cargo; IFR interactions with SJC	NASA approval needed	Source of funding not identified	Number of flights could be limited by NASA Community approval process
Use of General Aviation Airports	Limited diversion of flights in California markets, depending on specific airport; less than 1% reduction in SFO flights	Airport operator / FAA	Airports / FAA	Timing unknown Community approval process Noise concerns
SOIA / PRM for SFO (Simultaneous Offset Instrument Approach/Precision Runway Monitor)	Increases SFO arrival rate during low ceiling / visibility from 30 or less to about 38 arrivals per hour	FAA	FAA / Airport	Higher altitude noise shifts May effect SJC departures
Center TRACON Automation System (CTAS): • **aFAST** • **pFAST**	Could provide more efficient sequencing and spacing for arriving aircraft. Arrival flow must allow gaps to get departures out at SFO	FAA	FAA	10% capacity improvement at Dallas / Ft. Worth Effectiveness at SFO could be less due to different conditions
Airborne Information for Lateral Spacing (AILS)	Could permit simultaneous landings on closely spaced runways in poor weather	FAA	FAA	Long term NASA research effort. No proven technology to enable simultaneous arrivals with runways closer than 2,500 ft.
Intermittent Use of Oakland North Field	Shifting some airline arrivals to North Field could help reduce delays on South Field as needed	Airport / FAA	Airport / FAA	Community noise impacts a major concern 1976 Settlement Agreement limits certain types of North Field operations

Figure 4 - C
Alternatives to New Runways in the Bay

STRATEGY	EFFECTIVENESS	AUTHORITY	FUNDING	OTHER
High Speed Rail	Depends on HSR route, service frequency, and fares Estimated to reduce SFO daily flights by 4% to 7%	State	$26+ billion price tag Would need state voter approval for funding	In planning and environmental phase Earliest implementation around 2016
Airport Access Controls	Depends on type of control. Examples (2020): • "Upgauge" aircraft size in Southern California service (2% reduction in SFO flights) • Cap on Southern California Flights (3% reduction in SFO flights) • Upgauge commuter aircraft size (7% reduction in SFO flights) • Increase load factors (2.3% reduction in SFO flights). • Reduce GA operations (5% reduction in SFO flights)	Airport proposes; FAA must approve	N/A	Slot restrictions at congested airports have been phased out by Congress Restrictions on airline use of airports must meet six conditions specified in Airport Noise and Capacity Act of 1990 (Part 161): 1. Restriction not discriminatory 2. No burden on interstate or foreign commerce 3. Maintain safe/efficient use of airspace 4. No other conflict with federal law 5. Opportunity provided for public comment 6. No burden on national airspace system

WHAT CONCLUSIONS CAN WE MAKE ABOUT THESE OTHER ALTERNATIVES?

A New North Bay/Regional Airport. For BCDC to consider new runways in the Bay, a finding is required that there are no feasible "upland" alternatives. There has been little public support for a new airport in the Bay Area dating as far back to the earliest versions of the RASP (1972). A 1980 RAPC study specifically reviewed the role of existing airports in the North Bay and recommended that they be maintained as general aviation facilities. Finding an acceptable site for a major new airport within or outside the Bay Area is highly problematic given the potentially remote location for air travelers, community concerns with new aircraft noise and ground traffic, lack of an airport sponsor, infrastructure costs, etc. Even protection and preservation of existing airports is problematic as demonstrated by the lack of success in retaining Hamilton AFB as an airport and the continuing local opposition to expanding the use of Moffett Airfield, operated by NASA. In addition, our analysis of potential airline service at a North Bay site indicates that the market would not be sufficient to divert significant air travel from SFO or OAK. Developing a new airport would also be perceived as shifting airport impacts from one set of communities to another.

Finding: Development of a new airport in the Bay Area is not feasible given the financial, environmental, and community acceptance hurdles a new airport would need to overcome -- nor would it capture sufficient air traffic to effectively relieve SFO's long-range demand.

A Mechanism to Allocate Airline Flights Between OAK And SFO. While past planning work has referred to the "allocation" of passengers between airports, this term is grounded more in planning terminology than in the market itself. In fact, it is the market forces that are responsible for the airline service patterns at the three airports. Airlines generally have three motivations for new service: to lower cost, increase load factors, or charge higher fares. Given current levels of delays at SFO, there should already be sufficient inducement for the airlines to use OAK to reduce costs. Mechanisms designed to force airlines to use specific airports would not be consistent with the authority of the FAA or airports as defined in federal law. Nor would a regional airport authority have any higher powers, absent a change in law, as it would be subject to these same federal conditions. Carefully crafted regulations may have the effect of limiting some types of flight operations, but would not provide the ability to move large segments of activity from one airport to another. Finally, as noted in the forecast discussion, both OAK and SJC will also experience high growth rates over the next 10 years, limiting their ability to handle flights that may be displaced from SFO.

Finding: Regulatory reallocation of traffic between airports is not an available option under federal law.

Use of Travis AFB. For the present, this airport is not available for handling a significant share of Bay Area passenger traffic for the simple reason that it is under military control, and a high level of civilian use would not be consistent with the military mission. However, in the longer term, the airport does have substantial facilities that would still be of regional interest should the military's mission change. These uses could either be for limited domestic passenger flights or air cargo. Many of the fundamental questions raised above for a new airport would also apply to the future use of Travis AFB. Because of its remote location, additional ground access improvements would be needed to provide connections to the central Bay Area.

Finding: It is unlikely the military will vacate the airport; therefore, the future role if any for civilian use would be highly limited.

Use of Moffett Federal Airfield. The runways at this federal airport are not available because it is operated by NASA in support of NASA's research mission. Further, there are airspace limitations in poor weather, and there is no consensus on the future level or types of activity that might be acceptable to NASA and local communities. Therefore, while there is a regional interest in future aviation use of Moffett, its future availability is uncertain.

Finding: Moffett Airfield cannot be considered a significant factor in addressing regional aviation needs.

A System of Satellite Airports Providing California Corridor Air Service. In our sensitivity analysis of alternative strategies, we considered how a system of smaller general aviation airports with regional jet service to other California cities might reduce flights at the commercial airports. Since the California corridor is the largest air travel corridor in the world, measured by number of passengers, this market has some airline potential. However, individual airports would have a limited local catchment area and probably limited flight schedules. As a result we did not find that there would be significant flight diversion. In addition we were concerned about the impact on the Southern California airspace because the smaller regional jets would replace large jets, increasing overall flight operations in the California corridor. Further, some airports would need expanded runways, and noise impacts would be a key concern for local communities with these airports.

Finding: These airports may see limited air service at some point in the future, at the discretion of local communities; however, they would not have the capacity or level of air service required to relieve the need for improved runways at the commercial airports.

General Aviation Reliever Airports. Past regional airport plans envisioned a system of reliever airports, the function of which was to provide runways, navigational aids, parking space, and other services that could attract small aircraft away from the larger air carrier airport runways. While the Bay Area has such a system, this has not mitigated the need for corporate aircraft users to seek access to the commercial airports. Regulations that might be advanced by airports to limit general aviation flights on air carrier runways would have to meet strict federal requirements that such restrictions are "reasonable, nonarbitrary, and nondiscriminatory." We are not aware of any airport that has such a regulation.

Finding: Without a change in federal law, it will not be possible to free up runway capacity at the air carrier airports by eliminating general aviation users.

Airport-to-Airport Ground Connection. A rail or water connection has been proposed between SFO and OAK to enable passengers to more conveniently use either airport. We do not believe that this connection alone would change airline decisions about which airports they would choose to serve. The cost of an underwater rail connection between SFO and OAK would be substantial, requiring a source of regional funds well in excess of that available. The concept of an improved connection will receive detailed analysis as part of SFO's environmental review, in accordance with recent legislation (SB 1562).

Finding: Such a connection is unlikely to influence airline service decisions or air passenger preferences for airports.

Air Traffic Control Technology for Closely Spaced Parallel Runways. Technology will improve all weather capacity at SFO, but we have not uncovered any technology or combination of technologies that could enable aircraft to conduct simultaneous landings on SFO's closely spaced runways in bad weather. Current research indicates this capability could be achieved for runways spaced 2,500 feet apart, but not as close as the 750 feet at SFO. Critical issues include safety, redundancy, liability and pilot concerns. In studies at Dallas Fort Worth, NASA predicts capacity gains for runways using new technology called Traffic Management Advisor/Final Approach Spacing Tool. These programs will provide more efficient sequencing of aircraft arrivals to runways, but the benefits at SFO could be less because of the runway configuration (intersecting versus

multiple parallel runways at DFW) and the Bay Area's airspace operating environment.

Finding: Future studies could more accurately quantify benefits of these technologies, but these tools collectively are unlikely to approach the capacity of a new, properly spaced runway.

High Speed Rail. High Speed Rail has been evaluated based on the alignment and results of work conducted by the California High Speed Rail Authority. The primary benefit would be the diversion of travelers flying to major Southern California airports, and a secondary benefit would be for passengers flying on commuter flights to the Central Valley cities. Even with the large diversion of air passengers predicted by the Rail Authority (35% to 56%), we found that the projected runway demand at SFO would only be reduced 4-7%, due to the large number of SFO flights not associated with the California market. Additionally the diversion of passengers from flights to the Central Valley would be limited because the only city on the alignment with significant flight activity would be Fresno. Finally, it is possible that the airlines would compete more effectively with fares than assumed in the HSR report.

Finding: A HSR system would complement but not substitute for needed runway capacity in the Bay Area.

What Would Be The Cumulative Impact If Several Of These Strategies Could Be Implemented As A Package?

Given the many possible combinations of the strategies above, it is difficult to assess their combined effectiveness. We have selected one "Demand Management" concept to compare with proposed runway improvements. This scenario is designed to quantify the theoretical effectiveness of such an approach without regard to whether the scenario could be implemented or to the legal or environmental consequences, such as community noise. Some of the more obvious obstacles to implementation are listed in Figure 4. Demand/capacity comparisons for this scenario are shown in the next Chapter.

San Francisco International Airport. The hypothetical test consists of a cap on the number of flights in the already well-served California corridor, a required increase in the seating capacity of commuter aircraft (small aircraft serving smaller cities), and elimination of general aviation use of SFO's main runways. This combination of strategies would collectively produce about 15-18% fewer aircraft operations than currently projected.

On the capacity side we have assumed there would be an increase in IFR capacity due to the new SOIA/PRM procedure and an overall increase in both VFR and IFR capacity due to NASA-type air traffic management tools. Collectively we have assumed up to a 12% increase in runway capacity, depending on the forecast year.

Metropolitan Oakland International Airport. For OAK the major demand management assumptions were the use of the North Field by 25% of commercial airline arrivals (B737 size aircraft only, due to runway length) and by all general aviation and small air cargo aircraft that are required to use the South Field under OAK's noise abatement policy. These measures collectively would produce about a 21% reduction on South Field aircraft operations in 2020 (OAK would not need the demand management strategy in 2010).

Maximum theoretical increases in airfield capacity are the same as for SFO.

San Jose International Airport. For SJC, the main assumption was the elimination of corporate general aviation aircraft from the air carrier runways, which is equivalent to a 9% to 11% reduction in projected operations on the air carrier runways.

Capacity assumptions are similar to those for the other two airports.

CHAPTER 6
RUNWAY DEMAND AND CAPACITY COMPARISON

WHAT ARE THE CURRENT PROPOSALS FOR NEW RUNWAYS AT BAY AREA AIRPORTS?

Juxtaposed against the non-Bay fill strategies are proposals for new runway systems at SFO and OAK as explained below.

SFO Proposal. San Francisco International Airport (SFO) is the region's major international airport, a hub for United Airline flights, and a key transfer point for international air cargo. Faced with repeated delays during bad weather, SFO launched its Runway Reconfiguration Study in 1998 based on three objectives: 1) reduce delays, 2) reduce human exposure to aircraft noise, and 3) enable the airport to handle the next new generation aircraft with 550 to 650 seats (called New Large Aircraft). A number of runway "reconfiguration" plans have been analyzed in detail, and the airport is preparing an EIR/EIS on the most promising options. The SFO runway configurations include both lengthening of an existing runway (Runway 1/19) as well as providing increased spacing between runways to improve bad weather capacity. Lengthening of Runway 1R would also enable a larger number of heavy aircraft to take off over water as opposed to over land, providing noise relief to nearby communities. The principal runway alternatives being investigated are labeled:

- A3
- BX Refined
- F2

These plans are described in the Appendix D based on the airport's latest descriptions. Runway reconfiguration plans would create the need for at least 500 to over 1,000 acres of Bay fill.

OAK Study. Metropolitan Oakland International Airport and San Jose International Airport have both grown as providers of service first to California, then to the Western US, and now to more distant destinations on the East Coast. Oakland is also an air cargo hub for Federal Express and UPS. Oakland airport recently initiated its own runway study based on prior studies that indicated the single South Field runway would reach

capacity sometime after 2010. Oakland's runway study is considering a wide range of options (see Appendix E).

- Extension or realignment of North Field runways (used primarily by general aviation)
- A new "inboard" (non-fill) runway located between the existing runway and the airport terminal; an inboard runway would only have 700-800 feet of separation between the main runway and would not have the same bad weather capacity as a properly separated outboard runway
- A new outboard runway in the Bay separated from the existing runway by 1,000 to 4,300 feet. With adequate separation, this runway could provide the capability to accommodate simultaneous aircraft arrivals during poor weather. New runways in the Bay would create the need for 180 to about 290 acres of fill (based on preliminary estimates by the airport).

How Do We Analyze Runway Demand And Capacity in the Future?

We compare airport demand to capacity in two basic ways.

The first way follows the approach used in the *1994 Regional Airport System Plan* and compares the estimated runway demand in future years with the calculated runway capacities. This approach does not include the effect of airspace interactions on airport capacity. The ratio of runway demand to capacity is then related to general indicators of "delay acceptability" as described below.

The second approach is more comprehensive and involves the use of a computerized simulation of the Bay Area airport runways and the airspace. This analysis is capable of determining arrival and departure delays by phase of operation (in the air, on the ground, waiting in a queue to takeoff). Delay is calculated for each airport and for the Bay Area as a whole. Airspace interactions between airports are included in the model. This type of simulation is often used by the FAA in analyzing airspace issues and procedures.

Airport Runway Capacity

Figure 5 shows the estimated hourly capacity (number of aircraft arrivals and departures that can be processed) for each airport and each runway configuration. This process involves determining the capacity of each possible runway use option individually and then "weighting" these capacities to reflect the amount of time different runway configurations are used during the year.

Runway Demand

In order to develop runway demand and capacity comparisons, the forecasts for each individual airport were further detailed in terms of flight destinations, types of aircraft used by the airlines, and aircraft flight arrival and departure times. We then calculate runway demand for a "design" day (the number of flights on an average day in August) and for the peak hour and for the peak three hours of the day in 2010 and 2020.

Demand to Capacity Ratio

Runway improvement projects are typically designed to achieve an average "acceptable" level of delay rather than to eliminate all delay. We have compared demand to capacity for the following scenarios:

- Existing/Master Plan runway system configuration (assumes completion of new air carrier runway at SJC)
- Proposed new runway configurations at SFO and OAK
- Demand Management scenario (refer to Chapter 5), a theoretical scenario that reduces runway demand (takeoffs and landings) and increases runway capacity through potential new ATC technologies

Figure 6 shows the calculated ratio between demand and capacity. For ratios of demand to capacity less than 0.9, delay is defined as "acceptable"; for ratios between 0.9 and 1.1 delay is defined as "marginal". For ratios greater than 1.1· the delay is defined as "unacceptable". A general description of the effect of increasing air traffic at an airport on delay is provided by the FAA in their National Plan of Integrated Airport Systems (1998-2002):

"Experience shows that delay increases gradually with rising levels of traffic until the practical capacity of an airport is reached...Beyond this point delays are extremely volatile and a small increase in traffic, adverse weather conditions, or other disruptions can result in lengthy delays that upset flight schedules and impose a heavy work load on the air traffic control system. "

A demand-to-capacity ratio in the range of 1.0 to 1.1 is over the practical capacity of the airport runways and is labeled "marginally' acceptable. Above 1.1 the airport runways have essentially exceeded their practical capacity with the effects noted above. Based on these types of effects, we have labeled the delay "unacceptable".

FINDINGS

- SFO will continue to have inadequate runway capacity during poor weather in the future, due to the close spacing of its existing runways.
- SFO will also exceed its good weather runway capacity between 2010 and 2020.
- SFO's proposed runway reconfigurations would largely remedy the bad weather delay problem, but some reconfiguration alternatives will perform better than others. There is a chance that some bad weather delay would occur around 2020 due to the projected number of flights and the arrival and departure peaking of these flights.
- OAK will exceed its runway capacity after 2010 during both good and bad weather conditions.
- OAK's proposed inboard or outboard runway would provide sufficient capacity to serve 2020 demand, but the outboard runway option has greater long-term benefits in terms of poor weather capacity.
- SJC's air carrier runway improvements now under construction will provide adequate capacity throughout the forecast period. SJC may begin to experience more significant bad weather delays beyond 2020 due to traffic growth and the IFR capacity of the closely spaced air carrier runways.

These assessments reflect some underlying conditions that are worth noting.

- At SFO there is currently a large mismatch between the number of scheduled flights that can successfully operate without delay in good weather and the number of flights the airport can accommodate in bad weather. Given this situation, there is no realistic way to pare the schedule down to a level that works for both good and bad weather conditions.
- Small aircraft, both general aviation and commuter aircraft used extensively as feeder flights from small cities to SFO, comprise about 23% of the projected SFO flights in 2010 and 2020. These aircraft have a disproportionately high use of runway capacity compared to the percentage of passengers carried.
- Growth in air cargo flights, such as forecasted for OAK, does not necessarily lead to runway capacity problems as many of these flights will occur in the late evening and early morning hours.

Figure 5
PLANNING VALUES FOR DEMAND / CAPACITY ASSESSMENT
(Numbers are Aircraft Arrivals and Departures)

AIRPORT	HOURLY CAPACITY VFR	HOURLY CAPACITY IFR	PEAK HOURLY DEMAND 1999/2010/2020
San Francisco International Airport			91/99/123
• Existing Runways	107	77	
• Existing Runways + SOIA/PRM*	107	85	
• Refined BX	136	119	
• F2	136	111	
• A3	107	107	
• Existing Runways + Demand Management**	120	87	NA/77/101
Metropolitan Oakland International Airport			37/47/62
• Existing Runway	50	49	
• New Inboard Runway	90	64	
• New Outboard Runway	108	79	
• Existing Runways + Demand Management**	63	61	NA/NA/49
San Jose International Airport			47/42/63
• Master Plan Runways	80	43	
• Master Plan + Demand Management**	88	47	NA/NA/58

*SOIA/PRM = Simultaneous Offset Instrument Approach/Precision Runway Monitor
**Demand management concept assumes restrictions on the number of flights using airport runways as well as potential increases in runway capacity due to future advances in air traffic control technology (See Chapter 5).

Figure 6a

Airport Runway Demand/Capacity Ratio

OAK

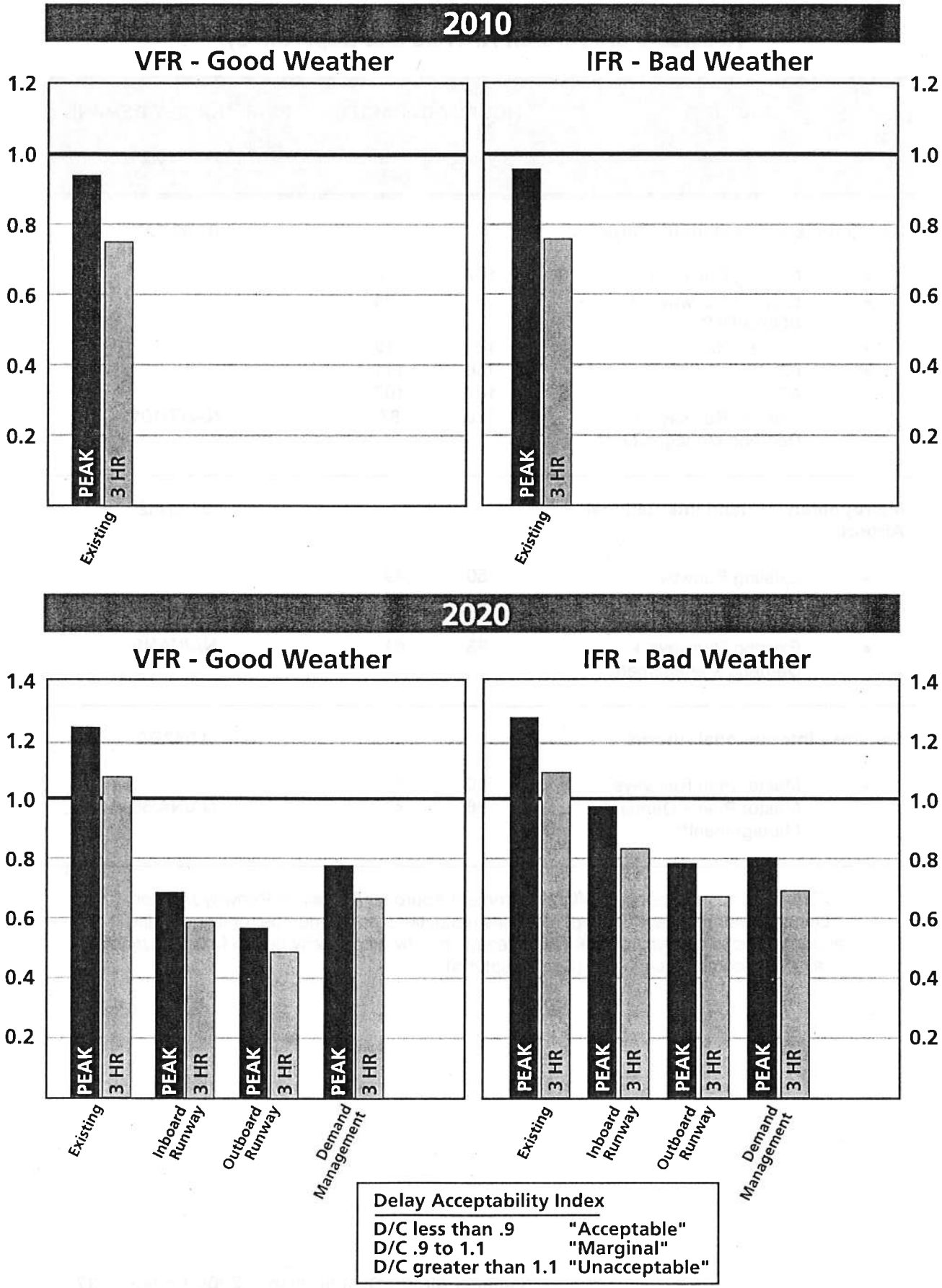
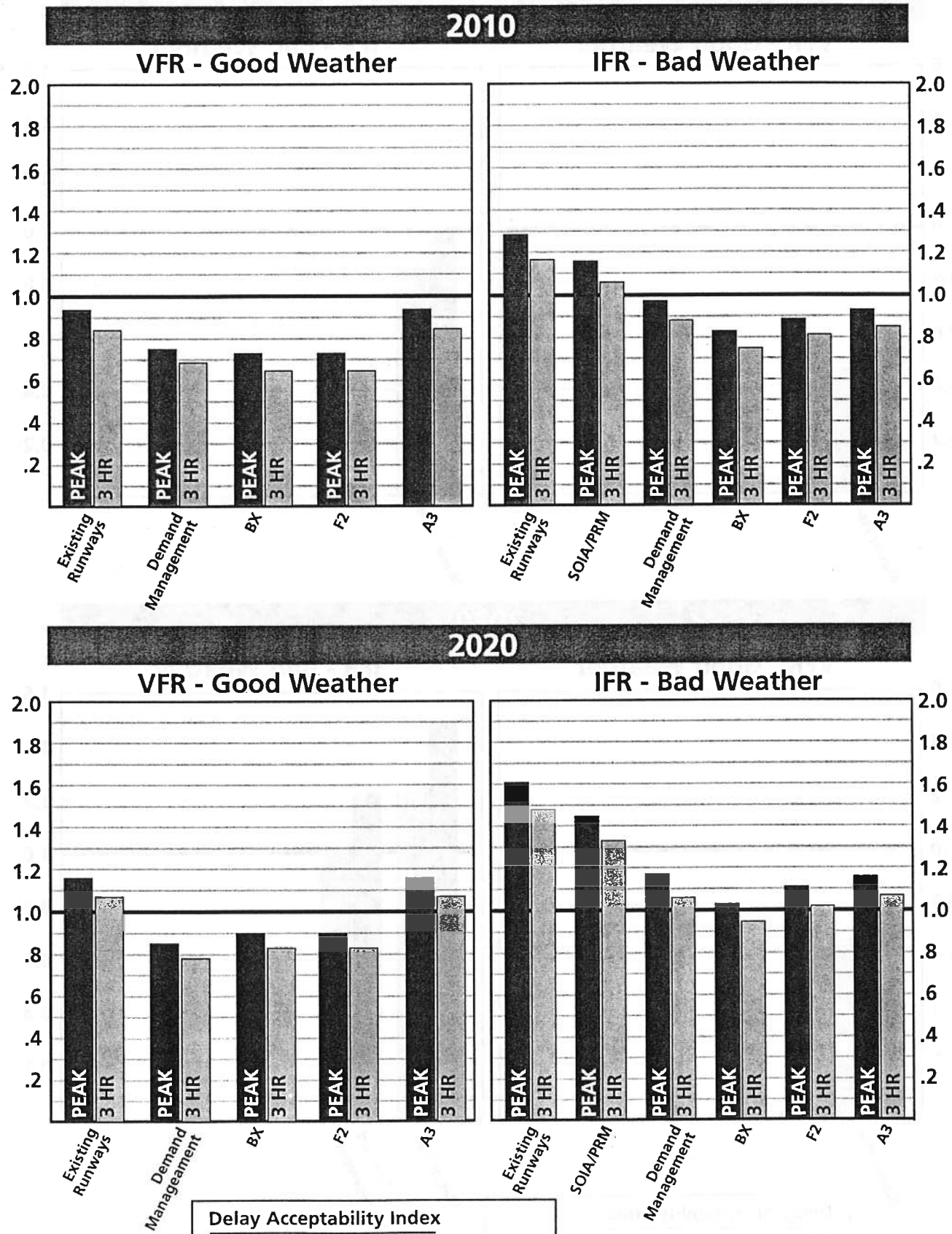


Figure 6b

Airport Runway Demand/Capacity Ratio

SFO

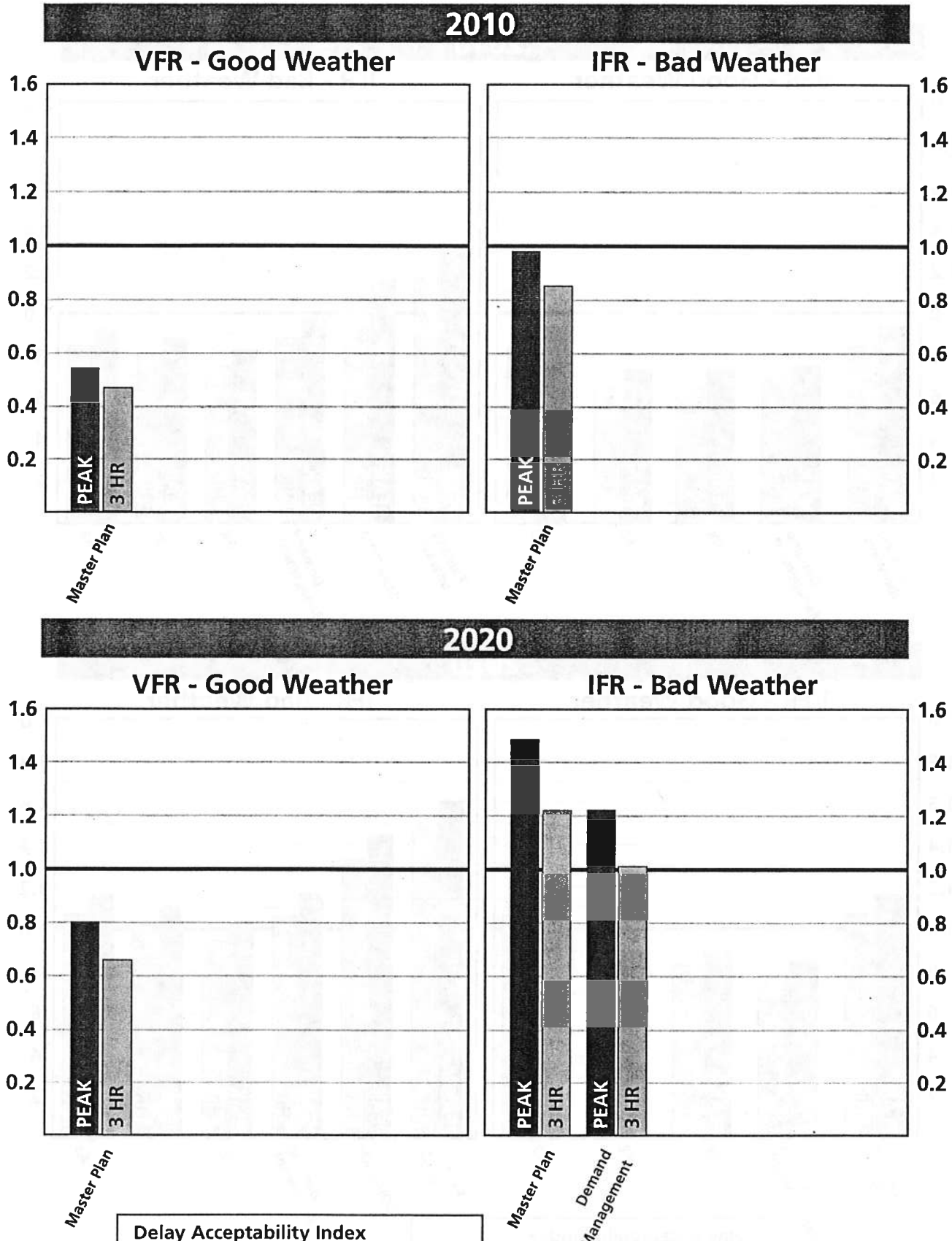


Delay Acceptability Index	
D/C less than .9	"Acceptable"
D/C .9 to 1.1	"Marginal"
D/C greater than 1.1	"Unacceptable"

Figure 6c

Airport Runway Demand/Capacity Ratio

SJC



How Will Different Airport Runway Configurations Perform As A System, Including Interactions Between The Runways and Airspace?

A tool that has also been used to better understand the future amount of delay and reasons for the delay at Bay Area airports is a computerized airport and airspace simulation model, called SIMMOD. SIMMOD is widely accepted and used by the FAA in analyzing interactions between airports and evaluating airspace operations. The SIMMOD model was operated for a set of "primary" runway alternatives identified by the Regional Airport Planning Committee (See Figure 7). These alternatives represent different combinations of runway configurations at the three airports and were simulated for different weather and instrument conditions (West Plan VFR, West Plan IFR, and Southeast Plan IFR) and different forecast years. Figures 8a and 8b schematically depict the Bay Area's complex airspace which involve multiple routes for aircraft arriving and departing the three major airports.

Because SIMMOD is a simulation model, it traces the movement of each individual aircraft on the airfield and in the airspace over a 24 hour period and summarizes delay statistics for these operations. The airspace simulation model was first validated for current (1999) conditions and then used for projected activity levels in 2010 and 2020. The main inputs to the SIMMOD model are:

Airfield Related-includes the layout of the runways and taxiways and gates; gate utilization rates, routes used between runways and gates, departure lineup procedures, and aircraft takeoff and landing characteristics

Airspace Related-includes airspace routings, airspace utilization, aircraft separation standards (including wake turbulence), arrival and departure procedures, metering and flow constraints, etc.

Activity Data- includes the number of daily arrivals and departures from each Bay Area airport to each domestic and international destination and the mix (size) of aircraft which determines airspace separation requirements

The main benefit of this airport simulation tool is that it can provide a much more detailed picture of the extent and causes of delays, including bottlenecks in the airspace itself. Thus it can describe how delays at one airport, such as SFO, affect flights into and out of OAK and SJC, considering the operation of the larger Bay Area airspace. Statistics generated by these simulations are then summarized by airport and runway configuration to identify significant differences in airport and airspace performance.

(Final results to be added after September 8)

Will There Be Significant Airspace Interactions With New/Reconfigured Runways?

Because of the complexity of the Bay Area's airspace routes, there could be potential interactions in the future due to new or reconfigured runways at existing commercial airports and/or accommodation of some flights at alternative airports. We have identified the following types of potential airspace interactions:

- **OAK/SFO**. If a new outboard runway in the Bay is developed at OAK and used for landings during Southeast Plan weather conditions, it could affect flights landing at SFO on SFO's existing runway system as well as on any reconfigured runways. The conflict arises due to lack of required vertical separation between aircraft arrival streams to both sets of airport runways under Southeast Plan conditions (which occur about 5% of the time). This interaction has been identified as a significant issue which the FAA must help resolve. Possible remedies include: using the outboard runway for departures instead of arrivals in the Southeast plan, constructing an inboard runway at OAK, raising the glide path for aircraft landing at SFO, shifting the threshold of the outboard runway to the east or west, or using advanced air traffic control sequencing tools to minimize loss of capacity at both airports.

- **SFO/SJC**. FAA has recently proposed a new procedure termed SOIA/PRM (Standard Offset Instrument Arrival procedure//Precision Radar Monitor) that could increase arrival rates at SFO during certain poor weather conditions (i.e. when ceilings are as low as 1,600 ft and visibility is limited to 4 miles). Such a procedure may affect SJC operations due to the merging of arrival aircraft over the South Bay airspace for final approach to SFO both in the near-term and in the future if similar flight paths are used with SFO's reconfigured runways. The FAA must help resolve this issue.

- **OAK**. Proposed aircraft routings in FAA's Environmental Assessment for SOIA/PRM indicate that there would be a minor effect on operations at OAK by lengthening arrival routes from the south and east, increasing air travel time and airline fuel consumption. These changes are not attributable solely to SFO's new procedure but relate in part to larger airspace efficiency measures being considered by the FAA.

- **SJC/Moffett Federal Airfield**. Runways at these airports are operationally dependent during poor weather when departures/arrivals at one airport would need to be held to allow an operation to take place at the other airport.

- **California Corridor Flights out of General Aviation Airports.** Initiation of flights to Southern California from one or more general aviation airports could require new airspace procedures for sequencing traffic with OAK and SFO. The most significant interactions would occur if service were to be provided at Gnoss (Marin County) and Buchanan (Concord). Airports further removed from the core of the Bay Area's airspace would have less interaction (e.g. Travis AFB, Sonoma County, Livermore, South (Santa Clara) County). The implementation of Global Positioning System (i.e. satellite based) navigational systems replacing the current Instrument Landing Systems (ILS) systems could provide significantly improved all weather navigation capability for these smaller airports.

Figure 7
REGIONAL RUNWAY ALTERNATIVES

ALTERNATIVE	San Francisco International Airport	Metropolitan Oakland International Airport	San Jose International Airport
1	**Existing** No change in runways	**Airport Development Plan** Airfield improvements include taxiways and aircraft holding bays only	**Master Plan** Two air carrier runways 11,000 ft. long (700 ft. separation)
2a 2b	**Refined BX** **F2**	**Airport Development Plan** (Same as above)	**Master Plan**
3	**A3**	**New Inboard Runway** (750 ft. spacing)	**Master Plan**
4a 4b	**Refined BX** **F2**	**New Inboard Runway** (750 ft. spacing)	**Master Plan**
5	**Existing** No change in runways	**New Outboard Runway** (Up to 4,300 ft. spacing)	**Master Plan**
6a 6b 6c	**Refined BX** **F2** **A3**	**New Outboard Runway** (Up to 4,300 ft. spacing)	**Master Plan**

Figure 8a

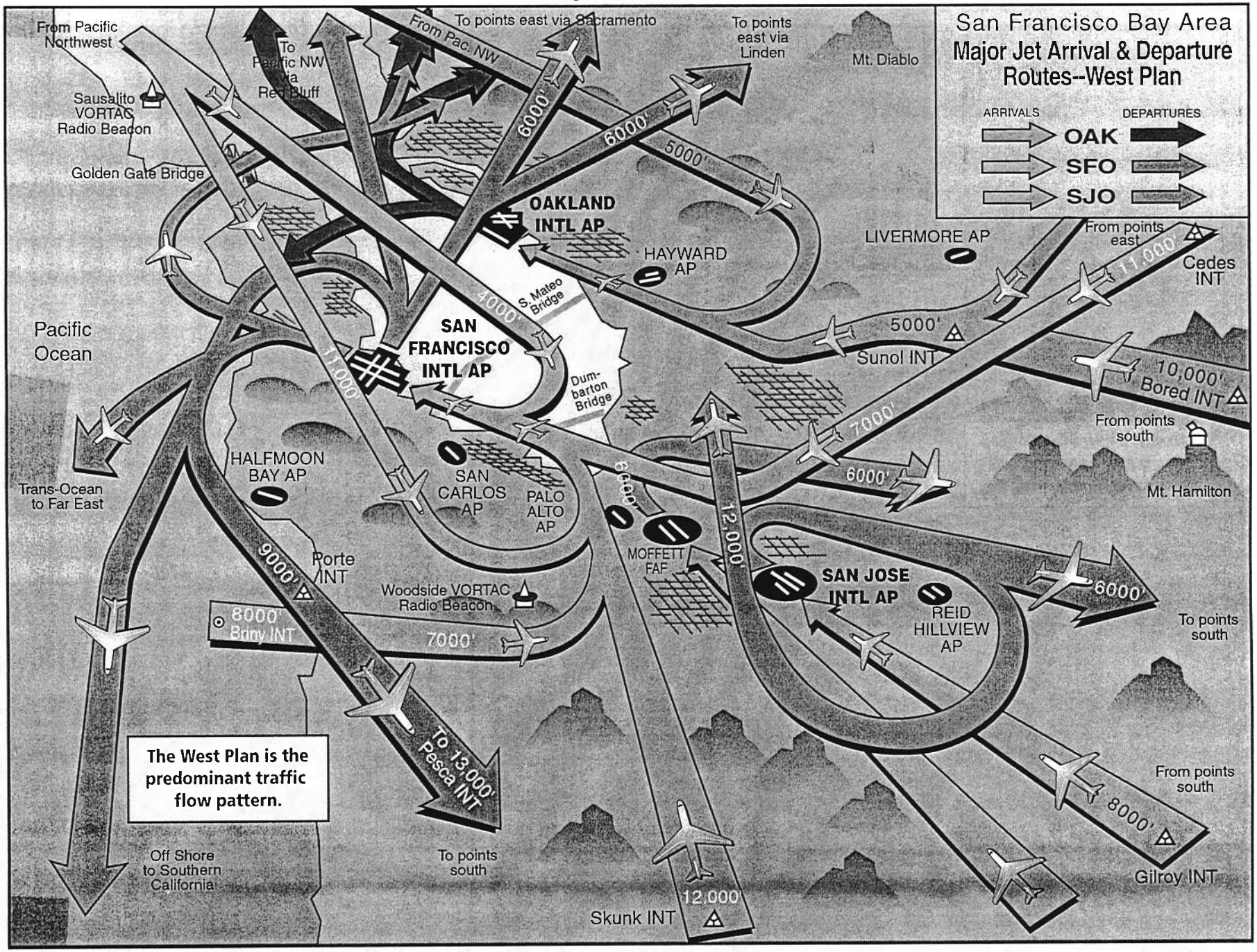
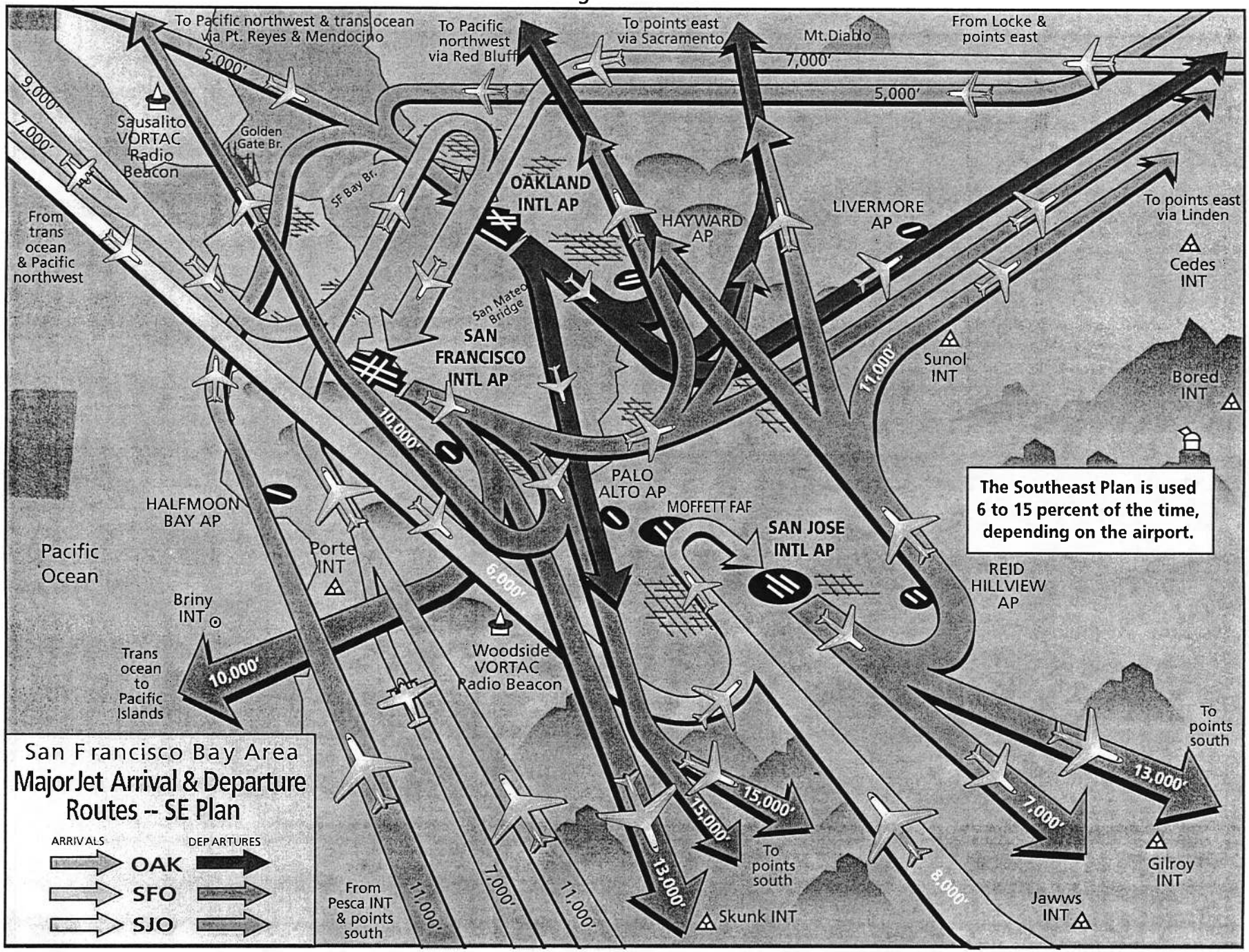

San Francisco Bay Area
Major Jet Arrival & Departure Routes--West Plan
ARRIVALS
DEPARTURES
OAK
SFO
SJO
From Pacific Northwest
To Pacific NW via Red Bluff
From Pac. NW
To points east via Sacramento
To points east via Linden
Mt. Diablo
Sausalito VORTAC Radio Beacon
Golden Gate Bridge
6000'
6000'
5000'
OAKLAND INTL AP
HAYWARD AP
LIVERMORE AP
From points east
11,000'
Cedes INT
S. Mateo Bridge
4000'
SAN FRANCISCO INTL AP
Pacific Ocean
11,000'
Dum-barton Bridge
5000'
Sunol INT
10,000'
Bored INT
7000'
From points south
HALFMOON BAY AP
SAN CARLOS AP
PALO ALTO AP
8000'
6000'
Mt. Hamilton
Trans-Ocean to Far East
MOFFETT FAF
12,000'
9000'
Porte INT
Woodside VORTAC Radio Beacon
SAN JOSE INTL AP
REID HILLVIEW AP
6000'
8000'
Brimy INT
7000'
To points south
The West Plan is the predominant traffic flow pattern.
To 13,000'
Pesca INT
From points south
8000'
Off Shore to Southern California
To points south
Skunk INT
12,000'
Gilroy INT
1998

Figure 8b


To Pacific northwest & trans ocean via Pt. Reyes & Mendocino
To Pacific northwest via Red Bluff
To points east via Sacramento
Mt.Diablo
From Locke & points east
5,000'
7,000'
5,000'
9,000'
7,000'
Sausalito VORTAC Radio Beacon
Golden Gate Br.
SF Bay Br.
OAKLAND INTL AP
HAYWARD AP
LIVERMORE AP
To points east via Linden
Cedes INT
From trans ocean & Pacific northwest
San Mateo Bridge
SAN FRANCISCO INTL AP
Sunol INT
11,000'
Bored INT
10,000'
PALO ALTO AP
MOFFETT FAF
SAN JOSE INTL AP
The Southeast Plan is used 6 to 15 percent of the time, depending on the airport.
HALFMOON BAY AP
Pacific Ocean
Porte INT
6,000'
REID HILLVIEW AP
Briny INT
Trans ocean to Pacific Islands
10,000'
Woodside VORTAC Radio Beacon
To points south
13,000'
15,000'
15,000'
7,000'
13,000'
To points south
Gilroy INT
From Pesca INT & points south
11,000'
7,000'
11,000'
Skunk INT
8,000'
Jawws INT
San Francisco Bay Area
Major Jet Arrival & Departure Routes -- SE Plan
ARRIVALS
DEPARTURES
OAK
SFO
SJO
1998

CHAPTER 7
ENVIRONMENTAL AND OTHER CONCERNS

WHAT WILL BE THE POTENTIAL EFFECTS OF INCREASING AVIATION ACTIVITY ON NOISE, AIR QUALITY, GROUND TRAFFIC, AND THE BAY, IF NEW RUNWAYS ARE CONSTRUCTED IN THE BAY?

RAPC has reviewed the effects of anticipated growth in aviation demand on bay resources, overflight noise, airport emissions related to air quality issues, ground access, and the seismic vulnerability of airport runways. These topics are discussed in greater detail in various reports (see Appendix B). MTC incorporates the Regional Airport System Plan as the Airport Element of the long range *Regional Transportation Plan*, but does not prepare an environmental report since airport decisions are not under MTC's purview. The primary sources of environmental impact information are federal and state environmental reports prepared by the airport operators for their master plans or for specific projects. These documents also include the necessary commitments to mitigate significant adverse impacts identified during the environmental review process. Our analysis complements that of the individual airports by providing a larger regional overview of trends in the potential impact areas listed above.

Bay Resources. As mentioned earlier, new runways in the Bay could require over 1,400 acres of new fill if both SFO and OAK were to add new/reconfigured runways (see Figure 9). Significant Bay resource issues were identified by a panel of scientific experts at a workshop in 1999; the panel also suggests the primary areas of investigation that will be required to answer critical questions. Further, BCDC staff has developed a "Scorecard" of environmental issues relevant to BCDC's authority which will be filled in once information becomes available (See Appendix F). SFO and the FAA have selected scientists in five specialties to help develop information on Bay Resources.

BCDC's responsibilities under the McAteer-Petris Act are triggered by most of the alternative development proposals at SFO and OAK; however, SJC is out of its jurisdiction. In order to authorize new Bay fill for runways, the law requires the Commission to find: that there are no feasible upland alternatives to Bay fill; that any permitted fill is the minimum necessary; that public access to the Bay is maximized, and that all significant adverse environmental impacts are mitigated to the maximum practical extent. Moreover, fill is explicitly allowed for essential airport expansion.

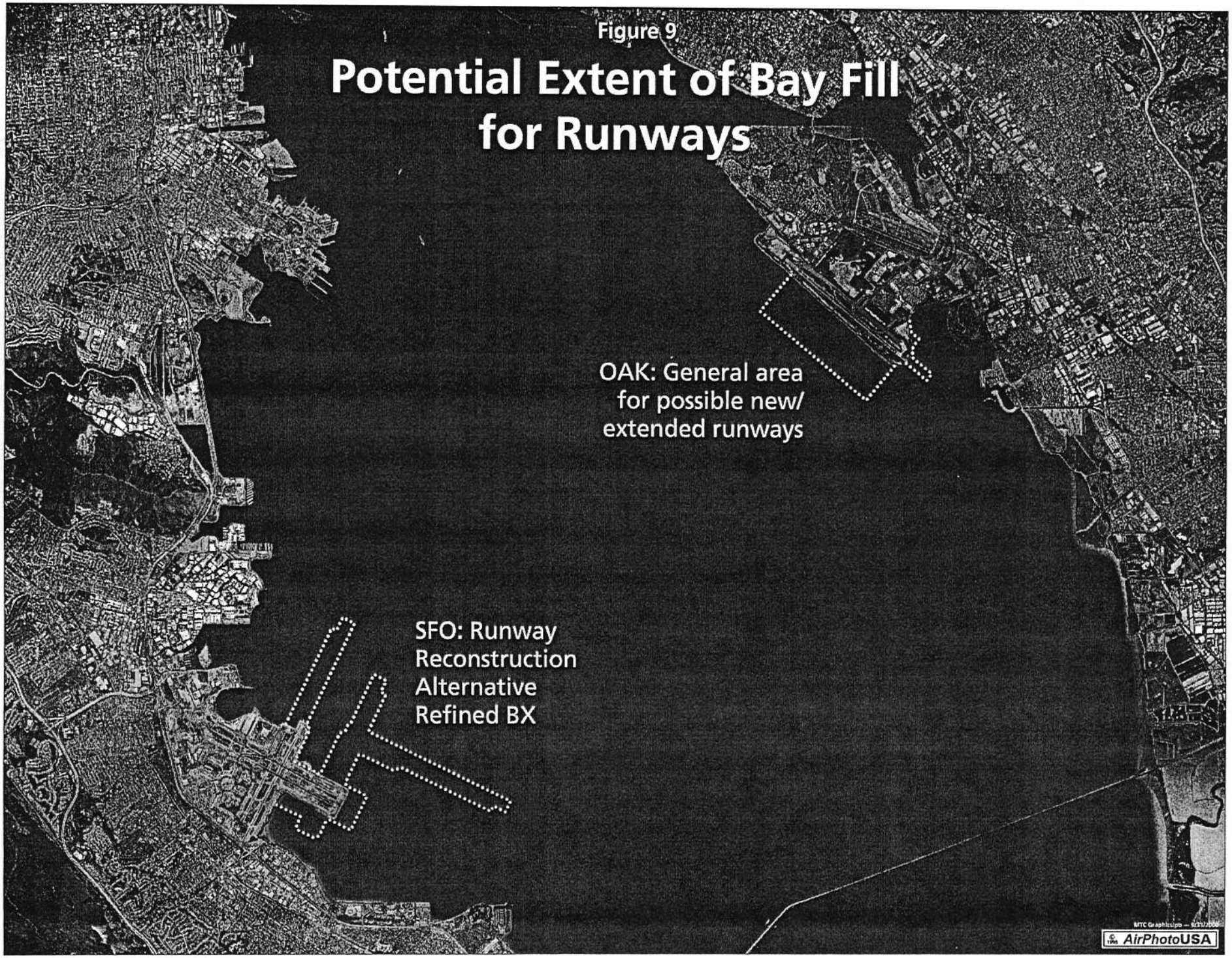


Figure 9
Potential Extent of Bay Fill for Runways
OAK: General area for possible new/ extended runways
SFO: Runway Reconstruction Alternative Refined BX
AirPhotoUSA

SFO is analyzing detailed reconfiguration alternatives and OAK is working on more conceptual plans for additional runways. Because both potential projects are in the planning stages, the required environmental assessments have yet to be completed. An independent scientific panel was convened in October 1999 to identify potentially significant Bay resource issues. This effort will help agencies anticipate the individual and cumulative impacts of new runways on the Bay. Furthermore, BCDC staff prepared a "Scorecard" of affected Bay resources and a scaling methodology to assess runway development scenarios proposed in the RASP's SIMMOD airspace capacity model (see Figure 7). Once the model is run successfully and additional environmental information is available, the scorecard can help assess the proposed runway capacity expansions' impacts on the Bay.

FINDINGS

- EIR/EIS documents for any runway expansion must include assessments of: hydrology (circulation impacts on the South Bay are important); geology (particularly sedimentation), biology (fish habitat impacts are critical); water quality; Bay recreational resources (windsurfing and boating are important); aesthetics; air quality; noise; and surface transportation.
- The cumulative impact of meeting the flight demand as projected by RAPC must be assessed on Bay resources as well as the airspace.

Overflight Noise. Communities closest to airports have benefited by the federal requirements (the Airport Noise and Capacity Act of 1990) that all commercial aircraft meet lower Stage 3 noise levels by January 1, 2000. Thus, changes in the aircraft fleet have significantly improved noise levels in the immediate vicinity of airport runways compared to prior years when substantially noisier aircraft were allowed to operate. While state law defines acceptable noise levels (termed Community Noise Equivalent Levels) for residents of communities near airports, there is no noise metric that defines acceptable levels at greater distances from the airport runways and at higher altitudes. RAPC reviewed this emerging overflight noise issue in four subregional public workshops, the purpose of which was to better understand the reasons for recent perceived changes in overflight noise around the Bay Area. In general, people believe there have been noticeable changes in the last two years, which they attribute to one or more of the following reasons: changes in aircraft flight tracks, a greater number of operations in the late night or early morning, and more aircraft flying at low altitude.

For the purposes of the RASP update, we focused on the larger regional issue of overflight noise. We projected flight track activity for each airport for an average day in August (the peak month) in 2010 and 2020. Specific factors evaluated included number of operations by flight track, types of aircraft flying these tracks in the future, and the time of day of the flights (See Appendix G *and Regional Overflight Noise Trends Report listed in Appendix B*). We caution that these projections involve numerous planning assumptions for distant future years and in actuality there is considerable variability on a daily and seasonal basis due to decisions made by pilots and Bay Area air traffic controllers.

FINDINGS

- Airport noise, both close to the airport runways and farther away at higher altitudes, is affected to some extent by the type of aircraft using the airports. The predominant type of aircraft at OAK and SJC (about 60%) will continue to be the 125+ passenger versions of the B737 and MD 80 type aircraft, whereas SFO will have a greater proportion of larger and heavier aircraft used for long haul domestic and international markets and significantly fewer aircraft in B737/MD 80 size category.
- Average daily flights in 2020 will be about 70% higher than 1999 at OAK, 30% higher at SFO, and 63% higher at SJC.
- The change in the use of flight tracks will be most prominent at OAK and SJC due to the addition of flights to new destinations, such as flights to the Midwest, South, and East Coast.
- Our forecasts do not indicate a significant shift in the distribution of flights between different times of the day, i.e., "day" (7 a.m. to 7 p.m.), "evening" (7 p.m. to 10 p.m.) and "late night" (10 p.m. to 7 a.m.). However, there will be greater numbers of flights in all time periods as would be expected from the projected growth in operations.
- No international standards have yet been adopted to transition from quiet Stage 3 aircraft to proposed, and even quieter, "Stage 4" aircraft noise levels. Any transition would necessarily occur over a number of years

Air Quality. Air quality is regulated by the state and federal governments to meet-health based standards. The development of air quality plans is a responsibility shared by federal, state, and regional agencies. In the Bay Area, the primary pollutants of concern are ground level ozone and small airborne particles, called particulates. Combustion of all fossil fuels creates certain chemicals that in high concentrations are known to be hazardous to health.

The RASP has considered future trends in emissions from aircraft and airport ground transportation modes used by air passengers and airport employees (automobiles, vans, buses, etc.). Emissions from airport ground service equipment and aircraft refueling have not been estimated but are normally provided as part of airport environmental documents. Future aircraft emissions were estimated based on the number of flights projected for 2010 and 2020 by type of aircraft. Ground transportation emissions were estimated from information gathered from MTC air passenger surveys on how passengers get to the Bay Area airports and by MTC forecasts of daily trips made by airport employees (See Appendix H).

FINDINGS

- Even with increasing airport vehicle trips, overall emissions of Reactive Organic Gases (ROG) and Nitrogen Oxides (NOX) will decline due to emission controls placed on automobiles by state regulators.
- However, emissions from commercial and general aviation aircraft using the air carrier airport runways will increase 80% for ROG and about 95% for NOX over the 20 year horizon as aircraft operations grow. While aircraft are likely to become an increasing share of regional emissions, total regional emissions are projected to decline over time due to mobile source controls mentioned above and other types of controls.
- Increased aircraft emissions are due, in part, to assumed increases in taxiing and idling time on airport runways and taxiways due to congestion.
- There are presently no standards in place to further lower emissions from aircraft engines, although there are ongoing discussions between the US and other nations on this topic.
- Some additional areas where airport emission reductions could be achieved include refueling, airport ground equipment and provision of electrical ground power to aircraft at the gate. Several Bay Area airports are actively pursuing one or more of these strategies.

Airport Ground Access. Growth in air passenger and air cargo volumes will generate increased auto and transit trips to the three airports. In the case of San Francisco International Airport, both the freeways and regional transit connections (BART and Caltrain) are being significantly improved in anticipation of future travel demands. At San Jose and Oakland airports, several major projects are funded to improve airport access while others such as automated rail

connections between the airport terminals and adjacent mass transit systems are being planned but are not yet fully funded. Regionally, a number of projects that will improve airport access are currently included in MTC's long range *Regional Transportation Plan*, while others have already been identified as a high priority should new funding opportunities present themselves (see Appendix I).

Obviously, the level of existing congestion on the Bay Area freeways suggests that additional airport trips will exacerbate traffic problems, particularly if the peaking of flights coincides with the peak commute times. It is clear that the key airport access strategy in the future has to be one of providing alternative means to get to the airports other than by personal car. Our forecasts of future air passenger and airport employee traffic at each airport reflect existing travel behavior as well as a modest increase in transit use based on planned improvements to the three airports. In response to increasing inconvenience in getting to the airports, it is possible that air passengers and airport employees will adjust their trips in terms of airport used, ground transportation modes, surface routes, and/or flight times. In addition to new connections by mass transit, there further planning will soon take place on a new water-based transportation network, yet to be funded, which could connect airports with ferry service from selected locations around the Bay.

FINDINGS

- Recent traffic counts indicate that the freeways serving all three airports are heavily congested during peak travel periods.
- There will be about 200,000 total daily air passenger vehicle trips to the three commercial airports in the region in 2020, an increase of about 84% from 1998. Vehicle trips by air passengers from outside the region will comprise about 8% of this number.
- The rate of increase in vehicle trips is estimated to be lower than the growth rate for air passengers (96%), due to the use of transit and higher occupancy vehicles (door-to-door shuttles, charter buses, hotel courtesy vehicles, etc.) to reach the airports. Use of public and private transit will range from 2% at SJC to 16% at SFO.
- The share of vehicle trips for each airport in 2020 is SFO (45%), OAK (27%), and SJC (28%). This is roughly the reverse of the passenger shares, where SFO has 55% of the passengers versus OAK and SJC which have 45% in 2020.
- Vehicle trips to OAK (56,000 daily trips in 2020) and SJC (59,000 trips in 2020) will increase at a much faster rate than SFO due to significant flight additions at these airports.
- Projected airline flight times based on the markets served at each airport, indicate about 39% of OAK and SJC air passenger trips will occur in the commute period (3 morning hours and 3 evening hours) versus 33% at SFO.
- Airport employees will largely drive to work (71%), but a significant percentage will also carpool (14%) and take transit to the airports (11%). Employee shifts also have the potential to be staggered to avoid exacerbating peak period congestion on the freeways.

Seismic. A study of the seismic vulnerability of Bay Area airport runways conducted by ABAG and their consultants concluded that all three commercial airports are highly vulnerable to damage from a future Bay Area earthquake on the San Andreas or Hayward faults. A major earthquake would cause liquefaction and associated differential settlement. Damage would not just affect the ends of runways, leaving the remainder of the runway usable, but the damage would also likely extend along bands crossing the central portions of the runways (Additional geologic and geotechnical information would be useful to help predict

earthquake-induced damage at OAK, SFO, and SJC under specific earthquake scenarios). Engineering measures typically used to fix seismic problems would require the closing of runways at SFO and OAK, something that is probably not feasible unless undertaken as part of a larger runway construction project. SJC could strengthen its runways as they are being presently reconstructed and lengthened.

CHAPTER 8
NEXT STEPS

The Plan's principal recommendation is that the process proceeds to complete the essential environmental analysis of new runway options at the existing airports (Chapter 2, Recommendation 5b). This recommendation recognizes that the central question that must eventually be asked and satisfactorily answered as part of any regional airport plan is the potential to expand the existing airports. If such expansion is not possible for environmental or other reasons, it will be necessary to reconsider other alternatives that have been addressed in this plan update but do not now appear to provide the necessary capacity to serve the projected demand.

The RASP provides a systems level overview of regional airport issues, recognizing that many of the questions that have been raised in this plan update will have to be addressed with additional information provided by the airports, FAA, and other responsible agencies. Therefore RAPC offers the following Checklist of issues for each airport that are relevant to this continuing evaluation. RAPC will continue to serve as a forum for fostering cooperation between the airports, and this chapter identifies the key areas for regional airport cooperation.

RAPC will also continue to meet in order to monitor issues raised in the RASP. RAPC further expects that the airports and FAA will make periodic reports back to the Committee on these issues and that the Committee may wish to provide additional comment at that time. RAPC also intends to seek public input on priorities for further planning activities after the plan update is completed.

RAPC wishes to specifically highlight the following next steps:

1. RAPC recommends that MTC and ABAG continue to integrate surface, air, water transportation and land use planning for the region to ensure that the region's citizens will be able to reach the region's airports without undue delay and thus effectively use the additional air transportation capacity provided through the implementation of the RASP.
2. RAPC requests that the region's three major airports agree to continue to cooperate in their planning and operations to resolve potential operational conflicts prior to proceeding with development of a runway at any airport.
3. RAPC recommends that to gain the maximum use of the existing and planned air transportation infrastructure in the region, FAA and NASA should give the San Francisco Bay Region the highest priority for the allocation and investment of federal funding for improvements in air traffic control technology in recognition of the region's high number of delays.

4. RAPC will schedule regular meetings to monitor the operation of the regional air transportation system, any changes in demand data, innovations in air transportation or control technology, further environmental studies, etc. to determine whether RAPC should consider revising the RASP.
5. RAPC offers to serve as a regional forum at which the public can express their views on noise, safety, environmental impacts, flight delays or any other issue related to the operation of the region's airports.
6. RAPC requests that staffs of ABAG, MTC and BCDC develop a financial plan that would provide funding to support RAPC's ongoing operations.

General

We expect that many of the issues listed below will be addressed in the draft EIR/EIS for the proposed runway reconfiguration project to be available in the summer of 2001.

Airport Delay and Airspace Interactions

Airspace route changes associated with SFO's reconfigured runways

It is not yet clear what changes in airspace routes are required for SFO's proposed runway reconfiguration versus route changes the FAA may wish to implement for other airspace efficiency purposes. SFO and FAA should clarify this issues in the draft EIR/EIS.

Airspace interactions between new runways at OAK and SFO.

A new outboard runway in the Bay at OAK appears to create airspace conflicts with SFO's existing runways in Southeast Plan conditions when used for arrivals. This conflict would become more complicated with SFO's alternative BX Refined that provides simultaneous landings to two runways in Southeast Plan conditions (there would be no conflicts between Alternative BX Refined and OAK's existing runway). There are several ways the potential conflict could be resolved as described in this report. SFO, OAK, and the FAA are working to resolve this issue.

Airspace interactions through implementation of SOIA/PRM

The FAA has proposed installation of a Precision Runway Monitor and Simultaneous Offset Instrument Approach Procedure at SFO to increase SFO arrival capacity during inclement weather, thereby reducing delays. These procedures require changes in aircraft feeder routes to SFO, including more aircraft merges over the South Bay. SJC has indicated these procedures could affect their operations. This issue will need to be addressed by the FAA in responding to comments on the Draft Environmental Assessment for the proposed procedures.

Airport Access Rule Development under Part 161.

Conclusion 3b requests that SFO continue to define an airport access rule addressing airline scheduling and equipment adjustments that would be needed to reduce delays. This rule would preserve the option to proceed with the FAA Part 161 process if delays are not reduced to more acceptable levels. It is recommended that a draft rule be developed concurrently with the environmental process.

Overflight Noise

Close-in Airport Noise

Reconfiguration of SFO's runways, one of the stated objectives for the runway improvements, has the potential to lower noise in communities near the airport by enabling more flights to operate over the Bay and by locating runways and runway thresholds further away from existing built up areas. The SFO draft EIR/EIS will examine changes in the number of residential units exposed to 65 CNEL or higher, the state standard for allowable noise in residential areas.

Higher altitude "overflight" noise.

At the same time, the proposed runway reconfiguration project could produce proportionately greater number of flights over some areas further away from the airport due to increased departures over the Bay and/or due to new or altered feeder routes to the reconfigured airport runways. Given the altitude of these flights, it is not clear whether these operations would constitute a significant noise impact. The draft EIS/EIR should define the criteria for a significant noise impact and indicate which locations around the Bay would be affected.

Air Quality

Regional emissions. Since airport emissions that contribute to ozone are projected to increase (largely from increased numbers of flights), the airport should coordinate with the Air District in evaluating the potential significance of increases in airport emissions over the longer term. This issue should be addressed in the draft EIR/EIS.

Local emissions. We expect the draft EIR/EIS will contain dispersion modeling of localized emissions, such as carbon monoxide levels, in and around the airport environs.

Hazardous compounds. Our recommendations call for the Air District and CARB to develop a budget and plan for monitoring concentrations of potentially hazardous chemicals near the airport. We encourage the airport to participate in such a program and provide information in the draft EIR/EIS.

Ground Access

Traffic impact analysis.

As indicated in this report, there are a number of Peninsula road and transit improvements that are under construction, planned, or proposed that will help get air passengers and air cargo to and from SFO. For example, we expect that the BART extension will make a major contribution to improving airport access over the long term. The draft EIR/EIS will evaluate the impact of additional airport traffic on nearby freeways and arterials. Given MTC's central role in regional transportation decisions, we encourage SFO to work closely with MTC in preparing the traffic analysis for the draft EIR/EIS.

Analysis of an airport-to-airport connection.
As required by SB 1562, SFO will analyze a rapid rail/water connection between SFO and OAK in the draft EIR/EIS. In addition, MTC will be initiating a new Bay Crossing Study in the Fall of 2000, which will also be considering alternative Bay Crossing options, possibly including an airport-to-airport connection as well (this alternative was in fact evaluated in MTC's 1991 San Francisco Bay Crossing Study). Therefore, SFO and MTC will need to coordinate their respective studies. In a related matter, the draft EIR/EIS should also discuss the compatibility of various SFO runway configurations with Bay Crossing bridge alignments that have been studied in the past, such as the one between I-380 in the West Bay and SR-238 in the East Bay.

New ferry services
MTC, the Bay Area Council, and SFO have all evaluated various ferry improvements for the Bay Area. Recently a Bay Area Water Transit Authority was created by the state Legislature to explore new ferry opportunities, such as service to the airports. SFO should work closely with MTC and the new authority in evaluating the role of ferries in providing access to the airport for future passengers and/or cargo.

Impact on Bay Resources
The Bay Plan establishes that fill is allowed for essential airport expansion and that any permitted fill is the minimum necessary.

Runway designs that minimize fill.
SFO should continue working with resource agencies on runway design options that involve the least amount of fill consistent with the purpose and need for the reconfiguration project.

Bay resources.
BCDC has identified the key Bay resource issues that need to be evaluated in the draft EIR/EIS (i.e., the BCDC "Scorecard"), including the effect of new runways on hydrology, geology, biology, water quality, recreation, and aesthetics. SFO will be conducting its evaluation in close coordination with BCDC and the other resource agencies. RAPC should be periodically briefed on the scientific studies that are underway and the interim findings.

Cumulative impacts on the Bay.
This plan update has determined that new runway capacity will likely be needed at both SFO and OAK (Chapter 2, Conclusion 4a.). Thus, SFO's draft EIR/EIS should address the cumulative impact of fill for runways at both airports to the degree that information regarding an OAK outboard runway is available.

Mitigation for bay fill.
The draft EIR/EIS should also address the cumulative mitigation needs of new runways at both SFO and OAK and whether there are sufficient mitigation sites available for both airports.

CHECKLIST FOR METROPOLITAN OAKLAND INTERNATIONAL AIRPORT

General

We understand that the focus of the OAK's current planning efforts will be to complete the state and federal environmental process for the short term Airport Development Program. At the same time, the airport has undertaken a study of future runway concepts that could meet longer-term projected demand.

Our report (Chapter 2, Conclusion 5b) recommends that OAK develop its runway options in sufficient detail to provide comparable environmental information to that prepared in the early stages of SFO's runway reconfiguration analysis.

Airspace/ New Runways

Southeast Plan airspace interactions with SFO

As explained earlier, a new outboard runway in the Bay at OAK could create airspace interactions with SFO's existing or reconfigured runways under Southeast Plan conditions. Therefore it is important that OAK work with SFO and the FAA to jointly examine ways to avoid or mitigate these impacts through measures listed in this report or other means.

Other OAK runway configurations

In addition to a new outboard runway, the ongoing OAK runway study is evaluating extension/realignment of North Field runways, adding a new perpendicular runway, or adding a new South Field "inboard" runway. OAK should continue to brief RAPC on the results of this study, including the criteria that will be used to narrow down the options.

Impact on Wetlands and Bay Resources

Areas designated as wetlands.

OAK is also investigating a new inboard runway that would not involve Bay fill but would affect areas currently designated as wetlands. OAK and the resource agencies should update RAPC on the extent of these wetlands, the number of acres that would be affected by a proposed inboard runway, and the biological issues involved.

Fill required for new runway in the Bay.

OAK has provided RAPC with preliminary estimates of fill for various outboard runway concepts. OAK should provide RAPC with more precise figures when they are available. It would also be helpful for OAK to describe the construction techniques that are contemplated and the approximate amounts of material required for dredging and filling.

Evaluation of Bay impacts.
While a detailed study of Bay resource impacts is probably a number of years away, OAK is encouraged to provide preliminary information, such as that indicated on the BCDC Scorecard, prior to the next RASP update.

Community Noise Impacts
Community noise levels.
RAPC received considerable testimony from community groups, cities, and individuals about OAK airport noise issues during the public review of the RASP. It is apparent that noise will be a critical factor in determining the feasibility of alternatives for new air carrier runways. Like SFO, a new outboard runway in the Bay at OAK has the potential to mitigate some of the anticipated noise impacts from increasing air traffic. To better understand the noise tradeoffs between an outboard runway in the Bay and other runway alternatives, OAK should provide projected noise contours (CNEL contours) for the different runway options currently under review.

Growth in air cargo operations.
The environmental document prepared for the Airport Development Program should discuss the contribution of air cargo operations to the calculated noise contours and options for altering flight tracks currently used for late night flights.

Air Quality
See comments under SFO Checklist.

Ground Transportation
Traffic Analysis
As discussed above for SFO, OAK should coordinate the ground traffic analysis for future environmental documents with MTC.

BART Connector
An environmental document is currently being prepared evaluating improved transit connections between BART and the OAK airport terminal. In addition, new funding could be provided for this project if a transportation sales tax measure is approved in the November 2000 election in Alameda County. MTC will continue to assist BART and the Port of Oakland with this project and is a member of the Stakeholder Advisory Committee to provide guidance on the current planning and environmental work.

CHECKLIST OF SAN JOSE INTERNATIONAL AIRPORT

General

With the recent approval of SJC's airport master plan, construction has begun on the various projects in the master plan. Like SFO, key highway and road improvements are underway while others will require additional coordination with local and regional transportation agencies regarding funding and project delivery.

Ground Transportation

Several significant airport ground transportation improvements were identified as needing to precede the construction of the new airport terminal (I-880/Coleman Ave interchange and transit connection to the Santa Clara County Valley Transportation Agency (VTA) light rail line). Projects requiring federal and state funds must be included in MTC's Regional Transportation Plan to be eligible for these funds.

Air Cargo Forecasts

SJC (and OAK) have expressed some concerns with the RASP air cargo forecasts given the current rate of growth in the industry. The air cargo forecasts could be improved with more detail about the volume of air cargo generated in the South Bay and other locations in the region. MTC is willing to collaborate with SJC and the other airports on methods to obtain such information.

CHECKLIST FOR FAA

General

The FAA would normally prepare an environmental assessment or Environmental Impact Statement (if significant impacts exist and cannot be mitigated to a level of less than significant) for major airspace changes. The FAA is also a co-lead agency with airports on federal environmental documents for proposed airport improvement projects. In addition, the FAA may undertake more informal airspace reviews from time to time in response to specific issues raised by the public or Congressional representatives.

Airspace

Aircraft routes over Marin and Richmond

In response to a number of public comments and letters from cities and Congressional representatives, the FAA will be evaluating options for addressing overflight issues in Marin County and Richmond. RAPC requests that the FAA present this information to the Committee when it is available.

Public information

Through its regional overflight forums, RAPC has attempted to identify issues and educate the public on the constraints the FAA has in managing the Bay Area airspace. As a follow up to this set of meetings, we believe it would be a service to the public if the FAA, with assistance from RAPC, could provide written material on commonly asked questions and answers which could be distributed to the public when they request such information from the FAA, airports, or RAPC.

Airspace Redesign

RAPC as well as others has expressed an interest in the topic of future redesign of the Bay Area airspace to capture new capabilities associated with future satellite based navigational equipment. It is generally believed that this technology will provide greater flexibility in routing aircraft to airports and have benefits in the areas of safety, efficiency, and noise reduction. The recommendations in Chapter 2 suggest that the first step would be to have FAA and NASA take the lead in developing a conceptual work program for such a study. A letter requesting such a first step could be sent by RAPC with a request that the FAA respond with suggestions about what they could be able to do and in what timeframe.

REGIONAL AIRPORT COOPERATION

The subject of improved regional cooperation between airports is difficult to discuss in the abstract; therefore, we list specific topics that will require cooperation among the airports and between the airports and RAPC.

RASP

- Cooperate with RAPC in identifying issues that require a regional planning approach to their resolution and in ensuring that projects proposed by one airport do not conflict with the reasonable future needs of another airport.
- Cooperate with RAPC with follow on studies to the RASP (e.g. further investigation of air cargo needs, the general aviation airport study, etc.).

Airport Master Plans and Runway Studies

- Keep RAPC and other airports regularly informed of the progress and findings of ongoing studies.

Airspace

- Advocate to the FAA for early deployment of new ATC technologies that will increase Bay Area airspace safety and efficiency.
- Advocate that the FAA develop a work plan for redesigning the Bay Area airspace to take advantage of the airspace efficiency and noise reduction potential of new GPS based navigational technologies.
- Continue to provide the public with up-to-date information on the causes and amounts of delays occurring at each airport.

Surface Transportation

- Cooperate in analyzing and possibly implementing improved ground connections between airports for passengers and air cargo and in undertaking the analysis required by SB 1562 (a high speed connection between SFO and OAK).
- Cooperate with other agencies exploring improved off airport transit access improvements (e.g. new ferry service that might be developed by the Bay Area Water Transit Authority).
- Assist in funding cost effective transit services to the extent permitted by federal law.
- Assist MTC with the next air passenger survey (schedule to be determined).

Overflight Noise

- Cooperate with RAPC and the various airport roundtables in defining a regional approach to addressing the overflight noise issues.

Bay Resources

- Cooperate with BCDC in filling out the Bay Resources "Scorecard" in the RASP.
- Coordinate with other airports that may need future mitigation for airport improvements in developing mitigation plans for airport runway or other projects requiring Bay fill.

Air Quality

- Cooperate with the Bay Area Air Quality Management District and California Air Resources Board in implementing reasonably available control measures to reduce on airport emissions from aircraft operations, ground service equipment, and vehicles used for airport access.
- Cooperate with the air agencies in studying concentrations of potentially hazardous air toxic chemicals in areas near the airports.

APPENDICES

APPENDIX A
1994 REGIONAL AIRPORT SYSTEM PLAN SUMMARY

- Prepared between 1991 and 1994

- Responds to State law requiring MTC Regional Transportation Plan address aviation facilities

- Stated that "the defining issue for the Bay Area airport system is the adequacy of existing runways and airspace to accommodate growth in air carrier and general aviation activity."

- Referred to existing airport master plans as the source of information for airport improvement proposals

- Performed an environmental impact study, but not an EIR

- Contained a set of Goals and Objectives

- Projected growth in passengers, aircraft operations, and air cargo to 2010
  - Assumed a significant redistribution of fights between airports
  - Assumed a significant growth in aircraft size and load factors
  - Assumed a 6% reduction in regional demand due to a combination of factors (e.g. some dispersion of service to Travis, general aviation airports, or HSR
  - Assumed some diversion of general aviation at SJC

- Projections in 2010
  - 84 million annual air passengers
  - 933,000 air carrier operations

- Runway capacity evaluated for annual and peak hour conditions
  - "The existing Bay Area air carrier airport system is only marginally capable of handling forecasted peak period demand and will experience unacceptable VFR and IFR delays during the planning period" (pg 1-12)
  - All airports were projected to have significant IFR problems (pg 1-6)

- Airport shares determined on a policy basis:
  - "The Plan supports a redistribution of regional air passenger activity among the air carrier airports to better balance system demand and capacity" (pg 1-11)
  - " The RASP recommends the following desired airport traffic shares at each level (stage) of air travel growth in the Bay Area" (pg 1-11)

- Oakland International Airport
  - "Specifically the Plan calls for a reevaluation of the second runway option at Oakland Airport at Stage 3 levels of demand. Policies relating to passenger convenience, airspace management, regional noise exposure and economic benefit would support development of a second runway at Oakland Airport to provide the next major increment of airport system capacity" (pg 1-12)

- San Francisco International Airport
  - SFO "development would take place according to the Airport Master Plan (adopted November3, 1992) and would be accommodated with existing runways" (pg 1-14)
  - "Depending on the growth in aircraft size and passenger load factors, existing delay problems during IFR/VFR weather may or may not be exacerbated. If growth in passengers at SFO can be accommodated with nearly the same number of operations (as forecasted in the plan for 2010), delay will not significantly increase. If these conditions are not realized, airlines may hold aircraft at the originating airport or flights may be delayed enroute by the air traffic control system. Overall, service could become less reliable during these weather conditions.) (pg 1-15)

- San Jose International Airport
  - Expand terminals (pg 1-18)
  - "San Jose will have significant IFR airfield capacity problems due to the presence of general aviation activity at the airport" (pg 1-18)
  - "San Jose Airport will require significant diversion of general aviation based aircraft and VFR/IFR operations to meet its regional air passenger share" (pg 1-8)

- Hamilton Army Air Field
  - Delete from RASP as a regional general aviation reliever airport (pg 1-13)
  - "If the airfield is flooded or developed as wetlands, the Plan proposes that the acreage created in this manner be "banked" as mitigation for possible development of airport projects elsewhere in the Bay Area...) (pg 1-13)

- Moffett Field
  - "The Plan does not propose any civilian use of this facility at this time." (pg 1-13)
  - "There is a continuing regional interest in potential civilian us of Moffett, and this interest would be activated if and when NASA no longer requires exclusive use of the facility." (pg 1-13)

- Reid Hillview Airport (General Aviation)
  - "Reid Hillview should be retained as part of the South Bay general aviation system in that it serves a large population of users and provides relief to San Jose Airport.) (pg 1-14)
- Travis AFB
  - "As currently envisioned in the regional airport plan, a joint use airport at Travis AFB would have an annual capacity to initially serve 1 to 2 million annual passengers, and eventually up to 3 million annual passengers or more." (pg 1-20)
  - If sufficient local interest, update the 1976 Joint Use Feasibility Study (pg 1-20)
- High Speed Rail
  - There is no investment plan that will generate competitive rail service (pg 1-12)
- Other
  - The plan included a general aviation component
  - Community noise exposure levels (noise contours) were prepared
  - Airport related air emissions were estimated
  - Ground access demand was estimated

APPENDIX B
REPORTS PREPARED FOR RASP UPDATE 2000

- San Francisco Bay Area Aviation Demand Forecasts (1998 to 2020),
- Airport Sensitivity Analysis-Factors Affecting Demand and Capacity
- Airport and Airspace Capacity Analysis (under preparation)
- Airport Access Report
- Regional Overflight Noise Trends Report
- Airport Emissions in the San Francisco Bay Area
- Airports and Bay Area Earthquakes, ABAG
- Regional Airport System Plan Update Public Workshop-Summary Report, Moore, Iacofano, Goltsman (MIG), June 3, 2000
- Report of the Results of the Over Flight Forums, memo from Walter E Gillfillan to Chris Brittle, May 17, 2000

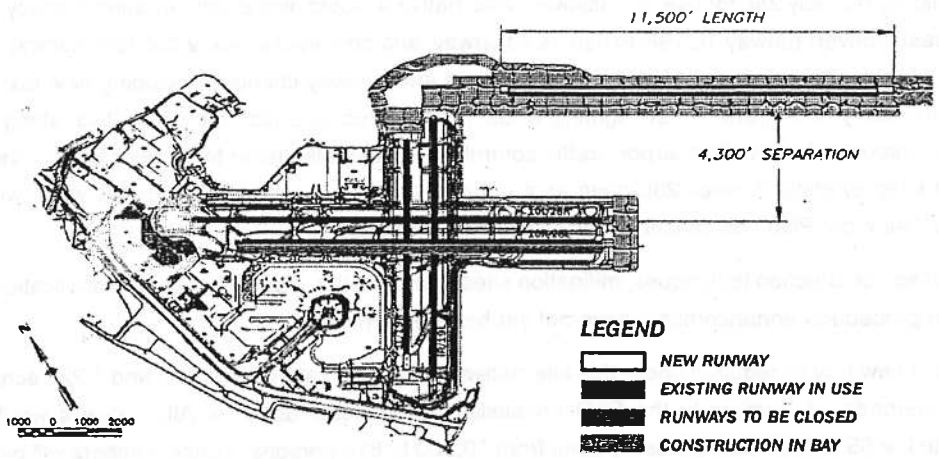
APPENDIX C
POTENTIAL NEW NONSTOP SERVICE IN 2020

	DOMESTIC	INTERNATIONAL
SAN FRANCISCO		
	Milwaukee Indianapolis Tampa Anchorage Columbus	Nagoya Melbourne Auckland Singapore Bangkok Guatemala Monterey Cancun Montreal Manchester Madrid Dublin Brussels
OAKLAND		
	Albuquerque St. Louis Birmingham San Antonio Oklahoma City Boise Baltimore Orlando New Orleans Minneapolis Fort Lauderdale Indianapolis Houston Boston Eugene Detroit Jacksonville New York Atlanta Raleigh-Durham Buffalo	London Amsterdam Paris Cancun Puerto Vallarta Cabo San Lucas Vancouver
SAN JOSE		
	Sacramento Fresno Washington New York City Detroit Raleigh Pittsburgh Philadelphia Orlando Honolulu Eugene Spokane	London Paris Cancun Puerto Vallarta Cabo San Lucas Vancouver Mexico City Frankfurt Osaka Seoul Taipei

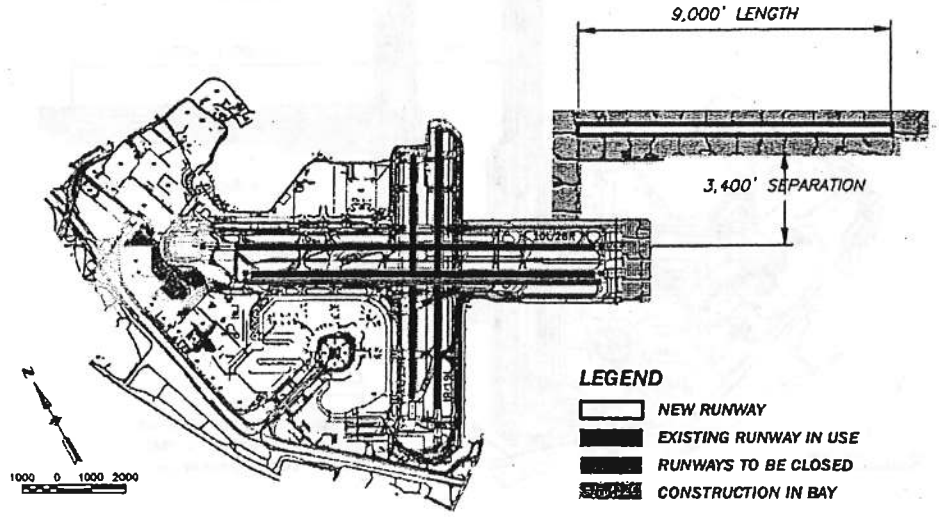
Note: New services represent a plausible set of routes based on known carrier strategies. Actual future city pairs could vary, but specific city identities aside, the number of new routes is indicative of the growing market potential for each airport.

RECONFIGURATION ALTERNATIVE 3A AND 3B
(Alternative 3A is the same as SFO's Alternative A3)

Reconfiguration Alternative 3A (SFO Alternative A3) would construct a new 11,500 foot runway 4,300 feet northeast of the centerline of existing Runway 28R to permit two aircraft to land simultaneously during bad weather conditions, and would convert existing Runway 28L/10R to a taxiway. Other airfield and taxiway changes, including new navigational aids and airfield lighting, would be constructed under this alternative for the new Runway 28R, as would an additional emergency response facility. The airport traffic control tower may also need to be relocated, and runway safety areas would be constructed adjacent to existing Runway 19L and 19R.



SFO has suggested that this alternative could be constructed with a 9,000 foot long runway instead of an 11,500 foot long runway if existing Runway 28L were kept in use as a departure-only runway (instead of a taxiway) when wind conditions force SFO into an "All West" condition (all takeoffs and landings on the Runway 28 system), which occurs about 10 percent of the time.



Reconfiguration Alternative 3B is being studied as a variant to Reconfiguration Alternative 3A. The option currently under consideration for inclusion in the EIR/EIS would construct a new 9,000 foot long runway built to Group V aircraft standards approximately 3,400 feet northeast of the existing Runway 28R, and would convert existing Runway 28L to use as a taxiway, except in the "All West Plan" described under 3A, above. This alternative would connect the new runway with the existing airfield further to the southwest than Alternative 3A, and would construct similar airfield and taxiway changes, including new navigational aids, airfield lighting, runway safety areas, and an additional emergencyresponse facility. The airport traffic control tower may also need to be relocated. This alternative could be constructed 3,400 feet from existing Runway 28R (instead of 4,300 feet away) provided the PRM technology described in Alternative 1 allows simultaneous arrivals in bad weather.

The EIR/EIS will consider a wide range of construction techniques for any Bay fill, including fill with rock dike wall, fill with bulkhead wall, use of piles, floating structures, or some combination of these techniques. The precise nature of these construction techniques has not been determined. The potential for combining features of Alternative 2 (i.e., technological or procedural enhancements and additional noise measures) with the reconfiguration alternatives needs to be determined.

The surface area of new Bay fill required under Alternative 3A is estimated at between 429-605 acres, depending on construction methods and taxiway configurations. Fill amounts for a 9,000 foot runway and for Alternative 3B may be less (but are unknown at this time). According to the SFO Runway Feasibility Study, construction of Alternative 3A would reduce the population living within the 65 CNEL noise exposure zone from 10,300 to 8,600 persons. Potential noise benefits of Alternative 3B are expected to be similar to 3A. These numbers will be refined in the EIR/EIS.

This alternative would include habitat mitigation, borrow, and disposal sites as described on pages 9 -10, below.

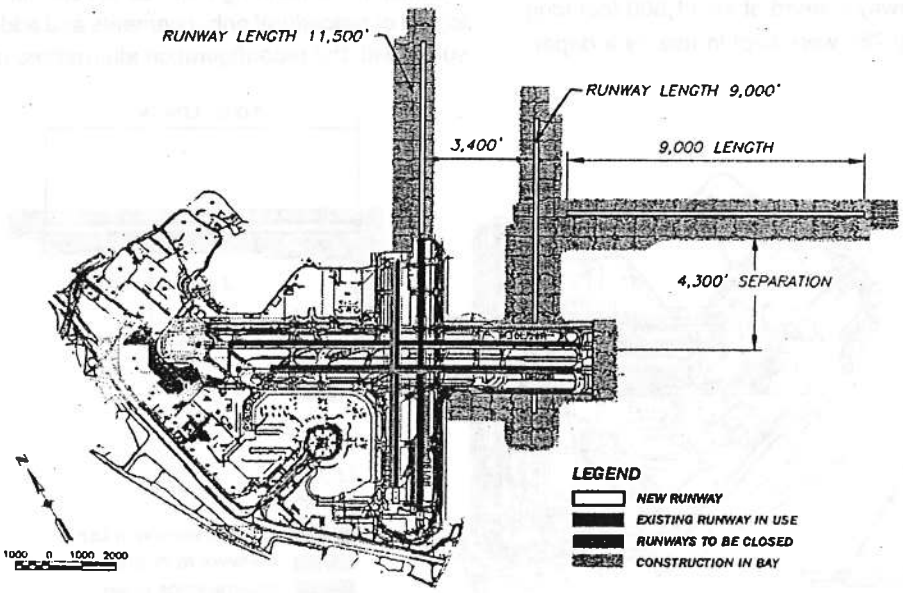
RECONFIGURATION ALTERNATIVE 4

(This aternative is the same as SFO's Alternative BX Refined)

Reconfiguration Alternative 4 (SFO Alternative BX Refined) would construct a new 9,000 foot runway (28R) 4,300 feet northeast of existing Runway 10L/28R to allow two aircraft to land simultaneously during all bad weather conditions and would convert existing Runway 28L for use as a taxiway. Alternative 4 would also extend existing Runway 1R/19L 7,500 feet to the northeast, convert runway 1L/19R to use as a taxiway, and construct a new 9,000 foot Runway 1R 3,400 feet to the southeast of (extended) Runway 1R/19L. Other airfield and taxiway changes, including new taxiways, navigational aids, runway safety areas, and airfield lighting would be constructed under this alternative, along with an additional emergency response facility. The airport traffic control tower may also need to be relocated. A variation of this alternative would keep existing Runway 28L open as a departure-only runway to be used only when wind conditions force SFO into an "All West Plan," as described for Alternative 3, above.

Other issues such as construction techniques, mitigation sites, borrow sites, disposal sites, and application of additional technological and procedural enhancements have not yet been determined.

The surface area of new Bay fill required under this alternative is estimated at between 888 and 1,222 acres, depending on construction methods. According to the SFO Feasibility Study, construction of Alternative 4 would reduce the population living in the 65 CNEL noise exposure zone from 10,300 to 810 persons. These numbers will be refined in the EIR/EIS.



Appendix D – 3

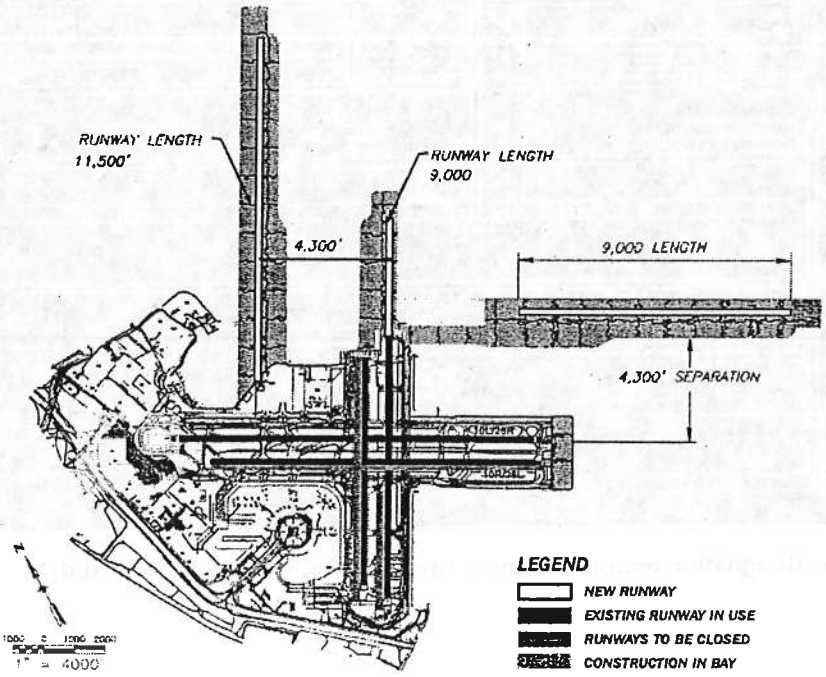
RECONFIGURATION ALTERNATIVE 5

(This alternative is the same as SFO's Alternative F2)

Reconfiguration Alternative 5 (SFO Alternative F2) would construct a new runway 4,300 feet northeast of existing Runway 10L/28R to allow two aircraft to land simultaneously during all bad weather conditions, and would convert existing Runway 28L to use as a taxiway. Alternative 5 would also extend existing Runways 1R/19L by 5,000 feet to the northeast, convert runway 1L/19R for use as a taxiway, and construct a new 11,500 foot runway 4,300 feet northwest of existing Runway 1R/19L. Other airfield and taxiway changes, including new taxiways, runway safety areas, navigational aids, and airfield lighting would be constructed under this alternative, along with an additional emergency response facility. The airport traffic control tower may also need to be relocated. A variation of this alternative would keep existing Runway 28L open as a departure-only runway to be used only when wind conditions force SFO into an "All West Plan," as described for Alternative 3, above.

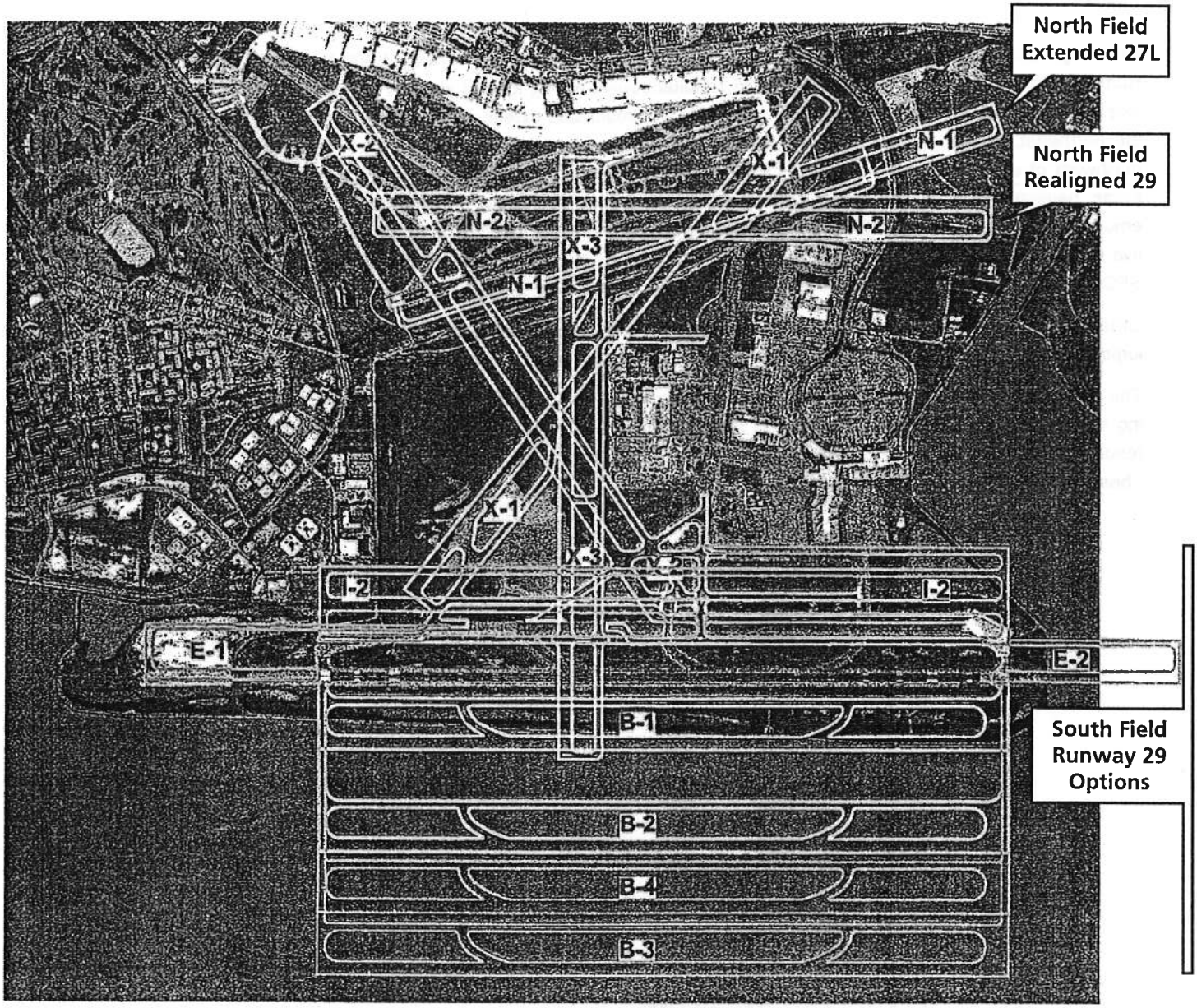
Other issues such as construction techniques, mitigation sites, borrow sites, disposal sites, and application of technological and procedural enhancements have not yet been determined.

The surface area of new Bay fill required under this alternative is estimated at between 959 and 1,332 acres, depending on construction methods. According to the SFO Runway Feasibility Study, construction of Alternative 5 would result in a reduction of the population living within the 65 CNEL noise exposure zone from 10,300 to 840 persons. These numbers will be refined in the EIR/EIS.



Appendix E

Oakland Airport Runway Configurations Under Study



Note: Runway designation options are those used by OAK in their ongoing study

Appendix F

Regional Airport System Plan Update

BAY RESOURCES IMPACT SCORECARD

San Francisco Bay Conservation and Development Commission

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San Francisco, CA 94111

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Revised 1 August 2000

This is a tool to understand the impacts of various proposed airfield developments on San Francisco Bay. The development scenarios described below are the sets of runway proposals currently being modeled for their ability to safely meet the region's projected flight demand through 2020. Most of these runway alternatives require Bay fill. Although the detailed environmental assessment of these proposals is just beginning, this scorecard is a simple method of judging the impacts of individual runway proposals and their cumulative effects. As projects are refined and environmental documents are made public, this scorecard can be completed by scaling the duration and extent of impacts on Bay resources. The matrix proposes a 1 to 4 ranking scheme. The table lists the resources vertically and the scenarios horizontally. A similar matrix system could be designed to evaluate mitigation suitability, priority or severity of impacts. These resources are the considerations required by the law governing BCDC. We hope it provides a useful perspective. Please let us know how we can help you understand these important issues. Thank you.

SCENARIOS

The following scenarios are the Regional Airport Planning Committee's primary runway alternatives being studied for airspace and runway capacity.

Scenario 1

This alternative assumes no additional runways at San Francisco International Airport (SFO) or Metropolitan Oakland International Airport (OAK). At San Jose International Airport (SJC), it considers two 11,000 ft. air carrier runways with 700 feet of separation as described in their Master Plan. This is their level of development for all scenarios. No Bay fill is contemplated at SJC.

Scenario 2a

This scenario analyzes the Refined BX Alternative at SFO and no new runways at OAK. Refined BX would construct a new 9,000 ft. runway 4,300 feet northeast of existing Runway 10L/28R to allow two aircraft to land simultaneously during inclement weather conditions, and would convert existing Runway 28L for use predominantly as a taxiway. This proposal would also extend existing Runway 1R/19L 7,500 ft. to the northeast, convert runway 1L/19R to use as a taxiway, and construct a new 9,000 ft. Runway 1R 3,400 feet to the southeast of extended Runway 1R/19L. Other minor runway modifications and additional facilities are also contemplated. Depending on the construction technique, the surface area of bay fill is estimated to be between 730 and 1,222 acres.

Scenario 2b

Scenario 2b considers no new runways at OAK with the F2 Alternative at SFO. F2 would construct a new runway 4,300 feet northeast of existing Runway 10L/28R to allow two aircraft to land simultaneously during all inclement weather conditions, and would convert existing Runway 28L to use predominantly as a taxiway. It would also extend existing Runways 1R/19L by 5,000 feet to the northeast, convert runway 1L/19R for use as a taxiway and construct a new 11,500 ft. runway 4,300 feet northwest of existing Runway 1R/19L. Other airfield improvements are included in this proposal. Between 789 and 1,332 acres of Bay fill could be required depending on which construction methods are employed.

Scenario 3

This alternative proposes new runways at both SFO and OAK. The runway at OAK would be inboard of the current runways but would not require Bay fill. At SFO, Alternative 3A would be analyzed. This would construct a new 11,500 ft. runway 4,300 feet northeast of the existing Runway 28R to permit two aircraft to land simultaneously during inclement weather conditions and would convert existing Runway 28L/10R predominantly to a taxiway. Other runway improvements and supporting facilities would also be constructed. The estimated Bay fill of the new runway is between 403 and 605 acres depending on construction techniques.

Scenario 4a

This scenario analyzes SFO's Refined BX with the new inboard OAK runway as described above.

Scenario 4b

Scenario 4b combines SFO's Alternative F2 with OAK's new inboard runway as described above.

Scenario 5

This scenario analyzes no new runways at SFO with a new outboard runway (B3) at OAK. The new runway at OAK would be 4,300 foot into the Bay parallel to Runway 11/29. This proposal would fill 459 acres of the Bay and create an enclosed lagoon of 543 acres.

Scenario 6a

Scenario 6a analyzes SFO's alternative Refined BX with OAK's B3 as described above.

Scenario 6b

This scenario analyzes SFO's alternative F2 with OAK's B3 as described above.

Scenario 6c

This scenario analyzes SFO's A3 alternative with OAK's B# as described above.

SCALE OF IMPACTS

TIME → / SPACE ↓	SHORT TERM (Construction Impacts)	LONG TERM (Permanent)
NEAR AIRPORT	1	3
REGIONAL/BAYWIDE	2	4

BAY RESOURCES	SCENARIOS									
	1	2		3	4		5	6		
		A	B		A	B		A	B	C
Hydrology										
Tidal Circulation										
Flooding Impacts										
Sea Level Change										
Geology										
Dredging Impacts										
Sediment Transport										
Mud Wave Potential										
Shoreline Erosion Impacts										
Shoreline Disposition Impacts										
Bathymetry Change										
Habitat Change										
Seismic Safety and Stability										
Biology										
Impacts on Plant Communities										
Impacts on Fish										
Impacts on Marine Mammals										
Impacts on Birds										
Impacts of Invasive Species										
Water Quality										
Effect on Fresh/Salt Mix										
Impact on Sewer Discharge										
Impact on Storm Discharge										
Effect on Turbidity										
Other Non-Point Discharges										
Groundwater/Aquifer Impacts										
Impact on Annual Bay Flushing										
Toxic Impacts										
Recreation										
Effects on Boating										
Impacts on Wind Surfing										
Effects on Sport Fishing										
Impacts on Parks										
Impacts on Public Access										
Aesthetics										
Visual Impacts										
Cultural Impacts										
Air Quality										
Aircraft Emissions										
Truck/Barge Emissions										
Microclimate impacts										
Noise										
Aircraft Noise										
Construction Noise										
Surface Transportation										
Traffic Generation										
Construction Traffic										
Potential for Ferries, Rail, etc.										
Marine Safety Impacts										
TOTALS										

APPENDIX G - 1
PROJECTED USE OF BAY AREA AIRPORT ARRIVAL AND DEPARTURE ROUTES

WEST PLAN

Departing Flights by Ground Tracks
(Percentage Use by Flight Track)

OAKLAND – South Field

	1999		2010		2020	
South (1)	164	54%	184	48%	220	46%
East (2)	108	35%	153	40%	199	41%
North (3)	34	11%	46	12%	60	13%
All Departing Flights	306	100%	383	100%	479	100%

(1) Climb from 29, left turn over San Francisco, then SKY 3 Standard Instrument Departure (SID)
(2) Climb from 29, right turn over Richmond, OAK 5 SID. Later track splits towards SAC and LIN
(3) Climb from 29, straight towards Skaggs Island, then towards RBL (Red Bluff) or ILA (Williams)

SAN FRANCISCO

	1999		2010		2020	
East from Rwy 1 (1)	229	37%	220	32%	264	32%
East from Rwy 28 (2)	37	6%	49	7%	61	7%
Oceanic (3)	38	6%	50	7%	72	9%
South (4)	211	35%	239	35%	265	33%
Pacific and NW (5)	100	16%	127	19%	151	19%
All Departing Flights	615	100%	685	100%	813	100%

(1) Climb straight from 1L/1R over Oakland, then SFO 8 SID. Later track splits towards SAC and LIN
(2) Climb from 28R, right turn over the Bay and Richmond. SFO 8 SID. Later splits towards SAC and LIN
(3) Climb from 28R, left turn over South San Francisco towards Oceanic routes. GAP 3 SID.
(4) Climb from 1L/1R, left turn over San Francisco, the head south along coast. PORTE 3 SID.
(5) Climb from 1L/1R, left over the Bay towards RBL. SFO 8 SID

SAN JOSE

	1999		2010		2020	
East (1)	143	56%	127	47%	172	48%
South (2)	111	43%	140	52%	175	49%
Oceanic (3)	1	1%	4	1%	11	3%
All Departing Flights	255	100%	271	100%	358	100%

(1) Full clockwise 360 over San Jose from 30L, north over Pleasanton and Danville. Loupe 9 LIN / SAC SID.
(2) Climb from 30L, right turn towards Gilroy and south. SJC 8 MOONY SID.
(3) Right turn over San Jose from 30L then west over OSI and Palo Alto towards Oceanic routes.

APPENDIX G - 2
WEST PLAN

Arriving Flights by Ground Tracks
(Percentage Use by Flight Track)

OAKLAND – South Field

	1999		2010		2020	
North (1)	45	19%	60	19%	81	20%
South/East (2)	197	81%	257	81%	333	80%
All Arriving Flights	242	100%	317	100%	414	100%

(1) Descend over Richmond, follow Contra Costa Range down wind and left turn over Hayward on to 29
(2) Descend over SUNOL and Fremont, right turn over Hayward on to final for 29

SAN FRANCISCO

	1999		2010		2020	
East (1)	247	39%	216	31%	260	31%
South (2)	212	34%	244	35%	270	33%
Oceanic (3)	34	5%	45	7%	70	9%
North (4)	133	22%	188	27%	221	27%
All Arriving Flights	626	100%	693	100%	821	100%

(1) Descend over CEDES, then right turn over SJC on to final for 28L and 28R.
(2) Descend over SKUNK, left turn over Palo Alto on to final for 28L and 28R.
(3) Descend over BRINY, left turn over Woodside VOR on to final for 28L and 28R.
(4) Descend over Point Reyes to Sausalito, down wind along mid-Bay, right on to final for 28L and 28R.

SAN JOSE

	1999		2010		2020	
North (1)	30	14%	61	23%	86	24%
South and East (2)	188	86%	207	77%	269	76%
All Arriving Flights	218	100%	268	100%	355	100%

(1) Descend over PYE and SFO, over JDOWNS and turn left on to final for 30L.
(2) Descend over GILRO from East and South, over San Jose, straight on final for 30L

Appendix G - 3
SOUTHEAST PLAN

Departing Flights by Ground Tracks
(Percentage Use by Flight Track)

OAKLAND – South Field

	1999		2010		2020	
South (1)	145	47%	176	46%	213	45%
East via Linden(2)	95	31%	126	33%	164	34%
East via Sacramento (3)	15	5%	13	3%	14	3%
North (4)	51	17%	68	18%	88	18%
All Departing Flights	306	100%	383	100%	479	100%

(1) Climb from 11, left turn over San Jose, then SKYLINE 3 Standard Instrument Departure (SID)
(2) Climb from 11, left turn over Fremont, then over Livermore and Marina Four SID over LIN
(3) Climb from 11, left towards Mt Diablo and Sacramento. Marina Four over FMG SID
(4) Climb from 11, left towards Concord and Pacific NW. SCD SID

SAN FRANCISCO

	1999		2010		2020	
West-Oceanic (1)	15	2%	17	3%	19	2%
North-Transocean (2)	121	20%	151	22%	193	24%
North (3)	19	3%	31	5%	44	5%
South (4)	238	39%	229	33%	257	32%
East via Linden (5)	194	31%	229	33%	272	34%
East and NW (6)	28	5%	28	4%	28	3%
All Departing Flights	615	100%	685	100%	813	100%

(1) Climb from 10L/10R, right over Palo Alto, then Gap 3 towards Oceanic tracks
(2) Climb from 10L/10R, right over Palo Alto and then over Golden Gate to Pacific NW and transocean.
(3) Climb from 10L/10R, left turn over Fremont, then Dumbarton Six ILA SID.
(4) Climb from 10L/10R, straight over San Jose, and then head south along coast. Luvve Two SID.
(5) Climb from 10L/10R, left over Livermore, then east. Dumbarton Six LIN SID
(6) Climb from 10L/10R, left over Fremont towards SAC. Dumbarton Sic SID

SAN JOSE

	1999		2010		2020	
South (1)	110	43%	137	51%	169	47%
East via Linden (2)	104	41%	65	24%	84	23%
East via Sacramento (3)	12	5%	12	4%	16	5%
Pacific NW, Europe (4)	29	11%	57	21%	89	25%
All Departing Flights	255	100%	271	100%	358	100%

(1) Climb from 12R, straight over Gilroy and South. Moony One SID to AVE.
(2) Climb from 12R, left turn then, right turn over SUNOL and east. Sunol Five SID.
(3) Climb from 12R, left turn then, right turn over Mt Diablo towards SAC. Danville One SID
(4) Climb from 12R, left turn then, straight over Oakland Hills towards North Bay. Danville One SID

APPENDIX G - 4
SOUTHEAST PLAN

Arriving Flights by Ground Tracks
(Percentage Use by Flight Track)

OAKLAND – South Field

	1999		2010		2020	
South (1)	125	52%	155	49%	194	47%
East (2)	73	30%	103	33%	141	34%
North (3)	44	18%	59	18%	79	19%
All Arriving Flights	242	100%	317	100%	414	100%

(1) Descend over San Francisco, turn right over Alcatraz to final for 11. Hadly Two STAR
(2) Descend over Berkeley, left turn over Bay Bridge to final for 11. Locke One STAR.
(3) Descend over Marin and Sausalito, straight in to final for 11.

SAN FRANCISCO

	1999		2010		2020	
East (1)	277	44%	250	36%	297	36%
South (2)	216	35%	254	37%	281	34%
North (3)	133	21%	189	27%	243	30%
All Arriving Flights	626	100%	693	100%	821	100%

(1) Descend over Mt Diablo, then left turn over OAK on to final for 19L and 19R. Locke One STAR
(2) Descend over Porte, right turn over Daly City and OAK on to final for 19L and 19R. Hadly Two STAR
(3) Descend over Stins, left turn over Daly City, right turn over OAK on to final for 19L/19R.

SAN JOSE

	1999		2010		2020	
South and East (1)	180	83%	196	73%	247	70%
North (2)	38	17%	72	27%	108	30%
All Arriving Flights	218	100%	268	100%	355	100%

(1) Descend over GILRO from East and South, over San Jose, right turn on final for 12R. Jawws One STAR
(2) Descend over PYE and SFO, over JDOWNS and turn left on Boldr and right over Moffett to final for 12R.

APPENDIX H
AIRPORT AND AIRCRAFT EMISSIONS

Bay Area Mobile Source Emissions, 1999-2020

Reactive Organic Gases (ROG) (Tons per Day)

Year	1999	2010	2020
Aircraft	3.530	4.105	6.301
Air Passengers	0.942	0.329	0.268
Airport Employees	0.472	0.140	0.084
TOTAL	4.944	4.574	6.653

Oxides of Nitrogen (NOX) (Tons per Day)

Year	1999	2010	2020
Aircraft	14.710	20.067	28.758
Air Passengers	3.149	1.995	2.188
Airport Employees	1.093	0.635	0.585
TOTAL	18.952	22.697	31.531

Note: Emissions for aircraft and air passengers have been calculated for the average day of the peak month. The aircraft category includes commercial and general aviation aircraft using air carrier runways.

APPENDIX I-1
PROPOSED REGIONAL TRANSPORTATION IMPROVEMENTS SERVING AIRPORTS

Insert I-1

Appendix I-2
Existing and Proposed Regional Airport Access Improvements

Project	Under Construction	In the Regional Transportation Plan	In the MTC Blueprint
Transit			
BART extension to SFO	2002		
UPGRADED CALTRAIN SERVICE			
• Faster speeds/more frequency		✓	✓
• Electrification			✓
• Downtown San Francisco extension			✓
• Connection to airport light rail			✓
• Service update to Gilroy		Funded with local sales tax	
BART TO OAKLAND AIRPORT CONNECTOR			Environmental review underway
CAPITOL CORRIDOR INTERCITY RAIL SERVICE UPGRADE WITH A STOP AT THE COLISEUM BART STATION		✓	✓
COMMUTER RAIL CONNECTION BETWEEN DOWNTOWN SAN JOSE AND BART WITH A CONNECTION TO VTA LIGHT RAIL (BART EXTENSION TO SAN JOSE WOULD BE A LONG TERM OPTION)		✓ Funded by local sales tax	
EXPANDED FERRY SYSTEM SERVING THE AIRPORTS			Proposed By The Bay Area Council
Highway			
ROUTE 101 AUXILIARY LANES IN SAN MATEO COUNTY (VARIOUS LOCATIONS)		✓	✓
San Mateo Bridge widening	✓		
I-880 widening from Fremont to San Jose	✓	✓	✓
I-880 to I-80 connector at the Bay Bridge "maze"	✓		
Caldecott Tunnel 4th bore			✓
I-238 widening between I-580 and I-880 in Hayward		✓	

Note: The *1998 Regional Transportation* is a 20-year plan constrained by available financial resources and the *Bay Area Transportation Blueprint for the 21st Century* is an advocacy document prepared by MTC for projects that require new revenues.

Appendix I-3
Airport Access Projects

Proposed Ground Access Improvements	Implementation Timeframe	Authority	Findings
San Francisco International Airport			
BART station at the terminal with BART shuttle to Caltrain	2002	BART	SFO transit mode share will increase in the future as a result of SFO extension.
Improved freeway interchanges under construction	Complete by 2001	Caltrans	Interchange improvements will facilitate vehicle access to SFO to and from US 101 and I-380.
Studies of ferry access completed	1999	Bay Area ferry operators	Some routes offer potential.
On-airport people mover under construction	2001	SFO	Benefits will be to on-airport circulation.
Oakland International Airport			
Airport Development Plan would provide a BART connector station	Depends on funding	BART	Improves airport transit access and provides an SFO to OAK airport transit link.
Cross airport road in environmental review	2-5 years	Port of Oakland	Funded; will improve access to airport from I-880.
Expanded airport parking in environmental review	2-5 years	Port of Oakland	OAK parking insufficient during peak periods.
San Jose International Airport			
Route 87 freeway and airport interchange	Underway	Caltrans/ City of San Jose	Improves main airport access entrance.
Improved I-880/Coleman Avenue interchange	Proposed	Caltrans	Improves regional freeway access to SJC.
Transit connection to Caltrain and VTA light rail – possible people mover	Proposed	SJC – funded by Airport	Improves transit access; ridership is not known.
Reconfigured terminal roadway system			
Expanded airport parking	2 – 5 years	SJC	SJC parking insufficient during peak periods

GLOSSARY

INSTRUMENT APPROACH: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

IFR (INSTRUMENT FLIGHT RULES): Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.

ILS (INSTRUMENT LANDING SYSTEM): Precision instrument approach system, which normally consists of localizer, glide slope, outer marker, middle marker, and approach lights (Ref. FAR Part 91).

PRM (PRECISION RUNWAY MONITORING): Provides air traffic controllers with high precision secondary surveillance data for aircraft on final approach to parallel runways that have extended centerlines separated by less than 4300 feet. High-resolution color monitoring displays (FMA) are required to present surveillance track data to controllers along with detailed maps depicting approaches and no transgression zone.

RELIEVER AIRPORT: An airport to serve general aviation aircraft, which might otherwise use a congested air carrier served airport.

SOIA (SIMULTANEOUS OFFSET INSTRUMENT APPROACH): An approach system permitting simultaneous Instrument Landing System (ILS) approaches to airports having staggered runways with centerlines, which are parallel. Integral parts of a total system are ILS/MLS, radar, communications, ATC procedures, and appropriate airborne equipment. SOIA combines Offset ILS and Instrument Landing System definitions.

TRACON (TERMINAL RADAR APPROACH CONTROL): An FAA air traffic control service to aircraft arriving and departing or transiting airspace controlled by the facility. TRACONs control IFR and participating VFR flights. The TRACON for the Bay Area, Bay TRACON, is located at Oakland International Airport.

VFR (VISUAL FLIGHT RULES): Rules governing procedures for conducting flight under visual meteorological conditions, or weather conditions with ceiling of 1,000 feet above ground level and visibility of three miles or greater. It is the pilot's responsibility to maintain visual separation, not the air traffic control authorization, may proceed to destination airport under VFR.

VOR (VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION): A ground based electronic navigational aid transmitting navigation signals 360 degrees in azimuth, oriented from magnetic north. The historic basis for navigation is the national airspace system.