



CITY OF PORTLAND, OREGON
BUREAU OF
Planning

 **PORT OF PORTLAND**
Possibility. In every direction.

Aviation Forecast Key Issues and Trends and Review of Initial Tests

Planning Advisory Group Meeting #4
January 15, 2008

AIRPORT FUTURES

CHARTING A COURSE FOR PDX

SUMMARY OF FORECAST SUBCOMMITTEE DISCUSSION

KEY ISSUES AND TRENDS (PAGE 1 OF 3)

Issues/Trends Identified by
Forecast Subcommittee, PAG,
Public



Action



Potential Influence on Forecast

Sustainability / Climate Change

- Listed on Key Issues and Trends Table
- Prepare memo and matrix of potential actions
- Research and consideration of potential policy actions
- Attend Northwest Conference on Climate Change, held in Portland, January 11, 2008

- Translate into increased costs of travel, with consideration of offsetting factors:
 - Alternative fuel development
 - Airline efforts to increase aircraft fuel efficiency and maximize profits

National Economic Recession (Potential in next few years)

- Consider recent economic projections
- Listed on Key Issues and Trends Table

- Consider forecast assumptions and the development of forecast scenarios

Cargo Leakage to Other Modes and Airports

- Add to Key Issues and Trends Table as a separate item related to cargo
- Further research of increasing use of trucks and available belly and freighter capacity at other airports

- Consider forecast assumptions and the development of forecast scenarios

SUMMARY OF FORECAST SUBCOMMITTEE DISCUSSION

KEY ISSUES AND TRENDS (PAGE 2 OF 3)

Issues/Trends Identified by Forecast Subcommittee, PAG, Public	Action	Potential Influence on Forecast
FAA and Airport Funding / Impact on General Aviation Costs	<ul style="list-style-type: none"> ● Add to Key Issues and Trends Table ● Summarize current proposals affecting general aviation costs 	<ul style="list-style-type: none"> ● Consider potential actions on forecasts of general aviation activity
Aircraft Size (seating capacity)	<ul style="list-style-type: none"> ● Listed on Key Issues and Trends Table 	<ul style="list-style-type: none"> ● Consider airline fleet plans in forecasts
Congestion at Other Airports	<ul style="list-style-type: none"> ● Listed on Key Issues and Trends Table ● Meeting with Port representatives and airline service consultant 	<ul style="list-style-type: none"> ● Consider future service to congested and capacity constrained airports in forecasts
New market / airline service development by Port	<ul style="list-style-type: none"> ● Listed on Key Issues and Trends Table 	<ul style="list-style-type: none"> ● Consider forecast assumptions and the development of forecast scenarios

SUMMARY OF FORECAST SUBCOMMITTEE DISCUSSION

KEY ISSUES AND TRENDS (PAGE 3 OF 3)

Issues/Trends Identified by Forecast Subcommittee, PAG, Public	Action	Potential Influence on Forecast
Distinguish between policy driven decisions, operational matters, and assumptions that could affect forecasts	<ul style="list-style-type: none"> ● Acknowledgment that policy is not made in forecast process, but a range of forecast options facilitate subsequent policy discussions 	<ul style="list-style-type: none"> ● Consider forecast assumptions and the development of forecast scenarios
Activity by Very Light Jets (VLJs)	<ul style="list-style-type: none"> ● Add to Key Issues and Trends Table ● Summarize existing forecasts of VLJs 	<ul style="list-style-type: none"> ● Consider potential range of activity in general aviation forecast scenarios
Price of oil (affected by increasing global demand)	<ul style="list-style-type: none"> ● Consider revised Department of Energy (DOE) forecasts dated December 2007 ● Listed on Key Issues and Trends 	<ul style="list-style-type: none"> ● Translate into increased costs of travel
Dot-com Bubble / Burst	<ul style="list-style-type: none"> ● Add to Key Issues and Trends Table 	<ul style="list-style-type: none"> ● Consider in definition of forecast model

Initial Model Tests and Results

- Dependent variable
- Independent variables
- Preliminary findings
- Preliminary model results

Forecast Scenarios

- Cost of travel
- Population growth
- Regional economic growth

INITIAL MODEL TESTS AND RESULTS

DEPENDENT VARIABLE

The dependent variable is what is being forecast and can be expressed in many forms.

PDX Enplaned Passengers

- Total enplaned passengers
- Domestic enplaned passengers
- Domestic originating passengers
- Initiated trips
- Trips per person (total enplaned passengers / population)

PDX Cargo

- Total cargo
- Domestic freight

INITIAL MODEL TESTS AND RESULTS

INDEPENDENT VARIABLES

Independent variables help to explain the variation in the dependent variable. For example, changes in the cost of travel help to explain changes in PDX passenger traffic.

- Portland-Vancouver Service Area
 - Population
 - Employment
 - Income (total and per capita)
- U.S. Gross Domestic Product (GDP)
- PDX yield (cents per passenger mile)
- U.S. domestic yield (cents per passenger mile)
- Price of oil (dollars per barrel)
- Price of aviation fuel (cents per gallon)
- Dummy variables (adjust for structural changes in airline industry)

INITIAL MODEL TESTS AND RESULTS

INDEPENDENT (DUMMY) VARIABLES

Dummy variables adjust for structural changes in the dependent variable. For example, September 11 terrorist events resulted in a fundamental change in the airline industry.

- Impact of 2001 traffic reductions resulting from terrorist event
[=1, if year = 2001]
 - Impact of September 11 on subsequent years of traffic
[=1, if year > or = 2002]
 - Declining impact of September 11 on subsequent years of traffic
[= 1 / (number of years after 2001)]
- Impact of PDX Southwest service
[=1, if year > or = 1994]
 - Declining impact of PDX Southwest service on subsequent years of traffic
[=1 / (number of years after 1993)]

INITIAL MODEL TESTS AND RESULTS

INDEPENDENT (DUMMY) VARIABLES

Dummy variables represented as data in models.

	Year 2001 (=1, if year =2001)	September 11 (=1, if year >=2002)	Years following September 11 (1 / # years after 2001)	PDX Southwest service (=1, if year >=1994)	Years following PDX Southwest service (1 / # years after 1993)
1990	0	0	0	0	0
1991	0	0	0	0	0
1992	0	0	0	0	0
1993	0	0	0	0	0
1994	0	0	0	1	1
1995	0	0	0	1	0.50
1996	0	0	0	1	0.33
1997	0	0	0	1	0.25
1998	0	0	0	1	0.20
1999	0	0	0	1	0.17
2000	0	0	0	1	0.14
2001	1	0	0	1	0.13
2002	0	1	1	1	0.11
2003	0	1	0.50	1	0.10
2004	0	1	0.33	1	0.09
2005	0	1	0.25	1	0.08
2006	0	1	0.20	1	0.08

INITIAL MODEL TESTS AND RESULTS

CONSIDERATION OF INDEPENDENT VARIABLES IN MODELS

The use of independent variables in a statistical models must include consideration of their relationship to each other.

- The construction of a statistical model may include consideration of independent variables which are highly correlated or related to each other such as Portland-Vancouver personal income and U.S. GDP.
- A high degree of correlation among independent variables makes it difficult to assess their importance in determining the dependent variable.
- More variables are not always better, given the limited data points available for an analysis of passenger traffic over a 30-year period.
- Objective is to have major causal variables operate independently of each other.

INITIAL MODEL TESTS AND RESULTS

FINDINGS: YIELD (FARE REVENUE PER PASSENGER MILE)

Initial findings from about 75 tests of 15 independent variables.

- Yield (fare revenue per passenger mile) is the average price that someone pays to fly one mile and is a measure of the cost of travel to passengers.
 - Yield also represents the fare revenue that airlines collect, on average, per passenger mile.
 - Yield does not reflect net profit.
- Based on initial tests, U.S. domestic yield is comparable to PDX yield as an independent variable in explaining the trends in PDX passenger traffic but has the advantages of:
 - 31 years of data (PDX yield data are available for 17 years)
 - May be easier to forecast than PDX specific yield because data for potential causal factors such as oil, labor, and other costs are more readily available on a national level.

INITIAL MODEL TESTS AND RESULTS

PRELIMINARY FINDINGS: SEPTEMBER 11

Initial findings from about 75 tests of 15 independent variables.

- The terrorist events of September 11, 2001 and the resulting decrease in passenger traffic are considered responsible for a fundamental change in the airline industry.
- The initial tests indicate that the dummy variables for September 11 and the year 2001 are significant as independent variables and help to explain the variation in PDX passenger traffic.
- When the dummy variables are excluded from the models, the coefficients of the other remaining variables are changed considerably.

INITIAL MODEL TESTS AND RESULTS

PRELIMINARY FINDINGS: SOUTHWEST SERVICE AT PDX

Initial findings from about 75 tests of 15 independent variables.

- The initiation of low cost airline service by Southwest Airlines at PDX in 1994 resulted in a fundamental change in service and passenger traffic at the Airport.
- The dummy variable for PDX Southwest service is significant as an independent variable and helps to explain the variation in PDX passenger traffic.
- When the dummy variable for PDX Southwest service is excluded from the models, the coefficients of the other remaining variables are changed considerably.

INITIAL MODEL TESTS AND RESULTS

FINDINGS: PRICE OF OIL AND AVIATION FUEL

Initial findings from about 75 tests of 15 variables.

- Aviation fuel costs accounted for 25% of airline operating costs during the second quarter of 2007, exceeding the share of airline labor costs (24%).
 - The price of oil (dollars per barrel) approached \$100 per barrel at the end of 2007.
- Although the price of oil and aviation fuel are important in understanding yield trends and the cost of travel, the data did not explain the variation in PDX passenger traffic as well as US domestic yield.
 - However, the data for the price of oil and aviation fuel did help to explain the variation in PDX cargo activity.

INITIAL MODEL TESTS AND RESULTS

FINDINGS: US GROSS DOMESTIC PRODUCT (GDP)

Initial findings from about 75 tests of 15 variables.

- Passenger traffic at PDX decreased five times in the past 30 years. Each decrease is associated with a national economic recession.
- Although PDX passenger traffic has tracked national economic trends, US GDP is highly correlated with Portland-Vancouver income. Therefore, only one of these variables can be included in a model.
- When the parameters of US GDP are significant, the parameters of other important variables become insignificant.

INITIAL MODEL TESTS AND RESULTS

PRELIMINARY MODEL RESULTS

Dependent variable = Natural Log (PDX Total enplaned passengers)

Coefficient	Independent variables	t - statistic
-0.484	Natural Log (U.S. domestic yield in constant 2006 dollars)	-2.43
+1.375	Natural Log (Service area population)	3.37
+0.869	Natural Log (Service area per capita income in 2006 dollars)	2.62
-0.200	Dummy variable for year 2001 (=1, if year = 2001)	-7.18
-0.263	Dummy variable for September 11 (=1, if year > or = 2002)	-4.47
+0.255	Dummy variable for Southwest service (=1, if year > or = 1994)	3.40
-3.545	Constant	-1.10

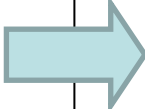
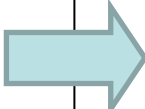
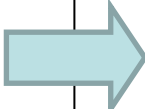
Note: Observations = 31; R-squared = 0.991; Adjusted R-squared = 0.989; F-statistic = 465.4.

Note: Service area consists of Clackamas, Multnomah, Washington, and Yamhill counties in Oregon and Clark county in Washington.

INITIAL MODEL TESTS AND RESULTS

MODEL INTERPRETATION

Elasticity of demand is the percent change in passenger traffic for a 1% change in an independent variable.

- Yield coefficient of -0.48 implies that a 1% increase in yield  results in a 0.48% decrease in enplanements, all else equal.
- Per capita income coefficient of 0.87 implies that a 1% increase in income  results in a 0.87% increase in enplanements, all else equal.
- Population coefficient of 1.35 implies that a 1% increase in population  results in a 1.35% increase in enplanements.

FORECAST SCENARIOS

Forecast scenarios allow us to test the impact of different assumptions about the key independent variables on future passenger traffic growth at PDX.



FORECAST SCENARIOS

KEY INDEPENDENT VARIABLES

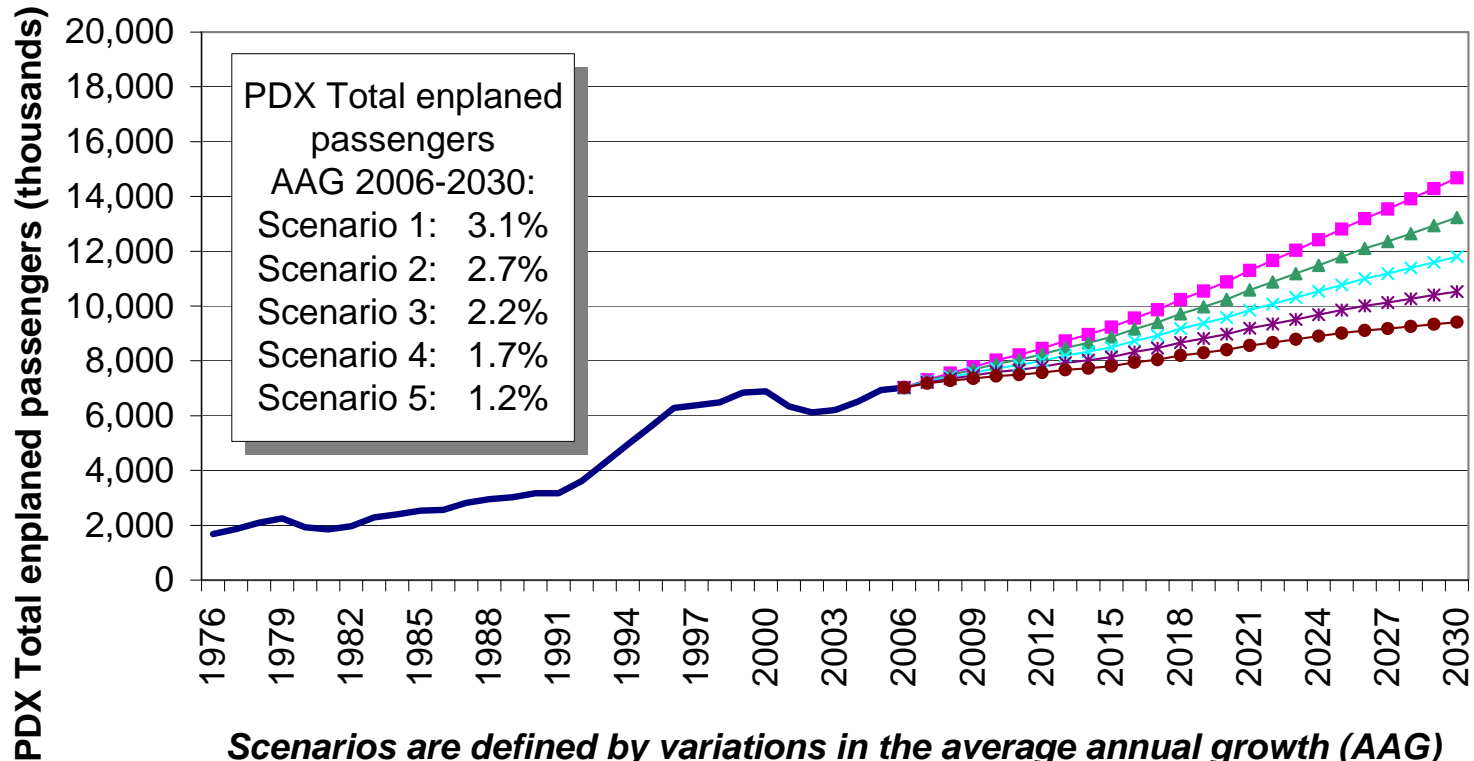
Cost of Travel

Population Growth

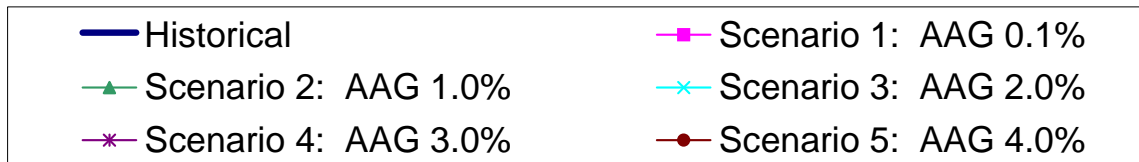
Regional Economic Growth

FORECAST SCENARIOS: CHANGES IN THE COST OF TRAVEL, MEASURED BY YIELD = FARE REVENUE PER PASSENGER MILE

Using the preliminary model results, scenarios with varying real yield assumptions result in average annual growth in total PDX enplaned passengers ranging from 1.2% to 3.1%.



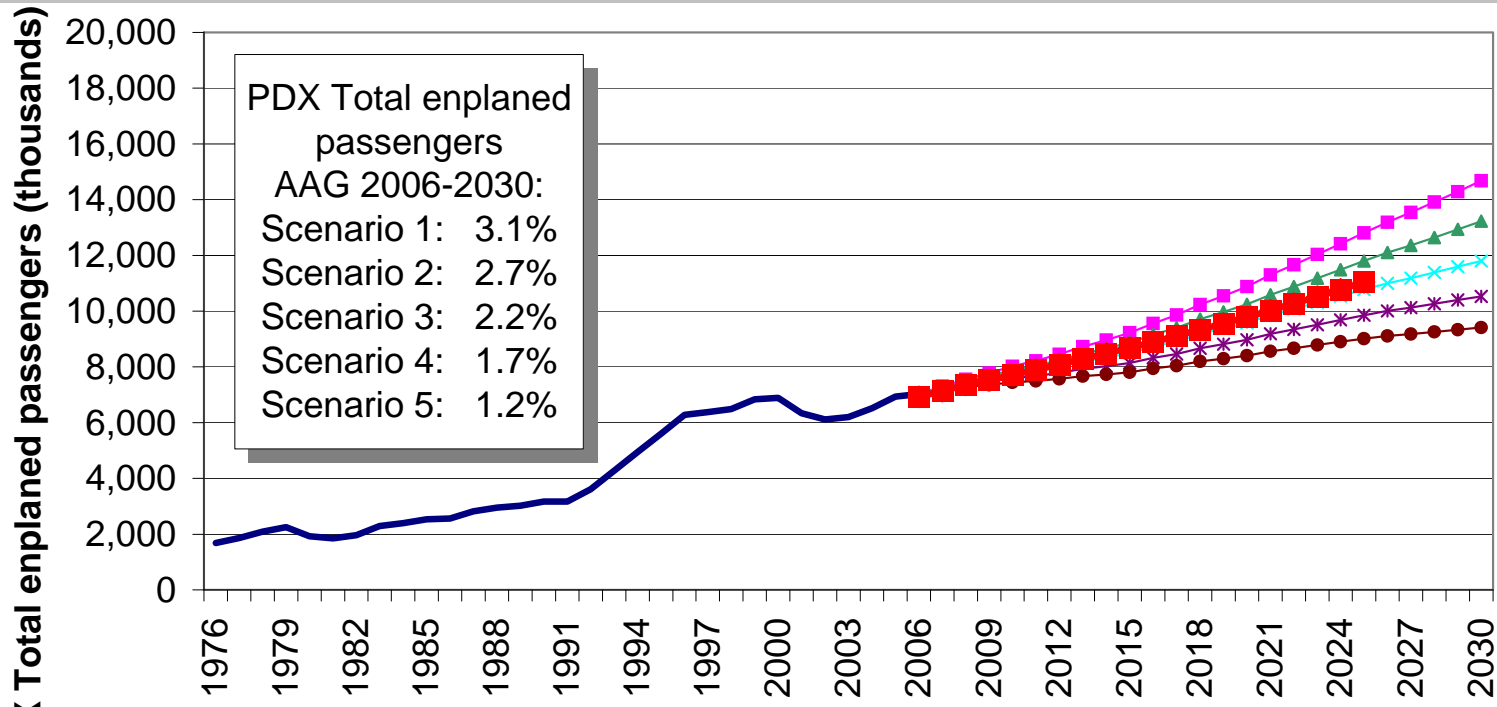
Scenarios are defined by variations in the average annual growth (AAG) of real U.S. domestic yield from 2006 to 2030 as noted below.



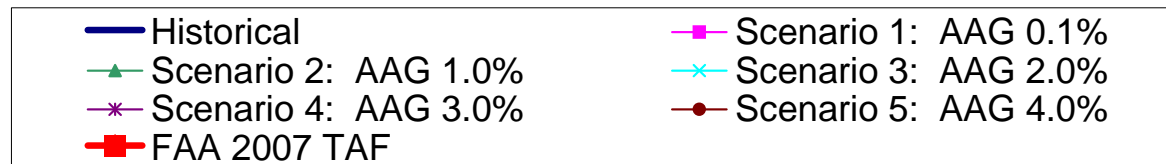
Note: Metro base case forecasts of population and income were used for all three scenarios.

FORECAST SCENARIOS: CHANGES IN THE COST OF TRAVEL, MEASURED BY YIELD = FARE REVENUE PER PASSENGER MILE

The FAA 2007 Terminal Area Forecast (TAF) falls in the middle of this range of scenarios.



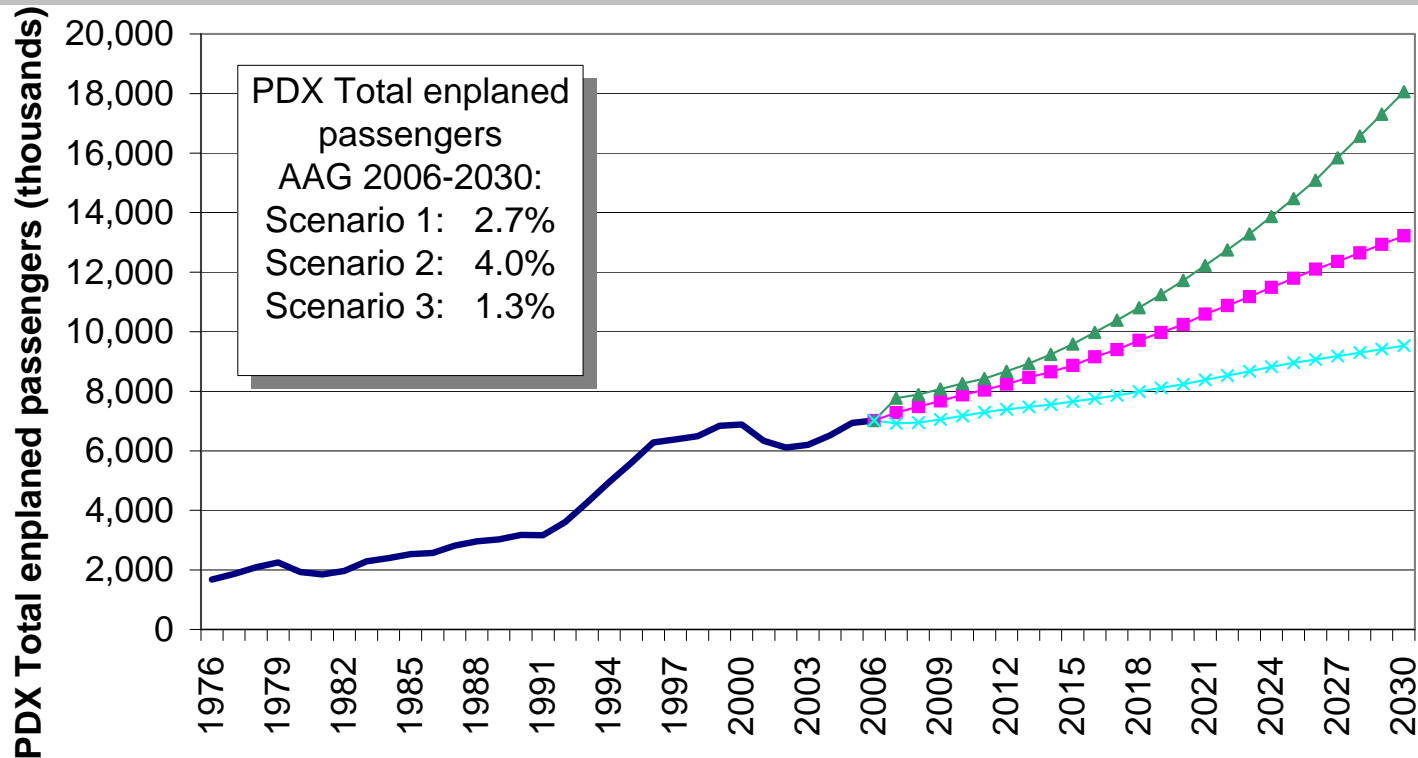
Scenarios are defined by variations in the average annual growth (AAG) of real U.S. domestic yield from 2006 to 2030 as noted below.



Note: Metro base case forecasts of population and income were used for all three scenarios.

FORECAST SCENARIOS POPULATION AND INCOME GROWTH

Scenarios defined by Metro's base, high, and low forecasts of population and income result in average annual growth in total PDX enplaned passengers ranging from 1.3% to 4.0%.



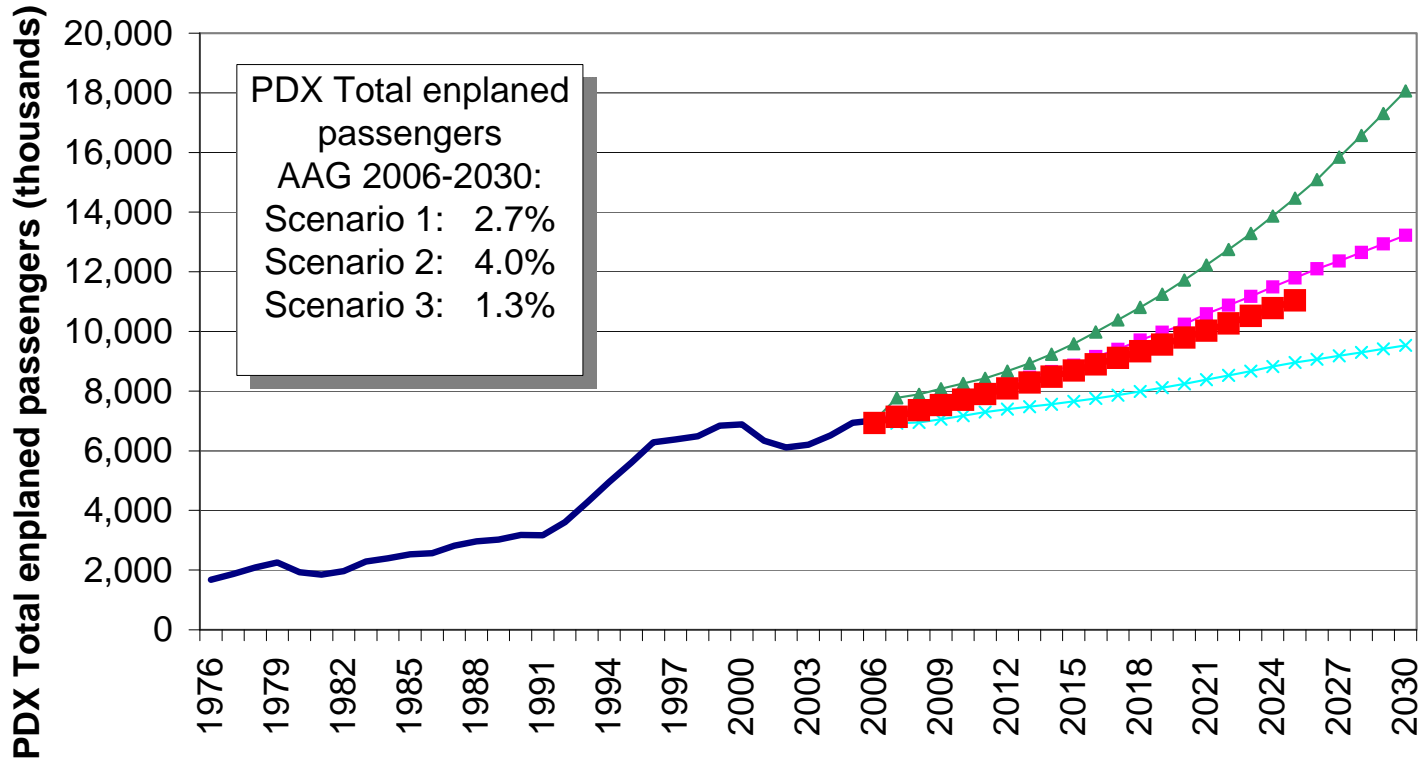
Scenarios are defined by Metro forecasts for both population and personal income through 2030 as noted below.



Note: U.S. real domestic yield was assumed to increase an average of 1.0% per year for all three scenarios.

FORECAST SCENARIOS POPULATION AND INCOME GROWTH

The FAA 2007 Terminal Area Forecast (TAF) falls in the middle of this range of scenarios.



Scenarios are defined by Metro forecasts for both population and personal income through 2030 as noted below.



Note: U.S. real domestic yield was assumed to increase an average of 1.0% per year for all three scenarios.

ALTERNATIVE VIEW

ANALYSIS OF PASSENGER TRAFFIC BY MARKET

An analysis of passenger traffic by market would provide an alternative view of passenger traffic growth at PDX, in addition to the total airport view.

Advantages

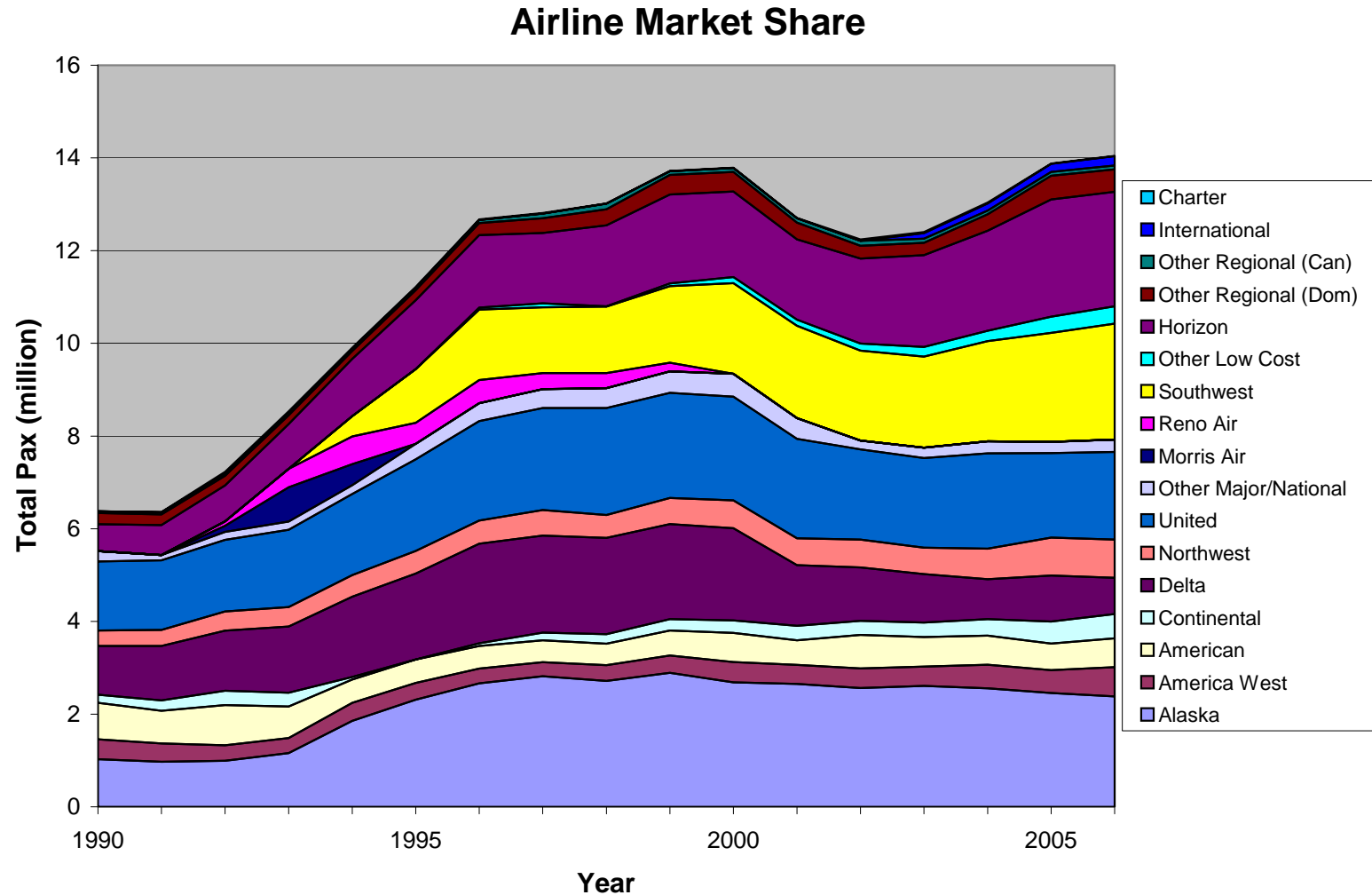
- More Data Points
- Understanding of Underlying Airline Decisions and Market Factors that Affect Overall Growth
- Facilitate Analysis of Scenario and Planning Issues

Disadvantages

- More Data Points = More Time for Analysis
- May Require Forecasts of Airline Service by Market and Forecasts of Other Variables by Market

ALTERNATIVE VIEW ANALYSIS OF PASSENGER TRAFFIC BY MARKET

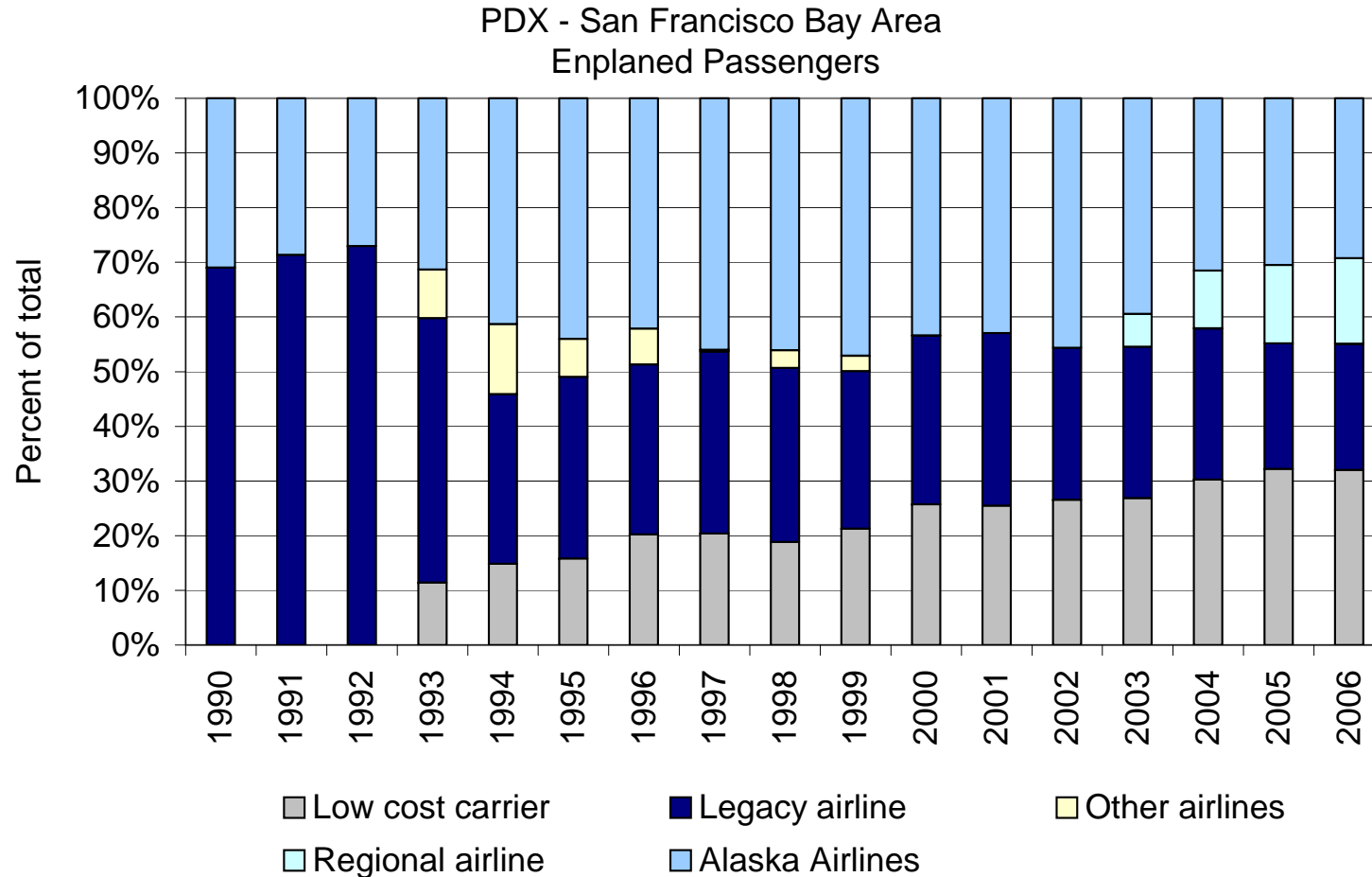
A review of airline market shares shows an increasing share of low cost carrier traffic, a shift of service between Alaska and Horizon, and declines in legacy airline activity.



ALTERNATIVE VIEW

ANALYSIS OF PASSENGER TRAFFIC BY MARKET

The PDX-San Francisco Bay Area market shows an increasing share of low cost carrier traffic, a shift of service between Alaska and Horizon, and declines in legacy airline activity.

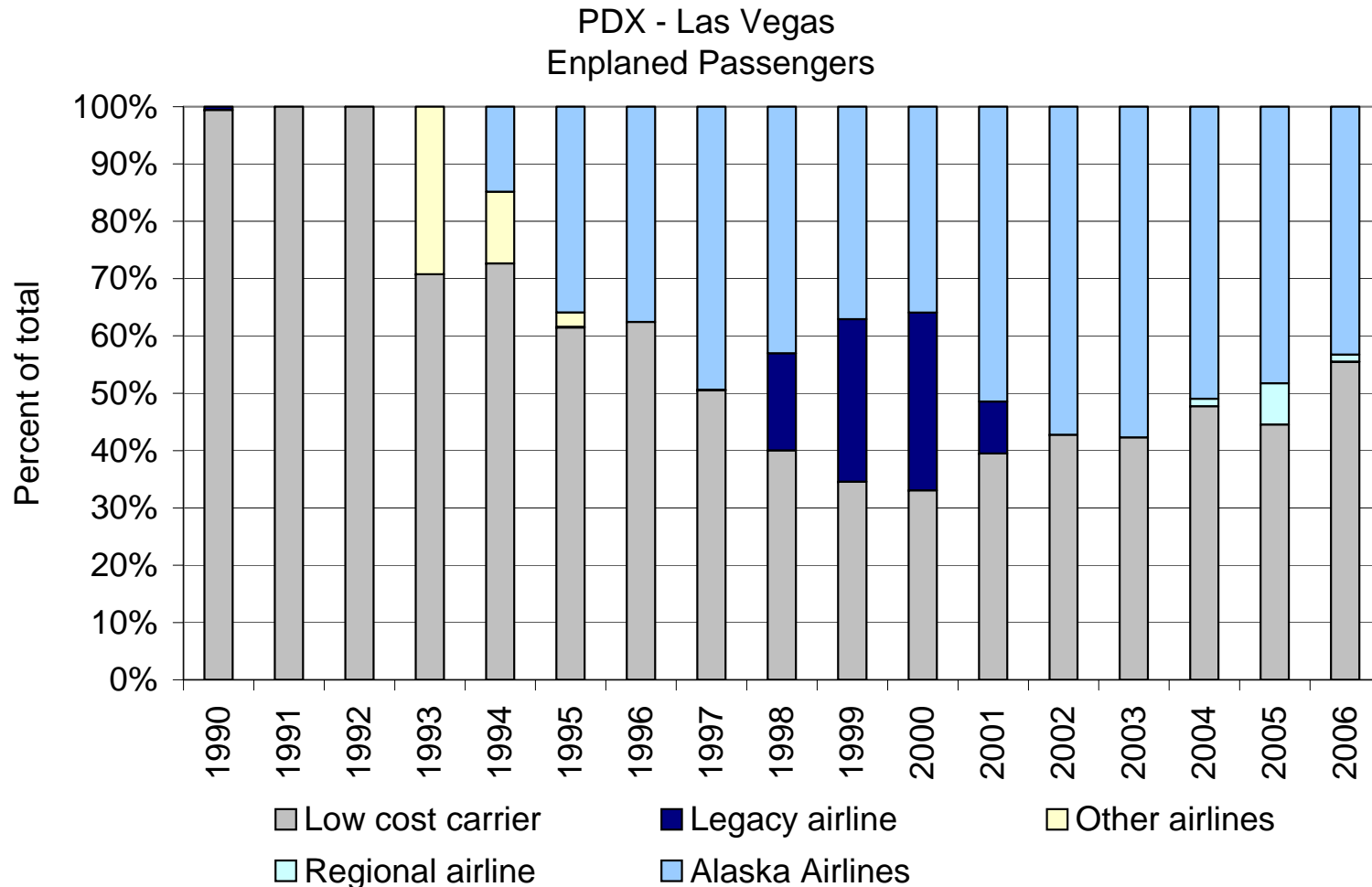


Source: U.S. Department of Transportation, Federal Aviation Administration, Schedule T-100, online database.

ALTERNATIVE VIEW

ANALYSIS OF PASSENGER TRAFFIC BY MARKET

However, the PDX-Las Vegas market shows a somewhat different view. From 2002 to 2006, passenger traffic increased an average of 9.5% per year.



Source: U.S. Department of Transportation, Federal Aviation Administration, Schedule T-100, online database.

- 1. Final Model will likely include socioeconomic and cost of travel variables.**
- 2. Consideration of other (secondary) key issues and trends will be in terms of how they affect the primary variables.**
- 3. Available, reliable data limits model construction and consideration of other key issues and trends.**

- 1. Input from Subcommittee on Initial Model Results, Preliminary Findings, and Forecast Scenarios**
- 2. Selection of Final Model**
- 3. Preparation of Passenger and Cargo Forecast Scenarios**
- 4. Definition of Probability Distributions of Independent Variables**