

Forecast Uncertainties

The forecasts in this document are forecasts of aviation demand, driven by models built on forecasts of economic activity. There are many assumptions in both the economic forecasts and in the FAA models that could affect the degree to which these forecasts are realized. Now that passenger and traffic volumes have returned to pre-COVID levels, this year's forecast is driven, at least in the near-term, by the strength of the U.S. and global economies that may be offset partially by supply chain constraints, most notably aircraft deliveries. It does go without saying that terrorism remains among the greatest worldwide risks to aviation growth. Any terrorist incident aimed at aviation could have an immediate and significant impact on the demand for aviation services that could be greater than its impact on overall economic activity.

In addition, changes in the geo-political landscape could lead to outcomes very different than the forecasts provided in this document. The ongoing crises in Ukraine and in the Middle East represent a very large uncertainty to this year's forecast. The impacts are still evolving and dependent in large part on the outcome of the armed conflicts. While there was an initial negative impact on airline bookings as well as a surge in oil prices, those impacts have diminished over time. The impact of the economic sanctions on Russia pushed the Russian economy (the world's 10th largest as of 2021) into a sharp four-quarter recession in 2022. European economic growth remained muted in 2023 as Europe moved to further restrict trade with Russia and its allies and reduce its dependence on energy from Russia. Many forecasters see continued low European economic growth in 2024 as well due to the impacts of the conflict. In the longer run, most analysts

are seeing a return to higher tensions between Russia and the West resulting in higher expenditures on defense that may push taxes higher and leave consumers with less money to spend on items like air travel.

The rapid spread of the novel coronavirus (COVID-19) that began in early 2020 resulted in the largest decline in aviation activity since the jet era began in the late 1950's. While aviation activity has almost fully recovered to pre-pandemic levels, there is still a good deal of uncertainty about the long run path of aviation activity once the recovery from the 2020 downturn is complete. There are questions as to whether the strategies that U.S. and foreign carriers are employing to recover from the downturn in demand will be successful in a post-COVID environment. Other questions surround the stability of consumer attitudes and behaviors towards aviation in a post-COVID environment, as well as the breadth and depth of the and the speed and nature of the economic recovery, all of which apply both domestically and globally.

The future direction of oil prices presents another considerable uncertainty in producing the forecast. The FAA's baseline forecast (derived from economic assumptions in S&P Global December 2023 U.S. macro forecast and 30-Year Focus released during November 2023) calls for oil prices to fall from \$78 per barrel in 2023 to \$73 per barrel in 2025. Over the long term, the FAA baseline forecast assumes that oil prices will rise gradually to about \$89 per barrel in 2030 and about \$107 per barrel by the end of the forecast period in 2044. However, there are other oil price forecasts that vary considerably from the FAA base forecast in the next 2-5 years. These include the latest Energy Information

Administration (EIA) Short Term Energy Outlook released in March 2024, the International Monetary Fund (IMF) Commodity Price Forecast released in October 2023 and the World Bank Commodity Price Forecast released in October 2023. The EIA forecast projects the spot price of oil will reach \$85 per barrel by 2025, considerably above the FAA base forecast of \$73. The IMF forecast sees the price of oil around \$73 in 2025 and falling to \$66 per barrel in 2028, well below the FAA base forecast of \$86 per barrel. The World Bank forecast has oil prices at \$80 per barrel in 2025. Over the long run, lower oil prices give consumers an impetus for additional spending, including air travel, and should enhance industry profitability. In the case where oil prices turn out to be higher than the FAA forecast, we would expect lower spending on air travel by consumers, higher costs for fuel to airlines and reduced industry profitability.

The baseline forecast incorporates additional infrastructure spending in 2023 and beyond. However, there is considerable uncertainty as to the magnitude, timing, and nature of these programs that ultimately determines the impact on the future growth of the U.S. economy. In addition, how the U.S. will engage with the rest of the global economy over the next several years continues to evolve. Under the right conditions, a period of sustained high and more inclusive growth along with increased financial stability could occur. However, considering the recent Russia-Ukraine conflict there is an increased possibility of an outcome that leads to greater global economic fragmentation due to rising tensions resulting in slower growth and increased financial instability.

The baseline forecast assumes that the global economic recovery that began at the end of 2020 will continue but at a slower pace

in 2024. Thereafter, the baseline forecast assumes that China and India will be growth engines for emerging economies. The forecast assumes China successfully transitions the economy from heavy reliance on manufacturing and resource industries to one more oriented towards the services and technology sectors and India continues to implement reforms to make its economy more competitive. Many analysts are concerned that in light of the Russia-Ukraine conflict, China moves closer to Russia, limiting opportunities to further transition its economy away from manufacturing and resource intensive industries. In the case of India, the impact of the Russia-Ukraine conflict on energy prices and food prices may put pressure on trade and fiscal deficits resulting in a slowdown of reforms.

In the United States, economic growth in the near term is expected to be slow as the impacts of the Federal Reserve's moves to reduce inflation by raising interest rates are felt by consumers and businesses. The forecast anticipates that inflation returns to acceptable levels by 2024. Over the forecast horizon economic growth (real GDP) remains below 2 percent as population growth and productivity growth remain lower than historic averages. The forecast does not assume any measure of fiscal restraint will be implemented, despite government debt as percent of GDP exceeding 100 percent and approaching levels that were last seen at the end of World War 2. In Japan, the United Kingdom, and the European Union economic growth over the next few years will be well below rates seen over the past few years as these regions recovered from the COVID-19 recession. Demand growth will remain slow in these regions over the forecast horizon as they continue to be constrained by structural

economic problems (high debt, slow population growth, weak public finances, for example) and political instability. In most of the major advanced economies, governments need to shore up their finances after the increases in government spending to offset the impacts of COVID-19. If implemented, higher tax rates or reduced government spending would further contribute to suppress demand growth and a delayed strengthening of finances could result in even greater impacts. The current forecasts call for strong passenger growth for travel between the United States and other world regions, especially over the next few years. An unexpected slowing of worldwide economic activity could push the return of international passenger demand to pre-COVID levels beyond our current forecast of 2024.

Although demand has recovered and U.S. airline finances have improved considerably since the devastating impacts of COVID-19, the outlook for U.S. airline finances is not without risk. For the large network carriers, the steps taken to pay down debt incurred during COVID-19 has reduced the risk of bankruptcy in the next few years. However, many carriers have placed large orders for new aircraft to be delivered over the next 5 years and as new contracts with labor groups (pilots, flight attendants, mechanics) are negotiated and put into effect, U.S. airlines face substantially higher costs. If the demand recovery is slower than forecast, the increase in debt that these carriers are servicing plus the financing of large new aircraft orders along with higher labor costs increase the possibility of a bankruptcy or liquidation. Based on FY 2023 data, the top 6 (American, Delta, United, Southwest, Alaska and Jet-Blue) accounted for about 84 percent of the

U.S. airline industry capacity, and a combined Alaska and Hawaiian would make up about 6.5 percent.

The forecast assumes the addition of sizable numbers of large regional jets (70 to 90 seats) into the fleets of regional carriers. While the recovery in air travel demand from the COVID downturn has been robust, we are not projecting a uniform recovery across all segments. As network carriers continue to adjust the size and breadth of their networks in anticipation of the post-COVID environment, they are continuing to move forward with plans to significantly reduce the numbers of small regional jets they will need. Strong air travel demand has not ensured financial stability for regional carriers, as the bankruptcy filings of Republic Airways in 2016, Great Lakes Airlines in 2018 and Trans States Airlines in 2020 have shown. Financially strong and well positioned regional carriers may see increased opportunities for regional flying because of the network carrier actions, but the overall impact will most likely reduce opportunities for many regional carriers. In addition to managing changing relationships with network carriers, regional carriers have struggled with pilot shortages that have exacerbated during the pandemic recovery. The downturn prompted mainline carriers to reduce costs by, among other measures, offering voluntary retirements to flight crews but, as activity picked up, they drew replacements from the ranks of regionals, causing additional shortages for those carriers. To attract and recruit crews, carriers have raised salaries and offered bonuses, further increasing financial pressures, and possibly leading to new consolidation in the regional airline industry.

The general aviation sector did suffer a downturn in activity in 2020 due to the impacts of COVID-19, but the magnitude of the decline was much less than the decline in commercial aviation. By the end of 2021 most sectors, including corporate and business aviation, were at or exceeding pre-COVID activity levels and GA flight hours exceeded pre-COVID levels. Once returning to pre-COVID levels of activity, future growth in business and corporate aviation is based largely upon the prospects for economic growth and corporate profits. Uncertainty in these leading indicators poses a risk to the forecast, but the risk is not limited to these factors. Other influences, such as potential environmental regulations and taxes do not seem to be as much of a concern in the short term, but over the long term, uncertainties about the direction of these influences may place downward pressure on the forecast.

Overall activity at FAA and contract towers rose 3.7 percent in 2023 and exceed pre-COVID levels. Activity at large and medium hub airports (64 in total) increased 3.9 percent and 0.7 percent, respectively, in 2023, resulting in congestion and delays. In the long run, operations at large and medium hub airports grow faster than the overall national trend and congestion and delays could become critical limits to growth over the forecast period. FAA's forecasts of both demand and operations are unconstrained in that they assume that there will be sufficient infrastructure to handle the projected levels of activity. Should the infrastructure be inadequate and result in even more congestion and delays, it is likely that the forecasts of both demand and operations would not be achieved.

Not only is the volume of aircraft operating at most large hubs expected to increase over the next 20 years, but the mix of aircraft is

changing for this same period. The expected increases in the numbers of larger regional jets and business jets as well as the anticipated widespread deployment of UAS and Advanced Air Mobility (AAM) vehicles into the national airspace system will make the FAA's job more challenging. For example, in adding these new vehicles to the system, they could replace existing traditional aircraft. The integration of UAS and AAM could add to the workload above and beyond the current demand for aviation services.

As passenger demand and activity levels have returned to pre-COVID levels, there have been increasing concerns about the resources needed by the FAA to effectively manage the nation's airspace. The projected increase in activity by traditional aviation sectors (airlines, general aviation) coupled with anticipated growth in new entrant activity (commercial space, UAS/AAM) has renewed focus on FAA resources. In addition, much of the physical infrastructure supporting the nation's air traffic control system needs to be repaired or replaced, further exacerbating the resource concerns. FAA resources may prove to be inadequate to effectively address the myriad of future challenges. The likely result would be greater congestion and delays at airports, increasing airline passenger dissatisfaction. Furthermore, slower growth in new entrant activity could occur, delaying or reducing the benefits to the nation from expansion of these activities.

Increasing concerns about aviation's environmental impacts, including noise and emissions, could potentially limit or delay aviation's ability to grow to meet national economic and mobility needs. Airspace modernization and airport expansion, including new construction, are often contentious because of concerns over noise, air quality, and water quality. Efforts to mitigate aviation's climate

impacts could affect future aviation growth. In Europe, concerns about aviation's climate impact are leading to restrictions on airport expansion activities and proposals to limit short-haul domestic flights. Community concerns across the U.S. about aviation noise have led to increasing levels of public debate, political interest, and even litigation. Without effective measures to mitigate and abate aviation noise, the infrastructure projects and airspace redesign efforts needed to support currently forecasted aviation growth may be delayed. Similarly, community concerns about environmental and/or other considerations (e.g., privacy concerns) associated with UAS, AAM, and commercial space launch activity could impact growth in these aviation areas.

In addition to providing economic benefits, technologies to improve aircraft fuel efficiency and reduce fuel consumption provide benefits in terms of reduced emissions, impacting air quality and climate. Some technologies that improve fuel efficiency also result in reduced noise. Airlines are increasing their use of sustainable aviation fuels, which provides benefits in terms of improved local air quality and lifecycle greenhouse gas emissions reductions. The implementation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), a global market-based measure for international carbon dioxide emissions, will help ensure an approach that is economically preferable to a patchwork of State or Regional-level regulations around the world, and will help to further address aviation's climate im-

pacts. Industry, the U.S. government, and international aviation, through ICAO, have all set an ambitious goal of moving the sector to net zero carbon dioxide emissions by 2050. Continued advancements and fleetwide uptake of sustainable aviation fuels and new aircraft and engine technologies that result in improved fuel efficiency, reduced fuel consumption, noise reduction and reduced emissions are required to ensure that access restrictions or operating limitations on the in-service fleet are minimized.

Widespread deployment of UAS and AAM vehicles, and the electrification of conventional general aviation and short haul aircraft are other potential near-term tools for reducing aviation emissions, provided they replace traditional aircraft in the movement of people and goods and their power requirements are met using sustainable sources. Otherwise, such vehicles would result in a net life-cycle increase in environmental impacts related to greenhouse gas emissions. The environmental impacts of these new entrants from a noise perspective must also be properly understood, recognizing that these vehicles may interact with communities in different ways than the traditional vehicles they replace. The expansion of commercial space launch activity could also change the mix of aircraft in service, with associated impacts on aviation noise and emissions. The emissions from commercial space operations are expected to have a negative impact on both the climate and the ozone layer; however, the magnitude of the impacts is unknown at this time due to the various fuel types currently used to launch vehicles.