

COVID-19 Planning Dashboard and Guidance for Global Aviation Interests

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Introduction

The coronavirus pandemic has significantly impacted most sectors in our society. Most notably affected is the aviation sector, where domestic and international air traffic has ground to a halt. In the U.S., passenger traffic demand decreased by 96% at the height of the pandemic. Across the globe, COVID-19 infections in nearly all countries have similarly reduced international and global traffic demand to unprecedented levels. Due to these impacts and ongoing virus risks, aviation stakeholders supporting Air Navigation Service Providers (ANSP), airport authorities, and flight operators have modified operations to minimize COVID-19 infection risk (and associated disruptions) while still providing needed services.

The U.S. and much of the world has now entered what is expected to be a prolonged and uneven pandemic recovery period that is steeped in uncertainty. Governments are trying to balance the economic losses and hardship with the loss of human life and suffering. Pressure to open businesses and allow more free movement of the public has left transportation service providers scrambling to find a path forward. Air traffic stakeholders are now challenged to anticipate both the ongoing coronavirus threat and evolving resource demand requiring evolving services. This is a particularly daunting challenge given that (Figure 1):

- The pandemic, even in recovery, varies greatly in its severity and associated risks and disruptions around the world, and this variability continues to evolve.
- The behavior and evolution of the coronavirus threat are still not well known, partly because data used to infer both the COVID-19 threat and its effective mitigation is inconsistent, incomplete, or not well understood.
- The societal fallout from the pandemic has affected all countries and all facets of society therein, and understanding primary causal factors to infer anticipated changes or recovery, country by country, to the aviation sector is extremely difficult.
- The global aviation system is a connected network, where each country's unique air travel restrictions must be understood for individual stakeholder organizations to adequately assess evolving resource needs or operating opportunities.

In this balance, all stakeholders comprising the aviation ecosystem must continue to minimize COVID-19 exposure risk while also ensuring that adequate staffing and resources are in place to optimally service returning air traffic demand. The primary objective is to limit air traffic delays and any excess travel time that passengers and airport / airline employees seek to avoid given the ongoing infection threat. This is important given inability to execute ideal social distancing tactics and completely

mitigate infection risks while traveling or while working at airports or air traffic control facilities.

With COVID-19, travel is now a personal safety issue. Everyone must assess their risk level for themselves, their families, and their communities under all circumstances where we come into proximity with someone. So much of this type of movement has been ingrained without requiring this level of awareness and thought. This is new and society is collectively figuring out how to function. Working across its Federally Funded Research and Development Centers (FFRDCs), in areas such as aviation and transportation, healthcare, and homeland security, The MITRE Corporation is investigating the needs and opportunities for U.S. and global aviation stakeholders to strike this balance between coronavirus risk management and optimized and safe service delivery as air traffic demand evolves during the ongoing pandemic. This paper summarizes our approach for a COVID-19 planning dashboard concept for global aviation interests, examines the incremental value and utility of these planning aids, and summarizes its potential applications. Ultimately, decisions and plans derived from these capabilities will contribute to an air traffic operation that focuses more pointedly on public safety, and ultimately saves lives.



Figure 1. Uncertainties and challenges in assessing global aviation system response during the COVID-19 pandemic.

Approach for Providing Initial COVID-19 Planning Insights

Anticipating potential disruptions within the aviation sector, and the impacts on air traffic demand, associated with the coronavirus pandemic is incredibly challenging. Ultimately, all stakeholders want to understand the state of the global pandemic and its effect on air travel 6 to 12 months from now. At these lead times, a range of possible states for the aviation sector can be intelligently surmised, but quantified predictions for infection risks and resource demand cannot be made with enough certainty to support any reasonable planning or decision-making. Predictions of these kinds for such a sustained, multifaceted, and pervasive impact have never been done before. Therefore, when considering forecast capabilities of these kinds, that can provide actionable guidance for aviation stakeholders, we have focused research and development towards:

- Short-term, tactical forecasts that are more trustworthy and support incremental, actionable guidance
- Intuitive insights derived from multiple data areas that collectively describe the pandemic environment within which the aviation system operates

MITRE is investigating two forecast capabilities for the FAA U.S. flight operators, TSA, and airport operators. The short-term forecasts, with lead times from one week to one month, are for (1) potential COVID-19 disruptions at airports and air traffic facilities and (2) air traffic demand for airport and airspace resources. (Figure 2). The COVID-19 potential disruption forecast leverages diverse data¹, models, and epidemiological guidance available across MITRE's FFRDCs. These are being used to forecast airport and ATC facility areas with notably higher or lower potential risk for COVID-19 infections affecting either employees supporting the aviation system or passengers in those areas. Both have consequences that increase chances for operational disruptions (e.g., delay, need / cost for additional cleaning, increased containment / monitoring workload, impact of local air travel sentiment).

At a given time, each airport or air traffic facility is at a disruption level ranging from low to high. The forecast model predicts the risk trend (increasing risk, decreasing risk, no change) within this range and the rate of change (sooner or later with the month). Initially, this tactical forecast focuses on those outlier locations with notably high or low potential disruption due to the virus (see Fig. 2A). This helps to ensure more accurate, actionable guidance, whose applications may range from staffing decisions to informing schedules and strategies of flight operators targeting efficient recoveries while maintaining public health priorities.

Eventually, there will be models to assess these strategies and predict a reversal in disruptions. In parallel, the U.S. COVID-19 planning dashboard will also provide hourly and daily air traffic demand forecasts (see Fig. 2B), out to 4 weeks lead time, for airports, primary city-pairs, and discrete airspace resources (sectors, controller areas, altitude layers, and TRACON and Center airspace).

These short-term forecasts leverage extensive MITRE and FAA air traffic / airspace utilization data, flight restriction data, and non-pharmaceutical intervention (NPI) information and are also informed by pandemic characteristics. Advanced modeling methods are applied to provide near-term predictions of expected air traffic resource demand that must be serviced to minimize avoidable travel delay and excess passenger travel time. Daily monitoring of the forecasts is done to assess conformance tracking with the predictions, with significant deviations triggering additional analysis that may result in changing tactics. In time, the lead-times and resolution of these COVID-19-planning forecasts may be extended and enhanced, but it is important that these capabilities remain within bounds of forecast abilities to consistently provide value to aviation stakeholders.

¹ Data in use includes daily rates of infections / deaths / testing, active non-pharmaceutical interventions, mobility trends and cell phone mobility data, airport passenger volume.

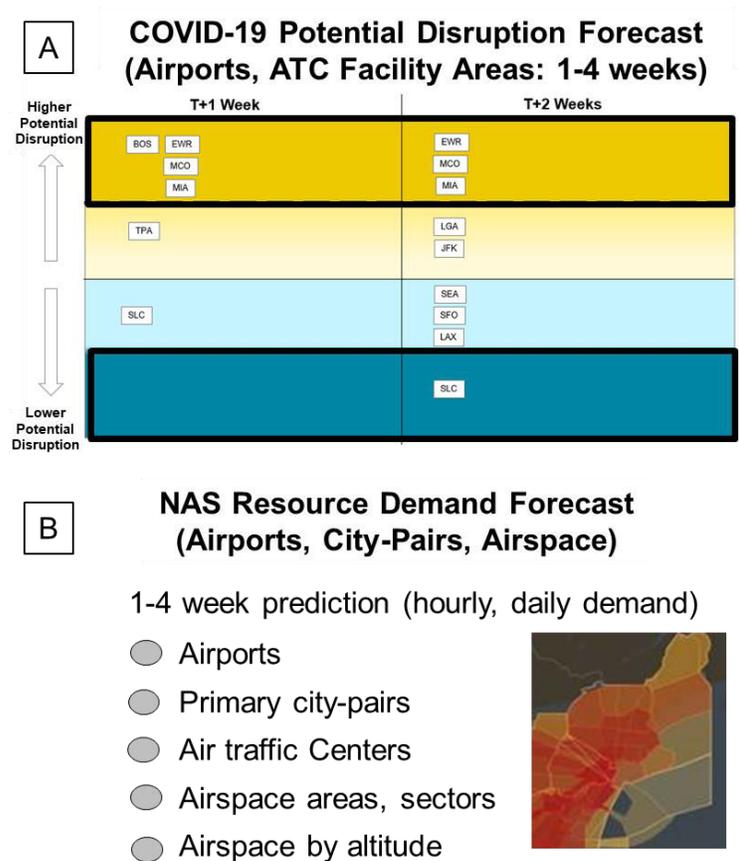


Figure 2. Initial forecasts under development for COVID-19 planning capability targeted for U.S. aviation interests.

As countries remove travel restrictions and allow more international flights, the global nature of aviation and the pandemic requires an understanding of the impact on each country. The U.S. aviation system does not operate in isolation, necessitating that the FAA understand the broader global context. The COVID-19 planning capabilities and dashboard concepts under development for the U.S. are readily extensible to provide the FAA this context and to other international aviation stakeholders. Just as for the U.S., specific information is available that allows tailoring to each country’s interests and needs across the globe. Each country’s Flight Information Region (FIR), and its associated ANSP, airport, and flight operator stakeholders, need intuitive insights and short-term predictions to proactively manage their operations and provide resources that strike an informed balance between virus infection risks (and associated consequences) and optimized service delivery. Along with extensible models and cross-domain expertise, MITRE has access to the needed coronavirus impact / evolution data, by country and its provinces by day, to develop COVID-19 potential disruption

predictions for key airport / air traffic facility locations across the globe. MITRE also has needed global fleet schedule and flight operation data to similarly provide 1-4 week demand forecasts (hourly and daily) for prioritized airports, as well as discrete airspace sectors and FIR domains, around the world. Here, MITRE Global Flight Informatics (MGFI) will be utilized to help translate airport and city-pair fleet schedules and associated, modified forecasts (accounting for ongoing pandemic impacts) to user-selectable airspace demand predictions (Figure 3). MGFI fuses and conditions a broad array of disparate, global aviation data sources to provide operationally meaningful data, including aircraft surveillance data, flight plan data, airline schedules, infrastructure information, and weather.

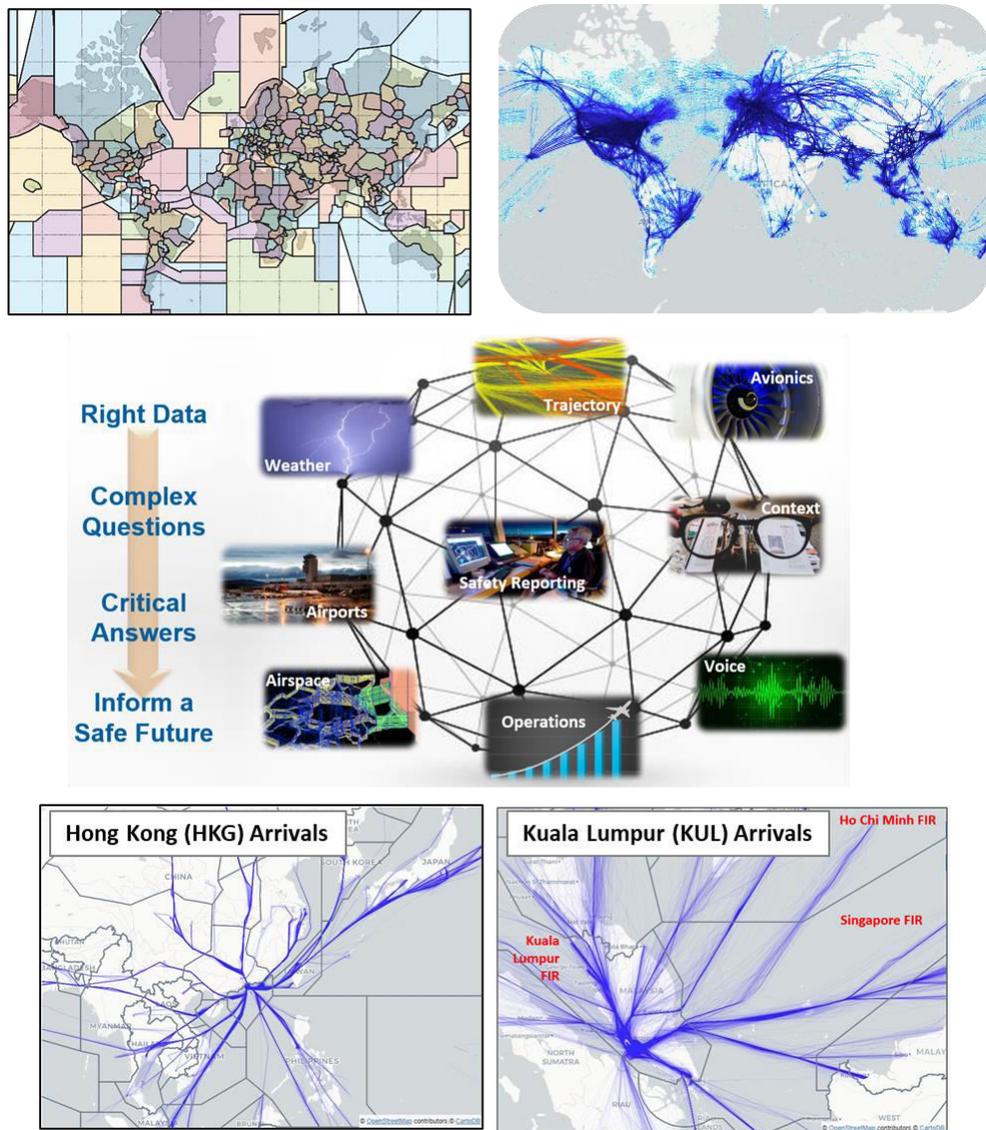


Figure 3. MGFI summary and sample data.

Even prior to development and availability of COVID-19 planning forecasts, there is great value in preparing a COVID-19 dashboard which integrates country-by-country observations and information for quick, comprehensive insights on the current (and trending) state of global aviation amidst the coronavirus pandemic. Currently, it is laborious and time-consuming to extract key information on COVID-19 infections / impact rates and the actions and responses by each country (and/or applicable to other countries) in managing virus impacts and risk, including those actions involving domestic and international air travel. MITRE has access to all this information (Figure 4) and more, as well as hands-on experience and expertise in data preparation data analytics, and dashboard development. We will use MITRE’s mission focus and extensive aviation, health, and security expertise to develop insightful guidance for complex scenarios associated with the COVID-19 pandemic.

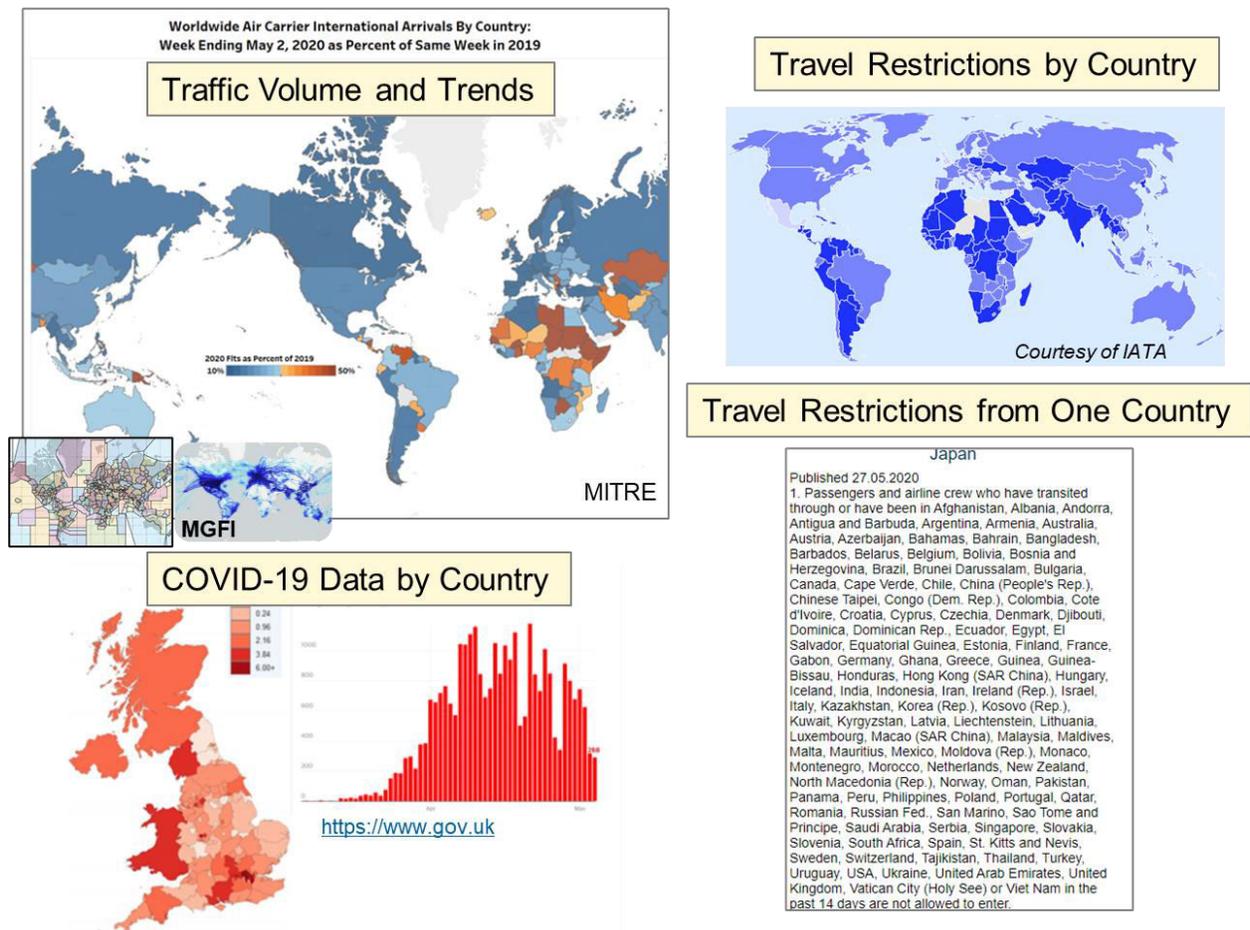


Figure 4. Sample range of disparate data to be parsed and integrated for intuitive COVID-19 planning dashboard supporting global aviation interests.

Summary

The impact of the coronavirus pandemic on global aviation has been historically significant. Many activities taken for granted now have a life-threatening risk. Personal safety is now front-and-center and must be adequately addressed. Demand is slowly returning to the air traffic system, but virus risks persist across the globe and both the societal and global air travel recovery will be uneven, uncertain, and challenging. During this recovery period, which may persist for a long time, global aviation stakeholders will need to balance the needs to minimize COVID-19 exposure risk among employees, the flying public, and the public at large in order to address personal safety. This must be done while also ensuring that adequate resources are in place to prevent unnecessary system delays that may extend operating losses or further expose passengers to discomfort or compromise public safety.

MITRE is leveraging cross-discipline and cross-domain expertise and resources to develop short-term forecasts and dashboards that can assist aviation stakeholders in the U.S. to make proactive data-driven decisions and monitor them. This is done in the context of an efficient air traffic recovery while still emphasizing appropriate public health and security protective measures. With these efforts, MITRE has focused on short-term 1 – 4 week forecasts, specific to airport and airspace operations, of potential disruptions associated with COVID-19 and air traffic demand. Short-term forecasts provide the opportunity to move quickly in developing initial decision support capabilities that will be useful.

The COVID-19 planning capabilities and dashboard concepts under development for the U.S. are readily extensible for international aviation stakeholders and their interests and needs across the globe. A key enabler here is MITRE's MGFI extensible data and analytics suite which provides comprehensive global aviation information that is fused and integrated for optimized utility. Even prior to the development of forecast capabilities, there is great value in preparing an intuitive COVID-19 planning dashboard focused on integrating and disseminating total, country-by-country data and information on COVID-19 infections and risk, flight and quarantine restrictions, and high-resolution, global air traffic data and trends. With this dashboard, previously-stovepiped data by country and FIR will be streamlined to support quick insights and more efficient planning and collaboration for effective service delivery, balanced against public health, among stakeholders supporting the global aviation sector.

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