Air Force Non-Rated Technical Traning

Opportunities for Improving Pipeline Processes

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Preface

In recent years the Air Force has faced persistent resource constraints while trying to deliver necessary training to its new officer and enlisted forces. While the cost of training is a key constraint, other resources such as instructors, training devices, and facilities are also in limited supply. Planning processes attempt to achieve training goals with the fewest resources possible, but alterations in training requirements, mismatches in the supply of students and available classroom space, and uncertainties in the flow of students through the training pipeline can tax resources and contribute to the Air Force falling short of targets for trained personnel. While achieving this balance is never simple, in years of plentiful manpower and financial resources the inefficiencies that can stymie this process are less perceptible. After several years of end strength and budget reductions, the Air Force is currently adapting to increases in end strength by accessing additional personnel who must receive initial skills training. However, these increases are putting a strain on the resources required to conduct technical training and highlighting inefficiencies that at other times might have gone unnoticed.

Realizing these challenges, Air Force leadership at Air Education and Training Command (AETC) asked RAND Project AIR FORCE (PAF) to identify ways to improve the efficiency and responsiveness of the Air Force's nonrated technical training processes, both officer and enlisted, to meet changing force and support requirements. The Air Force asked PAF to identify opportunities for optimizing overall processes at all levels of technical training—corporate Air Force planning and programming, AETC strategic training management, training management at 2nd Air Force and training wings, and the direct provision of individual courses.

This report presents the study team's assessment of the processes and policies in the technical training pipeline and identifies inefficiencies that fall into three broad areas: planning, flow of students, and resources. The report concludes with recommendations for improvements to training processes and policies and outlines the benefits that can be obtained from proactive modeling and the development and tracking of effective metrics. This report will be of interest to those involved in technical training for military personnel.

The research reported here was commissioned by the Air Force and conducted within the Manpower, Personnel, and Training Program of PAF as part of a fiscal year 2016 project, Optimizing Air Force Technical Training.

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Contents

Figures

Tables

Summary

The Air Force is a complex organization that uses myriad skills to accomplish its mission. To provide airmen with the skills they need to conduct their duties, the Air Force expends extensive resources on initial skills training. The Air Force trains approximately 30,000 airmen a year in initial skills. As airmen progress through their careers, continuing training helps airmen upgrade their skills and keep up with new techniques and technologies. Training is also a part of the process to inculcate airmen with Air Force culture. The Air Education and Training Command (AETC) is the organization within the Air Force with the mission to recruit, train, and educate airmen.

Declining defense budgets since the drawdown of forces in Iraq and Afghanistan have reduced the number of new airmen accessed into the Air Force. Accordingly, Air Force planners have reduced the resources slated for the training pipeline. This decline was abruptly reversed when the National Defense Authorization Act for Fiscal Year (FY) 2015 increased Air Force end strength. In response, the Air Force has increased accessions, which, in turn, increased demand on the training pipeline. After planning for declining accessions for several years, AETC had to rapidly adjust to train an additional 1,900 initial skills students in FY 2016—an increase that is expected to continue for several more years. The sudden increase left AETC scrambling to support the new requirements and highlighted inefficiencies at all levels of the training process.

This dramatic increase in training requirements and the challenges faced in responding to them prompted AETC's Directorate of Intelligence, Operations and Nuclear Integration to undertake a study of pipeline inefficiencies. The Air Force asked RAND Project AIR FORCE (PAF) to identify ways to improve the efficiency and responsiveness of the Air Force's nonrated technical training processes, both officer and enlisted, to meet changing force and support requirements. The goal of the study was to identify opportunities for optimizing overall processes at all levels of technical training—corporate Air Force planning and programming, AETC strategic training management, training management at 2nd Air Force and training wings, and the provision of training in individual courses—and to recommend policy and process changes that could improve overall efficiency. Evaluation of course content and delivery and the rated pipelines was outside the scope of this study.

The study team used a mixed-methods approach to address the research objective, combining the results of three primary research streams to identify inefficiencies in the technical training system:

1. *Stakeholder discussions and process observations*. The team conducted 40 semistructured interviews between October 2015 and June 2016 with over 100 stakeholders representing the policy and planning, leadership, training manager, instructor, and student communities. In addition, we observed three technical training working group sessions.

2. *Analysis of training data and metrics.* We relied primarily on data from the AETC Decision Support System (ADSS), for the period 2011 to mid-2016 to characterize student flow through the training pipeline.
3. *Development of a technical training pipeline model.* We developed a model of the AETC technical training pipeline to analyze policies and processes including student flows and priorities, instructor availability and allocation decisions, and class scheduling alternatives.

To augment these research streams, the study team reviewed prior RAND research on service training pipelines, primarily in the Air Force. We also explored technical training pipeline planning and processes for the Army and Navy through discussions with subject matter experts.

At key points throughout the project, results from these streams were compared so that they could inform development of our representation of the baseline technical training process, serve as inputs for the model, and identify themes for further exploration. The process helped the team identify key inefficiencies in the Air Force's technical training pipeline and develop an initial set of policy and process changes that could improve overall efficiency. The team identified inefficiencies in three broad categories: inefficiencies in the planning process, in the flow of students through the training pipeline, and in the resources required to support the technical training pipeline.

Inefficiencies in the Technical Training Planning Process

We examined the technical training process in detail and identified six inefficiencies, many of which result from the timing and accuracy (or inaccuracy) of information flow. Workarounds used by participants in the system help get the job done, but they do not overcome the lack of adherence to timelines prescribed in Air Force instructions or problems with the use of data systems.

- *Unrealistic expectations associated with changing requirements.* Two different perspectives concerning end strength management became apparent over the course of interviews with stakeholders: one held by those at headquarters and one by those in the field. Although everyone agrees that changing requirements are inevitable, AETC feels that the Air Staff should be better at predicting changing requirements and communicating those changes down the chain with greater lead time. While many changes that affect requirements setting are outside the Air Staff's control, such as those motivated by congressional direction, some of these unrealistic expectations in setting requirements are driven by the potentially misplaced confidence in the accuracy of Air Force specialty sustainment models. These models, generally used for long-term accession planning, have also been used in recent years to make monthly estimates of requirements in the year of execution, which imposes a level of precision that may exist only in the short term. In addition, other mechanisms to meet changing end strength requirements aside from accessions could be considered. Moreover, challenges in meeting changing requirements are exacerbated by the lack of communication among stakeholders and a reluctance to share information until it is a certainty. Early insight into the magnitude and direction of potential changes

in requirements, even before precise information is available, can ensure that strategic management decisions at AETC do not run counter to anticipated change.

- *Lack of agility in responding to changing requirements*. While AETC may have unrealistic expectations associated with the requirements setting process, stakeholders on the Air Staff suggested that AETC should be able to adjust more rapidly to changing requirements, including in the year of execution. But the realities of the training process make it difficult to make last-minute adjustments. Processes associated with bringing new instructors online and allocating associated resources, for example, react almost too late—and these realities need to be recognized up the chain of command. Although such constraints do exist and improvements are needed in information flows, as mentioned previously, infusing greater flexibility into the planning process would help AETC more readily adapt to changing requirements. Greater flexibility might include planning for a range of students instead of precise estimates that may change later in the fiscal year. Such flexibility would accommodate many of the changes likely to occur so that last-minute planning "drills" would only occur when a significant and/or unexpected policy change arises.

- *Insufficient visibility into technical training capacity*. The inability to view schoolhouse capacity is one factor that contributes to the lack of flexibility in the technical training pipeline. Because of insufficient visibility into technical training capacity, higher echelons are not able to project the impact of decisions affecting training pipelines. As explained to us during interviews with stakeholders throughout the technical training pipeline, when requirements change 2nd Air Force has to contact each schoolhouse and determine whether they have enough capacity and resources to support the training plan. The response is then passed to Headquarters Air Force who decides whether to provide additional resources or adjust the plan. This process is time- and resource-intensive, and a source of frustration to all involved. Moreover, there is no systematized approach to determine capacity. Stakeholders at each level maintain their own personalized spreadsheets and methods for calculating capacity. The sheer preponderance of these individual systems suggests that current data and analytics are insufficient. And the underlying problem of visibility points to a system that is reactionary, rather than proactive. A single model that provides visibility into the effect of changes and is used throughout the technical training pipeline would greatly improve the planning process.

- *Lack of readily available information to support execution planning*. The lack of visibility applies not only to schoolhouse capacity but also is endemic throughout execution planning processes. Lack of readily available information to support execution planning causes disconnects between training management levels and can lead to wasted resources or capacity. This inefficiency is particularly apparent when training seats are left vacant at the beginning of a course. There is no process that automatically fills a vacant seat with another student; only ad hoc processes exist, as explained to us during interviews, which vary in effectiveness. Formalizing a more rapid and flexible policy that would allow AETC to more effectively utilize all seats and reclaim those that might otherwise be wasted, and/or developing a system that provides information about empty seats in a more timely and regular basis would help maximize classroom capacity.

- *Missing participants in the planning process*. From requirements planning to execution planning, the absence of key actors in the planning process can cause delays in critical information sharing and a sense of disenfranchisement among key stakeholders. The need for consistent and efficient communication between pipeline process stakeholders emerged during interviews from Headquarters Air Force down to instructors. The project team observed that the right representatives are not always involved at the right points in the planning process. For example, AETC is not sufficiently involved in developing planning documents, training wings often feel they receive planning information too late, and there is little consistency in the role career-field managers play in determining training content requirements.

- *Complications of guard and reserve planning*. Across 2nd Air Force, the guard and reserve fill on average only 65–70 percent of the seats allocated to them. Leaving seats vacant complicates the planning process and may create inefficiencies in filling class seats. This occurs for a number of reasons, such as missed accession quotas, the fact that new members with prior military service may have already fulfilled technical training requirements, or lack of required security clearances. As explained to us during interviews at the schoolhouses, the training squadrons have come to count on these empty seats to help reduce student backlogs. Nevertheless, there is room for improved efficiency in how the guard and reserve plan, schedule, and fill training seats.

Inefficiencies in the Flow of Students Through the Pipeline

We also identified inefficiencies in the flow of students during the execution phase of the technical training pipeline. Inefficiencies in student flow cost the Air Force time and money, as empty seats and the time students spend waiting for training quickly add up over the course of a year. Students awaiting training or students on "casual status" before, during, or after courses make up a major portion of those costs. Many factors contribute to this phenomenon; delayed security clearances, problems in accessions and assignments, managing students who must repeat courses, missing scheduled seats, student surges, medical and personal issues, and capacity limitations all contribute to delays. In addition to inefficiencies in the pipeline itself, there appears to be a lack of clearly defined, readily visible, or consistently collected metrics for how to measure efficiency in student throughput. Given the high cost of potential delays, the Air Force makes every effort to minimize them. But having good metrics and processes that identify delays that are occurring is essential to reducing these costs.

- *Inefficiencies associated with time not in training*. Inefficiencies in managing student flow through the training process can lead to excessive time delays and associated costs. The study team analyzed waiting time in the pipeline for 246 enlisted and 36 officer Air Force specialty codes (AFSCs), including time between basic military training and initial skills training, time between courses (if there is more than one course), and time prior to an airman beginning his or her first assignment. While the Air Force plans on a certain amount of delay in the pipeline, our analysis indicated that actual wait times exceeded those planning factors by a significant amount—on the order of 786 man-years of

additional wait time for all the enlisted AFSCs and 120 man-years for officer AFSCs, at a potential annual cost exceeding $43 million.

- *Lack of realistic and consistent metrics.* Lack of realistic and consistent metrics can provide false perceptions of the status of individual students, the instructor pool, required resources, and the success of the training system as a whole. For example, after discussions with the training wings and analysis of available quantitative data, we could find no Air Force system that monitored nontraining time—a metric that is not only useful for monitoring cost but also can alert training managers when unexpected course delays are occurring. One contributing factor is the variety of information systems used by different organizations that support the pipeline. Undertaking a regular and systematic look at the metrics being followed throughout the training pipeline will assure that existing metrics are useful for decisionmakers and identify metrics that are not tracked but should be.

Resource Inefficiencies

A third source of inefficiencies in the technical training pipeline involves resourcing the schoolhouses to ensure they have enough capacity to appropriately meet training requirements while avoiding unnecessary overspending. While facilities and training devices are essential resources, the centerpiece of resourcing decisions, and therefore cost, at the schoolhouses involves rightsizing the instructor cadre for each training pipeline.

- *Improper rightsizing of the supply of instructors.* Finding the right balance between having too many instructors or too few is the most significant resourcing challenge for technical training—the ability to provide the quantity and quality of training at a minimum cost. Adjusting the size of the instructor cadre is challenging when requirements increase significantly over previous years, and particularly during the year of execution, because the process of bringing on new instructors is generally inflexible and tied to the broader Department of Defense planning, programming, and budgeting system. A major challenge in rightsizing the instructor corps involves the process by which individual training pipelines estimate how many instructors will be required, which is referred to as instructor pricing. This process is often criticized because of its lack of transparency, its inflexibility, and the outdated formula on which it is based—as we learned in at least a dozen separate interviews at the training wings, training groups, and schoolhouses. A consequence of the instructor pricing process and other factors, such as the policy change allowing instructors to deploy, is that many schoolhouses are chronically undermanned—which places a tremendous burden on the instructor cadre in place and can negatively affect course development, student mentoring, and potentially the quality of graduates. In addition, our modeling analysis illustrated how instructor shortfalls can not only result in fewer graduates but also significant increases in student wait times and associated costs.

- *Inadequate resourcing of training management and instructional systems.* Insufficient resources for training management and instructional systems can seriously undermine the delivery of training and lead to long student wait times and increased costs. After discussions with the training wings, groups, and schoolhouses, the study team identified

two areas where the training pipeline may be negatively impacted by IT systems: funding for technological resources and the use of technology (primarily computer information systems and models) to make pipeline processes more efficient. Training wings are concerned about infrastructure and the inability to adequately upgrade technological resources that can limit pipeline production—a problem in part limited by the ability to plan for these resources on a multiyear basis. These constraints are of particular concern in career fields such as cyber operations where the primary training system is technology-based and quickly outdated. Similar funding complications limit the opportunity for training managers to procure systems for capacity visibility and execution tracking that would provide valuable information needed to reduce inefficiencies.

Conclusions and Recommendations

Our examination of AETC's technical training pipeline processes has revealed numerous inefficiencies and identified many opportunities for improvement. While inefficiencies span the entire technical training process from planning to student flow to resources, there are some common denominators. For one, there is a demonstrable lack of accessible information both up and down the organizational hierarchy. This has significant implications for the efficiency of the planning process, as evidenced by the resources expended to coordinate questions about potential accession and training requirement increases. There is also a general lack of accessible analytic tools and data that could be used to better understand the implications of policy decisions. Solutions to these challenges will have broad applicability across the technical training process.

In considering recommendations for the Air Force, we acknowledge that streamlining the technical training process is a challenging undertaking. The system is complex with a high degree of uncertainty and many interdependent parts. We also acknowledge that not all inefficiencies in the pipeline can be eliminated. Inefficiencies related to cost, delays, and quality will continue to occur to some degree, but the goal is to reduce these inefficiencies as much as possible. In this context, we identified a number of actions the Air Force could take to improve efficiency in the technical training pipeline—focusing on those opportunities with the most return on investment or that pose solutions to costly problems experienced by a large number of pipelines. Our recommendations for AETC are as follows:

- *Develop a capacity visibility system.* AETC should develop, fund, and field an information system to enhance visibility into individual pipeline capacity. Such a system could be used to identify pipelines with sufficient capacity to accommodate increase throughput in times of increasing accessions. A capacity visibility system would also enable the Air Staff to do away with the lengthy coordination process that is currently used to determine if there is capacity in particular pipelines.

- *Develop a flow visibility system.* Similar to a capacity visibility system, the Air Force needs a system that would provide visibility into the flow of students in the pipeline. Formalizing a rapid, flexible system and appropriate policy to accompany it will allow AETC to more effectively utilize training seats. The literature on supply chain management

can inform development of a system to centralize data on and improve the flow of both existing capacity and the actual flow of students through the system. In fact, at the time of our research, a Headquarters AETC working group was formed to investigate the requirements and structure for such a system. Interviews with training senior leaders indicated that they understood that resources would need to be invested to develop and implement a system, and operating procedures would need to be adjusted.

- *Review and update instructor pricing methods and formulas and manning policies.* Updated pricing methods should take into account instructor manning standards and personnel policies that have changed since the standards were first developed. While doing so, Headquarters Air Force should make the system and methodologies more transparent. The Air Force Manpower Analysis Agency (colocated at Joint Base San Antonio-Randolph with Headquarters AETC) is best positioned to determine current manpower requirements and develop up-to-date manpower factors. A study of this magnitude would likely require endorsement from Headquarters Air Force senior leaders and the Air Force corporate structure.

- *Reinvigorate technical training pipeline modeling capabilities.* Even a very basic model as described in this report can shed light on potential impacts of policy and process decisions. Embedding estimation models within the AETC information architecture will help to rapidly provide estimates of the effect of planning, resource, or scheduling changes on pipeline costs and capacity.

- *Identify and track effective metrics.* AETC needs to reinvigorate its collection and evaluation of metrics in two ways. First, current metrics need to be reviewed for their utility; such a review can also help identify new metrics that could provide additional insight into the management of pipeline processes. Second, once a set of metrics is established, the information must be accessible to the appropriate management levels— including those making strategic management decisions that pertain to the training enterprise. AETC senior leaders reported that they recognized the data inefficiencies that have resulted from several years of inattention, including unnecessary, duplicative, and missing data, along with metrics that do not track the most useful data.

- *Improve management and communication across all levels of the pipeline.* Improvements that can address inefficiencies in management and communication include setting and enforcing limits on changes in training targets in the year of execution, standardizing the role of career-field managers in the planning process, and being more accountable with guard and reserve seats.

These recommendations are extensive in reach and aimed at long-standing concerns in the technical training pipeline. They represent significant investment for the Air Force in terms of funding, manpower, management structures, and the acquisition and maintenance of new systems. However, each of the issues addressed was consistently identified in the various components of our analysis and, therefore, warrants further examination. While it was not within the scope of our project to do a complete business case analysis to determine, for example, which inefficiencies are most costly or most prevalent, we can point to several recommendations that could be

accomplished relatively quickly and at little cost to address inefficiencies we heard repeatedly during stakeholder interviews.

- Communication could be improved immediately up and down the organizational structure, including regular communication between the office of the Deputy Chief of Staff for Manpower, Personnel and Services and Headquarters AETC as to potential changes in accession levels in the current year and out-years. In addition, inquiries as to the ability of 2nd Air Force and the individual schoolhouses to respond to changes in training goals could be funneled through 2nd Air Force and systematically tracked to ensure they are the best.
- The Air Staff and AETC could immediately establish and commit to using the existing "rack and stack" process to determine training requirements when there is a need to increase the total number of accessions.
- The model we describe in this report (or a model with similar functionality) could be used immediately by AETC's studies and analysis section to test changes in overall training policies or examine the impact of changes to specific AFSC pipelines.
- While programming for additional instructor manpower may be a longer-term solution, adjusting timelines for the Developmental Special Duty process will ensure that the additional vetting required by the program does not delay instructors reporting as required to move students through the pipeline.
- Headquarters AETC staff could select one or two key metrics to begin tracking immediately and to report to senior AETC leaders. For example, tracking delays in training by type and for each pipeline could help pinpoint problematic pipelines and areas for increased efficiencies across pipelines.

Future research should be aimed at understanding the gains to be realized by particular investments in order to be able to answer questions such as how much throughput is increased for each additional instructor. Identifying the methods needed to answer these types of questions can help guide an investment strategy for improving the efficiency and responsiveness of the Air Force's nonrated technical training processes to meet changing force and support requirements.

Acknowledgments

Abbreviations

14NX	Intelligence Officer
17NX	Cyberspace Operations Officer
2A3X3M	F-16 Tactical Aircraft Maintenance, Enlisted
3D0X2	Cyber Systems Operator, Enlisted
ADSS	AETC Decision Support System
AETC	Air Education and Training Command
AETC/A1M	Directorate of Manpower, Personnel and Services, Manpower and Organization Division
AETC/A1MRT	Directorate of Manpower, Personnel and Service, Manpower and Organization Division, Technical Training Section
AETC/A2/3/10	Directorate of Intelligence, Operations and Nuclear Integration
AETC/A3P	Technical Training Strategic Planning and Policy Division
AETC/A3PZ	Strategic Requirements Division
AETC/A3R	Resources and Requirements Division
AF/A1M	Air Force Manpower, Organization and Resources
AF/A1MO	Air Force Manpower, Organization and Resources, Organization Division
AF/A1MP	Air Force Program Manpower, Organization and Resources, Development Division
AF/A1P	Air Force Force Management Policy
AF/A1PF	Air Force Force Management Policy, Force Management Division
AF/A1PT	Air Force Force Management Policy, Accessions and Training Management Division
AFB	Air Force Base
AFM	AETC Flow Model
AFPC	Air Force Personnel Center
AFSC	Air Force specialty code
BMT	basic military training

COIE	course of initial entry
DLIELC	Defense Language Institute English Language Center
DoD	Department of Defense
DSD	Developmental Special Duty
EPMD	Enlisted Personnel Management Directorate
FY	fiscal year
FYDP	Future Years Defense Program
ISR	intelligence, surveillance and reconnaissance
IST	initial skills training
OTS	Officer Training School
PAF	Project AIR FORCE
PGL	Program Guidance Letter
PMO	Production Management Office
PRD	Program Requirements Document
PTT	Programmed Technical Training
QDP	Quarterly Demand Planning
ROTC	Reserve Officer Training Corps
SAT	students awaiting training
SNIT	students not in training
TLN	Training Line Number
TRAP	Training Resources Arbitration Panel
TS/SCI	Top Secret/Sensitive Compartmented Information
TTOC	Technical Training Operations Center
USAFA	U.S. Air Force Academy

1. Introduction

Background

The mission of Air Education and Training Command (AETC) is "to recruit, train and educate Airmen to deliver airpower for America" (AETC, 2016). The combat capability of the Air Force is directly affected by the quantity and quality of trained personnel—which relies heavily on effective management of the training enterprise. The Air Force is a complex organization that uses myriad skills to accomplish its mission and therefore expends extensive resources to conduct initial training to give new airmen the skills they need for their jobs. The Air Force trains approximately 30,000 airmen a year in initial skills. As airmen progress through their careers, continued training helps airmen upgrade their skills and keep up with new techniques and technologies. Training is also a part of the process to inculcate airmen with Air Force culture.

The Air Force technical training process, as illustrated in Figure 1.1, is comprised of two broad components: the planning process (blue boxes) and the training pipeline (red boxes). The purpose of the technical training planning process is to determine how many new entries are needed to ensure every career field has sufficient overall manpower. The planning process begins with the establishment of requirements for trained personnel as stated by the major commands (MAJCOMs) and continues to the development of course schedules and an accession plan, which are based on those requirements. Career field managers plan for the number of airmen that must be recruited, enter basic and technical training, graduate from technical training, and enter initial assignments to satisfy career-field requirements. Congressional constraints on total Air Force end strength limit the number of new entries, referred to as *accessions*.

Computer models consider staffing, authorization changes, attrition, current pipeline projections, sister service training requirements, and other factors to produce an initial requirement for trained personnel. The Air Staff then publishes guidance to AETC in the Accessions Program Guidance Letter (PGL). AETC uses the PGL to develop course schedules that will meet the requirements. For enlisted entries, Recruiting Service uses the course schedule to develop a plan for accessing individuals into the Air Force in time to graduate from basic military training (BMT) and go directly to initial skills training (IST). For officers, the Air Force Personnel Center (AFPC) uses the course schedule to plan for newly commissioned officers to attend the appropriate IST courses.

Despite all the advanced planning that goes into estimating accession requirements, issuing guidance on the number of graduates AETC needs to produce, and scheduling courses, changes are to be expected. Changes can come, for example, from end strength adjustments, which affect the required number of graduates, the number of recruits needed, the number of necessary

Figure 1.1. Air Force Technical Training Process

Acquire MAJCOM unit manning documents	Run AFSC sustainment model	Adjust FYDP end strength
Funded positions by AFSC and grade	Officers and enlisted accessions by AFSC to sustain funded positions	Adjustment to sustainment to meet officer and enlisted end strength in the aggregate

Prepare accessions Program Requirements Document (PRD)	Publish accessions Program Guidance Letter (PGL)	Develop Programmed Technical Training (PTT)
Unconstrained training requirements to meet adjusted sustainment	Prioritized PRD requirements; the training the corporate structure intends to fund	Distribution of training entries, quotas and courses to meet the PGL

Develop training schedule	Develop accession plan	Access/ classify individuals	Attend basic military training or officer commissioning
Courses scheduled at training locations to execute the PTT	Accessions scheduled for entry to the Air Force to fill the seats at courses scheduled		

Begin technical training	Graduate from technical training	Mission-ready airman
Course of Initial Entry	AFSC Awarding Course	

Planning (blue) | Pipeline (red)

NOTE: FYDP = Future Years Defense Program.

instructors, the number of scheduled courses, and so on. Thus, a change in end strength can have a cascading effect through the system.

A *training pipeline,* often referred to as the schoolhouse, resembles a factory, sending students through a prescribed set of courses in order to reach an initial qualification in a particular specialty. It is the sequence of courses (and associated travel and wait times) necessary for entry into an Air Force specialty (or to meet other career-field requirements). There is no individuality within a specialty; as in a factory production line, where an object goes through a set of specific processes and emerges as a finished product, in the training pipeline all students in a particular specialty take the same prescribed set of courses. AETC oversees over 260 pipelines for various Air Force specialties. While the MAJCOMs and Headquarters Air Force have responsibility for defining overall requirements, planning for, resourcing, and managing the flow of students through these pipelines is central to the mission of AETC and its subordinate units, including 2nd Air Force[1] and the various training wings.

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[1] 2nd Air Force is tasked with managing the various schoolhouses providing IST.

As depicted in Figure 1.1, enlisted airmen are recruited and graduate from BMT, while officers are commissioned after graduating from the U.S. Air Force Academy (USAFA), Reserve Officer Training Corps (ROTC), or Officer Training School (OTS), where they receive broad, fundamental skills and are then classified into individual Air Force specialties. The graduates are then transported to the Air Force bases that provide IST for their respective specialties. In the majority of cases, trainees are preselected for their specialties as part of their recruitment or commissioning process. It is desirable to reduce the waiting time before, between, and after courses as much as possible not only to optimize the time spent in training, but also to make the most efficient use of resources such as dorms, dining facilities, and supervisor oversight, which is required for trainees even if they are waiting for a course.

Trainees do not always flow smoothly through the pipeline from start to finish. If a student fails an evaluation event, such as a written test, he or she is taken out of training and must wait for another available space in the same block of training which the student failed (referred to as a *washback*). A certain number of seats in the schoolhouses are generally (though not always) set aside for washbacks; however, too many seats set aside for washbacks reduces the spaces available for new students, while too few results in an extended wait time before students can return to training. Students can washback multiple times depending on the policies in the schoolhouse and the judgment of schoolhouse leadership. High washback rates increase needed schoolhouse capacity and incur greater costs.

Students can also *wash out* from the training program at any point in the course for a variety of reasons, including discipline, medical, and academic issues. Depending on the reason for the washout, airmen may be taken out of a specialty, reclassified into another, or discharged from the Air Force.

After graduating, enlisted airmen are awarded apprentice status as designated by a 3-skill level in his or her Air Force specialty code (AFSC), and report to their duty assignments to begin work and continue on-the-job training. Similarly, officers in most AFSCs receive their initial specialty qualification after technical training and are assigned to their first duty assignment.

The pipeline must be sufficiently resourced to provide training to include instructors, facilities, and training devices. In many cases, these resources are specific to certain courses. However, many courses share resources like instructors, housing, the pool, gym, and firing range. Providing too many resources would be a waste of valuable training funds. Providing too few resources could degrade the quality and quantity of training. Thus, efficient operations of the technical training process can have a measurable effect on resource requirements.

Research Objectives and Scope

Following overall reduction in budgets and personnel after the wars in Iraq and Afghanistan, the need for accessions decreased and Air Force planners reduced the resources slated for the training pipelines accordingly. This decline was abruptly reversed when the National Defense

Authorization Act for Fiscal Year (FY) 2015 increased Air Force end strength. While there are a variety of means for achieving such a goal, one of the primary methods has been to increase accessions of new personnel, which, in turn, increases demand on the training pipeline. After planning for declining accessions for several years, AETC had to rapidly adjust to accommodate an additional 3,000 (an increase of 10 percent) initial skills students in FY 2016—an increase that is expected to continue for several more years. This left AETC scrambling to support the new requirements and highlighted inefficiencies at all levels of the training process.

This dramatic increase in training requirements and the challenges faced in responding to them prompted AETC's Directorate of Intelligence, Operations and Nuclear Integration (AETC/A2/3/10) to undertake a study of pipeline inefficiencies. The Air Force asked RAND Project AIR FORCE (PAF) to identify ways to improve the efficiency and responsiveness of the Air Force's nonrated technical training processes, both officer and enlisted, to meet changing force and support requirements. The goal of the study was to identify opportunities for optimizing overall processes at all levels of technical training—corporate Air Force planning and programming, AETC strategic training management, training management at 2nd Air Force and training wings, and the provision of training in individual courses. Evaluation of course content, instructional delivery methods, instructional models and theories, and rated training pipelines was outside the scope of this study.

We reviewed the entire process, shown in the blue and red boxes of Figure 1.1, from trained personnel requirements definition to planning, scheduling, and recruiting, as well as the flow of students from BMT to classification and technical training. The majority of our focus, however, was on the nonrated technical training process.

Approach

The study team used a mixed-methods approach to address the research objective, combining the results of three primary research streams to identify inefficiencies in the technical training system. The three research streams were:[2]

1. *Stakeholder discussions and process observations*. We conducted 40 semistructured interviews[3] between October 2015 and June 2016 with over 100 stakeholders representing the policy and planning, leadership, training manager, instructor, and student communities. Topics covered during these discussions included descriptions of the pipeline process and planning; student flow and capacity constraints; feedback loops with or between organizations; and recommendations for improvement. In addition, we observed three

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[2] Appendixes A–C contain further detail on the methodologies used in conducting stakeholder discussions, analysis of training data and metrics, and development of the technical training pipeline model, respectively.

[3] Extra care has been taken to ensure the anonymity of individual interviewees; therefore, quotes will either be unattributed or attributed only at the broadest organizational level possible.

technical training working group sessions. The results were then coded and analyzed for themes and insights using Dedoose, a qualitative analysis software program.

2. *Analysis of training data and metrics*. The team relied primarily on data from the AETC Decision Support System (ADSS), for the period 2011 to mid-2016 to characterize student flow through the training pipeline. ADSS collects data (including flying training data) from other training management data systems and provides tools to organize and analyze information to support decisionmaking.[4] AETC instructions describe several metrics to be monitored using ADSS, such as on-time graduation rates, course production rates, and course pass rates. We downloaded raw data from ADSS to support development of its training pipeline model (described next in methodology #3) and developed new ways to exploit this data that are not built into ADSS.

3. *Development of a technical training pipeline model*. We developed a model of the AETC technical training pipeline to analyze policies and processes including student flows and priorities, instructor availability and allocation decisions, and class scheduling alternatives.[5] The model inputs and outputs were manipulated and stored in an Excel workbook. The model was developed with a user interface that simplifies construction and editing for case studies, allowing sensitivity analysis of changes in numerous variables.

To augment these research streams, the study team reviewed prior RAND research on service training pipelines, primarily in the Air Force.[6] We also explored technical training pipeline planning and processes for the Army and Navy through discussions with subject matter experts. These discussions focused on challenges experienced by the other services and effective solutions that may be applicable to the Air Force.

At key points throughout the project, results from these efforts were compared so that they could inform development of our representation of the baseline technical training process, serve as inputs for the model, and identify themes for further exploration. The process helped the team identify key inefficiencies in the Air Force's technical training pipeline and develop an initial set of policy and process changes that could improve overall efficiency. The model was then used to test recommendations and identify the implications of alternative approaches.

In addition, AETC identified four representative AFSCs for in-depth analysis—two officer and two enlisted career fields. AETC felt that these four pipelines in particular would benefit most from an in-depth review but also believed that they are generally representative of the types

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[4] The standard reports catalogued in this instruction are the "single point of reference for reporting production and related training metrics up and down the chain-of-command" (AETC, 2014b, para. 5.1.1). Among the data systems that feed ADSS are Technical Training Management System-Student Management, Training Planning System, and Oracle Training Administration.

[5] The flow model was developed using the ExtendSim software language from Imagine That, Inc.

[6] We searched for but, did not find, research external to RAND on AETC nonrated technical training pipeline processes. The material we did find concerning AETC training was on rated training pipelines, instructional delivery methods, and instructional models and theories—topics outside the scope of this study. During discussions with Headquarters AETC/A3 and AETC Studies and Analysis Squadron we inquired about studies related to our research and they were not aware of any analyses other than the work RAND completed in 2004 through 2010. Appendix D contains a summary of prior RAND research on the technical training pipeline.

of challenges the Air Force faces in training an adequate pool of qualified airmen. These four career fields, listed below, were the focus of our data and pipeline model analysis and selected stakeholder interviews:[7]

- Intelligence Officer, 14NX
- Cyberspace Operations Officer, 17DX
- Tactical Aircraft Maintenance, F-16, Enlisted, 2A3X3M
- Cyber Systems Operator, Enlisted, 3D0X2

These four AFSCs vary in the number of courses taught during technical training, the location of the courses and the number of locations, the planned time spent in the training pipeline, and the average cost per graduate, as shown in Table 1.1.

**Table 1.1. Characteristics of the Training Pipeline
for the Four Example AFSCs Identified for In-Depth Review**

AFSC	Number of Courses	Course Location(s)	Planned Time in the Pipeline (Days)	Average Cost per Graduate
Intelligence Officer, 14NX	1	Goodfellow AFB	130	$100,000
Cyberspace Operations Officer, 17DX	2	Kessler AFB	115	$64,000
Tactical Aircraft Maintenance, F-16, 2A3X3M	3	Sheppard AFB and Luke AFB	106	$51,700
Cyber Systems Operator, 3D0X2	3	Kessler AFB	71	$42,000

NOTE: AFB = Air Force Base.

Organization of the Report

The types of inefficiencies identified during our research are broadly grouped into three areas covered in Chapters Two through Four—inefficiencies in the planning process, in the flow of students through the training pipeline, and in the resources required to support the technical training pipeline. While we grouped the identified inefficiencies into these categories for ease of presentation, the authors recognize that in some cases the inefficiencies are overlapping and interrelated. For example, issues that arise during the planning process, such as unanticipated surges in requirements, can affect the flow of students. The resultant training delays and resource shortfalls can affect aspects of the entire process. Similarly, effective information flows and the availability of accurate data and metrics—or the lack thereof—can have an impact on efficient operations in both the planning process and training pipeline. These overlaps and relationships are identified throughout the discussion.

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[7] Appendix E includes an overview of each of these example AFSCs.

The final chapter summarizes our observations and contains recommendations for how the Air Force can begin to reduce these inefficiencies. Appendixes A–C contain details on our methodological approach to stakeholder discussions, data analysis, and development of a model of the training pipeline, respectively. Appendixes D and E, meanwhile, contain a review of prior RAND studies on the training pipeline and an overview of the four example pipelines used in our analyses, respectively.

2. Inefficiencies in the Technical Training Planning Process

The technical training planning process allows the Air Force to determine how many training graduates are needed to ensure each career field has sufficient manpower. Based on this information, manpower planners are then able to determine the number of airmen that must be recruited, enter and graduate from basic and technical training, and receive an initial assignment in a career field to satisfy the career field's requirements. All of these decisions are made within the total manpower constraints set by Congress. Four major organizations are involved in the training planning process: Headquarters Air Force, AETC, 2nd Air Force, and the individual schoolhouses where training takes place. Each organization plays an important role in the process, and good communication among the organizations is essential.[1]

The four rows in Figure 2.1 highlight key activities associated with these organizations; arrows indicate important interactions among the organizational components and the documents associated with them. Headquarters Air Force produces the two documents that ultimately determine the number of enlisted personnel the Air Force must train and these effectively serve as the beginning of the planning process: the Program Requirements Document (PRD) and the PGL. The PRD identifies unconstrained accession and technical training requirements three years in the future. In August 2016, for example, AETC reviewed FY 2019 enlisted initial skills requirements (U.S. Air Force, 2013, para. 3.1.2; AETC, 2014a, para. 18.2.1). Planners and programmers then use the information in the PRD to budget or program for resources needed to support future-year requirements.

In contrast to the PRD, the PGL is not only developed by Headquarters Air Force, but also further vetted by the Air Force corporate structure. The PGL becomes the *official tasking document* for training requirements and represents fiscally constrained accession and training levels. This more refined and near-term document addresses requirements two years in the future; for example, in August 2016 AETC reviewed the FY 2018 PGL (U.S. Air Force, 2013, para. 3.1.3; AETC, 2014a, para. 18.2.2).

As the top row of Figure 2.1 illustrates, Headquarters Air Force uses the skills projection model and career-field sustainment analysis to determine personnel levels and training requirements for each career field and to develop the initial PGL. Through interactions with

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[1] This overview of the key organizations, processes, and documents that comprise the technical training planning process is based on descriptions in Air Force instructions and other documentation.

Figure 2.1. Training Planning Process Overview
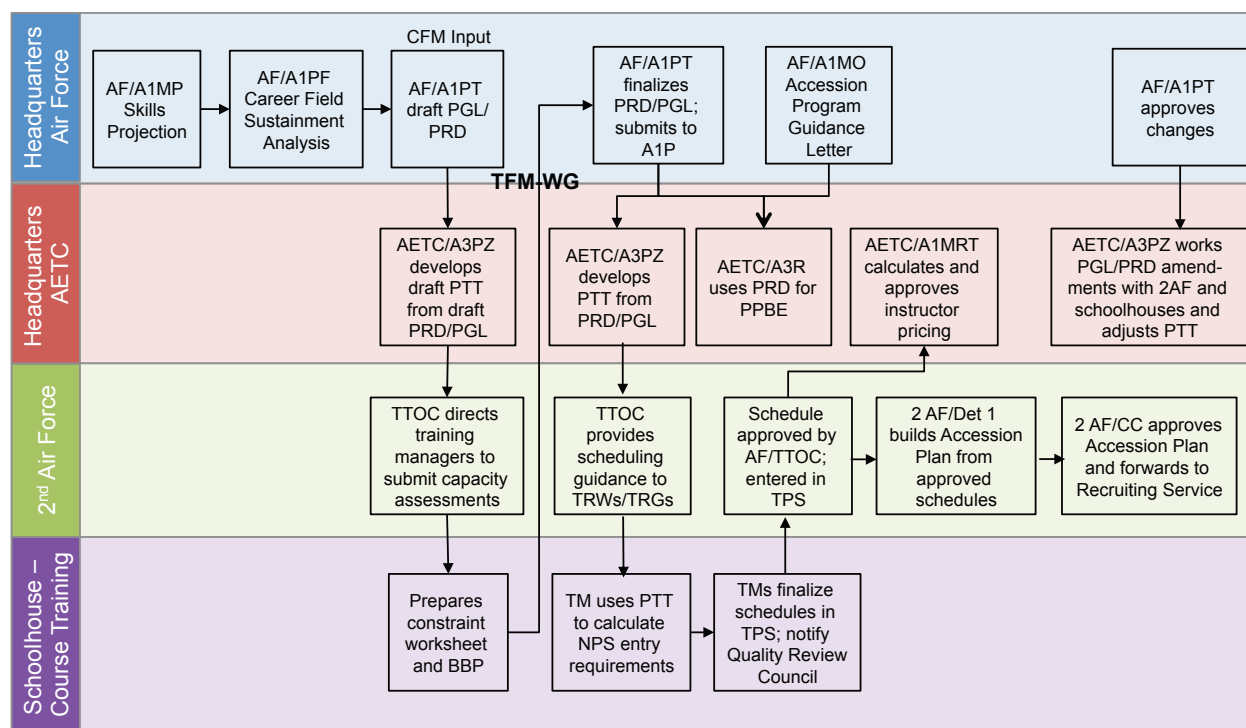
SOURCE: Based on 2nd Air Force, 2015; U.S. Air Force, 2013, 2015a; AETC, 2014b.

NOTE: 2AF/CC = 2nd Air Force Commander; BBP = Bullet Background Paper; NPS = nonprior service; PPBE = Planning, Programing, Budget, and Execution; TM = training manager; TPS = Training Planning System; TRW = training wing; TRG = training group.

key stakeholders, the final Accessions PGL is developed, which identifies enlisted and officer accession levels for the current year and FYDP.[2]

The second row of Figure 2.1 shows the major responsibilities of Headquarters AETC. Using the PGL, AETC develops the Programmed Technical Training (PTT) documents, which determine how many training slots will be funded and scheduled in technical training. AETC also uses the PRD to prioritize funding requirements throughout the Planning, Programming, Budgeting, and Execution process and to submit Air Force requirements for training programs that are operated by other services or agencies (AFI 2013, para. 1.2.3). AETC is also responsible for determining instructor requirements, a process known as "instructor pricing." The top row marks something called the Training Flow Management Working Group. This working group, cochaired by Air Force Management Policy, Accessions and Training Management Division (AF/A1PT) and AETC's Technical Training Strategic Planning and Policy Division (AETC/A3P),

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[2] Air Force Manpower, Organization and Resources, Organization Division (AF/A1MO) develops the Accessions PGL that identifies active-duty Air Force enlisted and officer accession levels for the current FY and the FYDP (U.S. Air Force, 2013, para. 1.2.2.2).

is an annual forum during which representatives from the active component, the guard, reserve, sister services, and international organizations discuss training requirements, capacity, and scheduling issues.

2nd Air Force is responsible for conducting BMT and nonflying technical training for Air Force, joint, and coalition enlisted members and support officers (U.S. Air Force, 2014). Once AETC develops the draft PTT, which is based on the draft PGL, the schoolhouses at 2nd Air Force assess their training capacities and determine whether there is sufficient capacity to meet the initial training requirements stated in the draft PGL. This process also provides an opportunity for schoolhouses to describe their constraints or request additional resources that will be required to accomplish the training goals. When the PGL is approved, 2nd Air Force provides scheduling guidance to the schoolhouses, determines the accessions that will be needed to fill those schedules, and forwards the accession plan to the Air Force Recruiting Service (which is also overseen by AETC).

When changes to requirements are made at the headquarters level in an execution year (upper right corner of Figure 2.1), AETC manages the coordination required to implement amendments to the PGL (AETC, 2014b, para. 2.3.6). As AETC prepared for the influx of additional students in FY 2016, schoolhouse constraints were the impetus for some changes to the PGL because there was a preference for making use of already available seats before incurring excessive financial costs needed to add additional capacity.

Relying on interview data that described the process and was supplemented by the quantitative efforts of the team, we examined this process in detail and identified a number of inefficiencies that are highlighted in the remainder of this chapter:

- Unrealistic expectations associated with changing requirements
- Lack of agility in responding to changing requirements
- Insufficient visibility into technical training capacity
- Lack of readily available information to support execution planning
- Missing participants in the planning process
- Complications of guard and reserve planning

Many of these process problems result from the timing and accuracy of information flow. Our interviews spotlighted a significant amount of unofficial interaction among participants in the process that helped get the job done; however, these workarounds were not enough to overcome the lack of adherence to timelines prescribed in Air Force instructions (e.g., timing of release of PGLs) or problems with the use of data systems (inaccurate data from some sources; difficulty in using available data to determine course capacities), as will be discussed in later chapters. In previous studies conducted in FY 2002–2003, RAND recommended flattening the AETC organizational structure in order to create fewer bureaucratic layers, along with simplifying the planning process in order to better align with required tasks and enhance the flow of information to and from the organizational elements—recommendations that are still applicable to the process today.

Unrealistic Expectations Associated with Changing Requirements

> If you measure sustainment every month and try to use accessions (the schoolhouse) to meet end strength, you are going to generate a lot of waste.

End strength drives the number of airmen accessed each year—all of whom must enter the training pipeline. As previously described, planning guidance is distributed several years prior to execution. But end strength changes can occur long after that guidance has been released, including in the year of execution. These changes can occur quickly and drive changes to the desired number of accessions.

Because personnel costs are by far the largest portion of the discretionary Department of Defense (DoD) budget, personnel reductions are sometimes made to free up resources that can be used to fund other priorities. Political pressures for larger budgets and expanded missions or smaller budgets and reduced operational involvement therefore play a role in determining end strength. Even if political guidance remains steady, the Air Force has at times chosen to reduce end strength in order to fund force modernization programs.

Not all changes to accession levels, however, are driven by end strength. Unplanned attrition (e.g., that caused by lower-quality recruits) or lower than expected retention (whether based on stay/leave decisions by members or by service-initiated force management programs) will increase the number of accessions needed above previously planned targets. These fluctuations directly affect the training pipeline.

There are two different perspectives concerning end strength management that became apparent over the course of interviews with stakeholders: one held by those at headquarters and one by those in the field. Both groups agree on one issue: that the target end strength will change, whether due to real-world operational events, current-year updates from inaccurately estimated retention rates, or from increases or decreases in personnel accounts to meet congressionally mandated end strength targets in the out-years. What they may disagree on is how, to what degree, and how often these changes should drive changes in the execution of already scheduled, resourced, and in some cases ongoing training.

From AETC's perspective, the Air Staff should be better at predicting changing requirements and communicating those changes down the chain with greater lead time. From the Air Staff's perspective, AETC should be able to adjust rapidly to changing requirements, including in the year of execution. To varying degrees, these expectations on behalf of both the Air Staff and AETC are unrealistic, but there is room for improvement in predicting and responding to changing requirements. This section discusses the Air Staff's role in predicting requirements and how that process and the communication of results could become more efficient. The next section addresses the need for AETC to improve its ability to respond to changing requirements, within existing limitations.

As will be discussed more in the next section, AETC has difficulty responding to the frequent changes passed down from Headquarters Air Force as new requirements for graduates in the year

of execution. These monthly planning alterations to the annual goal can cause a large degree of churn throughout AETC, with an accompanying waste of resources. As mentioned earlier, the current process uses sustainment models to set accession targets for each AFSC.[3] These models project retention behavior of individuals in a particular AFSC. These projections are scaled so that over a 30-year career they are equal to the number of manpower authorizations in that AFSC. And the projections are also scaled so that the sum of all the AFSCs does not exceed end strength. These profiles are used to determine the number of accessions needed to reach end strength targets in any given year. When end strength changes, the number of accessions changes as well.

Figure 2.2 shows a notional officer sustainment profile. This sustainment profile (the blue line) is based on average retention patterns for a ten-year period—that is the percentage of officers that remained in service from one year to the next. Thus, with retention rates of about 95 percent each year from four to 14 years of service, 50 percent of the initial accessions remain. Figure 2.3 shows the summation of all officer sustainment profiles needed to meet a given end strength. Both of the aggregate profiles (the blue and the green lines) reflect the ten-year yearly retention rates; the green line starts with the accessions needed to maintain an end strength of 61,000, and the blue line starts with the accessions needed to maintain an end strength of 48,000.

Figure 2.2. Notional Officer Sustainment Profile—Single AFSC
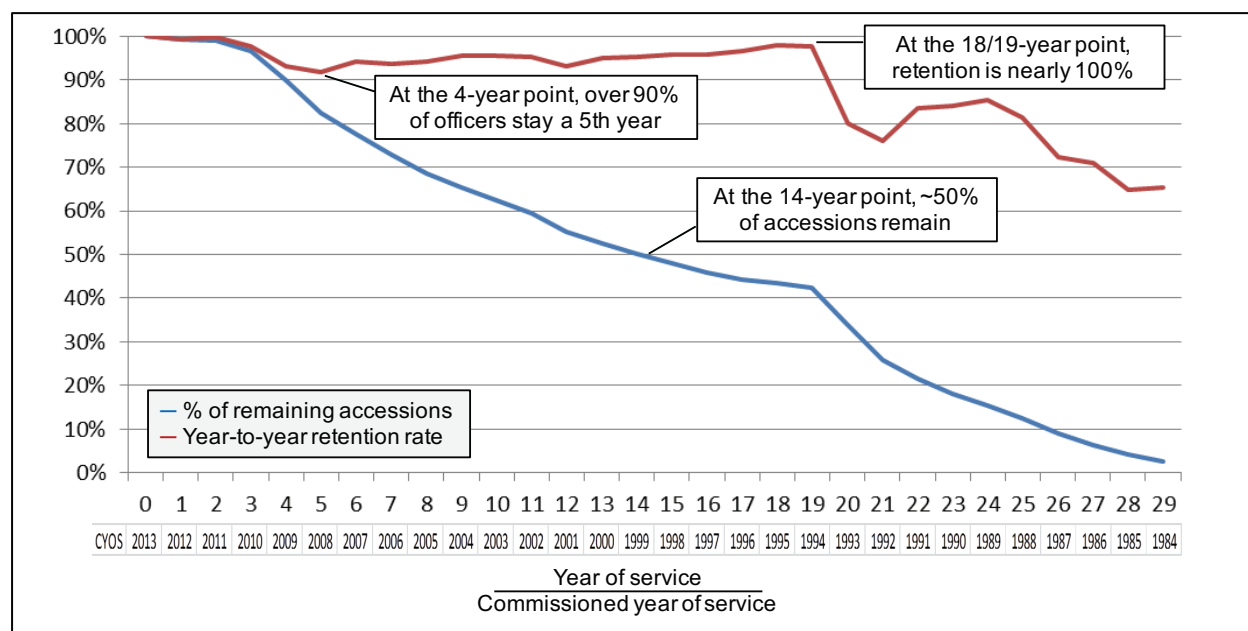
SOURCE: AF/A1PT.

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[3] These targets are for entries into the AFSC, not entries into the Air Force. AF/A1PT and AETC estimate the numbers of entries to BMT required to ensure AFSC entries are adequate accounting for training attrition.

Figure 2.3. Notional Officer Sustainment Profile—Summed to Meet End Strength
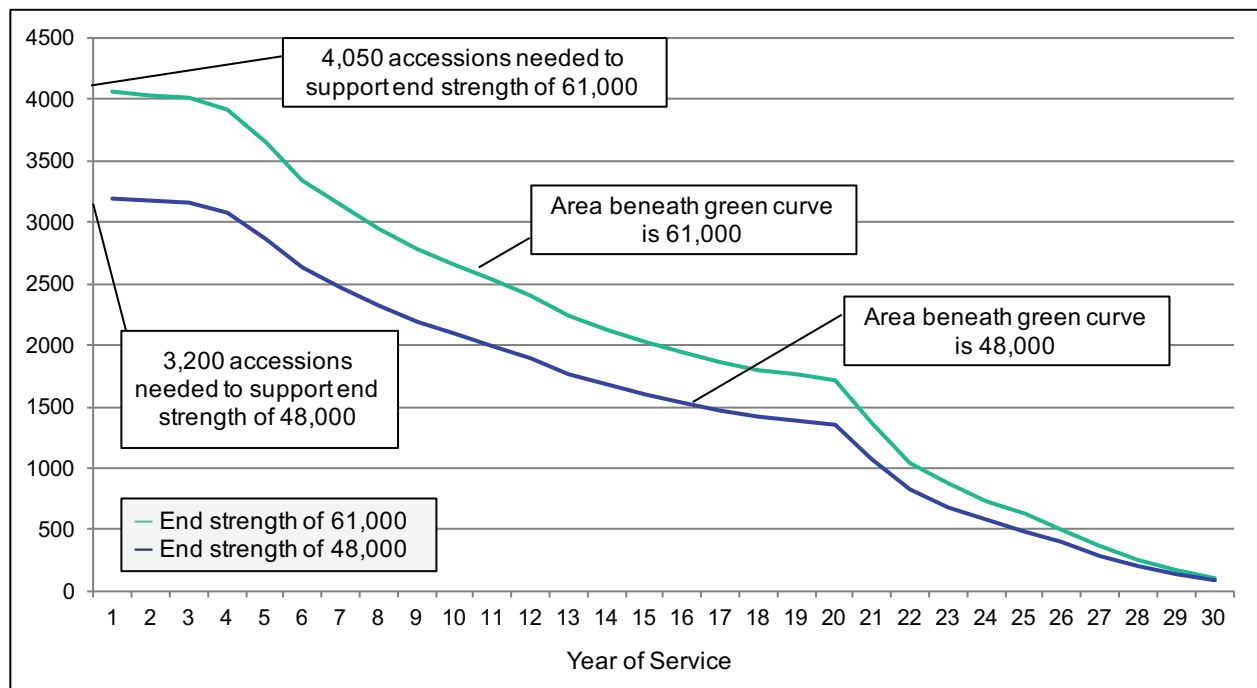
SOURCE: AF/A1PT.

Training leaders and managers at AETC and 2nd Air Force reported receiving *monthly* updates to training targets in recent years, as the Air Staff attempts to balance end strength in the year of execution. The problem with this method of management is twofold. First, the retention rates upon which the sustainment profiles are based are not stable enough to perform monthly updates. Consecutive ten-year cumulative continuation rates for an AFSC can jump significantly based on the cohort that just entered and the cohort that just exited the ten-year interval. For instance, Figure 2.4 shows six ten-year profiles for 3D0X2 to sustain an inventory of 4,725 (which happens to be the inventory in mid-2015). Although most years change little, the years 2006–2015 show higher retention which translates to a higher cumulative continuation rates and fewer accessions required to sustain it. Using these retention rates to determine the number of accessions needed to sustain the career field might suggest reducing the accession goal for enlisted cyber systems operators (3D0X2) from 526 to 493, a decision one might consider rash considering previous history.

As Figure 2.4 demonstrates, retention curves based on a ten-year average can vary significantly depending on factors not accounted for. Such factors can be policy-driven. A year in which force-shaping policies have been implemented can result in a year of artificially low retention and imply a falsely high accession requirement, while a year in which stop-loss has occurred will show misleadingly high retention and suggest a low accession requirement. Factors impacting retention averages can also be voluntary, such as retention or separation bonuses, economic changes in the civil sector, changes in operational tempo, or even changes in a personnel process.

Figure 2.4. Even Ten-Year Retention Profiles Can Change Unexpectedly

The area under all the curves reflects an inventory of 4,725 airmen. Retention changes drive the varying accession "requirement" at year 0.

Legend:
- 2001-2010
- 2002-2011
- 2003-2012
- 2004-2013
- 2005-2014
- 2006-2015

X-axis: Years of service

Years	Required accessions
2001–2010	525
2002–2011	513
2003–2012	520
2004–2013	526
2005–2014	526
2006–2015	493
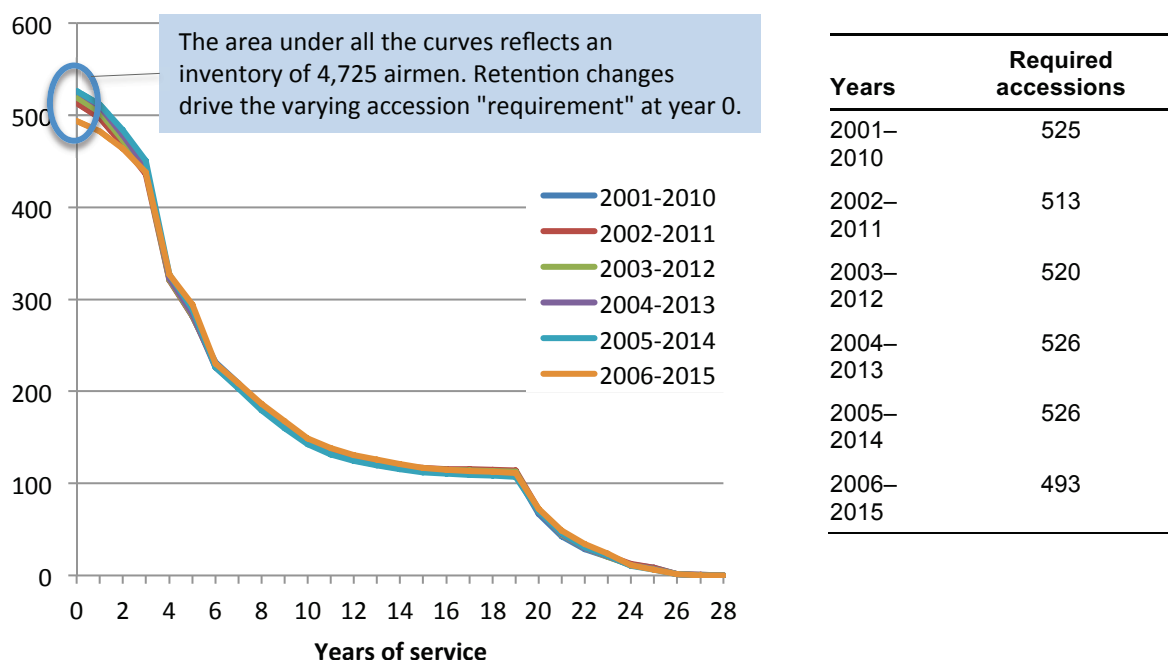
This single AFSC demonstrates the potential for unknowingly overcorrecting or undercorrecting for the number of accessions needed to sustain an AFSC based on factors that may occur only for a short interval. Such potential changes may not occur for all AFSCs or over the full ten-year period, but this example illustrates the downside of micromanaging accession targets. Additional analysis may be able to determine in which AFSCs such outcomes could be most problematic.

In addition to the instability associated with using retention as a basis for monthly requirement updates, other force-management techniques that can be used to adjust end strength are not related to accessions. It may be unrealistic to expect changes to the number of accessions to be the primary tool for meeting end strength constraints—solving an inventory problem for a single year using a method with 30-year consequences. While decreasing end strength will always be challenging to manage, a combination of force-management techniques to avoid "bathtubs" (cohorts with very few members) while also retaining experienced individuals is a balancing act the Air Force must attempt to perform.

To the extent that AETC is able to increase or decrease the number of expected graduates in the year of execution, steps can be taken during the planning process that will help set realistic expectations for changes. For example, we discovered in our review of training planning processes something called the "rack and stack." This is a tiered list of AFSCs in order of production priority, as shown in Table 2.1. Responsibility for developing and maintaining the list

Table 2.1. FY15 AF/A1P Guidance for Training Production Priorities

	Category 1		Category 2		Category 3
1A8X1	Airborne Crypto Lang Analyst	1C5X1	Aero Con/Warn Sys	1A2X1	Aircraft Loadmaster
1A8X2	Airborne ISR Operator	1C6X1	Space Systems Operations	1A3X1	Airborne Mission Systems
1CX1	Combat Control	1N0X1	Operations Intel	1C1X1	Air Traffic Control
1C4X1	Command Post	1N1X1A	GEOINT Analyst	1N1X1B	GEOINT Targeteer
1N3X1	Crypto Language Analyst	1N4X1B	Fusion Analyst	1N2X1A	Signals Intel Analyst-Electronic
1N4X1A	Network Intelligence Analysis	1U0X1	RPA Sensor Operator	1P0X1	Aircrew Flight Equipment
1T0X1	Surv, Evas, Res, Escape	1W0X1	Weather	2A2X3A	SOF/PR EWS (CV-22)
1W0X2	Special Operations Weather	2A2X1A	SOF/PR Comm/Nav/MSN System (CV-22)	2A3X3	Tactical Acft Maint
3E8X1	Explosive Ord Disposal	2A3X7	Tactical Acft Maint (5th Generation)	2A5X4	Refuel/Bomber Acft Maintenance
9S1X0	Technical Applications Specialist	2A6X1	Aerospace Propulsion	2A6X4	Acft Fuel Systems
		2A6X5	Acft Hydraulics Sys	2A7X2	Nondestructive Insp
		2A6X6	Acft Ele & Environ System	2A7X5	L.O. Aircraft Structural Maint
		2A7X3	Aircraft Structural Maint	2A9X1	Bomber/Special Comm/Nav/Msn
		2A8X2	Mobility AFs Integrated Instr & Flight Control Sys	2M0X2	Msl & Space Sys Maint
		2M0X3	Msl & Space Facilities	2W1X1	Aircraft Armament Sys
		2W0X1	Munitions Sys	3D0X2	Cyber Systems Ops
		3N0X2	Broadcast Journalist	3D0X3	Cyber Security
		3S0X1	Personnel	3D1X2	Cyber Transport Sys
		4H0X1	Cardiopulmonary Lab	4A0X1	Health Services Management
				4C0X1	Mental Health Services
				4E0X1	Public Health
				4M0X1	Aerospace and Operational Physiology
				4N0X1	Aero Medical Services
				4T0X1	Medical Laboratory
				4V0X1	Ophthalmic
				4Y0X1	Dental
				5J0X1	Paralegal
				6C0X1	Contracting

Table 2.1—Continued

	Category 4		Category 5		Category 6
1A0X1	In-Flight Refueling	1N2X1C	Comm Signals Intelligence	2A6X2	Aerospace Ground Equip
1A4X1	Airborne Operations	2A0X1K	Avnics Test Stat & Comp, Avnics Systems	1C832	Airfield Systems
1A9X1	Special Missions Aviation	2A0X1P	Avnics Test Stat & Comp, Sens Sys & EWS	3D1X7	Cable and Antenna Sys
1C0X2	Aviation Resource Management	2A3X4	A-10, F-15 & U-2 Avionic Sys	4Y0X2	Dental Lab
1C7X1	Airfield Management	2A3X8	RPA Maint	4D0X1	Diet Therapy
2A2X1	SOF/PR Integrated Comm/Nav/Msn	2F0X1	Fuels	3E0X1	Electrical Systems
2A2X2	SOF/PR Integrated Instr & Flt Control Sys	2P0X1	Precision Meas Equip	1C831	Ground Radar Systems
2A2X3	SOF/PR Integrated Elect Warfare Sys	2R0X1	Maint Mgmt Analysis	3E1X1	Heat, Vemt. A/C & Refig
2A3X5	Integrated Av Sys	2T1X1	Vehicle Operations	4T0X2	Histopathology
2A5X1	Aerospace Maintenance	2T3X2A	Special Veh Maint Fire Trucks	2S0X1	Material Mgmt
2A5X2	Helicopter/Tiltrotor Maint	3D0X4	Comp Sys Programming	4A1X1	Medical Material
2A6X3	Aircrew Egress Sys	3E0X2	Elect Power Production	2A8X1	Mobility AFs Integrated Comm/Nav/Msn
2A7X1	Aircraft Metals Technology	3E3X1	Structural	3E2X1	Pavements & Const Equipment
2A9X2	Bomber/Special Instr & Flt Control	3E6X1	Operations Management	3E4X3	Pest Management
2A9X3	Bomber/Special EW & Radar	3E7X1	Fire Protection	3N2X1	Premier Band
2G0X1	Logistics Plans	3E9X1	Emergency Management	3N1X1	Regional Band
2M0X1	Msl & Space Sys Elect Maint	4A2X1	Biomed Equip	3D1X3	RF Transmission Sys
2R1X1	Maint Mgmt Production	4B0X1	Bioenvironmental Engr	3P0X1	Security Forces-All Slick
2T0X1	Traffic Management	4J0X2	Physical Medicine	3M0X1	Services
2T2X1	Air Transportation	4P0X1	Pharmacy	2T3X2C	Special Veh Maint Mhe
2W2X1	Nuclear Weapons	4R0X1	Diagnostic Imaging	4N1X1D	Surgical Serv-Otorhinolaryngology
3D0X1	Knowledge Operations Mgt	6F0X1	Financial Mgt & Comptroller	2T3X1	Veh & Veh Equip Maint
3D1X1	Client Systems	8G0X0	Honor Guard	2T3X7	Vehicle Mgmt & Analysis
3E5X1	Engineering			3E4X1	Water and Fuel Sys Maint
3N0X5	Photojournalist				
4N1X1	Surgical Service				
4N1X1C	Surgical Serv-Orthopedics				
4Y0X2	Dental Laboratory				

SOURCE: AETC/A3P.

rests with AF/A1PT, which coordinates the prioritization with Headquarters AETC. In recent FYs there have been significant increases in the number of accessions, but Headquarters AETC staff members reported that this preexisting planning tool was not used to determine which career fields or schoolhouses should receive the increases.

One would have expected the Air Staff to provide AETC with new accession targets and AETC, in turn, to systematically ask 2nd Air Force and the schoolhouses how many additional graduates could be produced for each AFSC in priority order. Instead, we were told that the Air Staff repeatedly asks AETC, Headquarters 2nd Air Force, and the individual schoolhouses about the number of graduates that could be produced for each AFSC. The Air Staff was suggesting particular AFSC pipelines and specific numbers of increased graduates, and they were asking these questions about AFSCs one at a time rather than proposing all AFSC changes at one time. This is just one example of how using proactive, precoordinated methods for dealing with changes in end strength targets could help facilitate responses to changing requirements.

The Air Staff, for its part, explained to us that it was constantly adjusting the aggregate end strength based on congressional actions and adjusting the requirements for specific AFSCs based on decisions by DoD and Air Force senior leaders. If additional end strength was available or even needed, they wanted to do all that they could to improve manning in what they deemed important AFSCs—for example to support new weapon systems or to improve manning in hard-to-fill specialties. The problem, as discussed above, is that their changes to training targets may be "late to need" and their individual changes may be suboptimal across all AFSCs.

In addition to the problem of micromanaging requirements, numerous stakeholders talked about the difficulty of reacting to changes in training requirements in the year of execution—explaining that it was almost too late for the schoolhouses to make adjustments at that point in time. In some cases the difficulty stemmed from the lack of communication about potential changes, such as when the Air Staff might be aware of possible changes in end strength, and in turn accession targets, but would wait to relay that information "until they knew for sure." In other cases, career-field managers were aware of factors (related to weapon systems, technologies, organizational changes) that would require changes in training targets but did not report this information to AETC or to the applicable schoolhouse.

Training leaders stressed that while they understood that it is not practical for the Air Staff to provide exact changes to training targets in times of political and budget uncertainty, being provided early insight about potential change could ensure that strategic management decisions at AETC do not run counter to the change. In fact, daily decisions at all levels of the training enterprise can influence the number of graduates—including such decisions as whether to cancel a class, perform maintenance on a dormitory, or increase or decrease capacity in particular pipelines. Therefore, early insight into the magnitude and direction of changes in requirements can influence such decisions and better position training organizations to respond.

Lack of Agility in Responding to Changing Requirements

> Changing on a dime is the new normal. . . . The final PGL should be available
> one year prior to execution in order to complete the planning process. However,
> in FY16, the funded PGL was available only 2 months prior to the start of the
> programmed year.

From the Air Staff's perspective, changes in end strength (whether an increase or decrease)
should lead to a corresponding change in the number of airmen that the Air Force accesses
because there is no need to produce more or fewer than needed. From its corporate perspective,
this is prudent management. While the Air Staff is relatively quick to react to changes, the
realities of the training process make it more difficult to make adjustments in the technical
training pipeline in the year of execution. Air Force manpower and assignment processes, for
example, do not react fast enough when additional instructors are needed to meet increased
training requirements. Additionally, facility expansions take time and funding may arrive too late
to address increases needed for more students.

Moreover, from AETC's perspective, increases to end strength and accessions may require
increased resources. The number of instructors and training leaders must be sufficient for the
new training goals. Funding for food, equipment, lodging, and other related requirements should
increase and be available as needed—rather than requiring training wings and schoolhouses to
make do with existing resources when requirements change. While it is unrealistic to expect
Headquarters Air Force to push back on congressional, budgetary, and operational adjustments, it
may be just as unrealistic to expect AETC to make immediate and underresourced adjustments to
personnel training requirements.[4] Nevertheless, there is room for AETC to insert more agility
into its processes.[5]

The original concept for the technical training pipeline planning process assumed a stable
PGL one year prior to execution, but that is not always the reality, as the previous section
describes. For example, preceding RAND's 2003 study for AETC analyzing the cost, capacity,
and management of the Air Force's technical training system (see Manacapilli et al., 2004),
the PGL was modified to include a large increase in security police in the aftermath of the
September 11, 2001, terrorist attacks. Such changes are a consequence of the political and
military environments surrounding the training system. Limiting constant adjustments to career-
field sustainment (and the corresponding changes in needed accessions), as discussed in the prior

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[4] We heard very little discussion from either AETC or the Air Staff about returning resources, including funding, if
requirements for trained personnel decrease.

[5] It was beyond the scope of this study to assess how agility varies across training pipelines, so it is not clear what
additional factors might be involved in determining how agile any given pipeline can be. Agility might vary
according to the size of the AFSC, the length of the pipeline, etc. We recommend that future research efforts
examine these aspects of agility.

section, will reduce the changes AETC must adjust to; however, the command must be able to adapt to marginal changes in the PGL prior to or even within the year of execution.

Historically, higher end strength numbers have equaled a greater ability to absorb small changes, but reductions in the size of the force have limited the ability to solve problems by moving readily available personnel and resources. The processes at AETC, the training wings and group, and the schoolhouses must become more flexible and responsive to inevitable changes in requirements. This agility becomes especially important when budgetary and end strength decisions drive rapid increases or decreases in accessions and when dealing with smaller, more routine adjustments to career fields.

Currently there is no alternative to the lengthy PGL and this is one of the major observed challenges to the ability to quickly react to end strength changes. Although the process is based on a stable planning document one year prior to execution, stakeholders point out that this rarely happens—delays create considerable uncertainty as planners await final numbers for the year and then deal with inevitable changes throughout the year. According to planners in 2nd Air Force, the final PGL should be available one year prior to the year of execution in order to provide sufficient time for scheduling and instructor pricing. However, in recent years the PGL release has been delayed. In FY 2016 it was not released until two months before the start of the FY, which delayed the selection and training of instructors and limited the ability to provide additional classes if necessary.

The PGL converts accessions per career field into programmed training seats. Some schoolhouses are operating under capacity and can easily accept small changes to the PGL without additional resources. Most often, however, when the number of students increases requirements for instructors, class offerings, equipment, and infrastructure increase as well, which, in turn, may require additional funding, as mentioned previously (resources will be discussed further in Chapter Four).

For example, using our model of the training process, we calculated the additional number of students that could have graduated from the four example AFSCs based on the 2015 class schedule. In Figure 2.5, blue bars show the total of number of students that graduated during 2015. The red bars show the number of students that could have graduated if there had been additional instructors and all of the classes that were held had been completely filled, without any changes to the class schedule. For the 17D1 and 3D032 AFSCs, there is only a negligible difference between the blue and the red bars, indicating that the final classes scheduled in the course sequence were essentially filled to capacity. However, for the 14N1 and 2A333M career fields, an additional 30–40 students could have completed the AFSC course sequence without changing the classes scheduled. For 14N1, which has a one-course sequence, adding additional students could have yielded about 30 more graduates. For 2A333M, which is a two-course sequence, seats for about 40 graduates are not used in the second course in the sequence. To increase the number of graduates, therefore, additional class offerings for the first class in the sequence would be necessary.

Figure 2.5. Actual and Maximum Graduates for Four AFSCs, 2015
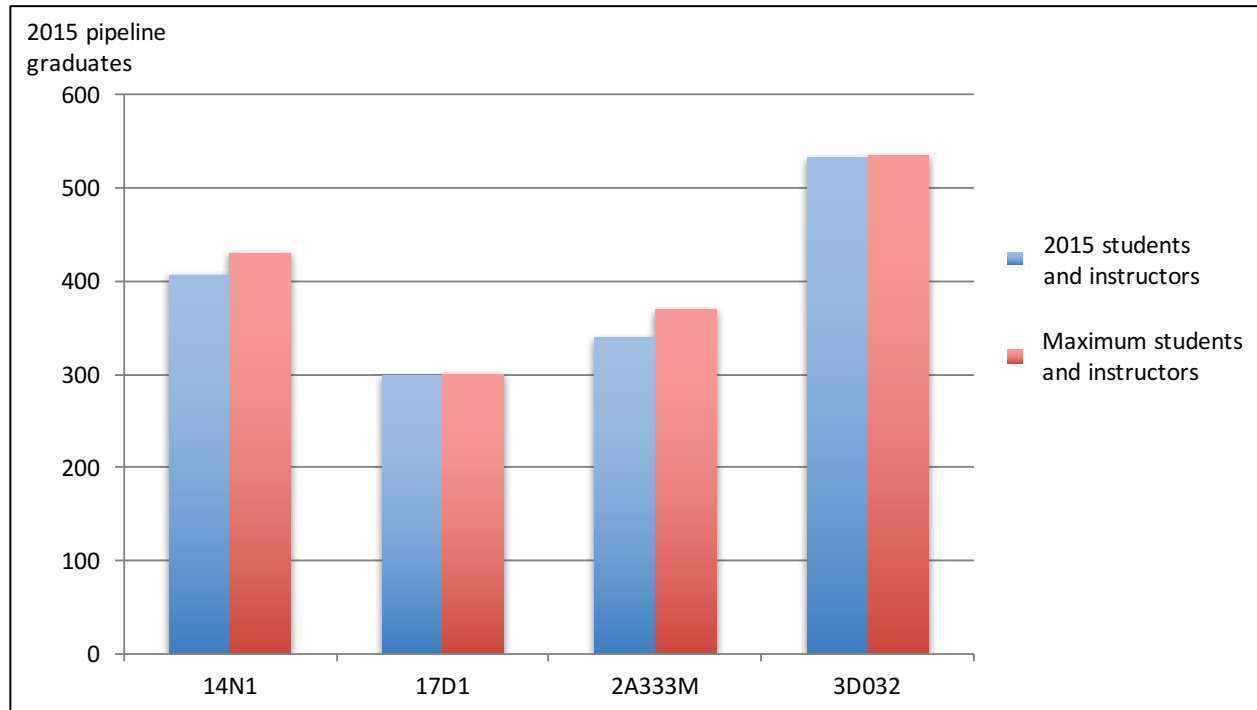
SOURCE: RAND-generated based on 2015 ADSS data.

Adding to the complexity of the timing associated with the planning process is the lead time required for procuring instructors, funding, and equipment. These critical resources must be obtained within time cycles that do not always align with the demand-planning portion of the technical training process and are not suited for last-minute adjustments. It can take a year to get a trained new instructor through the pricing process and equipment funding is often tied to FY funding, so operating outside of these cycles is challenging. In order to ensure that these resources are available when needed, an early and unchanging PGL is required to allow planners to identify and secure resources in plenty of time to meet the need.

Inefficiencies are exacerbated when schoolhouses are asked to accommodate a changing number of students. As numbers of students change, each planning iteration requires significant time and effort to adjust to last-minute changes. As numerous stakeholders noted, even for courses that have spare capacity or the flexibility to create additional capacity, there is no systematized way for planners to account for this space. In addition, lack of communication about changes can be equally frustrating. One training wing recalled a recent circumstance where an inbound instructor did not show up. Only when they called to find out why the instructor did not report to the schoolhouse did the wing learn that a recent change to the PGL had reduced the need for the extra capacity. The instructor simply had been canceled without notification to the wing.

Additionally, processes outside the training pipeline, particularly the accession process, impact the flexibility of the system. The Air Force Recruiting Service explained that it could take six months to respond to new accession targets; that is, to find the recruits who in turn become new entries into basic and technical training schoolhouses. Among the accession sources, enlisted accessions are more flexible while USAFA and ROTC operate on a four-to-five year schedule (due to the length of time to complete an undergraduate degree) and struggle to quickly produce increased numbers of airmen with specific degree qualifications on short notice. To make up the difference, candidates are recruited from OTS, but OTS also faces facility constraints, restricting its ability to rapidly surge. Moreover, it is not possible to fully adjudicate long-lead-time requirements like top secret clearances in the short training window of OTS, leading in some cases to extended waiting periods for students after graduation. Like resourcing, the accession process requires a longer-term planning cycle.

Stakeholders at different stages in the process use different strategies to increase flexibility. First, AETC and 2nd Air Force have worked hard to start the planning cycle earlier in the year. In October 2015 (the first month of FY 2016), a working group met to finalize the FY 2016 PGL, leaving little time for any adjustments within the funding or instructor procurement timelines. For FY 2017, the same working group met six months earlier, in March 2016. Nevertheless, it is likely the system will require further assessments and adjustments all along the pipeline. While starting planning earlier is a big positive step, those involved in the process can still expect last-minute alterations. Different organizations approach these challenges differently and may offer insights that can be used to improve the efficiency of the process down the line.

At the schoolhouse, flexibility occurs "on the backs of the instructor corps." Instructors create capacity by working longer hours, taking less leave, and exceeding the student-to-instructor ratio—all at an unknown cost to the quality of instruction. In extreme cases, schoolhouses extend instructor tours and one group even reported waiving security clearance requirements. For courses with equipment limitations, schools run multiple shifts or request funds from relevant MAJCOMs or career fields. One schoolhouse noted that the joint operational world has a special fast-track process to request urgent operational funds; however, they lamented no such parallel exists in the training environment, even when increased requirements are mandated by Congress. A similar process would help schoolhouses keep pace with emergent changes or urgent needs in the training pipeline and reduce some of the inefficiencies that the planning process encounters.

At the training wings, several stakeholders proposed to introduce more flexibility into the planning process by planning for a range of possible training targets, called a "band," rather than the point estimates contained in the initial PGL. For example, the band may be plus or minus 10–20 percent around the PGL targets. So using a 10 percent planning band and a PGL target of 200, the schoolhouses would plan for a range of 180 to 220 students. In this scenario, changes to the PGL within band limits could be accommodated within the planned pipeline capacity. Significant changes to the PGL outside the band would require additional resources (or the loss thereof). Such an approach, however, would limit the number of times stakeholders have to react

to last-minute changes in the PGL, particularly since many changes that occur would likely fall within the band. Because of metrics, reporting requirements, budgetary concerns, and the precedence in previous FYs of managing to the exact training requirement, 2nd Air Force and Headquarters Air Force prefer a more granular PGL with specific established targets as compared to broader bands that would still have to be narrowed down to exact numbers. Many argue it is impossible to plan *for* changes, but it is possible to plan *on* changes. Early publication of the PGL (even if only at the 80–90-percent-complete level) and allocating resources to support a range of eventual targets would introduce the type of flexibility needed in the planning process.

Insufficient Visibility into Technical Training Capacity

> There is no visibility into tech training capacity. . . . The capacity assessment drills require a lot of time—because we need to examine empty seats, course availability, interaction with other courses, input from BMT and other issues.

As noted in the previous section, the inability to view schoolhouse capacity limits the flexibility of the technical training pipeline. Early in the planning process, 2nd Air Force is forced to contact all schoolhouses (which often delegate to over 100 training managers) and determine whether they have enough capacity and resources to support the draft training plan (Figure 2.6). If not, schools report what resources they would need to do so. This information is passed to Headquarters Air Force which decides whether to provide additional resources or adjust the PGL. Under current procedures, this process iterates sequentially from the Air Staff to 2nd Air Force to the training wing, the training group, and the appropriate training manager. The training manager then schedules the courses and seats and assesses the resources required at the same level of detail as if they were actually planning for the students to report. Then the assessment of the change is coordinated back up the reporting chain and the Air Staff is informed of whether their proposed change is feasible and at what cost. Each time the PGL is adjusted, it is at a great cost in time and staff resources. The lack of real-time visibility into the current training planning process is a source of repeated frustration and wasted resources.

Stakeholders throughout the technical training pipeline were frustrated by the lack of visibility into training capacity and this void forces assessment "drills" every time the PGL needs adjustment. These assessment drills are hugely inefficient and time-consuming. Schoolhouses reported that it can take training managers up to eight days to evaluate each proposed change to each class. Evaluations must consider a wide range of variables: students coming from BMT, current empty seats, interaction with other courses, infrastructure, the possibility for shared instructors, follow-on courses, and other related issues. Each proposed change becomes a complicated multivariate problem and the time involved quickly adds up, especially when dozens of proposed changes to the PGL can affect hundreds of specialties across multiple technical training facilities. Also, as the magnitude of the proposed changes increases, so does the complexity of determining a way to accommodate the change.

Figure 2.6. Information to Support Execution Planning Is Often Not Readily Available and Must Be Passed Through Many Organizational Layers
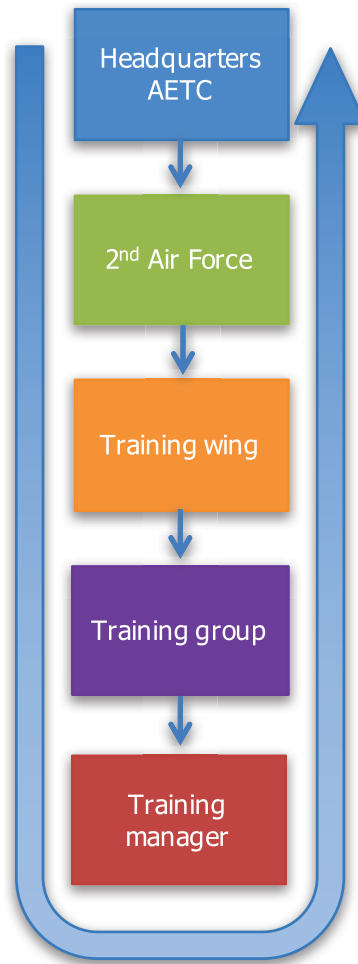
A related inefficiency is the lack of a systematized approach to determine capacity. Stakeholders at each level maintain their own personalized spreadsheets and methods for calculating capacity. The sheer preponderance of these individual systems suggests that current data and analytics are insufficient. Every stakeholder from Headquarters Air Force to the schoolhouse managers stressed the importance of improved methodology and data sharing. Headquarters Air Force, AETC, and 2nd Air Force all agree that "it would be nice to have a model that could provide better estimates of any impacts of changes [to the PGL]." They advocate for the availability of automated, real-time information on schoolhouse capacity rather than the current system where they must "run an entire scheduling process with an exact schedule just to get pricing options." Such a model would help address daily issues like instructor deployments and infrastructure failure. Each of these same stakeholders agreed there should be a more readily available answer to the question "What is a schoolhouse's or AETC's capacity?"

In addition to being inefficient, assessment drills have broader implications for the training pipeline process as a whole. The underlying problem of visibility points to a system that is reactionary rather than proactive. As an alternative, schoolhouses should have standardized outcomes and supporting data on their current capacity and what resources would be needed to produce more students. The results of such a standardized approach should also be readily available to decisionmakers at headquarters.

During the working group the research team observed in October 2016, Headquarters Air Force and AETC reported that FY 2016 accessions were increased by 1,900 above the originally finalized PGL. Fewer than 900 of those accessions could be placed in a class seat given current capacity and training constraints. Rather than supplying resources to the constrained courses, AETC and 2nd Air Force were asked what courses could take extra people. It is problematic that these accessions are directed to courses with capacity and not to AFSCs with valid requirements and higher operational priority. The implication is that budgetary and end strength pressures can drive training requirements rather than operational needs.

Lack of Readily Available Information to Support Execution Planning

> It would be good to have rapid visibility on any seats that are likely to be missed, so that we can quickly replace a vacant seat with a re-class or another student in waiting. This visibility needs to permeate AETC, the 2nd Air Force detachment, schoolhouses, everywhere.

The lack of visibility applies not only to schoolhouse capacity; it is endemic throughout execution planning processes. It is especially apparent between AETC and the schoolhouse when it comes to filling empty training slots, or seats. When a training seat is left vacant at the beginning of a course, there is no process to automatically fill that seat with another student, such as an airline might have with stand-by passengers. There is no triggering mechanism to notify AETC when a training seat at the wing is empty.

Informally, there is horse-trading whereby components give unused seats to another component, particularly among the guard, reserve, and sister service components, but some seats still go unfilled. Schoolhouses try to fill empty seats, but relying on ad hoc processes does not make the best use of training resources and is symptomatic of a lack of transparent communication among hierarchical levels, information sharing, and established process. With proper procedures and enough advance notice, AETC could more efficiently reclassify students or accession sources could bring additional students into the pipeline earlier to take advantage of empty seats. AETC's options are limited, however, to students awaiting training (SAT); AETC cannot, for example, alert Recruiting Service, AFPC, 2nd Air Force, BMT, or officer commissioning sources with enough time to fill these seats (to be discussed in greater detail in Chapter Three).

In FY 2016, AETC implemented a process to address classroom vacancies that attempts to collect information on classroom assignments 60 days prior to the beginning of each session to

give them enough time to fill empty seats. At this time, however, it is not a formal policy but one that is used based on individual or organizational preferences. Formalizing a more rapid and flexible policy that will allow AETC to more effectively utilize all seats and reclaim those that might otherwise be wasted, and/or developing a system that provides information about empty seats on a more timely and regular basis, will help maximize classroom capacity.

Missing Participants in the Planning Process

AETC needs to pay more attention to the PRD than they currently do.

One theme that cut across a variety of participants in the interviews from Headquarters Air Force down to instructors is the need for consistent and efficient communication between pipeline process stakeholders. The project team observed that the right representatives are not always involved at the right points in the planning process. This inefficiency became apparent in a number of different circumstances. At the earliest planning point, AETC is not sufficiently involved in creating the PRD, which lays out the expected accession plan for the next three FYs. Nor is AETC necessarily involved in discussions at Headquarters Air Force that affect training, which, as AETC staff explained, is often due to location, travel and time constraints, but also to a historical disinterest in that part of the process by previous AETC senior leaders. By comparison, relevant MAJCOMs are usually involved in strategic requirements and capabilities discussions, such as those involving a new airframe. Ensuring that AETC participates early in these conversations is important.

Similarly, training wings often feel that they are in the dark about changes to the PGL until well after those changes have been executed, especially in the year of execution (as in the case, previously described, of the canceled instructor). Improving communication about forecasted increases or decreases in accessions, throughout the pipeline, will give each participant greater time to effectively adapt to anticipated changes.

Another variable voice in the planning process is the career-field manager. From Headquarters Air Force to the schoolhouses, stakeholders reported little consistency in the career-field manager's role in determining requirements. Career-field managers often do not receive extensive training and their involvement is often personality-dependent. Numerous interviewees said that "the squeaky wheel often gets the grease" and "up to 25 percent of the calculus for requirements and accessions comes from their input." Vocal managers, then, can have a disproportionate amount of influence regardless of their requirements, while comparatively absent or quiet managers may risk unnecessary reductions that could harm their career field. Standardizing the roles career-field managers play and evening out their access to the planning process would help ensure that there is a more even playing field when it comes to developing the requirements that feed into the PRDs and PGLs.

Complications of Guard and Reserve Planning

> Training managers here sort of rely on guard, reserve, and international students
> not making their quotas and so they use those seats as spots for washbacks.

The reserve components present unique challenges in the technical training planning cycle. Traditionally, the guard and reserve relied heavily on trained personnel who leave active duty and join their ranks. Today, as both components access more nonprior service accessions, they require more training seats at BMT and technical schools. However, the current training planning process for the reserve component is not precise, and across 2nd Air Force the guard and reserve continue to fill on average only 65–70 percent of their overall seats in a given FY.[6] This occurs for a number of reasons. First, as the reserve components work to recruit quality applicants, they must compete with the active component for accessions from the same pool of recruits. Losing a recruit even to active duty means the reserve component will not fill a seat allocated to them for BMT and technical training.

Second, the guard and reserve plan for each new member to go through technical training, while in reality many recruits have prior military service and may not need the technical training quota. Whether a new reserve-component member has prior military service or not, the reserve component assigns them a Training Line Number (TLN), which reserves a seat for them at BMT and IST for enlisted and IST for officers. Once a unit receives a TLN, they provide the member with information on when the training will occur so the member can adjust their civilian schedules to accommodate the training dates. Issues arise when members may not need the training and therefore do not report for training as anticipated by the schoolhouse. If there is little warning, a seat may go unfilled even if there are students waiting for a spot in the particular course.

Third, unlike the active component, guard and reserve personnel must schedule training around their full-time civilian careers, and often cannot predict precisely if or when they will be able to attend school. Finally, to complete some of the longer pipelines guard and reserve students must permanently relocate to the training base rather than complete the coursework as a temporary duty. Unlike active-component personnel, reserve-component members are unlikely to uproot family members to attend a training course. Consequently, they may have to support two households to complete such training programs. This challenge discourages many members from going to these longer training pipelines, accounting for some of the missed seats.

Funding also plays a role in the priority status accorded to most guard and reserve students when they do arrive for training. Though there is some variation, almost all schoolhouses give guard and reserve students higher priority when assigning students to fill seats because active-component members are already being paid full time, whereas reserve members are only paid

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[6] Estimate provided during discussions with 2nd Air Force staff.

when they are on duty. If a guard or reserve student has to wait for more than 30 days for training to begin, they will be sent home. This can be particularly problematic if a member receives a "broken TLN"—a TLN in which BMT and technical training school dates are not sequential. If the gap between courses is greater than 30 days, units typically recall the member back to home station while they wait for training.

In addition, many schools reported that even though guard and reserve members more regularly arrive with security clearances already in order, there are times when home units will send members who are unprepared because they do not want to risk losing the seat. Several schoolhouses also suggested that guard and reserve units will often send a surge of students at the end of a FY—either due to missed accession quotas earlier in the FY or because a reserve member is not available for training due to constraints presented by their civilian job. We were told in our discussions with training managers that the end of FY surge in reserve students can occur at the same time a surge of airmen graduates from BMT—a time when both the active and reserve components are trying to play catch up and hit their recruiting quotas at the end of year. From the perspective of the schoolhouses, this end-of-year surge has the potential to overwhelm schoolhouse capacity and cause an increase in SAT.[7]

Schoolhouses are quick to caution, though, that there is a silver lining to this inefficiency. For courses with a large number of SAT, a missed seat provides an opportunity to fill that space with a washback or a student who has been waiting for some time to begin training. In cases where there are not backlogs, this gap often provides instructors with some breathing room to work on course development, conduct their additional duties, or take leave if the number of students drops enough so that a class is canceled or particularly small. Thus, seats left open by the guard and reserve provide flexibility that many schoolhouses have come to rely on.

Several schoolhouses complained that AETC and 2nd Air Force's recent attempt to reallocate these missed seats to active-component students has proven detrimental to their operations. It has limited their ability to both deal with SAT and absorb occasional undermanning inefficiencies. Nevertheless, there is room for improved efficiency in how the guard and reserve plan, schedule, and fill training seats—and these efficiencies, such as planning for a range of possible training targets (banding), as discussed previously in this chapter, should be pursued. If achieved, the schoolhouses will no longer be able to count on missed seats as the "slack" that allows them flexibility. Overall management of the training pipeline will need to improve to avoid placing unintended stress on the schoolhouses.

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[7] An initial analysis of overall Air Force Reserve technical training entry data from FY 2012 to FY 2015 showed no clear evidence of such surges, rather a general increase in entries from February to the end of the FY. Further analysis by individual technical training course would be needed to assess this claim.

Summary of Technical Planning Process Inefficiencies

As stated at the outset of this chapter, many of the inefficiencies identified in the technical planning process are the result of insufficient or ineffective information flows throughout the process, which can set up unrealistic expectations. While there is inherent uncertainty associated with setting requirements, particularly when the planning process begins several years in advance of execution, Headquarters Air Force's reliance on sustainment models designed for longer-term accession planning to micromanage accession targets is problematic from the start. And the challenges of responding to frequent changes in requirements, particularly in the year of execution, are made all the more difficult when potential changes are not communicated until information is solidified. Communicating potential changes early can at least influence strategic decisions that could make responding to increases in requirements, in particular, even more difficult. In addition, the Air Staff should consider other force management techniques to adjust end strength which are not related to accessions.

At the same time, AETC needs to inject more agility into its ability to respond to inevitable requirements changes while recognizing limitations associated with long-lead-time resources such as facilities. One mechanism to introduce more flexibility into the planning process, aside from starting the process earlier so information is available earlier, may be to plan for a range of possible training targets using banding, rather than for the point estimates contained in the initial PGL.

Insufficient visibility into schoolhouse training capacity also limits the flexibility of the technical training pipeline and creates enormous frustration among stakeholders. Not only does it take a considerable amount of time and energy to determine where capacity exists in response to changing requirements, the inherent lack of visibility results in a system that is reactionary rather than proactive. Schoolhouses should have standardized approaches to determining capacity and the resources needed to produce additional students. And the results of a standardized process should be made available to decisionmakers. Lack of visibility applies not only to schoolhouse capacity but throughout the execution planning processes, affecting all types of details such as filling vacant seats and reclassifying students. Lack of information and inefficient communication is further exacerbated when the right representatives are not always involved at the right points in the planning process.

3. Inefficiencies in the Flow of Students Through the Pipeline

> I think we literally have [casual] lieutenants everywhere on this base.

The study team also identified inefficiencies in the flow of students during the execution phase of the technical training pipeline. Inefficiencies in student flow costs the Air Force time and money, as empty seats and the time students spend waiting for training quickly add up over the course of a year. SAT or students on "casual status" before, during, or after courses make up a major portion of those costs. Many factors contribute to this phenomenon; delayed security clearances, problems in accessions and assignments, washback management, missing scheduled seats, student surges, medical and personal issues, and capacity limitations all contribute to delays. Some of these factors, such as student surges on the officer side, are beyond AETC's control as they are due to graduation cycles at other institutions. This is particularly true for USAFA and OTS graduates who must go straight to active duty, unlike their ROTC counterparts who traditionally return home after college graduation and wait for their training date to enter active duty. In this chapter, we discuss a number of the factors that contribute to inefficiencies in student flow, which were identified primarily via the interviews with training wings and available quantitative data. They are ordered based on the magnitude of the number of students affected.

In addition to inefficiencies in the pipeline itself, the team also could not identify clearly defined, readily visible, or consistently collected metrics for how to measure efficiency in student throughput. Using data collected from a variety of sources, the team assessed the current metrics in place and developed additional metrics that might assist AETC in better tracking potential areas for improvement. We also developed a model of the training pipeline that was used to examine the effect of inefficiencies and approaches to mitigating them.

The Air Force technical training pipeline is an enormous enterprise. On the enlisted side alone, the Air Force recruited almost 32,000 people in FY 2016,[1] and all of these new airmen must go through BMT followed by technical skill training. With such a large number of people in the training system, costs associated with delays in training increase very quickly. For example, in an August 2015 briefing, 2nd Air Force indicated that 597 officer students experienced average training delays of 26 days while awaiting the security clearances necessary for their classes. At a cost of $285 per day per student, this represented a cost to the Air Force of almost $4.5 million. Delays result from other reasons as well: medical problems, the inability to satisfy physical requirements, delays between the end of BMT and the start of technical training, and delays between courses for those AFSCs with multiple courses. Given the high cost of potential delays,

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[1] End of FY recruitment data provided by AETC.

the Air Force makes every effort to minimize them. But having good metrics and processes that identify delays that are occurring is essential to reducing these costs.

We analyzed ADSS data to examine delays in two ways: first, to check for objective evidence of delays described by interviewees, and second, to see if there might be delays that were not currently monitored or recognized by the Air Force. This section begins with our exploration of nontraining time that appears in the data.

Inefficiencies Associated with Time Not in Training

Air Force instructions require tracking metrics as part of effective pipeline management. But some required metrics are not tracked, such as time in the training pipeline. Our analysis indicates that key planning factors do not align with reality and this mismatch can be costly to the Air Force.

Costs Associated with Nontraining Time

Table 3.1 shows the results of our analysis of waiting time for the top ten enlisted AFSCs, which together have on the order of 6,000–7,000 trainees per year. These results are a clear illustration of how rapidly the total amount of nontraining time can accumulate. Over the five-year period examined, 2011–March 2016, an average of only 203 students progressed

Table 3.1. Top Ten Enlisted AFSCs in Terms of Nontraining Man-Years

AFSC	Title	Average Annual Number of Students (with No Washback or Ineffective Status)	Nontraining Man-Years (Excluding Planned Breaks)
1T2X1	Pararescue	203	49.2
3P0X1	Security Forces	3608	45.1
3D1X2	Cyber Transport Systems	651	42.6
1A8X1	Airborne Linguist	266	35.5
3D0X2	**Cyber Systems Operator**	**673**	**27.3**
1N4X1A	Fusion Analyst	163	23.9
2A3X3E	Tactical Aircraft Maintenance (U-2)	185	23.5
1C2X1	Combat Control	95	21.9
2A5X4A	Aerospace Maintenance (E-3)	446	20.5
1A2X1	Loadmaster	412	19.6

through the Pararescue training courses without any recorded delays or washbacks. The Air Force *plans* on a certain amount of time between courses, which in this AFSC is 50 days,[2] to account for travel between training locations and delays associated with limited class sizes. These delays accumulate to 27.8 man-*years* of nontraining time each year (203 students × 50 days = 10,150 nontraining days). However, ADSS data show that even after taking this expected wait time into account, other delays cumulate to an additional 49 man-years of nontraining time for this AFSC. The cyber systems operator AFSC, 3D0X2, which has 27.3 man-years of nontraining time, is highlighted in the table because it was of special interest to our sponsor and we will return to it later in this discussion. The total annual nontraining time that enlisted students spend in the IST pipeline for all 246 enlisted AFSCs is 786 man-years.

Similarly, Table 3.2 shows the nontraining man-years for the top ten officer AFSCs. Nontraining time in the pipeline ranges from 31.7 man-years for intelligence officers to 1.1 man-years for special tactics officers. The intelligence and cyber operations career fields are highlighted in red because they were of particular interest to the research sponsor, and they were the two officer AFSCs experiencing the most nontraining man-years. The total nontraining

Table 3.2. Top Ten Officer AFSCs in Terms of Nontraining Man-Years

AFSC	Title	Average Annual Number of Students (with No Washback or Ineffective Status)	Nontraining Man-Years (Excluding Planned Breaks)
14NX	**Intelligence Officer**	401	31.7
17DX	**Cyber Ops**	240	30.4
35PX	Public Affairs	102	16.7
46NX	Clinical Nurse	141	14.0
13NX	Nuclear and Missile Operations	102	8.7
13DXA	Combat Rescue Officer	12	6.4
21MXN	Nuclear Munitions Mx	30	4.1
13SXC	Space	38	3.8
13SXA	Space	33	3.1
13CX	Special Tactics Officer	11	1.1

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[2] The Pararescue course is unusual in that it requires students to take courses at five locations: Lackland AFB, Tex.; Keesler AFB, La.; Fort Benning, Ga.; Fairchild AFB, Wash.; and Pope Field, N.C. The Air Force necessarily allows significant time for travel among the bases and potential delays because of limited class sizes.

time for all 36 officer AFSCs in this analysis is 120 man-years. As mentioned previously, the Air Force recognizes the costs of delays such as those for medical problems or the inability to satisfy physical requirements. The nontraining time determined in Tables 3.1 and 3.2 represents a significant cost above that already planned for.

Table 3.3 shows the potential costs of this nontraining time. According to the table, annual nontraining costs for officers and enlisted personnel in the training pipeline could exceed $43 million—an order of magnitude more than the cost of delays that 2nd Air Force has calculated for approval of security clearances.

Table 3.3. Potential Annual Cost of Nontraining Time

	Total Annual Man-Years	Annual Composite Rate[a]	Cost of Nontraining Man-Years
Officer	120	$91,366	$11M
Enlisted	786	$40,635	$32M

SOURCE: Office of the Under Secretary of Defense (Comptroller), 2015.
[a] The enlisted rate is for an E1 (airman basic). The officer rate is for an O1 (second lieutenant). Composite standard pay rates are used to determine military personnel costs for budget studies. The composite rate includes average basic pay plus retired pay accrual, Medicare-eligible retiree health care accrual, basic allowances for housing, basic allowance for subsistence, incentive and special pay, permanent change of station expenses, and miscellaneous pay.

Other Insights Associated with Nontraining Time

Tracking time in the training pipeline can yield other insights. Using cyber systems operators as an example, Figure 3.1 shows where unplanned waiting time appears to occur. The first row in the figure shows the waiting time the Air Force expects: five days between the end of BMT and the start of technical training classes; no waiting time between classes since the three classes that make up the training course are all taught at Keesler AFB; and no delay from completion of the course to departure for the student's first assignment. The second and third rows of the figure show that, according to the data, students are not waiting much longer than expected between BMT and the start of technical training, but the mean time between classes is nine days, with half of the students experiencing more than five days of waiting time.

ADSS data allow analysis of students by component as well, which we illustrate in Figure 3.2 for cyber systems operators. While mean and median waiting times between classes for active and guard students are about the same, guard students spend significantly less time waiting before the start of class.[3]

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[3] An initial review of 360 courses attended by both guard and active enlisted personnel hints that guard students in general have less waiting time before the start of a class. For active-component students, the time before the start of a class was greater than five days for 78 percent of the classes. For guard students this was the case for only 59 percent of the classes.

Figure 3.1. Waiting Times for Cyber Systems Operators, 3D0X2

	Time before class start	Time between classes	Time before next assignment
Planned	5	0	0
Mean Active	7	9	1.5
Median Active	6	5	0
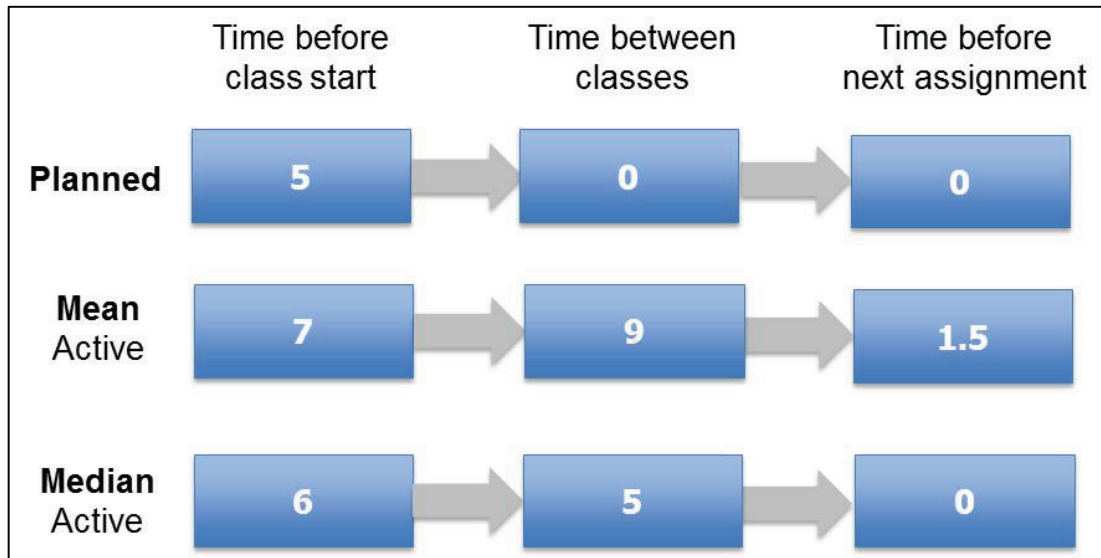
SOURCE: RAND-generated based on ADSS data.

NOTE: Time before class start and time before permanent change of station are means/medians from 2011 through March 2016. Time between classes is based on 2016 data for the time between the three courses "Information Technology Fundamentals," "Cyber Systems Operations Apprentice," and "Security + Certification."

Figure 3.2. Active and Guard Waiting Times for Cyber Systems Operators, 3D0X2

	Time before start	Time between classes	Time before next assignment
Mean Active (Guard)	7 (4)	9 (9)	1.5 (0)
Median Active (Guard)	6 (0)	5 (6)	0 (0)
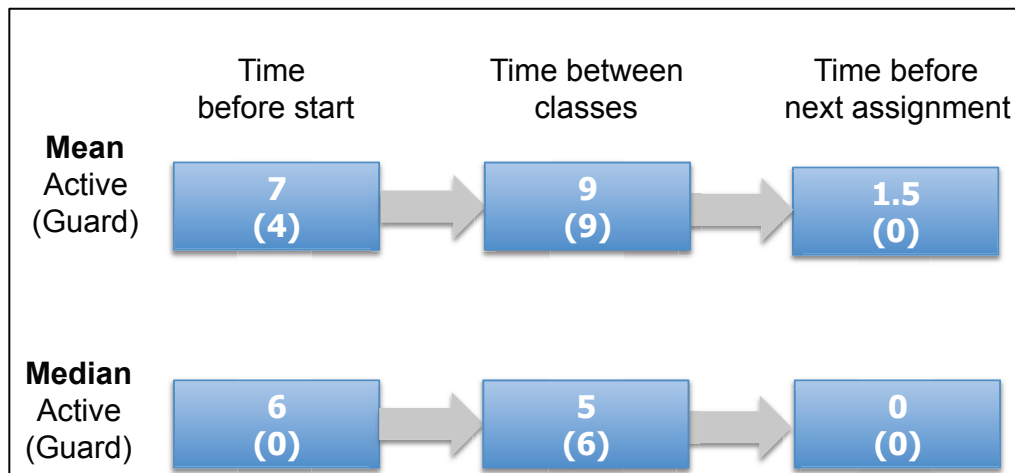
SOURCE: RAND-generated based on ADSS data.

These examples illustrate the value of using ADSS data to examine training and waiting time for students in the training pipeline. Examining these results provides an indication of whether actual training time is in line with what is expected, and also has the potential to highlight time

not in training that may need to be examined more closely. Finally, it allows comparisons of pipeline time for different student categories, which may also highlight problem areas in scheduling.

The remainder of this section discusses a number of factors that contribute to student delays in the training pipeline: lack of security clearance delays, accession and assignment delays, and lack of consistent management processes for washbacks.

Security Clearance Delays

> Of our 220 students, 50 are currently stuck in SAT status because of clearance issues.

Delays in training due to security clearances are not a problem for all career fields, but in some career fields the impact is significant, as some training wing elements indicated in their interviews. Interviewees also described ways in which they attempt to mitigate some of these delays. Delays in conducting background investigations have increased dramatically since the Office of Personnel Management database containing security clearance information was compromised in 2015—and delays are expected to continue into 2020.[4] The schoolhouses reported that it can take from 90 to 220 days for an individual to get a fully adjudicated clearance, even longer if there are complications. Graduates from USAFA and ROTC usually arrive at their technical training schools with the ability to gain an interim clearance because these processes are started in the students' junior year of college. However, enlisted personnel and those coming from OTS often experience the longest delays associated with clearances, as their clearance processes are not started until they are in BMT or OTS. Guard and reserve students occasionally have problems, but most are not sent to training if they do not have the required clearance or are sent home instead of remaining at the schoolhouse location.

The pipelines most affected by clearance delays are those requiring the highest-level security clearances (Top Secret/Sensitive Compartmented Information [TS/SCI]) like the intelligence and cyber career fields we studied. The career-field managers for these AFSCs need their officers and enlisted members trained on topic areas with real-world materials on real-world systems to ensure they are adequately trained and qualified for the career field; this means that the trainees must have the appropriate security clearances. The intelligence schoolhouse in particular struggles with large numbers of SAT because officers must have their TS/SCI investigations fully adjudicated before they can begin the course and enlisted students must have the TS/SCI partway through training. While officers can start their clearance process while still at USAFA or in

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[4] The Office of Personnel Management is responsible for conducting background investigations and issuing clearances across the DoD. The Air Force has no authority to change or shorten the process for security investigations.

ROTC, the clearance process for enlisted personnel does not begin until they enter BMT. With the current delays in clearance processing, enlisted airmen may not receive their clearance by the time they are ready to begin technical training. This TS/SCI requirement, then, generates an ever-growing backlog of students, especially on the enlisted side.

One way to minimize the effect of clearance delays on the technical training pipeline is to have the security clearance process start earlier—assigning responsibility to the Recruiting Service and using a delayed-entry program to ensure students do not enter the training pipeline until their clearances were approved. In the current course structure, students access highly classified networks which require a fully adjudicated clearance. Thus, issuing interim clearances (granted when the background investigation has begun but is not yet complete) or waiving the clearance requirement for training is not feasible for the intelligence pipeline.

To mitigate delays associated with the clearance process, the cyber pipeline has removed the need for a fully adjudicated clearance from its course prerequisites. As long as students arrive with an open investigation, they are granted interim clearances at the schoolhouse which are sufficient to complete their training coursework. While this approach reduces the number of SAT due to clearance delays, it does require the career field to take on a certain level of risk. One downside to this approach is that if a student graduates from this course and is not granted a full clearance, they are ineligible for assignments in the cyber career fields. These students would then have to reclassify into another career field—effectively wasting a valuable training spot.

Other training pipelines, such as the F-16 crew chiefs, have little or no direct problems with security clearances as the career field only requires a Secret clearance. However, some of the specialized F-16 courses (and similar courses in related career fields) do have higher security clearance requirements. Many of these pipelines are unwilling to accept the risk that students will fail their background investigations and therefore waste resources, so students do not go to those locations until their upgraded clearances are complete. Instead, students will wait around at their first technical training location until they can be cleared to move on. This is another source of SAT, with associated resource implications that are often not accounted for in data and metrics. While there will always be some uncertainty when it comes to balancing waste, cost, and risks, clearer metrics can help to identify recurrent inefficiencies and help mitigate some of the trade-offs.

Concern about delays associated with security clearances was so widespread that we expected delays to be obvious in student-related records, so we looked closely at ADSS data on delays for the three in-depth AFSCs in our study that require clearances: 3D0X2, 14NX, and 17DX.

ADSS documents why students are awaiting training (SAT status), including any security clearance issues.[5] We collected data for all students who entered training in these three AFSCs from 2011 through 2014 and checked for students in SAT status for reasons related to security clearances. Figure 3.3 shows the total number of students who entered training during this period and the number who were in SAT status for clearance reasons. The largest number of delays due to clearance issues was found for the Intelligence Officers (14NX) course, where 226 out of 4,018 students (8.7 percent) experienced delays in the five-year period. The Cyber Operations career field (17DX) had only 11 students out of 1,174 (1 percent) who experienced delays for clearance issues, and the Cyber Systems Operator career field (3D0X2) had none.[6]

Figure 3.3. Students Awaiting Training for Security Clearance Reasons
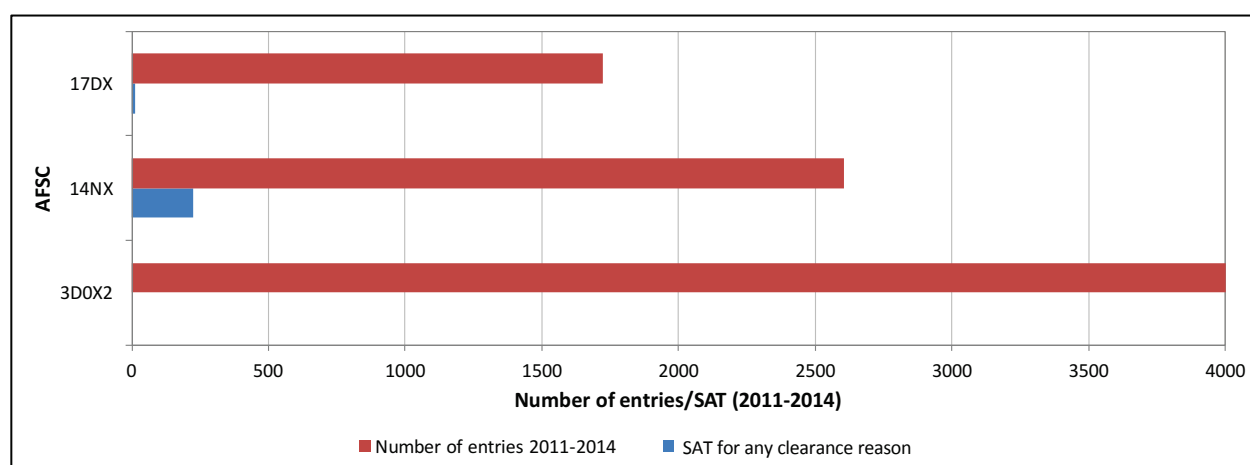
SOURCE: RAND spreadsheet "Pipeline Stats v2 14 April 2016."

Based on available data, very few students appear to be affected by security delays, yet training managers cited security clearance delays experienced in cyber-related courses as a big problem—seemingly conflicting results. It is possible that the SAT categories are not flexible enough to allow schoolhouses to record security clearance related delays, so the available data isn't reflecting the magnitude of the problem. It is also possible that training managers have found ways to work around the problem so that students can complete their training despite clearance problems, which again means that the delays do not show up in the data. It is also possible that concerns over security clearance delays are somewhat inflated relative to the actual

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[5] The reasons are labeled "Ineffective: Awaiting Security Clearance," "Ineffective: Awaiting Security Clearance – Equipment," and "Ineffective: Awaiting Security Clearance – Fundamentals."

[6] After this analysis was completed, we received copies of training status "dashboards" that, among other displays, includes a "SNIT" (students not in training) dashboard. As of August 16, 2016, it showed no 3D0X2 SAT for security issues, only three 17DX SAT, but 136 SAT in the 14NX course.

severity of the problem. Whatever may be the case, this analysis highlights the importance of collecting data in a way that that accurately captures the nature of pipeline problems and makes them visible to both the schoolhouses and to managers at higher levels in the pipeline.

Accessions and Assignments Delays

> At end of the fiscal year there is often a surge [of accessions] as recruiters try to meet their quotas. This results in lots of BMT graduates, which overwhelm the tech schools' capacity and results in a lot of SATs.

Complications with prepipeline accessions and postpipeline assignments are not part of the technical training pipeline but can create challenges for the flow of students. To maximize schoolhouse resources, the process is designed for a smooth flow; that is, an equal number of students flowing through the schoolhouses throughout the year with the assumption that students will normally leave for their first assignment as soon as they graduate. Surges in the system can overwhelm a school's capacity in any given week, causing a buildup in SAT, with graduates taking up housing space and other resources. Reductions in the number of students can cause some seats to go unfilled. Though most of these inefficiencies may not be major nor systemic, small but persistent irregularities can stymie the pipeline and cost time and money.

Unpredictable accessions—such as those caused by the 2016 push for increased end strength—are a major challenge to the training pipeline process. Both 2nd Air Force and BMT leaders noted there are currently 30–60 extra students arriving for BMT each week and 65 percent have a designated career field. Though not having a guaranteed career field allows some students to be quickly slotted into whichever technical training school that they are qualified for and has the first opening, the numbers are currently exceeding the capacity of the combined schoolhouses and creating a bow wave of SAT that continues to grow. While the schoolhouses can draw from this group of students to fill empty seats at the last minute, there is no systematic way to identify and fill these seats, as previously discussed. Instead, a schoolhouse that identifies a last-minute opening emails organizations throughout the pipeline to identify an available student. The time it takes to go through this process is lengthy enough that often the course will start without the seat being filled.

A more routine but similar problem is generated when academy graduates all arrive at the schoolhouses right after May graduation and must wait, sometimes for weeks or months, before a seat in a course opens up, a problem noted by both schoolhouses and students. ROTC and OTS graduates help balance this surge, since they can arrive at any point during the year. But ROTC students still must contractually be brought into the Air Force within a year of their graduation, which can create a similar surge a year later. Similarly, guard and reserve components may also surge their students at the end of the FY, as mentioned previously. Stakeholders at AETC and the training wings suggested that schoolhouses should have the ability to surge classes during peak graduation periods. But since instructors are one of the primary constraints on capacity, having

available instructors to surge during peak graduation periods might result in having an excess capacity during other times.

Graduates in "casual status" also present a problem for schoolhouses, as they use up time and resources. The assignments process usually operates so that graduates are at their first assignment within five days of graduation. However, there are instances where longer periods elapse and the graduate is placed in casual status—better understanding of what creates these added delays may be an opportunity for improved efficiency in the overall student flow. Several schoolhouses noted that recently assignments have been taking quite a bit more time than normal, something they attribute to a changeover in the personnel who process assignments actions. They claim that because orders are drawn up by people rather than an automated process, every time there is changeover there are bumps in the system which cause delays. Because a number of those we interviewed mentioned this problem, we believe there is an opportunity for AETC to partner with AFPC and develop processes that improve the efficiency of this process and reduce some of the delays.[7]

The most commonly cited delays occurring after the completion of technical training were for graduates with follow-on orders to an overseas location. The orders themselves take time, but so do all the various medical clearances for the student and his or her family. In addition, it was reported to the project team that there are additional delays for graduates going to some overseas assignments because they must have orders for their assignment after technical training, and also for their follow-on assignment. Some schoolhouses said that it routinely takes these graduates 30 days, but sometimes up to 90, before they are ready to leave. Better organizing and managing of the preparation for overseas tours may help to reduce some of the costs of these delays and the loss of manpower as these airmen are not yet of direct use to their career fields.

Washback Management

When students fail a class, the schoolhouse has the option to separate them from the Air Force, reclassify them into another career field, or allow them a second chance to retake the class. This decision is often based on the broader personnel management climate. When personnel reductions are being made, schoolhouses are free to fail students entirely; in contrast, when end strength requirements are on the rise, schools and instructors are more inclined to allow students to retake classes or move to a different career field to minimize the loss of personnel entirely. However, when accessions are increasing, course pipelines are often already

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[7] Using the available data, we attempted to quantify the average number of man-years spent by graduates awaiting assignment. While the total time spent in casual status can be quantified (see the section "Costs Associated with Nontraining Time" above), it was not possible to reliably associate the reason students were not in training. We discovered that there were few entries in the data for students delayed due to assignment orders and therefore must rely on concerns raised during interviews. The lack of available data to be able to study ways to address this inefficiency is a good example of the need for appropriate metrics.

full and there is not always room to immediately give students another chance to complete the course. Some courses actually have a policy that students must wait one or two class cycles before restarting a class to give them time to work on independent study. As a result, it is not uncommon for washbacks to turn into students awaiting the next available training opening. Our data analysis suggested that there are occasional instances where enough washbacks can form an unscheduled class, but adding a class depends on the availability of resources such as instructors or facilities and the number of washbacks.

As there is no way to easily account for students failing courses in advance, the primary inefficiencies associated with washbacks are in how they are managed. Currently, there is no systematic way to consider the effect of washbacks and no consistent or formal planning policy. The F-16 crew chief pipeline, for example, does not build in any open seats for washbacks and instead relies on enough students not showing up for training to produce the empty seats that can be filled with students needing to repeat the course. In contrast, the cyber pipelines intentionally build two seats into every class specifically to account for washbacks, perhaps because both cyber pipelines regularly have students who fail.

During our interviews, we learned that all of the training wings we spoke to believe there is no policy on how to prioritize washbacks in a course and so they felt free to implement locally derived solutions. AETC interviewees told us that there was a policy, however they did not elaborate; nor did we discover any documentation of such a policy.[8] As a result of this lack of communication, the schoolhouses use a variety of different techniques to decide which students get the highest priority for filling a seat, varying between guard or reserve initial entries, washbacks, and students who have been waiting the longest (as will be discussed further in the next section). Active-duty students entering the pipeline for the first time are usually at the bottom of the priority list because these delays are considered to be a more acceptable cost to the Air Force rather than requiring reserve-component elements to fund students who are not in training or to make washbacks wait longer and potentially lose what they have learned.

In some courses, where washbacks can be particularly problematic, the content of these initial skills courses may be the source of the inefficiency. For example, in order to graduate from the enlisted or officer cyber courses, it is currently a requirement to pass the Security+ exam—a fee-based test designed and administered by a private company that is a fairly common qualification in civilian industry. However, in industry, the exam is normally taken by cyber-related practitioners who have been working in the career field for two or more years. Interestingly, this test is more important when applying for new jobs rather than for learning

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[8] AETC, 2014b, discusses management and administration guidelines for coding washbacks, for coordinating when washback results in delays, and for reporting the numbers of washbacks, but not the prioritization and queuing practices to be followed when managing seats.

skills, and appears to be of little need or relevance to airmen just coming out of IST. Even for civilian professionals, the average failure rate is reported to be 50 or 60 percent.[9]

It is little surprise, then, that it was reported to us that half of the students going through the cyber technical training pipeline initially fail the test, as they are still learning the basics and have not yet begun practicing their craft in a professional setting. The exam is also one that must be retaken every few years, as it is not a lifetime certification, so cyber personnel would likely have to be recertified while in later assignments. At the time of our interviews, the training wing reported that there was a two-month wait to complete the training again and then retest, which adds significant amounts of time (and associated costs) to the training pipeline. In instances like this, washback rates or rates of failure of a key exam may indicate a need to examine a career field's priorities and ensure that there is adequate communication between the senior leaders who make decisions about course content, AETC, and the schoolhouse to balance genuine needs with hidden costs that may result from particular training requirements.

In an attempt to identify reliable metrics to address washbacks, the project team learned that washback rates are reported by the schoolhouse. In cases where washback rates of greater than 15 percent are reported, the schoolhouses are asked to do a root cause analysis.[10] When we reviewed the data for 2015, we found that 270 students were enrolled in Security+. Of these, 14 were eliminated and the rest eventually graduated. Of those who graduated, there was a great disparity in the days they were enrolled in the course (from 10 days to 467 days, with an average of 30 days). This single course could be one reason why the Cyber Transport Systems, Cyber Systems Operator, and Cyber Operations officer AFSCs have the high nontraining times observed in Tables 3.1 and 3.2. This example highlights the importance of ensuring that metrics are appropriate and that there is clear and disciplined reporting practices for student statuses.

In addition, metrics for washbacks, completion rates, and failure rates, must be evaluated in the context of overall end strength goals and whether these goals are increasing or decreasing. At times of increasing end strength, there is pressure to graduate as many students as possible, so the tendency is for fewer washouts and more washbacks. Looking strictly at the washout rate in this case may present a false or at least incomplete picture of student quality or predictions for future washbacks.

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[9] The private firm that makes and administers the Security+ course does not publish pass or fail rates for the exam, but a private interview with a cyber-security professional suggests that industry professionals generally accept that the fail rate is 50–60 percent.

[10] This analysis is usually a qualitative assessment with leaders, instructors, and students at the schoolhouse to establish what extenuating circumstances may have led to such a high failure rate for any given class. The rates at which such incidences occur can vary widely and schoolhouses reported that they are often tied to inexperienced instructors or changes in curriculum, but there is not necessarily data to support that claim one way or another.

Alternative Prioritization Schemes

Because of the lack of a widely known formal washback policy, the training wing, training group, or the schoolhouse may make decisions about whether or not students can retake courses. The research team modeled the outcomes of different methods by which students are prioritized for class enrollment. The results suggest that prioritization decisions, including washback policies, are best made by the individual pipelines and that these decisions should be based on more rigorous analysis. Different prioritization schemes can be devised based on the amount of time students have been waiting for a class, the number of washbacks, and their service component. We used the RAND-developed AETC Flow Model (AFM) to examine four different combinations of these characteristics.

In the first, we prioritized students who had washed back the fewest number of times. Since multiple students had the same number of washbacks, we sorted those students by component—with the reserve-component students sorted preferentially over the active-component students. Within each group with the same number of washbacks and the same component, those who had waited longest were selected above those that had waited the least amount of time. Therefore, a student with no washbacks from the reserve component who had been waiting the longest would be picked to fill the first available seat in the class. A student who had many washbacks from the active component who had been waiting the shortest amount of time would be the very last priority. The rationale for this selection is to give new students arriving at a base the first opportunity to enroll. Then, because guard and reserve students are limited in their time availability, they received the next highest priority. Finally, those that had been waiting longest would be enrolled. We title this method "Washback/Component/Longest."

In the second scheme, "Component/Washback/Longest," we prioritized the component, then washbacks, and then students waiting the longest. This scheme seated guard and reserve students before active-duty students regardless of the number of washbacks they had or the amount of time they had been waiting. The third approach ignored the component and enrolled based on washbacks first, then longest time waiting; this approach is titled "Washback/Longest." The final scheme, "Longest," enrolled students based only on the amount of time waiting.

Figures 3.4 and 3.5 show the results of these different enrollment schemes on the number of awards and on the total wait time. Generally, the amount of AFSC graduates changed very little based on the ordering. This is not entirely unexpected. For each of the AFSCs, there is at least one course that is either filled or nearly filled to capacity. Therefore, the overall number of graduates will remain about the same even when the component composition of the graduates differs.

The small deviation in Figure 3.4 is primarily due to the differences in the historic graduation, washback, and elimination rates among the components and those that washback. A somewhat greater impact can be seen in Figure 3.5. Here, again, the rates are a significant factor in the outcomes. For example, the "Longest" bars (purple) are generally lowest (least average student wait time) because students who have longer wait times, primarily those that washback multiple

Figure 3.4. Number of Pipeline Graduates for Different Enrollment Schemes
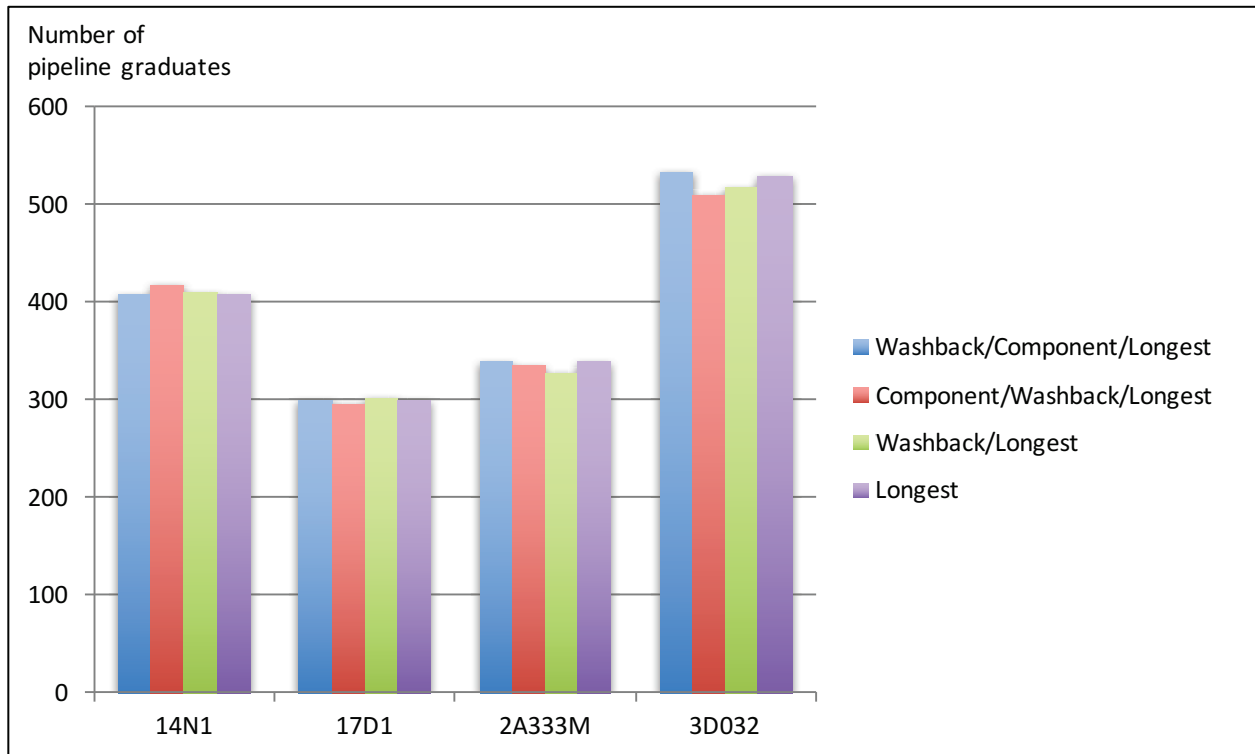
SOURCE: RAND-generated based on 2015 ADSS data.

Figure 3.5. Average Student Wait Time for Different Enrollment Schemes
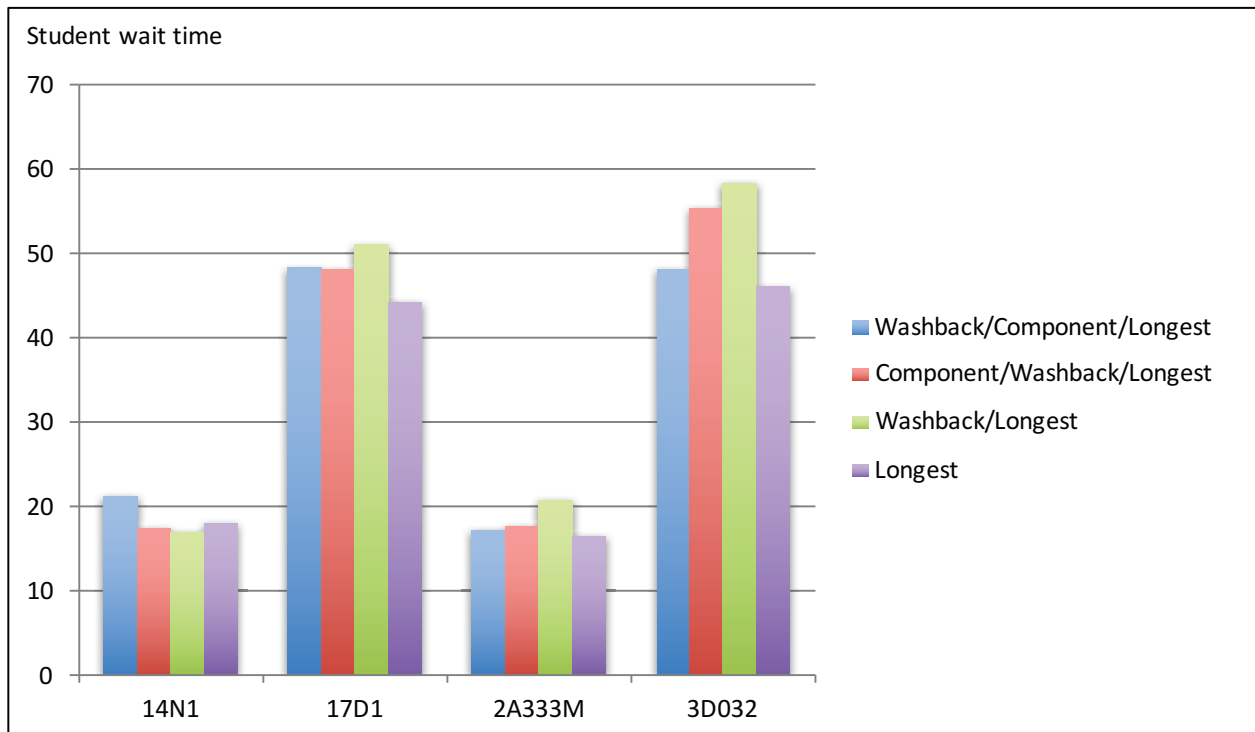
SOURCE: RAND-generated based on 2015 ADSS data.

times, are pushed through the classes so that they either eventually graduate or are eliminated (wash out). This analysis illustrates that prioritization is likely not going to make much of a difference in the number of graduates, although it will make a bigger difference in the amount of time, on average, that students wait for a class. So, for example, the number of graduates for 3D032 varies by about 2–3 percent of the total graduates whereas the amount of wait time varies by about 20 percent. Additionally, these results show that the outcome for different prioritization schemes is dependent on each of the AFSCs and each training squadron should determine the scheme used.

Lack of Realistic and Consistent Metrics

Part of the difficulty associated with improving student flow is a lack of realistic, consistent, and reliable metrics that are needed to gain a more comprehensive picture of the technical training pipeline. One contributing factor is that different organizations supporting the pipeline use a variety of information systems that neither reliably feed into each other nor organize information in the same way. Thus, metrics like washback rates are not always captured and may not be coded consistently across all the systems; and numbers can also become scrambled. One schoolhouse reported that four student entries in a particular pipeline all graduated on time, yet their production rate was erroneously calculated at 104 percent. While the high production rate may look good for that pipeline, it creates doubt about the validity of all numbers in the system.

Schoolhouses also feel that the metrics on which they are graded do not always reflect realities of the system. For example, it is not possible to meet production rate targets in the PGL if the schoolhouse does not receive enough students into the pipeline. Leaders of training pipelines with long courses that frequently cross over FYs worry that assessments of their production rates do not take course length into account and make it appear that they are always behind schedule. The project team explored a number of metrics and was able to consider alternatives for more useful and reliable ones in the future, which are discussed later in this chapter.

Despite concerns about the quality of existing data, schoolhouses, training wings, and groups often were more concerned about the lack of qualitative metrics on student production. While much of the analysis presented here offers ways to improve efficiency in the training pipeline, stakeholders explained that there is no readily available way to assess the impact of these changes on the quality of the product—the student. For instance, when the classroom time was extended from six hours of podium time to eight hours, increasing instructors' workloads by ten hours a week, schoolhouses were unable to track the effect of that policy change on the quality of the graduates.

While schools often send out surveys to see whether a student's first duty station feels they were prepared for the job, response rates tend to be low, and there is no effective way to formally connect survey results back to the greater needs and intent of the career field more broadly. Many schoolhouses reported that it "is not always clear what an apprentice-level graduate needs

to know." In RAND research performed in 2006, estimates were made of the appropriate division between schoolhouse IST and on-the-job training. Surveyed supervisors were not always in agreement with each other potentially because of specific differences between duty assignments. However, a median estimate was calculated that sometimes suggested that IST should be longer and sometimes that it should be shorter (Manacapilli, 2007b). This sort of metric, though, is difficult to easily or consistently collect. While a broad assessment of the quality of students exiting the training pipelines is likely to be of importance to the Air Force, as is the establishment of more formal feedback systems, offering recommendations on how to do so is beyond the scope of this research.[11] Instead, our focus is on quantitative metrics within the training pipeline itself.

AETC understands the importance of monitoring BMT and technical training metrics in order to keep track of student production and how well the training pipeline is functioning. AETC instructions describe five metrics that should be used to assess the function of the training pipeline: one for BMT and four for the technical training pipeline, as shown in Table 3.4.

Table 3.4. Key BMT and Technical Training Metrics

Metric	Definition
Basic Military Training	
BMT On-Time Graduation Rate	Number of students that graduate with their originally assigned "week group" divided by the number of accessions in that week group
Technical Training	
Fill Rate (Enlisted Initial Skills/Officer Initial Skills (Fill) Rate for course of initial entry [COIE])	Number of original entries divided by the adjusted programmed entries for the course
Course Production Rate	Number of actual graduates divided by the adjusted programmed graduates
Course Pass Rate	Measures overall course pass rate
Course First Time Pass Rate	Measures first time pass rate of airmen who graduated in the same class number they started in

SOURCE: AETC, 2014b, Tables 5.1 and 5.2.

These metrics are useful for understanding if there might be problems with BMT processes (e.g., if the number of on-time graduates decreases). The key technical training metrics are also important for determining if programmed production goals are being met or if course standards or student quality need to be examined (e.g., decreasing pass rates could be the result of

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[11] However, we would offer that any assessment of student quality should focus on student learning in training, student retention of knowledge immediately after training, and the ultimate application of graduates' knowledge and postskill training while on the job.

unprepared students or of poor instruction). In particular, decreased pass rates in follow-on courses in multiple course sequences could indicate that earlier, preparatory course need reviewing.

In addition to these standard key metrics, AETC has three standard supporting reports for BMT and 18 for technical training that are intended for root cause analysis of problems that arise in training (AETC, 2014b, Tables 5.3 and 5.4). 2nd Air Force recently began reporting many of these metrics in a series of "dashboards" accessible at a Technical Training Operations Center (TTOC) website.[12] The dashboards cover five major areas, as listed in Table 3.5.

Table 3.5. Metrics Dashboards

Dashboard	Content
Production	The four standard key technical training metrics—COIE (Fill) Rate, Course Production (Grad) Rate, Course Pass Rate, and Course First Time Pass Rate—and some supporting metrics
Forecast	Anticipated production rates
Utilization	COIE entry rate (key metric) and the supporting metrics "no show rate" and "missed seat rate"
Student accountability	Information on individual students, such as personal information, training location, and current training status
SNIT status	Information on students who are not in training, such as the reason they are not in training and how long they have not been in training; also computes the cost of the students not being in training

These new dashboards appear to be excellent tracking tools, and many of the metrics tracked in them are important. However, one reason we devoted so much time earlier in this chapter to examining training and nontraining time in the pipeline is that none of these dashboards appear to monitor nontraining time. This is curious because AETC (2014b) notes that "Due date performance" (days in training pipeline) is a supporting metric, and is one that used to be monitored.[13] In discussions with AETC, we learned that this metric was once tracked, but producing these comparisons became too labor-intensive, and they were discontinued.

Our analysis showed, however, that this metric is important not only for monitoring the cost of nontraining time (a cost that, as we have seen, AETC monitors for other delays), but also for alerting training managers when unexpected course delays are occurring. AETC senior leaders reported recognizing data inefficiencies that have resulted from several years of inattention,

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[12] The website address is https://keesler.eis.aetc.af.mil/2AF/2%20AF_TTOC1/SitePages/Home.aspx (the site is accessible only from computers with a "*.mil" address).

[13] A March 13, 2016, email from AETC/A3PS notes that from 2008 to 2011 these comparisons were tracked in what was called the "Training Pipeline Continuum" package in ADSS.

including unnecessary, duplicative, and missing data, along with metrics that do not track the most useful data, and planned to revive many data collection practices.

As an example, we refer again to the high failure rates of the Security+ course. Although students and course instructors mentioned the impact of high failure rates for the course, upper-level leadership *did not seem aware of it*—yet this is the type of metric about which senior leadership should be aware.[14] Excessive delays caused by a single course might highlight the need to redesign the course or determine if it is actually necessary for the AFSC. In general, AETC and 2nd Air Force should take a closer look at the metrics being followed throughout the training pipeline to make sure that the metrics they do track are useful for decisionmakers and identify metrics that are not tracked but should be.

Summary of Inefficiencies in the Flow of Students

When students spend time in the training pipeline waiting to enter required courses, a significant cost to the Air Force accumulates, particularly when delays exceed those that the Air Force typically plans on. As the foregoing analysis has shown, nontraining time for officer and enlisted pipelines, beyond that accounted for in planning, cumulated to 120 total man-years for officers and 786 man-years for enlisted personnel at a cost of more than $43 million. These delays can be caused by many factors, including security clearance delays, accessions and assignment delays, and lack of consistent management processes for washback, among others. Tracking time in the training pipeline can help illuminate whether training time is in line with what is expected and where unplanned waiting time is taking place—highlighting issues that may need to be evaluated more closely.

In addition to the inefficiencies associated with disruptions in the flow of students, the lack of realistic and consistent metrics prevents AETC from gaining a comprehensive picture of the technical training pipeline and hampers its ability to pinpoint problems that can be resolved. Throughout the pipeline, different organizations capture different metrics, in different formats, and there is little effective information sharing. Moreover, some metrics that are collected and evaluated do not necessarily reflect the full realities of the system. In addition to concerns over the quality of existing data, there is also the matter of metrics that are not captured at all—both quantitative and qualitative. Furthermore, simply tracking metrics is not sufficient. The metrics must be useful and the data captured must be analyzed so that training managers can be alerted to problems that are arising.

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[14] Some leaders felt, though, that if the delays were caused by repeat failures that it was acceptable since the career-field manager had determined that the completion of the course was important. As mentioned previously, however, they may also not be aware of the failure rates since we observed from the data that the students appeared to be continuously enrolled in the course.

Chapter 4. Resource Inefficiencies

> How we do requirements, budgets, and instructor training is a nightmare.

The technical training pipeline is also plagued by resource inefficiencies and challenges in providing adequate capacity to appropriately meet training requirements while avoiding unnecessary overspending. While facilities and training devices are essential resources, the centerpiece of resourcing decisions at the schoolhouses involves rightsizing the instructor cadre for each training pipeline. Adjusting the size of the instructor cadre is particularly challenging when requirements increase significantly over previous years or when changes to the PGL are made during the year of execution because of the time involved in identifying and preparing qualified instructors. The funding infrastructure and the process of bringing on new instructors are generally inflexible and tied to the broader DoD planning, programming, and budgeting system. The result is that schoolhouses can have excess capacity one year and be underresourced the next. The latter case increases costs associated with SAT, as discussed in the previous chapter, and increases the risks of instructors burning out or providing insufficient leadership for students.

Inefficiencies in Sizing the Instructor Corps

> It can be tricky to find the balance between the cost of hiring an instructor that we don't need versus not hiring one that we might need.

Finding the right balance between having too many instructors or too few is the most significant resourcing challenge for technical training. Given the widespread undermanning throughout the Air Force, schools are already being asked to do more with less. When schools are asked to accommodate a surge in students to meet increasing end strength goals with little advance notice, strain on the instructor corps increases. When an initial increase of 1,900 students was being considered in FY 2016, Headquarters Air Force asked AETC to see what they could do with existing resources, with the intent of keeping additional spending at a minimum. The training wings interpreted this guidance as an expectation that they needed to surge capacity while remaining "resource neutral"; that is, without additional instructors or infrastructure support. One training wing representative told interviewers that in a "resource neutral environment we are forced to choose between quality and quantity. What do we lose if we try to increase production with no extra support?" Higher-level stakeholders, conversely, told the project team this was an incorrect interpretation, with interviewees at Headquarters Air Force stating that additional resources would be provided to those pipelines that ultimately required it. This communication divide was sharp and indicated a lack of clear feedback channels between different organizations involved in technical training.

Instructor Pricing

> The instructor pricing formula is not shared with us.

A major challenge in rightsizing the instructor corps involves instructor pricing, or the process by which individual training pipelines estimate how many instructors will be required to meet training demands. This process drives much of the capacity assessments and is based on a particular formula managed at 2nd Air Force. There is a great deal of mystery surrounding the pricing formula; in 12 separate interviews at the training wing and below, respondents from commanders to training managers complained about its lack of transparency. One training wing commander noted that the formula for technical training differs from that for flying training, even though the throughput for technical training is higher and instructors are required to do the same or more as flying training instructors, a fact confirmed by AETC's Directorate of Manpower, Personnel and Services, Manpower and Organization Division (AETC/A1M).

AETC/A1M also noted that the formula is extremely outdated and is the same one used in the 1980s, which does not account for the expanded set of additional duties, deployments, or extended maternity leave that schoolhouses must now account for. Nor does the formula account for the fact that several years ago instructors were priced at a six-hour teaching day, with two hours allotted for curriculum development, student mentoring, and other additional duties. Since then, podium time has increased to eight hours a day; as a result, those additional requirements outside the classroom are attended to on instructors' personal time, a fact not captured in the pricing formula.

In training groups, training wings, and even at 2nd Air Force, stakeholders are aware that many commands across the Air Force are undermanned, and they do not expect to be fully manned. However, most would prefer an updated formula that details actual needs in order to document the fact that some pipelines are perennially short on manpower and make it clear that some sort of adjustment needs to be made to the process more broadly. One interviewee from these groups noted, "We would rather have it on the books that we need so many instructors, even if we know we are only going to be manned to 80 percent of that, so Headquarters can see our real needs. But Headquarters won't, because they think the 'bill will be too big,' and don't want to admit that."

In addition to being opaque, the timing of the pricing cycle is often out of sync with information driving instructor requirements and therefore runs "late to need." As a result, additional instructors needed to meet requirements do not arrive until after the increase in students has already reached the schoolhouse. In recent years not getting a final (or near-final) PGL until the beginning of the FY has meant that there has not been enough time to price instructors, get them to the schoolhouse, and get them qualified to teach before the surge of students has arrived. It can take a year for some courses to get through this process, which makes it nearly impossible to match instructors to increases in student throughput that occur in the year of execution. Training wings and below lament the fact that the pricing cycle only happens once

a year, so between that fact and the realistic timeline required to bring in an instructor, the system for increasing instructor manning is very inflexible. Further complicating the timing is that most instructor tours are controlled-length tours; therefore, regardless of annual changes to requirements, any given instructor will remain in place for three to four years. As a result, the number of available instructors is systematically out of sync with changes in student manning levels—increases and decreases in the number of instructors will often trail about a year behind student number changes and leave a school with too many or too few in the out-years.

This problem is exacerbated by the addition of the Developmental Special Duty (DSD) step to the instructor assignment process. The DSD changes how airmen are selected and vetted for instructor positions and is intended to improve the quality of the instructor cadre. However, while many schoolhouses agree that it does improve quality, it also makes getting new instructors a significantly longer process. Because the DSD selection board only convenes twice a year, when an instructor chooses to leave the Air Force out of cycle schools can only get replacements during the preestablished DSD time frame, adding further inflexibility to the system. A substantial majority of the training groups interviewed expressed their desire to see the DSD process produce a pool of available candidates that could be quickly moved to a schoolhouse at any time. Ironically, this was one of the original selling points of the DSD process. Doing so would also help alleviate the bubbles of instructors arriving and leaving all at the same time, which reduces a course's effective instructors as an outgoing instructor has no time to train his or her replacement—yet another additional duty that falls to the remaining cadre who are often already undermanned. These mismatched timelines incentivize schoolhouses to retain excess instructor capacity in order to mitigate the risk of shortfalls.

Undermanning

> The system that measures capacity needs to capture nuance. Straight numbers of assigned instructors do not reflect their actual ability to teach, since they may be deployed or disqualified or in training.

While some pipelines have excess instructor capacity, quite a few interviewees felt they were undermanned, both as a result of the 2016 increase in student requirements and more generally because of the outdated instructor pricing formula and cuts to staffing at schoolhouses. Some of this undermanning is due to the delayed PGL, but some is due to all of the considerations that factor into whether an assigned instructor is actually available to teach. The policy change making instructors eligible for deployment is one factor that has strong implications for career fields with high deployment rates. One schoolhouse mentioned that it has between eight and nine instructors deployed at one time, while another training group said that they are likely to have between ten and 20 instructors deployed at any given time. There is no process to backfill these positions and so the remaining instructors have to carry the student load. It is not clear that there is consideration of the impact on the training pipeline when determining whether to deploy an additional instructor.

Similarly, several training wings and groups said that overhead administrative and leadership positions at the schoolhouse are also coded as instructors (referred to as "T-coded"), so individuals in these positions count against a schoolhouse's total instructor manning even though they do not teach. Cuts in formal administrative and leadership positions over the past several years have exacerbated this problem. One training group explained that they have lost 142 out of 700 positions, most of which were administrative, but still have to accomplish the same amount of work. Personnel brought on as instructors are often forced to pick up this slack as additional or primary duty, reducing their effective availability to be in the classroom. Due to the combination of these factors, one schoolhouse had only six instructors actively teaching despite having 14 instructors on their books. Other pipelines experience similar discrepancies between individuals assigned to instructor positions versus those actually available to teach, which often makes them appear to have greater levels of capacity than they do.

In addition, training managers who have been in their positions for upward of ten years explained that instructors are asked to do more today—a fact supported by AETC's description of the instructor pricing guidelines. In the past, the instructor work standard was calculated on spending six hours a day teaching, with the remainder of the work day devoted to planning, preparing, and helping students. Today, that calculation is based on an eight-hour teaching day, and the additional requirements have not changed. Instructors often work ten- or 12-hour days to accomplish curriculum development and various other duties over and above their teaching responsibilities. Additionally, at some schoolhouses, instructors do not have time to take leave or personal days, with some using "use it or lose it" leave on weekends, all of which can quickly lead to instructor burnout.

Furthermore, there are other risks involved in maintaining such an intense pace. Curriculum development and updates may be delayed. The quality of the graduates may decrease, as instructors become increasingly fatigued. The loss of time previously devoted in part to appropriately mentoring and providing leadership to students leaves some stakeholders concerned that inappropriate behavior and incidents among students will rise accordingly.

Implications on Pipeline Throughput

Our model of the training pipeline for intelligence officers, 14NX, illustrates the effect of changes in the instructor cadre on graduates. If the minimum number of instructors is not available to teach all the scheduled classes, some classes will be canceled. The result will be a decline in throughput and an increase in average student wait times. Figure 4.1 shows how outcomes change as the number of instructors is reduced below the minimum needed to teach all of the class offerings (14 instructors in our example). The graph on the left (blue line) measures the total number of students graduating. It is not a direct proportional relationship between the loss of instructors and the reduction in throughput. The loss of the first instructor has little impact since that instructor has been responsible for teaching only a small number of classes that must now be canceled. Graduates only slightly decline when 13 rather than 14 instructors are available

to teach, but then drop off from just over 400 to about 320 as only nine instructors are maintained in the available pool. Likewise, the effect on student wait times is also not proportional to the loss of instructors. The impact on average wait time, illustrated in the right panel (red line), is more dramatic. While wait time does not increase very much with the reduction of one instructor, additional reductions cause average wait times to increase rapidly; reducing instructors from 14 to nine changes the wait time from about 20 days to 135 days.

This analysis of the implications of instructor reductions is instructive in understanding the full effects of policy decisions. When considering only the outcome of decreasing classroom costs, reducing the instructor cadre by five might seem like an attractive option. Initially, the primary impact appears to be only a loss of about 90 graduates, or just over 20 percent, from the graduates with a full instructor complement—although for some career fields with personnel shortages, 20 percent fewer graduates may be significant. However, when considering the full costs of such a decision, assuming all other considerations remain unchanged, the costs also include an increase of 120 man-years of student wait time. It is this fuller picture on which decisions regarding the size of the instructor cadre should be based.

Figure 4.1. Reduction in Instructors Results in Fewer Graduates and Increased Student Wait Time for Intelligence Officers
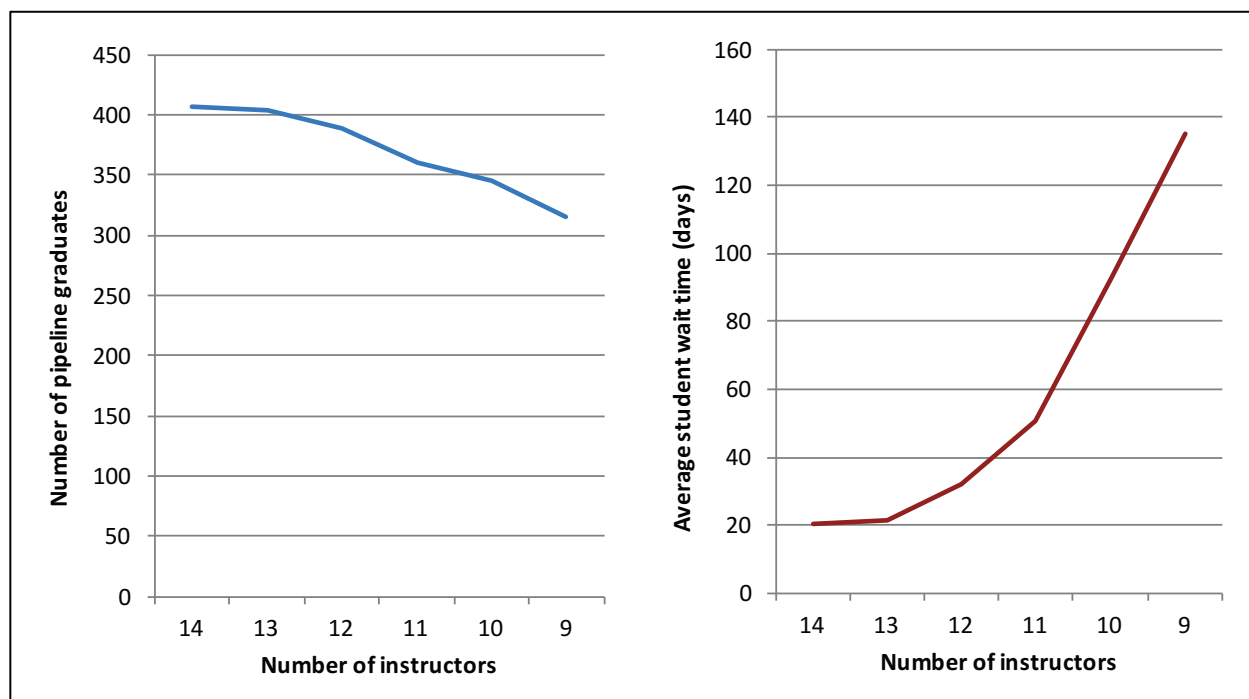
SOURCE: Generated by the RAND AFM based on 2015 ADSS data.

Mitigation Strategies

Organizations have developed several strategies to work around instructor shortages, none of which are ideal. But the need for workarounds further demonstrates the widespread nature of this inefficiency. One solution is to employ alternative workforce options. Most pipelines have civilian instructors who are valued for the consistency they bring, despite the need for concerted efforts to ensure they have current knowledge about how the career fields operate outside the training environment. Contractors are occasionally used to increase the instructor pool in the short term, but getting funding for contracts can be highly dependent on the career fields themselves supplying money. Numerous schoolhouses and guard and reserve representatives said that they would like to see guard and reserve personnel serve as instructors, but funding and timing complications make doing so challenging. If these personnel do not already live close by or do not arrive qualified to teach at least basic coursework, the time it can take to get instructors fully qualified often makes this approach unworkable.

Obtaining waivers to extend tours for interested (or even uninterested) instructors is a common solution, as well as temporary duty manning assists (though these still require 120 days' notice) and *family grouping*, where pools of instructors for related pipelines are grouped to both reduce costs and provide some flexibility. In the last scenario, if there are two related courses that both rate two and a half instructors, rather than having each pipeline earn three full instructors, the two and a half would be grouped for a total of five, with the understanding that they would be available for either course, especially for any shared classes like fundamentals. Schoolhouses caution, though, that family grouping can make a pipeline appear to have more capacity on the books than is available. If an instructor is pulled from one course to focus on a more general basic class, for example, and there is an increase in student requirements the following year, that pipeline will appear to have adequate instructors even if one is devoted to a course elsewhere.

One schoolhouse borrowed a concept from the flying world, changing the words but not the meaning. It has been a long-standing Air Force practice to return a limited number of new pilots to pilot training as instructors. In this context, FAIP does not mean "First Assignment Instructor Pilot" but rather "First Assignment in Place," where graduates stay at the school and begin teaching rather than going to an operational position. While instructors said doing so would not necessarily hurt their careers, there is a risk of instructors just barely knowing more than the students and not having the operational experience that gives them credibility.

A final solution, especially in the context of current efforts to increase accessions, is for schoolhouses to internally reshuffle students from AFSC pipelines that are overloaded to another AFSC pipeline with more available capacity, so long as the students meet qualifications of the new career field. Instructors are conscious of the risk of taking this approach because airmen who are dissatisfied with their new career fields will potentially request retraining at a later

time—which in effect reduces the value of such decisions in increasing pipeline throughput. However, retraining will only be allowed if there are unfilled requirements.

Classroom Capacity

Another mitigation strategy is to increase class size, perhaps through waivers on student-to-instructor ratios or other similar means; however, the impact of this strategy on throughput may not always be as significant as expected. Like many of the metrics we analyzed, outcomes are strongly tied to individual pipelines and such policies should be evaluated in that context.

Using the example career fields selected by AETC, we investigated the effect of increasing class size by increasing or decreasing classroom size in the AFM by a percentage. So, for example, 100 percent of class capacity is exactly equal to the adjusted program entries. A 10 percent increase in the number of possible class entries is measured as 110 percent, and 90 percent means a 10 percent decrease in the entries. In these cases, we did not change the number of students recruited and coming from BMT or the number of instructors available to teach.

The model indicates that throughput would increase the most for the 17D1 and 3D032 career fields if class capacity were increased, as shown in Figure 4.2, with the largest effect in the 3D032 career field. Throughput also increases for 17D1, but it is a more moderate increase because of the small class sizes for these courses and, eventually, the number of instructors or the number of students constrains throughput. However, there is little significant impact on total throughput if the capacity is changed for either the 14N1 or 2A333M career fields. This is because of both the small class sizes and the quantity and timing of students arriving from BMT relative to the fixed class schedule. The different effects on career fields suggest that analysis should be conducted on each career field and classroom capacity increased only in cases where a benefit is realized.[1]

Where changes in class capacity do appear to have a more universal impact is on the amount of time students potentially wait for a course. We use average student waiting time as a metric to capture this effect, though care must be taken in interpreting the results. This metric does not mean that every student will wait this average amount of time—in fact, some students wait very short periods of time between their arrival and the next class start, and some wait very long periods of time, particularly those that washback. Reducing wait times can have a significant effect on pipeline efficiency, even if throughput is not increased, because of the high potential costs associated with wait times, as discussed in the previous chapter.

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[1] These lines appear "bumpy" because AFM is a Monte Carlo simulation. This means that the results of each run depend on the outcome of the random probability draws that occur inside the model. Thus, the model outcomes differ every time the AFM is executed. Furthermore, since fractions of students do not make sense, the percentage of the class capacity is rounded to the nearest integer.

Figure 4.2. AFSC Throughput for Changes in Class Capacity
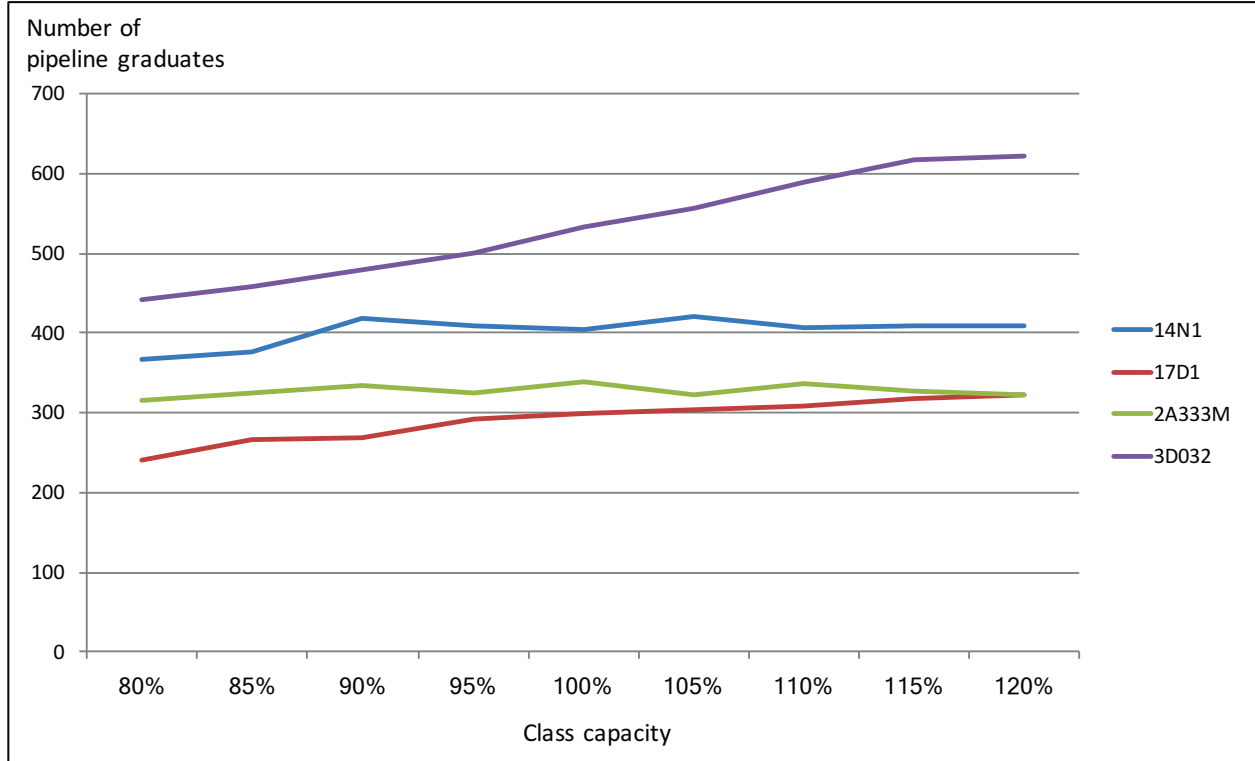
SOURCE: RAND-generated based on 2015 ADSS data.

As class capacity is increased, average student wait time declines (Figure 4.3). For example, at the current class size (100 percent) average student wait time for the 14N1 AFSC is 20 days. A 20 percent reduction in class capacity for the 14N1s leads to an increase in wait time of 30 days to a total average wait of 50 days. This occurs mostly because some portion of arriving students is unable to enroll in the immediate class offering and must wait until the next class. An increase of 20 percent class capacity for the 14N1s leads to a reduction in average wait time from 20 days to 12 days. In this case, the increase in class capacity benefits students who have washed back, providing them a seat sooner than they would have received at 100 percent capacity.[2]

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[2] Note that we have not shown the number of unused seats for higher class capacity. Increasing the class capacity allows greater flexibility for seating students waiting, but also potentially increases the number of seats that are vacant.

Figure 4.3. AFSC Waiting Time for Changes in Class Capacity
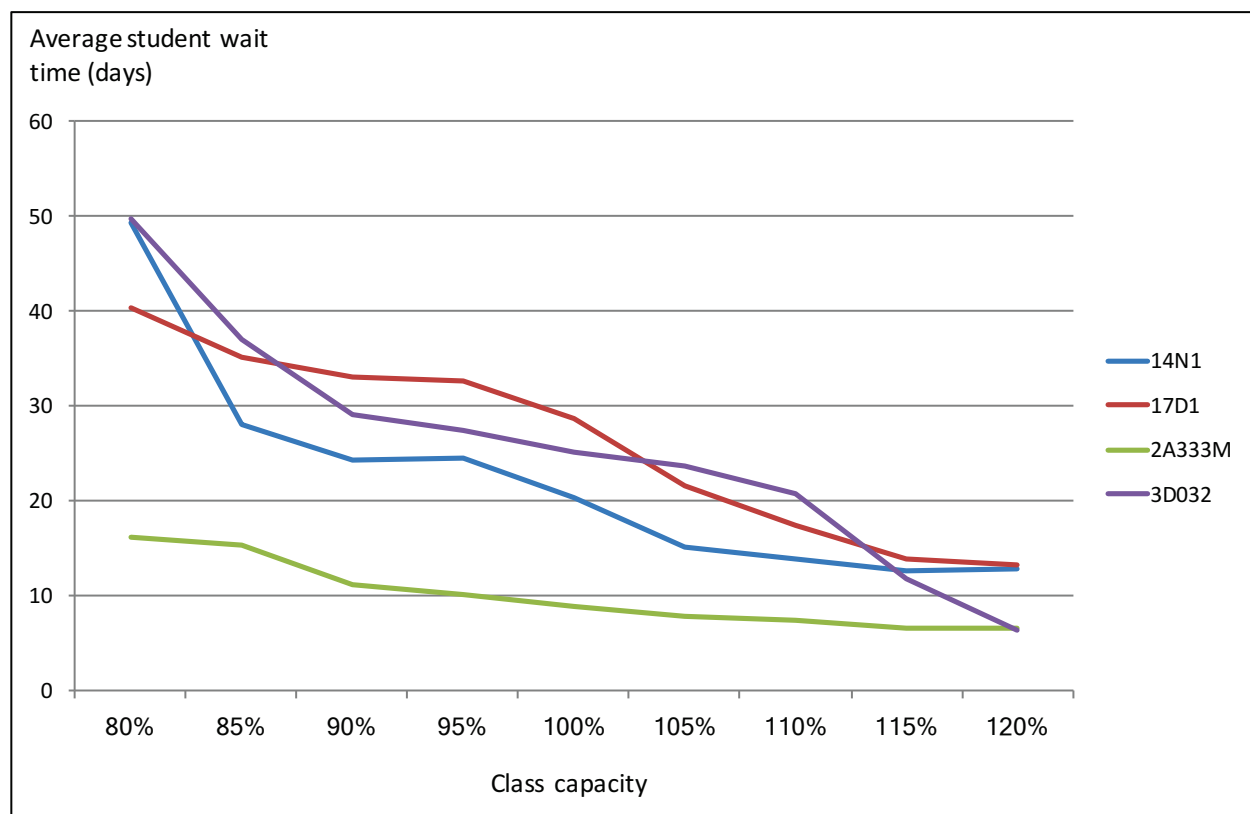
SOURCE: RAND-generated based on 2015 ADSS data.

Inadequate Resourcing of Training Management and Instructional Systems

While it was not within the scope of our research to assess how technology can contribute to improving the delivery of training or the quality of the graduate, we did discover two areas where the training pipeline may be negatively impacted by IT systems. The first relates to the funding of needed technological resources. The second concerns the use of technology (primarily computer information systems and models) to make pipeline processes more efficient.

Training wings are concerned about infrastructure and particularly the inability to adequately upgrade technological resources, which can limit pipeline production. Similar to the manpower provided for instructors, funding for computer networks, student computers, training devices, and other similar systems is tied to a given FY's PGL, and it can be difficult to develop and fund long-term plans for maintaining and updating infrastructure and equipment. During our discussions, we found that the cyber career field has felt these constraints most acutely, as their primary training system is technology-based and is quickly outdated. As one training wing noted, "There used to be a policy for a tech refresh every three years for the Air Force, but there isn't now because technology moves too fast. But without that policy, we're stuck with some computers from 2009. There's a software update that won't even run on our machines [because they are so

old]." Schoolhouses and training groups would like to have the ability to plan for equipment for a multiyear period rather than being limited to money allocated only for a single FY (sometimes referred to as "one-year money") or waiting for something to break and then finding it necessary to reallocate funding earmarked for other needs.

Interviewees told us that there used to be a policy that allowed for equipment refresh, particularly computers, every three years, but that the policy had been retracted. Career fields and MAJCOMs can and do balance out some of these shortfalls by supplying supplementary funding, but training stakeholders argue that this approach is not sustainable in the long term. Without appropriate resourcing, instructors are required to find workarounds, students must share equipment, and courses are delayed when equipment malfunctions—all issues that impede the efficient progress of students through the pipeline.

Similar funding complications make it difficult for those responsible for planning for and managing the training pipeline to develop capacities that would help them reduce inefficiencies. Training managers across all organizational levels expressed difficulties in getting systems funded for capacity visibility and execution tracking. Because of the lack of centralized systems, we found that everyone has their own Excel spreadsheet for monitoring and tracking the items of interest for their particular part of the training pipeline. For example, despite 2nd Air Force maintaining a purportedly "master" spreadsheet, each training manager we visited had his or her own individually tailored spreadsheet. In addition, training managers and leaders from headquarters down to the schoolhouses are using paper-based worksheets and emails to coordinate changes. Multiyear funding for the development of a single system of record for capacity visibility and execution tracking would allow training managers at all levels to share information more efficiently. Headquarters AETC is currently developing the requirements for a modeling and pricing tool; however, as of the end of calendar year 2016, it still remained unclear whether they would be able to obtain the funding for such a system (Jeffries, 2015).

Despite finding evidence of modeling and simulation capabilities present at AETC in 2006 (Manacapilli, 2006), we found no evidence of modeling or simulation tools that could help provide more efficient solutions to optimizing the pipeline as a whole. Individuals with appropriate analytical training were not available, and hardware and software to perform analysis were not sufficiently funded. Modeling and analyzing results from simulations, of the type we have outlined in this document, would assist AETC and the schoolhouses to better understand the effects of proposed policies and practices intended to improve the efficiency of the pipeline.

Summary of Resource Inefficiencies

As described in this chapter, one of the main resource decisions facing the schoolhouses is sizing the instructor corps. Because the timeline for bringing on new instructors is tied to the broader DoD planning and budgeting system, the ability to adjust the instructor cadre to last-minute changes in requirements is limited. And having too many or two few instructors is costly.

A major challenge in rightsizing the instructor corps involves the process by which individual training pipelines estimate the required number of instructors, or instructor pricing. The instructor pricing formula is extremely outdated—failing to account for such changes as additional instructor duties that have increased, deployments, extended maternity leave, and longer teaching days—and lacks transparency. Moreover, the timing of the pricing cycle does not align with changing instructor requirements, so additional instructors that may be needed often come well after the students, which increases student wait times and impacts pipeline throughput.

Undermanning is not only affected by the pricing cycle, but also by other factors that affect whether an assigned instructor is available to teach—factors such as administrative and leadership positions that are counted as instructors, instructors being on deployment but still on the books, and the longer teaching day which mean less time for planning and preparation. The risks of undermanning not only fall on the backs of available instructors, but also affect curriculum development and student mentoring. There are strategies available to mitigate instructor shortages, though most need additional examination. Alternatives include employing civilian instructors, using members of the guard and reserve, pooling instructors to share among multiple classes, assigning newly graduated students to instructor positions for their first assignment, and reassigning students to pipelines with available capacity. Classroom capacity can also be increased, but depending on the pipeline, this approach may not yield desired outcomes (i.e., increased output).

Funding constraints for technological resources are another concern and training wings worry about their ability to adequately upgrade technological resources—particularly in career fields such as cyber that rely heavily on technology-based training systems. While schoolhouses and instructors generally find workarounds, this is an approach that is neither efficient nor sustainable. Moreover, there are similar concerns about the ability to plan for and fund systems that can help with the management of the training pipeline, such as for capacity visibility and execution tracking.

Chapter 5. Conclusions and Recommendations

As previous chapters have detailed, our examination of AETC's technical training pipeline processes has revealed numerous inefficiencies and identified many opportunities for improvement. Inefficiencies in the pipeline include lack of visibility into training capacity, excessive student waiting time, and undermanning of the instructor cadre. While these inefficiencies span the entire technical training process from planning to student flow to resources, there are some common denominators.

For one, there is a demonstrable lack of accessible information both up and down the organizational hierarchy. Lower levels of the hierarchy spend a great deal of time and effort planning and replanning for proposed changes to the training requirement. Often, these changes are minor relative to the larger uncertainties in the training process and ultimately schoolhouses do not receive the information in time to properly respond to requirement changes. At the corporate and strategic levels, there is a lack of visibility into training capacity—information that could be used for end strength and programming decisions. This has significant implications for the efficiency of the planning process, as evidenced by the resources expended to coordinate questions about potential accession and training requirement increases.

Lack of transparency can create mismatches between the number of instructors on the books and those actually available to teach. Mismatches are also evident between students required to retake all or part of a course and those washbacked or required to start the entire course anew. These mismatches make it difficult to identify areas of concern and analyze root causes.

There is also a general lack of accessible analytic tools and data that could be used to better understand the implications of policy decisions. What is the effect of increasing enrollment, of reducing the instructor cadre, of increasing classroom capacity? Do these decisions achieve the desired outcomes? The answers to these types of questions are difficult to assess with current tools and data collection—particularly in a way that is useful to stakeholders at multiple levels of the technical training process.

Inefficiencies in the Technical Training Process

We identified inefficiencies in the training pipeline in three broad areas:

- Technical Training Planning Processes
    - There are unrealistic expectations about how rapidly AETC can accommodate major changes in training target changes in the year of execution; some of these unrealistic expectations are driven by the potentially misplaced confidence in the accuracy of AFSC sustainment models.

- The system for assessing changes to training targets is not efficient—processes must allow for the inevitable changes to training targets that result from Air Force end strength adjustments.
- Because of insufficient visibility into technical training capacity, higher echelons are not able to project the impact of decisions affecting training pipelines.
- Lack of readily available information to support execution planning causes disconnects between training management levels and can lead to wasted resources or capacity.
- From requirements planning to execution planning, the absence of key actors in the planning process can cause delays in critical information sharing and a sense of disenfranchisement among key stakeholders.
- Significant trainee no-show rates for guard and reserve students complicate the planning process and may create inefficiencies in filling class seats.

- Students Flowing Through the Pipeline

  - Inefficiencies in managing student flow through the training process can lead to excessive time delays and associated costs.
  - Lack of realistic and consistently applied metrics can lead to false perceptions of the status of individual students, the instructor pool, required resources, and the success of the training system as a whole.

- Resourcing the Technical Training Pipeline

  - Rightsizing the supply of instructors is critical in providing the quantity and quality of training at a minimum cost.
  - Inadequate resourcing of training management and instructional systems can seriously undermine the delivery of training and lead to long student wait times and increased costs.

Recommendations

We acknowledge that streamlining the technical training process is a challenging undertaking. The system is complex with a high degree of uncertainty and interdependent parts. Increasing efficiency in one aspect of the pipeline can cause another inefficiency to pop up somewhere else. Development of methods to track and analyze pipeline processes must be paramount to avoid such outcomes.

We also acknowledge that not all inefficiencies in the pipeline can be eliminated. Inefficiencies related to cost, delays, and quality will continue to occur to some degree, but the goal is to reduce these inefficiencies as much as possible. To improve the system, objectives must be well understood and anchored to measurable outcomes. Roles and responsibilities need to be clearly articulated, with accountability matching responsibilities. Since organizations within the technical training hierarchy are linked, communication and transparency are essential across levels to support decisionmaking, enhance accountability, and reduce uncertainty. This

includes synchronizing and, where possible, shortening timing cycles, flattening processes, and questioning traditional practices that may impede efficiency.

In this context, we identified a number of actions the Air Force could take to improve technical training pipeline efficiency. We do not offer solutions to each of the inefficiencies identified in this report. Instead, we selected those with the highest return on investment or pose solutions to problems that are particularly costly to a large number of pipelines, based on the information gathered from the stakeholders with whom we had discussions.

Our recommendations have applicability in two areas. Some recommendations offer tailored solutions for particular inefficiencies, such as enhancing capacity visibility and improving approaches to instructor pricing and manning. Others have broad applicability across the technical training process, such as proactive modeling and developing and tracking effective metrics.

Develop a Capacity Visibility System

We recommend that AETC develop, fund, and field an information system to enhance visibility into individual pipeline capacity. Such a system could be used to identify pipelines with sufficient capacity to accommodate increased throughput in times of increasing accessions. A capacity visibility system would also do away with the lengthy coordination process that is currently used to determine if there is capacity in particular pipelines. Specific recommendations for AETC pertaining to development of a capacity visibility system include the following:

- Develop standardized definitions for capacity and resource discussions. This can be done in several ways—either through explicitly defining data elements to be used to assess capacity or resource availability or through assessments by training leadership.
- Ensure the design of a capacity visibility system allows for these key attributes:

  - "what if" excursions to better understand the effects of a change in training target before a change is actually made (allowing time to reconsider policy options with costly negative effects)
  - analysis of the trade-offs for different proposed policies or practices
  - visibility on the cumulative effects of proposed changes at a particular schoolhouse when that schoolhouse supports multiple pipelines
  - visibility of the planning bands instituted to limit changes in the year of execution (if the concept of banding as discussed in Chapter 2 is accepted)
  - real-time updates to obviate the need for multiple versions of the PGL and the problems associated with version control.

- Provide access to such a system to all participants in the process to improve communication and ensure everyone is in general agreement about the status of individual pipelines. For example, an appropriate level of career-field manager involvement may be realized if they have reliable visibility on the capacity of the pipeline for their AFSC.
- Once a capacity visibility system is developed and fielded, discontinue face-to-face training workflow management conferences since training managers, AETC/A3 and AF/A1PT will all have visibility on planned training seats for future years and can coordinate any necessary adjustments within the system.

Develop a Flow Visibility System

Similar to the system outlined above for pipeline capacity, a system is required for visibility of the flow of students in the pipeline. Supply chain visibility in logistics systems is directly applicable to technical training pipeline visibility and will be examined in more detail by RAND in future research. Supply chain processes track products in transit from the manufacturer to the final destination—either parts or components used to make a final product or the final product itself. In a broader sense, visibility can be achieved when there is an increase in the availability of data that can be analyzed to make recommendations and determine strategies to improve and strengthen a supply chain. As risks in the supply chain occur and as customer demands require fewer disruptions, commercial companies are recognizing the importance of creating and managing a visible supply chain. The characteristics of an effective supply chain visibility system can guide the development of a student flow visibility system for AETC.

Formalizing a rapid, flexible system and appropriate policies to accompany it will allow AETC to more effectively utilize training seats. Such a system should push information about upcoming empty seats with sufficient time to project someone into that seat, or release the seat to the schoolhouse so they can make adjustments in student scheduling and resource allocation.

For example, the Navy uses a process called the Quarterly Demand Planning (QDP) process that is effective for both short-term planning and managing changes to training requirements. Each quarter, QDP participants meet to review current and future demand for Navy skills and, if necessary, recommend adjustments. In addition, every quarter key participants in the planning process hold an "execution year production alignment conference" (U.S. Navy Production Management Office [PMO], 2013a, p. 14). This virtual meeting considers the next 12 months of requirements and aligns those needs to training. Where deficiencies exist, the PMO[1] works with the training agent to add additional capacity or, if it is determined that some training is no longer needed, it can be canceled and at least some of its resources used elsewhere.[2] Finally, if new training requirements arise in the execution year, the PMO has a well-defined process for determining if the requirement can be satisfied with existing resources—a process that requires that the Navy equivalent of the training manager to respond within five business days with analysis of the capacity to accommodate an increase. Air Force adaptation of such a system could not only infuse more agility into the training planning process but also enable better data sharing among organizations involved in the technical training pipeline.

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[1] The PMO is the "chief operating officer" for the Navy's personnel supply chain strategy and is "focused on process improvement through the implementation of disciplined supply chain operations methodologies in the Navy Enlisted Accessions Supply Chain (NEASC)" (U.S. Navy, undated). Detailed information about the Navy's enlisted supply chain can be found in U.S. Navy PMO, 2013a and 2013b. See also Department of the Navy, 2014.

[2] May 4, 2016, interview with PMO.

The Army uses a process called the Training Resources Arbitration Panel (TRAP) to deal with changes.[3] A TRAP is initiated when changes to training programs are required, and is meant to "manage and implement budget and execution year training program adjustments . . . and to identify and resource the associated personnel, equipment, facility and finances" (U.S. Army, 2009, p. 16).[4] This process looks similar to the "emergent requirements" process used by the Navy PMO and addresses:

- potential civilian employee and contractor capabilities and costs
- capacity to support training requirement
- cost of any unsupplied equipment for commercial off-the-shelf or commercial purchase
- impact if a training increase is not supported
- if the request should be 100 percent funded or constrained within other Army priorities. (U.S. Army, 2009, p. 16)

The TRAP can apparently respond very quickly to change requests in the execution year: an interviewee from the Army's Enlisted Personnel Management Directorate (EPMD) described one example of a training increase that was requested in May, and the training was made available by June.

Review and Update Instructor Pricing Methods and Formulas and Manning Policies

We recommend that Headquarters Air Force Manpower, Organization and Resources (AF/A1M) review the instructor pricing methods and formulas used by AETC. Updated pricing methods should include:

- Instructor manpower standards that account for different types of instructor duties across the various training pipelines and account for personnel policies that have changed since the standards were first developed (e.g., maternity leave and deployments).
- A review of the duties, manpower standards, and the current manning of schoolhouse leadership positions as well as military training leader positions.
- Transparent assumptions and visible methodologies to determine instructor authorizations at each schoolhouse.

The Air Force Manpower Analysis Agency (colocated at Joint Base San Antonio-Randolph with Headquarters AETC) is best positioned to determine current manpower requirements and develop

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[3] Management of the Army's technical training pipeline is described in U.S. Army, 2009. A key component of training pipeline management for the Army is the Enlisted Personnel Management Directorate (EPMD) under the Human Resources Command, the mission of which is to "execute distribution and career management in order to optimize Army personnel readiness, enable leader development and strengthen an agile and versatile Army" (U.S. Army Human Resources Command, 2016).

[4] The Army regulation does not specify how often TRAPs are held, but implies they can be called for important changes. In an April 12, 2016, interview, EPMD personnel indicated that TRAPs were held quarterly.

up-to-date manpower factors. A study of this magnitude would likely require endorsement from Headquarters Air Force senior leaders and the Air Force corporate structure.

We recommend that Headquarters AETC undertake a cost-benefit analysis to provide justification for the additional manpower required to allow overlap for outgoing/incoming instructors. This analysis should consider if pipeline throughput, instructor performance, or graduate quality is improved. The DSD assignment process was repeatedly identified as a personnel practice that particularly contributed to gaps in individuals filling instructor positions. We recommend the DSD process be modified so that instructors are approved and selected for the list proactively and well in advance of when they are needed. The current process for selecting commanders was often highlighted as a more workable model, whereby an annual board identifies 1.3 times the expected number of commanders needed. With a pool of DSD-approved individuals, out-of-cycle assignments for instructors can be more quickly filled, especially in years where additional instructors are required due to increasing accessions.

We also recommend Headquarters AETC investigate possible methods to encourage, attract, and retain civilian instructors. Civilian instructors provide continuity and consistency and are a more flexible workforce than additional permanent military instructors. However, we heard that civilian instructors are disincentivized from applying for and remaining in instructor positions because of low General Schedule ratings, unpopular geographic locations, and higher paying positions in the civil sector. If Headquarters AETC can set aside funds to provide for either government civilians or contractor instructors, they may be able to mitigate the military instructor shortage. Expanding the duties of military training leaders to include administrative tasks to support instruction is another way to optimize military instructors' effectiveness so they can focus on curriculum development and the delivery of key training course objectives. However, before such tasks are reassigned, a larger manpower study should be conducted to determine the implications on the instructor corps, given all of the duties of instructors and military training leaders.

On the other hand, while stakeholder interviewees reported that efforts were ongoing to determine how to use reserve-component members as instructors, we see two key interrelated issues that make using reserve-component members problematic. First, funding their active-duty man-days could be difficult in an already fiscally constrained environment, and, second, the length of time a reserve-component member is available (either due to funding constraints or the reserve member's availability) may not allow he or she to perform instructor duties. It is not clear in what circumstances the reserve-component member is best suited.

Improve the Flow of Students in the Pipeline

There are several noteworthy recommendations to improve the flow of students through the pipeline. The visibility systems recommended previously and the subsequent recommendations

for metrics will help AETC identify additional sources of delay in the pipeline which should be addressed.

- In order to reduce SAT, encourage officer accession sources to start the security clearance process at the earliest possible date for individuals entering pipelines that require fully adjudicated clearances. Ensure that pipelines currently requiring clearances continue to mandate that requirement, or rather, accept interim clearances.
- Review in-processing and out-processing processes across all schoolhouses to determine if better scheduling, automated systems, or other process improvements can reduce student wait times before starting training and before departing the training location for their first duty station.
- In conjunction with improvements in tracking metrics, ensure that courses with high washback rates are identified. This may require improved methodology to ensure student statuses are accurately represented.
- Perform additional analysis on the best methods for prioritizing washbacks, recognizing that tailor-made solutions will have to be developed for individual pipelines.

Reinvigorate Technical Training Pipeline Modeling

We recommend that Headquarters AETC reinvigorate their technical training pipeline modeling capabilities. Even a very basic model as described in this report can shed light on potential impacts of policy and process decisions such as:

- estimating total capacity based on fixed resources
- anticipating resource constraints as production levels change or, conversely, estimating resources required for various levels of production
- minimizing uncertainty among a set of options for training production targets and for allocating resources
- minimizing cost among a set of options for training production targets and for allocating resources
- determining the result of some curricular changes (length of instruction, class size, class scheduling, changes in graduation/washback/elimination rates)
- calculating the impact of resources shared across classes or courses
- estimating the result of various prioritization schemes.

Embedding estimation models within the AETC information architecture will help to rapidly provide estimates of planning, resource, or scheduling changes on pipeline costs and capacity. We will transition to AETC/A3P the model developed for this research and assist in their understanding of the use of the model.

Identify and Track Effective Metrics

Realistic and consistent metrics can provide insights into the status of students in the pipeline and the status of the resources required for training. For this reason, AETC needs to reinvigorate its collection and evaluation of metrics in two ways.

First, current metrics need to be reviewed for their utility. AETC instructions direct the collection of several types of metrics, but we found that at least one of these metrics—nontraining time in the pipeline—does not appear to be monitored. A review of current metrics will show whether this and other metrics are still useful and will help identify new metrics that could provide additional insight into the management of pipeline processes. Metrics should be aligned with training goals so that progress toward, and problems with, achieving the goals are readily visible. And the data, once collected, must be analyzed and tracked to be useful. Initial recommendations for metrics that are not tracked today but that would provide useful insights include the following:

- washback/failure rates for individual courses
- delays in training by type
- clearance delays by type and accession source
- arrival date at the schoolhouse to compare to start date for the initial course
- departure date from the schoolhouse to compare to graduation date
- instructor hours in the classroom versus additional duties.

It may take the combination of several data elements to define a metric that is useful and tied to training goals, and it may take detailed processing of the data to create meaningful metrics. Business rules must be developed to ensure that metrics that are common across pipelines and schoolhouses are measured consistently over time. But these rules must also be flexible enough to recognize that not all metrics are appropriate for all schoolhouses.

Second, once a set of metrics is established, the information must be accessible to the appropriate management levels—including those making strategic management decisions that pertain to the training enterprise. The newly established "dashboards" accessible at the TTOC website are a step in the right direction, but AETC needs to ensure that such tools not only help instructors and training managers monitor day-to-day operations, but also enable planners and analysts to study long-term trends in the overall training pipeline and explore the implications of policy changes over the course of months and years.

Improve Management and Communication Across All Levels of the Pipeline

We also recommend specific improvements to address inefficiencies in management and communication:

- Set and enforce limits on PGL changes, outside of "bands," that are determined one year out from the year of execution. This will reduce top-down churn.
- Standardize career-field manager roles and equalize their influence during the planning process to help ensure there is an even playing field when it comes to developing the requirements that feed into the PRDs and PGLs.
- Be more accountable with guard and reserve seats. In doing so, understand that schoolhouses use these missed seats as informal flexibility to deal with washbacks and curriculum development, so policies to account for these requirements would have to be concurrent.

Concluding Thoughts

These recommendations are extensive in reach and aimed at long-standing concerns in the technical training pipeline. Each of the issues addressed was consistently identified in the various components of our analysis and therefore warrants further examination. The recommendations represent significant investment for the Air Force in terms of funding, manpower, management structures, and the acquisition and maintenance of new systems. While it was not within the scope of our project to do a complete business case analysis to determine, for example, which inefficiencies are most costly or most prevalent, we can point to several recommendations that could be accomplished relatively quickly and at little cost to address inefficiencies we heard repeatedly during stakeholder interviews:

- Communication could be improved immediately up and down the organizational structure, including regular communication between the office of the Deputy Chief of Staff for Manpower, Personnel and Services and Headquarters AETC staff as to the potential for changes in accession levels in the current year and out-years. In addition, inquiries as to the ability of 2nd Air Force and the individual schoolhouses to respond to changes in training goals could be funneled through 2nd Air Force and systematically tracked.
- The Air Staff and AETC could immediately establish and commit to using the existing "rack and stack" process to determine training requirements when there is a need to increase the total number of accessions.
- The model we describe in this report (or a model with similar functionality) could be used immediately by AETC's studies and analysis section to test changes in overall training policies or examine the impact of changes to specific AFSC pipelines.
- While programming for additional instructor manpower may be a longer-term solution, adjusting timelines for the DSD process will ensure that the additional vetting required by the program does not delay instructors reporting as required to move students through the pipeline.
- Headquarters AETC staff could select one or two key metrics to begin tracking immediately and to report to senior AETC leaders. For example, tracking delays in training by type and for each pipeline could help pinpoint problematic pipelines and areas for increased efficiencies across pipelines.

Future research should be aimed at understanding the gains to be realized by the particular investments needed to implement the full set of recommended actions. For example, AETC should be able to answer such questions as, how much is throughput increased for each additional instructor? Identifying the methods needed to answer these types of questions can help guide an investment strategy for improving the efficiency and responsiveness of the Air Force's nonrated technical training processes to meet changing force and support requirements.

Appendix A. Details of the Qualitative Analysis Methodology

As described in Chapter 1, the methodology used for this project involved a mixed-methods approach with several complementary streams of data collection and analysis, including qualitative interviews with key stakeholders, quantitative analysis of training data and metrics, and the development of a computer-based model of the process. These were augmented by a review of prior RAND research on the Air Force technical training pipeline and investigation into sister service processes. This appendix describes the detailed methods used in the analysis of interview results.

The qualitative stream of the research methodology first focused on exploring the full range of themes and issues and then, after comparing initial results with the quantitative stream, on uncovering more nuanced explanations of particular questions and concerns. Data collection consisted of both observation and interviews, with the project team attending two enlisted and one officer AETC-led technical training flow management working groups as well as conducting 40 semistructured interviews with over 100 key stakeholders, some individually and some as small groups.[1] Observational data were captured via note-taking based on topics discussed, observation of the proceedings, and discussions with participants. Interview data were recorded via multiple note-takers who compared and consolidates notes; the note-takers were focused on key topics but also captured particularly poignant quotes.

The interviews were largely free-flowing conversations conducted by the same team of interviewers with an emphasis on topics informed by an initial protocol (included at the end of this appendix) that was amended based on inductive analysis of early interviews. The stakeholders included leadership and staff from numerous Air Force organizations, including Headquarters Air Force, AETC, 2nd Air Force, AFPC, Recruiting Service, and BMT. In addition, the team conducted a deeper dive into two officer and two enlisted career fields, which involved interviewing wing, group, and squadron-level leadership, training managers, instructors, and students in each field, as well as collecting quantitative training data and metrics on these career fields. The four career fields selected in coordination with the project sponsor were 14NX (Intelligence Officer), 17DX (Cyberspace Operations Officer), 2A3X3M (F-16 Tactical Aircraft Maintenance, Enlisted), and 3D0X2 (Cyber System Operator, Enlisted). Table A.1 breaks down the numbers of interviews by type of organization.

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[1] Given the small sample size, extra care has been taken to ensure the anonymity of individual interviewees, meaning that many quotes will either be unattributed or only at the broadest organizational level possible.

Table A.1. Interviews by Organization

Organization/ Interviewees	Number of Interviews
Headquarters Air Force	3
AETC	5
2nd Air Force	2
Air Force Recruiting Service	1
AFPC	1
Training Wing	5
Training Group	7
Training Managers	6
Guard and Reserve Liaisons	3
Instructors	4
Students	3

The sponsor identified the particular organizations and commands interviewed, which cover all of the participants involved in the technical training pipeline process. These organizations identified specific candidate interviewees from within their organization who were then recruited by the project team. For students and instructors interviewed, the schoolhouses selected a panel of candidates based on their availability who were then formally recruited to participate when the team arrived on site.

Different interviews included different elements of the protocol, with a greater focus on execution at the lower echelons of the training process and a greater focus on policy at the higher ones. Due to the limited number of organizations and personnel involved and the fact that each organization has a very particular place in the process, the project team prioritized identifying the full range of relevant challenges unique to each organization in the available interview time, rather than attempting to cover territory of little immediate relevance. While this limited the team's ability to conduct major quantitative assessments of the data, the intent of the interviews was to be exploratory rather than explanatory, and the development of the codes was organized to reflect the emerging themes rather than the interview topics, which often cut across different portions of the interview protocol.

The team utilized the Dedoose software platform to organize, code, and conduct analysis. Analysis of the interview data was inductive and involved the development of a coding scheme derived from initial analysis of the interviews, which was refined to focus on specific topics emerging in the other research streams (data analysis, modeling, prior research, and other service practices). Interviews were coded for the following thematic categories:

- Active-duty versus guard and reserve
- Student accessions and assignments
- Capacity

- Change
- Communication and feedback
- Current plus-up
- Fill rates
- Financial resources
- Flow of students
- Instructors
- Metrics of success
- Miscellaneous
- Norms
- Officer/enlisted
- Planning
- Policy
- Requirements
- Risk
- Students

Multiple team members coded each interview transcript after initial tests for interrater reliability; but given the small sample size, discrepancies were deconflicted verbally. The results of the coding helped identify the major areas of concern in the technical training pipeline as perceived collectively by the interview respondents and by particular type of organization (such as training wings versus Headquarters Air Force).

The research team then compared these findings with the findings from the quantitative analyses of the training data and metrics to determine if common themes could be further explained, supported, or challenged by the data analysis. Simultaneously, the interview data helped inform some of the findings from the quantitative analysis and highlighted gaps in official Air Force metrics. Data analysis of the four example career fields was combined with information from the quantitative analysis to identify specific challenges faced by those particular career fields and potential solutions based on lessons learned by each career field. All of these results were shared with the modeling team to inform the model development process and identify particular points of concern that could be further analyzed, enabling the research team to identify alternatives to current Air Force processes.

All of the top-level codes were included in some fashion in the final report. The team gave particular weight to themes that overlapped with germane findings from the quantitative and modeling streams of analysis as well as those where the team could offer reasonably actionable recommendations to the sponsor. They were organized based on the options for implementing recommendations, with more policy-oriented themes being combined for consideration by Headquarters Air Force and Headquarters AETC and more execution-oriented themes being combined for AETC, 2nd Air Force, and the training wings.

Interview Protocol

Interview Questions

1. Pipeline Process

- Please describe the overall technical training pipeline process and your organization's role within that process. Can you sketch out a flow chart of the process and/or a rough sketch of an organizational chart as you understand it?
- Please describe any differences between the theoretical pipeline and how it actually works.

    – What other organizations does your organization interact with in this process? In what capacity? How often? How do you interact, e.g., face-to-face?
    – What other organizations that are involved in the process interact with each other? How does this affect your organization's role?
    – What is the theoretical and actual timeline for the pipeline process?
    – Have there been any major changes to the pipeline process recently? If so, please describe.

        ▪ In general, who determines what changes are needed and how they are implemented? What organizations are involved?

- What authorities and policies drive this pipeline and the role of your organization?

2. Planning

- How does your organization plan for the pipeline?

    – What are the inputs you use for your calculations and where do you get them?
        ▪ [Prompt: Numbers of trainees, manning documents, etc.]
    – [If not mentioned above] At your organization's level, is capacity also a factor in planning?
        ▪ What inputs are involved in determining capacity?
        ▪ [Prompt: Numbers of instructors, infrastructure, equipment, costing, etc.]
    – Do you get the information you need and do you get it when you need it? If, not, why not?

- How predictable are these input data?
- How often do inputs change? Why? What impact does that have on your organization and the pipeline?

- Examples

  - Tell me about a time when planning went smoothly.
    - What was the situation?
    - What happened?
    - What was the result?
    - Why do you think everything went smoothly in this situation?
  - Tell me about a time when planning was a challenge. What was the background?
    - What was the situation?
    - What happened?
    - What was the result?
    - Why do you think these challenges arose in this instance?
  - How often would you say planning goes smoothly vs. facing challenges?

- Where do you see room for improvement in the planning process?

  - Do you have recommendations that would make it run more smoothly?
  - What factors would facilitate or inhibit implementation of these changes?
    - [Communication, timelines?]

3. Execution

- What internal or external support does your organization require to implement its mission in regards to this pipeline?
- Students' Specifics

  - Washbacks
    - What is the priority for placing washbacks into classes with respect to new students?
    - How do you plan for washbacks?
    - How could the placement of washbacks be made more efficient?
  - Proficiency Advance
    - Are students allowed to proficiency advance?
    - If so, under what conditions and for what types of classes?
    - How regular is proficiency advancement?
      - Where might there be opportunities to increase these numbers?

- Capacity

  - What are the major sources and types of constraints for your organization in this process?
    - How routine and predictable are these constraints?

- How do you plan for fluctuations in constraints? What are common mitigation strategies when you face constraints?
  - Do you every face issues of excess capacity? If so, how do you address them?
- How do you plan for fluctuations in capacity?
- What are common mitigation strategies when you face excess?
- Can you give an example of some of the kinds of consequences (good or bad) of having excess capacity?

- Capacity and Execution

  - Tell me about a time when you faced constraints in capacity.
  - What was the situation?
  - What happened?
  - What was the result?
  - How did these constraints impact your mission execution?
  - Why do you think this situation happened?
  - Is this a fairly typical experience in this situation?

  - Tell me about a time when you had optimal capacity.
  - What was the situation?
  - What happened?
  - What was the result?
  - Why do you think this situation happened?

- Where do you see room for improvement in the execution phase, including managing excess or constrained capacity?

  - Do you have recommendations that would make it run more smoothly?
  - What factors would facilitate or inhibit implementation of these changes?
  - [Resources, personnel, infrastructure, equipment, costing]

4. Feedback Loops

- Are there any formal feedback loops in the training pipeline, either within or between organizations? Please describe.

  - What type of information is shared?
  - How (e.g., shared databases)?
  - When?
  - Who provides it?
  - Who receives it?

- Are there any informal feedback loops? Please describe.
- In what ways do the feedback loops work well?
- In what ways could they use improvement?
- What factors would facilitate or inhibit these changes to feedback loops?

- Where do you see room for improvement in the feedback process?
    - Do you have recommendations that would make it run more smoothly?
    - What factors would facilitate or inhibit implementation of these changes?
    - [Information systems]

5. Recommendations for Improvement

- Where do you see room for improvement in the overall organization of the pipeline process?
    - Do you have recommendations for policies that would make the process run more efficiently?
- Are there other areas that have room for improvement or other recommendations you would make that we have not covered so far?
   - [Personalities, Attitudes]

Appendix B. Calculating the Costs of Time Not in Training

This appendix describes the methodology used to calculate the costs of SAT, as discussed in Chapter 3. We used data from ADSS to conduct this analysis. ADSS records when a student arrives at a training location, starts a course, completes a course, starts the follow-on course (for AFSCs that require more than one course during technical training), and leaves the technical training location for his or her first assignment. This information makes it possible to determine how much time is spent in training and how much time is spent waiting.

Air Force briefings have some information on "ideal" training times for technical training courses, as well as the amount of time that is anticipated between BMT and the start of technical training and the amount of time that is expected between individual courses (see AETC, 2015).

Figure B.1 describes graphically how we used this information to examine wait times in the technical training pipeline.

Figure B.1 Examination of Nontraining Time in the Technical Training Pipeline
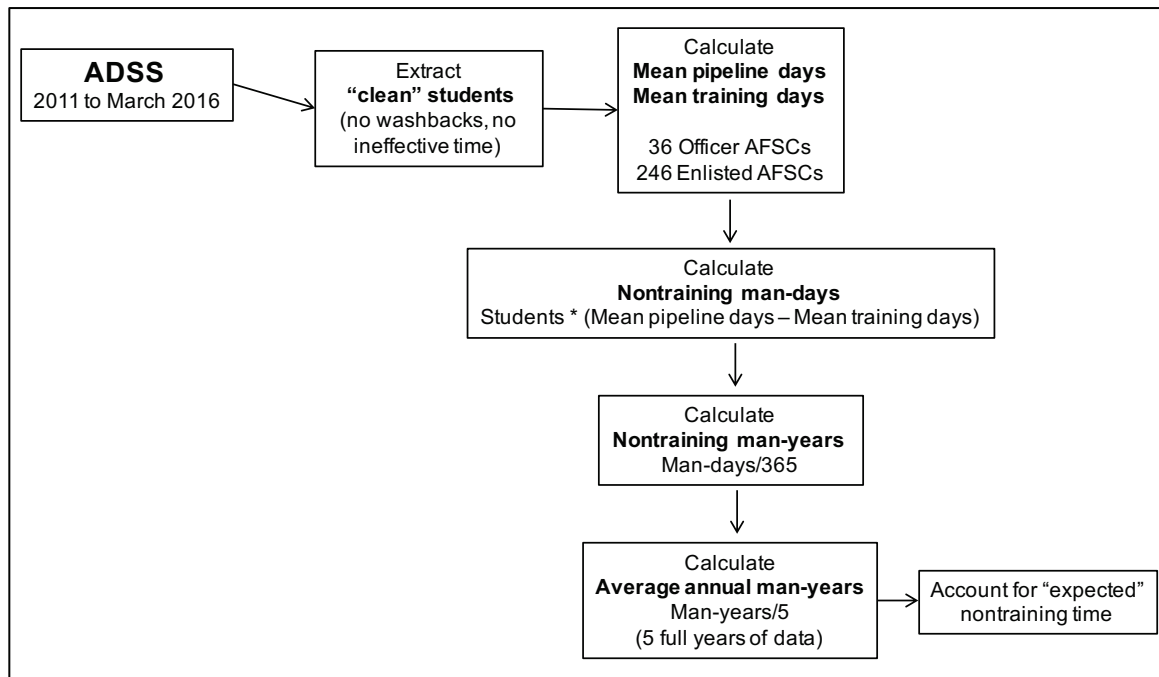
As shown in Figure B.1, we used ADSS data from 2011 through March 2016, and extracted data for "clean" students only (students who went through their training courses without any recorded delays or washbacks). Thus, any difference between their time in the pipeline (i.e., from the time they arrived at the training location to the time they left for their first assignment) and

their time in training would be the result of delays that are inherent in the system. We examined data for 36 officer and 246 enlisted AFSCs.[1]

For each AFSC we subtracted the mean number of training days from the mean number of days that students were at their training location to get the mean number of nontraining days, and then multiplied by the number of students trained to get the mean number of nontraining man-days. This value was divided by 365 to get man-years, and then divided by five (since there were five full years of data) to determine the average annual man-years spent in the pipeline each year that were not spent in training. Finally, the *planned* nontraining time for individual AFSCs was subtracted from this value. For example, almost all enlisted AFSCs expect students to arrive at their technical training location five days after the completion of BMT, so for a given AFSC the average number of students trained per year is multiplied by five, converted to years, and subtracted from the calculated average annual nontraining man-years (calculated by comparing the arrival date at the technical training school to the departure date from BMT).[2] Again, this is an effort to count only nontraining time that is not already planned for in the training system.

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[1] These numbers represent an approximate count of the AFSCs that had technical training courses from 2011 to mid-2016. For comparison, the official Air Force website lists about 149 officer AFSCs. Most of those career fields (such as various types of pilots) do not receive training in technical courses managed by 2nd Air Force. The website lists only 133 enlisted AFSCs. The reason there are more AFSCs in the ADSS data is that many AFSCs have several subcategories. For example, the website lists only 1N3XX as the enlisted AFSC for Cryptologic Language Analyst. However, each language has its own code (e.g., 1N3X1X for German and 1N3X7X for Turkish; see U.S. Air Force, 2015b).

[2] Counts of days in this examination were based on calendar days. Students generally graduate from BMT on Friday but do not ship to the next location until Monday morning; our data include the two weekend days as wait time before the start of the class.

Appendix C. The AETC Flow Model

The purpose of the AETC Flow Model (AFM) is to track course capacity, required resources, and student outcomes for initial skills courses leading to AFSC certification. AFM uses class schedules, student and instructor arrivals, and historical course completion rates in order to simulate outcomes. AFM combines a Monte Carlo,[1] discrete event-stepped[2] simulation with front- and back-end Microsoft Excel workbooks for managing the input and output data and analyzing results. The simulation is written in the ExtendSim software language from Imagine That, Inc.[3] Microsoft Excel, including Visual Basic for Applications routines, is used to manage the input and output data. AFM can flexibly represent a single class or course sequence for an AFSC, or multiple AFSC course sequences. The impact of alternative class schedules, instructor availability, student mixes and priorities, class lengths, and graduation rates on total production, waiting times, and maximum flow capacity can be calculated with the model. AFM and the postprocessors to AFM calculate various outcomes at the student, class, course, or AFSC level.

This appendix describes the ExtendSim simulation and the internal database used by the model, followed by an explanation of the Excel layout of the input data and management of the output data, including some templates for analyzing the results.

The AFM Simulation

Figure C.1 shows the top-level icons representing the processes used in AFM. The ExtendSim interface, which provides general controls and options for the simulation, is shown in the outer window labeled "A."[4] The inner window, labeled "B," shows various icons representing what ExtendSim terms "hierarchical blocks" or higher-level building blocks composed of multiple

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[1] Monte Carlo models explicitly use random-number draws to represent the uncertainty in the processes represented. This type of simulation was named after the gambling casinos in Monaco.

[2] Discrete event-stepped models advance simulation time asynchronously as specific events occur.

[3] ExtendSim provides a visual interface and modeling environment centering around a number of "blocks" that represent various processes. These blocks are contained in libraries and include the full functionality for representing various queues, activities, switches, gates, resources, random effects, and input/output processes. The model developer arranges and connects these ExtendSim blocks to represent the system of interest. In the event-stepped version of ExtendSim, items flow along the connection paths from block to block. Items can be assigned various attributes that describe the unique characteristics of the item. The blocks can also be connected in such a way as to share data. Clusters of blocks can be placed inside a hierarchical structure, a "block of blocks," in order to capture specific functions or processes and to unclutter the display. These hierarchical blocks can be nested with other hierarchical blocks as deeply as desired and opened to reveal the blocks inside.

[4] This interface appears with every ExtendSim simulation and is described in detail in *ExtendSim User Guide*, Imagine That, Inc., 2013

blocks. The primary hierarchical block for the simulation is shown with a red schoolhouse icon and labeled "Class Schedule Execution." Two hierarchical icons to the left of the schoolhouse, labeled "Initialize Instructors" and "Initialize Students," contain the processes to add either instructors or students to the simulation as they arrive at the schoolhouse.

Figure C.1. Top-Level Depiction of the AFM
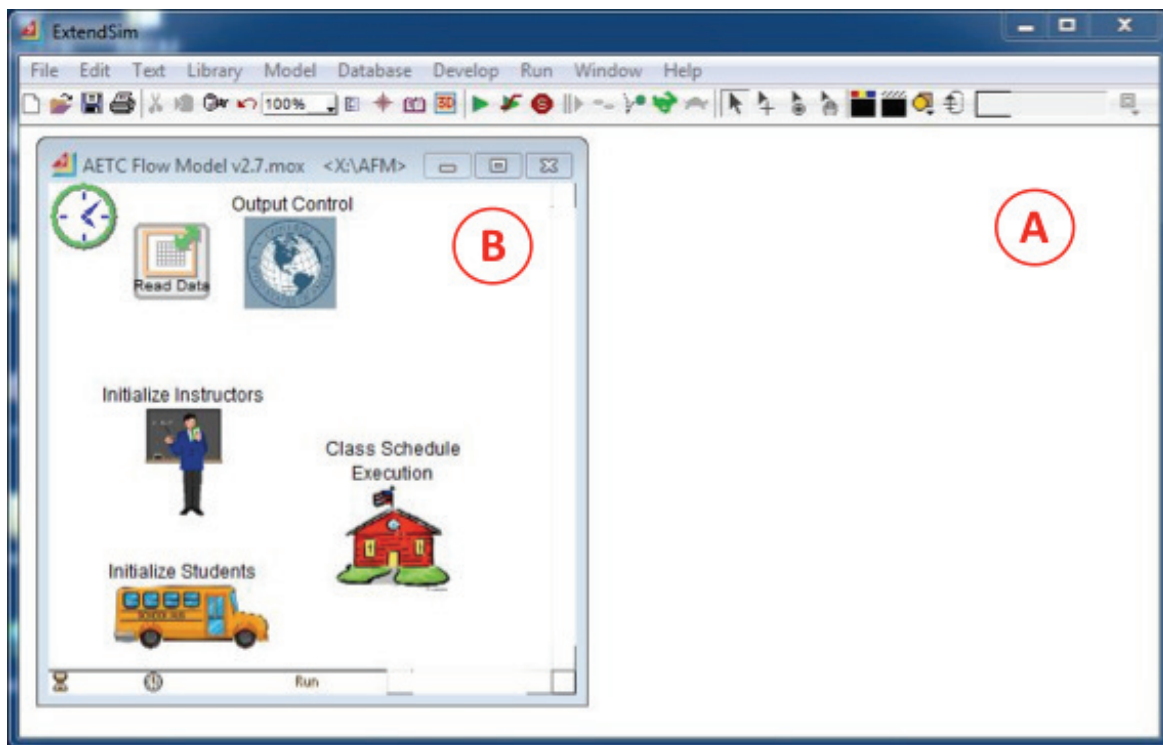
SOURCE: RAND-generated.

Above these three hierarchical blocks are three additional icons. In the upper left is an ExtendSim block that must be included in all discrete event-stepped simulations. It appears as a clock and is called the "Executive." It controls various aspects of the internal workings of the simulation and is described in the ExtendSim *User's Guide*. The block in the upper-middle, labeled "Read Data," is a hierarchical block devoted to reading the Excel-based input data. The final block, with the appearance of the western hemisphere, is a hierarchical block that contains output controls developed specifically for AFM. We will open the "Class Schedule Execution" block in order to provide the next level of modeling detail.[5] We then describe the ExtendSim

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[5] It is not the purpose of this section to provide a thorough description of all the components of AFM or document the ExtendSim blocks. We desire to provide an overview of the model only. For details on the ExtendSim blocks, refer to the *ExtendSim User Guide*.

database that holds all of the data for the model. Finally, we describe the Excel files that are read into the ExtendSim database.

Class Schedule Execution

The schoolhouse could be represented in a variety of different ways. One way would be to follow individual students from class to class as they progress toward AFSC course completion. An alternative method is to follow classes from initialization, to enrollment, to completion, and to determine the outcome results for each student. While the former may seem more natural, it requires more "moving parts" than the class representation. Because of this, we decided to follow the flow of classes. The "Class Schedule Execution" hierarchical block performs these steps and is at the heart of the AFM simulation.

Opening the "Class Schedule Execution" block (short-titled "ClassExecution") reveals the end-to-end process for each individual scheduled class. Figure C.2 shows the set of ExtendSim and hierarchical blocks that constitute the next layer beneath "ClassExecution." The blocks in this diagram, like the blocks within most other hierarchical blocks, are read generally left to right. On the far left, the ExtendSim "Create" block, labeled "A" in Figure C.2, sets items flowing through the model at the simulation time that each class has been scheduled. The items representing each class pass into the "Instructor" and "Student Enrollment" hierarchical blocks.

Figure C.2. Blocks Within the Class Schedule Execution Block
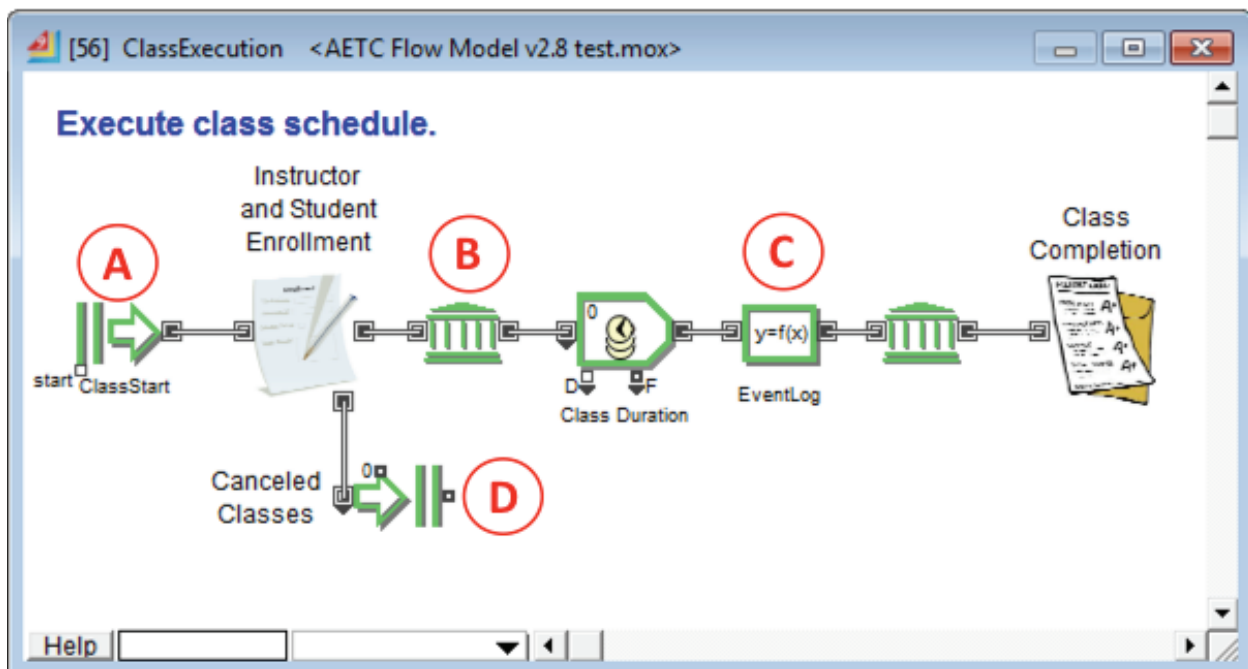
SOURCE: RAND-generated.

If either no instructor is available or an insufficient number of students are waiting to take the class, the class is canceled and the item flows out the ExtendSim "Exit" block (labeled "D" in Figure C.2). Otherwise, the class passes through the ExtendSim "History" block (labeled "B" in Figure C.2). The "History" block, here and throughout the model, records the instructor identifier and the number of students seated in the class. After the "History" block, the class item continues into an ExtendSim "Activity" block (labeled "Class Duration" in Figure C.2). Each class item waits in this block until the simulation time reaches the class completion time. When this occurs the item is released from the "Activity" block and proceeds to the ExtendSim "Equation" block (labeled "EventLog" in Figure C.2). This block records class, student, and instructor data in the EventLog table in the ExtendSim database so that each action can be analyzed in the postprocessor. Once completed, the class items pass to another ExtendSim "History" block and into the "Class Completion" hierarchical block, which determines the outcomes for each student and records outcomes at the student, class, course, and AFSC level. This block also makes the instructor available to teach a next course and either places students on the wait list for their next class, eliminates them from the AFSC, or awards them the AFSC.

AFM ExtendSim Database

ExtendSim includes a relational data management system for storing data used in a model. In order to provide a visual representation of the database and its tables and fields, ExtendSim includes a depiction that can be manipulated by the user. Figure C.3 shows this representation for the AFM database. Tables are shown as rectangular shapes with fields shown within the shape. Lines are drawn between tables to show the relationships between tables.[6] Fields colored pink are the unique values in the relationship. Fields colored green are references to the unique values. While this depiction may appear somewhat daunting, it enables the modeler to rapidly make changes in tables, fields, or relationships.

Table C.1 provides a brief description of all the tables used in the internal database. The table begins with the five tables containing unique character strings. Next are the six tables containing inputs describing the AFSCs, courses, washback and elimination rates, classes, instructor cohorts, and student cohorts. These are followed by two tables that expand the cohort tables into individual data for individual instructors and students. Finally, the last three tables contain the instructions for controlling the output of the model, the EventLog which captures all of the actions in the model, and a table with constants used in the model.

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[6] ExtendSim's internal databases are relational, meaning that the values in one table may be dependent on the values in another. In particular, as previously noted, each variable with text values must occur as an individual table. Other tables using text values must include a relational reference to the text variable table.

Figure C.3. The Internal Database for AFM
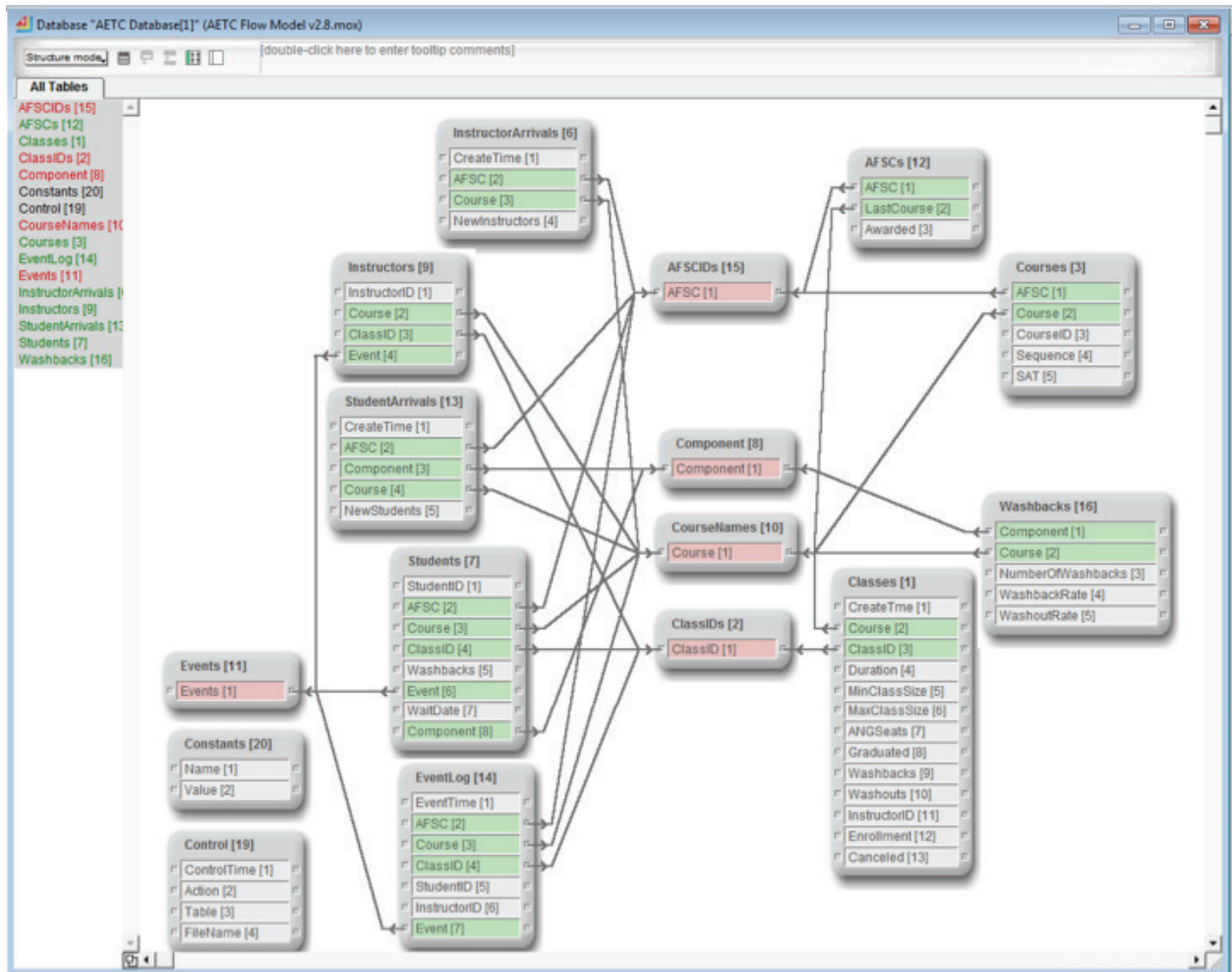
SOURCE: RAND-generated.

Table C.1. Tables and Fields in the AFM Database

Table Name	Purpose	Fields
AFSCIDs	Character strings for all of the AFSCs	AFSC
CourseNames	Character strings for all of the course names	Course
ClassIDs	Character strings for all of the class identifiers	ClassID
Component	Character strings for the three Air Force components	Component
Events	Character strings for the events used in the model	Event
AFSCs	AFSC-level inputs and outputs	AFSC, LastCourse, Awarded
Courses	Course-level inputs and outputs	AFSC, Course, CourseID, Sequence, SAT
Washbacks	Course washback and elimination rates	Component, Course, NumberOfWashbacks, WashbackRate, WashoutRate
Classes	Class-level inputs and outputs	CreateTime, Course, ClassID, Duration, MinClassSize, MaxClassSize, ANGSeats, Graduates, Washbacks, Washouts, InstructorId, Enrollment, Canceled
InstructorArrivals	Instructor cohort inputs	CreateTime, AFSC, Course, NumberOfInstructors
StudentArrivals	Student cohort inputs	CreateTime, AFSC, Component, Course, NewStudents
Instructors	Individual instructor data	InstructorID, Course, ClassID, Event
Students	Individual student data	StudentID, AFSC, Course, ClassID, Washbacks, Event, WaitDate, Component
EventLog	Events occurring in the simulation	EventTime, AFSC, Course, ClassID, StudentID, InstructorID, Event
Control	Instructions for data capture and output control	CreateTime, Action, Table, FileName
Constants	Constant values used in the simulation	Name, Value

Excel Input Tables

We now briefly present the Microsoft Excel inputs for AFM. Excel is used to accumulate the AFM data because of the potential extent of the data, which would be more difficult to manage in ExtendSim, and because much of the data already existed in spreadsheet format. Excel also offers an interface capability through Visual Basic for Applications UserForms. In defining AFM data, the first step is to specify an AFSC that already exists in the Excel data or to add a new AFSC. Behind the interface, the AFSC-based data can be seen. In this example, the four AFSCs particularly examined in this report are shown: 14N1, 17D1, 2A333M, and 3D032. For each of

these, it is also necessary to specify the AFSC awarding course in the associated course sequence (LastCourse) as well initializing the number of graduates (Initial Awarded).

Tables C.2 through C.6 show the contents of the other tabs in the Excel workbook and the remaining data needed for the four AFSCs in our example AFM case. Table C.2 contains all of the courses for the four AFSCs and the related course data. Each course is identified by a name.[7] The sequence number within the AFSC course sequence follows the course name and then the course identifier. The length of the course is given in days and the initial quantity of SAT. [8]

Table C.2. Course Data

AFSC	CourseName	Sequence	CourseID	Length	Initial SAT
14N1	14N1 AFSC Course	1	X3OBR14N1001	130	0
17D1	Cyber Training Phase 1	1	E3OQR17D1 001A	50	0
17D1	Cyberspace Training Phase 2	2	E3OBR17D1 002A	65	0
2A333M	2A333 Fundamentals	1	J3AQR2A333M026B	18	0
2A333M	2A333 MWS F-16	2	J3ABR2W131F026E	58	0
2A333M	2A333 MRA Training Course	3	J3ABP2A333M026B	20	0
3D032	IT Fundamentals	1	E3AQR3D031 02AA	10	0
3D032	3D032 AFSC Course	2	E3AQR3D032 00BB	46	0
3D032	Security +	3	E3ABR3D033 00BA	10	0

Class data is shown in Table C.3. Each class is shown with its associated AFSC and course ID. Each class for a course is numbered sequentially to create the class identifier. Each class has a start date, end date, and a maximum class size. In this sample case, we have only included a small number of classes, two for each course, all with fixed maximum class sizes of 20 students. Start and stop dates have also been idealized.

Table C.4 provides an example of the student arrival data. Student cohorts can be created in any number. A cohort consists of an arrival time from BMT (CreateTime in AFM), a single AFSC for the cohort, and a number of students. Arrivals can occur at any time, but care should be taken that students must arrive at least the day before their first course starts.

Table C.5 contains instructor arrival data. Similar to student cohorts, instructor cohorts arrive at the schoolhouse at the same time and in the same AFSC. Any number of instructors can be included in each cohort. In this example, each cohort has 100 instructors, although it could have been sent to some other value. Currently, instructors are identical and are qualified to teach exactly one course in the AFSC course sequence.

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[7] These names are also contained in ADSS.

[8] While Initial SATs are all set to zero in this case, AFM can be run with the Initial SAT set to a greater quantity representing, for example, the number of SAT going in to a new school year.

Table C.3. Class Data

AFSC	Course	ClassNumber	Classes	Start	MaxClassSize	End
2A333M	J3AQR2A333M026B	01	J3AQR2A333M026B 01	1/6/2014 0:00	20	1/12/2014 0:00
2A333M	J3ABR2W131F026E	01	J3ABR2W131F026E 01	1/13/2014 0:00	20	1/19/2014 0:00
2A333M	J3ABP2A333M026B	01	J3ABP2A333M026B 01	1/20/2014 0:00	20	1/26/2014 0:00
3D032	E3AQR3D031 02AA	01	E3AQR3D031 02AA 01	1/6/2014 0:00	20	1/12/2014 0:00
3D032	E3AQR3D032 00BB	01	E3AQR3D032 00BB 01	1/13/2014 0:00	20	1/19/2014 0:00
3D032	E3ABR3D033 00BA	01	E3ABR3D033 00BA 01	1/20/2014 0:00	20	1/26/2014 0:00
14N1	X3OBR14N1001	01	X3OBR14N1001 01	1/6/2014 0:00	20	1/12/2014 0:00
17D1	E3OQR17D1 001A	01	E3OQR17D1 001A 01	1/13/2014 0:00	20	1/19/2014 0:00
17D1	E3OBR17D1 002A	01	E3OBR17D1 002A 01	1/20/2014 0:00	20	1/26/2014 0:00
2A333M	J3AQR2A333M026B	02	J3AQR2A333M026B 02	1/20/2014 0:00	20	1/26/2014 0:00
2A333M	J3ABR2W131F026E	02	J3ABR2W131F026E 02	1/27/2014 0:00	20	2/2/2014 0:00
2A333M	J3ABP2A333M026B	02	J3ABP2A333M026B 02	2/3/2014 0:00	20	2/9/2014 0:00
3D032	E3AQR3D031 02AA	02	E3AQR3D031 02AA 02	1/20/2014 0:00	20	1/26/2014 0:00
3D032	E3AQR3D032 00BB	02	E3AQR3D032 00BB 02	1/27/2014 0:00	20	2/2/2014 0:00
3D032	E3ABR3D033 00BA	02	E3ABR3D033 00BA 02	2/3/2014 0:00	20	2/9/2014 0:00
14N1	X3OBR14N1001	02	X3OBR14N1001 02	1/20/2014 0:00	20	1/26/2014 0:00
17D1	E3OQR17D1 001A	02	E3OQR17D1 001A 02	1/27/2014 0:00	20	2/2/2014 0:00
17D1	E3OBR17D1 002A	02	E3OBR17D1 002A 02	2/3/2014 0:00	20	2/9/2014 0:00

Table C.4. Student Arrival Data

CreateTime	AFSC	NewStudents
1/6/2014 0:00	2A333M	40
1/6/2014 0:00	3D032	35
1/6/2014 0:00	14N1	22
1/6/2014 0:00	17D1	50
1/20/2014 0:00	2A333M	25
1/20/2014 0:00	3D032	60
1/20/2014 0:00	14N1	20
1/20/2014 0:00	17D1	10
2/3/2014 0:00	2A333M	20
2/3/2014 0:00	17D1	40

Table C.5. Instructor Arrival Data

CreateTime	AFSC	QualifiedCourseID	NewInstructors
1/1/2014 0:00	14N1	Intelligence Officer Course	100
1/1/2014 0:00	17D1	Cyberspace Training (phase 1)	100
1/1/2014 0:00	17D1	Cyberspace Training (phase 2)	100
1/1/2014 0:00	2A333M	Maint. Apprentice (F-16) Part 1	100
1/1/2014 0:00	2A333M	Maint. Apprentice (F-16) Part 2	100
1/1/2014 0:00	3D032	Info Tech Fundamentals	100
1/1/2014 0:00	3D032	Cyber Sys Ops Apprentice	100
1/1/2014 0:00	3D032	Cyber Sys Ops Security+ Cert	100

The final tab in the Excel workbook is shown in Table C.6. These data control the management of AFM outputs. CreateTime refers to the simulated time in which the subsequent command is executed. Three actions can be performed. The Write action causes the AFM internal database table specified to be output in total to the given output file. The file name must include a fully qualified path. The Start and Stop actions cause data to be written to the specified table within AFM. Outputs, for example, are included in the EventLog from the simulated time January 1, 2015, to January 1, 2016. The Students, Instructors, and Courses tables are written to the specified flat files on both January 1, 2015, and on January 1, 2016. Additionally, the EventLog is also written to a flat file on January 1, 2016. These flat files are comma-delimited and can easily be read and processed by Excel or other applications.

Table C.6. Output Control Data

CreateTime	Action	Table	Output File
1/1/2015	Write	Students	x:\AETC New\AETC Flow Model\Luke\Cases\MaxStudents\StudentStart
1/1/2015	Write	Instructors	x:\AETC New\AETC Flow Model\Luke\Cases\MaxStudents\InstructorStart
1/1/2015	Write	Courses	x:\AETC New\AETC Flow Model\Luke\Cases\MaxStudents\CoursesStart
1/1/2015	Start	EventLog	
1/1/2016	Stop	EventLog	
1/1/2016	Write	Students	x:\AETC New\AETC Flow Model\Luke\Cases\MaxStudents\StudentEnd
1/1/2016	Write	Instructors	x:\AETC New\AETC Flow Model\Luke\Cases\MaxStudents\InstructorEnd
1/1/2016	Write	EventLog	x:\AETC New\AETC Flow Model\Luke\Cases\MaxStudents\EventLog
1/1/2016	Write	Courses	x:\AETC New\AETC Flow Model\Luke\Cases\MaxStudents\CoursesEnd

Appendix D. Summary of Prior RAND Research

Since 2002 RAND has performed a variety of studies to assist AETC in improving the organization, planning, and management of the training system. The first of these examined the Air Force's training management and decision processes to determine the need for data to support informed decisionmaking (Manacapilli et al., 2004). It reviewed training management systems and associated organizational structures in the other services and the private sector to draw insights for a model management system for the Air Force. The study found that impediments in the Air Force's organizational structure inhibited the flow of cost and capacity data and hindered effective decisionmaking. RAND developed a four-level model of management to evaluate the flow of data in the AETC training pipeline. In the model, a *corporate level* validates and arbitrates training requirements; a *strategic training management level* concentrates on the training system's long-term effectiveness; a *training management level* handles the day-to-day operations of training; and a *direct training level* delivers training in the classrooms. The study also concluded that methodological tools, including simulations to evaluate trade-offs in the training pipeline, should be developed to improve data combination and interpretation, particularly in the area of cost.

As part of the 2002 study, the RAND team created a set of prototype models as a proof of concept. These models ranged from a very detailed schoolhouse model to a high-level, end-to-end model representing the processes from recruiting through unit absorption. At the same time, the AETC Studies and Analysis Squadron built a similar set of planning and execution assessment tools in the context of a larger suite of models to develop Program Objective Memorandum costs. Because of this, the schoolhouse model was selected for further development. The model specifically examined resources used and training limitations encountered during the execution of a training program (Manacapilli and Bennett, 2006). The schoolhouse was intended to investigate policy implications of numerous technical training pipeline issues.

In December 2003, the Air Staff requested that AETC conduct a course review on all of its technical training, flying training, and education courses, with the goal of finding cost efficiencies without reducing course requirements and offerings. In the fall of 2004, RAND initiated a study to examine the costs and productivity trade-off of changing the amount of training done full time in IST at the schoolhouse (centralized) versus part-time, on-the-job training at operational units (decentralized) (Manacapilli et al., 2007a, 2007b).

Although a shift to more decentralized training would cause an immediate drop in the schoolhouse training cost, the bigger question was whether it would reduce costs over the long term when the impact of on-the-job training on the operational unit was included. The study goal was to develop a methodology for optimally balancing the costs of IST to the costs of on-the-job

training by comparing the change in productivity. The study concluded that the technical training for some AFSCs would benefit from a reduction in the total number of full-time schoolhouse days while others would benefit from an increase. The report described specific AFSC examples in detail.

In a continuing effort to reduce training costs while maintaining or improving the training product, AETC's Directorate of Plans, Programs, Requirements, and Assessments asked RAND, beginning in FY 2006, to examine customized or personalized learning. The resulting study assessed educational approaches that would customize training to the individual. The intent was to minimize the trainee's time in training, focusing the training on the trainee's needs, and getting the trainee productive sooner—all leading to reduced costs (Manacapilli, O'Connell, and Benard, 2011). Experts in and out of the military were consulted, and a literature review on personalized learning and some contemporary models was completed.

The authors found that learning-style feedback shows the student how to enhance his or her own learning, and fosters a discourse between student and teacher on how the student can improve in a course. Customized learning increases the probability of creating lifelong learners. As individuals discover their learning styles, they are motivated to use that knowledge. If they have had bad experiences in the past, the new knowledge gives them a fresh point at which to reengage in learning. The authors recommended that the Air Force conduct some experiments with Air Force vocational training before implementation across Air Force training.

Some training courses have a high attrition rate or have a large number of students that are not able to complete certain training blocks (commonly called washbacks). High attrition requires a significantly greater input into the schoolhouses, increasing training and recruiting costs. High washback rates reduce schoolhouse capacity by requiring that seats be set aside for students who need to retake portions of a course, and they incur greater costs by increasing training time. As part of the FY 2009 research into personnel selection and screening, RAND researchers investigated washback rates in nine specific career fields including Air Traffic Control, Combat Control, Pararescue, Aerospace Ground Equipment, Explosive Ordnance Disposal, Operations Intelligence, Network Intelligence Analysis, Far East Linguist, and Middle East Linguist (Manacapilli et al., 2012a). The researchers found that significant savings could be realized through reductions in training attrition and washbacks. Interviews and focus groups provided a wealth of information that was not apparent from an analysis of the personnel and training databases. In addition, although there were common concerns across career fields, every career field studied had unique issues. This underscores the need for caution in applying findings in one career field to the circumstances in other career fields, even if they are ostensibly similar.

In September 2010, the Air Force Language, Region and Culture Program Office, Policy, and the Office of the Under Secretary of Defense for Personnel and Readiness, Defense Language Office, asked PAF to examine the Defense Language Institute English Language Center (DLIELC) to ensure that it is appropriately tasked, organized, operated, resourced, and managed to produce the English-language training capability needed to effectively and efficiently meet DoD mission

requirements. RAND researchers examined DLIELC student data; interviewed DLIELC officials; and reviewed pertinent regulations, directives, instructions, and policy documents (Manacapilli et al., 2012b). They also conducted a comparative analysis of 12 similar organizations that had a security cooperation focus. This study provided recommendations in eight critical management areas: policy, business model/requirements, financial risk, technology, identity, assessment, manpower, and organization and advocacy. In particular, the study suggested five immediate priorities, including clarifying mission priorities in conformance with Air Force, Defense Security Cooperation Agency, and Office of the Secretary of Defense policies and priorities; enhancing policies and procedures to increase managerial effectiveness; improving policies for predicting English-language training demand; overhauling the management of the finance system and key supporting tools; and establishing curriculum development only when reimbursable. The study also included an implementation plan to integrate all the recommendations in a way that informed the leadership of Headquarters AETC and the DLIELC management of the implications of change throughout the organization.

Appendix E. Example Career Fields

AETC asked the study team to examine four career fields that are illustrative of the training pipeline and selected two officer and two enlisted career fields for this purpose. The four career fields are Cyberspace Officer; Intelligence Officer; F-16 Tactical Aircraft Maintenance, Enlisted; and Cyber Systems Operator, Enlisted. This appendix contains an overview of each career field, including the courses required and their locations, cost of producing trained airmen, and particular inefficiencies associated with the pipeline drawn from discussions with training leaders and managers, instructors, and students in the respective pipelines.

Cyberspace Operations Officer, 17DX

Cyberspace operations officers execute cyberspace operations and information operations functions and activities. They plan, organize, and execute cyberspace and information operations, such as defensive cyber operations, offensive cyber operations, DoD Information Network Operations, and mission assurance for Air Force weapons systems and platforms operations (AFPC, 2014). Training for new cyberspace officers is managed and provided by the 333rd Training Squadron at Keesler AFB in Mississippi.

The course pipeline, as depicted in Figure E.1, utilizes one training location and two courses for technical training—Undergraduate Cyberspace Training Phases 1 and 2. The planned length of the pipeline is 115 days (excluding the time the new officer waits to start training after commissioning). A cyberspace officer graduate costs $64,000 to produce.[1] The courses present an introduction to cyberspace domain fundamentals and operations, doctrine and guidance, organizations, roles and responsibilities, network fundamentals and management, and deployed communications systems. Upon completion of Undergraduate Cyberspace Training, officers are awarded AFSC 17D2 or 17S2. Graduation from these Undergraduate Cyber Training phases ensures students meet the career-field initial qualification training standard (Department of the Air Force, 2015a).

During stakeholder meetings we identified several potential areas for improved efficiencies in the 17DX pipeline process. As with several officer pipelines, there is a surge in the summer months after May graduation at USAFA and a significant percentage of ROTC cadets graduate in May and June. Once students arrive at Keesler AFB there is additional nontraining time as

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[1] Cost estimates are based on variable costs only and are made up of the following: cost per graduate for training courses required for specific AFSCs at the basic skill level, acquisition costs (including the cost of initial travel and initial clothing issued), student pay and allowances, and time in transit and waiting for class to begin.

Figure E.1. Technical Training Pipeline for Cyberspace Operations Officers

Total Days in Pipeline (including days between courses): 115

Average cost per graduate: $64K

= USAF School
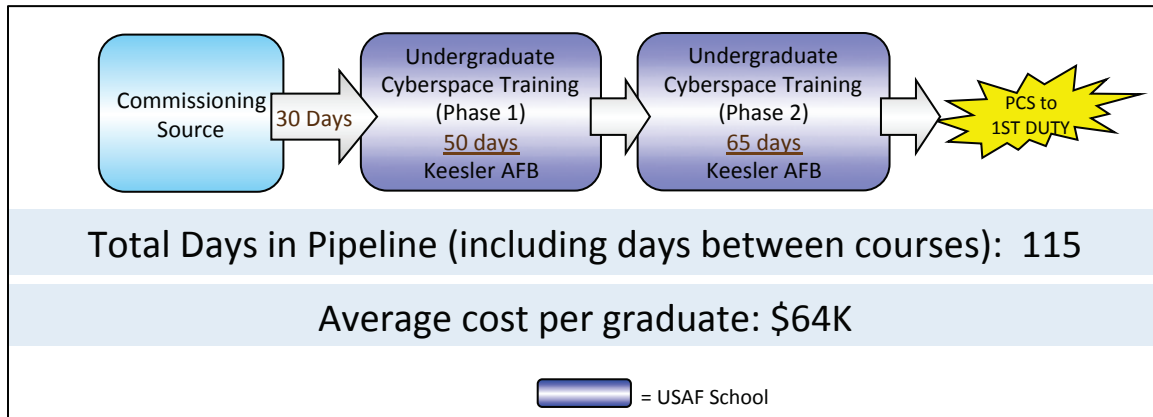
SOURCE: AETC/A2/3/10.

students wait for an open seat to begin class. Training managers reported that there have been as many as 100 SAT at any one time, with waiting times as high as four months. SAT perform other duties around the base and even help with course administration and the development of course materials.

Students reported that there is also waiting time after graduation from the Phase 2 course, especially for students with overseas assignments and those with problems and delays obtaining security clearances. Wait time at the start of the course is exacerbated by a reported policy wherein every effort is being made to graduate 17DX officers. This means that where in the past students would have been washed out, they are now being washed back, increasing the overall number of seats required.

We heard from training leadership that processes to determine the number of instructors they are allocated are not transparent. From their perspective, several factors, such as an increased demand for cyberspace officers, contribute to the need for more instructors—at the same time that AETC is reducing the size of the instructor cadre. The training leadership reports that there is a lack of alignment between the unit-manning documents at the units, MAJCOMs, and headquarters that makes it difficult to know which positions are earned and at what grade. Moreover, it was reported that every pricing drill is handled differently and depends on several factors. For example, the significant increase in the number of required graduates this past FY was not resourced at needed levels, nor at levels in proportion to what it would have been in the past.

AETC does its instructor pricing calculations once per year. Given the time it takes for AFPC to locate and vet additional instructors, new positions are almost always filled late to need. In addition, it can take six months to train an instructor and instructors can now be deployed—both reasons that contribute to significantly fewer qualified and present instructors than unit-manning

documents indicate, which are the numbers that influence Headquarters AETC and Air Staff perspectives.

In addition, Cyber is a particularly challenging pipeline to resource. Course content needs to be continually updated to ensure that it keeps current with rapidly changing technology and equipment, methods used in industry, and capabilities of U.S. adversaries. Cyberspace training stakeholders emphasized the need for adequately resourcing training courses to ensure there are trained and qualified individuals to meet increasing demands expressed by Cyber Command and internally from Air Force commands.

Intelligence Officer, 14NX

Intelligence officers direct, plan, manage, and conduct activities to assess industrial, technological, geographical, and sociological information; use processed intelligence information to support military operations; prepare intelligence assessments; engage in and support air, space, and cyberspace operations; use and manage intelligence data handling systems; and exchange information and intelligence with other services, agencies, and governments (AFPC, 2014).

Intelligence officers lead and perform intelligence activities across the full range of military operations, supporting the Air Force's service core function of global integrated intelligence, surveillance and reconnaissance (ISR). A single ISR mission may cover multiple geographic commands, simultaneously collecting data to meet strategic, operational, and tactical requirements for national, joint, coalition, or interagency partners in any combination. The 14NX career field thus encompasses an incredibly diverse set of missions requiring an equally diverse breadth and depth of experience, training, and education (Department of the Air Force, 2013).

Training for new intelligence officers is managed and provided by the 315th Training Squadron at Goodfellow AFB in Texas. The training pipeline, as depicted in Figure E.2, utilizes one training location and one course. The planned length of the pipeline is 130 days (excluding the time the new officer waits to start training after commissioning). An intelligence officer graduate costs $100,000 to produce.[2] The course presents an introduction to the breadth of Air Force intelligence core expertise and establishes the foundation new officers will need to develop the specific knowledge and skill sets prerequisite for their development throughout their careers (Department of the Air Force, 2013).

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[2] Cost estimates are based on variable costs only and are made up of the following: cost per graduate for training courses required for specific AFSCs at the basic skill level, acquisition costs (including the cost of initial travel and initial clothing issued), student pay and allowances, and time spent in transit and waiting for class to begin.

Figure E.2. Technical Training Pipeline for Intelligence Officers
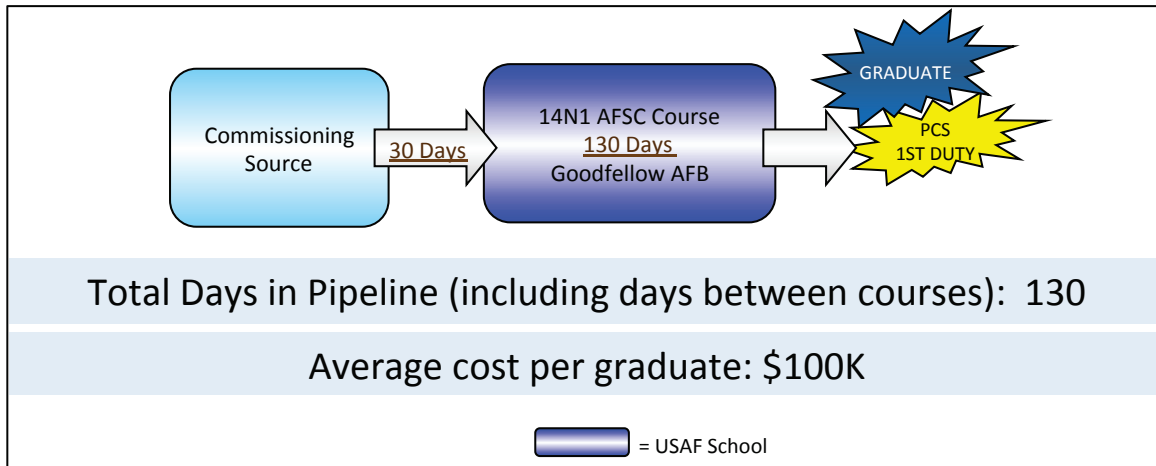
SOURCE: AETC/A2/3/10.

During stakeholder meetings we identified several potential areas for improved efficiencies in the 14NX pipeline process. Training managers and leaders called attention to extended waiting times for students who have arrived at Goodfellow AFB but have not yet started training. Most significantly is the issue of security clearances since trainees are not allowed to start classes until a top secret security clearance is fully adjudicated, which is often more problematic for students coming from OTS or ROTC than from USAFA. Both training managers and students complained about the seemingly uncoordinated timing of students being sent for training. Some students arrived with only one or two days to find housing and settle before classes begin; others arrive and wait months before a class seat is available. Some students mentioned that their reporting dates changed several times, which was very disruptive when they had obtained employment in the interim or planned to travel, for example. From the schoolhouse perspective, there seemed to be little coordination, with students often not showing up when they were expected.

Due to the length of the pipeline, assignment to Goodfellow AFB is a permanent change of station move rather than a temporary duty assignment. That provides particular challenges for guard and reserve students. Their housing allowance is based on living in the Goodfellow AFB area despite the fact that it is unlikely that they will move their family for the several months of class. Reserve-component students went to great lengths to schedule their training around their civilian employment. In some cases, however, students arrived only to find that their training had been delayed and they would be away from their civilian jobs longer than required.

Stakeholders emphasized the various reasons why current instructor manning is not adequate: instructors are deployed; instructors are not available due to medical issues, leave, and individual

officer development requirements; and the time required for instructors to be qualified to teach courses. They also stressed the implications of these manning issues:

- Instructors must teach multiple sections over and above a normal course load.
- Instructors find it hard to find the time to assess students and provide student feedback.
- Instructors have limited time for updating course curriculum.
- Individuals in training leadership roles must serve as instructors in the classroom.
- Heavy instructor demands result in reduced supervision and mentoring of students outside of the classroom.

Tactical Aircraft Maintenance, F-16, Enlisted, 2A3X3M

Tactical aircraft maintenance enlisted members maintain tactical aircraft, support equipment, and forms and records. They perform and supervise flight chief, expediter, crew chief, repair, quality assurance, and maintenance support functions (AFPC, 2013).

Upon graduation from BMT, airmen are assigned to the 82nd Training Wing, 362nd Training Squadron at Sheppard AFB, Texas, to attend formal technical training. This training begins with fundamental maintenance training common to all aircraft maintenance apprentices within the specialty. This generic training phase is followed by aircraft-specific maintenance training. For the F-16, these task-oriented follow-on courses are conducted first at Sheppard AFB and then at Luke AFB in Nevada (Figure E.3). Successful completion of formal technical training results in the award of the 3-skill level (Department of the Air Force, 2016).

Figure E.3. Technical Training Pipeline for Tactical Aircraft Maintenance, F-16, Enlisted
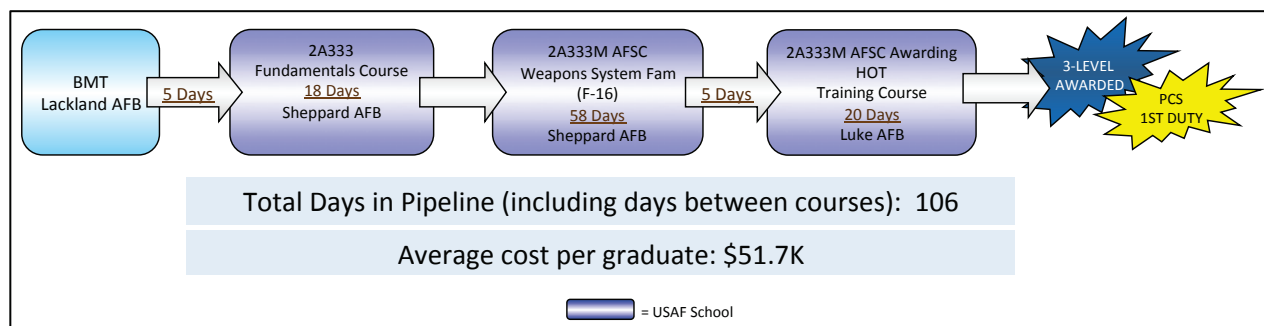
SOURCE: AETC/A2/3/10.

NOTE: Although AETC manages this pipeline as three courses, in practice, For F-16 tactical maintenance, we discovered that the fundamentals course is combined with the weapon-system-specific course and tracked as a single course.

The planned length of this pipeline is 106 days (including travel time and time between courses). An F-16 crew chief graduate costs $51,700 to produce.[3] Training includes fundamental maintenance requirements, system theory and operation, system components, component removal and installation, introduction to maintenance concepts, general flight line maintenance practices, and use of technical publications, maintenance documentation, and equipment familiarization.

During stakeholder meetings we identified several potential areas for improved efficiencies in the 2A3X3 pipeline process. Training managers and instructors reported that the primary cause of student wait times is related to delays in receipt of follow-on orders from AFPC and security and Personnel Reliability Program clearances for nuclear follow-on assignments. Instructors said that out-processing does not drive extended wait times for students because trainees take time from what would otherwise be training to accomplish out-processing tasks. While this practice keeps students from being delayed following training, it is not optimal since instructors are forced to make up for the lost training time. Instructors also pointed to mandatory wing events that cut into training time. One example is military training activities that students participate in every Tuesday for the first seven weeks of their time assigned to Sheppard AFB. This military training takes precedence over their skills training and is duplicative of the training they will receive during first-term airmen training at their first duty station.

Training leadership and managers highlighted multiple issues with changes to the required number of trainees in the year of execution. Training managers receive multiple revisions of the PGL, sometimes with conflicting changes—such as increases in one version with subsequent decreases in the next. They cite communicating these changes as the key problem. For example, 2nd Air Force started using unfilled guard and reserve training seats for active-component trainees without letting the training wing know that these seats, previously projected to be empty, would now be filled. Anecdotally, we were told that the wing tried very hard to find a trainee to fill a training seat that was scheduled to go empty for a highly prized F-35 course. After contacting 2nd Air Force and AETC, they received no response and the seat went empty.

Training leadership and managers also highlighted a fundamental issue with the instructor pricing scheme. If training managers plan for washbacks to take some of the available training seats, and therefore estimate fewer overall graduates, they will be assigned fewer instructors. To earn as many instructors as possible, it is best to plan for few washbacks and then use perennially unfilled reserve-component seats for washbacks.[4]

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[3] Cost estimates are based on variable costs only and are made up of the following: cost per graduate for training courses required for specific AFSCs at the basic skill level, acquisition costs (including the cost of initial travel and initial clothing issued), student pay and allowances, and time in transit and waiting for class to begin.

[4] AETC leaders, however, noted that this understanding of the instructor pricing formula is incorrect. This discrepancy points back to the broader problems of communication and transparency about instructor pricing.

As highlighted in other pipelines, sometimes instructor manning is a positive story on paper where a schoolhouse is fully staffed for their needs. In the classroom, however, with the changes in instructor pricing, the increased length of the formal class day, and the loss of administrative positions, instructors are stretched to the limit. Instructors do not always get the time for leave or upgrade training that is required. Course development and updating is also negatively impacted. Instructors pointed to the DSD process as a contributor to the time it takes to get instructors assigned in a timely manner.

Cyber Systems Operator, Enlisted, 3D0X2

Cyber systems operators install, support, and maintain servers or other computer systems and develop plans for responding to service outages and interruptions to network operations. They administer server-based networked systems, distributed applications, network storage, messaging, and application monitoring required to provision, sustain, operate, and integrate cyber-networked systems and applications in garrison and at deployed locations (AFPC, 2013).

Training for new enlisted cyber systems operators is managed and provided by the 81st Training Wing, 336th Training Squadron at Keesler AFB in Mississippi. The course pipeline, as depicted in Figure E.4, utilizes one training location and three courses for technical training: IT Fundamentals, 3D032 AFSC course, and Security+ (Department of the Air Force, 2015b). The planned length of the pipeline is 71 days (including travel time and time between courses)—the first and last courses take ten days each, the second course takes 46 days, and the time planned for students to transition from BMT, which is conducted at Lackland AFB, to Kessler AFB is five days. Training costs for a cyber systems operator graduate are $42,000.[5]

A significant issue with this pipeline is the bottleneck created by the third course in the sequence, Security+, which presents similar problems for enlisted personnel as it does the 17DX officers. This certification test is provided by a commercial firm, is designed to have a 60 percent failure rate, and is generally given to civilian professionals with several years of experience. Consequently, there is a significant backlog of students waiting to retake the course and attempt to pass the exam. We were told that there is currently a two-month waiting period before trainees can take the course again—several will take the course two or three times before they pass. It is unclear whether the career-field manager is aware of the impact of levying this requirement on the schoolhouse and the trainees.

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[5] Cost estimates are based on variable costs only and are made up of the following: cost per graduate for training courses required for specific AFSCs at the basic skill level, acquisition costs (including the cost of initial travel and initial clothing issued), student pay and allowances, and time in transit and waiting for class to begin.

Figure E.4. Technical Training Pipeline for Cyber Systems Operator, Enlisted

Total Days in Pipeline (including days between courses): 71

Average cost per graduate: $42K

= USAF School
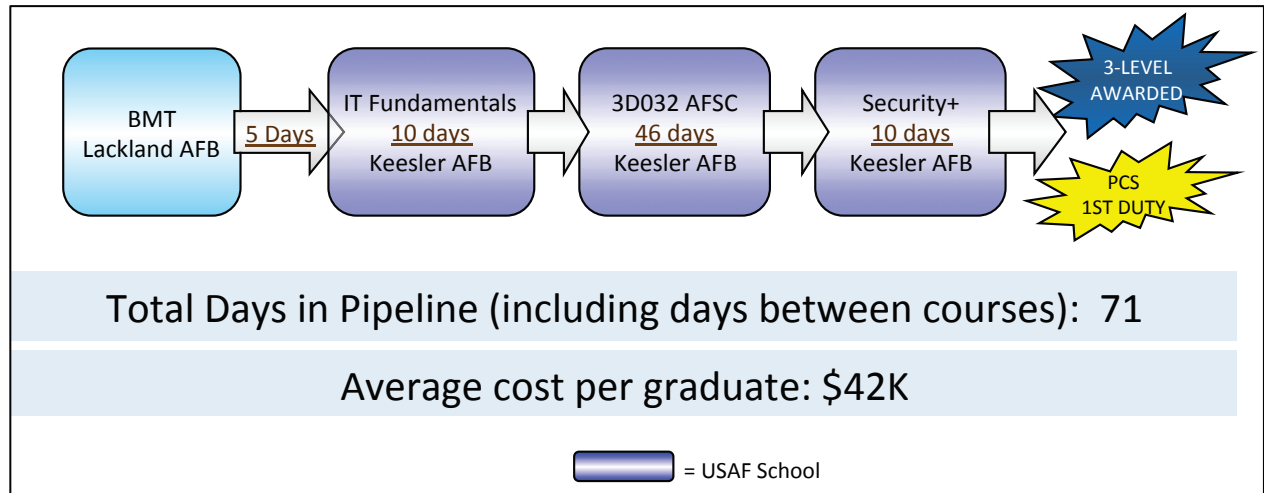
SOURCE: AETC/A2/3/10.

Training leaders expressed some frustration with instructor manning. They argue that instructor pricing is based on *perfect* circumstances. It does not include time for sickness, deployments, development, military events, curriculum upgrades, or similar factors. There are also difficulties in hiring civilian instructors with relevant current experience, particularly qualified individuals in Mississippi. In addition, retention of civilian instructors is also a problem as they are often recruited by civilian firms.

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This report presents RAND Project AIR FORCE (PAF)'s assessment of the processes and policies in the U.S. Air Force nonrated technical training pipeline. In recent years the Air Force has faced persistent resource constraints while trying to deliver necessary training to its officer and enlisted forces. The Air Force asked PAF to identify opportunities for optimizing processes at all levels of the nonrated technical training pipeline and to recommend policy and process changes that could improve efficiency. PAF used a mixed-methods approach to address the research objective, combining the results of three primary research streams—stakeholder discussions and process observations; analysis of training data and metrics; and development of a technical training pipeline model—to identify inefficiencies in the technical training system. PAF identified numerous inefficiencies that fall into three broad areas: planning, flow of students, and resources. The report concludes with recommendations for improvements to training processes and outlines the benefits that can be obtained from proactive modeling and the development and tracking of effective metrics. This report will be of interest to those involved in technical training for military personnel.

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