U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF INSPECTOR GENERAL

Underlying Data Quality Issues Hinder the Staffing and Placement of FAA's Maintenance Technicians

FAA

Underlying Data Quality Issues Hinder the Staffing and Placement of FAA's Maintenance Technicians

Requested by the House Committee on Appropriations

Federal Aviation Administration | AV2018057 | June 27, 2018

What We Looked At

The Federal Aviation Administration's (FAA) Technical Operations (Tech Ops) employs approximately 6,000 maintenance technicians who play a vital role in repairing, replacing, and certifying air traffic equipment. This workforce is the second largest mission-critical workforce in FAA after air traffic controllers. Therefore, a properly sized technician workforce is important to the safety and efficiency of the National Airspace System. In its 2017 Report, the House Committee on Appropriations directed us to assess FAA's plans for hiring and placing maintenance technicians. Accordingly, our objectives were to evaluate FAA's (1) methodology for determining maintenance technician staffing levels and (2) process for placing maintenance technicians.

What We Found

FAA does not have an effective method for accurately determining maintenance technician staffing levels. Although FAA has developed a Tech Ops Staffing Model, the model lacks several key factors and includes incomplete, inaccurate, and in some instances outdated workload, time reporting, and equipment inventory data. Until these issues are resolved, the model cannot be used to project staffing needs, and true staffing requirements remain unknown. In addition, although FAA has established a process for placing maintenance technicians, it does not ensure technicians are placed when and where they are most needed. In 2014, FAA instituted a standard operating procedure to establish staffing targets for maintenance technicians at facilities. However, the targets have not been clearly defined or validated for accuracy. In addition, FAA developed a priority tool to improve hiring and placement prioritization. However, the tool does not yet account for new technician training and certification time (approximately 2 to 3 years), making it difficult for the Agency to correctly place new technicians on an annual basis.

Our Recommendations

FAA concurred with all six of our recommendations to help improve its policy and procedures concerning the staffing and placement of maintenance technicians.

All OIG audit reports are available on our website at www.oig.dot.gov.

For inquiries about this report, please contact our Office of Legal, Legislative, and External Affairs at (202) 366-8751.

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Memorandum

Date: June 27, 2018

Subject: Underlying Data Quality Issues Hinder the Staffing and Placement of FAA's
            Maintenance Technicians | Report No. AV2018057

From: Matthew E. Hampton
            Assistant Inspector General for Aviation Audits

To: Federal Aviation Administrator

The Federal Aviation Administration (FAA) operates a vast network of facilities and communication, navigation, and surveillance equipment for managing air traffic throughout the United States. In recent years, FAA has experienced several catastrophic events that tested the Agency's ability to repair or replace damaged equipment and restore normal operations. For example, in September 2017 Hurricane Maria severely damaged Puerto Rico's aviation system, including air-to-ground and ground-to-ground communications, navigation, surveillance, and automation services. After the storm passed, FAA maintenance engineers and technicians volunteered to help the local workforce assess the damage, perform repairs, and develop repair/replacement plans. This event demonstrated the vital role maintenance technicians play in restoring airspace to normal operations.

FAA's Technical Operations (Tech Ops) employs approximately 6,000 Airway Transportation Systems Specialists, or ATSS (referred to in this report as maintenance technicians).[1] This workforce is the second largest mission-critical workforce in FAA after air traffic controllers. Therefore, a properly sized maintenance technician workforce is critical to the safety and efficiency of the National Airspace System (NAS). In its 2017 Report,[2] the House Committee on Appropriations directed us to assess FAA's plans for hiring, training, and placing maintenance technicians. Accordingly, our objectives are to evaluate FAA's (1) methodology for determining maintenance technician staffing levels and

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[1] FAA's Tech Ops service unit consists of several different job series that perform maintenance; however, we focused our audit work on the approximately 5,000 ATSS, job series 2101, which perform direct maintenance on NAS equipment.
[2] H. Rept. No. 114-606, at 17 (2016).

(2) process for placing maintenance technicians. In a follow-up review, we will address the Committee's concerns about training for maintenance technicians.

We conducted our work in accordance with generally accepted Government auditing standards. Exhibit A details our scope and methodology. Exhibit B lists the entities we visited or contacted.

We appreciate the courtesies and cooperation of Department of Transportation representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500 or Nelda Smith, Program Director, at 202-366-2140.

cc: The Secretary
        OST Audit Liaison, M-1
        FAA Audit Liaison, AAE-100

Results in Brief

FAA does not have an effective method for accurately determining Tech Ops maintenance technician staffing levels.

Although FAA developed a Tech Ops Staffing Model (TSM) in response to a National Research Council (NRC) study,[3] the model lacks several elements necessary to make reliable staffing projections. For example, the TSM does not account for fatigue mitigation requirements. In addition, the data used in the TSM are incomplete, inaccurate, and in some instances outdated. For example, in the TSM, FAA relies on estimates from subject matter experts to determine average annual maintenance times—rather than statistical data or data derived from actual maintenance logs—which historically has resulted in overestimations of technician workload. FAA's data weaknesses are due in part to inaccurate equipment inventory data, as well as technician time records that are inconsistent, inaccurate, and not recorded timely. As a result, the TSM does not yet accurately project maintenance technician staffing requirements.

Although FAA has established a process for placing maintenance technicians, it does not ensure technicians are placed when and where they are most needed.

In 2014, FAA recognized the need to improve the hiring and placement of maintenance technicians, and has taken some steps, such as instituting a standard operating procedure[4] and developing a tool to help place new technicians. However, some weaknesses limit the effectiveness of FAA's process. For instance, the standard operating procedure does not clearly define who is included in staffing targets, such as System Specialists and System Support Center Coordinators,[5] and does not define what constitutes a "watchstander," a critical staffing position.[6] According to our interviews, technicians become "watchstanders" after management endorses that they have the skills and knowledge to work independently in their area of specialty. In addition, although the standard operating procedure states it will be reviewed and updated annually, FAA has not updated the document since 2014, when it was first

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[3] National Research Council, *Assessment of Staffing Needs of System Specialists in Aviation* (Washington, DC: The National Academies Press, 2013).

[4] Federal Aviation Administration, Standard Operating Procedure: Tier 1/2/3 Staffing Allocations and Tier 1 Watch Coverage Requirements, 2014.

[5] The system specialists and coordinator positions are considered subject matter experts. They perform maintenance, coordinate work activities, and assist maintenance technicians with troubleshooting and restoring difficult equipment and service outages.

[6] FAA does not define a watchstander, but according to the National Research Council, watchstanders must have sufficient knowledge, skills and judgement to recognize and respond to unplanned or unanticipated equipment outages.

introduced. Therefore, it is unclear if FAA's staffing targets adequately reflect Support Center's staffing needs. This is a particular concern given that FAA has not validated its staffing targets to verify their accuracy. Also, FAA's hiring priority tool lacks key factors to correctly prioritize and place maintenance technicians, such as the training and certification time of new hires. This is important because it can take 2 to 3 years to fully train and certify a newly hired maintenance technician, and technicians-in-training are significantly limited in the duties they can perform. These limitations make it difficult for FAA to correctly prioritize hiring needs and ensure accurate placement on an annual basis.

We are making six recommendations to help FAA improve its policy and procedures concerning the staffing and placement of maintenance technicians.

Background

FAA's Tech Ops workforce maintains over 66,000 pieces of equipment at more than 400 facilities, otherwise known as System Support Centers (i.e., Support Centers) throughout the United States and its territories.[7] FAA's Support Centers are located in three Service Areas (Eastern, Central, and Western) and are managed geographically by District Offices. The Support Centers employ technicians that specialize in one or more of five areas of specialty: communication, surveillance, navigation, automation, and environmental. Each area of specialty requires specific training and certification requirements; therefore, individual maintenance technicians are not typically interchangeable.

Numerous studies have focused on FAA's maintenance technicians. In 2010, the Government Accountability Office (GAO) released a report evaluating FAA's workforce planning practices; the report identified the need for a more comprehensive plan that considered the competencies and number of technicians needed to certify and maintain equipment. In 2011, an assessment commissioned by FAA concluded that neither of the Agency's available models meets the criteria of a technician staffing model.

In 2012, the FAA Modernization and Reform Act[8] mandated a study of the assumptions and methods FAA uses to estimate the number of maintenance technicians it needs. In 2013, the NRC recommended FAA develop a new staffing model that includes nine key factors. Following the release of the NRC report,

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[7] In total, Tech Ops maintains over 74,000 pieces of equipment located at more than 10,000 different facilities, such as flight service stations and air traffic control towers.
[8] Public Law 112-95, § 605 (2012).

FAA contracted with a vendor to develop the TSM to improve the Agency's previous staffing models.[9]

The role and size of FAA's Tech Ops workforce remains a question with significant budgetary implications given FAA technicians no longer install or maintain all elements of the NAS. For instance, FAA has contracted both ownership and maintenance responsibilities associated with several recent billion-dollar programs, particularly Data Communications (DataComm)[10] and Automatic Dependent Surveillance – Broadcast System (ADS-B).[11] However, FAA remains responsible for certifying and ensuring the safety of these systems.

FAA's Staffing Model Incorporates Several Recommended Factors, but Underlying Data Problems Impede Its Effectiveness

FAA developed the TSM in response to a NRC study; however, the staffing model does not include several factors recommended by the Council. Moreover, data used in the TSM are incomplete, inaccurate, and in some cases outdated. As a result, the staffing model cannot be used at this time to accurately project maintenance technicians staffing requirements.

FAA's Staffing Model Includes Six of the Nine Factors Recommended by the National Research Council

In 2013, the National Research Council conducted a study of FAA's method for estimating the number of maintenance technicians needed. In particular, the Council recommended that FAA develop a new robust staffing model that includes nine factors, listed in table 1. In response, FAA developed the TSM. The TSM uses data from multiple sources to quantify and transform workload (hours spent on maintaining equipment) into full-time equivalent (FTE) counts for non-supervisory maintenance technicians at Support Centers.

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[9] FAA estimates that TSM development costs were approximately $750,000.

[10] DataComm is a data link communication service that is currently in use at 57 airports which allows 2-way digital messages between air traffic controllers and pilots.

[11] ADS-B is a satellite-based surveillance technology that combines the use of satellites, aircraft avionics, and ground-based systems to improve aircraft location information for pilots and air traffic controllers.

During our review, we evaluated FAA's progress incorporating the Council's nine recommended factors into the TSM (see table 1).

Table 1. Status of the National Research Council's Nine Recommended Factors

Recommended Factors	Status
1. **New hire training**. The time required for new hires to complete formal training at the FAA training center in Oklahoma City, receive on-the-job training (OJT), and complete certification, and the increased workload on technicians who provide OJT.	**Incomplete.** The TSM does not account for training time associated with new hires, including academy training, OJT, certification, or the increased workload on technicians who provide OJT.
2. **Distance and travel time**. The distance maintenance technicians must travel to reach remote facilities and the time required to make the trip.	**Complete.** The TSM includes a factor for travel time based on work location. The model does not include a factor for distance traveled. However, we believe the travel time factor effectively addresses distance traveled.
3. **Environmental challenges**. The potential challenges involved in maintaining equipment near a hazardous area or located in places that experience severe weather.	**Complete.** The TSM includes a credit for NAS equipment that is exclusively located in Alaska because Alaska has a reliable statistical basis for having environmental challenges, such as harsh weather conditions and expansive geographical area.
4. **Leave**. The time dedicated to serving in the military reserves or taking other forms of leave, including family and medical leave.	**Complete.** The TSM includes a leave allowance as a lump sum average calculation per person for all earned leave including military leave.
5. **Fatigue**. The ability of maintenance technicians to meet all the job demands without being unduly fatigued.	**Incomplete.** The TSM does not include a factor to address fatigue.
6. **Safety factors**. Safety requirements that include the need to have two (or more) workers in some situations (e.g., working on high-voltage equipment).	**Complete.** The TSM includes an additional workload factor for equipment that requires two workers.
7. **Problems with FAA's time reporting systems.** Problems with current time reporting systems, such as Labor Distribution Reporting (LDR) and Remote Monitoring and Logging System (RMLS), which provide data for estimating the time maintenance technicians spend on daily tasks.	**Incomplete.** Although FAA has tried using RMLS data and conducted a study to improve LDR data, issues of completeness and quality of the data continue to be an outstanding concern.
8. **Aging workforce concerns.** Pending retirements and attrition.	**Complete.** Attrition, including retirement data, is not in the TSM, but FAA has developed a separate attrition model that it is currently testing. In addition attrition and retirement data is included in the hiring priority tool, which guides maintenance technician placement.
9. **Other requirements on personnel time.** Nontechnical training and administrative tasks.	**Complete.** The TSM includes allowances for nontechnical training, administrative duties, flight check, escort, inspection, and installation.

Source: OIG Analysis and National Research Council. Assessment of Staffing Needs of System Specialists in Aviation, 2013

As shown in table 1, FAA has not fully addressed the following three recommended factors in the TSM:

- **New hire training and certification time.** The TSM does not address the significant amount of time required to train and certify new technicians. According to an FAA official, during the TSM development stage, FAA decided that the model should only predict how many fully certified maintenance technicians are needed regardless of hiring and attrition. FAA planned to develop a separate model that includes new hire training time and attrition. As of March 2018, FAA has developed and is testing a separate attrition model, but new hire training and certification time remains unaccounted for.

- **Fatigue requirements outlined in labor agreements.** The TSM does not include fatigue mitigation requirements agreed to in the 2014 Memorandum of Agreement between FAA and Professional Aviation Safety Specialists (PASS), the labor union that represents maintenance technicians.[12] The memorandum states that maintenance technicians must have a minimum of 9 consecutive hours, free of duty, between all scheduled activities and must receive managerial approval to work in excess of 14 consecutive hours. According to an FAA official, the Agency chose not to include these requirements in the TSM because fatigue can be addressed through work schedule modifications. However, modifying technicians' work schedules is challenging because the basic watch schedule is established a year in advance, and emergency repairs are often unforeseen. When repairs are required outside of normal work schedules, technicians may not be available to work their next assigned shift due to the 9-hour rest requirement. Instead, another technician must fill in, resulting in reduced staffing for other shifts or increased overtime.

- **Problems associated with time-reporting systems.** The Council recommended FAA improve its time-reporting systems, specifically Labor Distribution Reporting (LDR)[13] and Remote Monitoring and Logging System (RMLS),[14] to more accurately estimate the time technicians spend on daily maintenance tasks. FAA agrees that improving the deficiencies in its time-reporting systems is a major unresolved factor that must be addressed to make reliable staffing estimates. In 2013, FAA attempted to use actual maintenance information from RMLS. However, FAA found that RMLS produced results that could not be used for the staffing model because the system is designed to capture work performed, not track

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[12] The agreement took effect in January 2015.
[13] Technicians use LDR to record time and attendance.
[14] Tech Ops personnel use RMLS to record, track, and report maintenance and administrative activities related to the operational performance of NAS equipment.

maintenance time. Also, FAA found that RMLS is missing key information, such as crew size and travel time. FAA concluded that updates that could improve RMLS, such as adding new reporting fields, would likely take years to implement. More recently, in 2017, the Agency hired a consultant to analyze FAA's current use of LDR codes and recommend ways to improve Tech Ops' LDR reporting and accuracy.[15] However, FAA has not yet developed an action plan to address the recommendations to improve the LDR.

Lastly, age of equipment was not a factor considered by the Council; however, one of FAA's consulting firms explored the impact of age of equipment on maintenance time. The firm found that facilities with older equipment (commissioned 20-plus years ago), especially in the Northeast, logged more maintenance hours per piece of equipment than the national average.[16] In addition, according to GAO,[17] the age of equipment and facilities, and the resulting deterioration, contribute to the increase in outages and repair time. Although many factors—such as equipment age, location, and usage—can impact maintenance, FAA has not conducted a detailed analysis into whether equipment age impacts the number of maintenance hours, and how that correlation affects staffing needs.

Incomplete, Inaccurate, and Outdated Data Impede the Model's Effectiveness

As noted earlier, FAA's staffing model lacks comprehensive, reliable data on how maintenance technicians account for their work time. Specifically, the Agency does not have a single, primary system that records time spent performing maintenance and other activities. Therefore, FAA currently uses multiple sources for the TSM, including systems that maintain data related to timekeeping (LDR), equipment (Facility, Service, and Equipment Profile or FSEP),[18] and training (Electronic Learning Management System or eLMS).[19] We found a number of weaknesses associated with the data used in the TSM, as described below.

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[15] Ernst & Young LLP, DTFAWA-12-D-00066, Final Task B–Labor Distribution and Reporting Analysis, March 31, 2017.

[16] The consulting firm, Ernst & Young, LLP did not publish any results or examine whether increased maintenance hours or workload impacts staffing requirements.

[17] GAO, *Agency Is Taking Steps to Plan for and Train Its Technician Workforce, but a More Strategic Approach Is Warranted* (GAO 11-91), October 2010.

[18] FSEP is FAA's official inventory of NAS equipment and systems.

[19] eLMS is FAA's official source of personnel training histories, course profiles, scheduled offerings, and personnel training enrollments.

Workload Assessments

FAA relies heavily on technician surveys and workload assessments, which are based on the opinions of subject matter experts, but not statistical or reliable data. Workload assessments estimate the average amount of time it takes to maintain equipment elements or perform an annual activity. Specifically, maintenance times in the assessments are derived from time studies and consensus judgments of subject matter experts, supplemented by contractor-provided times for new equipment. Due to issues with data quality in FAA's time reporting system, workload assessments serve as a primary data source for maintenance time in the TSM. However, as both FAA and an FAA consultant have reported, the assessments have historically overestimated workload and have caused the TSM to overestimate staffing needs by as much as 50 percent.[20]

Our analysis identified other limitations of the workload assessments, including:

- **Infrequency of Workload Assessments.** FAA does not assess the maintenance time associated with key equipment every year. Similar to a 2012 study by an FAA consultant, we found that workload assessments are performed every 3 years, and the estimated time values for many pieces of equipment have not been reviewed or updated for almost 20 years. As a result, the estimated maintenance time values the Agency obtains from the workload assessments are not up-to-date for all equipment.

- **Incomplete and Inconsistent Equipment Inventory Data.** Another primary data source for maintenance work time is FAA's equipment inventory database, FSEP, which includes the types and quantities of NAS equipment at each Support Center. However, in 2013, FAA identified inconsistencies within FSEP. Without a correct accounting of how many types of equipment need to be maintained, it is difficult for FAA to accurately estimate workload and predict staffing needs. Although FAA began conducting yearly audits to improve FSEP data integrity, Agency guidance[21] does not require FSEP data to be validated by national or Service Center FSEP program managers at defined intervals before the staffing model is run. As a result, there is no assurance that the staffing model has accurate data about equipment and workloads.

Labor Distribution Reporting

LDR has the ability to capture all daily tasks, including maintenance and leave. However, LDR is highly dependent on whether technicians accurately enter their

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[20] Ernst & Young LLP, DTFAWA-12-D-00066, Task A–Tech Ops Staffing Standards Evaluation and Improvement Assessment Final, April 19, 2017.

[21] FAA Order 6000.5E, Facility, Service, and Equipment Profile (FSEP), August 1, 2017.

time and use the proper codes. Due to data-quality issues identified by FAA and a consultant in 2012, currently LDR cannot be used to estimate direct maintenance workload. Therefore, LDR is only used in the TSM as the primary data source for leave and a secondary data source for other duties. Problems associated with LDR, which we identified during both site visit interviews and our review of the consultant's data analysis, include:

- **Numerous Project Codes and Descriptions.** FAA's Tech Ops uses thousands of LDR codes to distinguish between work location, type of equipment, and type of maintenance performed. A 2017 consultant's review found that in calendar year 2015, Tech Ops used 48,243 unique LDR project codes. In contrast, all of FAA's lines of business and staff offices combined used less than 1,400 unique project codes. The consultant recommended that Tech Ops establish a standard LDR code structure and project descriptions. To date, FAA has not developed an action plan to address the recommendation.

- **Inconsistent and Inaccurate Reporting.** FAA's LDR policy[22] and the FAA and PASS Collective Bargaining Agreement[23] require employees to report time and attendance, which includes hours worked by project and activity, into the LDR each pay period. The policy also requires supervisors to assign project/activity codes to employees and review and approve the LDR data they submit. Our site visit interviews confirmed the findings of FAA's consultant in 2012, which found that maintenance technicians do not consistently enter their time in the LDR. For instance, the consultant found, and several technicians we interviewed stated, that they often log maintenance work to a single generic LDR code, such as Watchstanding, rather than to specific maintenance activities.

- **Lack of Timely Recording.** The LDR policy states that "employees should record their time by project, at a minimum, on a daily basis." According to technicians we interviewed, although they did enter their time and attendance into LDR by the end of the pay period, they did not necessarily record it in on a daily basis. For instance, technicians at more than half of the Support Centers we visited stated that accurately recording actual daily work takes a significant amount of time, and many wait until the end of the day or pay period to try to recall and record all of their work activities. In addition, technicians stated they rarely have access to Wi-Fi-enabled laptops, which inhibits their ability to enter their LDR time while working at remote locations.

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[22] FAA Order 2700.37, Labor Distribution Reporting, July 18, 2001.
[23] Collective bargaining agreement between FAA and PASS, effective December 16, 2012.

Although FAA developed the TSM to estimate the number of technicians needed based on hours spent maintaining equipment, it has not produced reliable results. For example, FAA adjusted the TSM results to match the Tech Ops budget-based staffing target by manually changing the workload associated with 29 different pieces of equipment. According to FAA, these adjustments reflected changes based on a review of pieces of equipment that consistently under- or overestimate workload at specific locations. FAA continues to adjust the TSM results, as needed, after each model run. Therefore, the TSM is not being used to drive budget decisions or project future maintenance technicians staffing needs, as intended. Until the underlying data problems, especially those associated with workload are resolved, FAA cannot use the TSM to accurately determine staffing needs, and its true staffing requirements remain unknown.

FAA Has a Process for Placing Maintenance Technicians, but It Does Not Place Them When and Where They Are Needed Most

Although FAA developed a standard operating procedure in 2014 to establish maintenance technician staffing allocation targets for Support Centers, the targets have not been clearly defined or validated. In addition, FAA developed a hiring priority tool to help prioritize hiring at the national level and help place maintenance technicians. However, limitations in the hiring priority tool, such as a lack of consideration for new hire training and certification times, diminish its effectiveness. As a result, it is difficult for FAA to correctly prioritize Support Centers' hiring needs to ensure it is placing technicians where and when they are most needed.

FAA Has a Process for Allocating Maintenance Technicians but Has Not Clearly Defined or Validated Its Staffing Allocation Targets

Beginning in 2014, FAA established a new process—a standard operating procedure—for determining maintenance technician staffing targets at Support Centers. Under this new procedure, FAA's process for determining staff levels depends on the Support Center's tier level. Specifically, FAA divided the Support Centers into three tiers—Tier 1, Tier 2, and Tier 3. The differences have not been clearly defined by FAA, but based on our analysis, the tier levels are loosely based

on the activity level of the facility where the Support Center is located (see table 2).

Table 2. Description of Tier 1, Tier 2, and Tier 3 Support Centers

Tier 1	Tier 2	Tier 3
169 Support Centers	36 Support Centers	202 Support Centers
Located at high activity facilities: • 21 Air Route Traffic Control Centers • 7 Large TRACONs • 30 Core Airports including 4 that FAA considers as Key Airports • Andrews Air Force Base • Boston TRACON	Located at midsize air traffic facilities, such as: • Pittsburgh • Cleveland • Albuquerque • Sacramento • St. Louis	Located at small activity air traffic facilities , such as: • Tulsa • Dayton • Birmingham • Wilmington • Fargo

Source: OIG Analysis of the FAA's Fiscal Year (FY) 2017 Hiring Priority Tool (HPT), as of September 2016.

Depending on the tier level, FAA manages its staffing processes as follows:

- **Tier 1.** FAA's Tier 1 Support Centers are typically located at the most busy or complex air traffic facilities. For the Tier 1 Support Centers, FAA's standard operating procedure contains a series of staffing tables that specify how many staff the Support Centers should have. In particular, the standard operating procedure includes four staffing tables that provide different allocations for Support Centers located at Air Route Traffic Control Centers (ARTCC),[24] Large Terminal Radar Approach Control facilities (TRACON),[25] and Core and Key Airports.[26] These staffing allocation targets vary based on the

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[24] ARTCCs are the major communication hubs for flight-plan routing and the systems that provide radar and communication services to aircraft operating above 18,000 feet. FAA has 21 ARTCCs geographically dispersed across the United States.

[25] TRACONs house FAA air traffic controllers who use radar displays and radios to control aircraft approaching and departing airports generally within a 30- to 50-mile radius up to 10,000 feet, as well as aircraft flying over that airspace. The standard operating procedure contains staffing allocation targets for seven large TRACONs located in Atlanta, New York, Dallas/Fort Worth, Chicago, Southern California, Virginia, and Northern California.

[26] The standard operating procedure includes staffing targets for the Core 30 Airports, which are the top 30 U.S. airport in terms of passenger activity, and distinguishes four of these as Key Airports: Chicago O'Hare International, Memphis International, Atlanta Hartsfield-Jackson International, and John F. Kennedy International. The standard operating procedure includes different staffing targets for Key Airports.

hours and days of operation, number of specialty areas, and in some cases equipment type.[27]

- **Tier 2 and Tier 3.** For FAA's Tier 2 and Tier 3 Support Centers, which are typically lower activity airports, FAA does not use staffing tables. Instead, FAA sets the staffing allocation targets once per year based on the TSM's recommended allocation targets and the current Actual-On-Board (AOB) staffing numbers.

We identified numerous deficiencies associated with the standard operating procedure that limit the effectiveness of the staffing allocation targets. For example:

FAA's Standard Operating Procedure Does Not Clearly Define Who Is Included in the Staffing Targets

The standard operating procedure does not articulate which job series are included in the staffing allocation numbers for Key or Core Airports and only uses the term "positions." In addition, according to the standard operating procedure, the allocated staffing numbers for large TRACONs include watchstanders, System Specialists, and System Support Center coordinators. Although the term watchstander is commonly used by FAA Tech Ops, the standard operating procedure does not define watchstander or establish minimum criteria for determining when a technician is considered qualified to stand watch. As a result, some managers were unclear as to who was included in the staffing target for their Support Center. Moreover, without clear definitions of which positions are included in its staffing targets, FAA cannot effectively validate that the targets are accurate.

FAA's Standard Operating Procedure Is Outdated and Staffing Targets Have Not Been Validated for Accuracy

Although FAA's standard operating procedure states that the document will be reviewed and updated annually, FAA has not updated the procedure since it was created in 2014. Furthermore, there is no requirement for FAA to validate the standard operating procedure's staffing allocation targets to ensure the number and type of technicians allocated for each specialty area and facility type is sufficient. As a result, the staffing targets in the standard operating procedure may not accurately align with each Support Center's needs.

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[27] For example, a Support Center located at an ARTCC that maintains automation equipment 16 hours a day 7 days a week has a staffing allocation of 10. Whereas, a Support Center located at a Key Airport that maintains automation equipment 16 hours 7 days a week has a staffing allocation of 7.

Tier 1 staffing allocations in the standard operating procedure are fixed and do not change without approval from all three Service Area Directors. In contrast, Tier 2/3 staffing allocation targets can be managed and updated by Service Area District Offices once per year. However, an FAA Headquarters official and several support managers we interviewed expressed concerns that this approach does not give managers the flexibility to adapt to changing staffing conditions, such as unexpected attrition, that can significantly impact a Support Center's workload and staffing needs. This is of particular concern because, as we noted, FAA does not perform annual reviews of the standard operating procedure to determine whether updates are needed. Given that FAA's staffing targets are used to guide hiring, the lack of flexibility to adjust the targets may leave Tier 1 Support Centers understaffed for a longer period of time than necessary.

FAA's Hiring Priority Tool Lacks Key Factors To Correctly Prioritize and Place Maintenance Technicians

FAA determines where to place newly hired maintenance technician staff using its hiring priority tool that the Agency began using in March 2014. Although FAA developed the hiring priority tool to improve hiring and training prioritization, the process is complex and the priority ranking does not include the significant time new technicians need to complete equipment training courses and certification.

FAA's hiring priority tool is used twice a year and identifies the critically understaffed Support Centers for hiring priority. In order to determine prioritization, the tool calculates the adjusted onboard staffing,[28] then compares the adjusted onboard staffing directly to the staffing allocation target[29] for each Support Center, to rank each Support Center's hiring priority. Based on the scoring system, the higher the score, the higher the Support Center ranks for priority placement. For example, the Support Center ranked number 1 receives the highest priority in hiring.

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[28] The hiring priority tool determines the adjusted onboard staffing by adding the number of AOB staff plus the number of potential new hires pending clearance minus projected retirements and other losses.

[29] The staffing allocation targets for the Tier 1 Support Centers are based on the tables in the standard operating procedure, while the Tier 2/3 Support Centers' staffing targets are based on the TSM's recommended allocation targets and the current AOB staffing numbers.

FAA's hiring priority tool is still a fairly new process, and the Agency is monitoring its usefulness and making updates accordingly. However, our analysis of the tool thus far indicates that there are limitations that impede its effectiveness for placing maintenance technicians:

- **New Hire Training and Certification Time.** The priority ranking does not include a factor to account for the amount of time new technicians need to complete training and certification, making it difficult for the Agency to correctly staff and prioritize the placement of new technicians at Support Centers on an annual basis. According to FAA, it takes a new technician 2 to 3 years to complete training assignments (see exhibit D). Although the National Research Council recommended that FAA include new hire training and certification time in its maintenance technician staffing model, this time is not included anywhere in the process, in either the TSM or the hiring priority tool.

- **Reliable Data.** As indicated previously, FAA has not clearly defined or validated its staffing allocation targets, which directly affects the results of the hiring priority tool. Uncertainty regarding the validity of the staffing targets and the definition of a watchstander has a significant impact on the formula FAA uses to prioritize Support Center staffing needs. Coupled with the exclusion of the amount of time it takes to train and certify new technicians, FAA's data reliability issues make it difficult for the Agency to correctly prioritize hiring needs to ensure it is placing technicians where and when they are most needed.

Conclusion

FAA's maintenance technician workforce plays a vital role in the safety and efficiency of the Nation's air transportation system. FAA has taken some steps to better determine how many technicians it needs and where they are most needed. However, the Agency still has much work to do to ensure its maintenance workforce is correctly positioned to respond to major system failures and support new capabilities. Until FAA takes steps to improve its data, validate its staffing targets, and factor in key considerations such as training into its staffing models, FAA cannot ensure it is accurately projecting maintenance technician staffing needs—now or in the future.

Recommendations

To improve policy and procedures concerning the staffing and placement of FAA's maintenance technicians, we recommend that the Federal Aviation Administrator:

1. Determine the impact of new hire training and certification time and fatigue mitigation requirements on technician staffing and incorporate into the maintenance technician staffing process.

2. Determine the impact of equipment age on workload and maintenance technician staffing needs and incorporate this factor into the staffing model, if found to be statistically significant.

3. Review and update the Facility, Service, and Equipment Profile policy to require user training and recurring data-validation reviews at the Support Center and national levels at defined intervals prior to running the staffing model.

4. Develop and implement a process to reduce and standardize codes in the Labor Distribution Reporting (LDR) system to improve accounting for direct maintenance workload.

5. Determine if the newly standardized LDR data are reliable for direct maintenance workloads in the Technical Operations Staffing Model, and if so, develop and implement an action plan with milestones to replace the workload assessments with LDR data.

6. Revise the current standard operating procedure, *Tier 1/2/3 Staffing Allocations and Tier 1 Watch Coverage Requirements* to:

   a. Define the job series and clarify whether system specialists and System Support Center coordinators are included in the Tier 1, 2, and 3 staffing targets;
   b. Require annual review, validation, and updating of staffing allocation targets.

Agency Comments and OIG Response

We provided FAA with our draft report on May 16, 2018, and received its formal response on June 14, 2018, which is included as an appendix to this report. FAA concurred with all six of our recommendations and provided appropriate actions

and completion dates. Accordingly, we consider all recommendations resolved but open pending completion of the planned actions.

Actions Required

We consider recommendations 1 through 6 resolved but open pending completion of planned actions.

Exhibit A. Scope and Methodology

We conducted this performance audit between October 2016 and May 2018 in accordance with generally accepted Government auditing standards as prescribed by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

To evaluate FAA's methodology for determining maintenance technician staffing levels, we interviewed officials from FAA Headquarters, the Professional Aviation Safety Specialists (PASS) labor union, as well as technicians and managers at 19 of 407 System Support Centers that had established staffing targets. We selected a non-generalizable sample of 19 site-visit locations based on geographical location, area of specialty, and tier level. We reviewed the 2013 National Research Council report titled *Assessment of Staffing Needs of System Specialists in Aviation* and independent consultant assessments concerning FAA's Tech Ops Staffing Standards and FAA's use of Labor Distribution Reporting codes. We evaluated the Tech Ops Staffing Model and interviewed officials from FAA Headquarters to determine the data used in the model, the extent to which the model includes the nine factors recommended by the National Research Council, and FAA's plans for improving data quality. During site visits, we interviewed System Support Center personnel to determine how they record maintenance time and update the equipment inventory database.

To evaluate the process for placing Airway Transportation Systems Specialists (ATSS), we analyzed FAA's Standard Operating Procedure, *Tier 1/2/3 Staffing Allocations and Tier 1 Watch Coverage Requirements*, which serves as criteria for determining staffing allocations for individual System Support Centers. We interviewed officials at FAA Headquarters to determine how the standard operating procedure was developed and the process for updating and validating the staffing allocations. We also evaluated the reliability of data and formulas used in the Hiring Priority Tool, which was developed to improve ATSS hiring and placement. Lastly, we interviewed technicians and managers about the challenges associated with the placement process.

Exhibit B. Organizations Visited or Contacted

FAA Headquarters, Washington, DC

Air Traffic Organization – Management Services

Air Traffic Organization – Technical Operations

Office of Financial Services – Office of Labor Analysis

FAA System Support Centers (SSC)

Atlanta Air Route Traffic Control Center Automation

Atlanta Air Route Traffic Control Center Communication

Atlanta Air Route Traffic Control Center Environmental

Atlanta Hartsfield Environmental

Atlanta Hartsfield Navigation/Communication

Atlanta Hartsfield Radar

Atlanta Terminal Radar Approach Control Communication/Automation

Atlanta Terminal Radar Approach Control Environmental

Chicago Air Route Traffic Control Center Automation

Chicago Air Route Traffic Control Center Communication

Chicago Air Route Traffic Control Center Environmental

Milwaukee Navigation/Communication/Environmental

Milwaukee Radar

Chicago O'Hare Communication

Chicago O'Hare Environmental

Chicago O'Hare Navigation

Chicago O'Hare Radar

Fulton County

DuPage

Other Organizations

Professional Aviation Safety Specialists

Exhibit C. List of Acronyms

ADS-B	Automatic Dependent Surveillance – Broadcast System
AOB	Actual-on-board
ARTCC	Air Route Traffic Control Center
ATSS	Airway Transportation Systems Specialist
DataComm	Data Communications
DOT	Department of Transportation
eLMS	Electronic Learning Management System
FAA	Federal Aviation Administration
FSEP	Facility, Service, and Equipment Profile
FTE	Full-Time Equivalent
GAO	Government Accountability Office
LDR	Labor Distribution Reporting
MOA	Memorandum of Agreement
NAS	National Airspace System
OIG	Office of Inspector General
OJT	On-the-job training
PASS	Professional Aviation Safety Specialists
RMLS	Remote Monitoring and Logging System
TRACON	Terminal Radar Approach Control
TSM	Techs Ops Staffing Model

Exhibit C. List of Acronyms 21

Exhibit D. Flowchart of FAA's Maintenance Technician Staffing Process
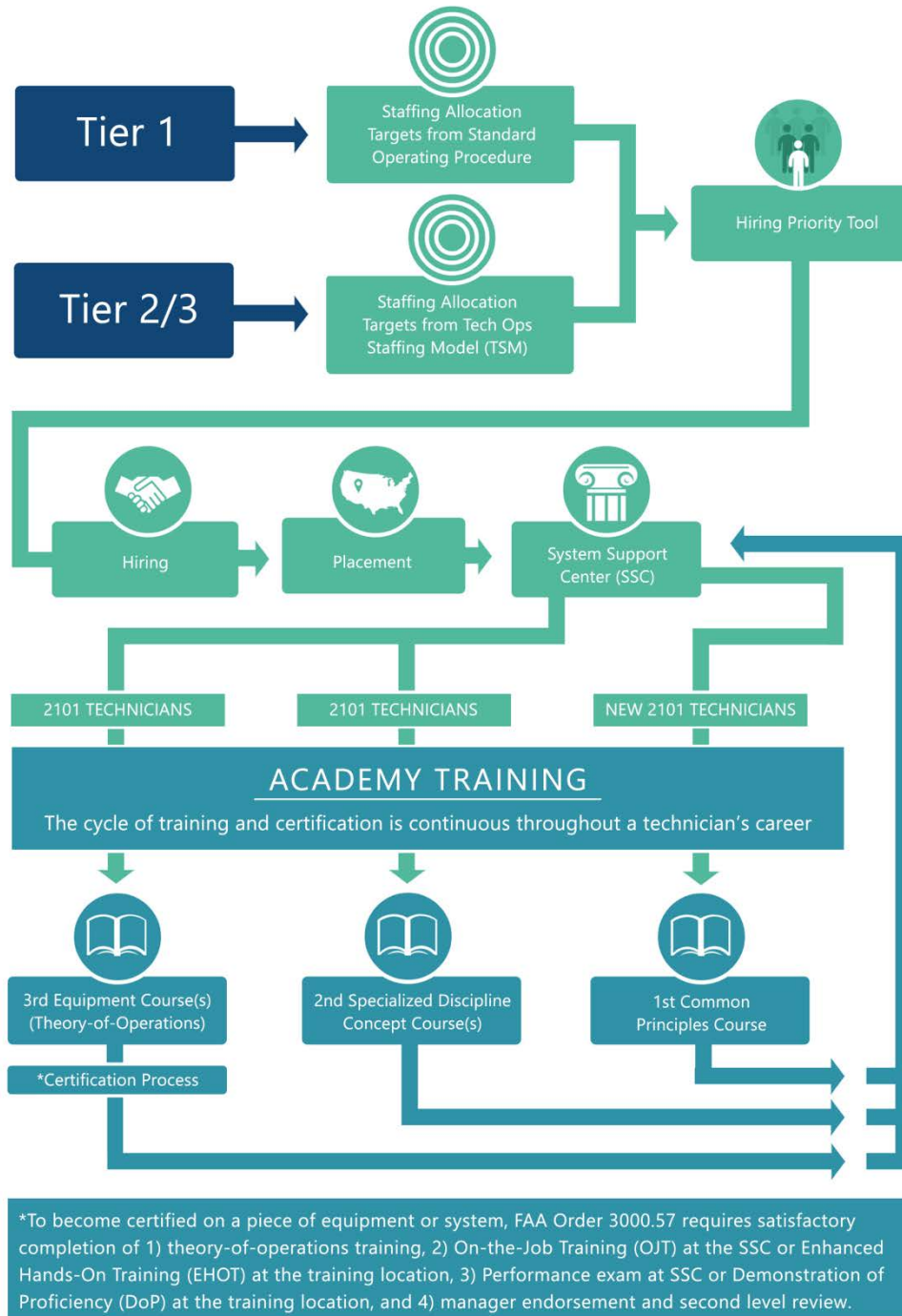
Source: OIG depiction of FAA-provided data

Exhibit E. Major Contributors to This Report

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Appendix. Agency Comments

Federal Aviation Administration

Memorandum

Date: June 14, 2018

To: Matthew E. Hampton, Assistant Inspector General for Aviation Audits

From: H. Clayton Foushee, Director, Office of Audit and Evaluation, AAE-1

Subject: Federal Aviation Administration's (FAA) Response to Office of Inspector General (OIG) Draft Report: Underlying Data Quality Issues Hinder the Staffing and Placement of FAA's Maintenance Technicians

The FAA's approximately 6,000 Airway Transportation Systems Specialists (ATSS) operate and maintain over 66,000 components of the National Airspace System (NAS) equipment and facilities. ATSS staffing practices allow the FAA to maintain a very high level of equipment reliability— 99.84 percent to date for fiscal year 2018—and still respond to events that affect staffing needs. In general, beyond normal operations and maintenance, NAS dynamics influence staffing requirements and include cyclical changes (such as peak travel periods and seasonal weather), planned activities (such as air shows and sporting events), and unplannable events (such as hurricanes, earthquakes, and fires). The FAA's ability to mobilize and augment "normal" maintenance staffing during these events exemplifies the strength and agility of the ATSS workforce.

Technical Operations has long supported improving tools and the integration of corporate data. In fact, many maintenance and operations decisions are data-driven. In the reality of today's resource-constrained environment, even when FAA and independent workload assessments demonstrate additional staffing is required to operate and maintain new or aged technology, there is no supplement. Hiring priorities focus more on forecasting and filling vacancies due to attrition in the workforce.

The FAA agrees that improving corporate data accuracy used to project staffing requirements and allocations will enhance the Technical Operations Staffing Model (TSM) and hiring projections. Adding elements including the age/workload of surveillance, navigation, and communication equipment and facilities infrastructure, as well as factors such as fatigue mitigation, could further improve the modeling for staff hiring and allocation. However, due to the evolution and complexity of the aviation system, technical staffing hiring and placement cannot be forecasted using solely corporate data. The TSM is, and with enhancements, will likely remain a starting point for ATSS hiring and placement. Management will continue to augment results to align with the future NAS demands.

Based on FAA's review of the draft report, we concur with the recommendations as written. We plan to implement recommendation 2 by February 28, 2019; recommendations 1, 3, 4, and 6 by September 30, 2019; and recommendation 5 by September 30, 2021.

We appreciate this opportunity to respond to the OIG draft report. Please contact H. Clayton Foushee at (202) 267-9000 if you have any questions or require additional information about these comments.

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