The fundamental objective of aircrew management is to ensure that inventories match up with requirements.\(^1\) Because this process is considerably more complex than simply matching up the total numbers, however, it will be useful to discuss the process at some length. We first discuss the factors involved in determining requirements. Our findings indicate that not every fighter pilot is qualified to fill every requirement; in particular, the only assignments inexperienced pilots can fill are API-1 billets in operational units. Next, we explain that there are only two parameters that affect total inventory size: the production of new fighter pilots and the retention of pilots who might otherwise separate from the service. We conclude that current fighter pilot production and retention rates are too low to support an inventory that meets requirements.

Our discussion of inventory size will be limited to a steady-state condition, as might be achieved after many years of holding both production and retention at constant levels. During those many years the inventory will, of course, vary, but we have left an examination of this dynamic behavior to future research.

\(^1\)Aircrew management addresses total force aircrew supply and demand in the grades of O-5 and below. O-6s and above are managed separately. Our discussion deals primarily with active-duty pilots, and we will attempt to ensure that this distinction is clear whenever the discussion is expanded.
REQUIREMENT CATEGORIES

The Air Force divides pilot requirements into four basic categories: force, training, staff, and other (man-year) requirements. All of the requirements for pilots to serve in primary cockpit billets at the squadron level (i.e., all API-1 billets) are accounted for in the force and training categories. This observation will take on additional significance as we develop some of the problems associated with matching inventory to requirements.

Force Requirements

Force requirements include all of the API-1 pilots assigned to operational squadrons. Most of these requirements are determined by simple crew ratio (CR) calculations, where one simply multiplies the unit’s PAA by its specified CR to determine its requirement. This requirement, in turn, is set as the unit’s API-1 pilot authorization. Squadron supervisors (commanders and operations officers) constitute the bulk of the non-CR force requirement. There are also a few flying squadrons that are neither operational units nor training units (these units are typically assigned flight test missions) but are included in the Air Force’s non-CR force requirement numbers.²

The non-CR portion of the force category is determined by the total manning requirement for the test units and by organizational parameters such as the number of operational squadrons, the PAA per squadron, and the number of squadrons per wing (for the various aircraft types).

²A more extensive discussion of requirements can be found in Claire Mitchell Levy et al., “Determinants of Pilot Requirements,” internal document, Santa Monica: RAND, 1993, and in Harry J. Thie et al., Total Force Pilot Requirements and Management: An Executive Summary, MR-646-OSD, Santa Monica: RAND, 1995. A useful treatment, including specific numbers (current as of FY 2000), is also included in Department of the Air Force, Rated Management Task Force, Rated Management Primer, January 1999. Requirement categories are further discussed in Department of the Air Force, AFI 11-412, August 1, 1997. Much of the material in this section is adapted from these documents.
Training Requirements

Training requirements establish IP requirements for squadrons that are tasked to provide formal training to Air Force pilots (or student pilots in training to become pilots). These squadrons further separate into two basic types: formal training units (FTUs) that conduct formal training for rated pilots, and units that provide undergraduate flying training (UFT) for student pilots who have not yet received their wings.3 Requirements for training units are determined primarily by annual student throughput rather than through CR calculations. The student throughput numbers are calculated from programmed flying training (PFT) documents. Squadron commanders and operations officers are added to the training requirements separately, as they are in the force requirement calculations. There are also certain training units that provide additional continuation training to operational pilots whose mission limits normal training opportunities. The instructors required by these units are also accounted for separately.

The training requirements discussed in the preceding paragraph address only the IPs who are required to man the training units; the students trained in these units must be accounted for separately. The rated pilots who are enrolled in a formal flying training program are accounted for using man-year calculations similar to the “other” category that will be discussed later. This separate accounting is required by the fact that these pilots are part of the pilot inventory even though they are not available to fill specific pilot billets while they are undergoing training. Undergraduate student pilots need not be counted in this manner because their rated service has not yet started.

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3Air Force pilots undergo undergraduate training in several UFT options. The most common is the Specialized Undergraduate Pilot Training (SUPT) program, where students select specialized basic tracks in the T-38 (fighter/bomber), T-1 (jet tanker/transport), T-44 (turboprop), or UH-1 (helicopter) following a generic primary phase in the T-37 or T-34. The Navy runs the joint T-34 primary option, and the Navy and Army conduct the turboprop and helicopter programs, respectively. An alternative is the Euro-NATO Joint Jet Pilot Training (ENJJPT) program, which includes a limited number of U.S. Air Force students who go on to fighter or bomber FTU programs. Air Force pilots receive their wings and begin their rated service upon graduating from any of these UFT programs.
Staff Requirements

All remaining requirements for pilots in specific billet authorizations are included in the staff category. Many of these are flying billets (above the squadron level), but the category also includes all nonflying billets. Examples of flying billets include the API-6 positions required for an operational wing to accomplish its mission. Nonflying staff requirements include such positions as air liaison officers who provide tactical air control to Army units, direct staff support for warfighting commanders in chief (CINCs), or essential command-and-control functions. These requirements can be as essential to successful mission accomplishment as the primary cockpit billets.4

Many staff requirements are determined from organizational parameters (e.g., numbers of squadrons, PAA per squadron, and squadrons per wing). The number of staff billets required to support three F-16 squadrons at the wing level and below, for example, is essentially determined by the number of wings. This number is independent of whether the squadron authorizations are 18 PAA or 24 PAA (or a mix thereof). Staff positions above the wing level are even more dependent on organizational structure. The numbers of major air commands and numbered air forces are primary factors in establishing these requirements, as are billets that directly support joint staff requirements and warfighting CINCs.

Other (Man-Year) Requirements

The final, or “other,” category does not establish specific pilot authorizations. Instead, it is based on man-year allowances and enables the assignment process to account for inherent features of the inventory that make pilots unavailable to fill specific billets. Many of these pilots are taken out of the assignment cycle to participate in career development or professional military education programs. Others are in transit between assignments or waiting out pipeline delays between courses and/or formal training programs. As mentioned earlier, rated pilots who are students in formal training units

4There may be legitimate concerns regarding the relative numbers of these requirements, and they undergo frequent review by the Air Force. In recent years, pilot requirements have been reduced significantly in all areas; we will return to this later.
are also included in man-year allowances. These requirements are an essential component if inventories are to be matched with requirements.

**FILLING REQUIREMENTS**

Each billet must be filled by a pilot with the proper qualifications. Every squadron- or wing-level flying billet, for example, must be filled by a pilot qualified in the specific aircraft mission design series (MDS) assigned to the unit. This need will often generate a formal training burden to qualify pilots for the assignment. Formal training needs include initial basic course (B-Course) training for new pilots in a weapon system; recurrency or transition (TX-Course) training for pilots returning from nonflying positions or assignments in another aircraft; and formal instructor (I-Course) training to prepare pilots to become FTU instructor pilots. Weapon systems with multiple-pilot crews often require formal aircraft commander upgrade training programs. All of these requirements generate formal FTU course obligations that add to student throughput needs and must be accounted for in the appropriate PFT documents. Many also contribute to the training pipeline delays that complicate inventory management.

Requirements are generated and tabulated by major weapon system (MWS) categories. These categories include fighters, bombers, tankers, strategic airlift, theater airlift, and helicopters. Requirements that are MDS-specific are tallied by MWS. The aircraft types (MDSs) included in each of the MWS categories are outlined in Table 3.1.

Some nonflying billets can be filled by pilots of several different aircraft. A staff billet that oversees tanker availability, for example, may not need to distinguish between a KC-135 pilot and a KC-10 pilot. Similarly, certain fighter training staff positions might be filled by either an F-16 pilot or an F-15 pilot. There are also requirements for

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5These are also referred to within the Air Force as rated distribution and training management (RDTM) categories. This is the aircrew management system that the Air Force implemented in the 1970s specifically to help future aircrew inventories meet well-defined requirements. Much of the information in Table 3.1 is adapted from Department of the Air Force, AFI 11-412, Table A.2.1, Attachment 2, August 1, 1997.
Table 3.1
Aircraft Types Included in Each MWS Category

<table>
<thead>
<tr>
<th>MWS Category</th>
<th>MDSs Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bombers</td>
<td>B-1B, B-52, B-2, U-2</td>
</tr>
<tr>
<td>Tankers</td>
<td>KC-135, E-8, RC-135, KC-10, E-3, E-4</td>
</tr>
<tr>
<td>Strategic airlift</td>
<td>C-5, C-17</td>
</tr>
<tr>
<td>Theater airlift</td>
<td>C-130, HC-130, MC-130, C-141, EC-130</td>
</tr>
<tr>
<td>Helicopters</td>
<td>H-1, MH-53, HH-60, CV-22 (after FY 2005)</td>
</tr>
</tbody>
</table>

strategic airlift expertise that need not distinguish between C-5 experience and C-141 experience; such billets need only be MWS-specific. Others may be MDS-specific but not pilot-specific, accepting any aircrew officer (pilot or navigator) from the required MDS. B-52 and B-1 crewmembers provide examples of rated officers who might deal with global attack issues from a bomber perspective. These billets provide added flexibility that greatly facilitates the matching of inventory to requirements.

The most flexible of all requirements are those that specify a pilot (or aircrew member) from any MDS. Such requirements, which are called unspecified, are reserved for staff functions that necessitate operational knowledge in some mission but do not require that the nature of the mission be specified. An example could be the oversight of aircrew assignment policies and issues for the Air Staff. Finally, there are billets that have been converted to specify a general operational knowledge that could result from experience in air battle management or space operations rather than rated aircrew expertise.

Requirements in all categories have certain grade constraints that typically imply constraints on the years of service, professional development, and profiles of prior assignments of the pilots that fill them. These constraints often require that pilots shuttle between flying and nonflying (e.g., staff, professional military education) assignments, thereby increasing the formal training burden. This burden complicates the assignment process and makes it more difficult to match inventories to requirements. Yet such constraints cannot be relaxed without fundamental changes in the mission needs and required combat capabilities of the Air Force.
As we will show, the most telling constraint is that almost all categories of requirements can be filled only by experienced pilots. We will deal later with specific experience definitions, but the essence of any definition of the term *experienced pilot* is that such pilots have a thorough knowledge and understanding of the specific operational mission for which they are tasked. Staff billets, whether flying or nonflying, must be filled by officers with a fundamental understanding of the specific operational mission.

Similarly, the entire training category (which includes instructors but not students) must be filled with experienced pilots. The same holds true for the entire non-CR force category as well because these are requirements for commanders, supervisors, or other pilots with special qualifications.

It is therefore clear that all newly trained pilots who complete B-Course training in an operational aircraft must initially go to a billet in an operational unit established by the CR force category. These, of course, are inexperienced pilots by any definition. Depending on the nature of the unit, such pilots will start flying either as copilots or as wingmen in the process of gaining essential experience and operational knowledge. This constraint is inherent in the nature of the requirements, and the number of such billets is rigidly set by force structure and CR policy decisions. It has not been set as a whim of inventory managers.

**INVENTORY MANAGEMENT**

The key feature driving inventory management is the closed and vertical structure of the Air Force pilot inventory. The only entry point into the inventory is at the bottom. This characteristic establishes several constraints.

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A single exception in the training category enables a few pilots to remain for instructor assignments in primary or basic trainer aircraft immediately following UFT completion, thereby delaying their assignment to an operational aircraft. Such pilots are called *first assignment instructor pilots* (FAIPs). We will see in the next chapter that the policy decision fixing the annual number of FAIPs is one of the parameters that influence absorption capacity.
Key Constraints

Two primary parameters control the size of the inventory: production and retention. Production accounts for the number of new pilots who are trained each year; retention establishes how many members of an annual production cohort remain on active duty each year. As previously discussed, new and inexperienced pilots must receive assignments to operational units as they exit their B-Course FTU programs at the end of their initial training pipeline. The requirement to absorb these new pilots into operational units imposes a major constraint on production numbers (and thus on the size of the inventory itself). The next chapter will address the issues associated with this absorption constraint. Production is also inhibited by the capacity of the initial training pipeline, and retention is influenced by assignment sequencing and career development opportunities. Thus, another important aspect of inventory management is the preparation needed for future jobs that sequentially follow an initial operational assignment.

To qualify for assignment to a particular billet, a pilot must previously have worked in appropriate jobs and received the training and education that is crucial to filling that billet. Pilots who now compete for an operational squadron command billet, for example, must have a career history that includes formal military educational programs, career-broadening opportunities, and appropriate staff experience as well as a fundamental understanding of the operational mission. The career sequences that meet these criteria must have been initiated a number of years in the past.

Air Force aircrew managers therefore recognize that they cannot be content merely with filling today’s needs. Rather, they must simultaneously ensure that enough pilots are able to gain the qualifications that are essential to meeting future needs.

The assignment process and its difficulties, however, are not our concern here. Rather, we are interested in the problems that occur at the very start of a fighter pilot’s career and the implications these problems have for supporting an inventory large enough to fill all fighter pilot requirements. The time required to prepare pilots for future job experiences depends in an essential way on the initial training pipeline.
The Initial Training Pipeline

The length of the initial training pipeline is important for inventory management because the longer the pipeline, the longer it will take an officer to become a qualified pilot, providing fewer years available to fill required billets during a typical career.

The pipeline begins when a prospective pilot receives an active-duty commission. After some delay, pilot candidates enter UFT. At the completion of UFT, they receive their pilot wings and begin active rated service. They also incur an active-duty service commitment (ADSC) that is currently set at ten years of active rated service beginning with UFT graduation. New pilots then receive (in some order) at least one survival training course; the Aerospace Basic Course (ABC), which stresses professional development for newly commissioned officers; the FTU B-Course for their specific MDS; and any additional training that is required to prepare them for FTU or for their initial assignment. New pilots in fighters, for example, must attend a formal flying course called Introduction to Fighter Fundamentals (IFF) before they begin their FTU programs. These pilots will not fill actual inventory billets until they arrive at their initial operational assignment. Man-year calculations should account for their status for the entire period between UFT graduation and arrival at their initial operational assignment. Figure 3.1 depicts this sequence of events along with typical times for each step in the process. These times and the reasons for them will be discussed in the paragraphs that follow.

The delay from commissioning to UFT entry can be a year or more. Although this delay has been a problem for years, it has become more crucial following some recent policy changes. Previously, pilot training candidates receiving reserve commissions from the Reserve

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7This is the most common sequence of events, but there are exceptions that we will address later. The initial formal training for some MWS categories is called initial qualification training (IQT) instead of the B-Course terminology used in fighters, and the length of these programs varies among weapon systems.

8These officers are often in “casual” status with very few responsibilities. Sometimes they are assigned as overages to operational units to serve as apprentice intelligence or targeting officers. In any case, they receive no formal training until UFT entry.
Officer Training Corps (ROTC) or the Officer Training School (OTS) were not brought onto active duty until they had received a class assignment and a reporting date so that they were ready to start pilot training. The delay between candidates’ receipt of their reserve commissions and their opportunity to enter active service often exceeded a year, during which time they received very little credit toward pay, promotion, or retirement considerations. For several decades, Air Force Academy graduates received regular, rather than reserve, commissions at graduation, and their commissioning dates also established their active service date. Those who opted for pilot training were given priority to begin their UFT program within three months of graduation. This meant that the historical delay between the active commissioned service date and the date when the 12- or 13-month UFT training program was completed was, for accounting purposes, consistent for everyone at between 13 and 15 months.

An earlier decision to eliminate any distinction in the types of commissions granted by the three commissioning sources led to a subsequent decision in the late 1990s to eliminate the preferential treatment in active-duty service dates and UFT training selection that academy graduates had previously enjoyed. The primary outcome of this decision for our purposes is that everyone’s active commissioned service date is now established when they receive their commissions. Thus, the delay between commissioning and the
The completion of UFT has increased from between 13 and 15 months under the previous policies to more than two years for most officers.9 During the military drawdown following the end of the Cold War, decisions were made that significantly reduced student throughput capacity in both the undergraduate and FTU programs. This reduction required that such schoolhouses operate at essentially 100 percent of capacity simply to maintain steady-state pilot production quotas. This was a sizable increase from the historical average of roughly 80 percent of capacity.10 Because fewer classes were conducted per year in each of these programs, it became harder to match the completion date from one required training program with the start date of a subsequent one, and the waiting period for officers between linked programs thus increased. Adding the ABC requirement and splitting the SUPT into separate basic tracks also reduced flexibility, further increasing pipeline delays. As a result, pilots are now taking up to 24 months of calendar time to complete the 19 months of required flying training. If we add in a one-year delay to start UFT initially, we find that some new pilots may have reached their fourth year of active commissioned service before they arrive at their initial operational flying assignments, where they can finally be counted as filling a required pilot billet. Yet the man-year allowances that should account for pilots between UFT graduation and their arrival in their initial operational billet have not been revised to capture the reductions in active rated service caused by the new pipeline delay problems discussed here. The added delay prior to UFT entry also adversely affects rated service time because the exit point for career pilots, who remain on active duty until retirement or

9The two years include at least a one-year pipeline delay plus another year for UFT. The official delay is even greater for a limited number of officers who are late-rated in the sense that they serve for three or four years on active duty in a nonpilot capacity before they begin their pilot training program. Many of these were navigators initially, so they actually complete two one-year UFT programs in addition to a notional three-year tour. Late-rated officers have a delay of at least four or five years between their active commissioned service dates and their active rated service dates. The background information on these policy changes was provided by the Air Staff.

10It is extremely difficult to operate these schoolhouses near 100 percent capacity because doing so severely restricts their ability to deal with unforeseen circumstances and dynamic factors. The capacity increase can thus be expected to cause queues and generate excessive delays. This is a well-known consequence in these circumstances. See Leonard Kleinrock, *Queuing Systems*, Vol. 1, New York: John Wiley & Sons, 1975.
promotion to O-6, is based on commissioned rather than rated service. Thus, pre-UFT delays shorten the time available to serve as a rated pilot on active duty.\footnote{The AFPC assignment staff is working with the major air commands that both train and gain these new pilots in an attempt to shorten the training pipeline. Unless they can significantly compress the initial delay of at least one year, however, these efforts will have little effect on the quoted numbers. To the best of our knowledge, the potential effect of these pipeline delays on pilot recruitment has not been investigated.}

**Managing Inventory Size**

As we pointed out earlier, production and retention are the only parameters that affect inventory size in a closed and vertical system, and aircrew management policies affect both. We next discuss how these parameters interact to determine the steady-state size of the fighter pilot inventory.

The *steady-state production quota* is the production rate that is needed to ensure that the inventory will meet requirements once it has achieved steady state. This production rate can be estimated by using year-over-year historical retention data to calculate the expected number of years pilots will serve on active duty as rated officers after they receive their pilot wings. Air Force managers call this expected value the *total active rated service*, or TARS, value. If the TARS value is representative of the average behavior of new pilots currently being produced, then the corresponding steady-state inventory relationship is given by\footnote{See Department of the Air Force, *Rated Management Primer*, January 1999, for an alternative discussion of this formula.}

\[
\text{Inventory} = \text{TARS} \times \text{ProdRate} \quad (3.1)
\]

We calculate the steady-state production quota (ProdRate) by setting the inventory equal to the requirement and solving Eq. (3.1).

Although this calculation gives a rough idea of the annual requirement for new pilots, several problems are associated with it. One problem is that actual inventories rarely achieve steady-state behavior. A second problem is that existing year-over-year retention
data reflect policies in effect during the drawdown period,\textsuperscript{13} thus, a TARS value that is based on these data may not be representative of current or future behavior.

Equation (3.1) remains true, of course, if the inventory is not set at a level equal to the requirement. As will be discussed later, the current pilot production rate is too low to support a steady-state inventory as large as the requirement. In this case, Eq. (3.1) allows us to estimate the eventual steady-state inventory from the production rate and TARS. By comparing that inventory to the requirement, we can estimate the pilot shortfall.

Equation (3.1) must be modified, however, in order to estimate the steady-state inventory of pilots available to fill requirements for a specific MWS. A limited number of pilots graduating from each UFT class are assigned to aircraft that do not meet the AFI 11-412 definition of an MWS. Many of these pilots, who do not follow the “standard” career path shown in Figure 3.1, are FAIPs who fly undergraduate trainer aircraft (T-1s, T-37s, or T-38s) in an initial assignment as UFT instructors after receiving their pilot ratings. These pilots cannot fill actual MWS billet requirements until they have completed the initial FTU B-Course associated with an MWS-identified aircraft type. For FAIPs, the TARS value will therefore fail to correspond to the expected number of years pilots serve as members of the MWS inventory.\textsuperscript{14}

\textsuperscript{13}Several pilot cohorts were offered monetary incentives to separate and bonus payments to stay in alternate years during the drawdown period. Also, the Air Force’s feet-on-the-ramp policy, which immediately grounded pilots who turned down the full pilot bonus (which required that they agree to remain on active duty through their 14th year of active commissioned service), meant that an inordinate number of them took the bonus (in 1994, say) and then separated as soon as the bonus payback criterion was met (about 1998). Moreover, the officer voluntary assignment system (OVAS), which was in effect at the time, caused many pilots who were at bases that were closing (or flying aircraft identified to leave the active inventory) to separate voluntarily because there were no openings for them in the operational units that remained in the active force.

\textsuperscript{14}The same discussion applies to other pilots who have an initial non-MWS flying assignment. AFI 11-412 indicates that other non-MWS assignments include mission support aircraft such as the C-9, C-12, and C-21 plus some highly specific variants with which we will not be concerned here. These alternative flying tours are normally about three years. When pilots’ formal training needs and transit times are added in, this generates an additional 3.5 years before pilots actually enter their MWS-associated FTU B-Course. Although these pilots are clearly filling billets generated by
Retention and the Bonus Take Rate

The pilot bonus program that the Air Force implemented in FY 1989 provides an alternative means of estimating retention and therefore TARS. The bonus take rate (BTR) is defined as the proportion of eligible pilots who accept the bonus at the end of the initial ADSC that they incurred as they received their pilot’s rating. The original pilot bonus required that bonus takers commit to remaining on active duty until they reached their 15th year of active commissioned service. The Air Force modified this policy in FY 1999 to provide pilots with additional options for accepting smaller bonus payments to stay in for shorter periods of time. Then, in FY 2000, the Air Force implemented a new bonus program that gives pilots reaching their end-ADSC point several bonus options, including acceptance of the full bonus either for five years or until they reach retirement eligibility at 20 years of active commissioned service. This program retained the smaller-payments-for-shorter-periods options while also providing new bonus options at later career points for pilots whose earlier bonus agreements had ended. The most useful bonus program for estimating TARS values turns out to be the long-term commitment options that ensure maximum payments will start at the end of the initial ADSC.\(^{15}\)

It is also worth identifying the timing differences that exist between pilots who have recently completed their bonus commitments (i.e., pilots who have reached the end of their bonus payback period) and those who have recently entered the pilot inventory. All pilots who have already completed their bonus payback have done so after an eight-year ADSC and thus started their rated service before the drawdown policy and training capacity changes occurred. This means that such pilots’ modal end-ADSC point occurred early in

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\(^{15}\)The Air Force estimates that 80 percent of the officers who elected the shorter period options in FY 2000 were not actually eligible to separate because another service commitment (generated by formal schooling or other criteria independent of their original commitment) applied. The long-term bonus take rate is the only one that we will use in our remaining discussion.
their 10th (or possibly 9th) year of active commissioned service.\textsuperscript{16} Pilots governed by the ten-year ADSC (which will begin influencing end-ADSC points in FY 2008) will have incurred at least some of the additional pipeline delays described previously. This will extend the modal end-ADSC point to late in the 12th (or possibly even the 13th) year of service for these officers. Although pilots who separate from active duty at the end of a ten-year ADSC will have a TARS value two years greater than that of pilots separating at the end of an eight-year commitment, those who remain on active duty until they retire (or reach the grade of O-6) can easily have a TARS value less than that of their career eight-year counterparts. This is because the exit point for career pilots is determined by years of \textit{commissioned} service, so that the extended training pipeline for the ten-year group reduces the number of years of rated service they will serve before becoming eligible for retirement or promotion. This means that the two-year ADSC increase will not generate an overall TARS increase of two full years. We will quantify this observation later.

The Air Force has recently experienced unprecedented losses of pilots from active duty. The BTR decreased from roughly 70 percent in FY 1994 to below 30 percent by FY 1997 and has remained near 30 percent in subsequent years. Unprecedented losses have also occurred after the 15th year of service following the bonus payback period.\textsuperscript{17} The Air Force reported at the June 2001 Four-Star Rated Summit that its inventory was approximately 1200 pilots short of its requirements. The gross shortfall may, however, reveal only a portion of the problem; if the billets identified with certain requirements or MWS categories are overmanned, for example, the problem areas will have greater shortages. This leads us to examine the propensity for certain kinds of billets to be overmanned even when an overall pilot shortage exists.

\textsuperscript{16}This is the year of active commissioned service in which \textit{most} of the members of a pilot cohort reach their end-ADSC point in a given year. It is a more reliable forecasting tool than the mean or median year because of the skewed distribution caused by late-rated pilots and inadvertent pipeline delays prior to UFT completion.

\textsuperscript{17}In early FY 2002, the Air Force implemented a stop-loss policy for pilots curtailing voluntary separations. This policy will definitely have a short-term effect on retention behavior, although its permanent effect is less clear.
Using the modified version of Eq. (3.1) to calculate production rates for an MWS category requires that the man-year-determined requirements be distributed by MWS. This is fairly straightforward because those that are not clearly part of one of the communities can be prorated according to the distribution of the requirements that clearly belong to a specific weapon system category. The nonflying staff requirements that generate unspecified billets can be distributed in a similar manner. The only concern here arises when specific policy decisions prevent certain types of pilots from filling some of these billets. Also, FAIPs and other pilots who do not establish their MWS category before they are assigned to valid flying billets must be accounted for. We will use BTR estimates to determine both the TARS values and the expected number of years pilots will spend in their MWS inventory. We will illustrate these issues as appropriate.

RETENTION AND PRODUCTION TRADE-OFFS TO MEET REQUIREMENTS

The data scrub conducted to support the June 2001 Four-Star Rated Summit estimated that the current 1200-pilot shortfall will gradually grow to about 1300 by FY 2008. The same data indicate that the largest MWS deficit occurs in fighters, with a shortfall that currently exceeds 500 pilots and is predicted to grow to over 800 pilots (almost 20 percent of the requirement) by FY 2008. Indeed, the fighter category accounts for more than half of the total pilot shortfall by FY 2003 and continues to worsen thereafter. We have counted a normal prorata share of the man-year-generated requirements to calculate the fighter demand but have included none of the unspecified billets. This conforms to current Air Force assignment policies, which attempt to fill unspecified billets with pilots from MWS categories that enjoy overages. Although shortages occur in other MWS categories, the relative numbers are small, so the Air Force pilot shortage is essentially a shortage of fighter pilots.

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18 We could modify the notation in Eq. (3.1) for FAIPs, but we defer to convention instead.

19 The Air Force Personnel Operations Agency (AFPOA) generated the inventory estimates using the Air Force Rated Aircrew Management System (AFRAMS) model (recently developed to replace the Rated Management Decision Support System, or
If we make several simplifying assumptions regarding retention, we can estimate parameter values on the basis of the BTR value. This provides a useful steady-state analysis of the relationships between production and retention. As a point of departure, consider the following assumptions about modal pilot career behavior:

1. All pilots graduate from UFT and receive their wings and rating in their third year of service.

2. Pilots proceeding to an MWS FTU program after UFT graduation enter the MWS-category inventory in the third year as well.

3. FAIPs and other pilots with an intervening non-MWS flying tour enter the MWS-category inventory in their sixth or seventh year of service.

4. Pilots exit the pilot inventory at only two career points: (a) at the end of their initial ten-year ADSC (end-ADSC) in the 12th or 13th year; and (b) upon retirement or promotion to O-6 (as career officers) in their 21st year.

5. BTR = 30 percent; i.e., 30 percent of each cohort take the career option.

There are clearly a number of errors in these assumptions, but they tend to compensate. Many career officers remain in the pilot inventory well past their 21st year of service, for example, but many enter the inventory later than the third, and many exit at the end of their initial “bonus-payback” period in the 15th year. Pilots who are promoted to O-6 early (and even on time in many instances) also exit the inventory prior to their 21st year. This list is equivalent to assuming that the modal career pilot gives 18 years of TARS (their 3rd to 21st years), while the modal pilot who separates from active duty provides nine or ten years (3rd to 12th or 13th) of TARS. The time included in the MWS inventory is similarly calculated: It is 18 years for career officers who proceed to FTU directly from UFT, and 14 or 15 years (6th
or 7th to 21st) for career FAIPs. For separating officers, the time in the MWS inventory is nine or ten years for the normal track and from five to seven years for FAIPs. We can “tune” the remaining parameters in our simplified model to replicate the most recent “Blue Line” outyear (FY 2008-plus) inventory projections made by AFPOA’s AFRAMS model.

These assumptions provide an overall average TARS value of just under 12.2 man-years, which is quite close to the value generated by the AFRAMS model for a ten-year ADSC.

The Air Force has been striving for several years to build its annual active-duty pilot production rate to a total of 1100 new pilots per year. The fighter pilot portion of that objective is currently set at 330 new pilots per year. These objectives will both be met simultaneously in FY 2002. We can use the calculated TARS value and the 1100-pilot production rate in Eq. (3.1) to yield a steady-state pilot inventory of 13,383 pilots, which is within one-half of one percent of the projected outyear requirement (13,319 pilots) and is thus highly consistent with recent planning decisions.

The Air Force estimate of the pilot shortage remains close to 1200 pilots through FY 2009 because the number of pilot-training cohorts who are eligible to exit in the intervening years is considerably smaller (500 to 800 pilots) owing to policy decisions made to accommodate the drawdown in the early 1990s.

In order to use Eq. (3.1) to estimate the MWS-specific pilot inventory, however, we must make the previously identified adjustments to reflect the expected number of man-years pilots will be able to fill actual MWS requirements. Thus, we must not count the rated time for FAIPs prior to FTU B-Course entry because such pilots are flying non-MWS aircraft as UFT instructors and cannot yet fill MWS-associated billets. Current production quotas include 120 total

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20The remaining parameter values that were used are as follows: (1) one-third of the separating pilots leave in the 12th year of service (YoS12), and the remainder separate in YoS13; (2) half of the FAIPs enter the MWS inventory in each of YoS6 and YoS7. Also, the ten-year ADSC will not begin to affect exiting pilots until FY 2008.
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FAIPs, 75 of whom will go to fighters. These FAIP values have been increased during recent policy decisions.21

When we incorporate these numbers into our simplified inventory model, the expected time each FAIP can be counted in any MWS inventory turns out to be only 8.67 man-years. In order to estimate the steady-state fighter inventory using Eq. (3.1), we must apply the formula separately to FAIPs and to pilots entering FTU following UFT. Using the 8.67 TARS value for the 75 FAIPs and adding the result to the 12.2 TARS value that applies to the remaining 255 fighter FTU graduates yields a steady-state fighter MWS pilot inventory of 3753 pilots. This is well short of the outyear requirement of 4381 but is fairly consistent with current Air Force estimates.22 If there were no fighter FAIPs, the inventory estimate would increase to 4015, which is still well below the steady-state requirement of 4381. Flowcharts tracking the notional behavior of fighter pilots are shown in Figures 3.2 and 3.3. Both figures incorporate the production and retention parameter values used in the inventory model. Figure 3.2 exhibits fighter pilot career flows in terms of years of total active commissioned service.

Figure 3.3 exhibits the flows for fighter pilots once they are absorbed into their MWS category. This provides information regarding the number of years pilots are available to fill designated fighter billets.

We can use Eq. (3.1) to solve for the combined retention and production rates required to meet the steady-state requirement of 4381 fighter pilots. Results are shown in Figure 3.4.

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21The number of FAIPs was taken to zero by drawdown-related policy decisions made in the early 1990s. The numbers have been building rapidly in recent years toward these objective numbers. FAIPs are the only pilots with an initial non-MWS flying assignment who normally go on to fighters.

22This estimate is actually slightly above the Air Force estimate. The previously cited database for the June 2001 summit reflects a fighter pilot inventory that drops slightly below 3700 in FY 2005 and remains there through FY 2010. Anyone attempting to replicate our numbers should use TARS values of 8.667 and 12.1667 for FAIPs and non-FAIPs, respectively.
In order to obtain a steady-state inventory of 4381, we can increase the BTR, the production rate, or both. If production remains at 330 fighter pilots (including 75 FAIPs), the BTR must increase to almost 53 percent. Conversely, if the BTR remains at 30 percent, new fighter-pilot production must grow from 330 to 382 pilots per year (again assuming that 75 of them are FAIPs). But what are the prospects for either a higher BTR or more fighter pilot production?

Historical retention data indicate that fighter pilots may have better retention rates than the general pilot population, but a valid analysis requires that we convert the retention information into TARS values in order to conduct an “apples-to-apples” comparison. A BTR of 53 percent corresponds to an overall (non-FAIP) TARS value that is almost 14.1 man-years (as determined from Eq. (3.1)). Thus, solving the fighter pilot shortage by improving retention alone would require that fighter pilots remain on active duty almost two years longer on average than the expected value for all pilots.
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This represents a significantly better retention advantage for fighter pilots than the historical data support. Recent retention data are contaminated by drawdown incentives, evolving bonus options, and stop-loss programs to support contingency operations. However, we can examine pre-drawdown retention data to obtain a reasonable estimate of relative retention rates among MWS communities. A four-year aggregation of pilot inventories and losses from FY 1986 through FY 1989 reveals a TARS value for fighter pilots that exceeds the total TARS value by nearly one man-year, which is less than half of the required premium. The actual pre-drawdown values were 12.9 man-years for fighter pilots compared to a total TARS value of 12.0 man-years. The total TARS value is lower than our current estimate because it is based on the six-year ADSC that was then in effect rather than on the ten-year commitment now in effect. Indeed, voluntary retention was significantly better during that period. In recent years,
any retention advantage among fighter pilots has essentially disappeared, so it is difficult to conclude that the shortage can be resolved through retention alone.\textsuperscript{23}

The other option is to increase production to 382 new fighter pilots per year. As mentioned earlier, the drawdown reduced the training

\textsuperscript{23}We can never expect to pick up the full increase in any ADSC change in the expected number of man-years. When voluntary separation is delayed, pilots are more likely to separate at their first opportunity because they have fewer voluntary options. Also, the pilot bonus has reduced the opportunity for a “wait-and-see” attitude at end-ADSC so that pilots who stay voluntarily face longer subsequent service commitments than did their pre-drawdown and pre-bonus counterparts. As we noted earlier, the training pipeline now consumes an additional man-year in the TARS calculations for career pilots. The Air Force made the transition from a six-year to an eight-year ADSC in the early 1990s. The current ten-year ADSC applies to pilots who entered UFT in FY 1997 or thereafter. All historical retention data are from the Air Staff.
infrastructure, so producing 382 fighter pilots per year is problematic at best. Moreover, all the pilots produced must be absorbed into operational fighter units as they complete their FTU training. We will examine absorption constraints in the following chapters. Here we merely assert that the current force structure would have enormous difficulty absorbing 382 new fighter pilots per year.

We caution that the above analysis has assumed a steady state. A steady-state analysis is suggestive, but one must consider the dynamic aspects of the system to untangle the complexities of the problem.