The Federal Aviation Administration's Approach for Determining Future Air Traffic Controller Staffing Needs

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Air traffic controllers are the frontline operators of the U.S. airspace system, the largest and most complex air navigation system in the world. Controllers' primary function is to separate aircraft safely from one another and from the terrain and to issue safety alerts. At busy facilities, they also support the efficient handling of traffic to increase throughput and reduce delays.

The Right Number

The Federal Aviation Administration (FAA) employs approximately 14,900 air traffic controllers at a cost of $2.8 billion per annum—18 percent of the agency's total budget. Establishing safe and cost-effective levels of controller staffing, however, is not an exact science.

No methods have been established for calculating the number of controllers needed to provide safe air traffic services; information from historical trends provides the only guidance. Data from the National Transportation Safety Board show that controller staffing levels in the United States are safe, at least in the aggregate, but how close these staffing levels are to the limit required to maintain the current safety level is not known.

Staffing to meet demand adds further complications. Controllers generally require two to three years of on-the-job training to qualify fully for all positions at an air traffic control facility, and even fully qualified controllers require at least one year to recertify after transferring to a new facility. Although traffic may suddenly drop in response to external factors—such as the global recession of 2008 or the terrorist attacks of September 11, 2001, in the United States—the controller workforce cannot immediately be right-sized.

The size of the controller workforce that will be available within the next year is also uncertain,

Austin–Bergstrom International Airport in Texas. Air traffic controllers ensure that flights are cleared safely and efficiently.

PHOTO: JIM HOWARD, FLICKR

A plane awaits clearance from the control tower. Retirements among the air traffic control workforce have posed a staffing challenge to the Federal Aviation Administration.

the National Academy of Sciences to study the FAA's methods for estimating the number of air traffic controllers needed for the safe and cost-effective operation of the nation's airspace system. The Transportation Research Board (TRB) and the Board on Human–Systems Integration of the National Research Council convened a 12-member committee of experts (see box, page 45) to address this task. The committee's findings are published in TRB Special Report 314, *The Federal Aviation Administration's Approach for Determining Future Air Traffic Controller Staffing Needs.*

because trainees may fail to qualify and controllers may retire or be promoted to supervisory positions. In recent years, FAA has faced special challenges in preparing for impending retirements. The Professional Air Traffic Controllers Organization strike and subsequent firings in 1981 necessitated the hiring of a large cohort of new trainees; as a result, a large proportion of the controller workforce has reached retirement age in the span of a few years. Staffing levels therefore often have appeared high because trainees had to be brought in to counter the impending retirements.

Request for a Study

In response to long-standing debates about appropriate levels of controller staffing, Section 608 of the FAA Modernization and Reform Act of 2012 tasked

Safety in Staffing

Air traffic control is vital to the safety of aviation operations. Nevertheless, the relationship between controller staffing levels and aviation safety is not well understood.

FAA gathers data on safety from various sources but lacks systematic and proactive mechanisms for analyzing these data in relation to staffing levels. As a result, the agency does not have the data needed for anticipating the safety effects of changes in current controller staffing levels or of changes in air traffic operations as the nation's airspace system is updated.

To overcome this problem, the committee recommended that FAA explore the relationships between controller staffing and safety by analyzing

Air traffic controllers at the Chicago En Route Center in Aurora, Illinois. Better models are needed to estimate staffing at en route centers.

the relevant data, including accident and incident data and voluntary reports from controllers. In addition, the controller workforce should be involved in staffing decisions, particularly as knowledge emerges about related safety issues.

Workforce Size

FAA uses a three-step process to determine the number of controllers needed to manage traffic at each facility:

1. Estimates are generated from mathematical models, including forecasts of air traffic demand.
2. The initial estimates are combined with input from facility managers to calculate staffing ranges.
3. The agency develops a hiring plan and transfer process, producing net changes to the total workforce and to the distribution of the workforce across FAA's 315 air traffic control facilities.

FAA's models for determining air traffic controller staffing needs are suitable for developing the initial estimates of the number of controllers required at terminal areas and airport towers. Nevertheless, the models to estimate staffing numbers for the centers that control air traffic between airports can be improved.

The steps that FAA takes to create and execute a controller staffing plan from the initial estimates are not consistently documented, and various organizations within FAA can modify the steps without coordination. Informed, data-driven decision making about staffing needs and hiring require not only justification but consistent documentation and application of the methods for determining the size of the controller workforce.

The committee therefore recommended that FAA take steps to ensure that the planning and execution of its process for determining air traffic controller staffing are clear, consistent, and transparent to a range of stakeholders, including the controller workforce and the U.S. Congress, which needs the information to set budgets for controller staffing.

Addressing Fatigue Risk

Work schedules determine how many controllers report to a facility at a given time, when they take breaks, and how long they have to recuperate between shifts. The schedules affect the cost-effectiveness of the use of controller staff, particularly at larger facilities, which can benefit from economies of scale.

In addition, scheduling can affect safety. Extensive evidence shows that fatigue is a risk factor in any air traffic control facility that operates 24 hours a day,
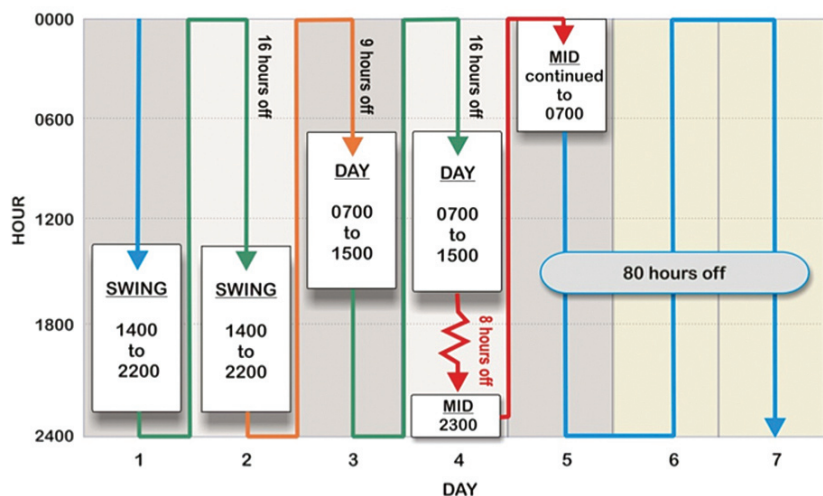

FIGURE 1 Example of a counterclockwise rotating 2-2-1 schedule.

seven days a week. Incidents of FAA controllers falling asleep on the job are rare but are widely publicized, highlighting the issue.

Of particular concern is the so-called "2-2-1" schedule (see Figure 1, above) in which controllers work five eight-hour shifts over four consecutive days, with the last assignment a midnight shift. Controllers favor this schedule, which allows 80 hours off afterward but likely reduces cognitive performance severely during the midnight shift, because of fatigue. The committee recommended that FAA should collaborate with the National Air Traffic Controllers Association to develop and implement an improved scheduling tool as a matter of priority, to create efficient controller work schedules incorporating strategies to mitigate fatigue.

FAA has begun establishing a fatigue risk man-

Hartsfield-Jackson Airport in Atlanta, Georgia. The annual controller workforce plan provides the number of air traffic controllers as well as target staffing ranges for each airport.
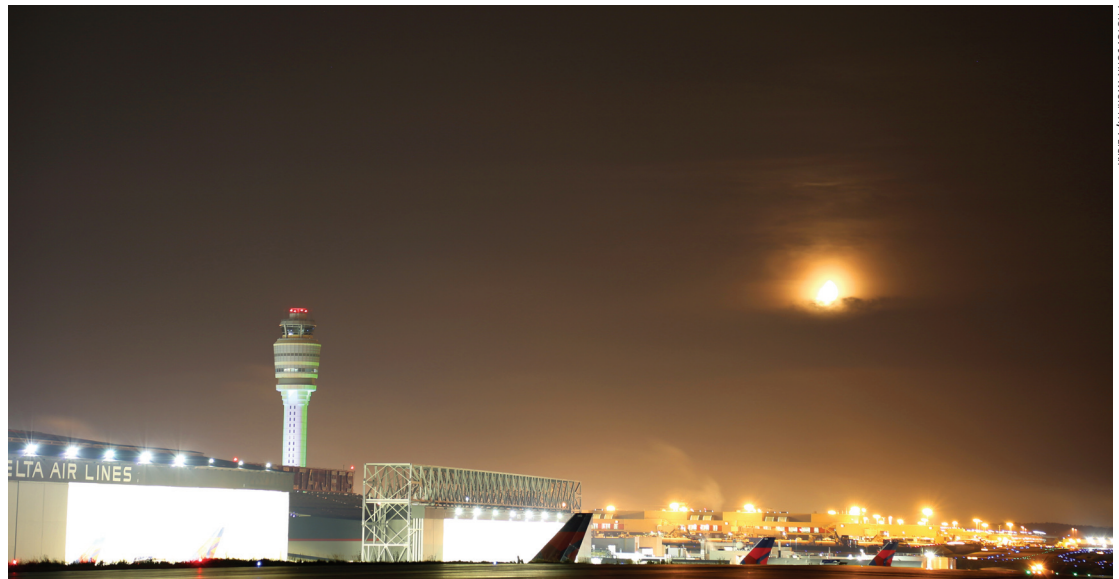
agement program that involves controllers, management, and experts in fatigue. Recent budget cuts, however, have eliminated the ability to monitor fatigue concerns proactively and to investigate whether the recent initiatives to reduce fatigue risks are providing the intended benefits.

Budgets and Cost-Effectiveness

Every year since 2004, FAA has submitted to Congress an updated version of the agency's controller workforce plan. The annual update describes the agency's staffing strategy for the next 10 years and identifies trends in air traffic and in controller staffing levels. In part, Congressional concerns about the cost-effectiveness of FAA's controller staffing stem from the observation that air traffic has declined significantly since its peak in 2000 and is not expected to return to that level in the near term, yet controller staffing levels are similar to those in 2000.

The systemwide data presented in the controller workforce plan are misleading. The data do not indicate that all air traffic control facilities are overstaffed or that controller productivity has dropped dramatically at all facilities since 2000. Several important facilities appear to be chronically understaffed, including the New York Terminal Radar Approach Control, or TRACON, which handles traffic for three major airports: John F. Kennedy, Newark Liberty, and LaGuardia.

Generalizations about controller productivity can mask significant variations at individual facilities. In particular, the volume and nature of traffic vary among facility types; although almost all operations have been reduced since 2000, the decline in air traffic control operations has been pronounced at smaller towers. Staffing levels at smaller facilities,

however, may depend on minimum requirements that are not determined by traffic levels but by the hours that the facility is required to provide service.

The annual controller workforce plan also provides target staffing ranges for all of FAA's 315 air traffic control facilities, as well as the actual numbers of controllers at each facility as of the end of the past fiscal year (FY).

Enabling Consistent Decisions

The lack of consistent documentation of staff planning processes prevented the committee from determining the effect of corrections to staffing imbalances across facilities over time in ensuring cost-effective staffing. The committee did note, however, that transfers of controllers between facilities appear to be poorly coordinated and do not achieve their potential in redistributing the workforce to meet facility targets.

The committee examined the costs of current and future air traffic control budgets and the estimated revenue streams available. The committee also considered hypothetical options for managing cost pressures related to the air traffic control workforce.

A lack of metrics on safety and performance and of information about staffing methods limited the committee's ability to assess the cost-effectiveness of FAA's staffing process, as requested by Congress. Consequently, the committee's recommendations—presented in full in Special Report 314—aim to enable decisions about controller staffing that are consistent; that are driven by proper science and data analysis; and that will address the interrelated goals of ensuring safety, meeting the operational needs of the aviation community, and demonstrating cost-effectiveness.
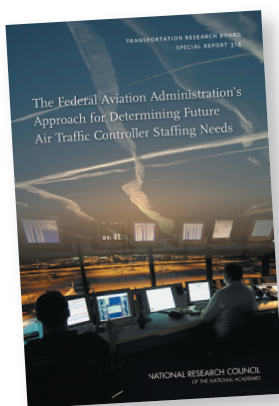
TRB Special Report 314, *The Federal Aviation Administration's Approach for Determining Future Air Traffic Controller Staffing Needs*, is available from the TRB online bookstore, https://www.mytrb.org/Store/Product.aspx?ID=7383; to view the book online, go to www.trb.org/Main/Blurbs/170870.aspx.