APPENDIX B:
Aviation Forecast

Appendix B – Aviation Forecast

This appendix includes:

- Appendix B.1 – Aviation Forecast
- Appendix B.2 – FAA's approval to use the aviation forecast for this Part 150 Update.

B.1 Aviation Forecast

A detailed operational forecast analysis for the 2023 A.B. Won Pat International Airport, Master Plan Update was developed by AECOM and included aviation forecasts for enplaned passengers, air cargo tonnage, aircraft operations, and based aircraft. The detailed methodology and results of the aviation forecasts are provided in this Appendix and summarized in Section 3.2 of the NEM Report.

The FAA recommended that GIAA utilize the same FAA approved forecast developed under the Master Plan Update Project for the Part 150 NEM Update so that a single aviation forecast would be utilized for cohesiveness and consistency in the assumptions for the overlapping time periods.

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AECOM

Antonio B. Won Pat International Airport Master Plan Update

Aviation Demand Forecasts

Delivering a better world

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3 Aviation Demands Forecast

Executive Summary

AECOM has been engaged by the A.B. Won Pat International Airport Authority, Guam (GIAA) to provide airport planning services associated with a Master Plan Update for the Antonio B. Won Pat International Airport (Airport). This chapter of the Master Plan presents a summary of historical aviation demand at the Airport and a forecast of unconstrained aviation demand through the 20-year planning horizon (the forecast period).

Forecast scenarios were developed for enplaned passengers, air cargo tonnage, aircraft operations, and based aircraft. The supporting analyses required in developing the forecasts are presented in the report and include an explanation of the forecast approach and methodology; the forecast results; and a comparison with other forecasts prepared for the Airport, including the Federal Aviation Administration (FAA) Terminal Area Forecast (TAF), the Enplanements Forecast prepared by InterVISTAS in August, 2022 (Forecast in the Report of the Airport Consultant), and the 2012 Airport Master Plan Forecast.

The recommended forecasts as summarized in **Table ES.3-1** below provide the basis for determining the planning activity levels and future facility requirements in the Master Plan Update.

Table ES.3-1. Summary of Aviation Demand Forecasts

Fiscal Year	Total Enplanements	Total Operations	Total Based Aircraft
Actual			
2019 [A]	1,885,108	72,699	36
2020	884,060	38,907	36
2021	135,566	20,363	37
Forecast			
2024	1,277,397	59,960	37
2029	1,960,402	83,655	38
2034	2,123,073	88,012	39
2039	2,312,858	92,643	40

Note: 2019 (pre-2019 Novel Coronavirus [COVID-19][1]-pandemic) is the base year for the forecast.
Source: AECOM Analysis

[1] 2019 Novel Coronavirus (COVID-19): Coronavirus disease 2019 is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The World Health Organization (WHO) declared the outbreak of COVID-19 a global pandemic in March 2020. The aviation activity level has dropped significantly since the pandemic.

3.1 Introduction

Forecasts of future aviation activity levels are the basis for effective decisions in airport master planning. The recommended forecasts provide the basis for determining the planning activity levels and future facility requirements in the Master Plan Update. It also provides a basis for the development of alternatives to meet the projected demand, environmental analyses, and economic and financial plans.

The forecast elements for this Master Plan include:

- Enplaned passengers
  - Domestic enplaned passengers
  - International enplaned passengers
- Air cargo
  - Cargo tonnage by air freighter aircraft
  - Cargo tonnage by small cargo aircraft
  - Cargo tonnage by passenger aircraft (lower deck, i.e., belly cargo)
- Aircraft operations
  - Air carrier (commercial passenger aircraft operations)
  - Air carrier (all-cargo aircraft operations)
  - Air taxi and general aviation (GA) operations
  - Military aircraft operations
  - Breakdowns between itinerant and local operations
- Based aircraft

Each forecast includes unconstrained demand for the 20-year planning horizon (2019 through 2039) grouped into 5-year periods and utilizing actual 2019 (pre-COVID-19-pandemic) statistics as the baseline.

The historical and forecast annual statistics in this report are summarized by fiscal year (FY), which is the 12-month period beginning 1 October and ending 30 September the following year. The identification of a FY is the calendar year in which it ends (i.e., FY2019 began on 1 October 2018 and ended on 30 September 2019). The use of FY ensures consistency with the FAA TAF and for the purposes of this report, years associated with all forecasts will be designated as its FY unless stated otherwise.

3.2 Airport Service Region

Guam is known as the jewel of Micronesia and a tourism destination. It is an island located in the Pacific Ocean, is the largest island in Micronesia, and is located about 1,200 miles east of the Philippines and 3,300 miles west-southwest of Hawaii.[2]

The Airport is the only commercial service airport serving the U.S. Territory of Guam. The other airport on the island is a military airport, the Andersen Air Force Base (AAFB) (GUA).

The Airport enplaned over 1.8 million passengers in 2019 to become the 75th busiest airport (out of 3,304 airports) in the U.S. National Plan of Integrated Airport Systems (NPIAS) based on enplanements. The FAA classifies the Airport as a small hub airport because it serves between 0.05 and 0.25 percent of annual U.S. commercial enplanements.[3] The Airport was ranked as the 14th busiest small hub airport in 2019.

The nearest public airports are located in the Commonwealth of the Northern Mariana Islands (CNMI), including Saipan International Airport (GSN) on Saipan Island, Tinian International Airport (TNI) on Tinian Island, and Benjamin Taisacan Manglona International Airport (GRO) on Rota Island. These three airports

[2] Distances are measured in nautical miles (nm).
[3] In 2019, the base year of the Master Plan, the Airport was designated as a small, primary hub airport however, subsequently, the airport has been designated as a primary, non-hub airport in the 2023-2027 National Plan of Integrated Airport Systems (NPIAS).

range from 49 to 112 nautical miles (nm) (or 35 to 50 minutes travel time by air) from the Airport. Because travel by air is the primary mode of transportation for visitors and residents to/from Guam and the Northern Mariana Islands, GSN, GWT, and GRO are not considered competitors to the Airport.

Farther from the Northern Mariana Islands, there are other Pacific islands outside the U.S. Territory but within Micronesia, including the Republic of Palau, Federated States of Micronesia, and Republic of Marshall Islands (**Figure 3-1**). Guam is closer to many east Asian countries including Japan, Korea, Philippines, China, and Taiwan than these Micronesian islands (**Figure 3-2**). In addition, the Airport is the largest airport amongst these islands, with more nonstop destinations, more operating airlines, and higher flight frequencies, and therefore it acts like a gateway to Micronesia. Flights between islands bring passengers to the Airport for connection to their final destinations. Visitors may also visit multiple islands during their stay in the region.

For the purposes of the aviation demand forecast analysis, the primary catchment area served by the Airport (i.e., the Airport service region) is defined as the island of Guam. The secondary catchment area served by the Airport may extend to the Northern Mariana Islands and other Micronesian islands as shown in **Figure 3-1**.

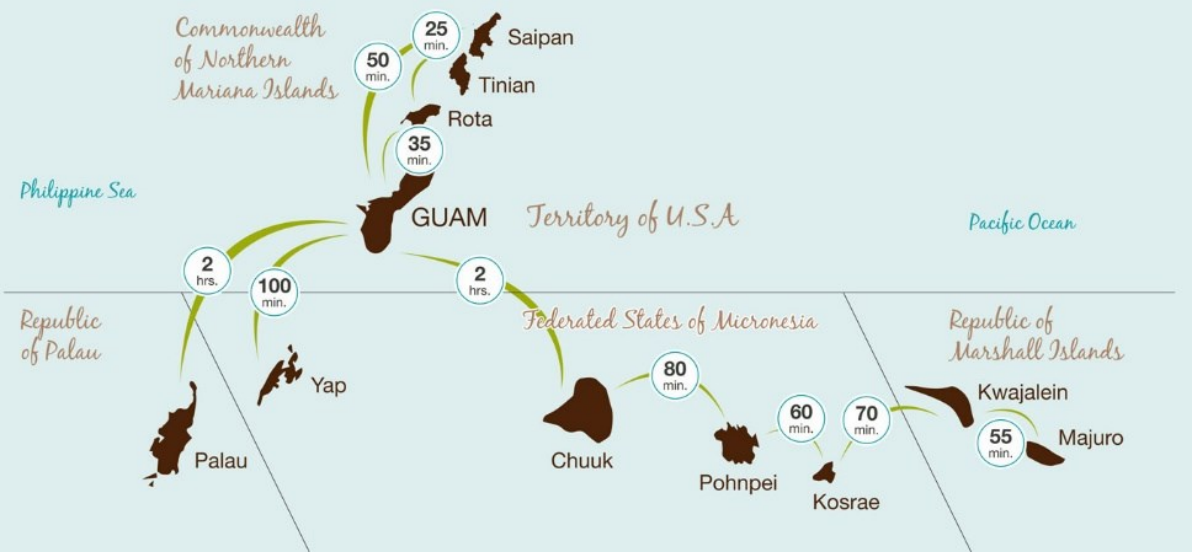

Figure 3-1. Flight Time Between Guam and Other Micronesian Islands in the Region

Source: Pacific Asia Travel Association Micronesia Chapter

Figure 3-2. Flight Time Between Guam and East Asia, Oceania, and U.S. Mainland/Hawaii

Sources:

1. *Base map - Guam Visitors Bureau (GVB), Gateway to Micronesia*
2. *AECOM edits*

Since Guam is a leisure destination, the majority of the international travel demand to/from Guam is driven by visitors. It is the economic basis of the top tourism markets, e.g., Japan, Korea, China, and Taiwan, that drives the principal demand for supporting the aviation activities at the Airport instead of the local economy of the primary or secondary catchment areas. **Section 3.4** focuses on describing the socioeconomic characteristics of the top tourism markets and supplements with the characteristics of the Airport service region. These socioeconomic characteristics were used to evaluate the long-term aviation activity trends at the Airport.

For the near-term aviation activity trends, the COVID-19 pandemic plays an important role. Hence, before discussing the analyses on the socioeconomic characteristics of different markets, **Section 3.3** describes the recent historical trends and impacts of COVID-19 to the economy and the aviation industry.

3.3 COVID-19 Pandemic

The COVID-19 pandemic created an unprecedented crisis in the U.S., leading to a declaration of national emergency on March 13, 2020. The U.S., like many countries, sought to curtail the spread of the virus by issuing domestic and international travel restrictions, including statewide stay-at-home orders and national social distancing measures. Despite these efforts to contain the spread of COVID-19, several waves of the virus hit the U.S. The first wave began in March 2020; the second wave, June 2020; the third wave, October 2020; the fourth wave, July 2021; and the fifth wave began in December 2021 due to the impacts of the Omicron variant.

Figure 3-3 and **Figure 3-4** show the daily number of new COVID-19 cases and death cases in the U.S. and identify the different waves of impacts. Since the Omicron variant is more transmissible than the original virus and other variants, the trend for the fifth wave as shown in **Figure 3-3**, is exaggerated. Considering the Omicron variant also causes less severe disease, hence **Figure 3-4** showing the death statistics is added.

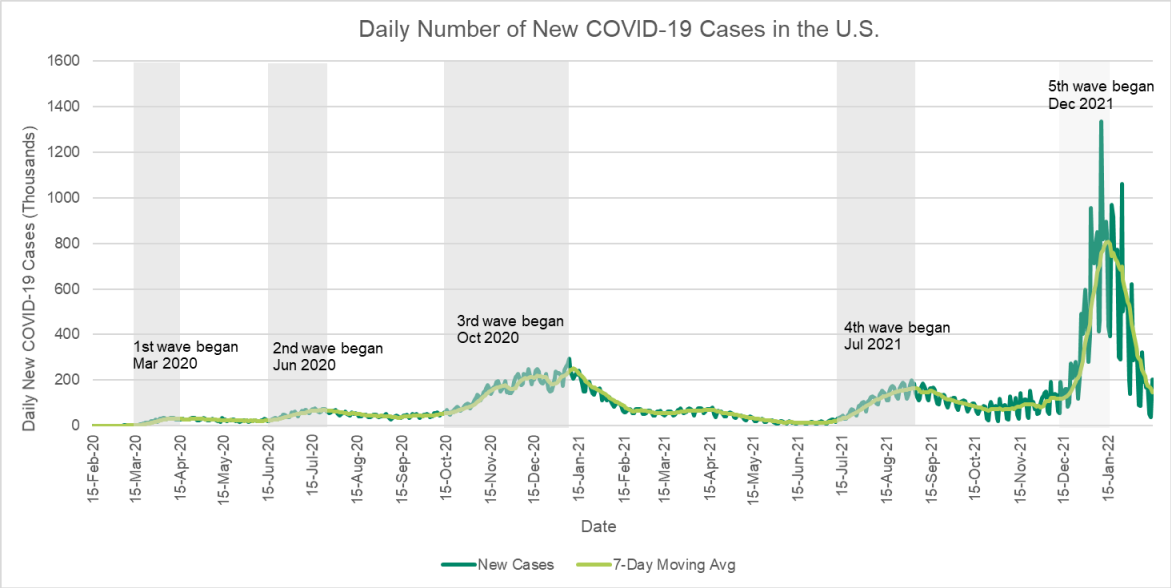

Figure 3-3. Daily Number of New COVID-19 Cases in the U.S.

Sources:
1. *Centers for Disease Control and Prevention (CDC), COVID Data Tracker (February 16, 2022)*
2. *AECOM analysis*

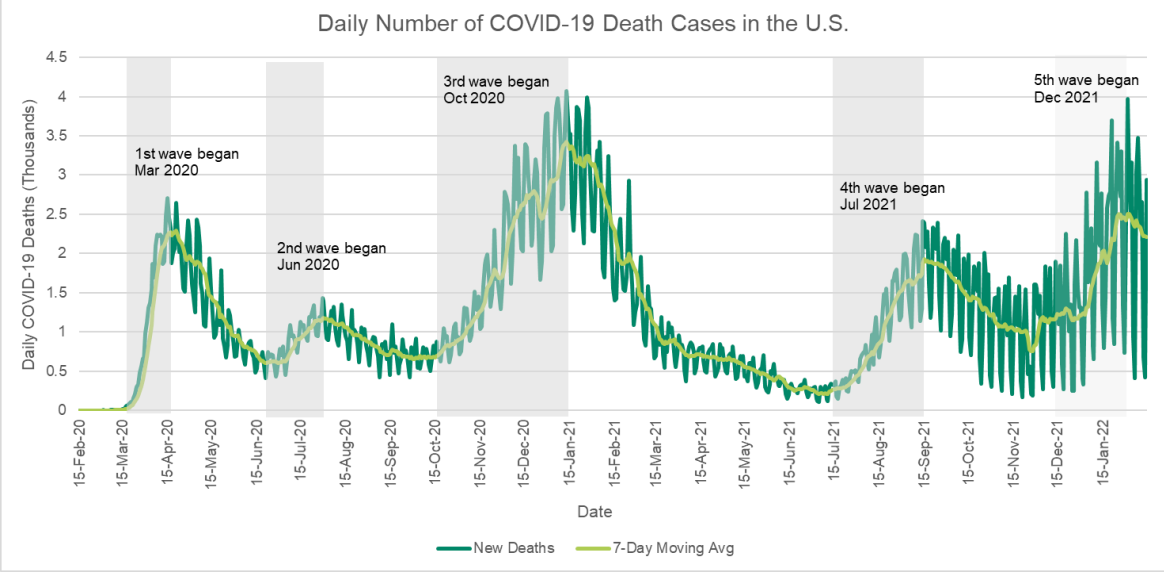

Figure 3-4. Daily Number of COVID-19 Death Cases in the U.S.

Sources:
1. *CDC, COVID Data Tracker (February 16, 2022)*
2. *AECOM analysis*

The number of daily new cases peaked in January 2022 in most states and territories, including Guam, due to the highly transmissible Omicron variant as shown in **Figure 3-5**. The first three waves that the U.S. mainland experienced are not as distinct in the daily new cases and daily deaths statistics for Guam, as given in **Figure 3-5** and **Figure 3-6**. This is mostly due to the smaller sample size in Guam as

compared to the U.S. mainland, and it also takes time for the virus to make its way to distant islands away from the main continents.

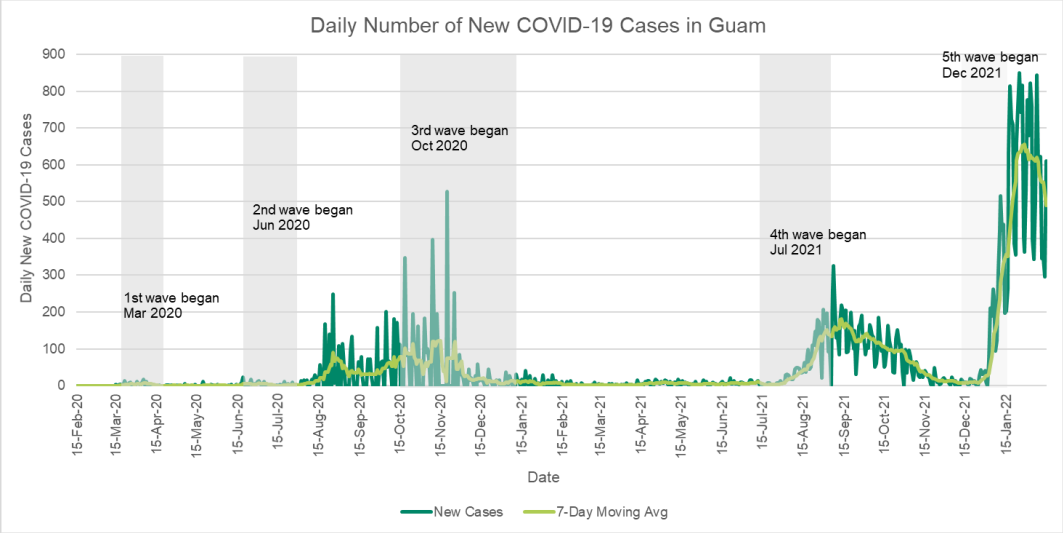

Figure 3-5. Daily Number of New COVID-19 Cases in Guam

Sources:

1. *CDC, COVID Data Tracker (February 16, 2022)*
2. *AECOM analysis*

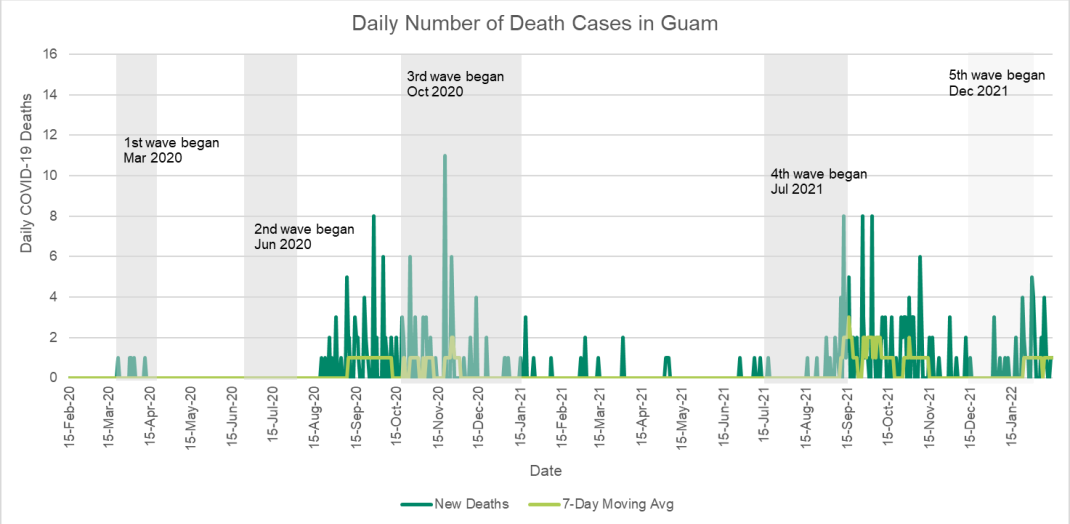

Figure 3-6. Daily Number of COVID-19 Death Cases in Guam

Sources:

1. *CDC, COVID Data Tracker (February 16, 2022)*
2. *AECOM analysis*

The pandemic devasted the U.S. economy and the airline industry worldwide. Because of travel restrictions and fears about the virus, many businesses were temporarily shut down and travel came to a near halt. **Figure 3-7** and **Figure 3-8** show the monthly visitors from the U.S. and outside the U.S. to Guam by air from January 2019 to November 2021. **Figure 3-9** and **Figure 3-10** show the monthly domestic and international enplanements at the Airport, which follow similar recovery patterns for monthly visitors in **Figure 3-7** and **Figure 3-8**, respectively.

In April 2020, the beginning of the pandemic, Guam lost 85.7 percent of its U.S. visitors and 99.7 percent of international visitors. Domestic enplanements at the Airport dropped 91.8 percent, and international enplanements dropped 99.6 percent. During the same period, the total travelers in the U.S. dropped by

95.3 percent based on the Transportation Security Administration (TSA) security screening statistics as shown in **Figure 3-11**.

Recovery is well under way for the domestic market. Guam experienced a strong recovery in July 2021, and domestic visitor statistics reached nearly 98 percent of their pre-pandemic level for the same month in 2019 (**Figure 3-7**). For the same period, domestic enplanements at the Airport returned to 93 percent of their pre-pandemic level in July 2021 (**Figure 3-9**). Nevertheless, recovery of international visitors is stagnant (**Figure 3-8** and **Figure 3-10**), and it is heavily impacted by the travel restrictions and quarantine policies of different countries. During the same period, total travelers in the U.S. recovered by approximately 80 percent (**Figure 3-11**).

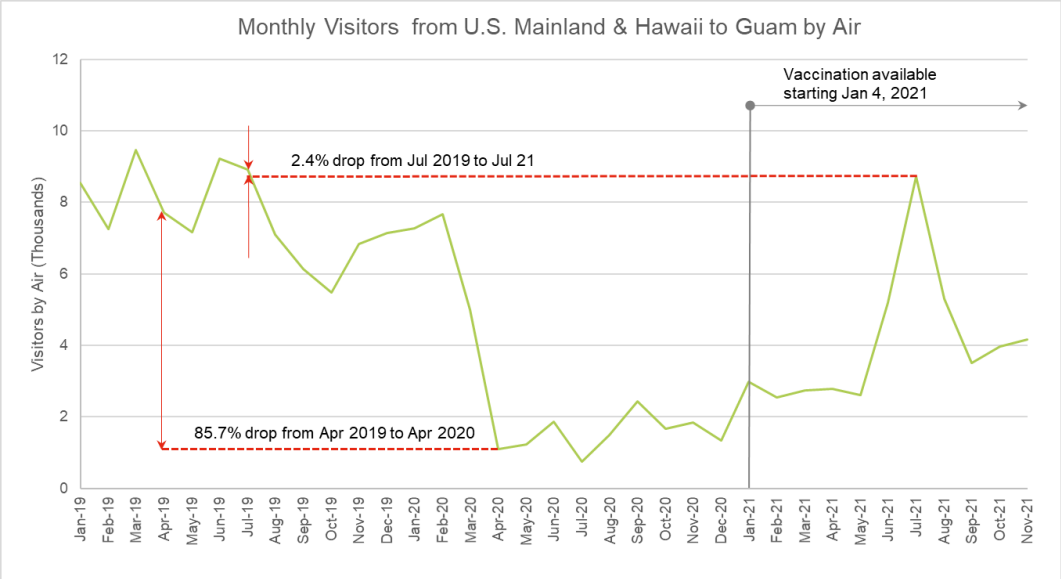

Figure 3-7. Monthly Visitors from U.S. Mainland and Hawaii to Guam by Air

Sources:

1. *Visitor statistics – GVB*
2. *First vaccination date – WHO*
3. *AECOM analysis*

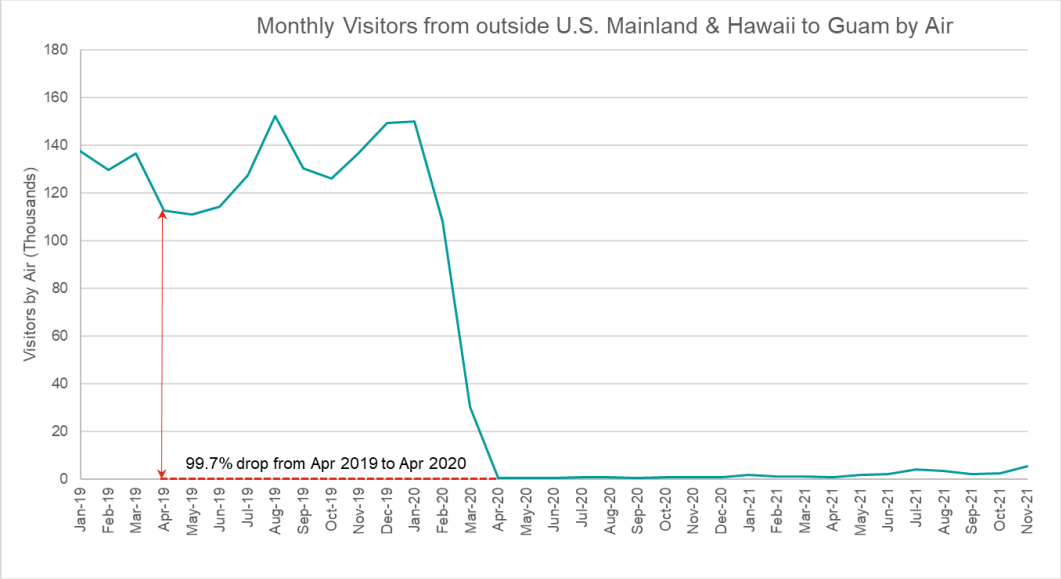

Figure 3-8. Monthly Visitors from Outside the U.S. Mainland and Hawaii to Guam by Air

Sources:

1. *GVB*
2. *AECOM analysis*

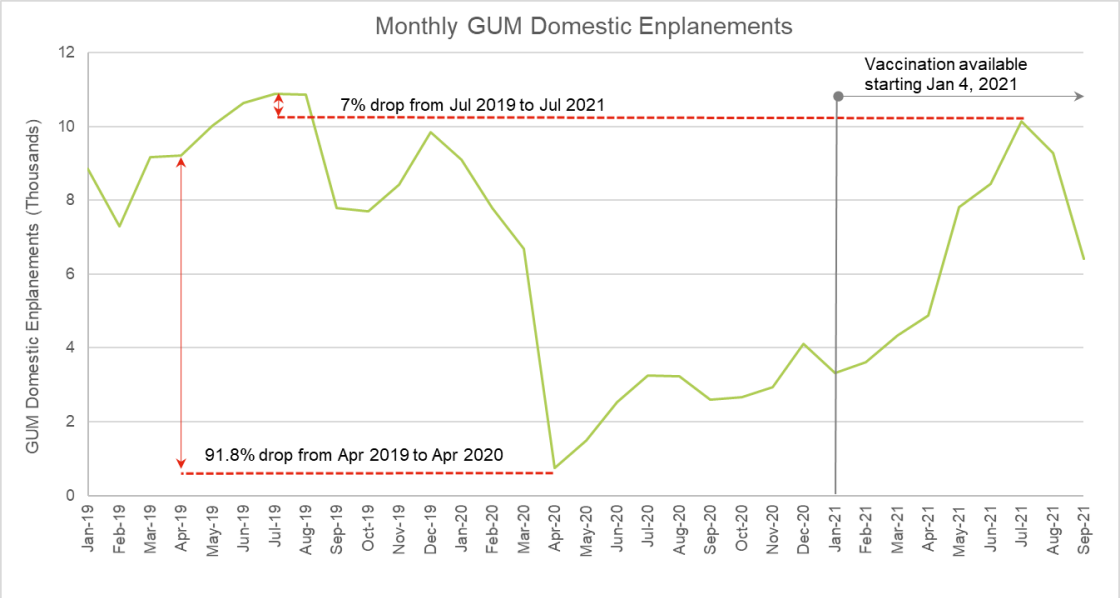

Figure 3-9. Monthly GUM Domestic Enplanements

Sources:

1. *GIAA*
2. *AECOM analysis*

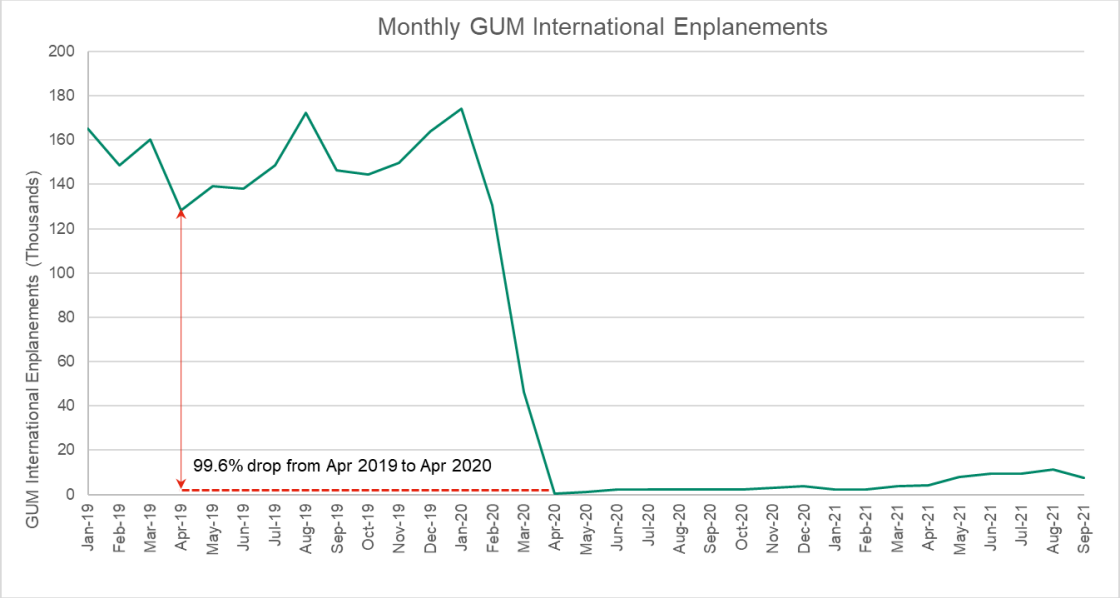

Figure 3-10. Monthly GUM International Enplanements

Sources:

1. *GIAA*
2. *AECOM analysis*

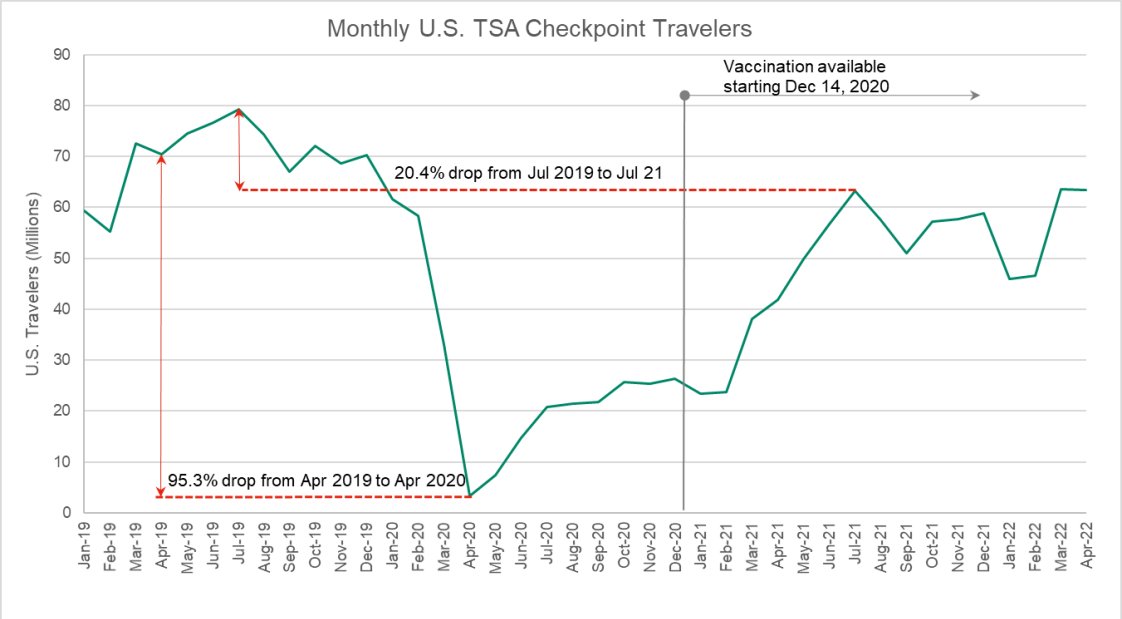

Figure 3-11. Monthly U.S. TSA Checkpoint Travelers

Sources:

1. *Traveler statistics – TSA*
2. *First vaccination date – WHO*
3. *AECOM analysis*

Sources: Traveler statistics – TSA; First vaccination date – WHO; AECOM analysis

Increased travel in July 2021 ties into the 4th wave, when the Delta variant began to emerge throughout the world. As the daily new cases surged, the traveler statistics began to decline again. A similar pattern was also observed during the 5th wave triggered by the Omicron variant. The recovery rate dropped in January 2022 after the growth in holiday season travel through November and December 2021.

As economic losses accumulated, pressures on local and state governments to ease travel restrictions and re-open the economy began to mount. In addition, vaccination was available beginning mid-December 2020 in the U.S. and early January 2021 in Guam.

Of Guam's population, 87.6 percent have had at least one dose of the vaccine and 79 percent are fully vaccinated as of mid-February 2022. The vaccination rates at the nearby Northern Mariana Islands including, Rota, Saipan, and Tinian, are similar to the Guam statistics. Both Guam and the Northern Mariana Islands have higher vaccination rates than the U.S. average (**Table 3-1**). Out of the 50 states, D.C., territories, and federal entities, the Northern Mariana Islands has the highest percentage of its population fully vaccinated, and Guam has the 7th highest.

The vaccination rates in the top international markets for the Airport, including Japan, Korea, Taiwan, and China, are similar to Guam, with over 80 percent of the total population with at least one dose of vaccine and over 74 percent fully vaccinated. Only destinations such as the Philippines, Micronesia, and Marshall Islands have vaccination rates lower than the U.S. average.

Aided by increases in vaccination rates and the increase in pressures to lift travel restrictions for economic recovery, it is anticipated that the recovery in the aviation industry is under way. The forecast section will further discuss the impacts and considerations of the pandemic in different near-term scenarios.

Table 3-1. Vaccination Rates in U.S., Guam, Pacific Islands, and Top International Markets

Location	% of Population with at least one dose of vaccine	% of Population fully vaccinated
U.S./Territories/Commonwealths		
U.S.	76.0%	64.5%
Guam	87.6%	79.0%
Northern Mariana Islands (CNMI)	86.6%	82.0%
International Markets		
Japan	80.1%	78.9%
Korea	87.2%	86.0%
Taiwan	80.7%	74.3%
China	86.7%	84.0%
Philippines	60.8%	54.4%
Micronesia (FSM)	55.8%	44.5%
Palau	93.4%	81.7%
Marshall Islands (RMI)	35.9%	30.4%

Notes:
CNMI = Commonwealth of the Northern Mariana Islands
FSM = Federated States of Micronesia
RMI = Republic of the Marshall Islands
Sources:
U.S./Territories/Commonwealths/Federal States – Centers for Disease Control (CDC) and Prevention, COVID Data Tracker (February 17, 2022)
Japan/Korea/China/Philippines – World Health Organization (WHO), Coronavirus Dashboard (February 17, 2022)
Taiwan – Our World in Data, Coronavirus Vaccinations (February 17, 2022)

3.4 Economic Basis for Aviation Demand

The economy of the top tourism markets and the region served by the Airport is an important determinant of long-term passenger demand at the Airport. The development and diversity of the economic base of these top tourism markets and the Airport service region is important to future passenger traffic growth. To identify the top tourism markets, the historical arrival statistics from the Guam Visitors Bureau (GVB) were analyzed and are included in **Section 3.4.1**. Then the socioeconomic characteristics, including historical and outlook in population, per capita personal income, and regional economy (in terms of Gross Domestic Product [GDP]), for each of the top tourism markets and for Guam are included in **Section 3.4.2**.

3.4.1 Tourism Statistics

Figure 3-12 summarizes the number of air visitors arriving in Guam by country of origin. **Figure 3-13** shows the corresponding percentage of market share. Both figures show that Japan, Korea, Taiwan, and China (including Hong Kong) are the top four international markets for Guam.

The Japan market has been the largest tourism market in Guam for many years. However, Japan's sluggish economy, depreciated currency, and aging populations continue to affect visitor arrivals to Guam. Since 2018, Korea has surpassed Japan as the dominant market for Guam, until 2020 when the COVID-19 pandemic effects began.

With the travel restrictions and quarantine requirements in these top tourism markets during the pandemic, U.S. domestic travel emerged as the dominant market in 2021.

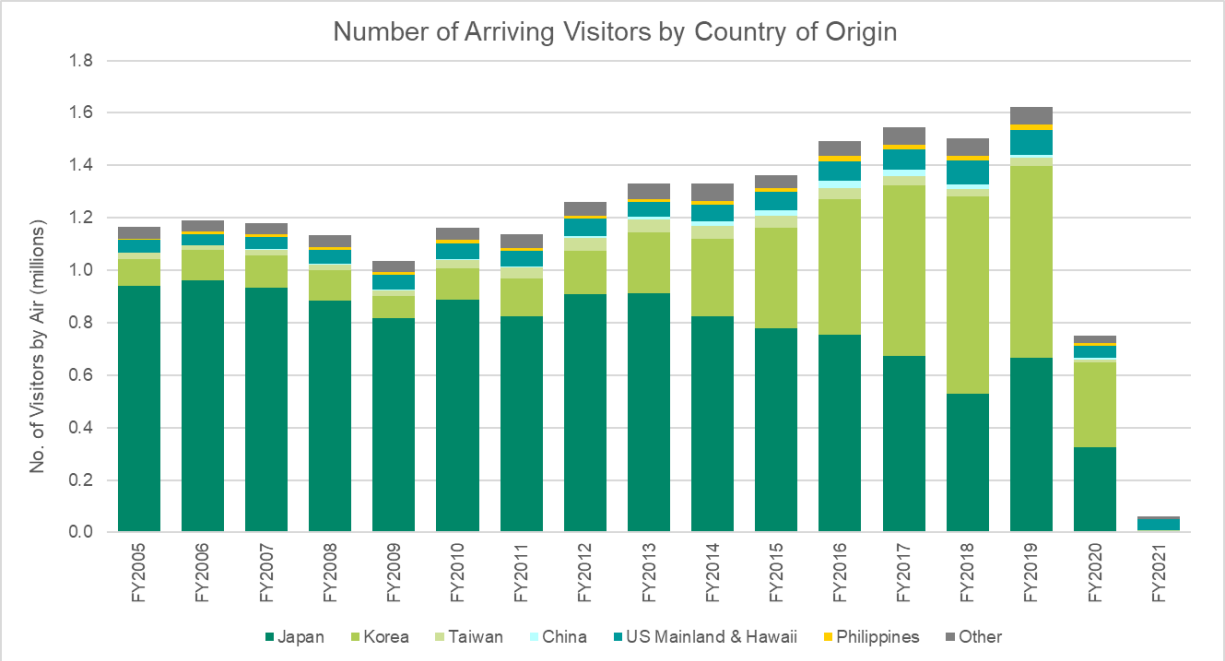

Figure 3-12. Number of Arriving Visitors by Country of Origin (FY2005 to FY2021)

Sources:

1. *Visitor statistics – GVB (January 2022)*
2. *AECOM analysis*

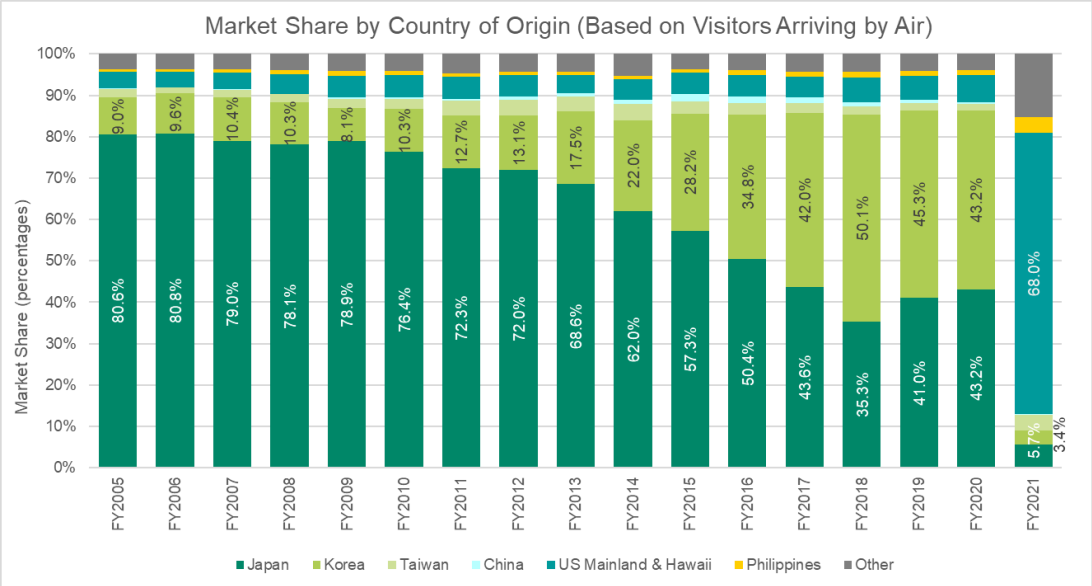

Figure 3-13. Market Share by Country of Origin (FY2005 to FY2021)

Sources:

1. *Visitor statistics –GVB (January 2022)*
2. *AECOM analysis*

The tourism statistics also provide an insight on the seasonal variations on air travel demands. **Figure 3-14** shows the seasonal variations based on monthly visitor statistics. Typically, the peak tourism seasons in Guam are December to March and June to August. Off-peak months with the lowest tourism demand are May, September, and October.

December to March is popular for Japanese and Korean visitors, as temperatures are a lot warmer in Guam during winter. June to August is the traditional peak season for many destinations because schools have summer breaks. August is the overall peak month throughout the year.

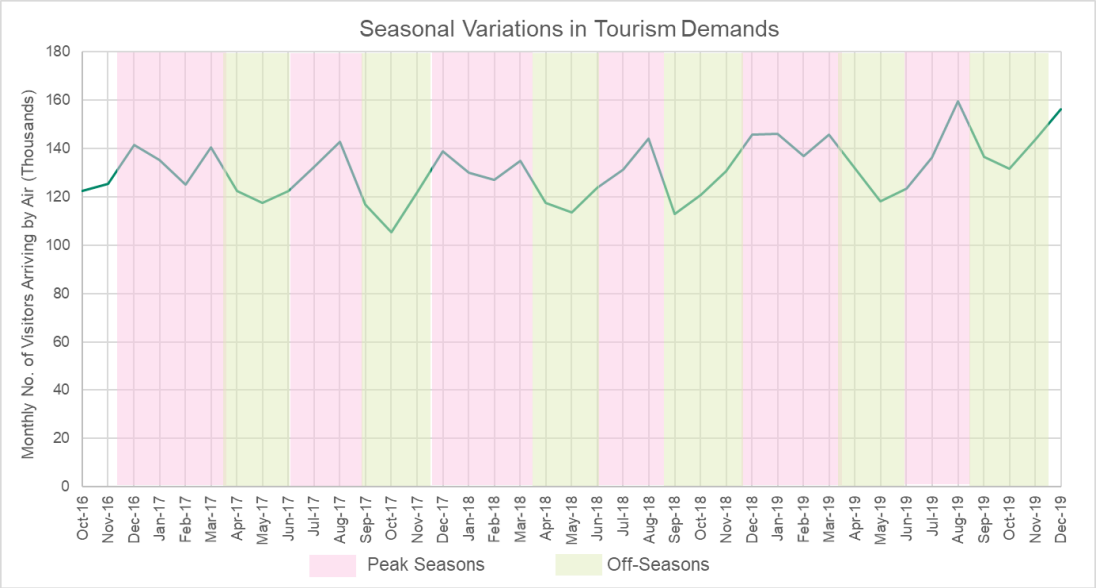

Figure 3-14. Seasonal Variations in Tourism Demands

Sources:

1. *Visitor statistics – GVB (January 2022)*
2. *AECOM analysis*

The tourism statistics were analyzed to determine the percentage of domestic (U.S. mainland, Hawaii, and CNMI) and international (other than U.S. mainland, Hawaii, and CNMI) visitors. **Figure 3-15** shows the percentage of domestic visitors varied between 5 and 8 percent over the past 15 years before the COVID-19 pandemic.

Less than 30 percent of the domestic visitors arrive from CNMI, as shown in **Figure 3-16,** and that statistic has decreased to less than 20 percent in recent years. The driver for the increase in domestic visitors is primarily from the U.S. mainland (via Hawaii).

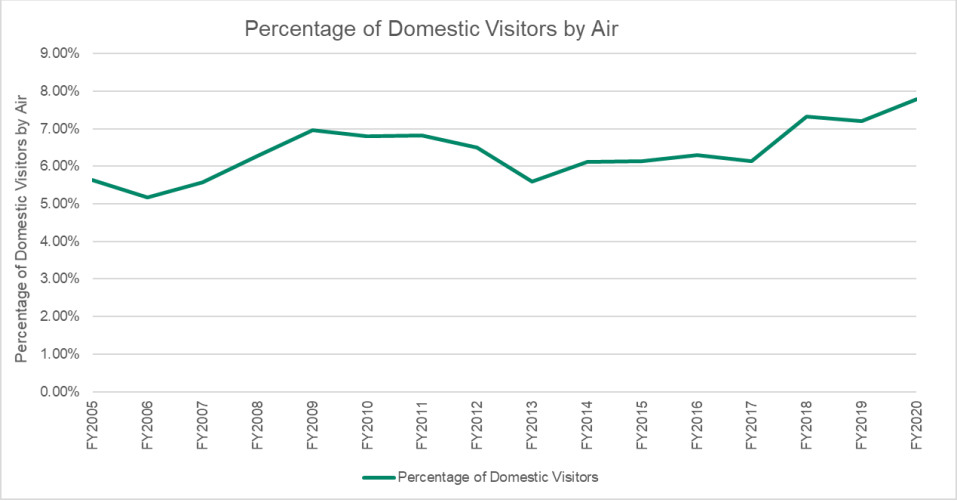

Figure 3-15. Percentage of Domestic Visitors by Air (FY2005 to FY2020)

Note: Percentage of domestic visitors was 73 percent in FY2021, as international travels were significantly reduced due to the COVID-19 pandemic, hence, the FY2021 data is excluded from the figure.

Sources:

1. *Visitor statistics – GVB (January 2022)*
2. *AECOM analysis*

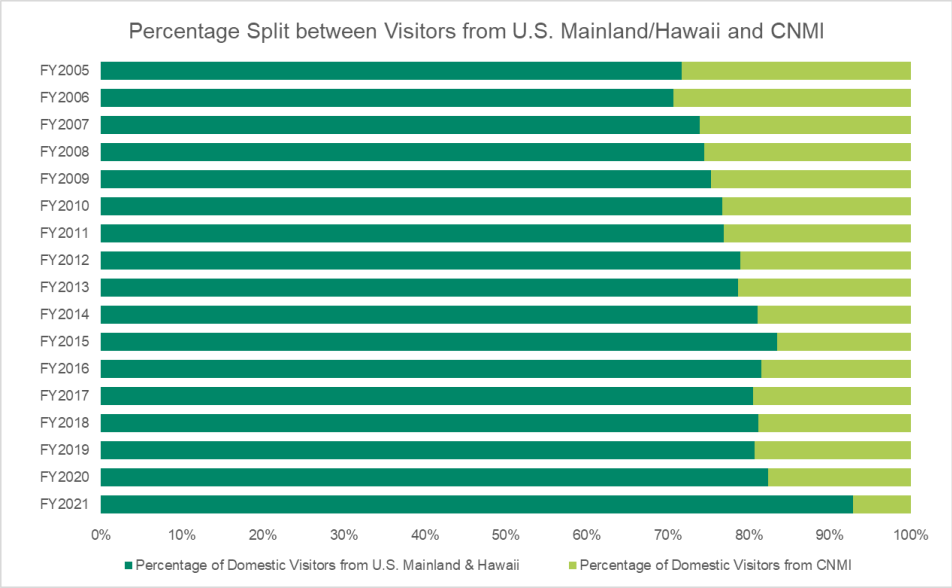

Figure 3-16. Percentage Split Between Visitors from U.S. Mainland/Hawaii and CNMI (FY2005 to FY2021)

Sources:

1. *Visitor statistics – GVB (January 2022)*
2. *AECOM analysis*

Visitor profiles of the top tourism markets provide additional insights on the correlation of socioeconomic characteristics to the air travel demands. Relevant analyses for the Japan, Korea, and Taiwan markets based on GVB's FY2020 Annual Report and Exit Survey Reports by country for the first quarter of 2020 are summarized below.

- Japanese visitors are mostly motivated by the short travel time to Guam (41 percent) and natural beauty (37 percent). Korean visitors' travel motivations are primarily for pleasure (66 precent) and relaxation (51 percent). Taiwanese visitors' top travel motivations are the natural beauty of Guam (47 percent) and for relaxation (41 percent).
- The average age of visitors is similar for these three markets and falls between 32 and 34 years.
- Average party size is 4.7 for Japanese visitors, 3.5 for Korean visitors, and 5.4 for Taiwanese visitors.
- The average length of stay is also similar and falls between three and five nights: three nights for Japanese visitors, four nights for Korean visitors, and five nights for Taiwanese visitors.
- Japan is a mature market with more repeat visitors as compared to Korea and Taiwan; 58 percent of Japanese visitors are first-time visitors versus 75 percent for Korean visitors and 76 percent for Taiwanese visitors.
- Peak months for Japanese visitors are March and August. January and July are the peak months for Korean visitors. February and July are the peak months for Taiwanese visitors.
- The income groups are very diverse. Guam appears to be popular with a wide range of visitors from different income groups.

For the domestic market, relevant analyses for the U.S. visitor profile based on GVB's Exit Survey Report for the first quarter of FY2020 are summarized below. The travel motivations for domestic visitors are different from international visitors, hence the visitor profiles also vary.

- The top motivations for U.S. visitors are related to government/military (41 percent), visiting friends and relatives (35 percent), vacation (27 percent), and business (23 percent).
- The average age of visitors is 41.7 years.
- Average party size is 2.1 persons.
- Average length of stay is 12.6 nights.

- 39 percent of U.S. visitors are first-time visitors.
- Peak months for U.S. visitors are August and December.[4]
- The income group is also very diverse; 56 percent of the U.S. visitors have annual household income before taxes between $50,000 and $150,000, including 18 percent at $50,000 to $75,000, 14 percent at $75,000 to $100,000, and 24 percent at $100,000 to $150,000.[5]

3.4.2 Socioeconomics

The socioeconomic characteristics of the top tourism international markets, the domestic U.S. market, and the local Guam market are described in this section. The projections of the socioeconomic characteristics and economic outlook through the planning horizon are included where available.

3.4.2.1 Japan

Japan is one of the largest and most developed economies in the world. It has a well-educated, industrious workforce, and its large, affluent population makes it one of the world's biggest consumer markets. Japan's economy was the world's second largest (behind the U.S.) from the 1960s to 2010, when it was overtaken by China. Its GDP in 2019 was $4.6 trillion (in constant 2015 U.S. dollars [USD]), and its population of 126 million enjoys a high standard of living, with per capita GDP of over $36,000 in 2019.

3.4.2.1.1 Population of Japan

Figure 3-17 summarizes the historical and projected population, and annual population growth rates of Japan. The rapidly aging population, the decline in birth rates, and continued migration restrictions shrink Japan's population. The United Nations predict the population of Japan will reduce by 9.6 percent from 126 million in 2019 to 114 million in 2039.

Both the aging population and overall decline in total population will reduce the size of the workforce and tax revenues, while placing an increase on demands on health and welfare expenditure. These factors add pressure to Japan's economy.

Since the average age of visitors from Japan is the youngest (32 years) among the top markets, only 2 percent of the Japanese visitors are over 60 years old. Guam will continue to face its challenges in silver tourism with the aging demographics.

3.4.2.1.2 Economy of Japan

Japan is a world leader in manufacturing of electrical appliances and electronics, automobiles, ships, machine tools, high technology equipment, machinery, and chemicals. In recent years; however, Japan has ceded some economic advantage in manufacturing to China, Korea, and other manufacturing economies. Japanese firms have reacted to this trend by moving some of their manufacturing production to low-cost countries. Japan's services sector, especially financial services, now plays a more prominent role in the economy than manufacturing.

International trade contributes significantly to the Japanese economy. Key exports include automobiles, machinery, and manufactured products. Despite the depreciated yen as a result of stimulatory economic initiatives, export growth remains sluggish.

Japan's economy and depreciated currency continue to affect Japanese visitors to Guam. The multi-year increases in its sales tax and deficit spending by the government, combined with limited opportunities for foreign direct investment, has resulted in annual GDP growth measured at an average of less than 1 percent in the past five years (2015 to 2019). Over the last two decades (2000 to 2019), the annual GDP growth has also been stagnant and averaged at less than 1 percent. The historical GDP and GDP per capita growth rates are given in **Figure 3-18**.

However, Japan remains immensely strong in the world of trade and commerce and an economic powerhouse. Growth is projected to continue at a moderate rate after the recovery from the pandemic.

[4] This data is based on annual arrival statistics instead of the quarterly Exit Survey Report.
[5] Throughout this report, "$" means U.S. dollars unless otherwise stated.

The long-term economic outlook referencing the FAA Aerospace Forecast FY2021–2041 assumptions is given in **Figure 3-18**.

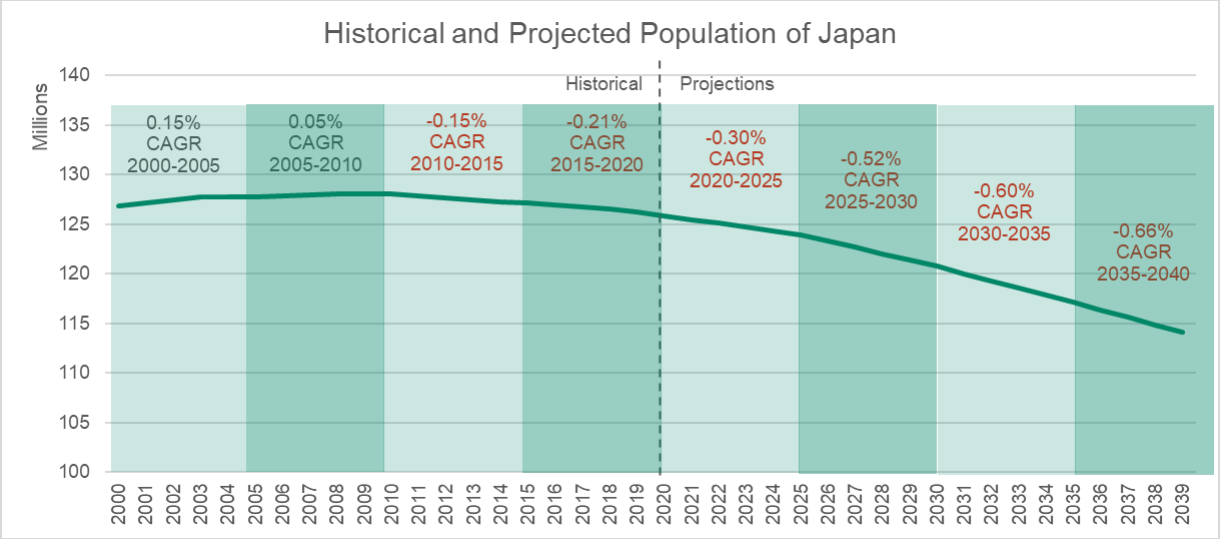

Figure 3-17. Historical and Projected Population of Japan

Sources:

1. *Historical population statistics – World Bank, World Development Indicators (January 2022)*
2. *Projected population statistics at 5-year intervals, median prediction – United Nations (November 2021)*
3. *Interpolation between 5-year internals and compound annual growth rate (CAGR) calculations – AECOM analysis*

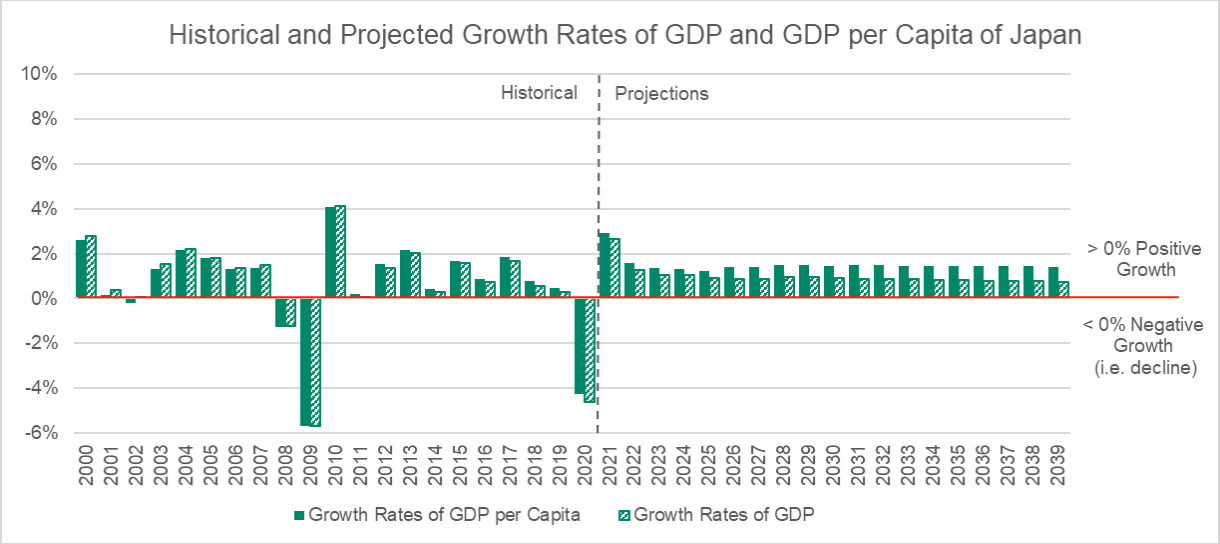

Figure 3-18. Historical and Projected Growth Rates of GDP and GDP per Capita of Japan

Sources:

1. *Historical GDP and GDP per capita (constant 2015 USD) statistics – World Bank, (January 2022)*
2. *Projected GDP, baseline scenario – Information Handling Services (HIS) Markit adopted in the FAA Aerospace Forecast FY2021–2041*
3. *Projected population statistics, median prediction – United Nations (November 2021)*
4. *Projected GDP per capita calculations based on projected GDP and population statistics – AECOM analysis*

3.4.2.2 Korea

Korea (i.e., Republic of Korea or South Korea), with a GDP of $1.6 trillion (in constant 2015 USD) in 2019, is the fourth-largest economy in Asia and the 13th largest in the world. It is an innovative, free-market economy with a highly educated and tech savvy workforce. It had a population of 51.7 million and per capita GDP of over $31 thousand in 2019.

3.4.2.2.1 Population of Korea

Figure 3-19 summarizes the historical and projected population, and annual population growth rates of Korea. Korea shares the same problem with rising longevity and low fertility rate as Japan, but to a less severe extent. The United Nations predicts the population of Korea will reduce by 3.4 percent from 51.7 million in 2019 to just below 50 million in 2039.

3.4.2.2.2 Economy of Korea

Advanced manufacturing and services dominate the economy of Korea and employ most of the population. Among its main manufactured products are mobile phones, consumer electronics, household appliances, cars, ships, and steel, all of which are exported around the globe. As an advanced manufacturing economy, Korea imports large quantities of natural resources such as coal, iron ore, and oil.

Korea's economic progress in the last half-century has in many ways mirrored Japan's that preceded it. In the recent decade, the economic growth in Korea has outpaced Japan. During the recent global financial crisis of 2008–2009, Korea was one of the few countries to avoid a recession.

Korea has had an average annual GDP growth of 2.8 percent over the past five years (2015 to 2019) and over 4 percent in the past two decades (2000 to 2019). The historical GDP and GDP per capita growth rates are given in **Figure 3-20**. Korea's GDP growth rate has outpaced Japan for the last two decades.

As described in **Section 3.4.1**, Korea surpassed Japan in 2018 as the most prominent market for Guam.

The long-term economic outlook referencing the FAA Aerospace Forecast FY2021–2041 assumptions and the forecast by the International Monetary Fund (IMF) (2021–2026) is given in **Figure 3-20**.

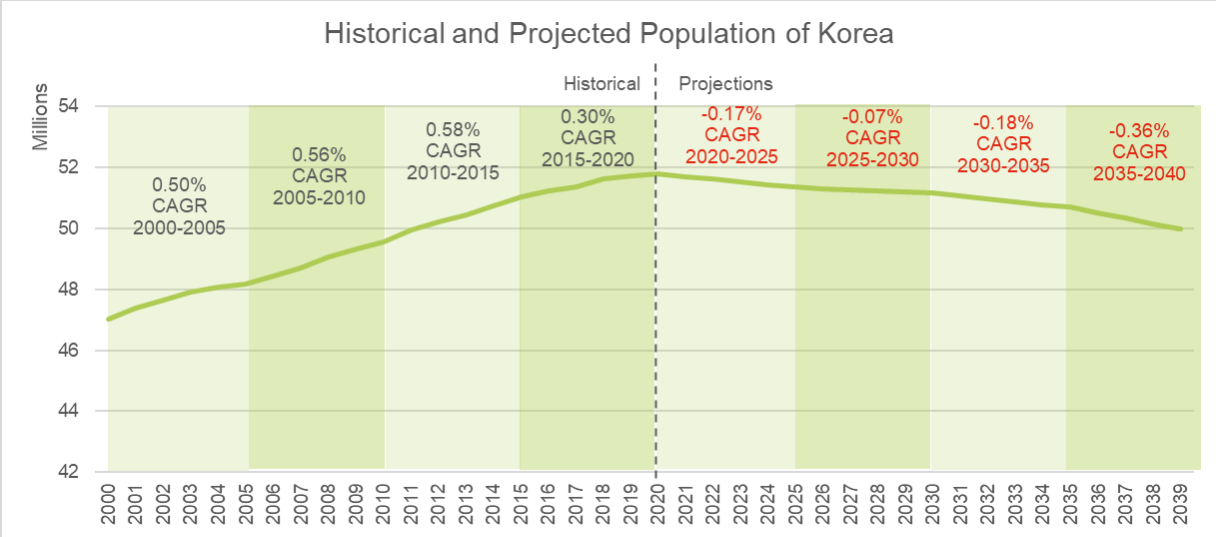

Figure 3-19. Historical and Projected Population of Korea

Sources:

1. *Historical population statistics – World Bank, World Development Indicators (January 2022)*
2. *Projected population statistics at 5-year intervals, median prediction – United Nations (November 2021)*
3. *Interpolation between 5-year internals and CAGR calculations – AECOM analysis*

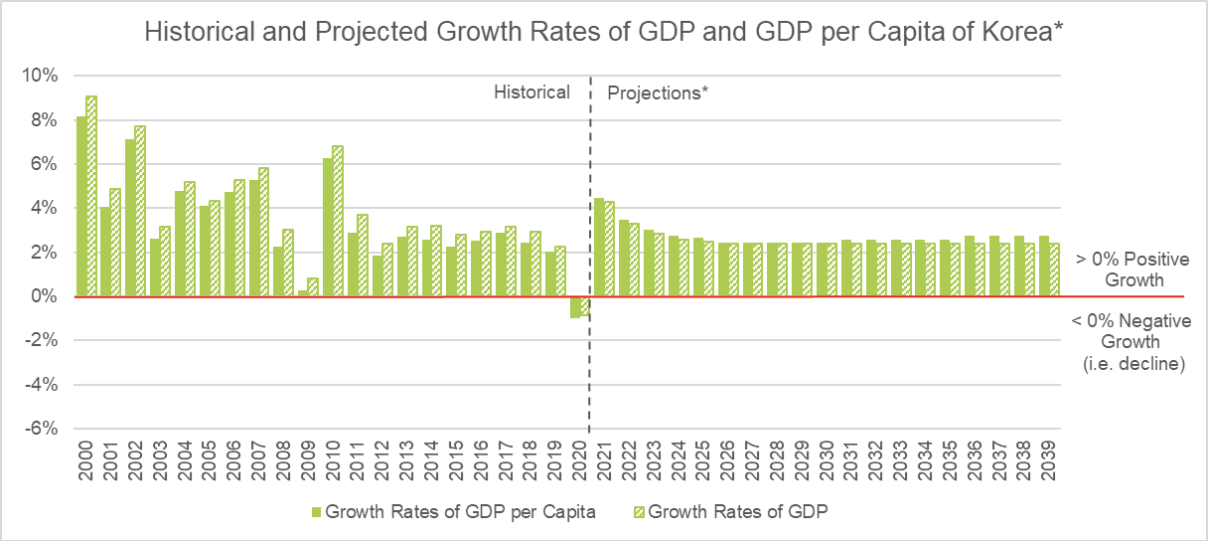

Figure 3-20. Historical and Projected Growth Rates of GDP and GDP per Capita of Korea

Note: Since the FAA Aerospace Forecast FY2021–2041 does not include country-specific data for Korea, projected GDP references the IMF forecast (2021–2026) for Korea and the global GDP growth, which is comparable to the historic trend of Korea.
Sources:

1. *Historical GDP and GDP per capita (constant 2015 USD) statistics – World Bank (January 2022)*
2. *Projected GDP growth rates – IMF (February 2022)*
3. *Projected GDP, baseline scenario – IHS Markit adopted in the FAA Aerospace Forecast FY2021–2041*
4. *Projected population statistics, median prediction – United Nations (November 2021)*
5. *Projected GDP per capita calculations based on projected GDP and population statistics – AECOM analysis*

3.4.2.3 Taiwan

As one of the original four "Asian Tigers[6]," Taiwan's (i.e., Republic of China's) economic performance stunned the world in the second half of the 20th century. Today, with its highly developed economy, free-market environment, and advanced information technology (IT) industrial production chains, Taiwan continues to be a leading force contributing to Asia's economic prosperity.

3.4.2.3.1 Population of Taiwan

Figure 3-21 summarizes the historical and projected population, and annual population growth rates of Taiwan. The United Nations predicts the population of Taiwan will increase slightly from 23.6 million in 2019 to 24 million in 2030. After 2030, the population is projected to decline slowly and return to 23.6 million in 2039.

3.4.2.3.2 Economy of Taiwan

Despite its contentious relationship with China, Taiwan has thrived over the last four decades. It plays a central role in the supply chain of the global IT industry and is a hub that links developed Western economies and emerging Asian markets.

Due to pressure from China, the country is not a member of the United Nations, but it has nevertheless emerged as a reliable exporter. Taiwan's GDP per capita was nearly $26 thousand in 2019. Its GDP was over $620 billion in 2019, with an average annual GDP growth of 2.6 percent over the past five years (2015 to 2019) and 3.8 percent in the past two decades (2000 to 2019), making this nation of 23.6 million people one of the strongest economies in Asia. The historical GDP and GDP per capita growth rates based on the National Statistics of Taiwan are given in **Figure 3-22**. The long-term economic outlook referencing the FAA Aerospace Forecast FY2021–2041 assumptions and the forecast by the IMF (2021–2026) is also included in **Figure 3-22**.

[6] The Four Asian Tigers are the economies of South Korea, Taiwan, Singapore, and Hong Kong. Between the early 1960s and 1990s, fueled by exports and rapid industrialization, the Four Asian Tigers have consistently maintained high levels of economic growth, and have collectively joined the ranks of the world's wealthiest nations.

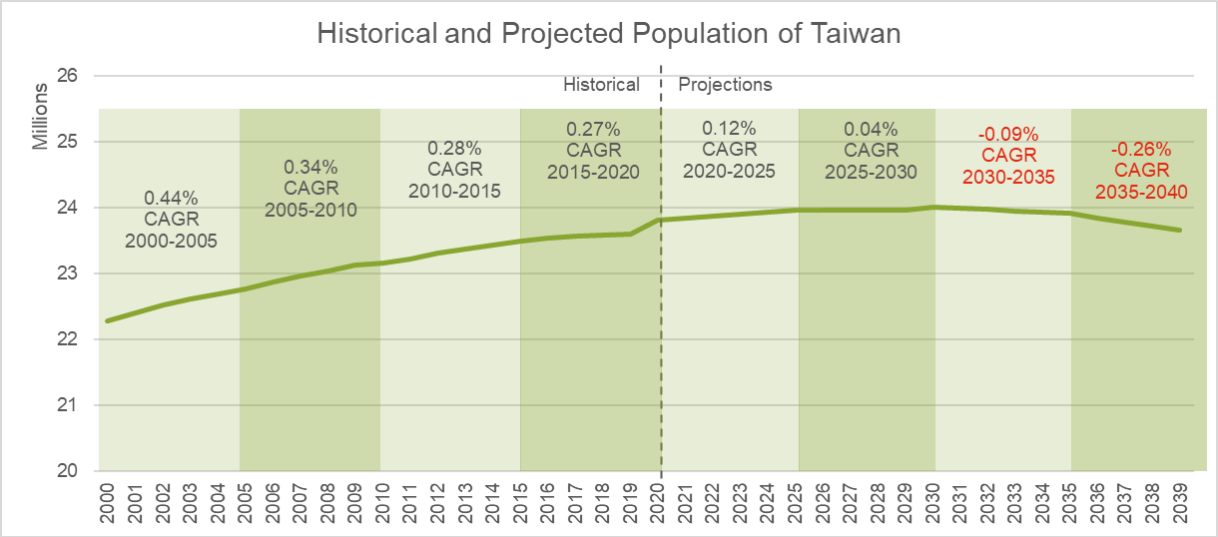

Figure 3-21. Historical and Projected Population of Taiwan

Sources:

1. *Historical population statistics – Taiwan Ministry of the Interior (February 2022)*
2. *Projected population statistics at 5-year intervals, median prediction – United Nations (November 2021)*
3. *Interpolation between 5-year internals and CAGR calculations – AECOM analysis*

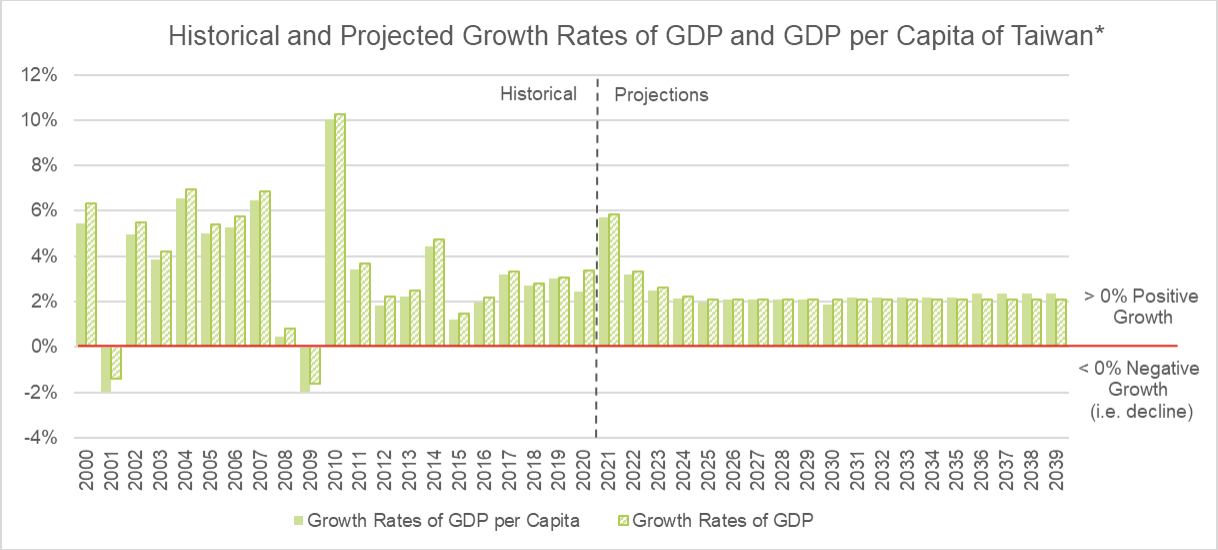

Figure 3-22. Historical and Projected Growth Rates of GDP and GDP per Capita of Taiwan

Note: Since the FAA Aerospace Forecast FY2021–2041 does not include country-specific data for Taiwan, projected GDP references the IMF forecast (2021–2026) for Taiwan and the global GDP growth, which is comparable to the historic trend of Taiwan.

Sources:

1. *Historical GDP and GDP per capita (chained dollars) statistics – Taiwan National Statistics (February 2022)*
2. *Projected GDP growth rates – IMF (February 2022)*
3. *Projected GDP, baseline scenario – IHS Markit adopted in the FAA Aerospace Forecast FY2021–2041*
4. *Projected population statistics, median prediction – United Nations (November 2021)*
5. *Projected GDP per capita calculations based on projected GDP and population statistics – AECOM analysis*

3.4.2.4 China

Forty years ago, after a long period of economic stagnation, China (i.e., People's Republic of China) was not among the world's top economies. Because of the social and economic transformation that began in the late 1970s, China's economy is currently the second largest in the world, behind only the United States. Its GDP in 2019 was $14.3 trillion (in constant 2015 USD), with a population of 1.4 billion and per capita GDP of over $10 thousand in 2019.

3.4.2.4.1 Population of China

The size of China's population has long been a controversial issue. After rapid population growth in the middle of the 20th century, the Chinese government sought to limit population growth by introducing the "one-child" policy. The scheme, which rewarded couples that agreed to have just one child with cash bonuses and better access to housing, proved to be so successful that the birth rate dropped significantly. As a result, there are concerns that China's low birth rate, combined with its aging population, will damage its future economic development. In addition, the one-child policy was met with a great deal of resistance, particularly in rural areas, and it also created an abnormal ratio of male to female births in China. The policy was ended in 2016.

China's population growth has slowed since the implementation of the one-child policy, and that slowing is projected to continue. The United Nations predicts the population to grow at increasingly slower rates until 2030, at which point the population should begin to decrease.

Figure 3-23 summarizes the historical and projected population, and annual population growth rates of China.

3.4.2.4.2 Economy of China

China's economy is the second-largest in the world. But after three decades of growth, China is now moving into a slower growth phase—an inevitable result of its transition from a developing economy to a more mature, developed economy. In the 1980s, 1990s, and early 2000s, China's annual GDP growth frequently exceeded 10 percent, but it gradually dropped to 6 percent in 2019.

The economy of China is managed by the Chinese Government through five-year plans that set goals, strategies, and targets. The current five-year plan focuses on increasing China's competitiveness through more efficient and increasingly advanced manufacturing on the east coast, attracting labor-intensive manufacturing to central provinces and increasing domestic demand.

The perception of China since the 1980s as a predominantly low-cost manufacturing hub, where it effectively served as an inexpensive producer for global brands, is changing as the economy grows. Average wages in China have been climbing to the point where China is changing from a low-cost hub to a dynamic and complex economy.

Rapidly rising income levels in China and mass migration from rural to urban areas have created an abundantly large class of urban consumers demanding improved housing, a cleaner environment, better education, health care, financial services, and overseas travel, which is the most relevant to the Guam's tourism market. From the sophisticated consumers of developed cities such as Beijing, Guangzhou, and Shanghai, to the growing middle classes in lesser-known inland cities, there are increasing opportunities in China.

Over the last decade, visitors from China to Guam increased until 2016/2017, when the geo-political issues started to impact the China market. During the historical peak periods in 2016/2017, not only did Air China and United Airlines have flights from Shanghai to Guam, but there were also charter flights (operated by Dynamic Air) from secondary cities such as Guangzhou, Chengdu, Dalian, Nanjing, Shenyang, and Zhengzhou.[7]

The historical GDP and GDP per capita growth rates are given in **Figure 3-24**. The long-term economic outlook referencing the FAA Aerospace Forecast FY2021–2041 assumptions is also included in **Figure 3-24**.

[7] FY2016, FY2017, FY2018, and FY2019 Financial Statements, A.B. Won Pat International Airport Authority, Guam (GIAA).

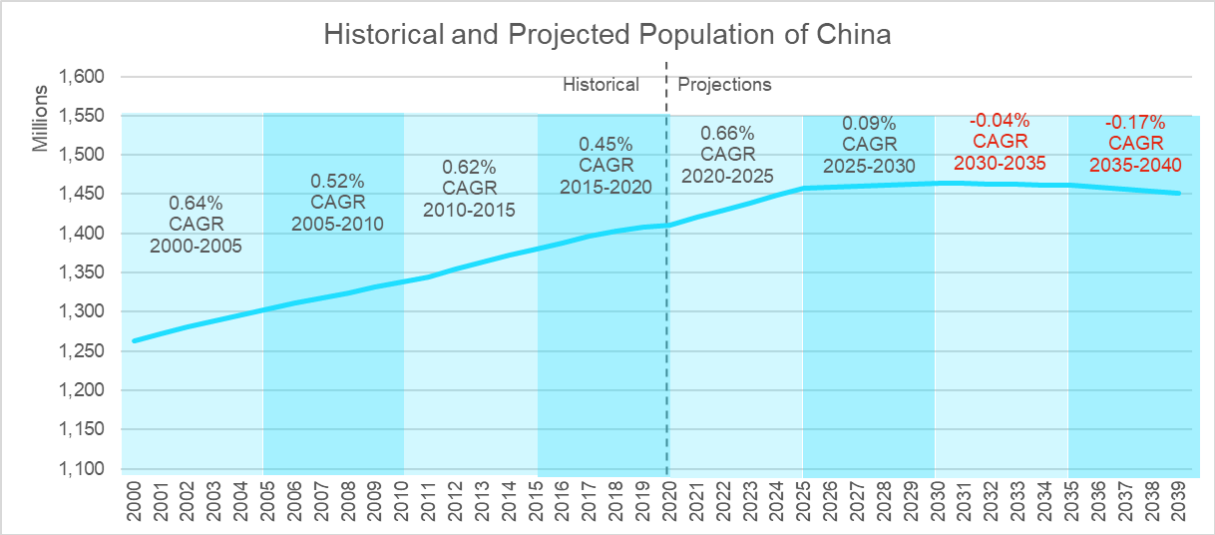

Figure 3-23. Historical and Projected Population of China

Sources:

1. *Historical population statistics – World Bank, World Development Indicators (January 2022)*
2. *Projected population statistics at 5-year intervals, median prediction – United Nations (November 2021)*
3. *Interpolation between 5-year internals and CAGR calculations – AECOM analysis*

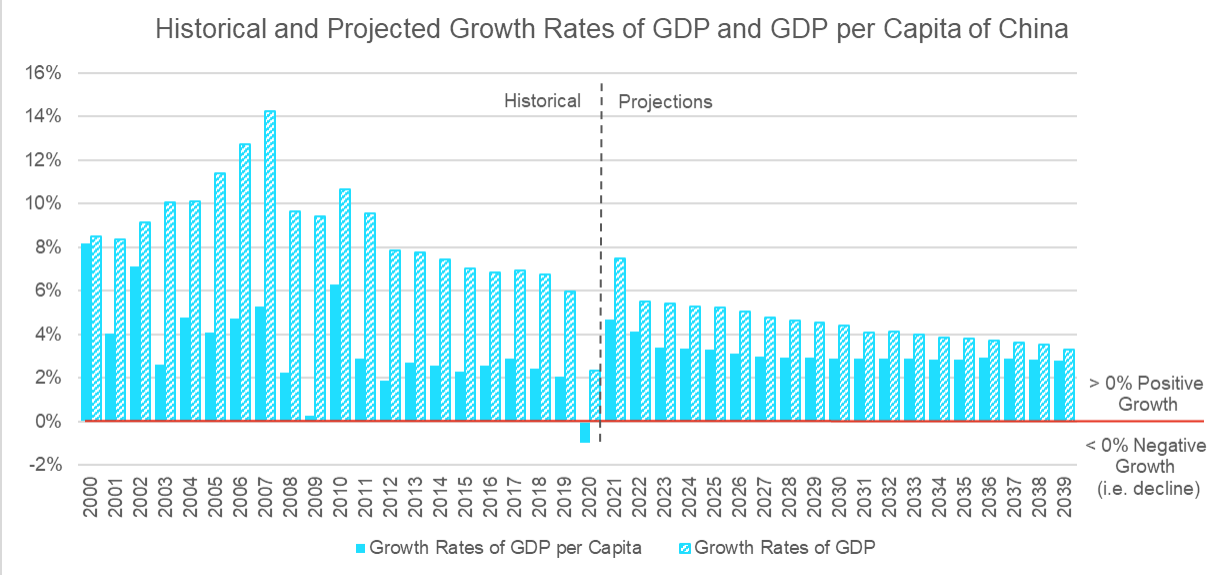

Figure 3-24. Historical and Projected Growth Rates of GDP and GDP per Capita of China

Sources:

1. *Historical GDP and GDP per capita (constant 2015 USD) statistics – World Bank (January 2022)*
2. *Projected GDP, baseline scenario – IHS Markit adopted in the FAA Aerospace Forecast FY2021–2041*
3. *Projected population statistics, median prediction – United Nations (November 2021)*
4. *Projected GDP per capita calculations based on projected GDP and population statistics – AECOM analysis*

3.4.2.5 United States

The U.S. has been the world's largest economy since the late 19th century. Several factors contribute to the U.S.'s powerful economy. The U.S. is known globally for cultivating a society that supports and encourages entrepreneurship, which encourages innovation and, in turn, leads to economic growth. The growing population in the U.S. has helped diversify the workforce. The U.S. is also one of the leading manufacturing industries in the world, coming second only to China. The USD is also the most widely used currency for global transactions.

The GDP for the U.S. is $20 trillion (in constant 2015 USD), with a population of over 328 million and per capita GDP of $60 thousand in 2019.

3.4.2.5.1 Population of the U.S.

Unlike China, the U.S. population is expected to continue growing throughout the century without decline. The population growth in the U.S. is mainly attributed to high rates of immigration, and the natural increase (the difference between number of births and deaths).

The U.S. population grew an average of 0.9 percent annually for the first decade of the 21st century and reduced to an annual average of 0.6 percent for the second decade. This is because of a decrease in the number of total births over the years. Additionally, more post-World War II baby boomers are reaching old age, which increases the number of deaths. Despite a decrease in the population growth rate in recent years, the population is still expected to grow continuously.

Figure 3-25 summarizes the historical and projected population, and annual population growth rates of the U.S. The United Nations predict the U.S. population will increase continuously from 328 million in 2019 to 365 million in 2039.

3.4.2.5.2 Economy of the U.S.[8]

The U.S. economy is one of the world's wealthiest and most diversified, led by a highly productive, highly developed, and technologically advanced services sector, advanced manufacturing, and world-class research and development. Its economy is dominated by service-oriented companies in areas such as technology, financial services, healthcare, and retail.

Even though the services sector is the main engine of the economy, the U.S. also has an important manufacturing base. The U.S. is one of the largest manufacturers in the world and a leader in higher-value industries such as automobiles, aerospace, machinery, telecommunications, and chemicals.

In the long-term, the U.S. economy is expected to maintain its powerhouse status through a combination of characteristics: It has access to an abundance of natural resources; it has a large, well-educated, and productive workforce; the well-established regulatory structure, legal system, and free-market environment facilitates economic growth; and the general population, including a diversity of immigrants, brings a mix of culture and ideas. Economic growth in the U.S. is constantly being driven forward by ongoing innovation, research, and development as well as capital investment.

The U.S. economy has been growing moderately with an average annual GDP growth of 2.5 percent over the past five years (2015 to 2019) and 2.1 percent in the past two decades (2000 to 2019). It is anticipated that the long-term growth trend will maintain at similar levels.

The historical GDP and GDP per capita growth rates of the U.S. are given in **Figure 3-26**. The long-term economic outlook referencing the FAA Aerospace Forecast FY2021–2041 assumptions is also included in **Figure 3-26**.

[8] Multiple sources such as the FAA Aerospace Forecast FY2021–2041, the Congressional Budget Office's (CBO's) July 2021 report The Budget and Economic Outlook: 2021 to 2031, and the World Bank's Focus Economics (https://www.focus-economics.com/countries/united-states).

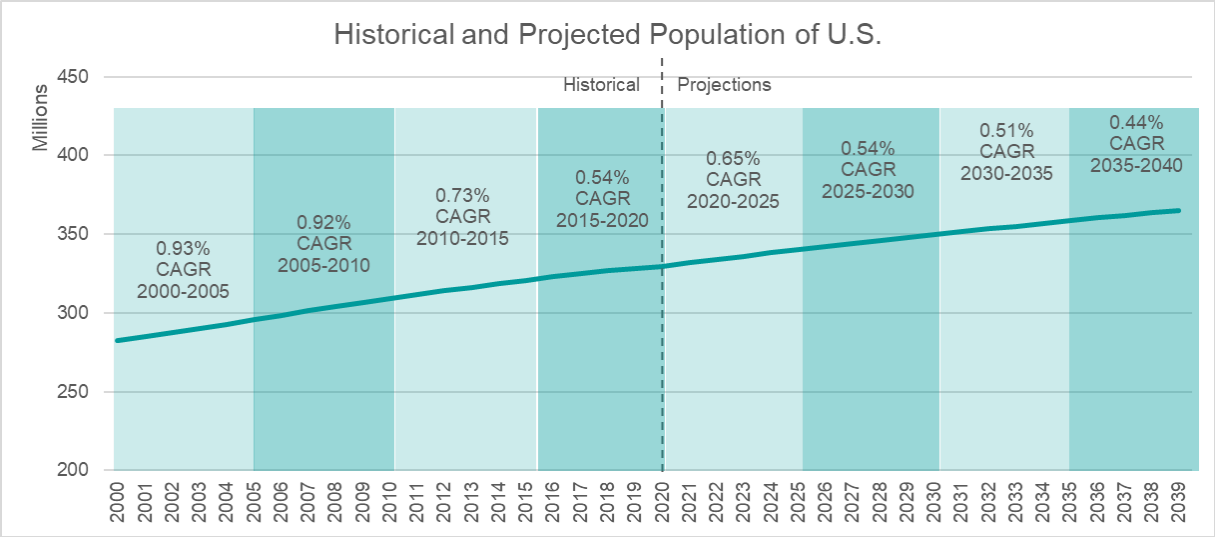

Figure 3-25. Historical and Projected Population of the U.S.

Sources:

1. *Historical population statistics – World Bank, World Development Indicators (January 2022)*
2. *Projected population statistics at 5-year intervals, median prediction – United Nations (November 2021)*
3. *Interpolation between 5-year internals – AECOM analysis*

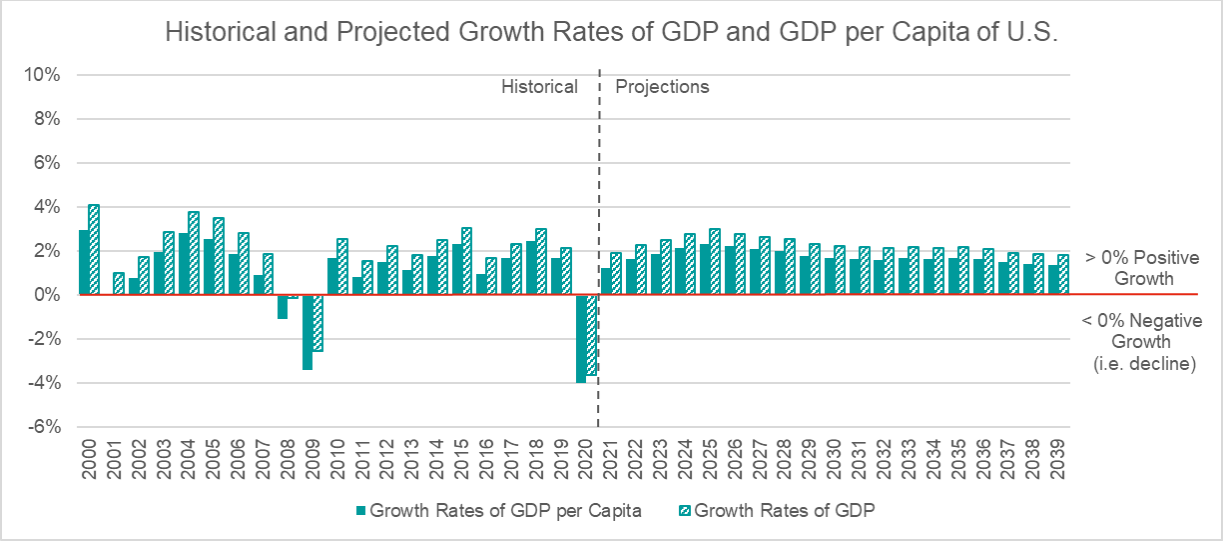

Figure 3-26. Historical and Projected Growth Rates of GDP and GDP per Capita of the U.S.

Sources:

1. *Historical GDP and GDP per capita (constant 2015 USD) statistics – World Bank (January 2022)*
2. *Projected GDP, baseline scenario – IHS Markit adopted in the FAA Aerospace Forecast FY2021–2041*
3. *Projected population statistics, median prediction – United Nations (November 2021)*
4. *Projected GDP per capita calculations based on projected GDP and population statistics – AECOM analysis*

3.4.2.6 Guam

Guam's economy is small and undiversified, but the island is endowed with natural resources and a multicultural workforce. It depends primarily on tourism, the U.S. Department of Defense (DoD) installations, and local businesses. Guam's economy is small in terms of both population and size, which will be discussed in the subsequent paragraphs.

Guam is the largest island in Micronesia and is located in the Western Pacific region. Being an island has its challenges, as it implies some level of geographic isolation and distance from larger markets. It also makes it vulnerable to natural disasters such as typhoons, earthquakes, and tsunamis that have significant and unpredictable impacts to the economy, in particular the tourism sector.

3.4.2.6.1 Population of Guam

According to the 2020 United States Census, the population of Guam was more than 153 thousand. According to the Bureau of Statistics and Plans, Guam, there are constantly between 10,600 and 13,600 active military personnel and their family members in Guam based on the available data from 2005 to 2017, which represents between 6.7 and 8.5 percent of Guam's total population. Military personnel and their dependents mostly travel to/from Guam by air and generate air service demands.

Figure 3-27 summarizes the historical and projected population, and annual population growth rates of Guam. The United Nations predicts the population of Guam will increase continuously from 153 thousand in 2019 to 187 thousand in 2039.

3.4.2.6.2 Economy of Guam

Guam's economy is heavily related to the military actions in the Pacific region, which brings not only the military population (including dependents), but also an increase in construction of infrastructure and military installations. For example, in late 1980s, Cold War military spending and closing of the U.S. bases in the Philippines increased Guam's military population significantly (23,800 in 1987), thereby adding to Guam's economic base.

Troops temporarily repositioned from the closed Philippine bases to Guam were relocated out of Guam at the end of the 1980s causing a decline in military population in the 1990s. The closure of the Naval Air Station (NAS) Agana in 1995 resulted in a reduction of the military population in Guam from over 20,000 in the 1980s to approximately 15,000 in the mid-1990s and remain between 10,600 and 13,600 in the 2000s and 2010s.[9, 10]

The agreement between the U.S. and Japan to reduce the presence of U.S. troops in Okinawa and relocate them to Guam, Hawaii, and other locations will also impact Guam's economy. Information from the local news indicates that the planned transfer of U.S. Marine Corps personnel from Okinawa to Guam may start in October 2024. Infrastructure projects to cope with the surge in population are under way. [11, 12]

Guam's undiversified economy is also highly impacted by tourism, hence the economy of those top tourism markets. Historically, Guam's Asia-oriented visitor base expanded and peaked in the mid-1990s, generating substantial increases in the construction of hotels and condominiums. However, the collapse of the Asian financial markets in 1997, compounded by the crash of Korean Air flight on approach to the Airport in August 1997, led to a decline in both the Japan and Korea markets. By 2000, the tourism industry appeared to recover, but the attacks of September 11 in 2001, the damage caused by Typhoon Pongsona in 2002, and the pandemic of sever acute respiratory syndrome (SARS) in 2003 hit Guam's tourism industry again.

Guam's economy continues to be volatile, and its performance is closely tied to overseas markets and occurrences of natural disasters. The aftermath of the Tohoku earthquake and tsunami that devasted northeastern Japan in March 2011, the global financial crisis that caused the Great Recession from December 2007 to June 2009, and COVID-19 in 2020 affected the tourism industry. Hotel occupancy rates along with related hotel occupancy taxes as well as employment and income for many island residents working in tourist-related activities all declined during those periods. Based on the GDP statistics from the U.S. Bureau of Economic Analysis (BEA) and the Guam population data from the World Bank, the GDP for Guam is over $5.6 billion (in chained 2012 USD), and per capita GDP was nearly $34,000 in 2019. The historical GDP and GDP per capita growth rates are given in **Figure 3-28**.

Authorities and organizations that provide GDP forecasts such as the IMF, the U.S. Congressional Budget Office (CBO), Organization for Economic Cooperation and Development (OECD), and the FAA Aerospace Forecast FY2021–2041 do not include the annual or quarterly forecasts for small economies like Guam, hence projected growth rates are not included in **Figure 3-28**. Nevertheless, the economic outlook for Guam FY2022 and FY2023 from the Department of Labor, Government of Guam, provide some insights

[9] Department of Defense (DoD), Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation, Final Environmental Impact Statement, July 2010. Chapter 16 Socioeconomics and General Services.
[10] Bureau of Statistics and Plans, 2020 Guam Statistical Yearbook, Chapter 8 Federal Programs.
[11] Marine Corps Times dated May 3, 2019. Website https://www.marinecorpstimes.com/news/your-marine-corps/2019/05/03/marine-corps-relocation-from-okinawa-to-guam-worthy-of-review-commandant-says/.
[12] Post Guam dated March 25, 2021. Website https://www.postguam.com/news/local/military-development-of-marine-corps-base-on-guam-on-track/article_17f1b0a0-8d03-11eb-9c09-f7aebad6ea29.html.

on the near-term recovery. Further discussions on the near-term recovery outlook in the aviation demand forecasts are given in **Section 3.6.1.1**.

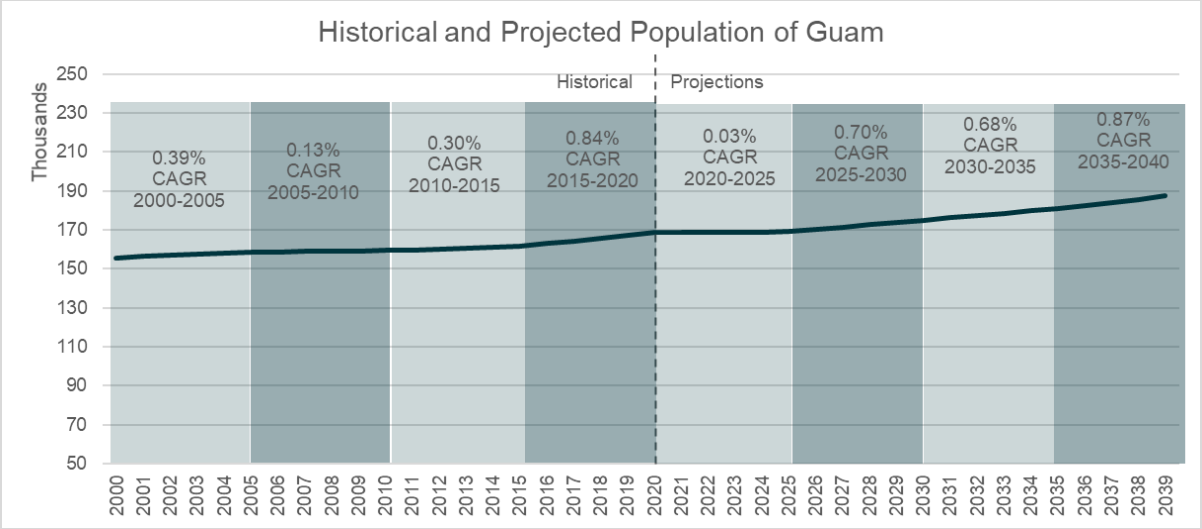

Figure 3-27. Historical and Projected Population of Guam

Sources:

1. *Historical population statistics – World Bank, World Development Indicators (January 2022)*
2. *Projected population statistics at 5-year intervals, median prediction – United Nations (November 2021)*
3. *Interpolation between 5-year internals – AECOM analysis*

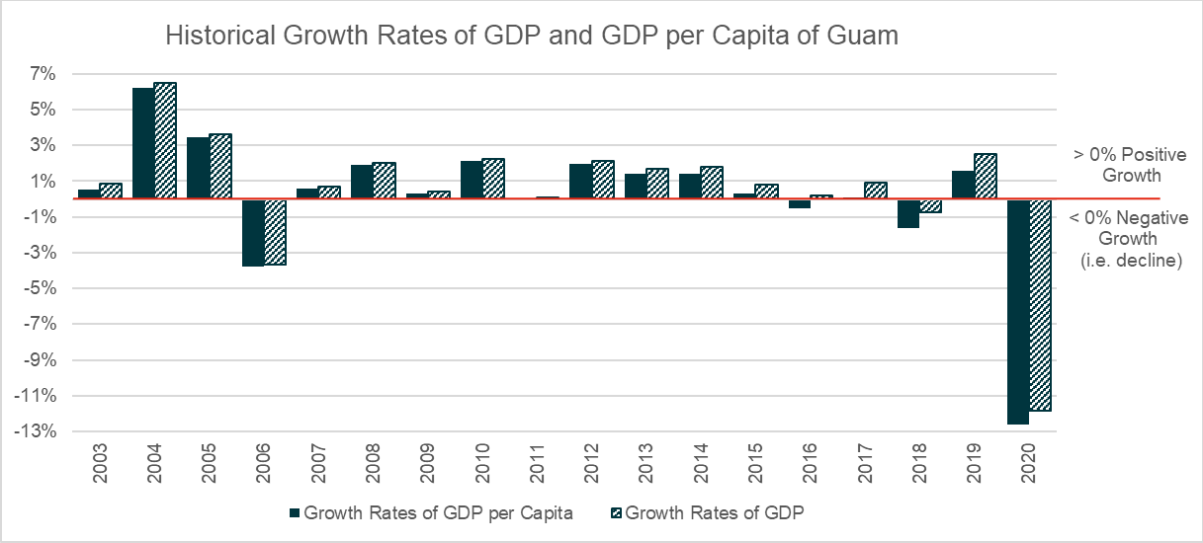

Figure 3-28. Historical Growth Rates of GDP and GDP per Capita of Guam

Sources:

1. *Historical GDP (chained 2012 USD) statistics – U.S. BEA (December 2021)*
2. *Historical population statistics – World Bank, World Development Indicators (January 2022)*
3. *Historical GDP per capita calculations based on GDP and population statistics – AECOM analysis*

3.4.3 Near-Term Economic Outlook

This section discusses the near-term outlook for the U.S., Guam, and worldwide economies.

3.4.3.1 U.S. Economy

The COVID-19 pandemic caused severe economic disruptions beginning March 2020 as households, government agencies, and businesses adopted a variety of mandatory and voluntary restrictions for social distancing to control the spread of the coronavirus. The impact was focused on particular sectors of

the economy, including travel and hospitality, and unemployment was concentrated among lower-wage workers.

Two years after the declaration of the global COVID-19 pandemic, the U.S. economy is on track for recovery. Vaccination is expected to reduce the number of new COVID-19 cases and both travel restrictions and social distancing requirements are expected to decline. Based on the national real GDP released by the BEA, real GDP returned to pre-pandemic level (2019 Q4) in mid-2021 (2021 Q2), which is consistent with the projections from the CBO released in February 2021 and the FAA's domestic baseline forecast assumptions in the FAA Aerospace Forecast FY2021–2041 released in March 2022.

Based on the economic outlook from the CBO, the economy is projected to continue to strengthen during the next five years. Additionally, labor market conditions continue to improve. As the economy expands, people are rejoining the labor force who had left it during the pandemic. The unemployment rate is projected to gradually decline through 2026, and the number of people employed will return to its pre-pandemic level in 2024. Inflation, as measured by the price index for personal consumption expenditures, is expected to rise gradually over the next few years as the Federal Reserve maintains low interest rates.[13]

While the impact of the pandemic on the economy waned, geopolitical tensions increased due to the Russian aggressions in Ukraine that started in February 2022. The Ukraine crisis is likely to increase inflation in the short term, but it is not likely to derail the recovery of the U.S. economy. The impacts are primarily from two main sources. First, the rise in oil price as sanctions on Russian oil companies have reduced crude oil supplies. However, how much the oil price is going to increase is still uncertain. Some economists have the opinion that oil is a global, fungible commodity and Russia can still sell its oil to countries such as China and India, which did not join the sanctions on Russia. The second source of impact is related to Europe's heavy dependence on Russian natural gas. As the U.S. is a major trading partner of the European Union (EU), slow economic growth in the EU will reduce demand from the U.S. as well as depreciating the euro against the dollar and will make U.S. products less competitive. Nevertheless, the combined impact of these two main sources may slow down the economic growth but may not be large enough to generate another recession in the U.S. based on the analysis from Deloitte's global economics team.[14]

3.4.3.2 Guam Economy

The near-term economic outlook for Guam references the Economic Outlook for FY2023, Department of Labor, Government of Guam.

Guam has three primary funding sources: tourism, federal expenditures, and construction capital investment. The Government of Guam expects partial rebound in tourism beginning in 2022 and continuing into 2023. However, the pace of recovery is still unknown, and the GVB has not issued its tourist arrival projections yet. Federal expenditures are likely to remain above normal levels due to COVID-19 stimulus and relief funding. However, the composition of the expenditures is expected to shift from pandemic relief to increased defense and infrastructure expenditures. Construction is projected to increase substantially with the support of private, Government of Guam, and federal projects already contracted. The growth in construction is indicated by an increase in employment, temporary worker demand, and gross receipt taxes paid for construction in FY2021. The total value of building permits for both civilian projects and DoD construction contracts also increased substantially in 2021. Building permits and DoD construction contracts are solid indicators of development plans backed by financial commitments to commence construction in the near term.[15]

In summary, Guam's economy is subject to many uncertainties, which widens the range of possible economic scenarios. The government's economist expects the economic expansion and partial recovery experienced in 2021 to continue in FYs 2022 and 2023. Despite the uncertainties, key economic sectors and funding sources have been, and are expected to remain, stable and increase in the near-term.[16]

[13] Congressional Budget Office, The Budget and Economic Outlook: 2021 to 2031, February 2021.
[14] Deloitte, United States Economic Forecast, March 2022.
[15] Department of Labor, Government of Guam, Economic Outlook for Guam FY2023.
[16] Department of Labor, Government of Guam, Economic Outlook for Guam FY2023.

3.4.3.3 World Economy and Economy of Major Markets

The near-term global economic outlook references the IMF's World Economic Outlook, April 2022, and the economic outlook in the FAA Aerospace Forecast FY2021–2041. Focuses of the outlook are on the major markets, i.e., Asia, Japan, and Korea, for the tourism industry of Guam.

The IMF summarizes five major considerations in relation to the near-term global economic outlook:

- Economic damage from the conflict in Ukraine will contribute to a slowdown in global growth in 2022. The economic contraction is more significant in Ukraine and Russia, and may spill over worldwide through commodity markets, trade, financial linkages, labor supply, and humanitarian impacts. Europe is likely to be impacted more than others.
- The Ukraine crisis and related sanctions have tightened global financial conditions. Inflation has risen, and many central banks have tightened monetary policy. One exception is China, where inflation remains low, and their central bank cut its policy rate to support the recovery.
- Fiscal condition in many countries has been eroded by higher COVID-related spending and lower tax revenue in 2020 and 2021. Governments around the world are increasingly challenged by the rising borrowing costs, and central banks increase interest rates to fight inflation.
- Slowing growth in China's economy has wider ramifications for Asia. The combination of more transmissible variants and a zero-COVID strategy entail the prospect of more frequent lockdowns, with consequential effects on private consumption in China.
- Worker shortages and mobility restrictions compounded supply chain disruptions and bottlenecks early in 2022, constraining activity and adding to inflation. Restrictions have begun to ease as the peak of the Omicron wave passes and global weekly COVID deaths decline. The risk of infection leading to severe illness or death appears lower for the Omicron variant than for others—especially for the vaccinated and boosted. IMF assumes that the health and economic impacts of the virus will start to fade in the second quarter of 2022 and that hospitalizations and deaths will be brought to low levels in most countries by the end of the year.

The outlook for Asian economies, which affect Guam's economy, mainly through tourism and through secondary effects on intertwined activities among various countries, as provided in items extracted from the IMF World Economic Outlook, April 2022, are summarized in **Table 3-2**. The projections for real GDP growth rate are lower, while the projections for consumer prices are higher than previous projections released in October 2021. The recovery of GDP in Japan lags other Asian countries and the U.S.[17]

International travel and tourism have been heavily impacted globally by COVID-19. Guam has a large component of its economy related to international tourism. Therefore, the economic effects of the pandemic are more severe in Guam than in most developed economies.[18]

Table 3-2. Near-Term Economic Outlook

	Annual Percent Change in Real GDP				Annual Percent Change in Average Consumer Prices			
	2020	2021	2022	2023	2020	2021	2022	2023
Markets	Historical		Projections		Historical		Projections	
United States	-3.4%	5.7%	3.7%	2.3%	1.2%	4.7%	7.7%	2.9%
Japan	-4.6%	1.6%	2.4%	2.3%	0.0%	-0.3%	1.0%	0.8%
Korea	-0.9%	4.0%	2.5%	2.9%	0.5%	2.5%	4.0%	2.4%
Taiwan	3.1%	6.3%	3.2%	2.9%	-0.2%	1.8%	2.3%	2.2%
China	2.3%	8.1%	4.4%	5.1%	2.4%	0.9%	2.1%	1.8%

Sources:
2020 data: International Monetary Fund, World Economic Outlook (October 2021)
2021 to 2023 data: International Monetary Fund, World Economic Outlook (April 2022)

[17] International Monetary Fund, World Economic Outlook, April 2022, and October 2021.
[18] Department of Labor, Government of Guam, Economic Outlook for Guam FY2023.

3.4.4 Aviation Fuel Prices

Fluctuations and overall trends in the cost of aviation fuel is an important factor affecting the aviation industry because it directly impacts an airline's operating cost and thus airfares and passenger demand. Fuel prices are particularly sensitive to worldwide economic uncertainty and political instability. Beginning in 2003, fuel prices increased as a result of the Iraq War, political instability in some oil-producing countries, the rapidly growing economies of China, India, and other developing countries, and other factors. By mid-2008, average fuel prices were three times higher than they were in 2003. In the second half of 2008 when the recession was approaching its peak, fuel demand decreased worldwide and prices followed. However, with the initial recovery stage in 2009, prices returned to a relatively steady cost between $3 and $3.5 per gallon until mid-2014. With surging oil production and declining demand, fuel costs dropped and has stayed between $1 and $2.5 per gallon since 2015, as depicted in **Figure 3-29**.

The decrease in aviation demand during the COVID-19 pandemic also reduced the aviation fuel demand. Fuel costs dropped to between $1 and $1.2 per gallon in summer 2020, which is the lowest since 2004. However, the supply has not kept up with the demand as the economy is recovering from the pandemic, and the fuel costs have risen again.

Nevertheless, the geopolitical factor is the most crucial and imminent concern as the economy enters the post-pandemic era in 2022. The Russian aggressions in Ukraine that started in the last week of February 2022 put the oil market on edge. Potential interruptions of Russian oil shipments and sanctions on Russian companies could impact Europe first and then the global energy supply chain. The impact highly depends on the duration of this ongoing crisis, how long the reserve can last for different countries, and whether other Organization of the Petroleum Exporting Countries (OPEC) can increase production. There are many uncertainties on the Russian-Ukraine crisis as this technical report is prepared.

Analysts hold different views regarding how oil and aviation fuel prices may change in the future. Reference case forecasts project fuel prices out into the future based on current market conditions, exchange rates, technology advancement in oil extraction, and other possible factors that may affect the supply and demand of crude oil.[19] Projections are uncertain because many of the events that shape energy markets as well as future developments in technologies, demographics, and resources cannot be foreseen with certainty. In order to consider future uncertainties, organizations such as the U.S. Energy Information Administration (EIA) develop multiple scenarios such as the high and low oil price forecasts in addition to a baseline reference case. The long-term annual projections of jet fuel by the EIA's latest Annual Energy Outlook 2022 (AEO2022), including the reference case and the high and low oil price cases, are illustrated in **Figure 3-30**.

The projected average annual growth rates of jet fuel price by the EIA from 2021 to 2050 are -1 percent, 1 percent, and 2.9 percent for the low, reference, and high oil price cases, respectively.[20] The FAA Aerospace Forecast FY2021–2041 projects U.S. mainline air carrier jet fuel prices to increase 0.2 percent per annum from 2021 to 2041 (using the increased actual price in 2021 instead of the estimated price), which is on the low side but falls within the projections by the EIA's reference and low oil price cases.

[19] U.S. Energy Information Administration, Annual Energy Outlook 2022.
[20] U.S. Energy Information Administration, Annual Energy Outlook 2022.

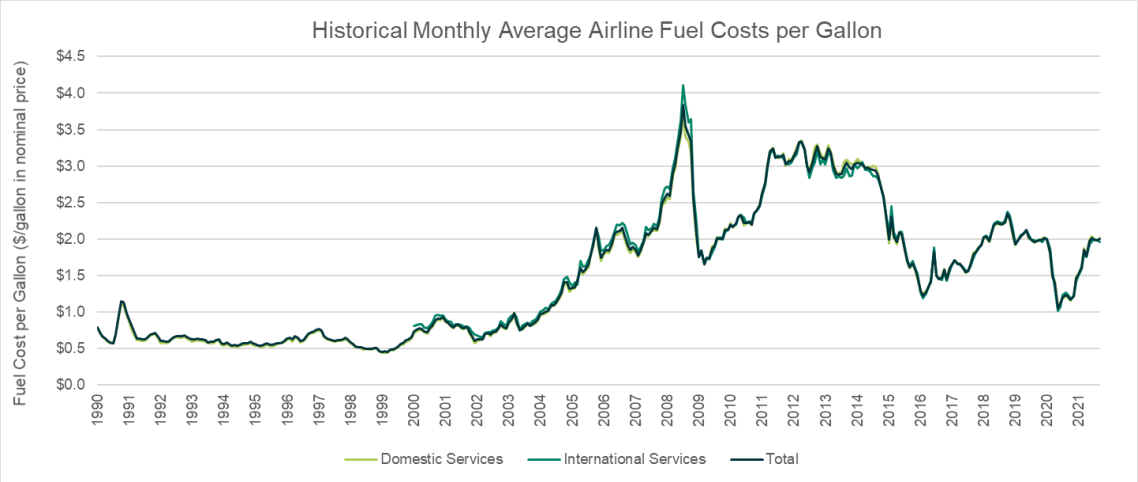

Figure 3-29. Historical Monthly Average Airline Fuel Costs per Gallon (Nominal dollars)

Sources:

A. Fuel consumption and cost – U.S. Bureau of Transportation Statistics (BTS) Form 41 Schedule P12A (March 2022)
B. Fuel cost per gallon calculations – AECOM analysis

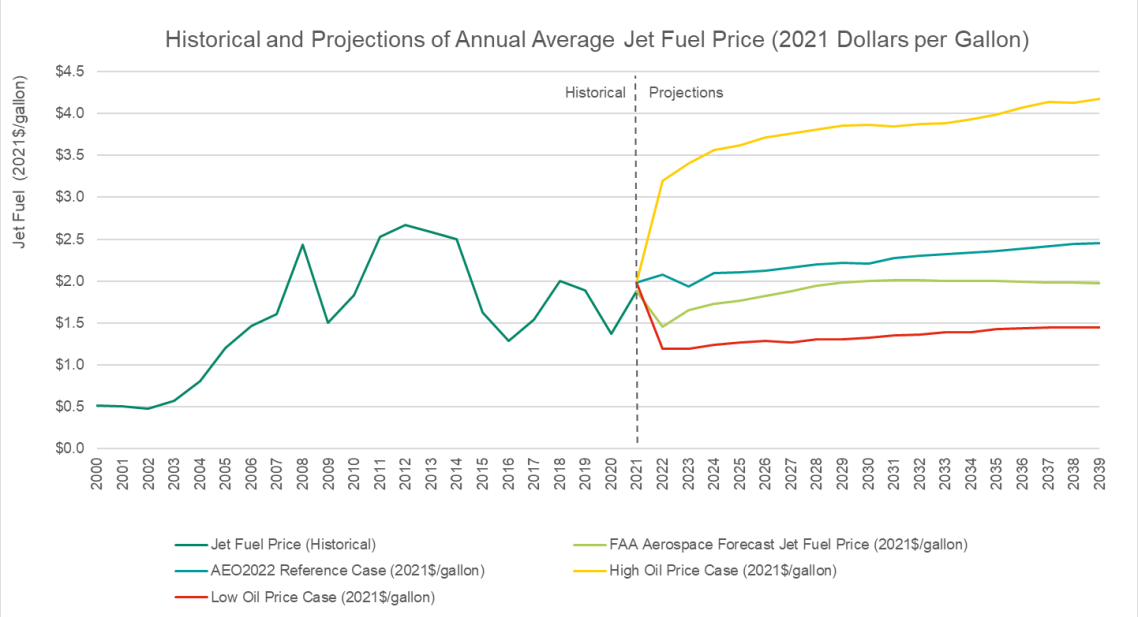

Figure 3-30. Historical and Projections of Annual Average Jet Fuel Price per Gallon (2021 dollars)

Sources:

A. Historical jet fuel cost – U.S. BTS Form 41 Schedule P12A (March 2022)
B. Consumer price index (CPI) for all urban consumers – U.S. Bureau of Labor Statistics (March 2022)
C. Projected jet fuel price – U.S. Energy Information Administration, Annual Energy Outlook 2022 (March 3, 2022)
D. FAA Aerospace Forecasts FY2021–2041
E. Conversions to 2021 dollars – AECOM analysis

3.4.5 Summary of Economic Basis for Aviation Demand

The various economic, demographic, and geographical characteristics discussed above collectively portray Guam as the gateway to Micronesia and a leisure destination capable of producing continuous demand for air transportation services. The historical trends and projections for key economic variables for the major tourism markets, the U.S., and Guam as summarized in this section were used in the development of the aviation demand forecasts. However, the results of these analyses do not necessarily provide a direct correlation between growth of an individual economic variable and the forecast elements. Instead, the trends in economic variables are compared with the trends in aviation demand to uncover

relationships between the two and identify reasonable indicators of growth in future aviation activity. The reason for this comparison is that innumerable outside influences can affect the ultimate reality of forecasting. Events such as economic recessions, financial crises, new technology, widespread health issues, terrorist attacks, and so forth cannot be predicted with any certainty or likelihood, and therefore, the results of the economic analyses serve as a guideline and indicator for projecting future aviation demand rather than a precise predictor.

3.5 Historical Aviation Demand

This section describes historical aviation demand at the Airport, including an analysis of commercial air carrier service providers; enplaned passengers, load factors, and seats per departure; airline shares of passengers; airline service; airline yields; air cargo tonnage; and aircraft operations.

3.5.1 Air Service Development

This section discusses the historic and current passenger service airlines at the Airport.

3.5.1.1 Passenger Airlines Serving the Airport

In 2019, 11 operating signatory air carriers provided scheduled service at the Airport, including United Airlines (United, UA), Korean Air (KE), Japan Airlines (JL), Philippine Airlines (PR), China Airlines (CI), Jin Air (LJ), Jeju Air (7C), T'way Air (TW), Air Busan (BX), Air Seoul (RS), and Cebu Pacific (5J). In addition, Star Marianas Air provides commuter services to the CNMI from Guam under Part 135 certification and use aircraft with nine passenger seats or less. **Table 3-3** below lists the passenger airlines that served the Airport in 2019 and early 2020 (pre-pandemic).

Table 3-3. Air Carriers for Passenger Services at the Airport

Carriers	Type1
Scheduled Passenger Services (Include seasonal on-demand charter)	
United Airlines (UA)	U.S. Air Carrier (Network Carrier)
Korean Air (KE)	Foreign (Korea) Air Carrier (Network Carrier)
Japan Airlines (JL)	Foreign (Japan) Air Carrier (Network Carrier)
Philippine Airlines (PR)	Foreign (Philippine) Air Carrier (Network Carrier)
China Airlines (CI)	Foreign (Taiwan) Air Carrier (Network Carrier)
Jeju Air (7C)	Foreign (Korea) Air Carrier (Low-cost Carrier)
T'way Air (TW)	Foreign (Korea) Air Carrier (Low-cost Carrier)
Air Busan (BX)	Foreign (Korea) Air Carrier (Low-cost Carrier)
Jin Air (LJ)	Foreign (Korea) Air Carrier (Low-cost Carrier)
Air Seoul (RS)	Foreign (Korea) Air Carrier (Low-cost Carrier)
Cebu Pacific (5J)	Foreign (Philippine) Air Carrier (Low-cost Carrier)
On-demand and Scheduled chart service by Part 135 Air Carriers	
Star Marianas Air	Part 135 Commuter Air Carrier

Note: U.S. and foreign air carriers are grouped into two broad groups: network carriers and low-cost carriers, based on their differences in operation and business models. In recent years, the differences between these carriers narrowed. Low-cost carriers in the U.S. are expanding into international markets such as Latin America and the Caribbean and compete against network carriers. Carriers may be grouped into three groups as the industry evolves: traditional network legacy carriers (American, United, Delta), ultra-low-cost carriers (Frontier, Allegiant), and something in between (Southwest, JetBlue, Alaska/Virgin America). The list of foreign low-cost carriers is based on International Civil Aviation Organization (ICAO) classification. For master planning purposes, the traditional grouping into two broad groups is still applicable in this analysis.
Sources:
Flight schedules for 2019 and 2020 via GIAA
GIAA FY2019 and FY2020 Financial Statements

Figure 3-31 presents the historical market share of passenger airlines serving the Airport. Over 90 percent of the market was served by U.S., Korean, and Japanese air carriers before the COVID-19 pandemic.

U.S. carriers include United and Delta Air Lines (Delta, DL). United operates at the Airport as its hub airport in the Pacific region and offers nonstop flights to and from four cities in Japan regularly (Tokyo, Osaka, Nagoya, and Fukuoka) as well as to and from Manila, Philippines. Within Micronesia, United also offers connections to and from destinations such as Koror in Palau, Chuuk, Kosrae, Pohnpei and Yap in the Federated States of Micronesia, and Majuro in the Marshall Islands. Delta used to offer flights to and from Japan (Tokyo, Osaka, and Nagoya), but the service was discontinued in January 2018 when Delta eliminated its Tokyo Narita hub. In 2019, approximately 47 percent of the market share was served by United, which remains the largest carrier at the Airport. As the aviation market was hit by the pandemic, international travel was severely impacted by traffic restrictions. Most of the foreign air carriers canceled their services at the Airport; hence, over 90 percent of the market was served by United in 2021.

Korean air carriers, including both network carriers (Korean Air Lines) and low-cost carriers (Jeju Air, T'way Air, Air Busan, Jin Air, and Air Seoul), are the second largest group of air carriers at the Airport, which are then followed by the Japanese air carrier (Japan Airlines). Korean air carriers offer flights to and from Korea (Seoul and Busan) and Japan (mainly Tokyo and Osaka, occasionally Nagoya, Fukuoka, and Okayama, etc.). Japan Airlines offers nonstop flights to and from Tokyo only.

Philippine and Taiwanese air carriers are the fourth and fifth largest passenger air carriers serving the Airport. Philippine air carriers include network carrier Philippine Airlines and low-cost carrier Cebu Pacific. They provide nonstop destinations to and from Manila. Philippine Airlines also offer connections from Los Angeles and San Francisco to Manila through Guam (i.e., LAX-GUM-MNL and SFO-GUM-MNL). Taiwanese air carriers include both China Airlines and Evergreen Airways (EVA Airways), which provide nonstop destinations to and from Taipei. However, EVA Airways ceased operations at the Airport in February 2017, and China Airlines became the only air carrier offering flights to and from Taipei until the pandemic. After ceasing operations at the Airport for four years, EVA Airways returned in July 2021 as air services recovered from the pandemic.

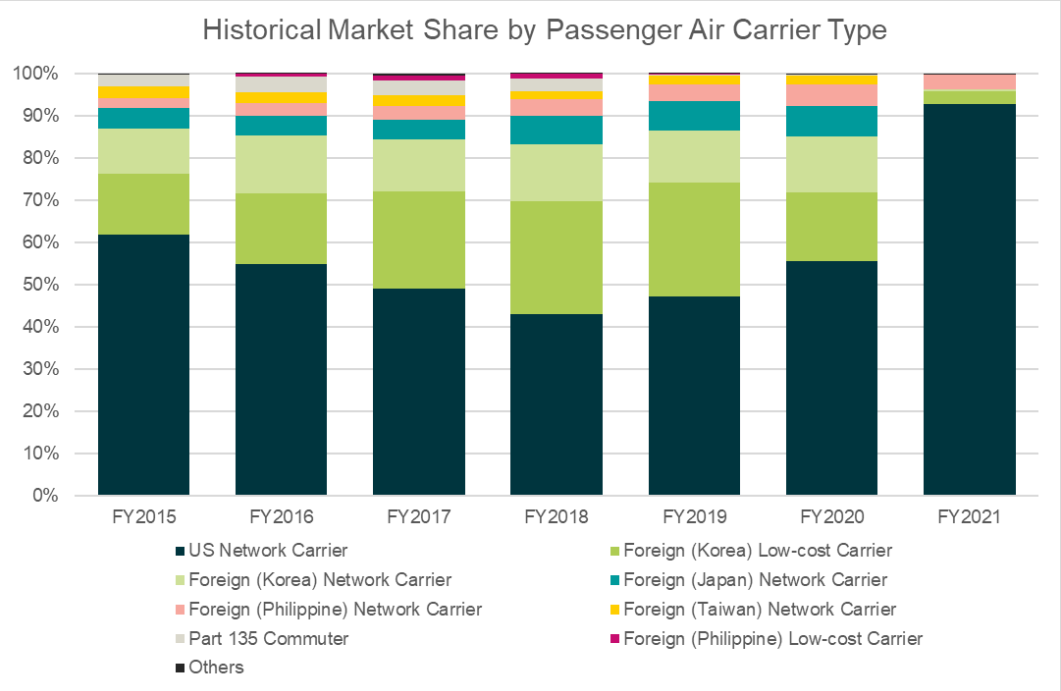

Figure 3-31. Historical Market Share by Passenger Air Carrier Type

Note: U.S. Network Carrier includes United Airlines (all years) and Delta Air Lines (FY2015 to FY2017 only)
Sources:

1. *Passengers by air carrier – U.S. BTS T-100 data*
2. *AECOM analysis*

3.5.1.2 Nonstop Services from Guam

Figure 3-32 shows 18 nonstop destinations served by the Airport during the peak month, August, in 2019. These destinations include 15 international destinations, two domestic destinations in CNMI, and domestic connections to the markets in the U.S. mainland through Honolulu, Hawaii.

Table 3-4 summarizes the total seat capacity for the nonstop destinations during an average week of the peak month, August 2019 (pre-pandemic), and comparison with August 2020 and 2021 (impacted by the pandemic). United was the first airline that returned to service and continues to offer domestic services between Guam and the U.S. mainland through Honolulu. United also maintains air services to Narita, Japan, as part of its Asia-Pacific network, and provides services to Saipan in CNMI; Koror in Palau; and Chuuk, Yap, and Pohnpei in the Federated States of Micronesia. After more than one year into the pandemic, foreign air carriers started to increase their capacity at the Airport. More Korean air carriers returned their nonstop services to and from Incheon, Korea, in summer 2021. Philippine Airlines and EVA Airways also returned services to and from Manila and Taipei, respectively.

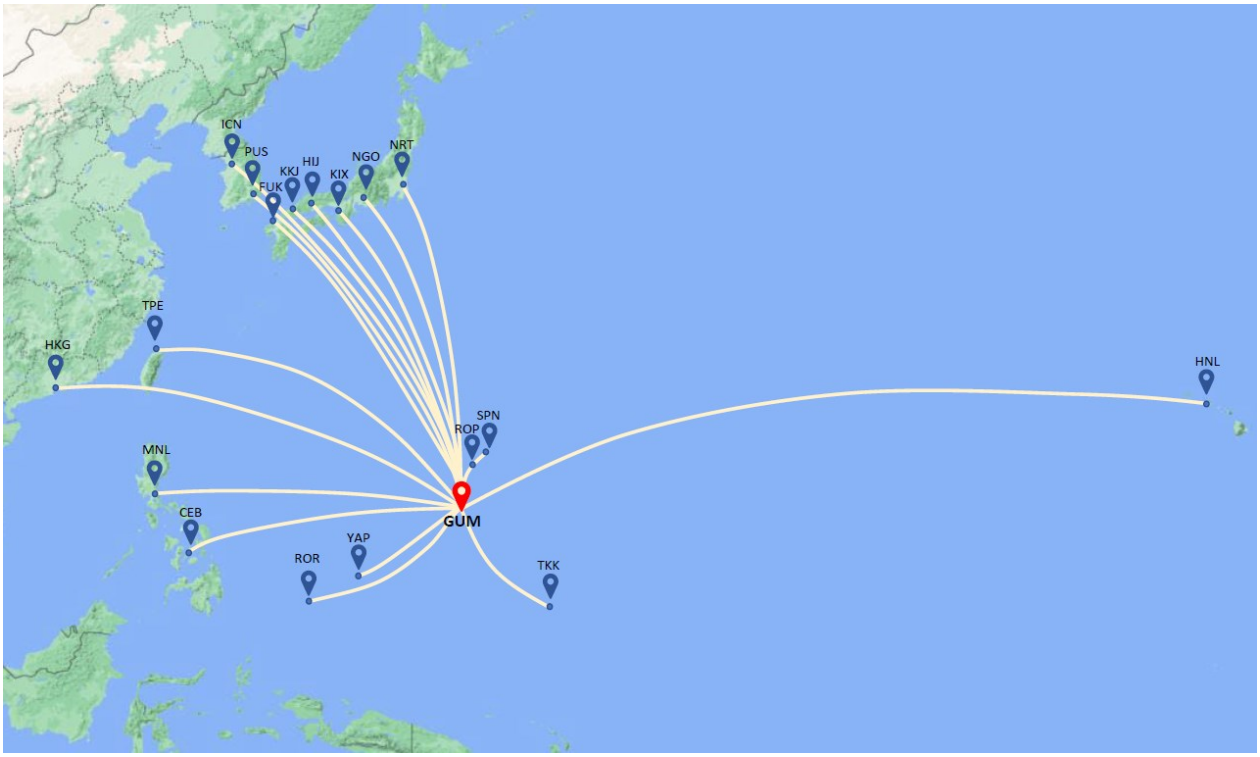

Figure 3-32. Nonstop Destinations in August 2019

*Notes: Abbreviations for airports are given in **Table 3-4.***
Sources:
1. *GIAA*
2. *Flight schedules for August 2019*
3. *AECOM analysis*

Table 3-4. Nonstop Destinations and Scheduled Departure Seats in August 2019, 2020, and 2021

Destination Airports	City, Country	Airlines in August 2019	Weekly Scheduled Departure Seats in August 2019	Airlines in August 2020	Weekly Scheduled Departure Seats in August 2020	Airlines in August 2021	Weekly Scheduled Departure Seats in August 2021
ICN	Seoul, Korea	7C, KE, LJ, RS, TW	13,545	LJ	189	7C, KE, LJ, RS, TW	1,458
NRT	Tokyo, Japan	7C, BX, JL, TW, UA	11,718	UA	1,512	UA	1,162
MNL	Manila, Philippines	5J, PR, UA	7,393	-	-	PR, UA	1,228
KIX	Kansai, Japan	7C, CI, TW, UA	4,318	-	-	-	-
NGO	Nagoya, Japan	7C, TW, UA	4,241	-	-	-	-
PUS	Pusan, Korea	7C, BX, LJ	3,644	-	-	-	-
HNL	Honolulu, Hawaii, U.S.	UA	2,394	UA	1,162	UA	2,394
FUK	Fukuoka, Japan	7C, TW, UA	1,500	-	-	-	-
SPN	Saipan, CNMI, U.S.	UA	1,414	UA	378	UA	1,162
HIJ	Hiroshima, Japan	CI	1,106	-	-	-	-
KKJ	Fukuoka, Japan	BX	1,040	-	-	-	-
ROR	Koror, Palau	UA	836	UA	126	UA	166
TPE	Taipei, Taiwan	CI	790	-	-	BR	920
CEB	Mactan, Philippines	PR	762	-	-	-	-
TKK	Chuuk, FSM	UA	750	UA	166	UA	332
HKG	Hong Kong, China	UA	504	-	-	-	-
YAP	Yap, FSM	UA	332	UA	126	UA	166
ROP	Rota, CNMI, U.S.	Star Marianas Air	56	-	-	-	-
PNI	Pohnpei, FSM	-	-	UA	126	UA	166
			August 2019		**August 2020**		**August 2021**
Weekly Scheduled Departure Seat			**56,343**		**3,785**		**9,154**

Notes:
CNMI = Commonwealth of the Northern Mariana Islands
FSM = Federated States of Micronesia
See **Table 3-2** for airline carriers by airline code.
Sources:
GIAA
Flight schedules for August 2019, 2020, and 2021
AECOM analysis

3.5.1.3 Air Service Recovery Incentive Program

Both the GVB and GIAA launched recovery incentive programs to support and strengthen air services to Guam. The programs include both scheduled air service and on-demand charter flights.

GVB's recovery incentive program targets the Japan, Korea, and Taiwan markets while remaining open to other new markets. Eligible and approved charter flight programs will receive incentives in the form of monetary support ($100) per seat sold. For the scheduled, regular air service, eligible and approved airlines will be provided with a subsidy of a fixed amount per sellable seat on each inbound flight to the Airport. Applications for GVB's air service recovery incentive program remain open until end of July 2022. However, the duration of these programs is subject to the availability of GVB funding.[21]

As of April 2022, five airlines (Air Busan, Jin Air, T'way, Philippine Airlines, and Korean Air) have applied for GVB's recovery incentive program. GVB expects the monthly total air seat capacity to increase from 37,000 in April 2022 to more than 107,000 in June 2022 as more international travel restrictions are lifted in Guam's major tourism markets of Korea, Japan, Taiwan, and the Philippines.[22]

Remaining budget from the air service recovery program could potentially be reallocated to the GVB program that provides free COVID-19 testing to eligible tourists before they return to their home countries. It means monetary savings for tourists visiting Guam.[23]

GIAA is launching an Airline Recovery Assistance and Incentivizing Service (RAISE) Program from May 1, 2022, through September 30, 2022. The objective of the Airline RAISE Program is to incentivize and stimulate air service travel demand in anticipation of Guam's plan to safely reopen with requirement of pre-arrival COVID testing. These targeted economic recovery incentives are intended to attract and encourage air service from all destinations in the Asia-Pacific region. The Airline RAISE Program applies to passenger air service with a minimum of one flight per week per destination. Airlines under the RAISE Program will receive discounts (up to 25 percent) on their rates and charges, such as Airfield Use (Landing) Fee, Loading Bridge Use, Immigration Inspection, Arrival Fees, and Departure Fees.[24]

3.5.2 Enplaned Passengers

Enplaned passengers represent one of the largest drivers in the master planning process for any commercial service airport. **Table 3-5** and **Figure 3-33** present enplaned passengers at the Airport for the period from 2005 through 2021. During this period, enplaned passenger levels varied with peaks of 1.8 million in 2017 and just below 1.9 million in 2019 before the COVID-19 pandemic.

As is typical for most commercial service airports, the trend of historical enplaned passengers generally follows the economic growth. The significance of the tourism industry in Guam and its geographical location as an island also make Guam vulnerable to natural disasters. The financial turmoil in late 2007, the Tohoku earthquake and tsunami which caused the Fukushima Daiichi nuclear disaster in 2011, the typhoon Mangkhut that passed through Guam in 2018 causing multiple cancellations of flights, and the COVID-19 recession in 2020 all correlate to a reduction in enplaned passengers at the Airport. In between these distinct incidents, there were also impacts on the historical enplanements due to the economic and geopolitical factors of the top tourism markets like Japan, Korea, Taiwan, and China. For example, tensions with North Korea with missile threats in Guam in 2018, increasing tensions between China and Taiwan in Taiwan's airspace in 2021, the ongoing trade war between the U.S. and China that started in 2018, and the Russian aggressions in Ukraine that started in February 2022 are unfavorable factors impacting the aviation demands in Guam. The previous, **Section 3.4**, also includes the discussions about the economy of these top tourism markets and the potential relationship with the visitor demands in Guam. The impacts on visitor demands are directly correlated to the aviation demands at the Airport.

[21] GVB website, https://www.guamvisitorsbureau.com/marketing/markets/air-service-development#.
[22] The Guam Daily Post dated April 4, 2022, https://www.postguam.com/news/local/5-airlines-apply-for-guam-subsidy/article_5a92e384-b4ad-11ec-9c12-2ba3ea57d313.html.
[23] The Guam Daily Post dated April 4, 2022, https://www.postguam.com/news/local/5-airlines-apply-for-guam-subsidy/article_5a92e384-b4ad-11ec-9c12-2ba3ea57d313.html.
[24] GIAA website, https://www.guamairport.com/corporate/airline-incentive-programs/airline-recovery-assistance-and-incentivizing-service-program.

Regardless of the historical events, enplanements rebounded after each financial downturn, recession, natural disaster, or pandemic. Enplanements increased at an average annual growth rate of 1.6 percent from 2005 to 2019. In the 5 years preceding the COVID-19 pandemic, enplanements increased at an average annual growth rate of 2.2 percent.

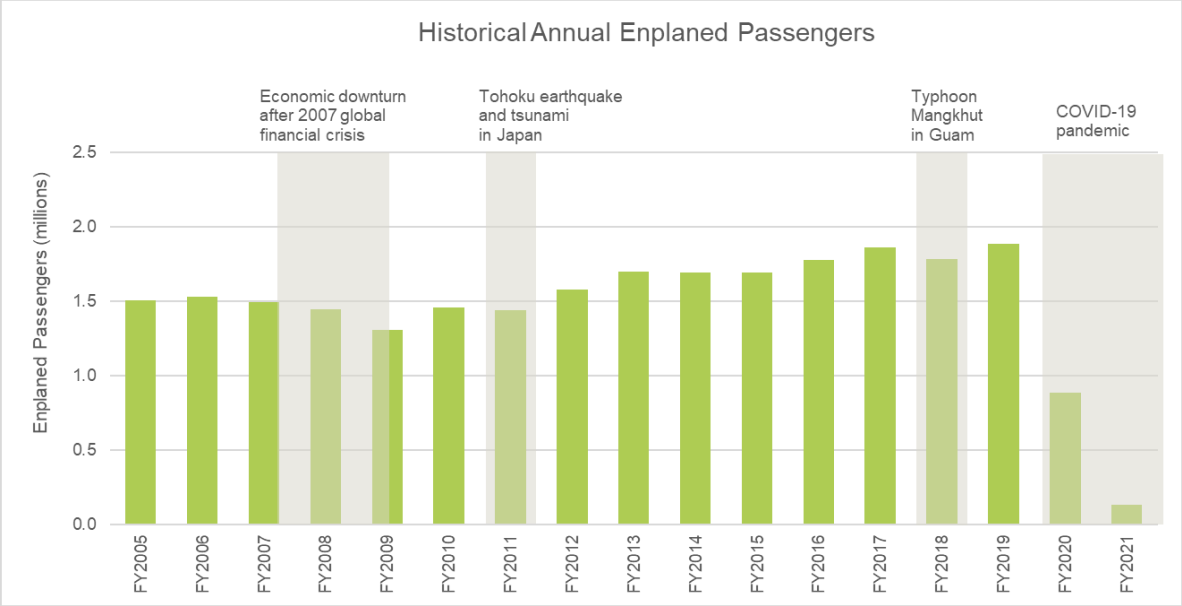

Figure 3-33. Historical Annual Enplaned Passengers

Source: Enplanement statistics – GIAA

Table 3-5. Historical Annual Enplaned Passengers

Fiscal Year	Enplaned Passengers	YOY % Change
2005	1,503,304	N/A
2006	1,526,931	1.6%
2007	1,491,188	-2.3%
2008	1,442,810	-3.2%
2009	1,305,209	-9.5%
2010	1,456,875	11.6%
2011	1,439,424	-1.2%
2012	1,574,491	9.4%
2013	1,697,986	7.8%
2014	1,690,900	-0.4%
2015	1,692,943	0.1%
2016	1,774,590	4.8%
2017	1,858,379	4.7%
2018	1,780,572	-4.2%
2019	1,885,108	5.9%
2020	884,060	-53.1%
2021	135,566	-84.7%

Period	CAGR	
2005 to 2019 (14-year)	1.6%	
2009 to 2019 (10-year)	3.7%	
2014 to 2019 (5-year)	2.2%	

Note:
N/A = Not available
CAGR = Compound annual growth rate
YOY = Year-over-year
Sources:
Enplanement statistics – GIAA
YOY and CAGR calculations – AECOM analysis

3.5.2.1 Domestic vs. International Passengers

The percentage of international passengers at the Airport is estimated by the analyses of the historical international visitor statistics from GVB. Between 92 and 94 percent of total visitors by air were international visitors from 2005 to 2019. Since most of the visitors in 2020 visited Guam before the COVID-19 pandemic starting March 2020, the percentage of international visitors in 2020 is similar to the historical trend at 92 percent. The impact of the COVID-19 pandemic is revealed in 2021. With the travel restrictions and quarantine requirements, the percentage of international visitors dropped significantly to below 27 percent in 2021.

Table 3-6 presents the split between domestic and international visitors to Guam from 2005 to 2021. The percentage of domestic and international passengers at the Airport are assumed to mirror these percentages.

Table 3-6. Historical Annual Domestic and International Visitors by Air

Fiscal Year	Domestic Visitors by Air (U.S. Mainland/ Hawaii and CNMI)	International Visitors by Air	% Domestic Visitors by Air	% International Visitors by Air	YOY % Change on Share of International Visitors by Air
2005	65,772	1,099,377	5.6%	94.4%	N/A
2006	61,571	1,128,320	5.2%	94.8%	0.5%
2007	65,689	1,114,538	5.6%	94.4%	-0.4%
2008	71,234	1,061,778	6.3%	93.7%	-0.8%
2009	72,172	963,622	7.0%	93.0%	-0.7%
2010	79,020	1,083,808	6.8%	93.2%	0.2%
2011	77,568	1,060,855	6.8%	93.2%	0.0%
2012	82,038	1,179,597	6.5%	93.5%	0.3%
2013	74,451	1,256,036	5.6%	94.4%	1.0%
2014	81,617	1,250,340	6.1%	93.9%	-0.6%
2015	83,502	1,277,586	6.1%	93.9%	0.0%
2016	94,117	1,398,132	6.3%	93.7%	-0.2%
2017	94,783	1,450,190	6.1%	93.9%	0.2%
2018	110,065	1,391,849	7.3%	92.7%	-1.3%
2019	116,707	1,504,247	7.2%	92.8%	0.1%
2020	58,581	693,281	7.8%	92.2%	-0.6%
2021	44,417	16,266	73.2%	26.8%	-70.9%

Fiscal Year	Domestic Visitors by Air (U.S. Mainland/ Hawaii and CNMI)	International Visitors by Air	% Domestic Visitors by Air	% International Visitors by Air	YOY % Change on Share of International Visitors by Air
Period	**CAGR**	**CAGR**	**CAGR**	**CAGR**	
2005 to 2019 (14-year)	4.2%	2.3%	1.8%	-0.1%	
2009 to 2019 (10-year)	4.9%	4.6%	0.3%	0.0%	
2014 to 2019 (5-year)	7.4%	3.8%	3.3%	-0.2%	

Notes:
N/A = Not available
CAGR = Compound annual growth rate
YOY = Year-over-year
Sources:
Visitor statistics – GVB
Percentage shares, YOY, and CAGR calculations – AECOM analysis

3.5.2.2 U.S. Mainland/Hawaii vs. CNMI Passengers

Within domestic visitors, the percentage of visitors from CNMI is summarized in **Table 3-7**. Because flying between Guam and CNMI, including Rota, Tinian, and Saipan, is within the range of smaller aircraft operated by Part 135 commuter operators such as Star Marianas Air, the characteristics are different from the demands from the U.S. mainland through Hawaii. In addition, there are U.S. Customs and Border Protection (CBP) processing requirements for visitors from U.S. Territories, such as Guam, to the U.S. mainland/Hawaii because of differences in visa validity. “Domestic” travel from Guam to the U.S. mainland/Hawaii is not exactly the same as domestic travel within the U.S. Hence, the share of CNMI passengers is estimated from the share of domestic passengers.

Table 3-7 shows that the average historical growth in domestic visitors from the U.S. mainland/Hawaii is at 5.1 percent per annum, which is much higher than the growth in domestic visitors from CNMI at 1.4 percent per annum from 2005 to 2019. The number of visitors from the U.S. mainland/Hawaii in 2019 is twice the number of visitors in 2005.

Table 3-7. Historical Annual U.S. Mainland/Hawaii and CNMI Visitors by Air

Fiscal Year	Domestic U.S. Mainland/Hawaii Visitors by Air	Domestic CNMI Visitors by Air	% U.S. Mainland/Hawaii Visitors by Air	% CNMI Visitors by Air	YOY % Change on share of CNMI Visitors by Air
2005	47,150	18,622	71.7%	28.3%	N/A
2006	43,501	18,070	70.7%	29.3%	3.7%
2007	48,590	17,099	74.0%	26.0%	-11.3%
2008	53,038	18,196	74.5%	25.5%	-1.9%
2009	54,386	17,786	75.4%	24.6%	-3.5%
2010	60,651	18,369	76.8%	23.2%	-5.7%
2011	59,636	17,932	76.9%	23.1%	-0.6%
2012	64,766	17,272	78.9%	21.1%	-8.9%
2013	58,546	15,905	78.6%	21.4%	1.5%
2014	66,151	15,466	81.1%	18.9%	-11.3%
2015	69,745	13,757	83.5%	16.5%	-13.1%
2016	76,727	17,390	81.5%	18.5%	12.2%
2017	76,291	18,492	80.5%	19.5%	5.6%
2018	89,363	20,702	81.2%	18.8%	-3.6%

Fiscal Year	Domestic U.S. Mainland/Hawaii Visitors by Air	Domestic CNMI Visitors by Air	% U.S. Mainland/Hawaii Visitors by Air	% CNMI Visitors by Air	YOY % Change on share of CNMI Visitors by Air
2019	94,141	22,566	80.7%	19.3%	2.8%
2020	48,263	10,318	82.4%	17.6%	-8.9%
2021	41,239	3,178	92.8%	7.2%	-59.4%
Period	**CAGR**	**CAGR**	**CAGR**	**CAGR**	
2005 to 2019 (14-year)	5.1%	1.4%	0.8%	-2.7%	
2009 to 2019 (10-year)	5.6%	2.4%	0.7%	-2.4%	
2014 to 2019 (5-year)	7.3%	7.8%	-0.1%	0.4%	

Notes:
CNMI = Commonwealth of the Northern Mariana Islands
N/A = Not available
CAGR = Compound annual growth rate
YOY = Year-over-year
Sources:
Visitor statistics – GVB
Percentage shares, YOY, and CAGR calculations – AECOM analysis

3.5.2.3 Originating/Terminating vs. Connecting Passengers

The Airport is primarily an origin and destination (O&D) airport with between 87 and 91 percent of the Airport's enplaned passengers being O&D passengers and 9 to 13 percent of passengers connecting through Guam to their final destinations. **Table 3-8** and **Table 3-9** summarize the approximate number of originating, terminating, and connecting passengers at the Airport. The share of O&D passengers has been increasing through the years and reached the highest at 91 percent in 2019. The historical growth in enplanements is driven by the increase in visitors flying to Guam as their destination instead of going to other islands in Micronesia.

Table 3-8. Historical Annual Originating and Connecting Passengers

Fiscal Year	Originating Passengers	Connecting Passengers	% Originating Passengers	% Connecting Passengers	YOY % Change on Share of Connecting Passengers
2005	1,303,975	199,329	86.7%	13.3%	N/A
2006	1,337,630	189,301	87.6%	12.4%	-6.5%
2007	1,308,607	182,581	87.8%	12.2%	-1.2%
2008	1,253,769	189,041	86.9%	13.1%	7.0%
2009	1,158,752	146,457	88.8%	11.2%	-14.4%
2010	1,273,445	183,430	87.4%	12.6%	12.2%
2011	1,264,243	175,181	87.8%	12.2%	-3.3%
2012	1,407,163	167,328	89.4%	10.6%	-12.7%
2013	1,498,419	199,567	88.2%	11.8%	10.6%
2014	1,480,349	210,551	87.5%	12.5%	5.9%
2015	1,476,574	216,369	87.2%	12.8%	2.6%
2016	1,559,141	215,449	87.9%	12.1%	-5.0%
2017	1,660,548	197,831	89.4%	10.6%	-12.3%
2018	1,596,054	184,518	89.6%	10.4%	-2.7%
2019	1,720,562	164,546	91.3%	8.7%	-15.8%

Fiscal Year	Originating Passengers	Connecting Passengers	% Originating Passengers	% Connecting Passengers	YOY % Change on Share of Connecting Passengers
2020	783,532	100,528	88.6%	11.4%	30.3%
2021	101,696	33,870	75.0%	25.0%	119.7%
Period	**CAGR**	**CAGR**	**CAGR**	**CAGR**	
2005 to 2019 (14-year)	2.0%	-1.4%	0.4%	-2.9%	
2009 to 2019 (10-year)	4.0%	1.2%	0.3%	-2.5%	
2014 to 2019 (5-year)	3.1%	-4.8%	0.8%	-6.9%	

Notes:
N/A = Not available
CAGR = Compound annual growth rate
YOY = Year-over-year
Sources:
Passenger statistics – GIAA Financial Reports
Percentage shares, YOY, and CAGR calculations – AECOM analysis

Table 3-9. Historical Annual Terminating and Connecting Passengers

Fiscal Year	Terminating Passengers	Connecting Passengers	% Terminating Passengers	% Connecting Passengers	YOY % Change on Share of Terminating Passengers
2005	1,301,073	199,329	86.7%	13.3%	n/a
2006	1,335,577	189,301	87.6%	12.4%	-6.6%
2007	1,308,112	182,581	87.8%	12.2%	-1.3%
2008	1,261,234	189,041	87.0%	13.0%	6.4%
2009	1,163,670	146,457	88.8%	11.2%	-14.2%
2010	1,296,795	183,430	87.6%	12.4%	10.9%
2011	1,284,203	175,181	88.0%	12.0%	-3.1%
2012	1,412,502	167,328	89.4%	10.6%	-11.8%
2013	1,485,648	199,567	88.2%	11.8%	11.8%
2014	1,489,971	210,551	87.6%	12.4%	4.6%
2015	1,492,347	216,369	87.3%	12.7%	2.3%
2016	1,579,609	215,449	88.0%	12.0%	-5.2%
2017	1,703,240	197,831	89.6%	10.4%	-13.3%
2018	1,625,932	184,518	89.8%	10.2%	-2.1%
2019	1,715,346	164,546	91.2%	8.8%	-14.1%
2020	794,593	100,528	88.8%	11.2%	28.3%
2021	88,037	33,870	72.2%	27.8%	147.4%

Fiscal Year	Terminating Passengers	Connecting Passengers	% Terminating Passengers	% Connecting Passengers	YOY % Change on Share of Terminating Passengers
Period	**CAGR**	**CAGR**	**CAGR**	**CAGR**	
2005 to 2019 (14-year)	2.0%	-1.4%	0.4%	-2.9%	
2009 to 2019 (10-year)	4.0%	1.2%	0.3%	-2.4%	
2014 to 2019 (5-year)	2.9%	-4.8%	0.8%	-6.7%	

Notes:
N/A = Not available
CAGR = Compound annual growth rate
YOY = Year-over-year
Sources:
Passenger statistics – GIAA Financial Reports
Percentage shares, YOY, and CAGR calculations – AECOM analysis

3.5.3 Load Factors

Enplaned passenger trends typically do not tell the complete story regarding airline service. It is also important to understand the historical trend of average load factors and seat capacity to understand airport utilization dynamics. The number of aircraft operations and the average size of aircraft serving an airport do not necessarily increase or decrease with the numbers of enplaned passengers. Thus, this section describes the Airport load factors, the subsequent section discusses Airport seat capacity, and fleet mix.

Table 3-10 presents historical data on load factors for 2003 through 2021. Graphic presentations of monthly and annual trends are shown in **Figure 3-34** and **Figure 3-35**. **Figure 3-35** includes the national trend on load factors for domestic, international, and the combined total for all U.S. air carriers per the FAA Aerospace Forecast FY2021–2041.

The load factors for both domestic and international departures from the Airport vary seasonally with peaks in summers and winters, and troughs during off-seasons fall between the peak seasons as illustrated in **Figure 3-34**. As soon as the travel restrictions were enforced due to the COVID-19 pandemic, load factors dropped to a record low at below 10 percent in April 2020. Airlines reduced capacity with flight cancelations to recover the load factors (and operating costs) in subsequent months.

Regardless of monthly variations, the overall annual load factor for international flights, hence the overall Airport average load factor, increased gradually throughout the past decade. The average load factor for international departures at the Airport increased from 71 percent in 2004 to 80 percent in 2019, as summarized in **Table 3-10**. However, the average load factor for domestic departures decreased from 86 percent to 74 percent during the same period.

The comparison of the historical trend at the Airport and the national systemwide trend is given in **Figure 3-35**. The average load factors at the Airport are generally lower than the nationwide average for both domestic and international flights.

Table 3-10. Historical Annual Load Factors for Departures

Fiscal Year	Domestic Load Factor	International Load Factor	Airport Total Load Factor
2004	86.5%	71.1%	73.2%
2005	87.6%	73.2%	75.0%
2006	86.8%	74.1%	75.5%
2007	87.2%	74.5%	75.8%
2008	85.4%	73.7%	74.9%
2009	79.1%	69.8%	70.9%

Fiscal Year	Domestic Load Factor	International Load Factor	Airport Total Load Factor
2010	84.4%	72.0%	73.4%
2011	87.2%	75.6%	77.0%
2012	71.8%	76.7%	76.1%
2013	74.3%	76.0%	75.8%
2014	75.7%	76.2%	76.1%
2015	71.7%	76.5%	75.8%
2016	74.0%	77.3%	76.8%
2017	74.9%	79.3%	78.7%
2018	77.2%	80.3%	79.8%
2019	74.3%	79.9%	79.0%
2020	41.8%	71.3%	62.2%
2021	46.2%	27.8%	40.5%
Period	**CAGR**	**CAGR**	**CAGR**
2004 to 2019 (15-year)	-1.0%	0.8%	0.5%
2009 to 2019 (10-year)	-0.6%	1.4%	1.1%
2014 to 2019 (5-year)	-0.4%	1.0%	0.7%

Notes:
CAGR – Compound annual growth rate
Sources:
T-100 Segment database – U.S. Department of Transportation (DOT) BTS
Load factors by fiscal year based on revenue passenger miles, available seat miles, and CAGR calculations – AECOM analysis

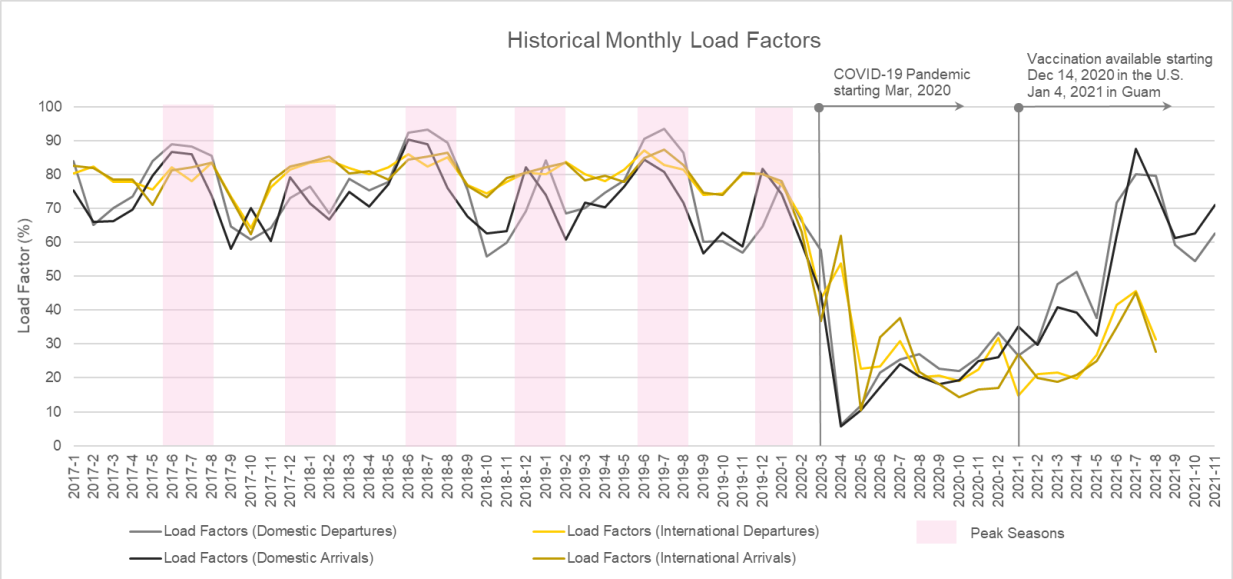

Figure 3-34. Historical Monthly Load Factors

Sources:

1. *T-100 Segment database – U.S. DOT BTS*
2. *First vaccination date – WHO*
3. *AECOM analysis*

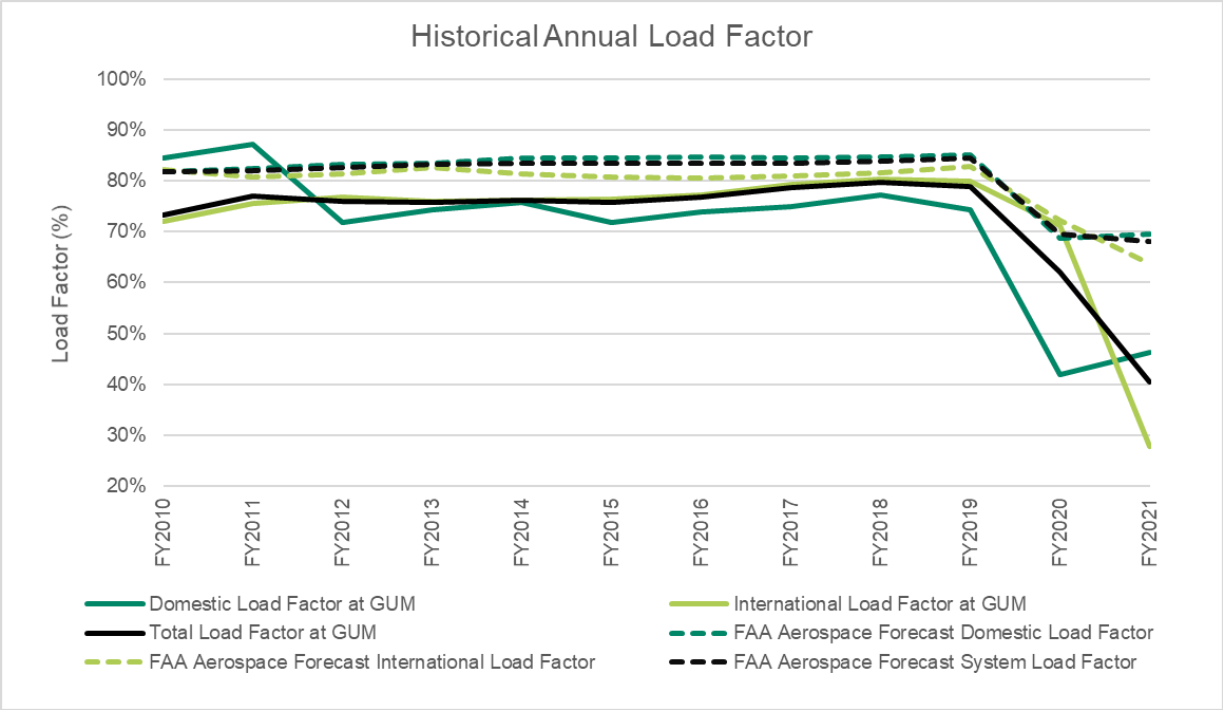

Figure 3-35. Historical Annual Load Factors

Note: U.S. Systemwide load factors in FY2020 and FY2021 are estimates and projections, respectively.
Sources:

1. *Airport statistics from T-100 Segment database – U.S. DOT BTS*
2. *U.S. Systemwide load factor statistics – FAA Aerospace Forecast FY2021–2041*
3. *Load factors by fiscal calculations – AECOM analysis*

3.5.4 Aircraft Fleet Mix and Average Seats per Departure

Figure 3-36 summarizes the major changes in passenger aircraft fleet mix based on the number of annual departures at the Airport since 2015. During this time frame, the most popular passenger aircraft at the Airport are the narrowbody aircraft Boeing (B) B737-800 and B737-700. They are mostly flown by United, Jeju Air, Jin Air, China Airlines, and Korean Air. Airbus (A) A321 and A320 aircraft are also common at the Airport. Air Busan, Air Seoul, Philippine Airlines, and EVA Airways operate their A321s, while Cebu Pacific operates an A320.

The most popular widebody aircraft is the B777-200 followed by the A330-200. United, Jin Air, Korean Air, Japan Airlines, and Philippine Airlines are the typical airlines that include some widebody aircraft in their fleet serving Guam.

Because of its location, Guam is served by mainline aircraft (long-range aircraft with 90 seats or more) for destinations farther than CNMI. None of the air carriers operate regional jets (short- to medium-range aircraft with less than 90 seats, including 50-seaters like Embraer Regional Jet [ERJ] ERJ-135/140/145 and Canadair Regional Jet [CRJ] CRJ-100/200 and larger jets with 70 to 90 seats like ERJ-170/175 and CRJ-700/900) at the Airport. Only commuter air carriers such as Star Marianas Air operate a short-range 8-seat Piper (PA) PA-31 for inter-island connections between Guam and Rota (or Saipan) in CNMI.

The average seat capacity per aircraft at the Airport increased from 176 in 2015 to 196 seats per departure in 2019 (pre-pandemic), as shown in **Figure 3-37**. The average seat capacity for international flights is slightly higher than domestic flights. The average seat capacity for international departures increased from 181 in 2015 to 202 seats per departure in 2019. The average seat capacity for domestic departures increased from 172 in 2015 to 190 seats per departure in 2019.

When the aviation demands were heavily impacted by the COVID-19 pandemic, airlines reduced frequency and used smaller aircraft to match capacity with the reduced demand. Average seat capacity per aircraft at the Airport reduced from 196 in 2019 to 174 seats per departure in 2021. During the same period, average seat capacity for international flights decreased from 202 to 175 seats per departure,

while domestic flights decreased from 190 to 173 seats per departure. As the load factors recover from the pandemic (**Figure 3-34**), airlines will gradually increase capacity by a combination of increasing frequency and resuming use of their larger aircraft. It is anticipated that the average seats per departure will eventually return to the historical pre-pandemic trend.

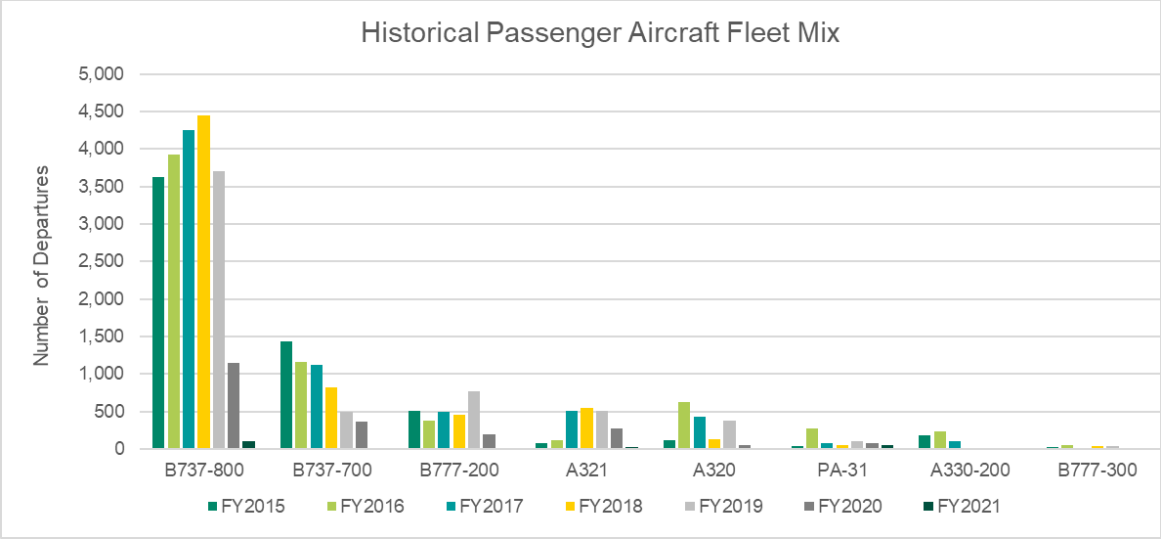

Figure 3-36. Historical Passenger Aircraft Fleet Mix

Note: Aircraft models with at least 10 departures in FY2019 are included.
Sources:
1. *Airport statistics from T-100 Segment database – U.S. DOT BTS*
2. *Summary by aircraft model – AECOM analysis*

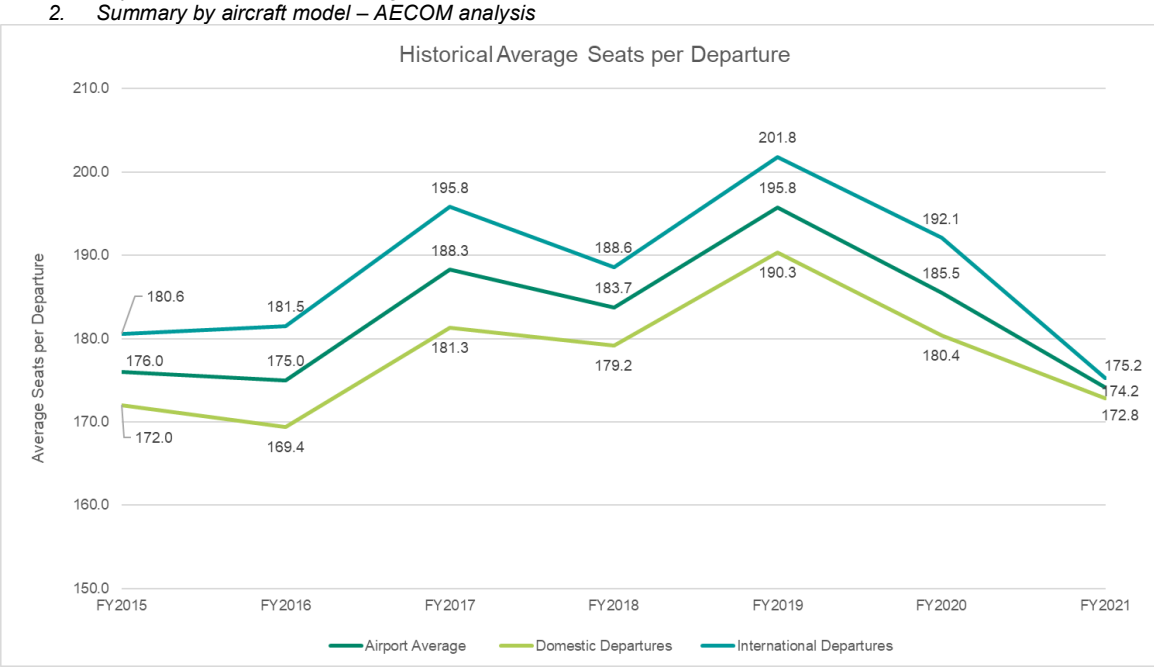

Figure 3-37. Historical Average Seats per Departure

Note: Operations by Part 135 Commuter such as Star Marianas Air, which operates with an 8-seat Piper PA-31, are excluded.
Source:
1. *Airport statistics from T-100 Segment database – U.S. DOT BTS*
2. *Average seats by departure calculations – AECOM analysis*

3.5.5 Airline Yield

Lower airfares attract passengers. A common measure of airfares per unit trip length is by airline yield. Yield is a measure of airline revenue, normalized for distance. It is measured in cents per revenue-passenger-mile and is calculated by dividing fare revenue by trip length. The information is based on data from the U.S. DOT BTS Airline Origin and Destination Survey (DB1B database), which collects ticket fare and miles flown for each domestic itinerary reported. The sample size of the Airline Origin and Destination Survey is approximately 10 percent of all air tickets.

Figure 3-38 summarizes airline yields for domestic itineraries to/from the Airport and the national average airline yields from 2015 through 2021. **Figure 3-38** also graphically presents the YOY changes on yields for both the Airport and the national average. Historical variations in yields for the Airport and domestic yields for the U.S. increase and decrease at a similar pattern. The drops in 2009 and 2016 airline yield are consistent with the drop in oil prices.

Figure 3-39 presents the changes in yields for the top U.S. carriers at the Airport.

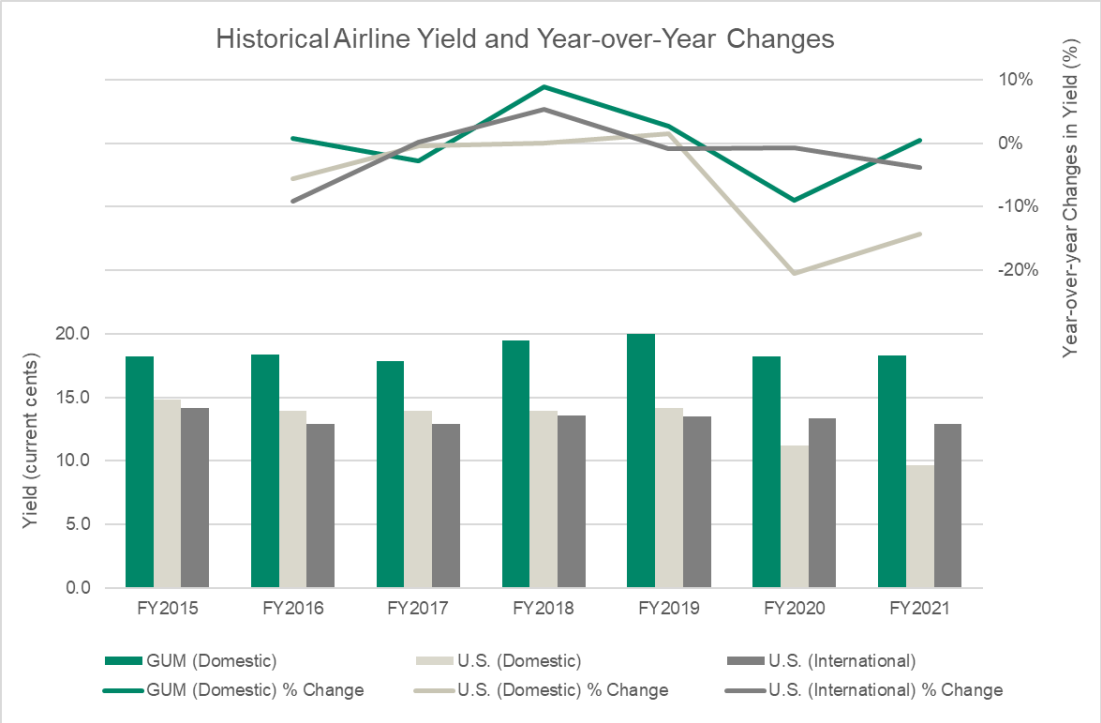

Figure 3-38. Historical Domestic and International Airline Yield and Year-over-Year Changes

Note: DB1B Market database provides information for domestic itinerary from the Origin and Destination Survey, which is a 10 percent sample of airline tickets from reporting carriers.
Source:

1. *Airport statistics from DB1B Market database – U.S. DOT BTS*
2. *U.S. statistics – FAA Aerospace Forecast FY2021–2041*
3. *Airport domestic airline yield and percentage change calculations – AECOM analysis*

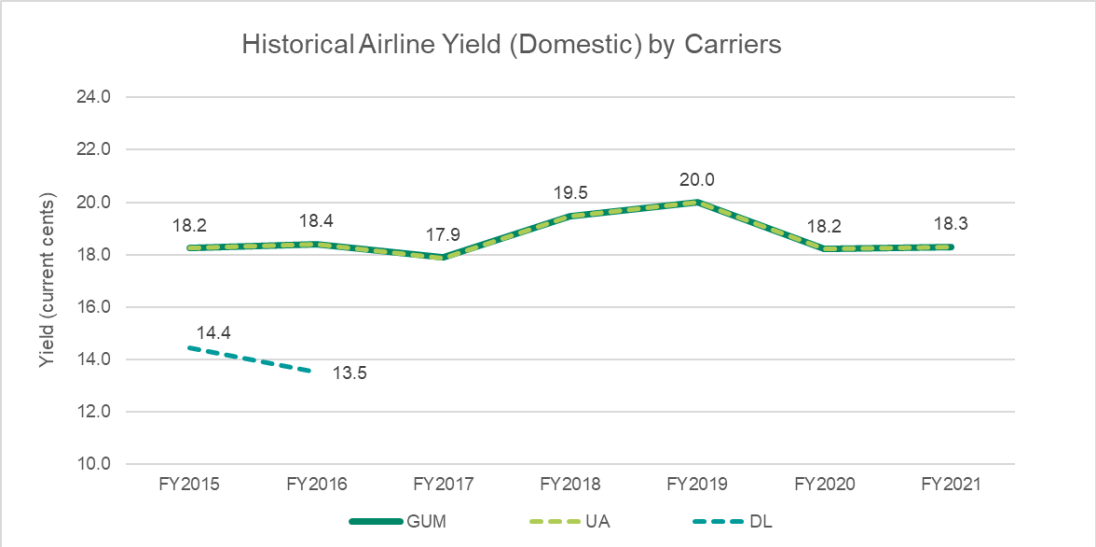

Figure 3-39. Historical Domestic Airline Yield by Carriers

Note: DB1B Market database provides information for domestic itinerary from the Origin and Destination Survey, which is a 10 percent sample of airline tickets from reporting carriers.
Sources:

1. *Airport statistics from DB1B Market database – U.S. DOT BTS*
2. *Airport domestic airline yield by carriers – AECOM analysis*

3.5.6 Air Cargo

Historical annual air cargo (air freight and mail) tonnage throughput from 2017 to 2021 is summarized in **Figure 3-40**. Freight throughput increased significantly from 6,700 tons in 2017 to the peak of 18,000 tons in 2020 and 15,500 tons in 2021 for outbound; volume was maintained between 6,900 and 9,400 tons for inbound freight throughput. Air mail also increased significantly from 2,000 tons in 2017 to 6,800 tons in 2021 for outbound and increased from 5,300 tons to 13,400 tons during the same period for inbound. The surge in demand in 2020 and 2021 is mostly related to the urgent need for supplies during the COVID-19 pandemic. Monthly air cargo tonnage given in **Figure 3-41** also shows the sudden increase in outbound freight at the beginning of the pandemic.

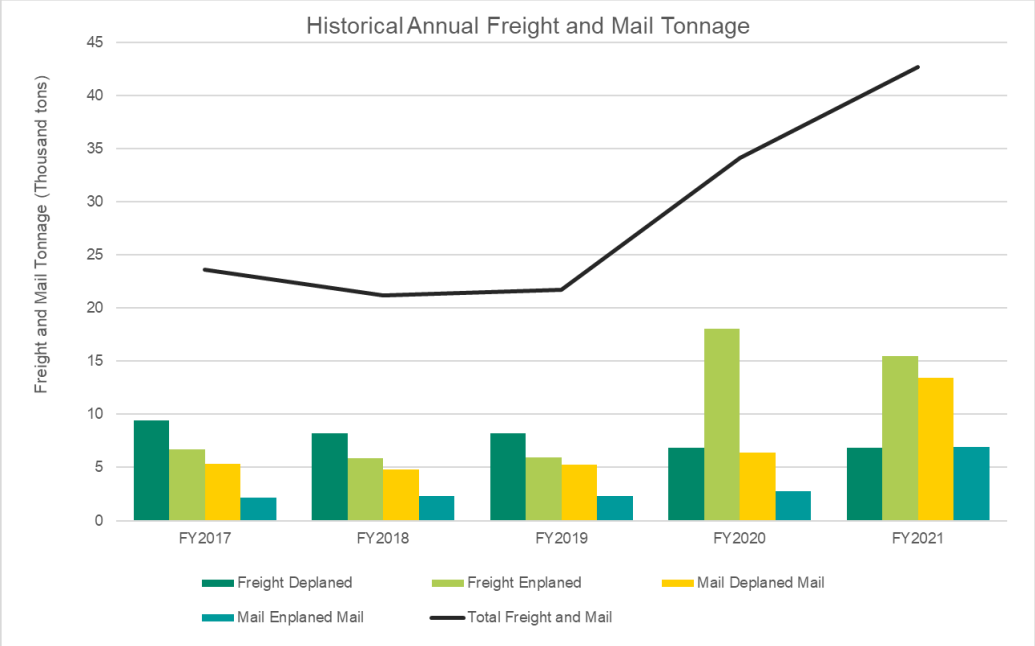

Figure 3-40. Historical Annual Freight and Mail Tonnage

Source: GIAA

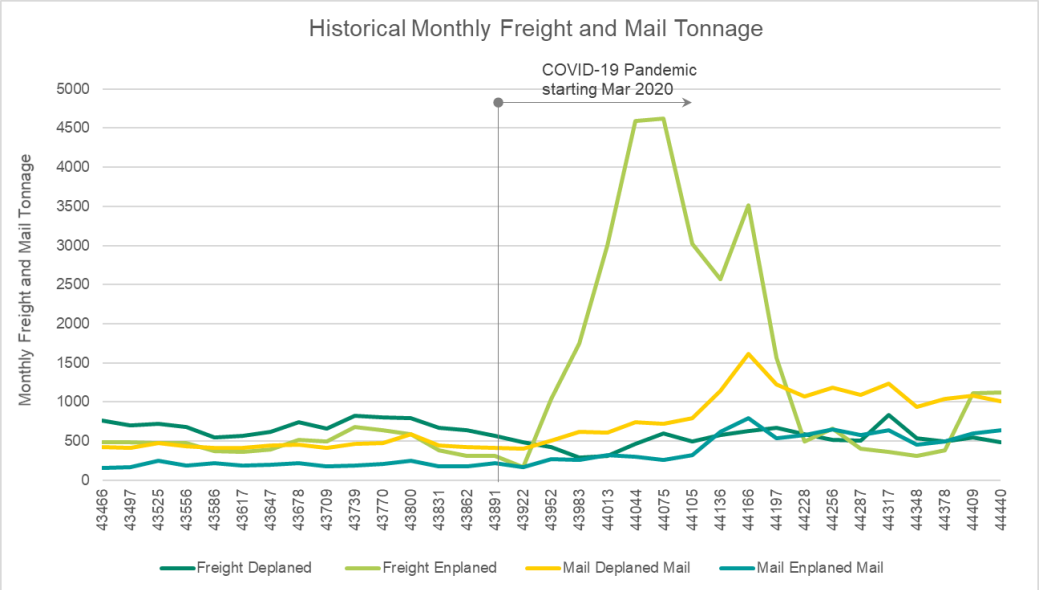

Figure 3-41. Historical Monthly Freight and Mail Tonnage

Source: GIAA

In order to analyze a longer historical trend of the air cargo demand than the period shown in **Figure 3-40**, the all-cargo data from the FAA were collected for the calendar years from 2009 to 2020, as summarized in **Figure 3-42** and **Table 3-11**. The landing weight of all-cargo aircraft at the Airport increased at an average rate of 15 percent per annum over the 10-year period from 2009 through 2019 and over 9 percent per annum over the 5-year period from 2014 through 2019. The national ranking of the Airport's all-cargo aircraft landing weight has been going up since 2017, which indicates the growth in cargo demand at the Airport outperformed other airports nationwide. There is also a surge in all-cargo aircraft landing weight in 2020 during the COVID-19 pandemic, which is similar to the trend described on the cargo tonnage and driven by the need for supplies to the Pacific Islands.

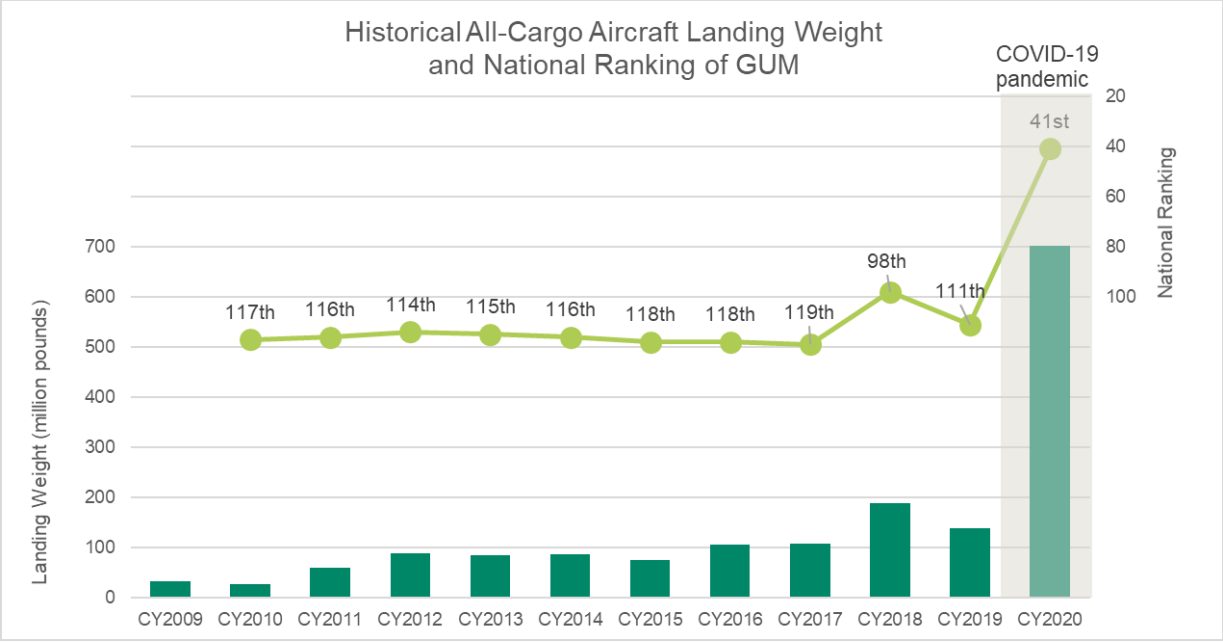

Figure 3-42. Historical All-Cargo Aircraft Landing Weight and National Ranking of GUM

Source: Landing weight and national ranking – FAA All-Cargo Data

Table 3-11. Historical All-Cargo Aircraft Landing Weight

Calendar Year	All-Cargo Landing Weight (Pounds)	YOY % Change
2009	33,909,200	N/A
2010	27,108,400	-20.1%
2011	61,117,700	125.5%
2012	89,287,000	46.1%
2013	84,912,300	-4.9%
2014	87,446,300	3.0%
2015	76,717,500	-12.3%
2016	106,768,850	39.2%
2017	108,440,100	1.6%
2018	189,833,874	75.1%
2019	138,511,079	-27.0%
2020	702,512,030	407.2%
Period	**CAGR**	
2009 to 2019 (10-year)	15.1%	
2014 to 2019 (5-year)	9.6%	

Notes:
N/A = Not available
CAGR = Compound annual growth rate
YOY = Year-over-year
Sources:
Landing weight – FAA All-Cargo Data
YOY and CAGR calculations – AECOM analysis

Figure 3-43 illustrates the changes in exports and imports via Guam in terms of value, geography, and type of commodities. Although the statistics include transportation by both air and ship, the combined statistics provide valuable insights on the characteristics and historic trend of the cargo industry in Guam. An average of 30 percent of the imports (by value) were delivered by air based on available historical statistics in 2017 through 2019.

This historical inbound air cargo throughput was much higher than the outbound throughput before the COVID-19 pandemic, as shown in **Figure 3-40**. A similar pattern is shown in the imports and exports statistics, as the value of monthly imports are much higher than the monthly exports. As an island in the Pacific Ocean with limited natural resources and productivity, Guam depends heavily on imports of supplies. High value, time- or temperature-sensitive goods and perishables are mostly delivered by air through the Airport. Bulky, heavy, and less time-critical deliveries are usually transported in container ships through the Port of Guam.

The majority of the imports are from the U.S., followed by Italy, China, Singapore, Korea, Japan, and Taiwan. The top commodities imported to Guam include food, alcoholic beverages, clothing, leather products, motor vehicles, watches, electrical appliances, perfumes and cosmetics, jewelry, and pharmaceutical products.

The FSM, Marshall Islands, and Palau are the top, the fourth, and the fifth country of destinations for exports from Guam, respectively. These three countries together represent 48 to 67 percent of the exports from Guam from 2017 through 2021. Other popular export destinations include Japan, Hong Kong, Korea, and Taiwan. The top commodities exported to these countries are tobacco products, beer, motor vehicles, fish (live, chilled, or frozen), perfumes and cosmetics, and watches. As Guam does not manufacture most of these products, the majority of these exports are transshipments redistributed to Micronesia.

Guam had a well-established fishery transshipment industry in the mid-1980s and 1990s. With the adoption of the Exclusive Economic Zone (EEZ), which extends 200 nm from the coast, established in

1982,[25] many Pacific Islands took actions toward the landing of fish caught in their EEZs by imposing licensing conditions with bilateral or multilateral access agreements between different nations. The FSM, with the most marine resources in its EEZs amongst the countries in the Micronesia region, adopted the land-fish-locally policy. An emerging pattern of air transshipment through both Guam (i.e., GUM) and Saipan (i.e., GSN) for sashimi-grade tuna bound for Japanese market accompanied imposition of the land-fish-locally policy. Smaller cargo jets transported these sashimi-grade tuna to Guam and Saipan, where shipments were consolidated for transshipment onto large cargo aircraft to Japan. Guam also developed secondary transshipment operations by processing the rejected fish that did not meet Japanese sashimi market standard and air freighting them to other destinations such as Europe via Korea.[26, 27] After the Asian financial crisis in 1997 and the drop of the Japanese yen against the U.S. dollar, the operating cost, fuel cost, port cost, and air freight cost for foreign-flagged vessels fishing in the Micronesia region went up and resulted in a significant decline in the fishery industry. Exports of fish (live, chilled, or frozen) from Guam continues to decline through the COVID-19 pandemic as shown in **Figure 3-43**.

Despite the decline of the fishery transshipment in Guam, there are potential opportunities for Guam in the transshipment industry resulting from the increasing need to address supply chain issues in a post-COVID era. Guam's geographically and politically strategic location within the Asia Pacific represents a vital component to not only U.S. military logistics and operations but it also provides easy access to manufacturing hubs in the Asia-Pacific supply chain. The Port of Guam at Apra Harbor has convenient access to the Airport and has the capacity to handle more shipments in comparison with other ports in the Pacific.[28] The Government of Guam set up a Transshipment Task Force in June 2021 to develop Guam into a transshipment hub by addressing issues such as federal and local regulations, tax policy, workforce development, incentive programs, infrastructure, finance, and outreach. With the strong support of both the government and local community, and the desperate need for a diversified economy for Guam to recover from the pandemic, the outlook for transshipment demands and the consequential impacts on air freight demands are encouragingly positive.

[25] The United Nations Convention on the Law of the Sea signed in 1982.
[26] Hamnett and Pintz, The Contribution of Tuna Fishing and Transshipment to the Economies of American Samoa, the Commonwealth of Northern Mariana Islands, and Guam. 1996.
[27] South Pacific Commission Port Sampling Workshop, Summary Report of the Tuna Transshipment Industry in Guam. 1994.
[28] Wang, Bhojwani, Tumaneng, and Ji, Transshipment on Guam. 2021.

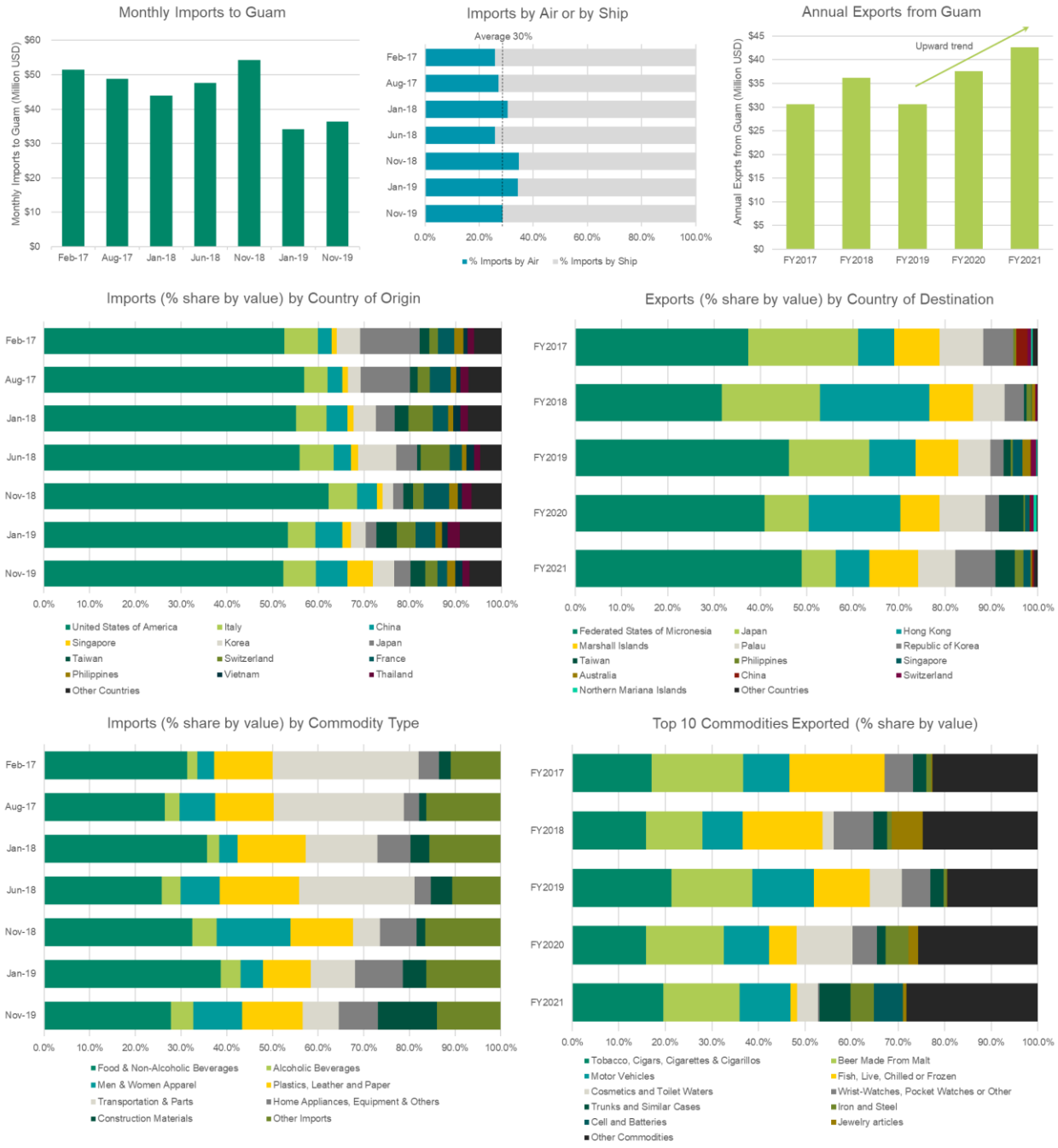

Figure 3-43. Historical Imports and Exports through Guam

Sources:

1. *Bureau of Statistics and Plans, Government of Guam*
2. *AECOM analysis*

Air cargo services are provided by five basic types of carriers:

- Combination carriers – passenger airlines offering cargo services. They use either passenger aircraft designed with additional freight capacity, or in some cases, air freighters. They may limit their services to express packages, mail, and palletized freight on scheduled passenger services or may operate their own cargo service with dedicated air freighters. With the surge in demand for Personal Protective Equipment (PPE) and medical supplies during the COVID-19 pandemic, some passenger airlines operated cargo-only flights on passenger aircraft or increased their belly cargo capacity by removing some passenger seats. United Airlines, Japan Airlines, Korean Airlines, and

Philippine Airlines are the most common combination carriers at the Airport. During the pandemic, both United and Korean Airlines operated regularly scheduled dedicated freighter service. Other examples of passenger airlines that had occasional on-demand cargo services at the Airport in the past 3 years include, EVA Airways, Jeju Air, Air China, China Southern, China Eastern, Hainan Airlines, Hawaiian Airlines, Lion Airlines, and Uzbekistan Airways.

- Integrated carriers offering door-to-door services by combining air and land transport (also known as integrated express operators or integrators). The largest air freight carriers are the integrated carriers FedEx and UPS. Both FedEx and UPS operate weekly flights to/from the Airport. They maintained the same weekly operations during the pandemic. UPS typically flies from Honolulu to Guam and continues to Hong Kong (HNL-GUM-HKG). FedEx typically flies the route from Anchorage to Guam and then Shanghai (ANC-GUM-PVG). FedEx also has occasional destinations at Osaka (KIX), Seoul (ICN), or Tokyo (NRT) instead of Shanghai (PVG).
- All-cargo airlines offering chartered and/or scheduled services. They operate scheduled services for contract shippers and provide charter operations for other airlines. They typically utilize freight forwarders to arrange most of their shipments. The largest all-cargo carrier at the Airport is Asia Pacific Airlines (APA) with their headquarters in Tamuning, Guam. APA operates cargo charter services from bases in Guam and Honolulu with its hub operation at the Airport. Its primary operation is the shipment of U.S. mail and freight throughout Micronesia. The second and third largest all-cargo carriers at the Airport are Air Transport International (ATN) and Polar Air Cargo (PAC). ATN operated freighter service primarily from Hong Kong to Sydney through Guam (HKG-GUM-SYD) during the pandemic (from July 2020 to January 2021). PAC operated freighters primarily from Hong Kong or Seoul to Sydney through Guam (HKG-GUM-SYD or ICN-GUM-SYD). Other common all-cargo airlines operating at the Airport include Atlas Air Cargo, Volga-Dnepr Airlines, Omni Air International, Antonov Airlines, Kalitta Air, Lynden Air Cargo, Cargo Aircraft Management, and National Airlines.
- Part 135 commuter air carriers offering charter or scheduled cargo only or passenger and cargo services. They operate with small aircraft with a maximum payload capacity of 7,500 pounds and a maximum passenger-seating configuration of 9 seats, or in any rotorcraft. They cannot operate in any turbojet aircraft. Micronesian Air Cargo Services (MACS, also operated as Skydive Guam) and Star Marianas Air are the top Part 135 operators at the Airport. MACS plays an important role in the U.S. Postal Service (USPS) operations in the region and delivers air mail to/from CNMI regularly. MACS also provides on-demand air cargo delivery between Guam, Rota, Saipan, and Tinian. Star Marianas Air offered daily scheduled flights to/from Rota, CNMI, before the COVID-19 pandemic and other non-scheduled charter services to Rota, Saipan, and Tinian, CNMI. Star Marianas Air typically ships cargo and rarely provides passenger service. Arctic Air (or Arctic Circle Air) is another Part 135 air carrier with headquarters in Saipan and is owned by Marianas Harvest. Their business plan is to establish a reliable supply of fresh produce from CNMI to Guam, but they also provide charter services for passengers and air cargo.
- Leasing companies providing air freighters on dry or wet lease or a combination lease arrangement. The historical statistics of cargo operations typically show the lessees as the air carrier instead of the lessors. They are included in the above-listed categories of air cargo carriers.

Figure 3-44 summarizes the historical share of air cargo tonnage carried by air freighters, small aircraft operated by Part 135 commuter air carriers, or as belly cargo in passenger aircraft. During the COVID-19 pandemic, passenger demands dropped significantly. Many passenger aircraft were used as cargo aircraft without passengers temporarily. Hence, the percentage of belly cargo on passenger aircraft was negligible, while the percentage of air freighters increased significantly in 2020 and 2021. It is anticipated that the percentage share between different types of aircraft will return to levels similar to those in 2019 after the pandemic. For the current forecasting effort, the share of air cargo on air freighters (excluding belly cargo) will be used to estimate the number of cargo aircraft operations, and the share of air cargo on small aircraft operated by Part 135 commuter air carriers will be used to estimate the number of air taxi operations for cargo delivery.

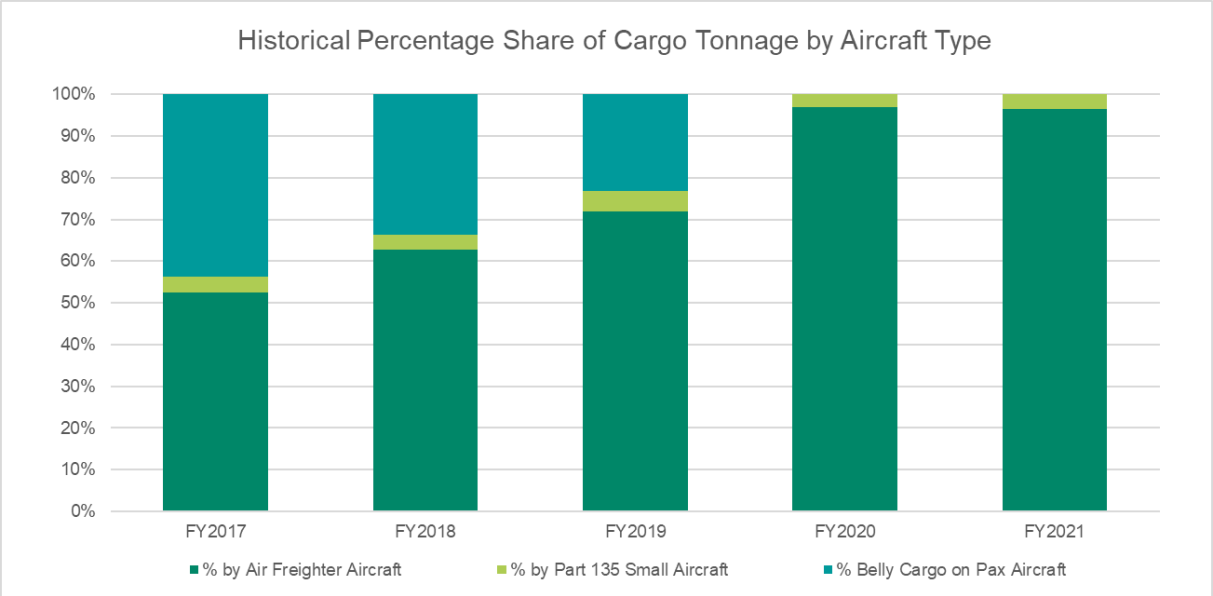

Figure 3-44. Historical Percentage Share of Cargo Tonnage by Aircraft Type

Sources:

1. *Cargo tonnage and operations – GIAA*
2. *Airport statistics from T-100 database – U.S. DOT BTS*
3. *Percentage share estimates – AECOM analysis*

Table 3-12 summarizes the fleet mix by the top cargo carriers at the Airport. **Figure 3-45** depicts the air freighter fleet mix by number of operations in 2018 through 2021. **Figure 3-46** shows the small cargo aircraft fleet mix by Part 135 commuter air carriers.

APA retired its B727 fleet in 2020 and only flies B757-200s. UPS is gradually changing its fleet from the older B747-400F to the newer B747-8F aircraft. FedEx typically flies the McDonnell Douglas (MD) MD-11 to/from Guam. As discussed above, United Airlines and Korean Airlines provided regularly scheduled dedicated freighter service during the pandemic. United flies mostly the B777-300ER, B787-9, and B737-800 for cargo delivery. Korean Airlines flies mostly the A330 and B787-9.

The most common small aircraft model used for cargo delivery at the Airport is the Cessna (C) C208 Caravan in MACS's fleet, followed by the Piper PA-32 and PA-31 operated by Star Marianas.

Table 3-12. Historical Regular Cargo Aircraft Fleet Mix at the Airport

Top Integrated/All-Cargo/Combination Carriers	Fleet [B]	Maximum Payload (Cargo Capacity, if available) [C]
APA	B757-200 Freighter	79,000 lbs
	B727 Freighter (Retired)	53,000 lbs
UPS	B747-400 Freighter	273,000 lbs
	B747-8 Freighter	292,400 lbs
FedEx	MD-11 Freighter	180,000 lbs
United Cargo	B777-300ER	154,000 lbs (Cargo capacity 153,040 lbs)
	B787-9	116,000 lbs (Cargo capacity 104,460 lbs)
	B737-800	20,200 lbs (Cargo capacity 15,580 lbs)
Korean Cargo	A330-200 or 300	100,500 to 151,000 lbs
	B787-9	116,000 lbs
Polar Cargo	B767-300 Freighter	120,000 lbs
Part 135 Commuter Carriers	**Fleet**	**Maximum Payload**
MACS	Cessna C208 Caravan (C208)	2,800 lbs
	Cessna C208EX Grand Caravan (C208 EX)	3,200 lbs
	Embraer EMB110 (EMB110)	3,400 lbs
Star Marianas	Piper PA-31-350 Navajo Chieftain (PA31)	2,500 lbs
	Piper PA-32 Cherokee Six (PA32)	1,500 lbs
Arctic Air	Britten-Norman BN-2 Islander (BNT2)	2,000 lbs

Notes:
APA = Asia Pacific Airlines
UPS = United Parcel Service
MACS = Micronesian Air Cargo Services
lbs = pounds
Only fleet with over 10 departures in the past 5 years are included.
Maximum payloads are approximate estimates from similar aircraft models or from carriers' website.
Sources:
Aircraft operations statistics – FAA Air Traffic Activity Data System (ATADS)
YOY and CAGR calculations – AECOM analysis

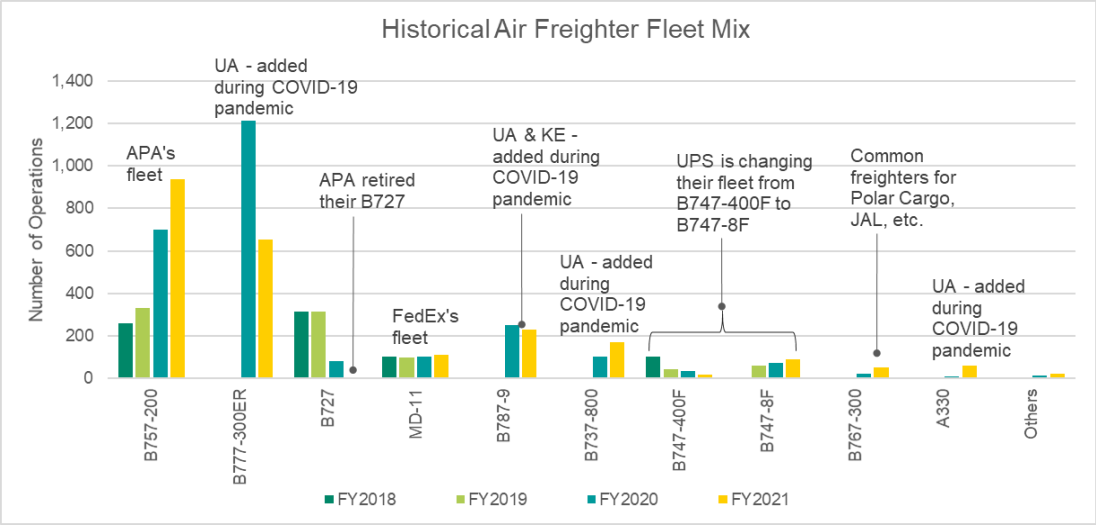

Figure 3-45. Historical Air Freighter Fleet Mix

Source: Cargo aircraft operations – GIAA

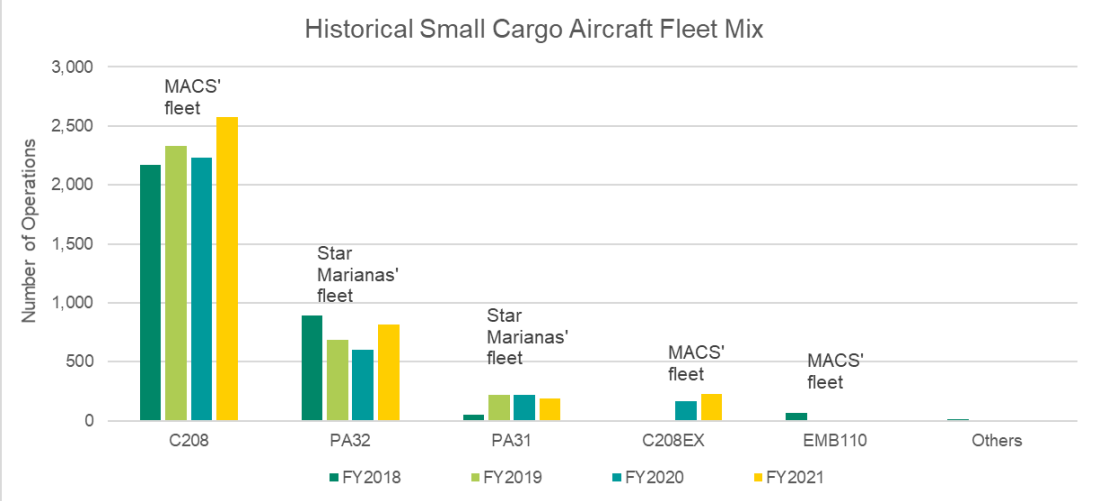

Figure 3-46. Historical Small Cargo Aircraft Fleet Mix

Source: Cargo aircraft operations – GIAA

3.5.7 Aircraft Operations

Figure 3-47 and **Table 3-13** present the historical aircraft operations at the Airport for the period from 2005 through 2021. Historical total aircraft operations data are based on the FAA Air Traffic Activity Data System (ATADS). During this period, total operations peaked at over 76,000 in 2017 and just below 73,000 in 2019 before the COVID-19 pandemic.

The trend of historical aircraft operations is similar to enplanements and generally follows historical events and the economy as discussed in previous **Section 3.5.2**.

After the economic downturn ended in mid-2009, total enplanements increased at 3.7 percent per annum from 2009 to 2019 and 2.2 percent per annum from 2014 to 2019; total operations increased at a slower rate of 2 percent and 0.7 percent per annum during the same period, respectively. This is consistent with an industry-wide trend, with airlines generally increasing aircraft size (i.e., upgauging), flying less frequently, and resulting in higher load factors.

Table 3-14 summarizes the historical aircraft operations by type of operations based on cargo statistics from both GIAA and FAA ATADS. The operations from air carrier (passenger and cargo), air taxi, GA, and military aircraft follow the FAA ATADS. The split between passenger air carrier and cargo carrier operations is based on GIAA cargo statistics.

Cargo aircraft operations increased significantly during the COVID-19 pandemic. Cargo aircraft operations increased by over 200 percent from 2019 to 2020, while passenger aircraft operations was reduced by 47 percent. A similar trend happened globally as air cargo demands were driven by urgent delivery of PPE, medical supplies, and booming e-commerce.

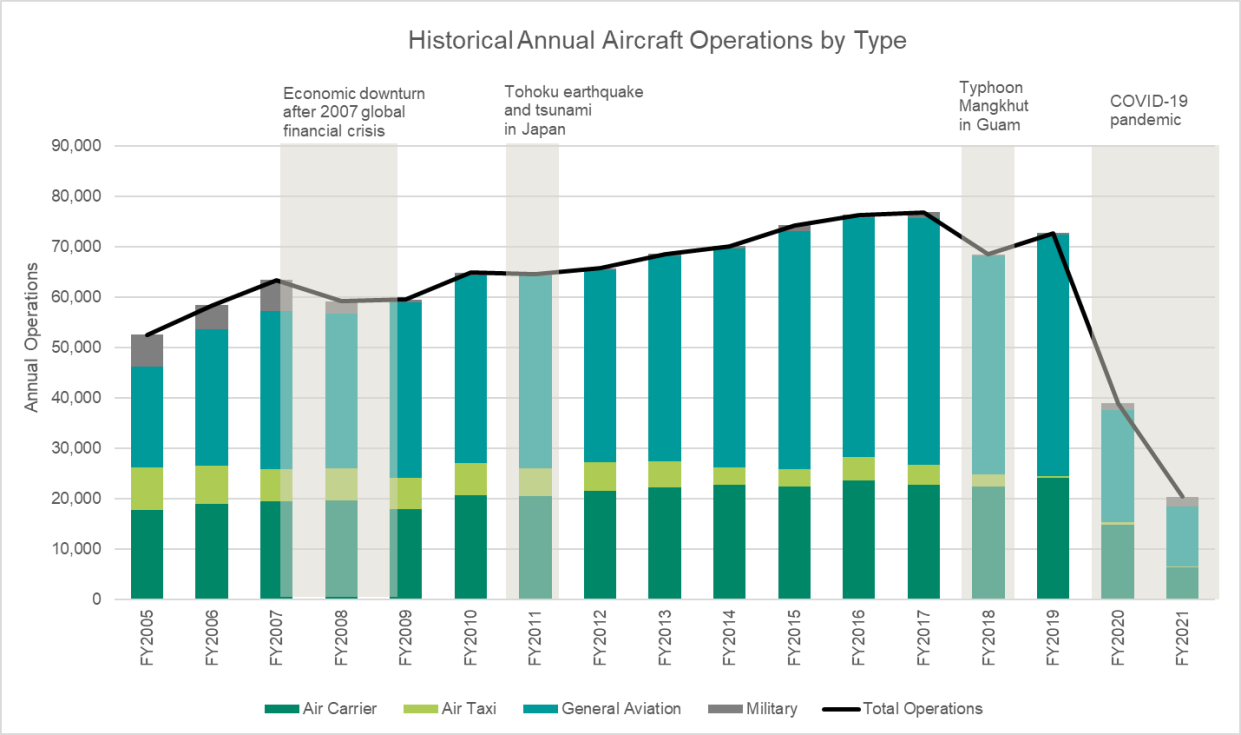

Figure 3-47. Historical Annual Aircraft Operations by Type

Source: Aircraft operations statistics – FAA ATADS

Table 3-13. Historical Annual Aircraft Operations

Fiscal Year	Aircraft Operations	YOY % Change
2005	52,549	N/A
2006	58,411	11.2%
2007	63,328	8.4%
2008	59,135	-6.6%
2009	59,525	0.7%
2010	64,855	9.0%
2011	64,492	-0.6%
2012	65,708	1.9%
2013	68,547	4.3%
2014	70,108	2.3%
2015	74,214	5.9%
2016	76,253	2.7%
2017	76,777	0.7%
2018	68,476	-10.8%
2019	72,699	6.2%
2020	38,907	-46.5%
2021	20,363	-47.7%

Period	CAGR	
2005 to 2019 (14-year)	2.3%	
2009 to 2019 (10-year)	2.0%	
2014 to 2019 (5-year)	0.7%	

Notes:
N/A = Not available
CAGR = Compound annual growth rate
YOY = Year-over-year
Sources:
Aircraft operations statistics – FAA ATADS
YOY and CAGR calculations – AECOM analysis

Table 3-14. Historical Annual Aircraft Operations by Type

Fiscal Year	Air Carrier		Total Air Carrier	Air Taxi	General Aviation	Military	Total Operations
	Passenger Aircraft	Freighter (Cargo Aircraft)					
2018	21,555	781	22,336	2,519	43,236	385	68,476
2019	23,289	849	24,138	370	47,777	414	72,699
2020	12,197	2,602	14,799	575	22,171	1,362	38,907
2021	3,988	2,345	6,333	197	11,906	1,927	20,363

Note: Skydive Guam (Mac-Cargo) and Star Marianas operate small turbine or piston aircraft for cargo delivery to/from the Airport. These operations are categorized under air taxi/GA instead of air carrier under the FAA ATADS. Hence, the number of freighter (cargo aircraft) operations in **Table 3-14** exclude cargo operations by Skydive Guam (Mac-Cargo) and Star Marianas.
Sources:
Aircraft operations statistics – FAA ATADS
Cargo aircraft statistics – GIAA
Breakdown of air carrier operations of cargo aircraft statistics from calendar year to fiscal year – AECOM analysis

3.5.8 Based Aircraft

Historical based aircraft records were obtained from the FAA Terminal Area Forecast (TAF) (2022 model, released in February 2023), and Form 5010-1 (April 2022). **Table 3-15** and **Figure 3-48** provide information on aircraft based at the Airport since 2005, including the number of single-engine, multi-engine, jet, and helicopter aircraft.

The number of based aircraft has decreased from the peak of 83 before and during the 2007/2008 economic downturn to 37 in 2021. Most of the decline occurred in the multi-engine and jet categories. The number of single-engine aircraft dropped after the economic downturn, but it has returned to an upward trend since 2017/2018.

While COVID-19 has had an overall negative impact on the aviation industry, general aviation was not as severely impacted as commercial passenger airlines. There are indications nationwide that charter activity, recreational flying, and flight training are returning to pre-COVID-19 levels. A new flight school, Aire Services, started service in April 2021. The upward trend in the number of single-engine based aircraft is indicative of increased demand for flight training and recreational flying.

Table 3-15. Historical Based Aircraft by Type

	Number of Based Aircraft					Percentage of Total Based Aircraft			
Fiscal Year	**Single**	**Multi**	**Jet**	**Helicopters**	**Total**	**Single**	**Multi**	**Jet**	**Helicopters**
2005	10	16	32	1	59	16.9%	27.1%	54.2%	1.7%
2006	18	8	47	1	74	24.3%	10.8%	63.5%	1.4%
2007	20	10	52	1	83	24.1%	12.0%	62.7%	1.2%
2008	20	10	52	1	83	24.1%	12.0%	62.7%	1.2%
2009	20	10	52	1	83	24.1%	12.0%	62.7%	1.2%
2010	20	10	52	1	83	24.1%	12.0%	62.7%	1.2%
2011	19	13	24	1	57	33.3%	22.8%	42.1%	1.8%
2012	12	9	21	0	42	28.6%	21.4%	50.0%	0.0%
2013	13	9	16	0	38	34.2%	23.7%	42.1%	0.0%
2014	21	7	15	0	43	48.8%	16.3%	34.9%	0.0%
2015	15	2	16	0	33	45.5%	6.1%	48.5%	0.0%
2016	14	8	16	0	38	36.8%	21.1%	42.1%	0.0%
2017	19	6	15	0	40	47.5%	15.0%	37.5%	0.0%
2018	18	5	12	0	35	51.4%	14.3%	34.3%	0.0%
2019	22	4	10	0	36	61.1%	11.1%	27.8%	0.0%
2020	22	4	10	0	36	61.1%	11.1%	27.8%	0.0%
2021	23	4	10	0	37	62.2%	10.8%	27.0%	0.0%
Period	**CAGR**								
2005 to 2019 (14-year)	5.8%	-9.4%	-8.0%	N/A	-3.5%				
2009 to 2019 (10-year)	1.0%	-8.8%	-15.2%	N/A	-8.0%				
2014 to 2019 (5-year)	0.9%	-10.6%	-7.8%	N/A	-3.5%				

Notes:
N/A = Not available
CAGR = Compound annual growth rate
Sources:
Based aircraft by type – FAA TAF 2022 (February 2023)
Form 5010-1 (April 2022)
Percentage share by type and CAGR calculations – AECOM analysis

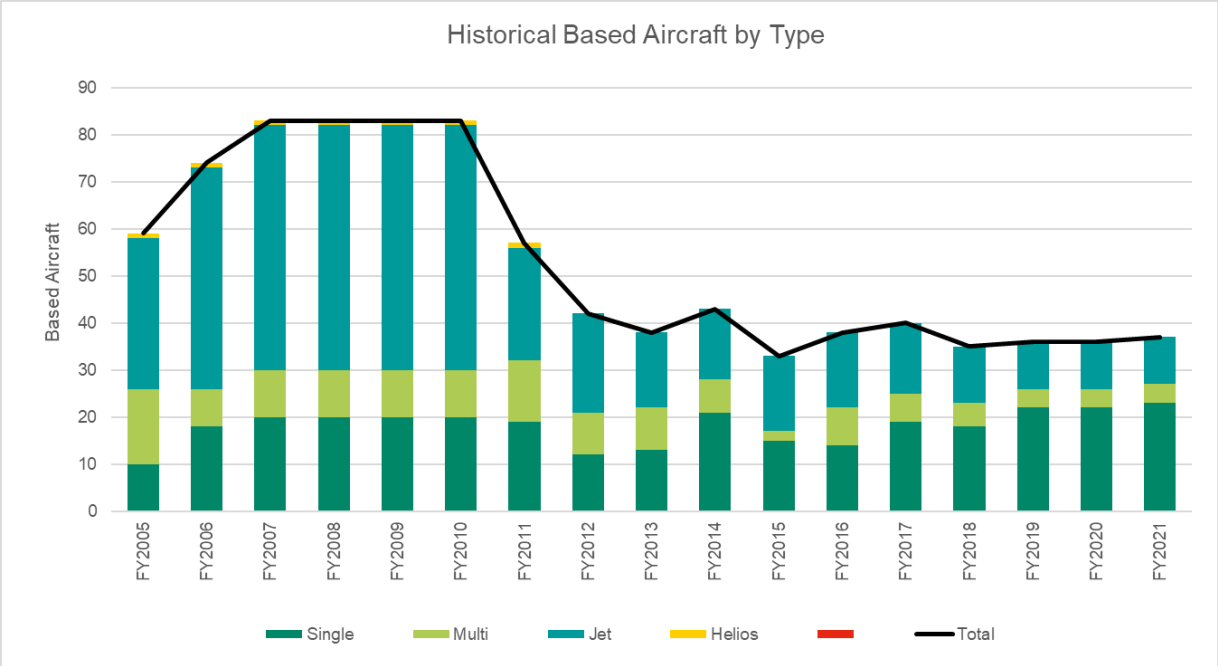

Figure 3-48. Historical Based Aircraft by Type

Sources:

1. *Based aircraft by type – FAA TAF*
2. *2022 model released in February 2023. Form 5010-1 (April 2022)*

3.6 Aviation Demand Forecasts

Forecasts of aviation demand were developed for the following categories:

- Enplaned passengers
  - Domestic enplaned passengers
  - International enplaned passengers
- Air cargo
  - Cargo tonnage by air freighter aircraft
  - Cargo tonnage by small cargo aircraft
  - Cargo tonnage by passenger aircraft (lower deck, i.e., belly cargo)
- Aircraft operations
  - Air carrier (commercial passenger aircraft operations)
  - Air carrier (all-cargo aircraft operations)
  - Air taxi and GA operations
  - Military aircraft operations
  - Breakdowns between itinerant and local operations
- Based aircraft

Each forecast includes expected demand for the 20-year planning horizon (2019 to 2039) grouped into 5-year periods and uses actual 2019 (pre-COVID-19-pandemic) statistics as the baseline.

The overall forecast approach is illustrated in **Figure 3-49**. Enplanements and air cargo demands are first developed by analyzing key socioeconomic drivers, historical trends, and industry outlook. Adjustments are made for the short-term forecast in response to the impact of the COVID-19 pandemic. Using the enplanement and air cargo forecasts, projections for aircraft operations are derived based on

assumptions for aircraft fleet mix, enplanement load factors, average seats per departure, share of cargo on different cargo carriers, and cargo volume per operation. Further explanations are given in subsequent paragraphs.

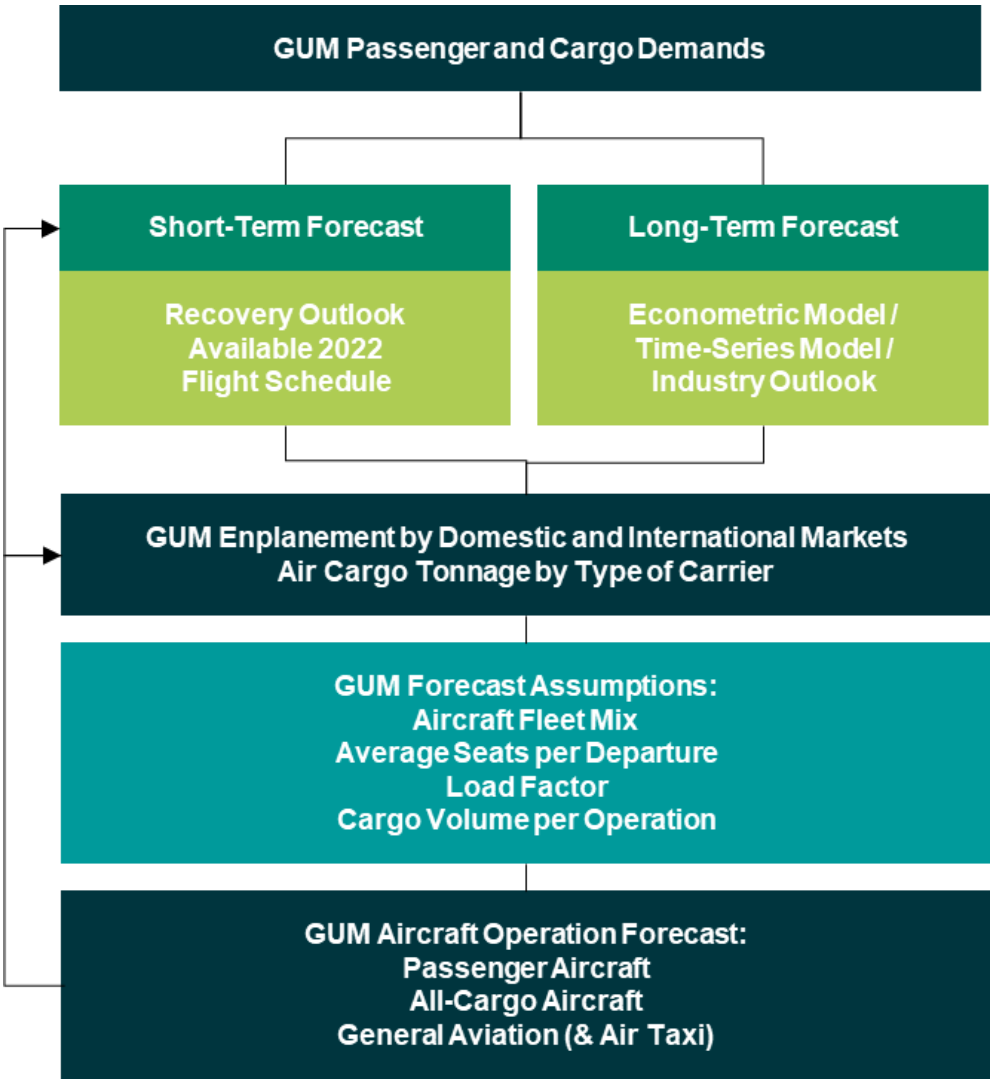

Figure 3-49. Overall Forecast Approach

Source: AECOM

3.6.1 Enplaned Passengers Forecast

As discussed in **Section 3.3**, the COVID-19 pandemic had significant impacts on air travel. Like many other airports around the world, the Airport experienced an unprecedented drop in passenger levels in April 2020. While a recovery is genuinely expected, the key question is when the aviation demands will return to pre-COVID-19 level.

Unlike previous experience in recovering from crises, international travel has been much slower to recover than domestic travel. Travel restrictions and quarantine requirements for travels to and from different countries discourage international travels. Although leisure and VFR (Visiting Friends and Relatives) travel has recovered faster than business travel, and leisure travelers have demonstrated a preference for outdoor-oriented leisure destinations in small and less dense cities to stay isolated while on vacation, most of the visitors to Guam are international travelers. The passenger traffic recovery at the Airport is still not as fast as other leisure destination airports. In addition, the primary markets for Guam's tourism are in the Asia-Pacific, which is the slowest region to remove international travel restrictions.

Airlines have responded to the decrease in passenger demands by reducing capacity through retirement of older aircraft, postponing the delivery of new aircraft orders, and grounding or storing larger aircraft. Airlines have also reduced their workforce by creating incentives for voluntary retirement and extended leave. As air travel demands began to return, airlines have gradually restored capacity and deployed flights to match demand.

Unlike the experience following the Great Recession, this time households have emerged, on average, with relatively healthy finances from the deep but brief recession induced by the economic lock-down and stay-at-home orders implemented to contain the spread of COVID-19. Pent-up demand for travel is backed up by capacity to spend.

The Russia-Ukraine conflict is ongoing, and the timeline and consequences for aviation are uncertain. Although it is expected to have some downside risks and impact on airline costs as a result of fluctuations in fuel prices or due to rerouting to avoid Russian airspace, the air transport industry is generally resilient against historical shocks. According to the International Air Transport Association (IATA), this Russian-Ukraine conflict is unlikely to impact the long-term growth of air transport.[29]

The forecast analysis consisted of two main elements: a short-term forecast, and a long-term forecast. The short-term forecast focuses on the coming 3 to 5 years and references the recovery outlook for the post-COVID era from the industry and known factors such as local air service incentive programs from the GVB and GIAA. The long-term forecast projects the enplanement demands in the 20-year planning horizon based on macroscopic socioeconomic conditions and historical trends at the airport. Forecast development also acknowledges the elevated uncertainty in the development of the pandemic and the implications for the outlook for the aviation industry and the overall economy. A range of scenarios from a high (optimistic) scenario, to baseline (moderate), to a low (pessimistic) scenario were considered. Because domestic and international demands have been recovering at different paces, forecasts for the two traffic segments were developed separately in the forecast models and then added to arrive at the total enplanement forecasts.

3.6.1.1 Short-Term Enplanement Forecast

The following factors were considered in developing the short-term enplanement forecast:

- Short-term forecast development considered the progress made so far in traffic recovery and what the latest airline flight schedules (early 2022) indicate the enplanement level may be for 2022.
- The near-term recovery trend considered current development in aviation industry, the business environment, trends in COVID-19 infection and vaccination rates, various travel sentiment surveys, and travel restrictions, especially for international travel.
- Recovery trends based on the TSA checkpoint screening throughput indicate strong domestic recovery, especially after the vaccine was available in the U.S. Total traveler throughput in April 2022 has already returned to 90 percent of the throughput in April 2019.
- Travel sentiment surveys conducted by different agencies indicate the travel industry is gradually moving forward. Comparison between 2020 and 2022 surveys shows an increase in confidence to travel again. The younger generation such as the millennials and generation Z[30] passengers are more eager to return to travel and they are also slightly less concerned about catching the coronavirus while traveling. When the vaccine is available for children and teens, more families are willing to travel again.[31]
- IATA's long-term forecast released in March 2022 includes the following highlights:[32]
    - Overall traveler numbers are expected to improve to 94 percent of 2019 levels in 2023, and 103 percent in 2024.
    - International traveler numbers are expected to improve to 82 percent of 2019 levels in 2023, 92 percent in 2024, and 101 percent in 2025.

[29] IATA, Press Release No. 10, Air Passenger Numbers to Recover in 2024, March 2022.
[30] Millennials, also known as generation Y, were born between the early 1980s and mid-1990s. Generation Z refers to the generational cohort following millennials, born between the late 1990s and early 2010s.
[31] Travel sentiment surveys from OAG, PwC, Indagare, and Oliver Wyman.
[32] IATA, Press Release No. 10, Air Passenger Numbers to Recover in 2024, March 2022.

  - Domestic traveler numbers are expected to improve to 93 percent of 2019 levels in 2022, and 103 percent in 2023.
  - Asia-Pacific: The slow removal of international travel restrictions, and the likelihood of renewed domestic restrictions during COVID outbreaks, are likely to slow down the recovery in traffic to/from/within Asia-Pacific, the weakest outcome of the main regions in IATA's analysis. The 2019 levels are expected to be recovered in 2025 due to slower growth on international traffic in the region.
  - North America: After a resilient 2021, traffic to/from/within North America will continue to perform strongly as the U.S. domestic market returns to pre-crisis trends, and with ongoing improvements in international travel. In 2022, passenger numbers are expected to reach 94 percent of 2019 levels, and full recovery is expected in 2023, ahead of other regions.

- Boeing's Commercial Market Outlook 2021–2040 include the following highlights:
  - Global GDP is forecast to return to pre-crisis level by mid-decade (2025).
  - Domestic markets and short-haul networks will lead the recovery. Domestic traffic is expected to return to 2019 levels in 2022.
  - International and long-haul markets are projected to return to 2019 levels in 2024 globally.
  - Traffic flow to/from Asia-Pacific and North America is expected to grow at an average annual rate of 3.5 percent from 2019 through 2040.
- FAA's Aerospace Forecast FY2021–2041 includes the following outlook:
  - Domestic U.S. mainline carriers' enplanement growth is forecast to recover strong in 2022 and 2023 and return to 2019 levels in early 2024. With the recovery complete, domestic enplanements will resume growth driven by economic fundamentals and average 2.3 percent over the remaining forecast period.
  - International U.S. mainline carriers' enplanement forecasts follow a similar path with strong growth early in the recovery and then slowing as enplanements return to 2019 levels in 2025. From then through 2041, international mainline enplanements are expected to grow at an average rate of 3.3 percent.
  - The Pacific region has had relative success in controlling COVID-19 transmission. Travel restrictions will be slow to lift. Although the region is forecast to have the strongest economic growth of any region over the next 20 years, led by China, enplanements growth over the forecast period are restrained in part because U.S. carriers continue to have most of their service in the region to Japan as opposed to faster-growing countries. Total passengers (including both U.S. and Foreign Flag carriers) in the Pacific region are projected to have a relatively slow return to 2019 passenger levels in 2027.
- Air service incentive programs from the GVB and GIAA will facilitate the recovery in the near-term.

For the Airport's short-term enplanement forecasts, domestic enplanements are expected to return to 2019 levels later in 2022 for the optimistic scenario, in 2023 for the moderate scenario, and in 2024 for the pessimistic scenario.

The majority of the international markets are impacted by the economic activity of Japan and Korea. The sluggish Japanese economic growth with aging population and the slow lifting in travel requirements such as quarantine and testing requirements in many Asian countries deter the recovery in Guam as compared to other global international markets. Hence, the Airport's international enplanements are expected to return to 2019 levels around 2026 for the optimistic scenario and 2028 for the moderate scenario. The timeline for the recovery of the pessimistic scenario for international enplanements is beyond the short-term forecast period and is driven by the long-term econometric model discussed in **Section 3.6.1.2**.

The recovery of total enplanements was projected by combining the outcome from the long-term forecast analyses and adjusting for the short-term recovery forecasts for domestic and international markets. Total enplanements are expected to reach over 1.8 million (2019 levels) around 2026 in the optimistic scenario, 2028 in the moderate scenario, and 2030 in the pessimistic scenario. The outcome is also summarized in the recommended enplanement forecast given in **Section 3.6.1.3**.

3.6.1.2 Long-Term Enplanement Forecast

The long-term forecast projects the enplanement demands in the 20-year planning horizon based on key socioeconomic forecasts and historical trends at the Airport. The projections for the international enplanements are focused on the ability of the primary international markets' socioeconomic base to generate increasing passenger demands in the long-term. The projections for the domestic enplanements considered the economy of U.S. and Guam.

3.6.1.2.1 Econometric Models

Econometric models using regression analysis were developed to project passenger demands in relation to socioeconomic factors, including GDP, per capita GDP, population, and jet fuel price as described in **Section 3.4.2**. The correlation may be single (pair-wise) or multiple correlations. Correlation analysis was first conducted to identify relevant independent variables for the regression models. Then the significance of the variables was tested to avoid multicollinearity. The following independent variables were used to develop the econometric models after testing for significance. The corresponding adjusted coefficients of determination (R2) for the econometric models are given in brackets. Dummy variables are included to consider unusual events, that do not correlate with underlying socioeconomic trends where applicable. The unusual events are descripted in **Section 3.5.2** and highlighted in **Figure 3-33**, which include economic downturns after the 2007 global financial crisis, Tohoku earthquake, typhoon Mangkhut and the COVID-19 pandemic. Autoregressive[33] variables are considered when there is a high tendency to correlate on historical trend.

- Domestic enplanements:
  - U.S. GDP (Adjusted R2 = 0.89)
  - U.S. and Guam GDP (Adjusted R2 = 0.85)
- International enplanements:
  - Japan and Korea per capita GDP (Adjusted R2 = 0.95)

The high adjusted coefficients of determination (over 0.85) signify a high percent of variation in the dependent variables (i.e., enplanements) that are explained by the independent variables (i.e., the socioeconomic parameters). **Table 3-16** summarizes the forecast enplanements for the econometric models.

The forecast for U.S. GDP is based on the long-term economic outlook for the U.S. from the FAA Aerospace Forecast FY2021–2041 assumptions as described in **Section 3.4.2.5**. The average U.S. GDP annual growth rates assume 2.3 percent for the period through 2039 and is adopted for the high scenario. The growth in Guam is estimated to be slower than the U.S. and assumes an average annual growth rate of 1.8 percent, which is adopted for the low scenario.

The forecast for Japan and Korea per capita GDP is based on the population projections from the United Nations and the projected GDP from the FAA Aerospace Forecast FY2021–2041 and IMF assumptions as described in **Sections 3.4.2.1** and **3.4.2.2** for Japan and Korea, respectively. Since there has been a shift of Japan's market share to Korea in recent years, the projections also factored into the changes in relative weighting (i.e., significance) between these two markets. The high scenario assumes a slower loss in weighting for the Japanese market than the low scenario.

Adjustments were made to each of the econometric models considering the optimistic, moderate, and pessimistic recovery timelines as discussed in the last section for the short-term enplanement forecast. **Table 3-16** summarizes the forecast enplanements for the econometric models.

3.6.1.2.2 Time-Series Trend Model

A time-series model was also developed to analyze the historical trends and to project the future aviation demands based on current or past trends. Aviation demand is typically cyclical in response to changing economic conditions as discussed earlier in **Section 3.5.2**, thus, the historical period analysis considered

[33] Autoregressive (AR) is a stochastic process used in statistical models in which future values are estimated based on a weighted sum of past values, i.e., past values have an effect on current values.

the historical peaks and troughs. The time-series model was developed for the period from 2005 to 2020 and was used to estimate the long-term enplanements in 20 years.

Similar to the econometric models, adjustments were made to include the optimistic, moderate, and pessimistic recovery timelines for the short-term enplanement forecasts. **Table 3-16** summarizes the forecast enplanements for the time-series model.

3.6.1.3 Recommended Enplanement Forecast

To account for the inherent uncertainty of aviation demand forecasting, a range of enplaned passenger forecasts was developed considering various socioeconomic and historical conditions. Together these forecast scenarios represent a reasonable range of potential demand. The outcomes of the short-term enplanement forecasts combined with the long-term forecasts from the econometric models and time-series model are summarized in **Table 3-16** as the baseline (moderate), high (optimistic), and low (pessimistic) scenarios, each representing varying levels of enplaned passenger activity that may occur based on economic conditions and recovery pace. The consolidated scenarios are presented in **Figure 3-50** and **Table 3-17**.

Comparisons of the recommended baseline enplanement forecast with the FAA TAF, the enplanement forecast from the Report of the Airport Consultant (August 2022), and the 2012 Airport Master Plan Update Forecast are included in **Figure 3-50** and **Table 3-17**.

The FAA's TAF is prepared annually for each commercial service airport in the U.S. Variations from the FAA TAF, while expected due to local growth in demand, need to be reviewed and approved by the FAA. Forecasts are considered consistent with the FAA TAF if the variations are less than 10 percent within the 5-year forecast period, and less than 15 percent in the 10-year forecast period. The baseline enplanement forecast for this Master Plan Update differs from the latest FAA TAF (issued February 2023) by less than 15 percent in the 10-year planning horizon (1.1 percent). However, the difference is over 10 percent in the near-term 5-year planning horizon (46.2 percent).

The difference with the FAA TAF is because of the discrepancies in historical enplanements recorded by GIAA versus those reported in the FAA TAF. As shown in **Table 3-17**, the historical enplanements in 2019 (base year) are 47.7 percent higher than the FAA TAF. The latest historical enplanements in 2022 is 418,234, which is also higher than the latest FAA TAF by 20 percent at 332,678.

The recommended baseline enplanement forecast in 5-year planning horizon (2024) projects approximately 68 percent recovery from 2019. The latest FAA TAF also projects 68 percent recovery by 2024, however, it is based on the lower historical enplanements at 1,276,443 instead of the record by GIAA at 1,885,108 enplanements. If the historical enplanements in the FAA TAF are updated to reflect the actual historical statistics from GIAA, the corresponding near-term forecasts from the FAA TAF are expected to increase proportionally and narrow the gap between the FAA TAF and this Master Plan Update forecast.

Table 3-16. Enplanement Forecast Models

Fiscal Year	Econometric Models			Time-Series Models		
	Econometric Model, Optimistic Recovery	Econometric Model, Optimistic Recovery	Econometric Model, Pessimistic Recovery	Time-Series from 2005 to 2020, Optimistic Recovery	Time-Series from 2005 to 2020, Moderate Recovery	Time-Series from 2005 to 2020, Pessimistic Recovery
Historical						
2019 (Base Year)	1,885,108	1,885,108	1,885,108	1,885,108	1,885,108	1,885,108
2020	884,060	884,060	884,060	884,060	884,060	884,060
2021	135,566	135,566	135,566	135,566	135,566	135,566
Forecast						
2024	1,461,419	1,288,617	1,115,816	1,536,243	1,242,911	1,018,551
2029	2,086,980	1,957,224	1,827,467	2,132,702	1,984,577	1,788,103
2034	2,262,705	2,113,789	1,964,872	2,281,274	2,277,982	2,215,441
2039	2,475,820	2,312,858	2,149,896	2,429,846	2,429,846	2,429,846
Period	**CAGR**					
2019 to 2024 (5-year)	-5.0%	-7.3%	-10.0%	-4.0%	-8.0%	-11.6%
2019 to 2029 (10-year)	1.0%	0.4%	-0.3%	1.2%	0.5%	-0.5%
2019 to 2039 (20-year)	1.4%	1.0%	0.7%	1.3%	1.3%	1.3%

Notes:
CAGR = Compound annual growth rate
Sources:
Historical statistics – GIAA
Projections – AECOM analysis

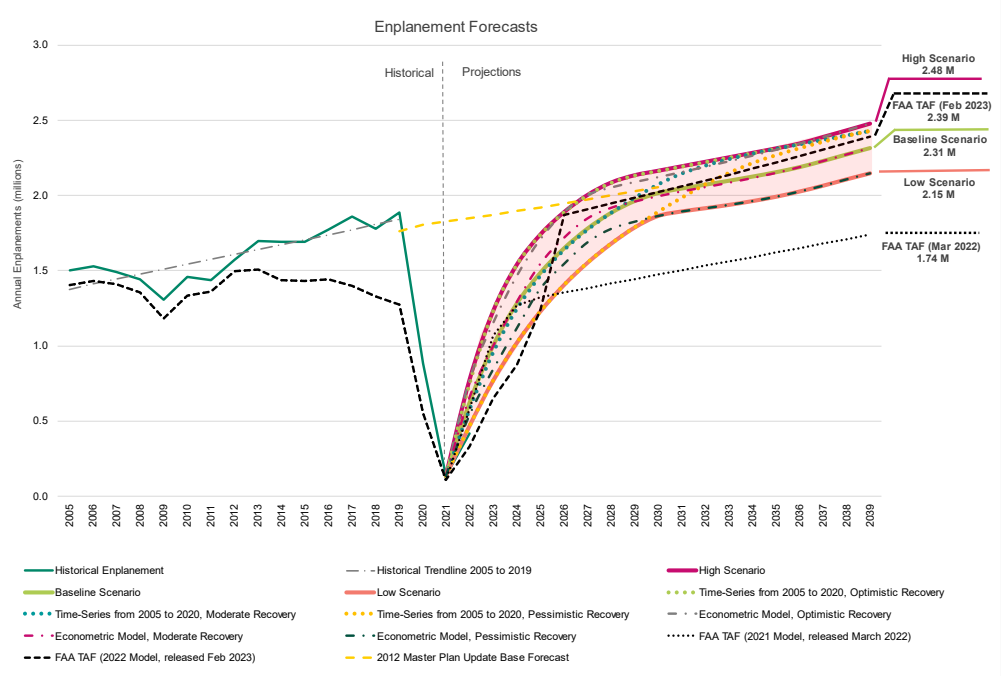

Figure 3-50. Enplanement Forecasts

Source: AECOM Analysis

Table 3-17. Enplanement Forecasts and Comparison with Other Forecasts

Fiscal Year	High Scenario	Baseline Scenario	Low Scenario	FAA TAF (2022 Model, released February 2023)	% Difference between Baseline and FAA TAF	FAA TAF (2021 Model, released March 2022)	% Difference between Baseline and FAA TAF	Report of the Airport Consultant - Low Range Enplanement Forecast by InterVISTAS (August 2022)	% Difference between Baseline and InterVISTAS' Low Range Forecast (August 2022)	Report of the Airport Consultant - High Range Enplanement Forecast by InterVISTAS (August 2022)	% Difference between Baseline and InterVISTAS' High Range Forecast (August 2022)	2012 Master Plan Update Base Forecast	% Difference between Baseline and 2012 Master Plan Update Base Forecast
	Historical			Historical		Historical		Historical/ Forecast		Historical/ Forecast		Forecast	
2019 (Base Year)	1,885,108	1,885,108	1,885,108	1,276,443	47.7%	1,276,443	47.7%	1,885,108	0.0%	1,885,108	0.0%	1,760,947	7.1%
2020	884,060	884,060	884,060	555,576	59.1%	555,576	59.1%	884,060	0.0%	884,060	0.0%	1,804,341	-51.0%
2021	135,566	135,566	135,566	101,779	33.2%	101,779	33.2%	135,566	0.0%	135,566	0.0%	1,827,052	-92.6%
	Forecast			Forecast		Forecast		Forecast		Forecast		Forecast	
2024	1,536,243	1,277,397	1,018,551	873,733	46.2%	1,269,750	0.6%	1,300,000	-1.7%	1,600,000	-20.2%	1,897,566	-32.7%
2029	2,132,702	1,960,402	1,788,103	1,982,619	-1.1%	1,443,446	35.8%	N/A	N/A	N/A	N/A	2,027,337	-3.3%
2034	2,281,274	2,123,073	1,964,872	2,178,600	-2.5%	1,591,016	33.4%	N/A	N/A	N/A	N/A	N/A	N/A
2039	2,475,820	2,312,858	2,149,896	2,391,019	-3.3%	1,738,251	33.1%	N/A	N/A	N/A	N/A	N/A	N/A
Period	CAGR			CAGR		CAGR		CAGR		CAGR		CAGR	
2019 to 2024 (5-year)	-4.0%	-7.5%	-11.6%	-7.3%		-0.1%		-5.8%		0.2%		1.5%	
2019 to 2029 (10-year)	1.2%	0.4%	-0.5%	4.5%		1.2%		N/A		N/A		1.4%	
2019 to 2039 (20-year)	1.4%	1.0%	0.7%	3.2%		1.6%		N/A		N/A		N/A	

Notes:
FAA = Federal Aviation Administration
TAF = Terminal Area Forecast
N/A = Not available
CAGR = Compound annual growth rate
Sources:
FAA TAF (March 2022 and February 2023)
2012 Airport Master Plan Update Forecast
Report of the Airport Consultant by InterVISTAS (August 2022)
AECOM analysis

3.6.1.4 Domestic and International Enplanement Forecasts

The domestic and international enplanement forecasts for the three scenarios are summarized in **Table 3-18**. The average annual growth rates for domestic enplanements outpace international enplanements, which is consistent with the historical trend on growth of domestic visitors described in **Section 3.5.2.1**. The long-term growth in the U.S. population and GDP will continue to drive the strong domestic demands.

Table 3-18. Domestic and International Enplanement Forecasts

	High Scenario		Baseline Scenario		Low Scenario	
Fiscal Year	Domestic Enplanements	International Enplanements	Domestic Enplanements	International Enplanements	Domestic Enplanements	International Enplanements
Historical						
2019 (Base Year)	109,693	1,775,415	109,693	1,775,415	109,693	1,775,415
2020	63,417	820,643	63,417	820,643	63,417	820,643
2021	67,948	67,618	67,948	67,618	67,948	67,618
Forecast						
2024	150,688	1,385,555	128,830	1,148,567	106,413	912,137
2029	195,499	1,937,203	182,129	1,778,273	168,647	1,619,455
2034	233,522	2,047,751	216,413	1,906,660	199,313	1,765,560
2039	271,989	2,203,831	249,040	2,063,818	226,091	1,923,805
Period	**CAGR**					
2019 to 2024 (5-year)	6.6%	-4.8%	3.3%	-8.3%	-0.6%	-12.5%
2019 to 2029 (10-year)	5.9%	0.9%	5.2%	0.0%	4.4%	-0.9%
2019 to 2039 (20-year)	4.6%	1.1%	4.2%	0.8%	3.7%	0.4%

Note:
CAGR – Compound annual growth rate
Source:
Historical statistics – GIAA
Projections – AECOM analysis

3.6.1.5 Mainline and Regional Enplanement Forecast

Mainline carriers (air carriers) are defined as those providing service via aircraft with 90 or more seats. Regionals are defined as those providing service via aircraft with 89 or fewer seats and whose routes serve mainly as feeders to the mainline carriers. Enplanement forecasts are divided into passengers traveling with mainline or regional carriers for the calculation of passenger aircraft operations based on different seat capacities.

In addition, breakdowns into mainline and regional enplanements and aircraft operations are required for the FAA's standard summary table for the approval of the forecast in the event there is any inconsistency with the FAA TAF.

As described in **Section 3.5.4**, none of the U.S. or foreign air carriers operate regional jets at the Airport. Only Part 135 commuter air carriers such as Star Marianas Air operate short-range 8-seat Piper PA-31 for inter-island connections between Guam and Rota (or Saipan) in CNMI. The operations for Part 135 commuter air carriers are included in the general aviation/air taxi category instead of air carriers.

In summary, the total enplanements given in **Table 3-17** are classified as passengers for mainline carriers for the calculation of mainline aircraft operations.

3.6.2 Air Cargo Forecast

The objective of the air cargo forecast is to provide a reasonable order of magnitude projection of cargo activity that can be expected to occur over the 20-year planning horizon. Due to the cyclical nature of the economy, the focus of the forecasts is not to predict year-to-year fluctuations, but to establish a trend that represents long-term growth potential. The air cargo industry is undergoing some transformations, as carriers adjust operations, and new carriers expand their distribution networks in the growing e-commerce marketplace. The Airport experienced similar fluctuations in air cargo demand in the past as discussed in **Section 3.5.6**. Nevertheless, the air cargo throughput is expected to grow with the economy in the long-term.

Various air cargo growth forecasts were analyzed to identify a reasonable expectation for air cargo volume in the future:

- Time-Series Models: Two time-series models were developed for the cargo forecast. The first one is based on the FAA's all-cargo aircraft landing weight from 2009 to 2020 and applied a similar historical trend to project the total air cargo tonnage at the Airport. The second time series model is based on the recent available historical total air cargo tonnage from GIAA for the period between 2017 and 2020. Dummy variables were adopted in both models to deter the impacts of the COVID-19 pandemic in 2020. The adjusted R^2 for the time-series models were 0.98 and 0.96, respectively.
- The FAA Aerospace Forecast FY2021–2041: The FAA projects the U.S. air cargo revenue ton miles (RTMs) for the Pacific region to increase at 8.6 percent from 2020 to 2021, at an average annual rate of 4.7 percent for the 10-year period from 2021 to 2031, and at 4 percent for the 20-year period from 2021 to 2041. This model references the projected year-to-year growth rate from the FAA Aerospace Forecast for the Pacific region.
- Boeing's World Air Cargo Forecast 2020–2039: Boeing biannually develops a detailed analysis and forecast on the air cargo industry for worldwide regions and markets. The latest forecast includes high, base, and low cases from 2020 to 2039. The high, base, and low cases forecast the air cargo tonnage on the trans-Pacific route between North America and East Asia to grow at an average annual rate of 5.2 percent, 4.3 percent, and 3.4 percent over the 20-year period from 2020 to 2039, respectively. Three growth models were developed referencing Boeing's World Air Cargo Forecast 20-year growth rates for the air trade across the Pacific for the high, base, and low cases.

Table 3-19 summarizes the air cargo forecasts for these six models, which are then consolidated to the baseline, high (optimistic), and low (pessimistic) scenarios representing varying levels of air cargo throughput estimates for the 20-year planning horizon. The consolidated scenarios are presented in **Table 3-20** and **Figure 3-51**.

A comparison between the air cargo forecast and the projections from the 2012 Master Plan Update is also included in **Table 3-20** and **Figure 3-51**. The 2012 Master Plan Update air cargo forecast is within the range of our projections in the long-term.

For the purpose of estimating cargo aircraft operations in the next section, the air cargo volumes carried by air freighter aircraft, small cargo aircraft under Part 135 commuter air carriers, or the lower deck of passenger aircraft (i.e., belly cargo) are estimated in **Table 3-21**.

Table 3-19. Air Cargo Forecast Models

Fiscal Year	Time-Series Models		Industry References			
	Time-Series Model on FAA's GUM All-Cargo Landing Weight 2009 to 2020 (tons)	Time-Series Model on GUM Cargo Tonnage 2017 to 2020 (tons)	FAA Aerospace Forecast (tons)	Boeing's High Case (tons)	Boeing's Base Case (tons)	Boeing's Low Case (tons)
Historical						
2019 (Base Year)	21,724	21,724	21,724	21,724	21,724	21,724
2020	34,147	34,147	34,147	34,147	34,147	34,147
2021	42,704	42,704	42,704	42,704	42,704	42,704
Forecast						
2024	26,944	21,724	44,010	27,991	26,814	25,676
2029	34,652	23,762	54,633	36,065	33,096	30,349
2034	42,360	25,992	65,533	46,470	40,850	35,871
2039	50,068	28,431	77,106	59,875	50,422	42,398
Period	**CAGR**					
2019 to 2024 (5-year)	4.4%	0.0%	15.2%	5.2%	4.3%	3.4%
2019 to 2029 (10-year)	4.8%	0.9%	9.7%	5.2%	4.3%	3.4%
2019 to 2039 (20-year)	4.3%	1.4%	6.5%	5.2%	4.3%	3.4%

Note:
CAGR = Compound annual growth rate
Source: AECOM analysis

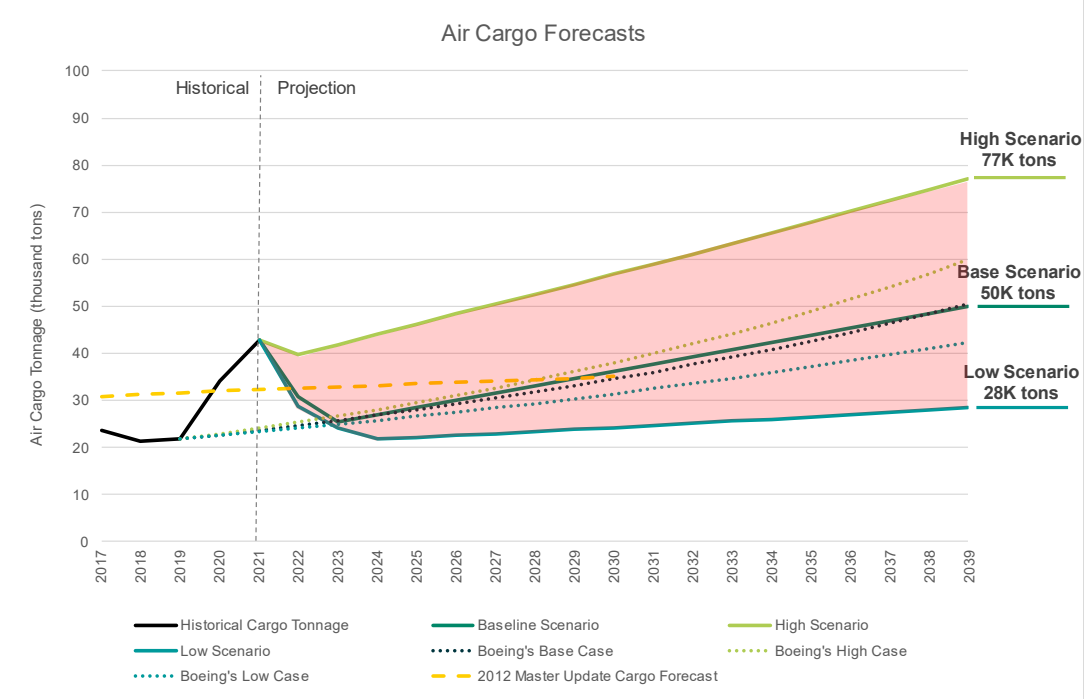

Figure 3-51. Air Cargo Forecasts

Source: AECOM Analysis

Table 3-20. Air Cargo Forecasts and Comparison with Previous Master Plan Forecasts

Fiscal Year	High Scenario (tons)	Baseline Scenario (tons)	Low Scenario (tons)	2012 Master Plan Update Forecast (tons)	% Difference between Baseline and 2012 Master Plan Update Base Forecast
	Historical			Forecast	
2019 (Base Year)	21,724	21,724	21,724	31,644	-31.3%
2020	34,147	34,147	34,147	31,977	6.8%
2021	42,704	42,704	42,704	32,268	32.3%
	Forecast			Forecast	
2024	44,010	26,944	21,724	33,158	-18.7%
2029	54,633	34,652	23,762	34,714	-0.2%
2034	65,533	42,360	25,992	N/A	N/A
2039	77,106	50,068	28,431	N/A	N/A
Period	CAGR			CAGR	
2019 to 2024 (5-year)	15.2%	4.4%	0.0%	0.9%	N/A
2019 to 2029 (10-year)	9.7%	4.8%	0.9%	0.9%	N/A
2019 to 2039 (20-year)	6.5%	4.3%	1.4%	N/A	N/A

Note:
CAGR = Compound annual growth rate
Source:
2012 Airport Master Plan Update Forecast
AECOM analysis

Table 3-21. Air Cargo Forecasts by Type of Carrier

	High Scenario			Baseline Scenario			Low Scenario		
Fiscal Year	Air Freighter Aircraft (tons)	Small Cargo Aircraft (tons)	Belly Cargo on Pax Aircraft (tons)	Air Freighter Aircraft (tons)	Small Cargo Aircraft (tons)	Belly Cargo on Pax Aircraft (tons)	Air Freighter Aircraft (tons)	Small Cargo Aircraft (tons)	Belly Cargo on Pax Aircraft (tons)
Estimate from Historical									
2019 (Base Year)	15,249	1,098	5,377	15,249	1,098	5,377	15,249	1,098	5,377
Forecast									
2024	31,247	2,200	10,562	18,995	1,212	6,736	15,207	869	5,648
2029	38,789	2,732	13,112	24,430	1,559	8,663	16,634	950	6,178
2034	46,528	3,277	15,728	29,864	1,906	10,590	18,194	1,040	6,758
2039	54,746	3,855	18,506	35,298	2,253	12,517	19,902	1,137	7,392
Period	CAGR								
2019 to 2024 (5-year)	15.4%	14.9%	14.5%	4.5%	2.0%	4.6%	-0.1%	-4.6%	1.0%
2019 to 2029 (10-year)	9.8%	9.5%	9.3%	4.8%	3.6%	4.9%	0.9%	-1.4%	1.4%
2019 to 2039 (20-year)	6.6%	6.5%	6.4%	4.3%	3.7%	4.3%	1.3%	0.2%	1.6%

Note:
CAGR = Compound annual growth rate
Pax = Passenger
Source: AECOM analysis

3.6.3 Aircraft Operations Forecast

Aircraft operations were projected for the four major categories of users: commercial passenger airlines, commercial all-cargo carriers, GA, and military.

Commercial air carrier operations include those certified under Federal Aviation Regulations (FAR) Part 121 or 129 to conduct scheduled services on specific routes. Commercial air carrier operations typically include the activities by both mainline aircraft and regional jets. However, in the case of Guam, there are only mainline aircraft operations as discussed in **Section 3.5.4**.

Passengers and/or cargo commuter air carriers like Star Marianas, Arctic Circle Air, and MACS, who operate scheduled and/or on-demand services under Part 135 certification are included as GA/air taxi operations. The fleet of Part 135 carriers typically consists of small aircraft with a maximum seating configuration of 30 seats for on-demand certificate holders or nine seats for commuter certificate holders.

Air taxi operators typically hold Part 135 certification and provide on-demand services for compensation or hire. The air taxi operations were analyzed together with the GA activities. The approach and methodologies are detailed in the following sections.

3.6.3.1 Commercial Airline Operations

Commercial airline operations were estimated utilizing the enplaned passenger forecasts for this Master Plan Update. The projected number of commercial operations was determined by evaluating three main factors: total passengers, average aircraft size (seat capacity), and average load factor. The number of operations was derived by total passengers divided by the multiple of average seat capacity and average load factor. Total passengers include both enplaned and deplaned passengers.

Passenger aircraft operations were further divided into domestic and international air carrier operations based on the forecast enplanements for each group as well as differences in average aircraft size (seat capacity) and average load factor.

The aircraft sizes (seat capacity) for the fleet mix are grouped into categories, and their future trends are described in **Table 3-22**. The future trends reference industry trends, the age of the existing fleet for the major airlines, and their outstanding orders for new aircraft. The average retirement age for commercial passenger aircraft is assumed to be 25 years.

The historical average seat capacity for domestic and international markets were first estimated (**Section 3.5.4**), and then projected to the future for the high, baseline, and low scenarios. Historical average load factors for domestic and international markets (**Section 3.5.3**) were also referenced for the projection of future load factors. Airlines are expected to gradually increase the average seat capacity by either increasing the size of aircraft and/or updating the seating configurations for both new and existing aircraft. Load factors are also expected to increase over time. Both of these trends allow airlines to accommodate more passengers without increasing the number of flights and improve their operational efficiency. Average seat capacity for the domestic market is projected to increase to the range of 185 to 195 seats per departure over the 20-year planning horizon. Average seat capacity for the international market is projected to increase to the range of 195 to 205 seats per departure over the same period. Average load factor for the domestic market is estimated to return to between 78 and 82 percent, while the average load factor for the international market is expected to return to between 80 and 84 percent during the same period. **Table 3-23** and **Table 3-24** summarize the assumptions on average seats per departure and enplaning load factors, respectively.

The projected passenger aircraft operations for the three scenarios are summarized in **Table 3-25**.

Table 3-22. Aircraft Size Categories and Future Trends

Aircraft Size Categories	Seat Capacity	Typical Aircraft Models at the Airport (2019)	Notes and Future Trends
Widebody (WB) (Twin-aisle airplanes)	240 to 393 seats	B777-200 (United) B777-200ER (Jin Air) B777 (Japan Airlines, Korean Air) A330-300 (Philippine Airlines, Korean Air) A340-300 (Philippine Airlines)	• United typically flew its B777-200 with over 340 seats to/from Honolulu daily and two flights a day to/from Narita before the pandemic. The older B777-200 is expected to be replaced by the newer B777-300ER with 350 seats. • Jin Air's B777-200ERs are relatively new at less than 20 years. It is likely to continue service at the Airport when international demands are recovered. Jin Air's B777-200ER configuration fits 393 seats. • Philippine Airlines retired their A340 in 2021. They anticipate return of their A330-300 for their international routes in the Pacific region together with some of their A321s. • Korean Air flies both B777 and A330-300 to/from the Airport. Older B777s may be replaced by their new orders of B787s in the long-term. • Japan Airlines is planning to retire their B777s and replace them with A350s in 2023. Seat capacity will increase from 244 to 391 seats.
Narrowbody (NB) (Single-aisle airplanes)	120 to 200 seats	A321 (Air Busan, Air Seoul, Philippine Airlines) A320 (Cebu Pacific) B737 (T'way Air, China Airlines) B737-800 (Jeju Air, Jin Air, United) B737-700 (United)	• The average age of Air Busan's A321-200 fleet is 14 years old. Similar to Philippine Airlines, new orders of A321 neo will gradually replace the older A321-200s in the existing fleet. • The average age of Air Seoul's A321-200 is 11 years old. No new orders are in its plan. • Philippine Airlines operates A321-200 (ceo) and A321 neo. New orders of A321 neos will gradually replace the older A321s. • Cebu Pacific's entire fleet is less than 10 years old. A320-200s, A320 neos, and potentially A321-200 and A321 neos may be included in future itineraries. • T'way Air's B737 fleet is still relatively new. Individual older B737-800 aircraft are likely to be replaced by new orders of B737 Max 8s. • China Airlines is gradually retiring and placing its B737-800s with A321 neos. Seat capacity will increase from 158 to 180 seats. • Jeju Air operates an all B737 fleet with an existing B737-800 fleet and future orders for B737 Max 8s. • Jin Air retired some of its older B737-800s, which were former Korean Air aircraft. • United typically flies its B737-700 and B737-800 between the islands in Micronesia and other international destinations in Asia. The older B737s with 126 to 166 seats are going to be replaced by the B737 Max 8 or 9 with approximately 179 seats.
Regional Jets	Less than 90 seats	N/A	• No commercial airlines fly regional jets to/from the Airport in their regular flight schedules

Notes:
WB = Widebody aircraft
NB = Narrowbody aircraft
N/A = Not available

Table 3-23. Assumed Average Seats per Departure

Scenarios	Markets	Historical			Projected Trend			
		2019 Base Year	2020	2021	2024	2029	2034	2039
High Scenario	Domestic	190.3	180.4	175.2	178	180	182	185
	International	201.8	172.8	172.8	178	186	190	195
Baseline Scenario	Domestic	190.3	180.4	175.2	180	185	187	190
	International	201.8	172.8	172.8	185	196	198	200
Low Scenario	Domestic	190.3	180.4	175.2	185	190	192	195
	International	201.8	172.8	172.8	195	200	202	205

Note: Higher seats per departure yield lower number of operations and vice vera.

Table 3-24. Assumed Average Enplaning Load Factors

Scenarios	Markets	Historical			Projected Trend			
		2019 Base Year	2020	2021	2024	2029	2034	2039
High Scenario	Domestic	74.3%	41.8%	46.2%	75%	77%	77.5%	78%
	International	79.9%	71.3%	27.8%	65%	78%	79%	80%
Baseline Scenario	Domestic	74.3%	41.8%	46.2%	75%	78%	79%	80%
	International	79.9%	71.3%	27.8%	65%	80%	81%	82%
Low Scenario	Domestic	74.3%	41.8%	46.2%	75%	79%	80.5%	82%
	International	79.9%	71.3%	27.8%	70%	82%	83%	84%

Note: Higher load factors yield lower number of operations and vice versa.

Table 3-25. Passenger Aircraft Operations Forecasts

Fiscal Year	High Scenario			Baseline Scenario			Low Scenario		
	Domestic Pax Aircraft	Int'l Pax Aircraft	Total Pax Aircraft	Domestic Pax Aircraft	Int'l Pax Aircraft	Total Pax Aircraft	Domestic Pax Aircraft	Int'l Pax Aircraft	Total Pax Aircraft
Estimate from Historical									
2019 (Base Year)	1,531	21,758	23,289	1,531	21,758	23,289	1,531	21,758	23,289
2020	1,500	10,697	12,197	1,500	10,697	12,197	1,500	10,697	12,197
2021	1,516	2,472	3,988	1,516	2,472	3,988	1,516	2,472	3,988
Forecast									
2024	2,257	23,951	26,208	1,909	19,103	21,012	1,534	13,365	14,899
2029	2,821	26,705	29,526	2,524	22,682	25,206	2,247	19,749	21,997
2034	3,303	27,223	30,526	2,923	23,780	26,702	2,573	21,012	23,585
2039	3,770	28,254	32,024	3,277	25,169	28,445	2,828	22,344	25,172
Period	**CAGR**								
2019 to 2024 (5-year)	8.1%	1.9%	2.4%	4.5%	-2.6%	-2.0%	0.0%	-9.3%	-8.5%
2019 to 2029 (10-year)	6.3%	2.1%	2.4%	5.1%	0.4%	0.8%	3.9%	-1.0%	-0.6%
2019 to 2039 (20-year)	4.6%	1.3%	1.6%	3.9%	0.7%	1.0%	3.1%	0.1%	0.4%

Notes:
Int'l – International
Pax – Passenger
CAGR – Compound annual growth rate

3.6.3.2 All-Cargo Operations

As previously described in **Section 3.5.6**, the largest all-cargo carrier at the Airport, APA, has retired its smaller B727 freighter and only flies the larger B757-200 freighter. UPS is also gradually changing its fleet from the older B747-400F to the newer B747-8F with greater cargo capacity. It is anticipated that the average cargo volume per cargo aircraft operation will increase from the existing ratio of just below 18 tons per operation to the range between 19 and 21 tons per operation over the planning period.

For air cargo delivered by small cargo aircraft such as the Cessna C208 Caravan in MACS's fleet, or the Piper PA-32 and PA-31 operated by Star Marianas, a similar fleet is expected over the planning horizon. While the cargo capacity for each small cargo aircraft will stay the same as the existing fleet, each flight will carry more cargo to optimize each delivery. The projections assume the average cargo volume per operation will gradually increase from the existing ratio of just below 700 pounds per operation to the range between 700 and 1,500 pounds per operation.

The forecast all-cargo aircraft operations by air freighter and small cargo aircraft are summarized in **Table 3-26**. The forecast air freighter operations are combined with the passenger aircraft operations to obtain the total air carrier operations. The small cargo aircraft operations are included in the general aviation and air taxi operations.

Table 3-26. All-Cargo Aircraft Forecasts by Type of Carrier

	High Scenario		Baseline Scenario		Low Scenario	
Fiscal Year	**Air Freighter Aircraft Operations**	**Small Cargo Aircraft Operations**	**Air Freighter Aircraft Operations**	**Small Cargo Aircraft Operations**	**Air Freighter Aircraft Operations**	**Small Cargo Aircraft Operations**
Estimate from Historical						
2019 (Base Year)	849	3,238	849	3,238	849	3,238
2020	2,602	3,211	2,602	3,211	2,602	3,211
2021	2,345	3,805	2,345	3,805	2,345	3,805
Forecast						
2024	1,715	4,527	1,050	3,566	838	3,216
2029	2,099	4,967	1,306	3,907	873	3,261
2034	2,483	5,281	1,544	4,068	910	3,308
2039	2,881	5,508	1,765	4,096	948	3,355
Period	**CAGR**					
2019 to 2024 (5-year)	15.1%	6.9%	4.3%	1.9%	-0.3%	-0.1%
2019 to 2029 (10-year)	9.5%	4.4%	4.4%	1.9%	0.3%	0.1%
2019 to 2039 (20-year)	6.3%	2.7%	3.7%	1.2%	0.6%	0.2%

Note:
CAGR = Compound annual growth rate
Source:
Historical all-cargo aircraft operations – GIAA
Conversions of cargo aircraft statistics from calendar year to fiscal year and forecasts – AECOM analysis

3.6.3.3 GA and Air Taxi Operations

The forecast for GA and air taxi[34] operations is based on the estimated number of landings per based aircraft by benchmarking the type of aircraft, ownership, and usage at the Airport with the national statistics. The based aircraft forecast is given in the subsequent section, which is used in this section to estimate the general aviation and air taxi operations forecast. The methodology is illustrated in **Figure 3-52**, and the assumptions in the model are listed below.

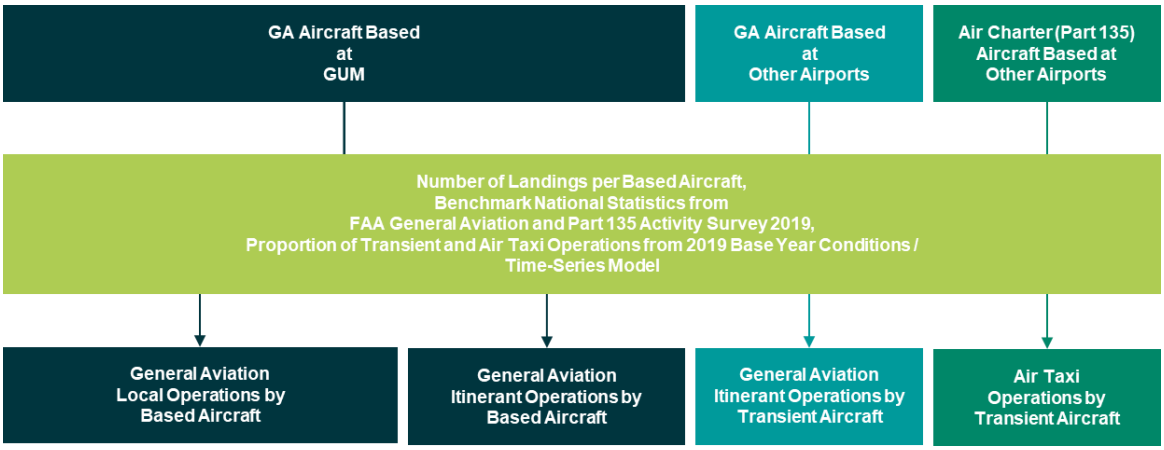

Figure 3-52. General Aviation Operations Methodology Illustration

Source: AECOM

- The number of landings by type of active aircraft for different usage referencing the FAA GA and Part 135 Activity Survey 2019 is given in **Table 3-27** and are adjusted to reflect the characteristics of the Airport. It is generally assumed that based aircraft owned by individuals tend to fly mostly for personal use, while corporation-owned aircraft are used mostly for business. Based aircraft operated by the flight school are used for instructional purposes.
- **Table 3-28** summarizes the number of based aircraft by type, ownership, and average aircraft age. Most of the based aircraft are owned by corporations or operated for business purposes. The top four general aviation businesses with based aircraft and their number of landings in the base year 2019 and during the pandemic in 2020 and 2021 are summarized in **Table 3-29**. Comparison between the national average number of landings for different usage in **Table 3-27** and the characteristics of the Airport in
- **Table 3-28** and **Table 3-29** shows that the number of landings per based aircraft is much higher than the national average. The unique island characteristics drive strong demands for delivery of mail and cargo between islands. Competitive cost for flight training at Guam as compared to Australia/New Zealand/U.S. mainland attracts Asian student pilots. The tourism industry drives demand in aerial sightseeing and skydiving. The turbine engine aircraft at the Airport are relatively new, and they are expected to be the driver of aviation activity referencing the national trend. In summary, the average number of landings per based aircraft assumed 600 in the forecast model. The number of operations include both landings and takeoffs. Hence, the model assumes each based aircraft generates 1,200 operations.
- Based on the GA operations in 2019, the model assumes 87 percent of the total operations flown by a based GA aircraft in each year are either departures or arrivals, which include 48 percent local operations (e.g., instructional, sightseeing, and skydiving) and 39 percent itinerant operations (including small cargo aircraft delivery estimated previously in **Table 3-26**).
- The proportion of transient GA aircraft operations is estimated to be approximately 38 percent of the total itinerant GA operations based on 2019 estimates.

[34] Air taxi operators are air carriers that transport persons, property, and mail using small aircraft under 30 seats or a maximum payload capacity of 7,500 lbs. Air taxi operators typically hold FAR Part 135 certification and provide on-demand services (for compensation or hire).

- The proportion of air taxi aircraft operations is estimated to be approximately 0.8 percent of the total general aviation and air taxi operations based on 2019 statistics. These are mostly operations similar to Star Mariana Air (Part 135 air carrier) with based aircraft in Saipan and Tinian and other air charter companies providing on-demand services (for compensation or hire).

Table 3-27. National Average Number of Landings per Aircraft for Different Usage

Type of Aircraft	Overall Average	Business (without a paid flight crew)	Business (with a paid flight crew)	Instructional	Sightseeing	Part 135 Air Taxi
Single-Engine Piston	155	64	88	231	100	168
Multi-Engine Piston	168	106	185	448	N/A	1,253
Single-Engine Turboprop	430	101	189	254	N/A	273
Multi-Engine Turboprop	230	122	154	537	N/A	409
Jet Aircraft	174	260	360	303	N/A	673
All Aircraft	176	75	147	246	100	290

Note:
N/A = Not available
Source:
FAA General Aviation and Part 135 Activity Survey 2019
AECOM analysis

Table 3-28. Type of Based Aircraft Ownership, Average Age, and Characteristics

Type of Aircraft	Type of Ownership	Number of Based Aircraft (FY2019)	Average Age of Based Aircraft	Notes
Single-Engine Piston	Corporation	7	44	• 4 owned by Aire Services (previously Sky Guam Aviation or Micronesian Aviation) and 3 owned by Trend Vector Aviation International. Both of them provide flight training.
	LLC	2	46	• Owned by Silver Fox Aviation LLC and leased to Sky Guam Aviation. Since Sky Guam Aviation ceased operation during the pandemic in August 2021, these two aircraft are likely to be transferred to other operators on the island, such as Aire Services.
	Individual/ Partnership	8	49	• Although these are individually owned aircraft, six of them are either owned by the President of Aire Services or operate for Aire Services (previously Sky Guam Aviation or Micronesian Aviation). The remaining two aircraft are also for business use based on an interview with the stakeholder.
Single-Engine Turboprop	Corporation	7	14	• Owned and operated by Skydive Guam / Skydive Saipan / MACS.
Multi-Engine Piston	Individual	4	53	• Individually owned aircraft are available for rental. E.g., the Piper PA-23 is available for rental via Aire Services. Two of them are owned by the President of Aire Services, which are likely to be available for operation by Aire Services.
Multi-Engine Turboprop	Corporation	1	24	• Owned by Pacific Mission Aviation (PMA). PMA provides free medical care, sea searches, rescue, and disaster relief; transports medical and food supplies; and provides logistical help to the islands.
	Individual	1	45	• Individually owned aircraft, anticipate primarily for personal use.
Not on the FBO list		6	N/A	
Total Based Aircraft at the Airport in FY2019		**36**	**N/A**	

Type of Aircraft	Type of Ownership	Number of Based Aircraft (FY2019)	Average Age of Based Aircraft	Notes

Notes:
N/A = Not available
FBO = Fixed base operator
MACS = Micronesian Air Cargo Services
Sources:
Based aircraft registration N-numbers – GIAA
AECOM analysis

Table 3-29. Number of Landings per Based Aircraft for Top General Aviation Businesses at the Airport

Top Aviation Business	No. of Based Aircraft	Number of Arrivals			Number of Landings per Based Aircraft		
		FY2019	FY2020	FY2021	FY2019	FY2020	FY2021
Sky Guam Aviation [1]	7	5,310	2,276	101	759	325	14
Micronesian Aviation System [1]	4	3,092	1,064	18	773	266	5
Skydive Guam (includes MACS)	7	2,653	1,755	1,520	379	251	217
Trend Vector Aviation	3	2,501	1,212	472	834	404	157
Total for Top 4 General Aviation Business at the Airport	**21**	**13,556**	**6,307**	**2,111**	**646**	**300**	**101**

Note: Sky Guam Aviation and Micronesian Aviation System ceased operation during the pandemic in August 2021. Aire Services started its service at the Airport in April 2021 and purchased the based aircraft of the other two companies.
Sources:
Airline statistics – GIAA
AECOM analysis

- A time-series model based on the historical trend of GA and air taxi operations from 2009 through 2020 was developed and used to project the long-term GA and air taxi operations over the 20-year planning horizon. A dummy variable was adopted to reflect the impacts of the COVID-19 pandemic in 2020. The adjusted R^2 for the time-series model is 0.88.
- Three scenarios were developed using the average landings per based aircraft approach and the time-series model with the following adjustment for the short-term recovery outlook in the post-COVID era:
  - High Scenario: The long-term forecast for the high scenario assumes the upper bound of the two models, which is the outcome of the time-series model. The short-term forecast assumes optimistic recovery to 2019 levels between 2024 and 2025, which is consistent with the recovery projections from the FAA Aerospace Forecast FY2021–2041 for total active general aviation and air taxi hours flown.
  - Baseline Scenario: The long-term forecast for the baseline scenario assumes the midpoint between the upper bound and lower bound of the two models. The short-term forecast assumes moderate recovery to 2019 levels in between 2025 and 2026, which is consistent with the recovery projections from the FAA TAF (issued Mach 2022).
  - Low Scenario: The long-term forecast for the low scenario assumes the lower bound of the two models, which is the outcome of the model based on average landings per based aircraft. The short-term forecast assumes pessimistic recovery to 2019 levels between 2026 and 2027.

The forecast annual total GA and air taxi operations based on the based aircraft forecast and the historical trend for the baseline, low, and high scenarios are given in **Table 3-30** and **Figure 3-53**.

Table 3-30. General Aviation and Air Taxi Operation Forecasts

Fiscal Year	High Scenario				Baseline Scenario				Low Scenario			
	Air Taxi	General Aviation		Total	Air Taxi	General Aviation		Total	Air Taxi	General Aviation		Total
		Itinerant	Local			Itinerant	Local			Itinerant	Local	
Historical												
2019 (Base Year)	370	26,908	20,869	48,147	370	26,908	20,869	48,147	370	26,908	20,869	48,147
2020	575	12,295	9,876	22,746	575	12,295	9,876	22,746	575	12,295	9,876	22,746
2021	197	5,121	6,785	12,103	197	5,121	6,785	12,103	197	5,121	6,785	12,103
Forecast												
2024	335	24,351	18,886	43,572	276	20,104	15,592	35,972	218	15,856	12,297	28,371
2029	457	33,211	25,757	59,425	424	30,858	23,933	55,216	392	28,506	22,108	51,006
2034	489	35,569	27,586	63,645	444	32,324	25,070	57,838	400	29,079	22,553	52,032
2039	522	37,927	29,415	67,864	465	33,815	26,226	60,506	408	29,703	23,036	53,147

Source: AECOM analysis

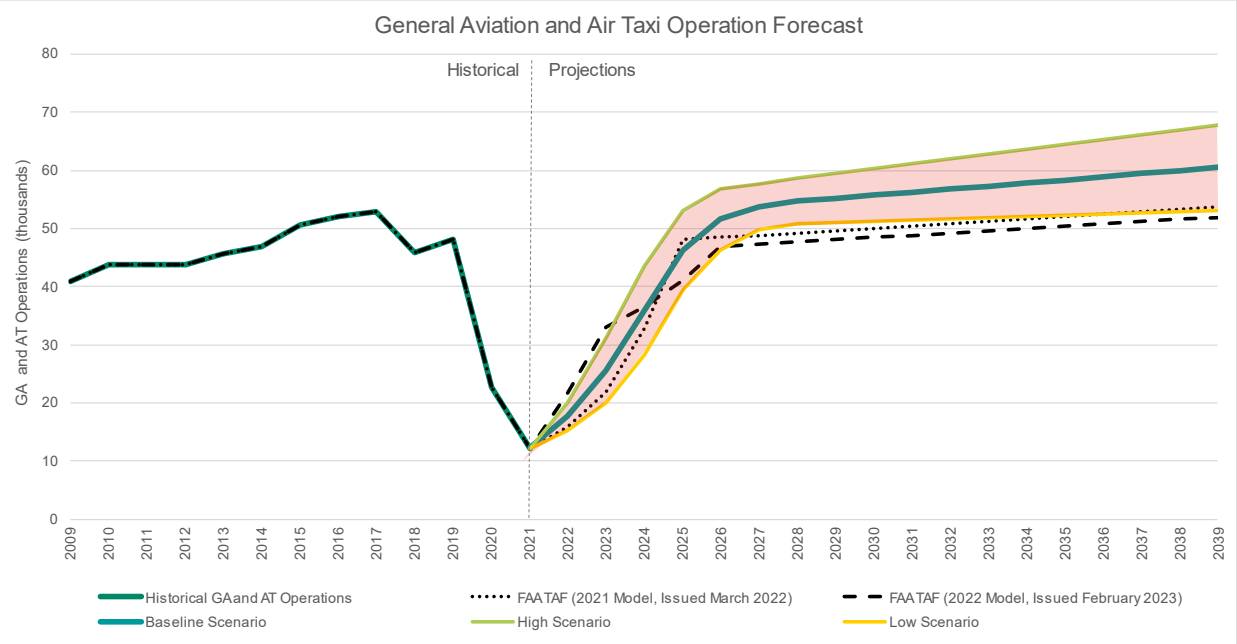

Figure 3-53. General Aviation and Air Taxi Operation Forecasts

Source: AECOM Analysis

3.6.3.4 Military Operations

Historical operation records indicate that other than operations from the U.S. armed forces (Marine Corps, Navy, and Coast Guard), there were occasional operations from foreign armed forces. Foreign armed forces include aircraft from Royal Canada Air Force/Canadian Armed Forces, Japan Air Self-Defense Force, New Zealand Air Force, Philippine Air Force, Royal Air Force, Royal Australian Air Force, and Republic of Korea Air Force, etc. There were occasional joint forces between alliances for bilateral or trilateral exercises in the Pacific region and at AAFB that attracted air traffic for transportation of personnel and supplies. C130, A330, KC30A, and B727 aircraft are the common aircraft models. For the purpose of Master Plan forecasts, the military activities at the Airport over the planning horizon assume maintaining annual aircraft operations at the 2021 level (i.e., 1,927 annual military operations) as summarized in **Table 3-14** and **Figure 3-47**.

3.6.3.5 Total Aircraft Operations

The total aircraft operations forecast, including commercial passenger air carrier, all-cargo carrier, air taxi, general aviation, and military aircraft operations, for the 20-year planning period are summarized in **Table 3-31** and **Figure 3-54**. A comparison of the projected total operations with the FAA TAF is also included in **Table 3-31**. The forecasted total operations for the baseline scenario differ from the latest FAA TAF (issued February 2023) by less than 10 percent in the 5-year forecast period (9.4 percent). However, the difference is over 15 percent in the 10-year planning horizon (16.2 percent).

The latest FAA TAF forecast enplanements per air carrier departure are approximately 60 to 90 enplanements per departure, which are significantly lower than historical actual enplanements per departure. The Master Plan Update forecast assumes mainline aircraft with an average of over 180 seats per departure based on the actual Airport market.

Table 3-31. Total Aircraft Operation Forecasts and Comparison with FAA TAF

Fiscal Year	High Scenario	Baseline Scenario	Low Scenario	FAA TAF (2022 Model, released February 2023)	% Difference between Baseline and FAA TAF	FAA TAF (2021 Model, released March 2022)	% Difference between Baseline and FAA TAF
	Historical			**Historical**		**Historical**	
2019 (Base Year)	72,699	72,699	72,699	72,699	0.0%	72,699	0.0%
2020	38,907	38,907	38,907	38,907	0.0%	38,907	0.0%
2021	20,363	20,363	20,363	20,363	0.0%	20,363	0.0%
	Forecast			**Forecast**		**Forecast**	
2024	73,422	59,960	46,035	66,179	-9.4%	59,145	1.4%
2029	92,978	83,655	75,803	99,886	-16.2%	78,629	6.4%
2034	98,581	88,012	78,454	106,244	-17.2%	82,962	6.1%
2039	104,697	92,643	81,194	112,914	-18.0%	87,472	5.9%
Period	**CAGR**			**CAGR**		**CAGR**	
2019 to 2024 (5-year)	0.2%	-3.8%	-8.7%	-1.9%		-4.0%	
2019 to 2029 (10-year)	2.5%	1.4%	0.4%	3.2%		0.8%	
2019 to 2039 (20-year)	1.8%	1.2%	0.6%	2.2%		0.9%	

Notes:
FAA = Federal Aviation Administration
TAF = Terminal Area Forecast
CAGR = Compound annual growth rate
Sources:
FAA TAF (2021 Model, issued March 2022 and 2022 Model, issued February 2023)
AECOM analysis

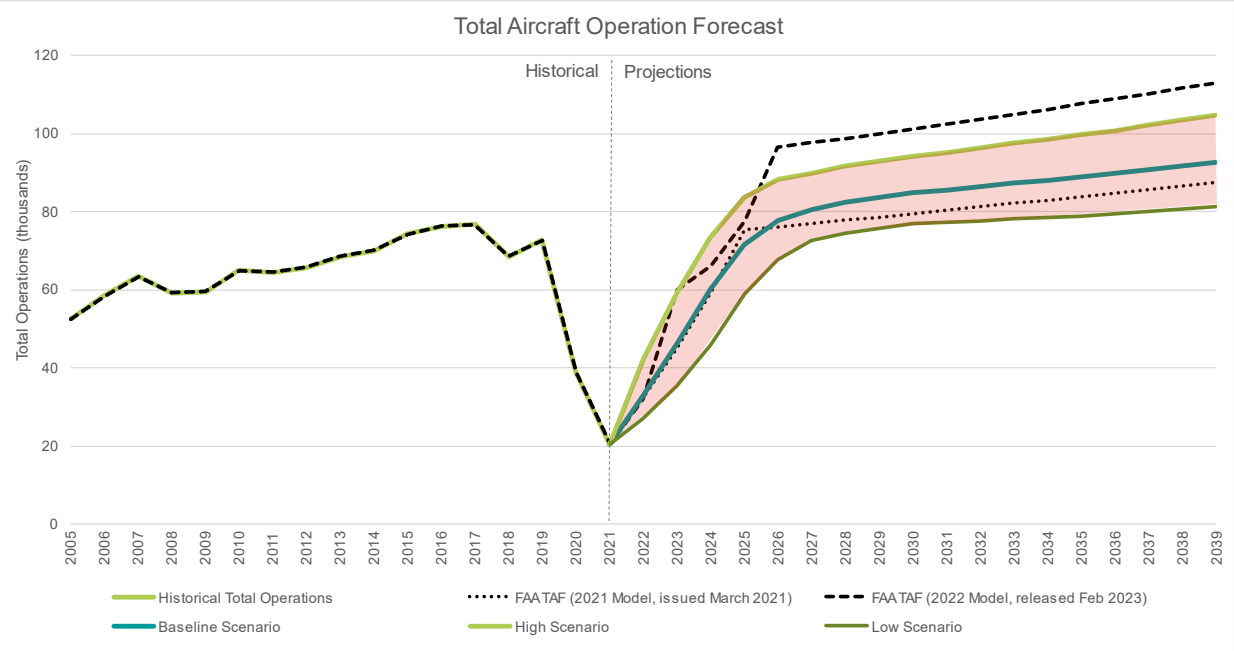

Figure 3-54. Total Operation Forecasts

Source: AECOM Analysis

3.6.4 Based Aircraft Forecast

Three methodologies were used to project the number of based aircraft at the Airport during the planning period.

3.6.4.1 Forecast Methodology

The forecast for based aircraft considers the historical trends and includes both top-down and bottom-up approaches:

- The top-down approach estimates the total regional demand for based aircraft in Guam and CNMI. The future based aircraft fleet is then allocated to each airport in the competitive area to derive future based aircraft.
- The bottom-up approach projects the based aircraft by type of aircraft based on growth rates predicted nationally by the FAA. Different growth rates are applied for fixed-wing single-engine piston aircraft, multi -engine piston aircraft, turboprop, and jet aircraft.
- The historical trend at the Airport is included in a time-series model for the past decade.

The results of the different approaches are compared and consolidated into a recommended baseline scenario, a high scenario, and a low scenario. Findings are then compared with the FAA TAF based aircraft forecasts.

3.6.4.2 Based Aircraft Projections for the Region

The decision by an aircraft owner on where to base the aircraft depends on many factors, such as the proximity of the airport to the owner's residence or business, the facilities, and services available at each airport. Based aircraft owned by individuals for personal use are mostly based on the same island as the owner. Owners of business aircraft for services between the islands in the region have the choice of their home base in Guam, GSN, or TNI. Since there is no FBO or aircraft maintenance support services in GRO, there is no historical based aircraft at GRO.

For example, Star Marianas Air operates from TNI and provides passenger and cargo services for the islands of Saipan, Tinian, Rota, and Guam. Their fleet of eight Piper PA-32-300 Cherokee Six and five

Piper PA-31-350 Navajo Chieftains aircraft are primary based in TNI. They also park their aircraft overnight at GSN for the first morning departures from GSN to TNI and from GSN to GRO.

Another example is Skydive Guam, which also operate as Skydive Saipan and MACS with a fleet of five Cessna C-208s, three Pac Aerospace Crop P-750s, and one Cessna 172S Skyhawk. Of the nine-aircraft fleet, seven of them are based in Guam according to the FBO record (April 2022), and the remaining two aircraft are based at GSN. They provide flight operations for tandem skydiving under the brand name of Skydive Guam and Skydive Saipan, respectively. They also provide regular and on-demand air cargo services for the islands of Guam, Rota, Saipan, and Tinian under MACS.

This historical based aircraft and market share in GUM, GSN and TNI are summarized in **Figure 3-55**.

The forecast regional demand for based aircraft in Guam and CNMI was estimated by a time-series model from 2013 to 2022 based on the historical trend shown in **Figure 3-55**. The model projects that the total number of based aircraft in the region will increase to 78 aircraft at an average annual growth rate of 0.64 percent over the 20-year planning period. The share of based aircraft is estimated from this projection and described in the next section.

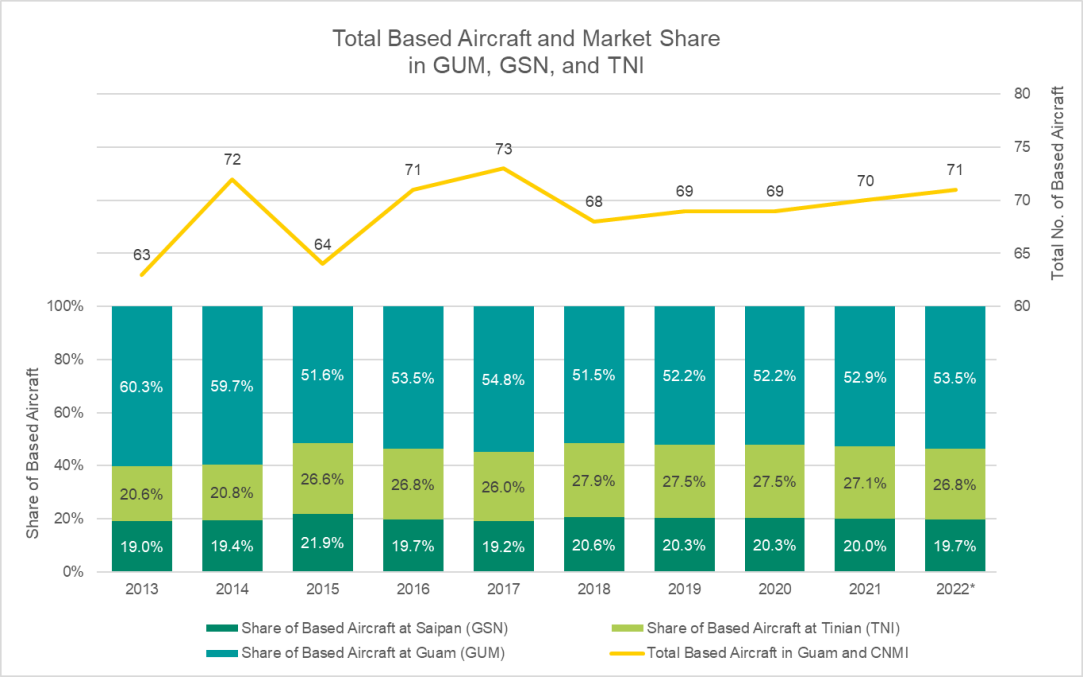

Figure 3-55. Historical Based Aircraft and Market Share in GUM, GSN, and TNI

Note: The number of based aircraft for the Airport in 2022 was updated with the Form 5010-1 information from GIAA.
Sources:

1. *Historical based aircraft – FAA, TAF, and GIAA*
2. *Calculation of market share – AECOM*

3.6.4.3 Based Aircraft Projections for the Airport

The three forecast methodologies are described below.

3.6.4.3.1 Top-Down Approach

The forecast of based aircraft was obtained by distributing the total demand of the region based on the following two cases:

- Existing-share case: It assumes the relative attractiveness of Guam to other airports in the region will stay constant throughput the planning horizon. The share of based aircraft at the Airport stayed at the existing share of 53 percent.
- Increasing-share case: It assumes there will be improvements in the facilities, support businesses, and services at the Airport as compared to other airports in the region and will attract more based

aircraft. The share of based aircraft will gradually increase to 60 percent, which is the historical share in 2013 and 2014.

Table 3-32 summarizes the distribution to the Airport for these two cases.

3.6.4.3.2 Bottom-Up Approach

The bottom-up approach projects the based aircraft by type based on growth rates predicted nationally by the FAA. **Table 3-33** summarizes the projected average annual growth rates for different types of aircraft by the FAA Aerospace Forecast FY2021–2041. **Table 3-32** summarizes the forecast of based aircraft numbers using the bottom-up approach.

3.6.4.3.3 Time-Series Model

A time-series model was developed for the based aircraft using the historical trend from 2013 to 2022. The number of based aircraft in 2022 was updated to 38 aircraft based on GIAA's submission for the Airport Master Record, Form 5010-1, in May 2022.

Table 3-32 summarizes the forecast of based aircraft using the time-series model.

Table 3-32. Summary of the Top-Down, Bottom-Up, and Time-Series Based Aircraft Projections

Fiscal Year	Top-Down Approach: Existing-Share Case	Top-Down Approach: Increasing-Share Case	Bottom Up Approach: Growth by Aircraft Type	Time-Series Model
Historical				
2019 (Base Year)	36	36	36	36
2020	36	36	36	36
2021	37	37	37	37
Forecast				
2024	38	39	37	36
2029	40	42	38	35
2034	41	44	39	34
2039	42	47	40	32
Period	**CAGR**			
2019 to 2024 (5-year)	1.3%	1.6%	0.7%	-0.1%
2019 to 2029 (10-year)	1.0%	1.4%	0.5%	-0.4%
2019 to 2039 (20-year)	0.8%	1.3%	0.5%	-0.5%

Note:
CAGR = Compound annual growth rate

Table 3-33. Projected Based Aircraft Growth Rate by Type

Period	Fixed-Wing Piston			Fixed-Wing Turbine			Total GA and Air Taxi Fleet
	Single-Engine	Multi-Engine	Total Piston	Turboprop	Turbojet	Total Turbine	
Historical							
Historical CAGR (2010 to 2021)	-0.86%	-2.46%	-1.02%	0.86%	2.87%	2.01%	-0.86%
Historical CAGR (2020 to 2021)	-0.92%	-0.61%	-0.89%	-0.34%	2.46%	1.34%	0.43%
Forecast							
Forecast CAGR (2019 to 2029)	-0.95%	-0.54%	-0.91%	0.03%	2.55%	1.59%	-0.19%
Forecast CAGR (2019 to 2039)	-0.92%	-0.44%	-0.88%	0.39%	2.32%	1.61%	-0.07%

Notes:
GA = General aviation
CAGR = Compound annual growth rate
Source:
FAA Aerospace Forecast FY2021–2041, Table 28
Calculations of CAGR from 2019 to 2029 and from 2019 to 2039 – AECOM

By comparing the outcomes of the top-down, bottom-up, and time-series models, it is anticipated that the number of based aircraft will be between the optimistic estimate of 47 and the conservative estimate of 32 aircraft. The baseline scenario is projected to reach 40 based aircraft over the 20-year planning horizon.

Figure 3-56 and **Table 3-34** summarize the baseline, low, and high scenarios for forecast based aircraft and the comparison with FAA TAF.

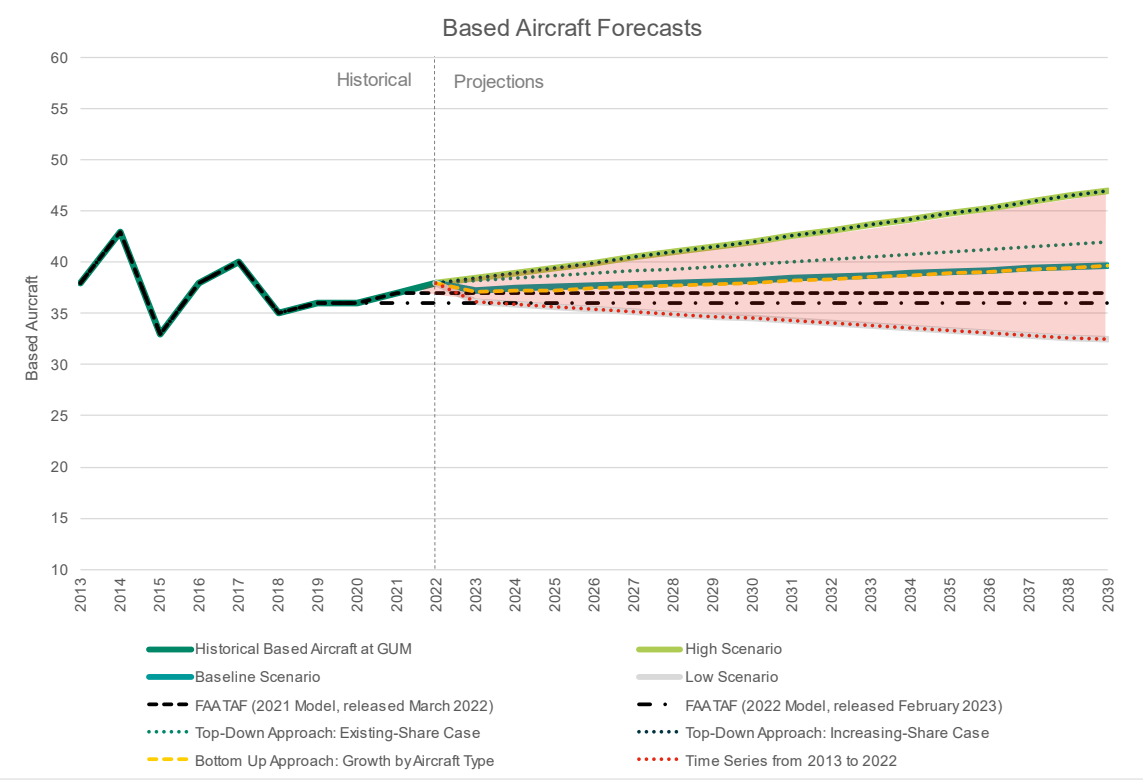

Figure 3-56. Based Aircraft Forecast

Source: AECOM Analysis

Table 3-34. Based Aircraft Forecast and Comparison with FAA TAF

Fiscal Year	High Scenario	Baseline Scenario	Low Scenario	FAA TAF (2022 Model, released February 2023)	% Difference between Baseline and FAA TAF	FAA TAF (2021 Model, released March 2022)	% Difference between Baseline and FAA TAF
	Historical			Historical		Historical	
2019 (Base Year)	36	36	36	36	0.0%	36	0.0%
2020	36	36	36	36	0.0%	36	0.0%
2021	37	37	37	36	2.8%	37	0.0%
	Forecast			Forecast		Forecast	
2024	39	37	36	36	4.0%	37	1.2%
2029	42	38	35	36	5.9%	37	3.1%
2034	44	39	34	36	8.1%	37	5.1%
2039	47	40	32	36	10.4%	37	7.4%
Period	CAGR			CAGR		CAGR	
2019 to 2024 (5-year)	1.6%	0.8%	-0.1%	0.0%		0.5%	
2019 to 2029 (10-year)	1.4%	0.6%	-0.4%	0.0%		0.3%	
2019 to 2039 (20-year)	1.3%	0.5%	-0.5%	0.0%		0.1%	

Note:
CAGR = Compound annual growth rate
Source:
FAA TAF (2021 Model, issued March 2022, and 2022 Model, issued February 2023)
AECOM analysis

3.6.5 Peak Activity Forecast

The passenger and aircraft traffic demand patterns at an airport are subject to seasonal, monthly, daily, and even hourly variations. These variations result in peak periods when the most demand is placed upon the facilities. Peaking characteristics identify the expected peak periods throughout the planning horizon for facility planning purposes. The objective of developing peak activity forecasts is to provide a design level that sizes facilities so they are neither underutilized nor overcrowded too often.

The peak activity forecasts in this section include:

- Enplanements
- Commercial passenger carrier operations
- Total aircraft operations

3.6.5.1 "Average Day of the Peak Month" and "Peak Hour"

FAA guidance recommends using the peak hour of the average day in the peak month (ADPM) for the purposes of physical facility planning. The peak hour determination for enplanements and aircraft operations are based on monthly and hourly historic data from the Airport statistics from GIAA and FAA ATADS.

3.6.5.2 ADPM Peak Hour Enplanements

Figure 3-57 depicts the historical monthly enplanements for the past 5 fiscal years between 2017 and 2021. The peaks occurred during August in the summer except during the COVID-19 pandemic. Approximately 9.5 percent of the annual enplanements were recorded in the peak month, as shown in **Table 3-35**, based on the three years before the pandemic. The ADPM peak hour analysis is based on the commercial airline flight schedules in August 2019.

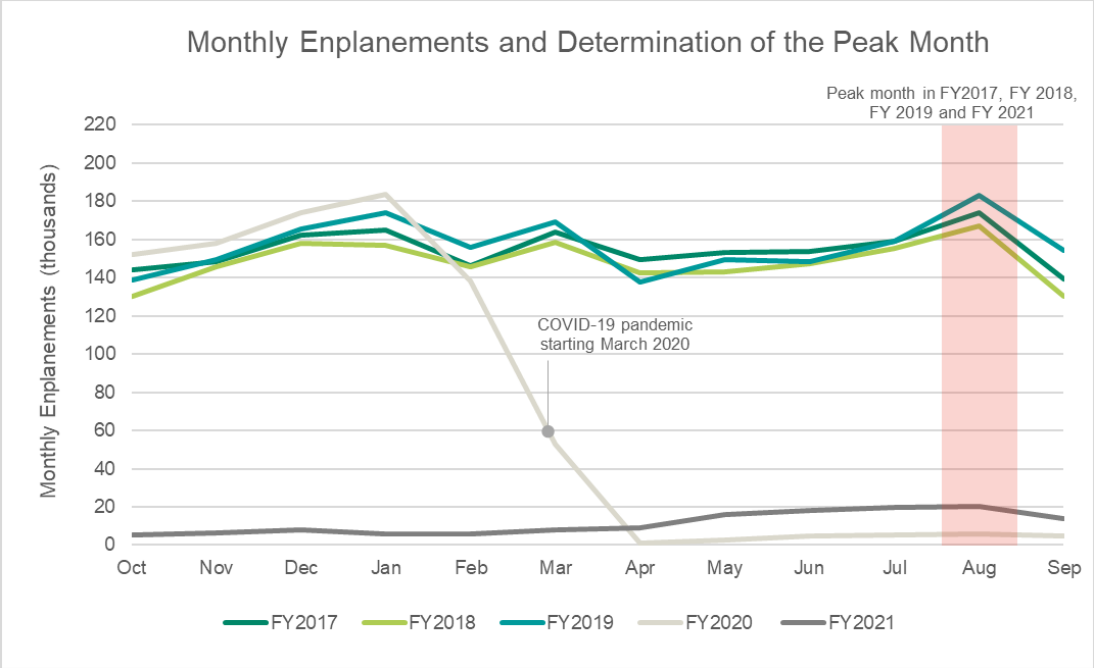

Figure 3-57. Monthly Enplanements and Determination of the Peak Month

Source: Monthly statistics for FY2017 to FY2021 – GIAA

Table 3-35. Percentage of Enplanements in the Peak Month

Fiscal Year	Annual Total Enplanements	Monthly Average Enplanements	Peak Month Enplanements	Peak Month	Percentage of Peak Month Enplanements over Annual Enplanements
2017	1,858,379	154,865	173,825	August	9.4%
2018	1,780,572	148,381	167,180	August	9.4%
2019	1,885,108	157,092	183,096	August	9.7%
				Average Peak Month Factor	**9.5%**

Sources:
Monthly statistics for FY2017 to FY2019 – GIAA
Percentage of enplanements in the peak month – AECOM analysis

Table 3-36 presents the daily scheduled departure and arrivals seats in the peak month August 2019. For planning purposes, we recommend selecting a weekday in the peak month representing the average activities that is not the highest day over the weekends. Hence, Monday, August 19, 2019, was selected as the design day (i.e., ADPM) for the peak hour demand analysis.

Table 3-36. Daily Scheduled Operations and Scheduled Seats in the Peak Month

Day of Week	Daily Scheduled Operations		Daily Scheduled Seats		Percentage Difference from Average Operations	Percentage Difference from Average Seats	Total Percentage Difference
	Arrivals	Departures	Arriving	Departing			
Sunday	39	40	8,061	8,187	2.5%	1.9%	4.4%
Monday	**39**	**39**	**8,031**	**8,031**	**2.2%**	**0.4%**	**2.6%**
Tuesday	39	38	7,833	7,707	4.7%	6.9%	11.6%
Wednesday	40	41	8,099	8,225	5.4%	2.8%	8.2%
Thursday	40	39	8,087	7,921	2.5%	2.1%	4.6%
Friday	37	38	7,651	7,857	9.8%	7.3%	17.1%
Saturday	42	41	8,581	8,415	10.5%	11.2%	21.7%
Average	39	39	8,049	8,049			

Note: **Monday** was selected as the design day for planning purposes.
Sources:
Flight schedules – GIAA
Daily scheduled operations and daily scheduled seats calculations – AECOM analysis

The peak hour demand analysis is based on the flight schedule for the design day in the base year 2019. **Figure 3-58** and **Figure 3-59** show the daily distribution of enplaned and deplaned passengers, respectively. **Table 3-37** summarizes the peak hour demands in the base year and the projected peak hour demand based on the forecast annual enplanements, peak month ratio (9.5 percent), and the peak hour ratio (22.4 percent for enplanements and 22.8 percent for deplanements). Based on the historical trends, it is anticipated that the peak hour enplanements will increase from 1,477 to 1,812 and the peak hour deplanements will increase from 1,483 to 1,820 during the 20-year planning horizon.

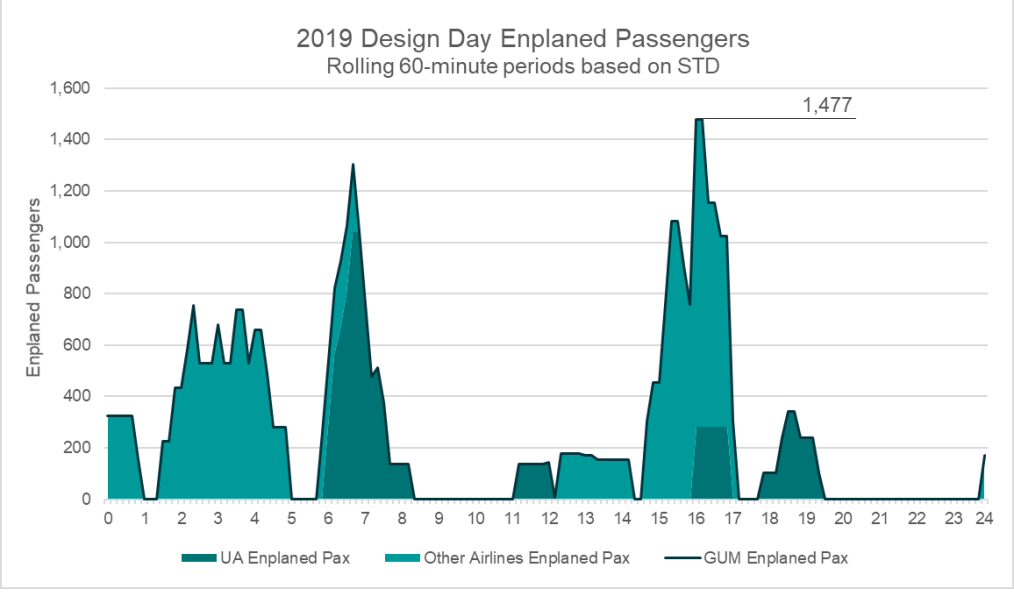

Figure 3-58. 2019 Design Day Enplaned Passengers

Note:
A. Abbreviations
STD = Scheduled time of departure
PAX = Passenger
Sources:
1. Flight schedules for August 2019 – GIAA
2. Load factor in August 2019 – U.S. DOT T-100 database
3. Rolling-60 minutes enplaned passengers – AECOM analysis

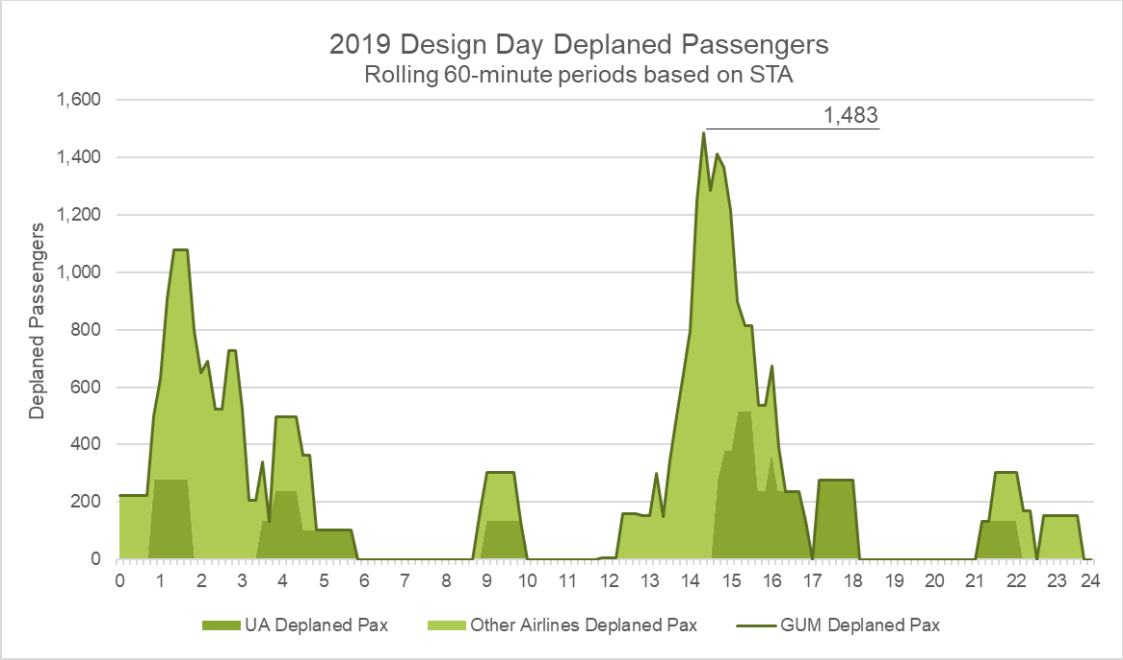

Figure 3-59. 2019 Design Day Deplaned Passengers

Note:

A. Abbreviations
STA = Scheduled time of arrival
Pax = Passenger

Sources:

1. *Flight schedules for August 2019 – GIAA*
2. *Load factor in August 2019 – U.S. DOT T-100 database*
3. *Rolling-60 minutes enplaned passengers – AECOM analysis*

Table 3-37. Peak Hour Enplanement and Deplanement Forecast

Fiscal Year	Annual Enplanements[A]	Peak Month Enplanements	Design Day Enplanements	Peak Hour Enplanements	Peak Hour Deplanements
Historical					
2019	1,885,108	183,096	6,585	1,477	1,483
Forecast					
2024	1,277,397	121,353	4,462	1,001	1,005
2029	1,960,402	186,238	6,848	1,536	1,542
2034	2,123,073	201,692	7,417	1,663	1,670
2039	2,312,858	219,722	8,080	1,812	1,820

Note:
Annual enplanement forecasts for the baseline scenario.

3.6.5.3 ADPM Peak Hour Commercial Passenger Air Carrier Operations

Figure 3-60 shows the daily distribution of scheduled departures, arrivals, and total operations throughout the same design day as passenger enplanements (i.e., August 19, 2019).

Table 3-38 summarizes the peak hour demands in the base year and the projected peak hour demand based on the forecast annual passenger aircraft operations, peak month ratio (9 percent), and the peak hour ratio (17.9 percent for departures, 20.5 percent for arrivals, 15.4 percent for combined operations).

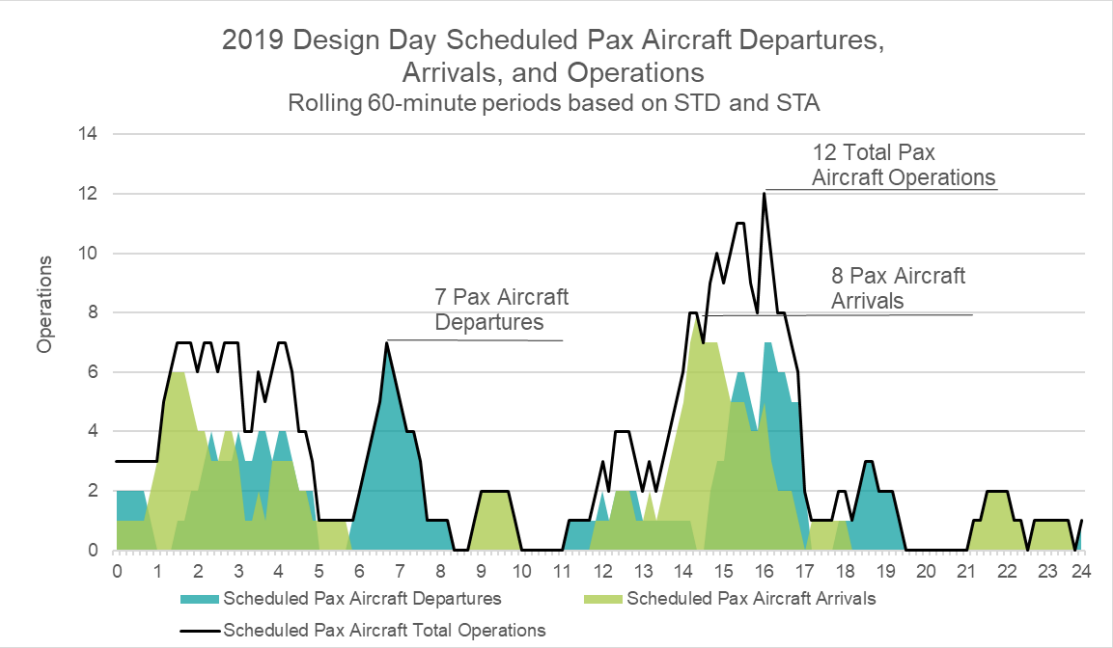

Figure 3-60. 2019 Design Day Scheduled Passenger Aircraft Operations

Note:

A. Abbreviations
STD = Scheduled time of departure
STA = Scheduled time of arrival
Pax = Passenger

Sources:

1. *Flight schedules for August 2019 – GIAA*
2. *Rolling-60 minutes enplaned passengers – AECOM analysis*

Table 3-38. Peak Hour Commercial Passenger Air Carrier Operation Forecasts

Fiscal Year	Annual Operations[A]	Peak Month Operations	Design Day Departures	Design Day Arrivals	Peak Hour Departures	Peak Hour Arrivals	Peak Hour Operations
Historical							
2019	23,289	2,062	39	39	7	8	12
Forecast							
2024	21,012	1,860	35	35	6	7	11
2029	25,206	2,232	42	42	8	9	13
2034	26,702	2,364	45	45	8	9	14
2039	28,445	2,518	48	48	9	10	15

Note:
Annual commercial passenger air carrier operation forecasts for the baseline scenario.

3.6.5.4 ADPM Peak Hour Total Aircraft Operations

Table 3-39 summaries the historical monthly total aircraft operations for the five FYs between 2015 and 2019 before the COVID-19 pandemic. Peak operations occurred in different months in different years and do not follow a regular pattern. The peak month accounts for an average of 9.6 percent of the annual total aircraft operations as shown in **Table 3-40**. In FY2019, the peak month for total aircraft operations was October 2018. To determine the peak hour operations for non-scheduled operations (e.g., GA and cargo aircraft operations), flight data from the GIAA were adopted for analysis.

The recorded monthly total aircraft operations from the GIAA flight data for the peak month in FY2019 was 5,166 operations, which represents over 76 percent of the total 6,759 operations from the FAA ATADS. The missing data are general aviation operations, which do not require a landing fee. The average daily and peak hour estimates were increased proportionally during the daytime to compensate for the missing general aviation operations.

Figure 3-61 presents the daily total aircraft operations in the peak month in FY2019, i.e., October 2018. An average day on Thursday October 11, 2018, was selected for peak hour analysis.

The findings of the peak hour total operations analysis are given in **Figure 3-62** through **Figure 3-64**. The number of departures, arrivals, and total operations throughout the day are shown in separate graphs. The aircraft operations obtained from the GIAA flight data are included in each graph. The white space between the operations from the GIAA flight data and yellow lines in **Figure 3-62** and **Figure 3-63** represent the estimated missing non-scheduled general aviation arrival and departure operations.

Peak hour total departures were estimated to be 14 operations, peak hour total arrivals were 16 operations, and peak hour total aircraft operations were 25 operations based on the estimates on the design day in base year 2019. **Table 3-41** summarizes the peak hour demands in the base year and the projected peak hour demand based on the forecast annual total aircraft operations.

Table 3-39. Monthly Total Operations

Fiscal Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Peak Month
2015	5,512	6,252	6,275	5,392	6,920	5,446	5,107	6,510	5,764	7,024	**7,424**	6588	Aug
2016	5,751	5,558	5,967	6,597	6,868	6,805	5,580	**7,048**	6,906	6,512	6,821	5840	May
2017	6,066	6,303	6,371	7,307	6,031	5,961	5,844	**7,590**	6,160	6,780	6,571	5793	May
2018	4,979	5,037	5,612	6,008	5,849	6,443	5,457	5,561	5,905	**6,694**	5,960	4971	Jul
2019	**6,759**	6,210	6,505	6,103	6,109	5,878	6,138	6,512	5,691	5,276	5,652	5866	Oct

Source: Monthly operation statistics – FAA ATADS

Table 3-40. Percentage of Total Operations in the Peak Month

Fiscal Year	Annual Total Operations	Monthly Average Operations	Peak Month Operations	Peak Month	Percentage of Peak Month Operations over Annual Operations
2015	74,214	6,185	7,424	Aug	10.0%
2016	76,253	6,354	7,048	May	9.2%
2017	76,777	6,398	7,590	May	9.9%
2018	68,476	5,706	6,694	Jul	9.8%
2019	72,699	6,058	6,759	Oct	9.3%
				Average Peak Month Factor	**9.6%**

Sources:
Monthly statistics for FY2017 to FY2019 – GIAA
Percentage of enplanements in the peak month – AECOM analysis

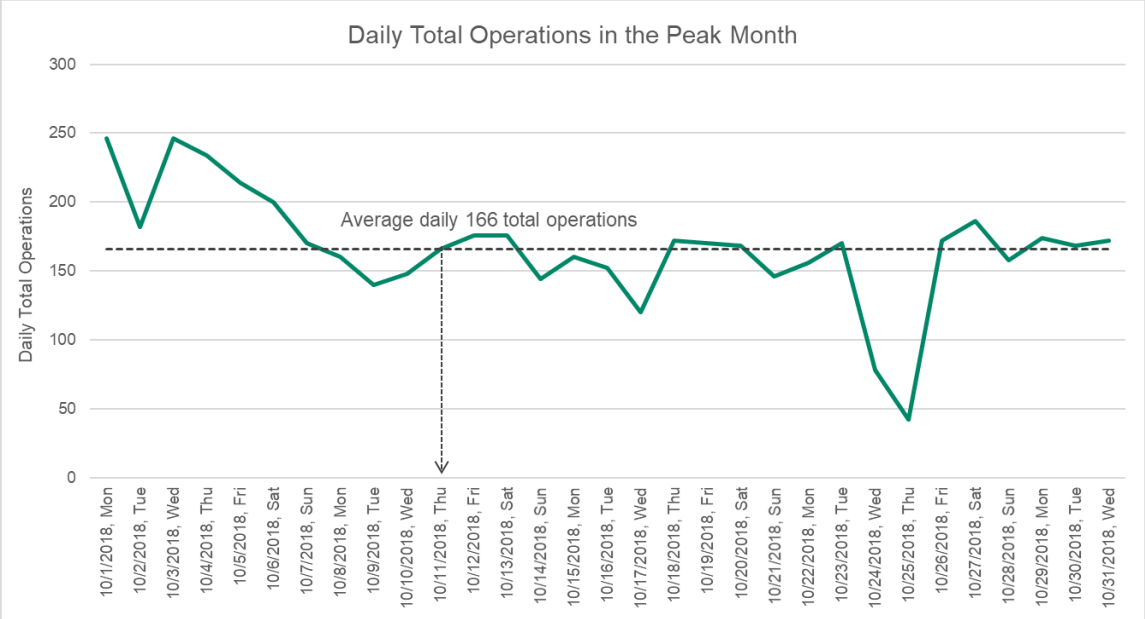

Figure 3-61. Daily Total Operations in the Peak Month

Sources:

1. *Flight data – GIAA*
2. *Average daily total operations and selection of design day – AECOM analysis*

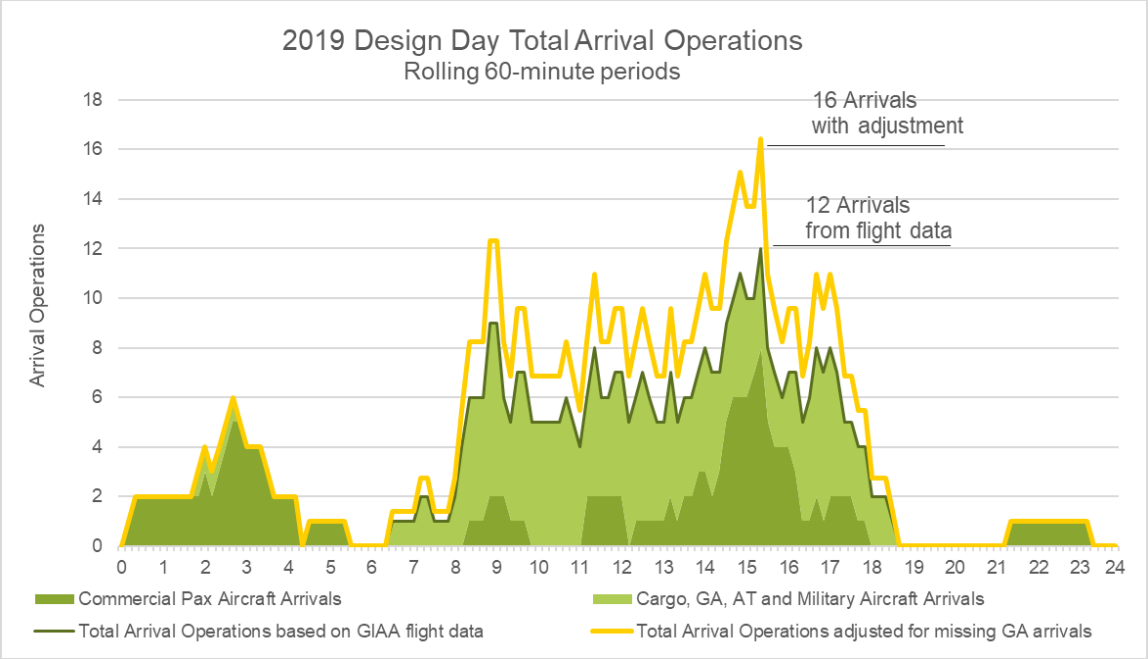

Figure 3-62. 2019 Design Day Total Arrival Operations

Note:

A. *Abbreviations*
GA = General aviation
AT = Air taxi
Pax = Passenger

Sources:

1. *Flight data – GIAA*
2. *Rolling 60-minutes arrivals and adjustment for missing GA arrivals – AECOM analysis*

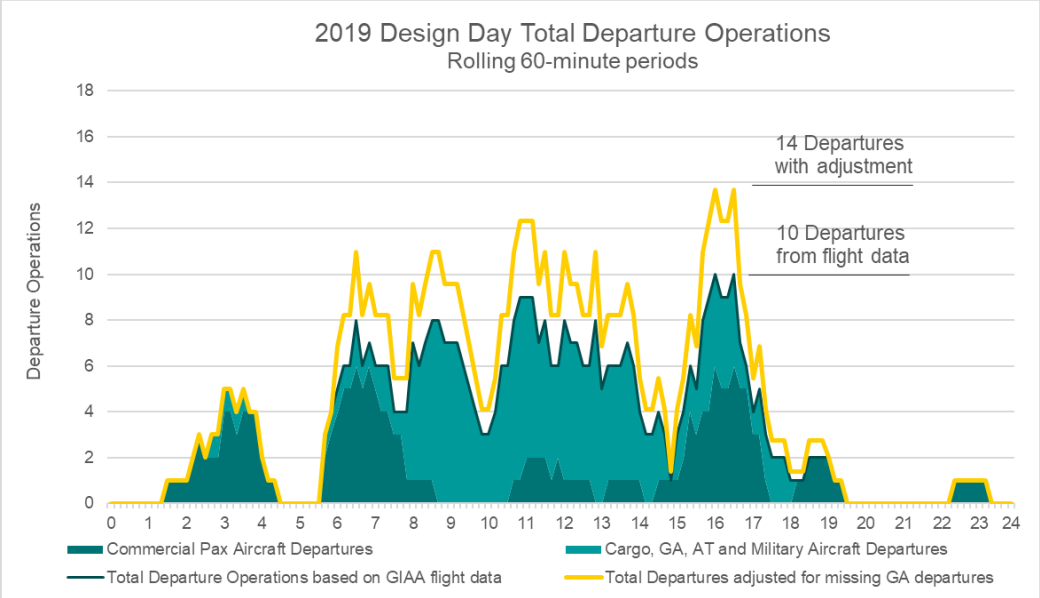

Figure 3-63. 2019 Design Day Total Departure Operations

Note:

A. Abbreviations
GA = General aviation
AT = Air taxi
Pax = Passenger

Sources:

1. *Flight data – GIAA*
2. *Rolling 60-minutes arrivals and adjustment for missing GA arrivals – AECOM analysis*

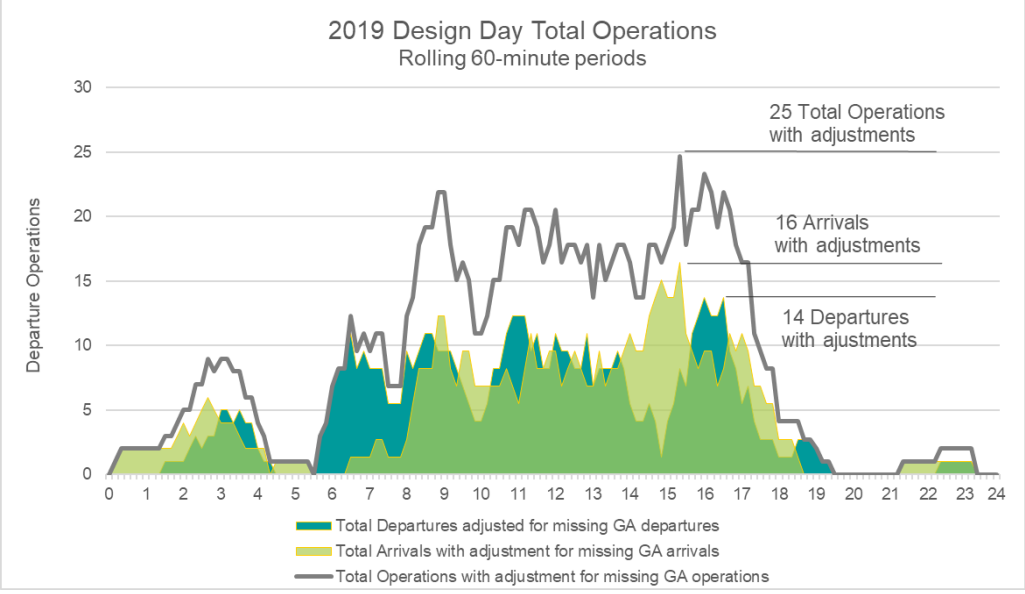

Figure 3-64. 2019 Design Day Total Operations

Note:

A. Abbreviations
GA = General aviation

Sources:

1. *Flight data – GIAA*
2. *Rolling 60-minutes total operations and adjustment for missing GA operations – AECOM analysis*

Table 3-41. Peak Hour Total Aircraft Operation Forecasts

Fiscal Year	Annual Operations[A]	Peak Month Operations	Design Day Daily Operations	Peak Hour Departures	Peak Hour Arrivals	Peak Hour Operations
Historical						
2019	72,699	6,759	218	14	16	25
Forecast						
2024	59,960	5,756	186	12	13	21
2029	83,655	8,031	259	16	18	29
2034	88,012	8,449	273	17	19	30
2039	92,643	8,894	287	18	20	32

Note:
Annual total operation forecasts for the baseline scenario.

3.7 Summary of Aviation Demand Forecasts

Table 3-42 summarizes the recommended baseline unconstrained forecasts for enplanements, aircraft operations, and based aircraft for the Airport over the 20-year planning horizon.

Table 3-42. Summary of Aviation Demand Forecasts for the 20-Year Planning Horizon

		Operations					Based Aircraft			
Year	Total Enplanements	Air Carrier	Air Taxi	General Aviation	Military	Total Operations	Single-Engine	Multi-Engine	Jet	Total Based Aircraft
Historical										
2019 (Base Year)	1,885,108	24,138	370	47,777	414	72,699	22	4	10	36
2020	884,060	14,799	575	22,171	1,362	38,907	22	4	10	36
2021	135,566	6,333	197	11,906	1,927	20,363	23	4	10	37
Forecast										
2024	1,277,397	22,062	276	35,695	1,927	59,960	22	4	11	37
2029	1,960,402	26,513	424	54,791	1,927	83,655	22	4	12	38
2034	2,123,073	28,246	444	57,394	1,927	88,012	21	4	14	39
2039	2,312,858	30,210	465	60,041	1,927	92,643	21	4	15	40
Period	**CAGR**									
2019 to 2024 (5-year)	-7.5%	-1.8%	-5.7%	-5.7%	36.0%	-3.8%	0.0%	0.0%	1.9%	0.5%
2019 to 2029 (10-year)	0.4%	0.9%	1.4%	1.4%	16.6%	1.4%	0.0%	0.0%	1.8%	0.5%
2019 to 2039 (20-year)	1.0%	1.1%	1.1%	1.1%	8.0%	1.2%	-0.2%	0.0%	2.0%	0.5%

Note:
CAGR = Compound annual growth rate

Table 3-43 summarizes the forecast levels and growth rates, and **Table 3-44** summarizes the comparison with the FAA TAF. These tables adopt the format required by the FAA.

Table 3-43. Summary of Forecast Levels and Growth Rates

A. Forecast Levels and Growth Rates

Base Year: 2019

						Average Annual Compound Growth Rates			
	Base Yr. Level	Base Year +1 Year	Base Year +5 Years	Base Year +10 Years	Base Year +15 Years	Base Year to +1	Base Year to +5	Base Year to +10	Base Year to +15
	2019	2020	2024	2029	2034	2019 to 2020	2019 to 2024	2019 to 2029	2019 to 2034
Passenger Enplanements									
Air Carrier (Mainline) [A]	1,885,108	884,060	1,277,397	1,960,402	2,123,073	-53.1%	-7.5%	0.4%	0.8%
Commuter (Regional) [B]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	**1,885,108**	**884,060**	**1,277,397**	**1,960,402**	**2,123,073**	**-53.1%**	**-7.5%**	**0.4%**	**0.8%**
Operations									
Itinerant									
Air Carrier (Mainline) [A]	23,289	12,197	21,012	25,206	26,702	-47.6%	-2.0%	0.8%	0.9%
Commuter (Regional) [B]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cargo Carrier	849	2,602	1,050	1,306	1,544	206.5%	4.3%	4.4%	4.1%
Total Commercial Operations	*24,138*	*14,799*	*22,062*	*26,513*	*28,246*	*-38.7%*	*-1.8%*	*0.9%*	*1.1%*
Air Taxi	370	575	276	424	444	55.4%	-5.7%	1.4%	1.2%
General Aviation	26,908	12,295	20,104	30,858	32,324	-54.3%	-5.7%	1.4%	1.2%
Military	379	963	927	927	927	154.1%	19.6%	9.4%	6.1%
Local									
General Aviation	20,869	9,876	15,592	23,933	25,070	-52.7%	-5.7%	1.4%	1.2%
Military	35	399	1,000	1,000	1,000	1040.0%	95.5%	39.8%	25.0%
Total Operations	**72,699**	**38,907**	**59,960**	**83,655**	**88,012**	**-46.5%**	**-3.8%**	**1.4%**	**1.3%**
Peak Hour Operations	25	N/A	21	29	30	N/A	-3.4%	1.5%	1.2%
Cargo/Mail (Enplaned + Deplaned Tons)	21,724	34,147	26,944	34,652	42,360	57.2%	4.4%	4.8%	4.6%
Based Aircraft									
Single-Engine (Non-jet)	22	22	22	22	21	0.0%	0.0%	0.0%	-0.3%

	Base Yr. Level	Base Year +1 Year	Base Year +5 Years	Base Year +10 Years	Base Year +15 Years	Average Annual Compound Growth Rates			
						Base Year to +1	Base Year to +5	Base Year to +10	Base Year to +15
	2019	2020	2024	2029	2034	2019 to 2020	2019 to 2024	2019 to 2029	2019 to 2034
Multi-Engine (Non-jet)	4	4	4	4	4	0.0%	0.0%	0.0%	0.0%
Jet Engine	10	10	11	12	14	0.0%	1.9%	1.8%	2.3%
Helicopter	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Military	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	**36**	**36**	**37**	**38**	**39**	**0.0%**	**0.5%**	**0.5%**	**0.5%**

Notes:
A. Mainline aircraft refers to aircraft with over 90 seats, including small narrowbody (B737 classics, MD-80s, A319, E190), medium narrowbody (B737 MAX8, MD-90, A320), large narrowbody (B757, B737 MAX9, A321 neo), and small widebody (B787-8, A330). Regional aircraft refer to aircraft with less than 90 seats, e.g., ERJ135/140/145/175, Q400, CRJ-200/700/900, and turboprops.
B. There is no commercial regional aircraft flying to/from the Airport regularly based on the 2019 to 2021 flight schedules.

B. Operational Factors

	Base Yr. Level	Base Yr. +1yr.	Base Yr. +5yrs.	Base Yr. +10yrs.	Base Yr. +15yrs.
	2019	2020	2024	2029	2034
Average Aircraft Size (Seats)					
Air Carrier (Mainline) [C]	196	185	184	195	197
Commuter (Regional) [C]	N/A	N/A	N/A	N/A	N/A
Average Enplaning Load Factor					
Air Carrier (Mainline) [D]	79.0%	62.2%	65.9%	79.8%	80.8%
Commuter (Regional) [D]	N/A	N/A	N/A	N/A	N/A
GA Operations Per Based Aircraft	1,327	616	965	1,442	1,472

Notes:
C The average aircraft sizes (seats per departure) for 2019 and 2020 are estimated from the U.S. DOT T-100 Segment database
and supplemented with the 2019 and 2020 flight schedules.
D The load factor in 2019 is based on the U.S. DOT T-100 Segment database.
N/A – Not available

Table 3-44. Comparison Between Airport Planning and FAA TAF Forecasts

	Fiscal Year	Airport Forecast	FAA TAF (2022 Model, issued February 2023)	% Difference	FAA TAF (2021 Model, issued March 2022)	% Difference
Passenger Enplanements						
Base year	2019	1,885,108	1,276,443	47.7%	1,276,443	47.7%
Base year + 5 years	2024	1,277,397	873,733	46.2%	1,269,750	0.6%
Base year + 10 years	2029	1,960,402	1,982,619	-1.1%	1,443,446	35.8%
Base year + 15 years	2034	2,123,073	2,178,600	-2.5%	1,591,016	33.4%
Commercial Operations						
Base year	2019	24,138	24,138	0.0%	24,138	0.0%
Base year + 5 years	2024	22,062	28,180	-21.7%	24,443	-9.7%
Base year + 10 years	2029	26,513	50,355	-47.3%	27,071	-2.1%
Base year + 15 years	2034	28,246	54,819	-48.5%	29,413	-4.0%
Total Operations						
Base year	2019	72,699	72,699	0.0%	72,699	0.0%
Base year + 5 years	2024	59,960	66,179	-9.4%	59,145	1.4%
Base year + 10 years	2029	83,655	99,886	-16.2%	78,629	6.4%
Base year + 15 years	2034	88,012	106,244	-17.2%	82,962	6.1%

Notes:
FAA = Federal Aviation Administration
TAF = Terminal Area Forecast

B.2 Forecast Approval Letter

The use of the Master Plan aviation forecasts was approved for use in completing the Part 150 Study in a letter from the FAA dated April 10, 2024, and is provided in this Appendix.

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U.S. Department
of Transportation
**Federal Aviation
Administration**

Western-Pacific Region
Office of Airports
Honolulu Airports District Office

Federal Aviation Administration
300 Ala Moana Blvd. Rm 7-12
Honolulu, HI 96850

March 27, 2024

VIA EMAIL

John M. Quinata
Executive Manager
Guam International Airport Authority
P.O. Box 8770
Tamuning, Guam 96931

Dear Mr. Quinata:

A.B. Won Pat International Airport (GUM)
Airport Master Plan Update: Forecast
AIP Grant/Project: 3-66-0001-113-2021

The Federal Aviation Administration (FAA) has completed its review of the Aviation Demand Forecast associated with the Airport Master Plan Update, dated March 28, 2023, for A.B. Won Pat International Airport (GUM). The FAA approves these forecasts for airport planning purposes, including Airport Layout Plan development.

In summary, although the master plan forecast isn't within the 10 percent allowance for the 5-year planning horizon, the airport forecast appropriately explains the difference is due largely in part to the inconsistent historical TAF data. Based on the latest TAF released January 2024, both the enplanement and total operation forecast for the Master Plan Update differ from the latest FAA TAF by less than 15 percent in the 10-year planning horizon (3.4 percent for enplanement, 2.6 percent for total operations). The master plan forecast is consistent with the FAA TAF in 10-year and 15-year.

This forecast was prepared at the same time as the evolving impacts of the COVID-19 public health emergency. Forecast approval is based on the methodology, data, and conclusions at the time the document was prepared. However, consideration of the impacts of the COVID-19 public health emergency on aviation activity is warranted to acknowledge the reduced confidence in growth projections using currently-available data.

Accordingly, FAA approval of this forecast does not constitute justification for future projects. Justification for future projects will be made based on activity levels at the time the project is requested for development. Documentation of actual activity levels meeting planning activity levels will be necessary to justify AIP funding for eligible projects.

If you have further questions or need for clarification, please feel free to contact me via phone at (424) 405-7313 or via email at joseph.carlini@faa.gov.

Sincerely,

JOSEPH M CARLINI

Digitally signed by JOSEPH M CARLINI
Date: 2024.03.27 16:34:50 -07'00'

Joseph Carlini
AWP Regional Planner

Cc: Frank Santos, Director, Transportation Management Group, LLC
Elliott Lindgren, Vice President, Aviation, AECOM