



PROJECT AIR FORCE

User's Guide for the Total Force Blue-Line (TFBL) Model

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Preface

Aircrew management across the Total Force is complex and would benefit from greater coordination among active and reserve components. To effect that coordination, the Air Force has established a Total Force Aircrew Management (TFAM) office. Reliable and consistent projections of requirements and inventories are critical to such coordination. To assist in making such projections, RAND Project AIR FORCE (PAF) has developed a modeling capability—the Total Force Blue-Line (TFBL)—that projects inventories for the active duty, Air Force Reserve, and Air National Guard. This model is being delivered to the TFAM office, and this document provides the information necessary for Air Force personnel to use the model.

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RAND Project AIR FORCE

RAND Project AIR FORCE (PAF), a division of the RAND Corporation, is the U.S. Air Force's federally funded research and development center for studies and analyses. PAF provides the Air Force with independent analyses of policy alternatives affecting the development, employment, combat readiness, and support of current and future air, space, and cyber forces. Research is conducted in four programs: Force Modernization and Employment; Manpower, Personnel, and Training; Resource Management; and Strategy and Doctrine. The research reported here was prepared under contract FA7014-06-C-0001.

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Abbreviations

ABCCC	airborne command and control center
ABM	air battle manager
AFPC	Air Force Personnel Center
AFR	Air Force Reserve
AFRAMS	Air Force Rated Aircrew Management System
AFRC	Air Force Reserve Command
AFS	Air Force specialty
AFSC	Air Force specialty code
ALFA	Air Liaison Officer (ALO), Lead-In Fighter Training (LIFT), Forward Air Controller (FAC), and Air Education and Training Command (AETC)
ANG	Air National Guard
ARC	Air Reserve Component
AWACS	airborne warning and control system
beat	requirement category
Bmb	bomber
C2ISR	command, control, intelligence, surveillance, and reconnaissance
CSAR	combat search and rescue
CSO	combat systems officer
CYOS	commissioned years of service
Ftr	fighter
FY	fiscal year
FYDP	Future Years Defense Plan/Program
icat	inventory category
JSTARS	joint surveillance target attack radar system
MAH	major airline hiring
Mob	mobility

MWS	major weapon system
NPS	non-prior service
plt	pilot
rcat	rated category
RegAF	Regular Air Force
RIF	reduction in force
RL/BL	red-line/blue-line
RPA	remotely piloted aircraft
SO	special operations
TFAM	Total Force Aircrew Management
TFBL	Total Force Blue-Line
TPR	trained personnel requirement
UND	University of North Dakota
USAF	U.S. Air Force

Summary

Information for Personnel Managers

This document is a user's guide for those who use the Total Force Blue-Line (TFBL) model. The organization is as follows: Chapter One describes the nature of the pilot management problem, the analytic capabilities the Air Force has to cope with it, and how the TFBL model helps the Air Force manage all rated personnel. Chapter One also describes the input data, the various data divisions, and their definitions. Lastly, it describes the model's outputs. Chapter Two tells you how to run the model. It contains detailed instructions, including a list of steps to follow, the inputs to use, how they can be generated, and, depending on the method you use to run the model, any output messages and a list of steps for generating red-line/blue-line charts. Those who are interested only in running the model need not read any other chapters.

Those who want to know more about the model or who may need to explain the model to audiences that are not savvy about modeling should read the remaining chapters. Chapter Three provides an overview of the TFBL model and the logic behind it. Chapter Four provides descriptions of additional excursions, including a discussion of major airline hiring excursions and the impact of major airline hiring on the Air Force blue-line projections. Chapter Five gives detailed and specific information on the input data. Chapter Six contains detailed and specific information about the output files from the model. Finally, the appendix contains an exhaustive list of all versions of data created or used in all previous model runs for completeness and for reproducibility.

Note that since this model will reside with the Air Force, we do not indicate where things might be stored, because that decision will rest with the Air Force.

Chapter One. Introduction to the Total Force Blue-Line Model

Yogi Berra is reputed to have said, “Prediction is really hard, especially about the future.” U.S. Air Force (USAF) personnel managers would certainly agree. They routinely struggle to ascertain whether future inventories will match the requirements. And it is not simply a matter of total supply of personnel matching the total demand, because each element of the total supply must meet a corresponding element of the total demand. This means that the total number of personnel in the Air Force Reserve (AFR) must meet the total Reserve demand, the total number of pilots must meet the total demand for pilots, the supply of pilots must be distributed across major weapon systems (MWSs), and so on and so forth across all rated career fields.

This task has become more urgent in recent years because USAF’s ability to train and season its pilots has decreased as the number of aircraft has decreased. Fewer aircraft mean fewer flying hours to train new pilots. As capacity to provide flight experience to pilots in the active component declines, the USAF will need to use more of its total capacity to train its new rated officers, potentially tapping into that of the Air Reserve Component (ARC), which would require intensive, coordinated management of rated inventories in all three components—that is, Total Force rated management. The penalties for imbalances are high, because once out of balance, it can take a long time to restore the balance between supply and demand.

Recognizing that aircrew management throughout the Total Force would benefit from greater coordination among the active and reserve components, the Air Force Chief of Staff (CSAF), at a 2013 Rated Summit, directed the formation of a Total Force Aircrew Management (TFAM) office. On September 18, 2014, the Secretary of the Air Force, CSAF, Chief of AFR, and Director of the Air National Guard (ANG) signed the TFAM Charter. The mission of the TFAM office is to integrate the management of the Regular Air Force (RegAF), AFR, and ANG aircraft resources to maximize Total Force combat readiness.

Critical to the success of the TFAM office is a capability to conduct and use objective analysis, which includes generating reliable, consistent projections of aircrew requirements (represented by red lines on the resulting graphics) and inventories (represented by blue lines) and to assess the effect of policy changes on these projections. The active component has an analytic capability to generate its red-line/blue-line (RL/BL) projections called the Air Force Rated Aircrew Management System (AFRAMS) model. The capabilities in the ARC have been more limited. Thus, the USAF asked RAND Project AIR FORCE (PAF) to integrate AFRAMS with similar RL/BL projections for the ARC to provide the first Total Force RL/BL projections.

Overview of the Total Force Blue-Line Model

The USAF asked RAND PAF to help by updating and improving RAND's Total Force Blue-Line (TFBL) model, which predicts future inventory for the RegAF, AFR, and ANG and accounts for interactions among them. The model estimates future inventories by component (e.g., AFR), rated category (rcat) (e.g., pilot), MWS (e.g., fighter), number of commissioned years of service (CYOS) completed, and fiscal year (FY) by trying to match inventory to requirements.

Think of predicted inventories as having characteristics that specifically identify a population—each population can be identified by a component, rcat, MWS, CYOS, and FY. For each combination, (of component, rcat, MWS), the model calculates the inventory (at CYOS, FY) as the inventory (at CYOS – 1, FY – 1) plus production in FY minus losses in FY. User inputs specify some gains and losses directly (e.g., number of mobility pilots trained to become special operations [SO] pilots, which is a gain of SO pilots and a loss of mobility pilots). User inputs constrain other gains and losses, but leave the model some scope to adjust those gains and losses so as to match inventories to requirements (e.g., the user specifies maximum affiliation rates,¹ the model determines whether to affiliate rated officers at the maximum rate or something less).

TFBL is distinctively a policy model. By changing the input values (production, loss rates, and affiliation rates) based on potential policy changes, the user can see how the potential policy changes affect the future force and whether each career field is healthy, overmanned, or how many years, if ever, it would take for that community to be healthy again (i.e., when inventory is equal to requirements).

Overview of the Required Data

Before running the model, it is necessary to understand the data required to run it, at what level of granularity the model operates, and the kinds of output that can be obtained from the model. To this end, we generally describe the input and output data, and then the different categories that define the data, such as type of pilot or FY. This information should match with your intuition of data required to do Total Force inventory projections given a red-line requirement while making assumptions about maximum production, target affiliation rates, and separation rates.

Input Data

The model accepts the following general inputs:

¹ A rated officer who separates from the RegAF and subsequently joins AFR or ANG as a rated officer has *affiliated* with AFR or ANG. The *affiliation rate* is the ratio of those affiliations to separations.

- Valid requirement categories (bcat)—define the actual career fields that you are allowed to input requirements; for example, RegAF fighter pilot, AFR mobility combat systems officer (CSO), and ANG air battle manager (ABM) are a few career fields currently of interest.
- Requirements—current and projected.
- Valid inventory categories (icat)—define the actual kinds of officers that exist in the model; for example, RegAF fighter pilots, AFR mobility CSOs, or ANG ABMs.
- Assignment options—specify which icat can fill which bcat. For example, a RegAF mobility pilot can fill a RegAF mobility pilot requirement or a RegAF “unspecified” pilot requirement.
- Initial inventory—inventory of officers at the start of the first FY specified for a particular run of the model.
- Production—projected number of officers who successfully complete formal training in each FY.
- Distribution of production entries by CYOS—as officers earn their wings, they do not all enter the rated force for their first assignment in CYOS 0 (as the CYOS clock starts upon commissioning). Historically, officers enter the rated force ready for assignment between zero and six CYOS, and so we have a distribution that says, for example, 5 percent enter CYOS = 0, 25 percent enter CYOS = 1, 35 percent enter CYOS = 2, etc.
- Loss rates—the fraction of rated officers in each component who cease to be rated officers in that component by the end of the next FY (including promotion to O-6, grounding, retirements, and other separations).
- Affiliation rates—the maximum rate at which officers who separate from the RegAF and are allowed to affiliate with the AFR or ANG.
- Affiliation options—specify with which AFR and ANG rated categories and MWSs each RegAF rcat and MWS can affiliate. For example, a RegAF fighter pilot can affiliate with AFR or ANG as an 11F (fighter pilot) or an 11K (trainer pilot).
- Reduction in force (RIF)—the number of officers planned or programmed to be force managed in current and future years.
- Force transfer of officers that mimics being recoded (or reclassified into another primary Air Force specialty [AFS])—which states how many officers of a certain kind are going to be recoded as another; for example, RegAF mobility pilots being recoded as RegAF SO pilots.

Divisions of Data

It is also important to know the categories of concern because all the input data mentioned above are defined across several dimensions (such as component, rcat, MWS, CYOS). For example, at the end of FY15 there were 213 RegAF fighter pilots in CYOS 4.²

- Component
 - RegAF
 - AFR

² Source: September 30, 2015, initial inventory used by AF/A1PF as input into AFRAMS.

- ANG
- FY
- CYOS from zero to 30
- Category of rated career field
 - Pilot
 - CSO
 - ABM
 - Remotely Piloted Aircraft (RPA) pilot
- MWS for RegAF pilots, CSOs, and RPA pilots
 - Bomber (Bmb)
 - Command, Control, Intelligence, Surveillance, and Reconnaissance (C2ISR)
 - Combat Search and Rescue (CSAR)
 - Fighter (Ftr)
 - Mobility (Mob)
 - Special Operations (SO)
 - Unmanned/18X
- MWS for RegAF ABMs
 - Airborne Command and Control Center (ABCCC)
 - Airborne Warning and Control System (AWACS)
 - Joint Surveillance Target Attack Radar System (JSTARS)
 - Ground
- AFS³ for AFR and ANG pilots (11-series), CSOs (12-series), and RPA pilots
 - 11B/12B (aligns with RegAF bomber pilot)
 - 11E (AFR only, experimental test pilot)
 - 11F/12F (aligns with RegAF fighter pilot)
 - 11G/12G (aligns with RegAF generalist pilot, usually staff positions)
 - 11H/12H (aligns with RegAF CSAR pilots)
 - 11K/12K (aligns with RegAF Trainer pilot)
 - 11M/12M (aligns with RegAF Mobility pilot)
 - 11R/12R (aligns with RegAF C2ISR pilot)
 - 11S/12S (aligns with RegAF SO pilot)
 - 11U/12U/18X (aligns with RegAF Unmanned pilots/Unmanned CSOs/RPA pilots)

Output Data

Lastly, it is important to understand the model outputs so that analysis and interpretation can be done. The model creates the following outputs:

- Projected inventories for all components, rcac, etc.
- Assignments of inventories to requirements, including unassigned inventories and unfilled requirements.

³ Synonymous in this case with MWS, so for consistency with the RegAF, we will use MWS to mean major weapon system for the RegAF and AFS for the AFR and ANG.

- Production actually used in the model in each FY.
- Projected number of separations/retirements in each FY.
- Projected affiliations to AFR and ANG in each FY.
- Echoed inputs: We have found it convenient for subsequent analysis to echo some of the inputs in the outputs, including requirements, RIFs, officers forced to transfer from one MWS to another, and loss rates.

Chapter Two. Running the Total Force Blue-Line Model

The TFBL model was designed to help the USAF meet the manpower needs of the future more effectively. As recruitment, education, and training require substantial time and resources, the ability to plan is crucial in meeting expected requirements in the rated community. By capturing dynamics of current inventory, future demands, separations, and affiliations, the TFBL model projects inventory to meet forecasted demand when it can and minimizes unmet requirements when it cannot.

The objective of the model is to adopt a forward-looking perspective to identify the number of personnel to assign to requirements within a category, where a requirement is defined by a *rcat* (i.e., pilot, CSO, ABM, or RPA pilot), a component (RegAF, AFR, or ANG), and an MWS or AFS (e.g., bomber, fighter, 11M, etc.). The model finds the best solution such that the number of unfilled requirements is minimized and the number of officers assigned to a requirement category is maximized while producing the fewest number of officers possible.

The appropriate audience for this chapter is interested in using inventory projections to help make informed policy decisions regarding potential long-term effects on inventory when considering changes in production, requirements, retention, or affiliation patterns. Those who are interested only in running the model and acquiring model results would just need to read this chapter. However, Chapter Five might also prove worth reading if the user will need to add, modify, or delete input data and goes into great detail about the input data, allowed formats, and examples. This chapter provides detailed instructions on the inputs to use and how the inputs can be generated, details the two options available for running the model, and includes descriptions for generating RL/BL charts.

Preliminary Work

This section will help you prepare the necessary input files to run the model. Some input files just need confirmation that the inputs are still relevant for the proposed model run, while other input files are likely to need current data to be added. First, we start with the files that need a visual confirmation that nothing has changed because the data contained in these files are the basic building blocks of the rated community and do not change very often. If additions are required, you add a new record that provides the appropriate information, including *rcat*, component, and MWS (referred to as *icat* when discussing inventory [people] and referred to as *bcat* when discussing requirements).¹ To modify any records, make the appropriate changes to

¹ It is not necessarily true that requirements and inventory match in a one-to-one manner; for example, unspecified or staff requirements exist that any pilot can fill. However, MWS defines categories for both requirements and

any incorrect cells. To remove incorrect records, delete the appropriate rows from the file. The model is case-sensitive, so make sure to enter values correctly. Chapter Five will be an invaluable reference for greater detail on the input data, allowed formats, and examples. We provide all the information concerning model input data in a single chapter for completeness, but want to keep that information separate from the set of instructions required to perform a model run in case the user is not interesting in changing the data, but rather in running the model with various sets of information that already exist in the input files. We will use the convention that bolded text refers to files that exist, which are either input files to the model, output files from the model, or files from which model input data are created.

1. **bvldSas14.csv**. This file contains the list of valid beat that you might want considered by the model from the requirements perspective. Note the “r” in the value of beat to help distinguish between the beat and the icat.²
2. **ivldSas14.csv**. This file contains the list of icat that you want considered by the model from the inventory (or personnel) perspective.
3. **PrefAsgnSas14.csv**. This file contains the list of valid or preferred (as in the title) assignments of an officer in the inventory for career fields considered by the model in **ivldSas14.csv** compared with a requirement considered by the model in **bvldSas14.csv**. Think of this file as the general rule set you would follow if you were on an assignment team: Given the primary AFS of the officer, what jobs could that officer perform and in which career fields do those jobs reside? The first three columns define the “from” icat, and the fourth through sixth columns represent the “to” beat. Adding a new valid assignment requires defining which icat (personnel) can fill which beat (positions) and adding the row to the file.
4. **AllowTrans14.csv**. This file specifies the allowed affiliations, i.e., explicitly stating that officers can separate from particular RegAF icat and affiliate into specific AFR or ANG icat. The “trans” part of the title refers to affiliations as one method of transferring officers from one icat to another. For example, a RegAF fighter pilot is allowed to separate and affiliate into the ANG 11F, but a RegAF mobility pilot is not allowed to separate and affiliate into the ANG 11F. The first three columns define the “from” icat and the fourth through sixth columns represent the “to” icat. Adding an allowed affiliation means defining the icat in the RegAF from which an officer will separate, defining the icat in the AFR or ANG into which an officer can affiliate, and adding the row to the file. **AllowTrans14.csv** is the original version of the file that is compatible with version 1 through version 6 of **TFBL_Officer vn_yymmdd.sas** (where “n” represents the version number, 6 for example), which will be discussed near the end of this section.

inventory. So the variable to refer to MWS when discussing requirements is *bcat*. The variable to refer to MWS when discussing inventory is *icat*. In essence, they are interchangeable when there is a one-to-one mapping (matching fighter pilots to fighter pilot requirements), but they differ because fighter pilots can fill an unspecified or staff pilot requirement.

² The “b” in bvld and beat is meant to represent requirements data. We are not sure how the “b” came to symbolize this, but “r” was already taken to mean rated. “Vld” means valid and this file represents all valid beat to be considered in the model.

Next, we discuss files that need be updated on an annual basis because the data are likely to remain unchanged over the course of the year. We also detail how to make the appropriate modifications to the data that exist in each of the files. Note that any version name created by the user must be 15 characters or fewer due to model code restrictions.

5. **AllowTrans14MW.csv**. This file specifies the allowed affiliations and the historical number of observations from FYs 1996 to 2015, i.e., explicitly stating that officers can separate from particular RegAF icat and affiliate into specific AFR or ANG icat and the number of occurrences observed over the years for each allowed affiliation. It replaces **AllowTrans14.csv** in versions of the model that try to make projected affiliations align more closely with historical affiliations. As an example, in the version AF150525, RegAF fighter pilots affiliated mostly to AFR 11Ks when, historically, RegAF fighter pilots affiliated mostly into AFR 11F. **AllowTrans14MW.csv** addresses this concern and is to be used with **TFBL_Officer vn_yymmdd.sas**, version v8 or later. The first column provides the version name (e.g., AF151125). The next three columns define the “from” icat, and the fifth through seventh columns represent the “to” icat. Adding an allowed affiliation means defining the icat in the RegAF from which an officer will separate, defining the icat in the AFR or ANG into which an officer can affiliate and the number of times this affiliation has happened historically, and adding the row to the file.
6. **ForceTrans14.csv**. This file contains the number of officers who are being pulled from one icat in a specific FY and CYOS and recoded into another icat in the model in the same FY and CYOS. We call these *force transfers*, as the model is forced to transfer personnel from one icat to another as specified by the data contained in this file. The first column contains a version number (e.g., AF151125) that typically corresponds to a run with data from the most recent FY. The next three columns define the “from” icat, and the fifth through seventh columns represent the “to” icat. One practice would be to copy an old version and delete any transfers that are not applicable; modify the applicable transfers to reflect the correct CYOS, FY, and number of officers transferred; add any additional transfers that are not in the file by defining the “from” icat, the “to” icat, the CYOS of the officers being transferred in each FY, and the number of officers transferred; and add these data as a row in the file.
7. **RiftotSas.csv**. This file contains the number of officers who are being force managed from the inventory in a specific career field, FY, and CYOS. The version variable in the first column allows you to easily declare no RIFs, shown in Table 8, with version = NoRIF, so it does not matter what values are in this row as long as they are valid and inven = 0. Or you can list the planned or programmed RIFs by creating a new version and defining the rcat, component, and icat of the officers being RIFed in each CYOS and FY and the number of RIFed officers.
8. **CYOS0Inv.csv**. This file contains the number of officers that are entering the rated force in a specific icat and FY at initial commissioning (CYOS = 0) and are available for assignment without entering through the usual training pipeline.³ This file is intended to

³ These kinds of entries are few in number and represent entry programs outside of the normal commissioning process. For example, Army helicopter pilots were coming into the Air Force and not requiring the standard initial training. All those accessing into the Air Force and entering initial training will enter the rated career field through the **AllDistroSas14.csv** file.

mimic the CYOS = 0 inventory (hence the file name) input that is entered into the AFRAMS model for the RegAF. For each new run, you should confer with AF/A1PF to ensure that this file mimics the inputs into AFRAMS. Create a new version for the appropriate run (e.g., AF151125); copy the appropriate previous inventory; delete any inventory that no longer applies; modify the applicable rows to reflect the correct FY and number of officers entering; and add any additional inventory that are not in the file by defining the icat the personnel will be entering, in which FY they will enter, and the number of officers.

9. **AllDstEntSas14.csv**.⁴ This file specifies the distribution of non-prior service (NPS) production at entry over CYOS = 0 through CYOS = 6 for each icat considered by the model in **ivldSas14.csv**. Because this is a distribution, the sum of the percentages of officers who are produced and enter in CYOS = 0 through CYOS = 6 must equal 1 (i.e., 100 percent of the produced officers get put into one of the CYOS bins from zero to six). Adding a different distribution requires defining a unique version name in the first column, then the icat in columns two through five, the CYOS (values from zero to six), and the percentage of produced officers who will be available for assignment in each CYOS. The version just created will have to contain every icat found in **ivldSas14.csv** that you want considered in the model run, not just the particular MWS or CYOS distribution that might be changing; if not, the model will not read in the data because they do not exist in the version name and, thus, the produced officers would not be available for assignment. Concatenate the current version of **AllDstEntSas14.csv** with the new dataset you have created. Do not modify or delete the data in the file. They exist and remain in the file for reproducibility.

Next, we discuss each file that likely needs new datasets added to it to be used in a proposed model run. Not every file needs to be updated for each run. If you are running an excursion where everything stays the same except requirements (e.g., you are assessing the effect of the A-10s remaining in the USAF rather than being removed), you only need to modify the requirements file. For each file discussed below, you will need to include every category found in either **bvldSas14.csv** (if you are modifying the **AllRqmtsSas14.csv**) or every category found in **ivldSas14.csv** (if you are modifying the other four files to include **AllInitInvSas14.csv**, **AllDistroSas14.csv**, **AllRateSas15correct.csv**, and **AfilSas14.csv**) you want considered in the model run, not just the particular MWS you might be changing; if not, the model will not read in the data because they do not exist in the version name and, thus, the data for that category will be zero. For these remaining files, whatever versions of data you are creating, you should concatenate them onto the existing file. Do not modify or delete any older data in the file. The older data exist and remain in the file for reproducibility. The model is case-sensitive, so you must input the values correctly. Lastly, all version names must be 15 characters or fewer due to model code restrictions.

⁴ **AllDstEntSas14.csv** is meant to represent the distribution across CYOS of produced officers, which you could think of as entries into the system, so the file was originally named “distribution of entries.”

10. **AllRqmtsSas14.csv**. This file contains the requirements for each career field considered by the model in **bvldSas14.csv**. Adding a new requirements dataset requires defining a unique version name in the first column, defining the beat, and specifying the FY in which the requirement will exist and the number of requirements. The new version name will have to contain every beat found in **bvldSas14.csv** that you want considered in the model run. Note that the model is case-sensitive, so you must include the “r” in front of the MWS for the beat value.
11. **AllInitInvSas14.csv**. This file contains the initial inventory for each career field considered by the model in **ivldSas14.csv**. Adding a new initial inventory dataset requires defining a unique version name in the first column, defining the icat, and specifying the CYOS and the number of personnel that exist in each CYOS. The new version name will have to contain every icat found in **ivldSas14.csv** that you want considered in the model run.
12. **AllDistroSas14.csv**.⁵ This file specifies the NPS production for each category for each future year for each career field considered by the model in **ivldSas14.csv**. Adding a new production dataset requires defining a unique version name in the first column, defining the icat, and specifying the FY and the number of personnel produced in each FY. The new version name will have to contain every icat found in **ivldSas14.csv** that you want considered in the model run.
13. **AllLrateSas15correct.csv**.⁶ This file specifies the loss rates (Lrates) for each icat considered by the model in **ivldSas14.csv** and each CYOS. Adding a new loss rate dataset requires defining a unique version name in the first column, defining the icat in columns two through five, and specifying the CYOS, FY, and the percentage of each CYOS that will separate for that FY. These rates can be thought of as year group loss rates. The new version name will have to contain every icat found in **ivldSas14.csv** that you want considered in the model run.
14. **AfilSas14.csv**. This file specifies the maximum rates at which RegAF rated officers that have separated can affiliate to AFR, ANG, and AFR + ANG by MWS between CYOS 0 and 16. Adding a new affiliation rate dataset requires defining a unique version name in the first column, defining the icat in columns two through five, and specifying the CYOS and the maximum affiliation percentage for AFR, ANG, and AFR + ANG in columns six, seven, and eight, respectively. The new version name will have to contain every icat found in **ivldSas14.csv** that you want considered in the model run.

All new datasets created and inputted into a file need to be documented as described in this manual in Chapter Five under the appropriate file subsection. Each new version description of the input data should include the date the dataset was created, the file name from which the

⁵ **AllDistro** is meant to represent the upper-bound production (or entries) that can come in annually. If the optimization is set to force production to equal this upper bound, then this production is distributed across CYOS bins. If the optimization uses this as an upper bound, then production will not exceed these numbers and the production variable will determine how many are produced and then distributed across CYOS.

⁶ **AllLrateSas15correct.csv** is meant to represent all the loss rates for each community by CYOS and FY. An error was found in the file and corrected in FY 2015, hence the title name.

dataset was pulled, the provider of the originating file, and the reason of existence or change from previous versions.

Lastly, we provide a list of instructions, which involve running two **.sas** files that will automatically generate new datasets for **AllInitInvSas14.csv**, **AllRqmtsSas14.csv**, **AllDstEntSas14.csv**, **AllLrateSas15correct.csv**, **AllowTrans14MW.csv**, and **AfilSas14.csv** based on the appropriate historical data from FYs 1996–2015. Note that the data versions created from running the **.sas** files in **AllInitInvSas14.csv** and **AllRqmtsSas14.csv** might not be used because these data inputs are typically received from AF/A3X. Also note that this automation code should be run once a year to update **AllDstEntSas14.csv**, **AllowTrans14MW.csv**, **AfilSas14.csv**, and **AllLrateSas15correct.csv**.

1. Download the Air Force Personnel Center (AFPC) data files **BAE199609** through **BAE201509**, **BRE199609** through **BRE201509**, and **BGE199609** through **BGE201509** onto the computer provided to you by the RAND Corporation.⁷
2. Download the **formats.sas7bdat** file onto your computer.⁸
3. Download and open **Inventory macros v7.sas**.⁹
4. Change the location of **libnames aug** to be the path to the folder where all the AFPC personnel data files and formats are kept,¹⁰ which should include the AFPC active officer extracts **BAE199609** through **BAE201509** and **formats.sas7bdat**. The path name should be in quotations. These **BAEyyyyymm**, **BREyyyyymm**, and **BGEyyyyymm** files can be obtained from AFPC Research, Analysis & Data Division (AFPC/DSY), but must contain the **RAND_ID** instead of the Social Security number.¹¹ AFPC is capable of providing the data with **RAND_ID**s instead of Social Security numbers. The **formats.sas7bdat** file can be obtained from the lead author, Tara Terry, of the RAND Corporation, at tterry@rand.org.
 - a. **aug** should be set to a folder where the following **sas** datasets that are built later for calculating historical rates will be stored: **careers**, **breaks**, **allpop**, and **alltran**.
5. Change the macro variables to the appropriate values:
 - a. Set the location of **dataFolder** to be the path to the folder where the previous versions of all input **.csv** files are kept.
 - b. Version should be a character string different from all previous versions and no more than 15 characters in length. Typically the following naming convention is

⁷ These files contain the de-identified personnel records that are used in calculating historical rates and inventory as well as future projected requirements.

⁸ This file puts all the data contained in the files from Step 1 into the necessary formatting required for running the code.

⁹ This is the code that actually calculates the historical rates, inventory, and future projected requirements using the files contained in Steps 1 and 2.

¹⁰ In the code from Step 3, **Inventory macros v7.sas**.

¹¹ **RAND_ID** is a de-identified, but unique identifier RAND uses to maintain anonymity in the data due to human subjects protection agreements that RAND has with the USAF.

used to denote different versions: AFyymmdd***** where the * can be any letter or number to help convey the uniqueness or purpose of the run. Each input .csv file should contain all previous version names.

- c. startYear should remain 1996, and endYear should be the most recently completed FY.
6. Run **Inventory macros v7.sas** code by hitting the Submit button (looks like a running person). Make sure there is nothing highlighted or you will submit only the highlighted lines as opposed to the entire file.
7. Download and open **calculate Rqmts 150814.sas**.
8. Set the location of **libname CF225** to be the path to the folder where **pastree201409** and **MPW201409** are located. The year will automatically take the value of startYear. AFPC/DSY is capable of providing these data.
9. Change the macro variables to the appropriate values:
 - a. Date is today's date in the form YYMMDD. Version is the same version name chosen in Step 5b.
 - b. Set startYear to the most recently completed FY, and endYear to 5 years later. For instance, they are currently 2015 and 2020, respectively.
10. Run **calculate Rqmts 150814.sas**.

Now that the input data files are prepped and ready, we move on to the two methods available to run the model. The TFBL model is implemented in the SAS programming language, so both methods incorporate running SAS.¹² One involves running the SAS code within the SAS software (referred to as the SAS code method). The other, more user-friendly method is run within Excel and contains an Excel macro with visual basic (referred to as the Mercier Tool method).¹³ We will now provide a list of instructions for running the model using both methods, but we start with the most preferred method: the Mercier Tool method. Note that RAND is not the author of the Mercier Tool, and we are therefore not responsible for it. Using the Mercier Tool method would require the SAS code to be updated by Mark Mercier to ensure correctness.

Mercier Tool Method

To run the Mercier Tool in Excel, the user should execute the following steps:

1. Download the Excel macro program **TF_RLBL_ExcelTool_v57TT.xlsm** onto the desired machine.
2. Download the SAS program for the Mercier tool, either **TF_RLBL_Model_Master_v27_x32.sas** or **TF_RLBL_Model_Master_v29_x64.sas**

¹² PC SAS is the software available on Windows-based computers to write SAS code as well as submit the SAS code to be executed by the SAS compiler and the optimization model by the SAS optimization solver.

¹³ The author, Mr. Mark Mercier, used the RAND input files and SAS code to create the Excel macro, which also outputs the RL/BL projections into a predetermined template in PowerPoint and auto-populates the charts with specific model output data. The chart format was determined by AF/A3X. Contact Mark W. Mercier, Headquarters AFRC Studies and Analysis (AFRC/A9A), at mark.mercier.2@us.af.mil, 478-327-2482.

depending on whether you have a 32-bit or 64-bit machine and your version of SAS is 32-bit or 64-bit, respectively. **TF_RLBL_Model_Master_v27_x32.sas** and **TF_RLBL_Model_Master_v29_x64.sas** should be consistent with each other.

3. Download **RLBLTemplatewBGDataParams v5.pptx** to use for PowerPoint chart generation.
4. Open **TF_RLBL_ExcelTool_v57TT.xlsm** and click Cancel in the dialog box that pops up. If an additional dialog box pops up specifying an error, click End.
5. Make sure all input files reside in the desired folder.
6. Click on the Parameters tab when the file is done loading.
7. Specify the correct paths in Column D for the items labeled in Column C, rows 2 through 9:
 - a. Input Files Folder (where you placed the input files from Step 5), highlighted in blue (row 2)
 - b. Output Files Folder (a location of your choosing, but create the folder first if it does not exist), highlighted in blue (row 3)
 - c. SAS Code Folder (where you placed the **.sas** file you downloaded in Step 2), highlighted in blue (row 4)
 - d. *cyfirst* is the first CYOS to be considered, is usually set to zero, and is highlighted in green (row 5)
 - e. *cylast* is the last CYOS to be considered, is usually set to 30, and is highlighted in green (row 6)
 - f. *fyfirst* is the first FY to be considered, is usually the previous FY that has completed for which you have 30 Sept data, and is highlighted in purple (row 7)
 - g. *fyast* is the last FY considered, is usually 30 years out from *fyfirst*, and is highlighted in purple (row 8)
 - h. *npslb* is the multiplying factor between zero and one to enforce a minimum amount of non-prior accession production and is highlighted in teal (row 9). If the factor is zero, the lower bound on production will be zero, which allows the model to not produce any officers in a particular icat. This might happen if the icat has inventory levels above requirements. When the factor is one, indicating the desire to ensure 100 percent of the maximum amount of the production, the lower bound will be the same as the maximum amount entered from **AllDistroSas14.csv**.
8. Click on the “Datasets” tab.
9. Make sure Column E contains all the correct version names for each input dataset for the run you wish to make. The input dataset is listed in Column A, rows 2 through 29; the input file the dataset resides in and will be pulled from is listed in Column B; and the component and rcat are in Columns C and D, respectively.
10. Click on the “MASTER” tab.
11. Click the “Run SAS Code” button located in cells G2 through H2.
12. Click “Create a New Data File” if this is the first time running this excursion and continue to Step 13. Click “Update an Existing Data File” if you need to re-run the model and overwrite the previous output and continue to Step 17.
13. Click “Change Folder” and navigate to the location where you would like the new output file to be written. Enter the new data file name without the extension in the box labeled “Enter New Data File Name (without the extension):” and click “OK.”

14. Navigate to the folder containing the .sas program from Step 2 and click “Open.”
15. Click “OK” on the “SAS Code o[sic] Execute” dialog box.
16. Click “Yes” to save the SAS log and output files and continue to Step 17; otherwise, click “No” and skip to Step 18.
17. Click “OK” on the box stating the names of log and output files. Skip to Step 19.
18. Navigate to the location where the older file exists that you would like to update and click “Open.” Continue to Step 19.
19. You should see “Executing the SAS Code (May take several minutes)” on the bottom gray bar within Excel while the Excel tool runs the SAS code.
20. When the Mercier Tool is done running the model, you should see that the charts have been populated with red-lines and blue-lines (coming from the model results) and that the table in cells D4 through H47 has been filled with the output data. Additionally, an Excel file should exist in the folder chosen in Step 13 with the name entered in Step 13. To see the solution status of the model run, open up the SAS output file generated from the run. This will be identical to the Results Viewer window that opens up in SAS when running the SAS Code method. Please see the solution status discussion at the end of the SAS Code method section for the possibilities and definitions.
21. To generate the PowerPoint RL/BL charts:
 - a. Click on the “Select RLBL Template” button in cell H3.
 - b. Navigate to the folder where you downloaded **RLBLTemplatewBGDataParams v5.pptx** in Step 3 and select this file.
 - c. Click on the “Send All AFSCs to PP Slides” button in cells M2 through N2 to generate all the PowerPoint slides. Or, if you only want one Air Force specialty code (AFSC), choose the Component in cells C2 through F2, the Category/AFSC in cells C3 through G3, and the Rating in cells J3 through M3, and click the “Send Current AFSC to PP Slides” button. Make sure to save the PowerPoint slides for future use.

At this point, you have a PowerPoint briefing composed of RL/BL charts and summary data upon which to assess the results of the model run.

SAS Code Method

To run the SAS code within PC SAS, the user should execute the following steps:

1. Download and install the SAS program onto the desired machine.
2. Make sure all input files reside in the desired folder where the program will execute and output results.
3. Change the name of the SAS program **TFBL_Officer_vn_yymmdd.sas** to represent the current date in YYMMDD format. For the purpose of this instructional guide, the desired folder will be “Model” and it will be on the directory path “C:/Model”. When changing the name of the SAS program, be sure to include the correct version number by changing the version number.
4. Open SAS.
5. Go to the “File” menu and select “Open Program...”.
6. Navigate to the folder where you copied the contents (“C:/Model”) and select the user-named program **TFBL_Officer_vn_yymmdd.sas**.

7. Once the program is open, change the macro variable “%Let folder=” to the directory where you copied the contents (“C:/Model”).
8. Set the variables *cyfirst*, *cylast*, *fyfirst*, *fylast*, and *npslb* to the values you want for this run.
 - a. *cyfirst* is the first CYOS to be considered and is usually set to zero
 - b. *cylast* is the last CYOS to be considered and is usually set to 30
 - c. *fyfirst* is the first FY considered and is usually the previous FY that has completed for which you have 30 Sept data
 - d. *fylast* is the last FY considered and is usually 30 years out from *fyfirst*
 - e. *npslb* is the multiplying factor between zero and one to enforce a minimum amount of non-prior accession production. If the factor is zero, the lower bound on production will be zero, which allows the model to not produce any officers in a particular icat. This might happen if the icat has inventory levels above requirements. When the factor is one, you are saying that you want to enforce 100 percent of the maximum amount of production, as the lower bound will be the same as the maximum amount entered from **AllDistroSas14.csv**.
9. Change the version input in the SAS code for each input file according to the instructions specified in Chapter Five.¹⁴ Each input file should include the version name and dataset you created from the “Preliminary Work” section earlier in this chapter. You will need to verify or modify the version name for each of the following files:
 - a. **RiftotSas.csv**
 - b. **AllDstEntSas14.csv**
 - c. **AllRqmtsSas14.csv**
 - d. **AllInitInvSas14.csv**
 - e. **AllDistroSas14.csv**
 - f. **AllRateSas15correct.csv**
 - g. **AfilSas14.csv**
10. Go to the “Run” menu and select “Submit.”

After completion of the model, the SAS program will display in its “Results Viewer” a SAS output. You should look at the *Solution Status* of this output and check for one of the following:

1. *Optimal*. This means the program executed successfully and all the output files that were generated are valid.
2. *Out-of-memory*. The program did not have sufficient memory. If you are running a 32-bit SAS program, you will need to upgrade to 64-bit SAS. If you are already using 64-bit SAS, the model cannot solve the problem as presented.
3. *Infeasible*. This means that no feasible solution exists to the problem (because any solution presented would violate one of the constraints). As an example, one of the constraints enforces that inventory can never fall below zero (i.e., you cannot have a negative number of personnel). However, if the current inventory for a given category in a given year is 10 and the input files try to force-transfer 15 people out of that category into another category, this will lead to an infeasible solution. You should examine

¹⁴ Chapter Five contains code excerpts and highlights of exactly what needs to be changed to help guide you in verifying or modifying the version inputs for each appropriate input file.

inventory levels as compared with forced transfers and RIFs as a starting place to find any infeasible inputs. If the solution is not there, you will have to investigate and diagnose the infeasibility.

At this point, provided the model run completes with an optimal solution status, you have successfully completed a model run.

SAS Code Method Model Output

Unfortunately, we do not have a tool that automatically generates PowerPoint charts for analysis, but we hope to provide this capability in the next FY. However, one could create RL/BL charts in Excel for each combination of component, rcat, and MWS by using two of the output files. Therefore, we provide a brief description about each of the output files and a short summary of how one can create RL/BL charts using each file:

1. **goodprod.csv** shows the input production numbers that were used in the model run to act as the upper bound on production (when the *npslb* parameter is less than one). Otherwise, this file shows the production values that were set equal to the production variable.
2. **goodrqmts.csv** shows the input requirements that were used in the model run.
3. **ptrans.csv** shows which forced transfers were executed.
4. **vrifs.csv** shows which RIFs were executed.
5. **svall.csv** shows the survival rates (1 – loss rates) for all of the categories in each CYOS for each FY.
6. **vinven.csv** specifies the projected inventory of personnel in each future FY.
7. **ventry.csv** specifies the projected production of personnel that occurred in each future FY (which will be equal to the values in **goodprod.csv** if the *npslb* parameter is equal to one).
8. **vseps.csv** specifies the projected losses of personnel that occurred in each future FY.
9. **allafil.csv** specifies the projected affiliations that will occur from one component to another by CYOS, FY, rcat, and icat.
10. **allasgn.csv** specifies the number of assignments of personnel to the requirements that occurred each FY.

To create a RL/BL chart, you first create a pivot table from the **goodrqmts.csv** file that contains the component, rcat, and MWS of interest as filters; FY in the corresponding column; and sum requirements. This creates your red-line data. To generate the inventory data, you create a pivot table from **vinven.csv** with component, rcat, and MWS of interest as filters; FY in the corresponding column; and sum inventory. This creates your blue-line data. Now create an Excel chart with FY on the horizontal axis and plot requirements as a red-line and inventory as a blue-line. Repeat this exercise for each combination of component, rcat, and MWS.

Chapter Three. High-Level Model Description

The TFBL model was designed to help the USAF meet the manpower needs of the future more effectively. As recruitment, education, and training require substantial time and resources, the ability to plan is crucial to meeting expected requirements in the rated community. By capturing dynamics of current inventory, future demands, separations, and affiliations, the TFBL model projects inventory to meet forecasted demand when it can and minimizes unmet requirements when it cannot.

The objective of the model is to adopt a forward-looking perspective to identify the number of personnel to assign to positions within a category, where a position is defined by an rcac (i.e., pilot, CSO, ABM, RPA pilot); a component (RegAF, AFR, or ANG); and a MWS or AFS (e.g., bomber, fighter, 11M, etc.). The model finds the best solution such that the number of unfilled positions is minimized and the number of officers assigned to a position is maximized while producing the fewest number of officers possible.¹

Model Flow

The inventory of personnel for a particular FY is calculated as follows: Starting with the inventory from the previous year, add the production of the current year, subtract the number of personnel who have separated during the current year, add in those who have affiliated (into AFR or ANG), and either add or subtract those personnel who have been transferred into or out of each category. Figure 3.1 illustrates this calculation for the fiscal year “fy.”

¹ The model is a linear program and not an integer program. Thus, solutions will contain fractions of personnel being produced, lost, and available in the inventory. There are many practical reasons why we use a linear program and not an integer program, and that value is greater than the complexity required to have integer solutions.

Fiscal Year

fy-1		fy
-------------	--	-----------

$$\text{Inventory in } \text{fy} = \text{Inventory in } \text{fy-1} + \text{Production in } \text{fy} - \text{Separations in } \text{fy} + \text{Affiliations for ARC in } \text{fy} \pm \text{Transfers in } \text{fy}$$

Several pieces of input data enable the calculation in Figure 3.1 to occur, and we use FY = 2015 to illustrate:

- The end-of-FY 2014 initial inventory of personnel in the light blue circle (found in **AllInitInvSas14.csv**).
- The maximum number of personnel who will be produced in FY 2015 and the number of personnel who are available for assignment in CYOS = 0 in the green circle (production found in **AllDistroSas14.csv**, CYOS = 0 entries found in **CYOS0Inv.csv**).
- The FY 2015 separation rate applied to the end-of-FY 2014 inventory plus the number of FY 2015 RIFs results in the number of FY 2015 separations in the red circle (separation rates found in **AllRateSas15correct.csv**, RIFs found in **RiftotSas.csv**).
- The maximum affiliation rate applied to the FY 2015 separations from the RegAF to determine the number of personnel affiliating to the AFR or ANG in FY 2015 in the dark blue circle (found in **AfilSas14.csv**).

- Transferring personnel from one category to another in FY 2015, including the ALFA tours² and RegAF mobility pilots transferring to RegAF SO in the orange circle (found in **ForceTrans14.csv**).

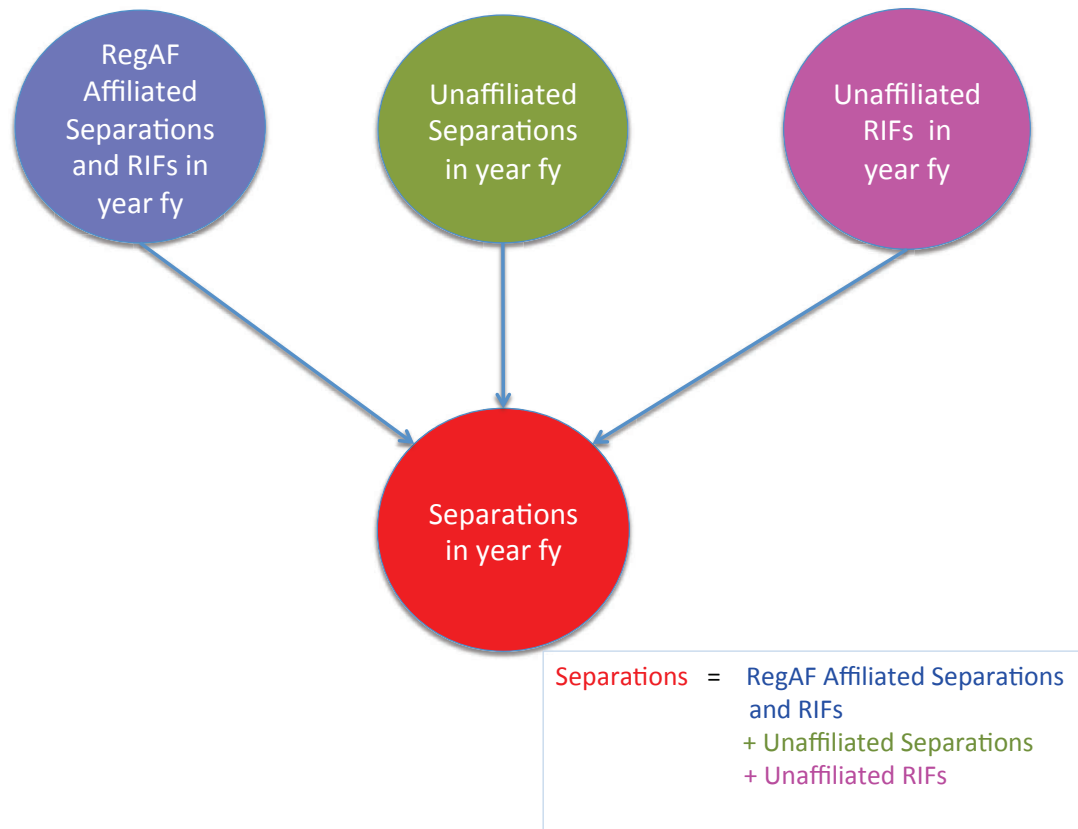
Figure 3.1 is the heart of the model, and it is easy to understand this when you think about it sequentially, in that you can “solve” each future year by knowing or having solved the previous year(s), starting with the FY after the initial inventory is defined.

Figure 3.2 hints at the complexity of bringing together the Total Force in this model. Affiliations to the ARC in a given FY must first have separated or been force-shaped from the RegAF as shown in the blue circle. When determining RegAF separations, the blue and green circles will have non-zero values, meaning that you will have some separations affiliating to the ARC and some separations leaving the USAF altogether. Those leaving the Air Force altogether are placed into the “Unaffiliated Separations” category (in the green circle). Those personnel who are force-shaped are allowed to affiliate and are therefore included in the blue circle. Those personnel who are forced-shaped and do not affiliate are captured in the pink circle. To determine ARC separations (whether ANG or AFR), the blue circle will be zero, the pink circle will capture all of the RIFs, and the green circle will capture all remaining separations not resulting from force shaping.

The number of affiliations, in the blue circle, is bounded below by zero and bounded above by a maximum percentage of separations. The maximum percentage is found in **AfilSas14.csv**. Current versions of these input data (e.g., version = AF151124) are based off of the average affiliation rate over FYs 1996–2015.

² Though the origin dates to the Vietnam era, the term *ALFA tour* is still used to describe assignments that are “bills” to be paid by the operational flying community (i.e., experienced aviators) (AFI 11-412). ALFA stands for ALO, LIFT, FAC, and AETC (Air Liaison Officer, Lead-In Fighter Training, Forward Air Controller, Air Education and Training Command).

Figure 3.2. Different Types of Separations



The last piece needed to understand what drives this model is what is being optimized. The model is designed to minimize the following five items:

1. The number of unfilled requirements, which can be thought of as providing an incentive to have the number of personnel be greater than or equal to the number of requirements.
2. The number of unassigned personnel, which can be thought of as providing an incentive to have the number of personnel be less than or equal to the number of requirements.
3. The number of officers produced, which can be thought of as providing an incentive to have the requirements be met with as few personnel in the inventory as possible.
4. The number of affiliations short from calculating affiliations using the historical affiliation rate, which can be thought of as providing an incentive to have the number of personnel affiliating to the ARC be greater than or equal to the number of affiliations calculated using the historical affiliation rate.
5. The number of affiliations in excess of affiliations calculated using the historical affiliation rate, which can be thought of as providing an incentive to have the number of

personnel affiliating to the ARC be less than or equal to the number of affiliations calculated using the historical affiliation rate.³

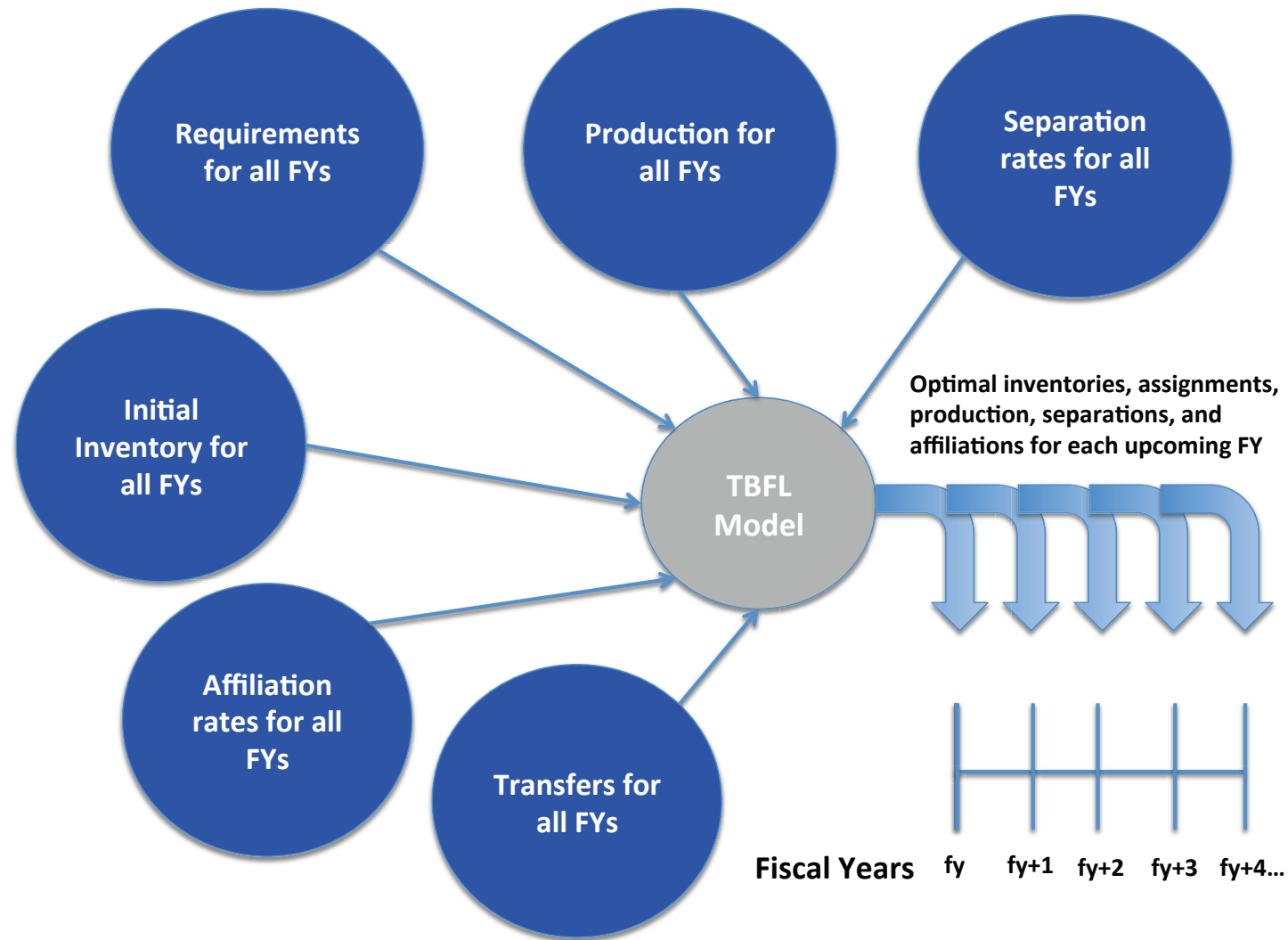
Note that the first two items result in the objective to have the inventory match the requirements exactly and the last two items result in the objective to have the affiliations match the affiliations derived from multiplying separations by the historical affiliation rate.

Mathematically, the number of personnel that the model assigns to a position plus the number of positions left unfilled will equal the number of Air Force requirements; for example, if the USAF requires five pilots and the model assigns three pilots, the number of assignments is three and the number of unfilled requirements is two. Similarly, the number of personnel without an assignment is the difference between the total inventory of personnel and the number of personnel that have been assigned to a position; for example, if there are ten pilots in the inventory and seven have been assigned, the number of personnel without assignment is three.

Lastly, all of the inputs discussed and shown in Figure 3.1 are input into the TFBL model, and we get optimized inventories, assignments, production (when *npslb* is less than 1.0), separations, and affiliations for each future FY. Figure 3.3 provides an overview of the model, which shows the inputs into the model and the projected and optimized output for each future FY.

³ Items 4 and 5 are saying that the historical distribution is the target for the affiliations. If the affiliations are greater than the target, you have excess. If the affiliations are less than the target, you have a shortage. The point is to minimize deviations from the target, and the model solution will deviate from the target only if the deviation penalty is smaller than that for not filling the ARC requirements or having excess ARC personnel.

Figure 3.3. General Overview of the TFBL Model



Chapter Four. Modeling Total Force Blue-Line Excursions

At some point, an analyst constructs a base case for the TFBL model. For the base case, the analyst assumes that then-current USAF policies and procedures will continue to be followed for the indefinite future, and that factors not controlled by the Air Force will behave according to the analyst's best estimates. In all likelihood, at least one community is not doing well—that is, not considered healthy—in the base case; perhaps the projected active duty fighter pilot inventory falls well short of the requirement (this has been a prominent aircrew management problem for decades). Perhaps there are problems in AFR or ANG. To investigate potential solutions to these problems, the analyst will define additional cases or excursions for the TFBL model, cases with different assumptions than the base case. The analyst may change production of certain categories of rated officers, or change retention patterns, or affiliation patterns, to name a few examples. Or the USAF may worry that some factor not controlled by the Air Force—e.g., the number of pilots hired by major airlines—will be less favorable to the USAF than assumed in the base case.

So how does the analyst define a case? More specifically, given some idea of what may happen in the real world, how does the analyst translate those real-world happenings into a complete set of input files for the TFBL model and the SAS program that will read them and generate the associated projections of future rated inventories? In this chapter, we relate some of our experiences answering these questions. We hope this will help other analysts to use and modify the model effectively.

Optimizing versus Forcing Production

In all versions of the TFBL model before May 2014, NPS production was set equal to data specified in the input dataset **AllDistroSas14.csv**. In late April and early May of that year, in preparation for the Aircrew Management Executive Council 14-2 meeting, the NPS production constraint was changed to be no more than the data specified in the same input dataset. This change was made because production numbers were not changing or being provided whenever there was a requirements change. Moreover, it seemed that the production numbers were out of sync with the requirements, thereby forcing production that was out of alignment with structure changes or otherwise unnecessary.

To make inputs from **AllDistroSas.csv** upper bounds, RAND modified the SAS code as shown in Code Excerpt 4.1.

Code Excerpt 4.1, from TFBL_Officer_140607.sas

```
* NPS accessions no larger than distro inputs ;  
CON c_distro{<ri,ci,si,fy> in s_ent: fy GT &fyfirst}:  
v_ent[ri,ci,si,fy] <= p_prod[ri,ci,si,fy];
```

The modification was changing the equality constraint into a $\leq$ constraint. With this modification presented in Code Excerpt 4.1, the model can lower production (v_ent) from p_prod to make the inventory match the requirements. This could result in several years of zero production to address an overage of personnel. However, it is unrealistic that a training course would be entirely shut down. So RAND introduced a new parameter ($npslb$) that the user should set to a value between 0.0 and 1.0. RAND also introduced a lower bound on NPS production, which is equal to p_prod times $npslb$. Code Excerpt 4.2 shows the modification:

Code Excerpt 4.2, from TFBL_Officer_140607.sas

```
* NPS accessions no smaller than fraction of distro inputs ;  
CON c_npslb{<ri,ci,si,fy> in s_ent: fy GT &fyfirst}:  
v_ent[ri,ci,si,fy] >= &npslb*p_prod[ri,ci,si,fy];
```

A user-entered value of 0.0 means that the lower bound on production is zero for each FY and the upper bound is the value entered in the **AllDistroSas14.csv** file. If the model sees the inventory level is above the requirements, it will lower production to make the inventory match the requirements in the long term. If the model sees the inventory level is below the requirements, the model will increase production to the upper bound to have all requirements met or meet requirements as best it can in the long term. If $0 < npslb < 1$, the lower bound is that number times the production values entered in **AllDistroSas14.csv**. If $npslb = 0.5$, the model will have more restricted flexibility and will force at least 50 percent of the production levels entered in **AllDistroSas14.csv**. If $npslb = 1.0$, the model has no flexibility and production is forced to be equal to the production levels entered in **AllDistroSas14.csv**. This parameter is one of the main drivers of health (inventory in relation to requirements and retention levels) for each rated community, and modifying programmed production levels can have significant and cascading effects far into the future, thereby making it one of the most important input factors in the RL/BL projections.

Matching Historical Affiliation Rates

The model is minimizing the deviation of affiliations from the historically derived affiliations, but this change is much more recent. To better portray how these two situations differ, we show the code excerpts and walk through some of the changes that occurred and provide the example that prompted this change. In **TFBL_Officer v6_150416.sas**, the objective function was as shown in Code Excerpt 4.3.

Code Excerpt 4.3, from TFBL_Officer v6_150416.sas

```
*****;  
* Objective function ;  
*****;  
MIN fill = (SUM{<ri,ci,si> in s_ivld, fy in s_fy} v_unasgn[ri,ci,si,fy])  
+ (SUM{<rb,cb,sb> in s_bvld, fy in s_fy} v_unfill[rb,cb,sb,fy])  
+ 0.01*(SUM{<ri,ci,si> in s_ivld, fy in s_fy} v_ent[ri,ci,si,fy]);
```

In words, for every unassigned rated officer (v_unasgn) and every unfilled requirement (v_unfill), the model assesses a one-unit penalty. Failing to fill a JSTARS ABM billet is penalized as much as failing to fill a fighter pilot billet. Failing to fill a RegAF billet is penalized no more than failing to fill an AFR or ANG billet. Failing to fill a billet in FY 2035 is penalized the same as failing to fill a billet in FY 2015. The production is weighted less than unassigned personnel and unfilled requirements because the USAF would rather have slightly higher production to have the inventory match requirements than not, especially since production is often forced to match the levels specified in **AllDistroSas14.csv**. If each icat could be assigned to only one beat, it would not matter whether the cost of failing to fill every billet was the same or different (meaning that RegAF mobility pilots could only fill RegAF mobility pilot requirements). However, there are icat that can be assigned to two or more beat (in reality, RegAF mobility pilots can fill RegAF mobility pilot requirements as well as unspecified pilot requirements), so the model can make unrealistic-looking choices because of these multiple options.

For example, the model allows RegAF fighter pilots to affiliate with AFR or ANG as 11F (fighter pilots) or 11K (trainer pilots).¹ Historically, RegAF fighter pilots mostly affiliate to the ARC as 11Fs (fighter pilots), but the model was choosing to affiliate an unhistorical share of them as 11Ks. We were asked to modify the model so it would produce affiliations that looked more like the historical record.

RAND modified the model as follows:

1. For each RegAF icat, read in the number of affiliations that occurred between FY 1997 and FY 2015 to each ARC icat and calculate the historical percentage for each kind of affiliation.
2. Introduce new constraints that calculate the amount by which model affiliations deviate from historical calculated affiliations.
3. Modify the objective function so that both positive and negative deviations from the historical calculated affiliations would be penalized.

Here are the before-and-after code excerpts (see Code Excerpts 4.4 through 4.6) that accomplish these steps. First, the code excerpt that read the allowed affiliations without historical

¹ There are some kinds of affiliations allowed which can be seen in **AllowTrans14MW.csv** and **AllTrans14.csv**, but these are the most common.

affiliation data (Code Excerpt 4.4) is presented and then the code excerpt with historical affiliation data (Code Excerpt 4.5) is presented with the changes highlighted.

Code Excerpt 4.4, from TFBL_Officer v6_150416.sas

```
*****;
* Allowed transfers from one inventory category to another ;
DATA AllowTran;
  LENGTH ri1 ci1 icat1 ri2 ci2 icat2 $ 8;
  INFILE "&folder\AllowTrans14.csv" DELIMITER=', ' FIRSTOBS=2;
  INPUT ri1 ci1 icat1 ri2 ci2 icat2 $;
RUN;
```

Code Excerpt 4.5, from TFBL_Officer v7_150503.sas

```
*****;
* Allowed transfers from one inventory category to another ;
DATA AllowTran;
  LENGTH ri1 ci1 icat1 ri2 ci2 icat2 $ 8;
  INFILE "&folder\AllowTrans14MW.csv" DELIMITER=', ' FIRSTOBS=2;
  INPUT ri1 ci1 icat1 ri2 ci2 icat2 $ hist;
RUN;
```

Next, the code that calculates the historical percentages of affiliations is presented in Code Excerpt 4.6, which can be summarized as adding up the historical affiliations to get the denominator and then calculating the historical percentage as the number of historical affiliations for each kind of affiliation (RegAF fighter pilot to ARC fighter pilot) divided by the total number of historical affiliations (RegAF fighter pilot historical affiliations over the total number of RegAF fighter pilots affiliations to the ARC).

Code Excerpt 4.6, from TFBL_Officer v7_150503.sas

```
* Normalize historical fractions ;
PROC SORT DATA=AllowTran; BY ri1 ci1 icat1; RUN;
DATA sumbyorig;
  SET AllowTran; By ri1 ci1 icat1;
  KEEP ri1 ci1 icat1 hsum;
  RETAIN hsum;
  IF FIRST.icat1 THEN hsum=0;
  hsum=hsum+hist;
  IF LAST.icat1 THEN OUTPUT;
RUN;
DATA AllowTranNorm;
  MERGE AllowTran sumbyorig; BY ri1 ci1 icat1;
  KEEP ri1 ci1 icat1 ri2 ci2 icat2 hfrac;
  hfrac=hist/hsum;
RUN;
```

Next, the block of constraints that calculates deviations of model affiliations from the historically derived affiliations is presented. The variables v_afpos are positive deviations (i.e., model affiliations are larger than historically derived affiliations), while v_afneg are negative deviations (model affiliations are smaller than historically derived affiliations). In Code

Excerpt 4.7, the historical percentages have been read into the parameter p_atran. The number affiliating according to the historical data is p_atran*(v_sep-v_unafil), while the model results say that the number affiliating is v_afil. Code Excerpt 4.7 was a new addition to the model.

Code Excerpt 4.7, from TFBL_Officer v7_150503.sas

```
* Penalize deviation of affiliations from historical distribution ;
CON c_histafil{<ri1,cil,sil,ri2,ci2,si2,fy> in s_hafil: fy GT &fyfirst}:
  p_atran[ri1,cil,sil,ri2,ci2,si2]*(SUM{cy in s_cy} v_sep[ri1,cil,sil,cy,fy])
  - p_atran[ri1,cil,sil,ri2,ci2,si2]
  * (SUM{cy in s_cy} v_unafil[ri1,cil,sil,cy,fy])
  - (SUM{cy in s_cy} v_afil[ri1,cil,sil,ri2,ci2,si2,cy,fy])
= v_afpos[ri1,cil,sil,ri2,ci2,si2,fy]
- v_afneg[ri1,cil,sil,ri2,ci2,si2,fy];
```

Lastly, the revised objective function is presented to now include the one-unit penalty for each model affiliation that differs from the historically derived affiliation, as shown in Code Excerpt 4.8.²

Code Excerpt 4.8, from TFBL_Officer v7_150503.sas

```
*****;
* Objective function ;
*****;
MIN fill = (SUM{<ri,ci,si> in s_ivld, fy in s_fy: fy GT &fyfirst}
  v_unasgn[ri,ci,si,fy])
  + (SUM{<rb,cb,sb> in s_bvld, fy in s_fy: fy GT &fyfirst}
  v_unfill[rb,cb,sb,fy])
  + 0.01*(SUM{<ri,ci,si> in s_ivld, fy in s_fy: fy GT &fyfirst}
  v_ent[ri,ci,si,fy])
  + (SUM{<ri1,cil,sil,ri2,ci2,si2,fy> in s_hafil: fy GT &fyfirst}
  v_afpos[ri1,cil,sil,ri2,ci2,si2,fy])
  + (SUM{<ri1,cil,sil,ri2,ci2,si2,fy> in s_hafil: fy GT &fyfirst}
  v_afneg[ri1,cil,sil,ri2,ci2,si2,fy]);
```

These model revisions appeared to have the desired effect. Once this feature was added, about 75 to 80 percent of RegAF fighter pilots in the model outputs affiliated to the ARC as 11Fs, aligning with the historical affiliation behavior, and a much smaller percentage of RegAF fighter pilots affiliated to the ARC to fill 11K requirements.

² The reader will note that there are some differences between Code Excerpts 4.3 and 4.8 besides the terms in Code Excerpt 4.8 that contain v_afpos and v_afneg. Those differences are the result of cleaning up the code. They had little influence on the model outputs overall, no influence on affiliations, and hence are irrelevant to the present discussion.

Major Airline Hiring Excursions³

It has long been the case that many pilots who leave the USAF do so to take jobs with civilian airlines. The airlines do not hire at a uniform rate; as is the case with many industries, airline hiring waxes and wanes with economic cycles and business expansion. The Air Force has a vested interest in these cycles because they affect pilot loss rates, which are higher when the airlines are hiring more pilots and lower when airlines scale back hiring. If the USAF focuses only on its own internal hiring demand for pilots, it might find itself short of pilots if the airlines substantially increase their hiring. For example, if the Air Force considered its internal hiring demand during times of low airline hiring, it might conclude that it had too many pilots and needed to scale back the number of pilots it was producing. But if the airlines had increased their hiring at the same time, more pilots might leave the USAF than anticipated, leaving the Air Force with a shortage of pilots rather than an overage. Recently, airline experts have predicted an upswing in the hiring of pilots, largely driven by mandatory retirements and anticipated major airline expansions. Thus, it is important to consider the impact major airline hiring (MAH) will have on future Air Force pilot losses.

The rest of this section explains several things, including the link between MAH and USAF pilot loss rates. As the next MAH surge has started affecting the Air Force, it is important that we are able to model the effect of the surge on USAF pilot losses. Before forecasting the potential effect, we discuss quantifying the MAH that is going to occur in the short term. Then, we modify the official AFRAMS baseline loss rate by CYOS and MWS, resulting in a MAH loss rate by CYOS and MWS. Once we have this MAH loss rate by CYOS and MWS, we can run TFBL excursions to see the potential effect on long-term pilot inventories and whether the USAF will need to increase production to mitigate the MAH losses.

Historical Relationship Between Hiring Surge and Loss of Air Force Pilots

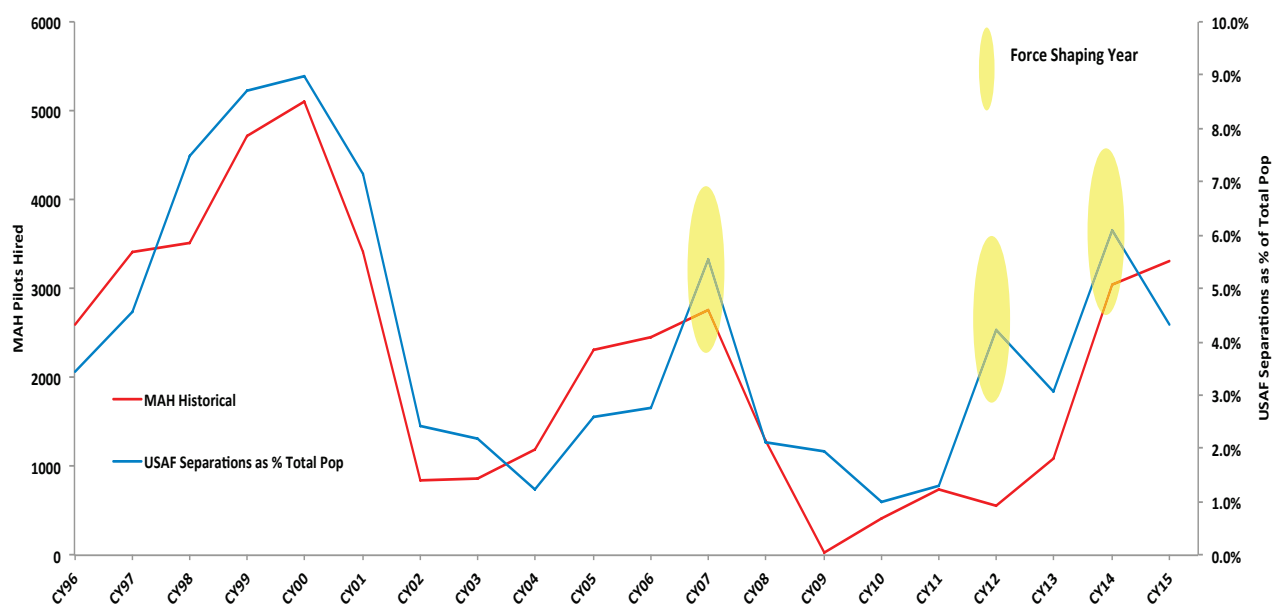
Researchers from RAND analyzed the historical relationship between periods of hiring by the major airlines and USAF pilot loss rates with an eye to predicting future Air Force pilot losses under different conditions of airline hiring. RAND determined the historical relationship between airline hiring and USAF pilot loss rates by comparing data on airline pilot hiring from 15 major passenger and cargo airlines with data on Air Force pilot losses from 1996 to 2015. Losses were drawn from the AFPC annual *Rated Officer Retention Analysis*,⁴ which places pilot losses into four categories: separations, retirements, promotions, and other (e.g., grounding).

³ The material in this section has largely been drawn from Michael McGee's Ph.D. dissertation at the Pardee RAND Graduate School. See Michael McGee, *Air Transport Pilot Supply and Demand*, thesis, Santa Monica, Calif.: The Frederick S. Pardee RAND Graduate School, 2015.

⁴ Air Force Personnel Center, "Air Force Personnel Statistics—Static Reports," web page, January 12, 2017. We drew losses from the report titled "End FY 2015 Rated Retention Report."

Focusing on separation losses, RAND determined the historical relationship between separation rates of RegAF pilots and actual airline hiring. Figure 4.1 shows the statistically significant historical relationship between historical MAH and USAF pilot separations.

Figure 4.1. Major Airline Hiring and USAF Pilot Separations, 1996–2015



SOURCE: McGee, 2015.
NOTE: CY = calendar year.

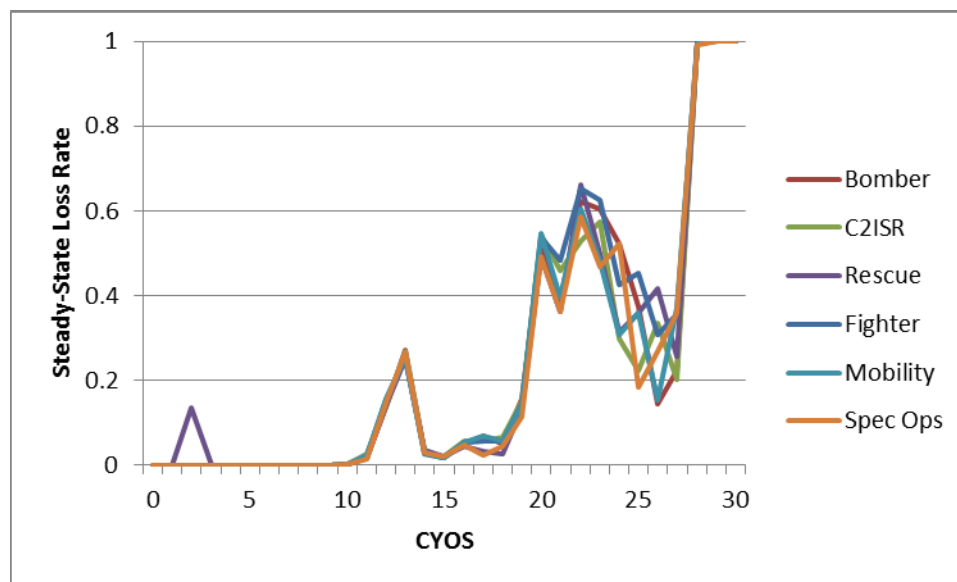
Projected Baseline Pilot Loss Rates

Pilot loss rates vary along multiple dimensions, e.g., by the number of CYOS. Pilot loss rates also vary by MWS. The Air Force simulation model, AFRAMS, projects future inventory levels for RegAF pilots. This model accounts for CYOS and MWS as well as retention behavior and likelihood of a pilot accepting a bonus in exchange for additional service based on historical data. AFRAMS models the RegAF rated officer population and produces the published (official) inventory level (and losses) for rated RegAF officers for 30 years into the future (FY 2016 to FY 2045). However, AFRAMS does not provide a forecast for the rated Total Force (including RegAF, AFR, and ANG officers). Therefore, as AFRAMS is the official blue-line, RAND incorporates the AFRAMS output within the TFBL model for the RegAF.⁵ To illustrate how we incorporate AFRAMS output into our methodology for evaluating the effect of MAH on pilot

⁵ The steady-state loss rates are derived from an AFRAMS output run on October 14, 2014, as described in the main text. The historical data used in this run to determine retention behavior were from FY 2006 to FY 2014. The aggregate bonus take rates were as follows: FY 2014: 60 percent, FY 2015: 58 percent, FY 2016: 56 percent, FY 2017: 54 percent, FY 2018 and onward: 52 percent.

inventory levels, we use AFRAMS projected steady-state loss rates (average loss rate from AFRAMS output for FY 2029 to FY 2045) by CYOS and MWS. The AFRAMS projected steady-state loss rates for each MWS were calculated as the projected total losses divided by the projected total inventory from AFRAMS by CYOS based on the output ranging from FY 2029 to FY 2045. Figure 4.2 shows the RAND-replicated, AFRAMS-predicted steady-state loss rate by CYOS and MWS for RegAF pilots.

Figure 4.2. Steady-State Loss Rates for Regular Air Force Pilots



SOURCE: AFRAMS run October 14, 2014, AF/A1PF.

CYOS is used as a proxy to identify points in time where officers are allowed to separate or retire from the USAF and potentially affiliate to the ANG or AFR. For example, pilots incur a ten-year active duty service commitment and are not allowed to separate from the Air Force before 10 CYOS. Pilots are allowed to separate from the RegAF and affiliate to the Guard or Reserve between 10 and 16 CYOS.⁶ Rated officers are not allowed to retire until approximately 20 CYOS. Figure 4.2 shows that almost no losses occur before 10 CYOS and that a large spike in losses occurs around 20 CYOS as officers become retirement-eligible.

Forecasted Major Airline Hiring Separations versus Baseline Loss Rates

Three things drive airline pilot hiring: the need to replace pilots who retire; the need to replace pilots who leave for reasons other than retirement (e.g., loss of medical clearance); and the need to provide pilots for airline expansion. To predict future pilot separation rates as

⁶ Analysis of historical affiliation data shows that almost no affiliations occur after 16 CYOS.

influenced by MAH, RAND researchers, based on Michael McGee’s work, used the MAH projections from FY 2016 to FY 2028, which can be seen in the MAH row in Table 4.1, and the formula below to establish the projected aggregate pilot MAH separation rate as a percentage. RAND researchers also defined three scenarios for airline hiring—low, middle, and high—which they did by drawing on various industry and academic studies, further enabling them to project low, middle, and high MAH separation rates for each year.⁷

Table 4.1. Effect of Major Airline Hiring on Air Force Pilot Loss Rate

	CY 2014	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025	CY 2026	CY 2027	CY 2028
MAH	2,139	3,037	3,479	3,485	3,680	3,306	4,302	4,695	4,782	4,540	4,509	4,909	4,823	4,264	4,603
% <19 CYOS Separation Rate	3.6	5.4	6.4	6.4	6.9	6.0	8.3	9.2	9.4	8.8	8.8	9.6	9.5	8.2	9.0

SOURCE: MAH row from McGee, 2015. Separation rates calculated by authors from AFRAMS results.

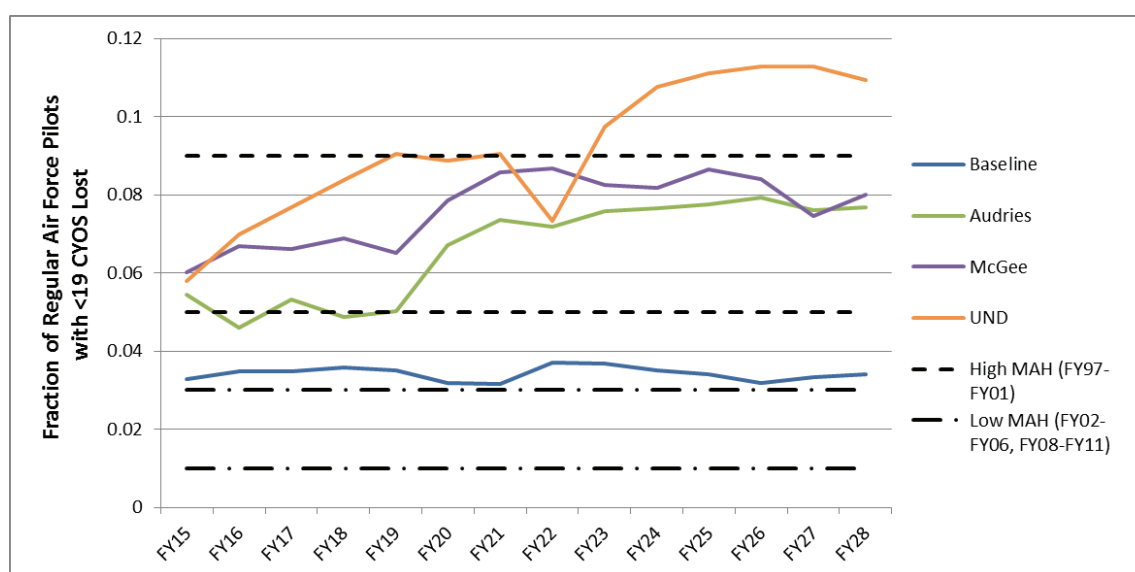
$$\text{Projected MAH Separation Rate (\%)} = \text{Projected MAH} \times \frac{\text{Historical Pilot Separation Rate (\%)}}{\text{Historical MAH}}$$

Researchers then estimated the aggregate percentage of RegAF pilots who had less than 19 CYOS (separation-eligible but not-retirement eligible) who would separate in each of the years FY 2016 through FY 2028, assuming that major airlines hired pilots at the projected rates over time (shown in the %<19 CYOS Separate row in Table 4.1). This is important because the regression analysis has shown a statistically significant relationship of increased pilot separations from pilots who are separation-eligible but not retirement-eligible (less than the 20 CYOS required for retirement eligibility) when the major airlines have increased their hiring. Figure 4.3 shows the loss rates that were calculated for each of the three scenarios and the projected baseline loss rate from AFRAMS. The low-loss scenario is derived from the Audries analysis in Harrison, 2013; the high-loss scenario is derived from the University of North Dakota (UND) analysis in Higgins, et al., 2013; and the middle-loss scenario was drawn from the McGee, 2015, analysis. The baseline scenario is derived from the AFRAMS output as described in the previous subsection.

⁷ Low: Brant Harrison, “Pilot Demand Projections/Analysis for the Next 10 Years,” *Audries Aircraft Analysis*, 1st Edition, 2013; middle: McGee, 2015; and high: James Higgins et al., *An Investigation of the United States Airline Pilot Labor Supply*, University of North Dakota, 2013.

You can see that the fraction of RegAF pilots who are not retirement eligible and who separate under the MAH scenarios is two to three times higher than in the baseline case. A historical analysis of the last MAH period (from FY 1997 to FY 2001) shows that the three airline hiring scenarios (Audries/McGee/UND) are within the highest and lowest separation rates seen during the last MAH period (“High MAH” in the legend),⁸ except UND, which predicts higher losses in FY 2023 and onward. If we compare the baseline loss rate with the highest and lowest separation rates seen during low MAH years (FYs 2002–2006 and FYs 2008–2011, excluding force shaping years FYs 2007, 2012, and 2014, and titled “Low MAH” in the legend), we see that the baseline loss rate is just above the highest separation rate seen during low MAH years. However, the baseline is also 1 to 2 percent below the lowest separation rate seen during the high MAH years. These results allow one to posit that if the airlines are going to increase hiring significantly, the baseline loss rate is conservative and could result in inventory levels that are far too optimistic.

Figure 4.3. Estimates of Future Regular Air Force Pilot Losses



SOURCE: McGee, 2015.

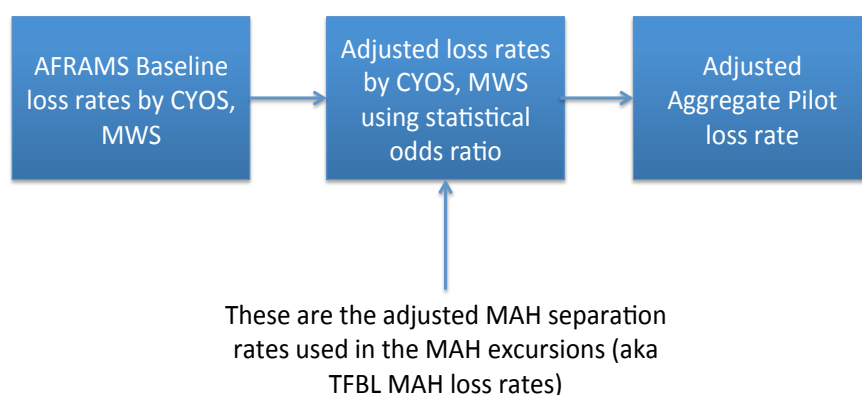
NOTE: The high MAH and low MAH lines show the minimum and maximum separation rates for the years stated to provide historic bounds. We did not include years in which force management actions were taken and thus we excluded FYs 2007, 2012, and 2014.

⁸ In Figure 4.3, the legend represents a time period while the lines represent the highest and lowest separation rates seen during the time period. As the two ranges of separation rates during the two distinct time periods (low MAH and high MAH) do not overlap, we used the same lines in the legend to bound the vertical range.

Projected Major Airline Hiring Pilot Loss Rates

Having developed a baseline loss rate and the percentage of pilots who would leave the USAF under various loss scenarios of airline hiring, the next task was to calculate Air Force loss rates by CYOS and MWS for each of the different cases of airline hiring. In short, researchers took the AFRAMS baseline pilot loss rate by CYOS and MWS and calculated the adjusted aggregate pilot loss rate by CYOS and MWS by using a standard statistical odds ratio formula solved for the adjusted aggregate pilot loss rate. This allowed RAND to calculate the aggregate adjusted loss rate (sum of adjusted losses by CYOS < 19 and MWS divided by sum of inventory across CYOS < 19 and MWS), where the odds ratio is such that the adjusted aggregate pilot loss rate is equal to the projected MAH separation rate provided in the earlier formula.⁹ An adjusted loss rate by CYOS < 19 and MWS was calculated for each airline hiring scenario. Figure 4.4 graphically depicts the mathematical procedure used to calculate MAH loss rates. Figure 4.5 shows the perturbed loss rates for RegAF fighter pilots in FY 2015 using the Audries, McGee, and UND (low, mid, and high) loss rates against the baseline loss rate. As Figure 4.5 shows, the loss rates can vary significantly depending on losses generated by increased MAH. For example, at year 12, loss rates can range from about 15 percent (0.15) in the baseline case to 25 percent (0.25) for the largest airline hiring scenario. Similar curves could be calculated for each type of pilot, and, for any given year, they could be aggregated to tell the USAF what the losses would be across all pilots. These results are similar for each kind of MWS.

Figure 4.4. Forecasting Effect of Major Airline Hiring



NOTE: The odds ratio is such that the adjusted aggregate pilot loss rate is equal to the projected MAH separation rate in the formula presented earlier.

⁹ The adjustment was done through a mathematical process call perturbation, which finds an approximate solution for a problem by starting from the exact solution for a related problem.

Figure 4.5. Adjusted Loss Rates for Regular Air Force Fighter Pilots

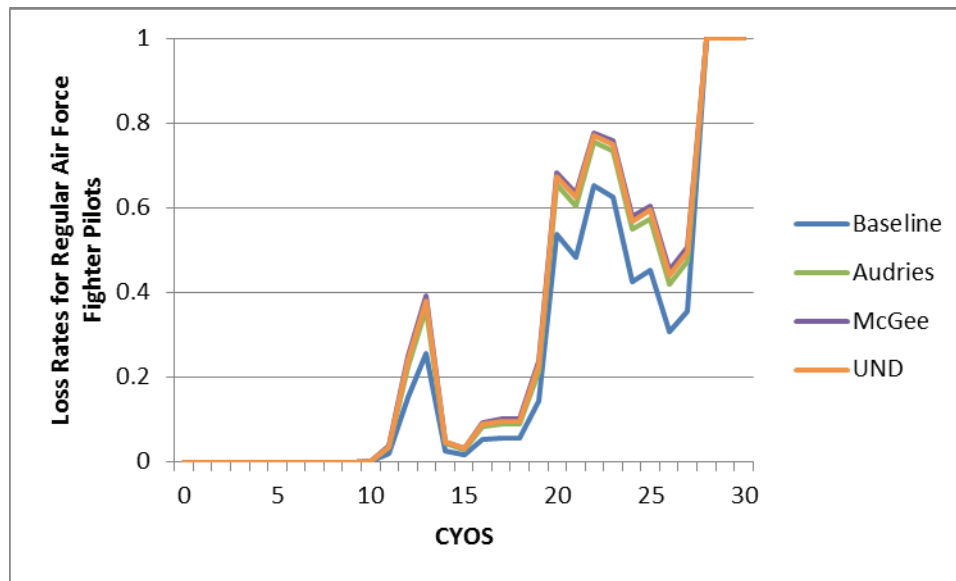
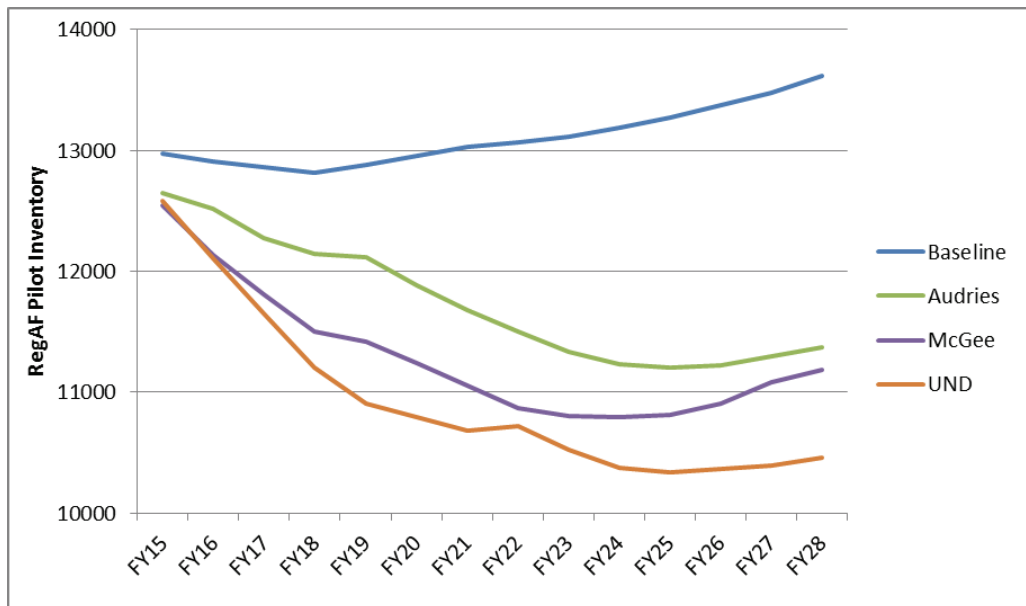


Figure 4.6 shows the resulting Air Force pilot inventories for each of the three airline hiring scenarios compared with the baseline.¹⁰ Given the similarity in loss rates (shown in Figure 4.5 for fighter pilots but consistent for all pilots) between the Audries/McGee/UND scenarios, it is not surprising that the shapes of the curves are similar. Note that each airline hiring scenario has a relatively steep decline from FY 2015 to FY 2022, indicating that USAF losses due to airline hiring are increasing during this time frame and production is not high enough to offset the losses. Then the inventory levels stabilize and start modestly increasing, but with notable differences among the three scenarios, which vary by close to 1,200 officers in FY 2019 (which is about 9 percent of the end-of-FY 2014 RegAF pilot inventory). Even in the scenario of the lowest expected airline hiring, this modeling predicts that there will be 325 fewer pilots in FY 2015 than in the current baseline model, which did not take into account forecasted airline hiring. In fact, the gap between the baseline inventory and the airline hiring inventories continues to grow over time, indicating a possible large and unanticipated shortfall of pilots if the USAF was to make no policy or production changes. This difference is a concern and shows the need to consider important and relevant outside influences on the Air Force inventory.

¹⁰ Unmanned pilots (11U) are categorized in RPA and are not included in any of the pilot calculations or inventories.

Figure 4.6. Inventory Levels for Different Airline Hiring Scenarios



Chapter Five. Model Inputs and Code Versions

This chapter describes the model inputs and specifies some code versions. This model requires a variety of input data, which are provided to the model in the form of “comma separated values” (.csv) files. The sources, assumptions, and organization of those .csv files are discussed below. Table 5.1 shows the name of the scalars, sets, and parameters, what each of them means, the component to which it belongs (if applicable), and the permitted range of values, which are important when specifying or creating input data that will be used in the model.

Table 5.1. Explanation of Sets, Scalars, and Parameter

Name	Meaning	Component	Allowed Range of Values
Scalars			
<i>cyfirst</i>	Lowest CYOS considered		[0, 1, ..., 30]
<i>cylast</i>	Highest CYOS considered		[0, 1, ..., 30]
<i>fyfirst</i>	First FY for the analysis		Any year
<i>fylast</i>	Last FY for the analysis		Any year
<i>npslb</i>	Lower bound on NPS production as a fraction of the maximum of NPS production allowed		[0,1]
version	Unique name given to identify distinct datasets		
Sets			
rcat	Rated category		{Plt, CSO, ABM, RPA}
compo	Component		{RegAF, AFR, ANG}
icat	Inventory category	RegAF, AFR, ANG	See Table 5.4
bcat	Requirement category	RegAF, AFR, ANG	See Table 5.2
cyos, cy	Commissioned years of service		[0, 1, ..., 30]
fy	Fiscal year under consideration		Any year
Parameters			
rqmt	The actual requirement amount		[0, infinity]
inven, asgn, prod, trans	The actual inventory, assigned inventory, production upper bound, and transfers		[0, infinity]
percentage	Percentage of the population		[0, 1]
production	The actual NPS production		[0, infinity]

Requirements

Two files are associated with requirements: (1) the file that specifies all the bcat that will be considered by the model and (2) the file that actually provides the number of requirements per

bcat. We now explain these two files in detail, provide code excerpts where appropriate, and descriptions of the most recent version of data used.

Valid Requirement Categories

The file **bvldSas14.csv** specifies the valid bcat for a particular model run. The full set of valid requirements categories can be found in Table 5.2. The first column specifies the rated category (rcat), the second column specifies the component (compo), and the third column specifies the MWS (bcat).

Table 5.2. Current Valid Requirement Categories

Rated Category (rcat)	Component (compo)	Major Weapon System (bcat)
ABM	AFR	r13B
		r13B
		rABCCC
		rAWACS
		rGround
		rJSTARS
CSO	AFR	rUnspec
		r12B
		r12F
		r12G
		r12H
		r12K
CSO	ANG	r12M
		r12R
		r12S
		r12B
		r12F
		r12G
CSO	RegAF	r12H
		r12K
		r12M
		r12R
		r12S
		rBmb
Plt	AFR	rC2ISR
		rCSAR
		rFtr
		rMob
		rSO
		rUnspec
Plt	AFR	r11B
		r11E
		r11F
		r11G
		r11H
		r11K
Plt	AFR	r11M

Rated Category (rcat)	Component (compo)	Major Weapon System (bcat)
		r11R
		r11S
Plt	ANG	r11B
		r11F
		r11G
		r11H
		r11K
		r11M
		r11R
		r11S
Plt	RegAF	rBmb
		rC2ISR
		rCSAR
		rFtr
		rMob
		rSO
		rUnspec
RPA	AFR	r18X
RPA	ANG	r18X
RPA	RegAF	rRPA

NOTE: Gray shading represents a new category (rcat or component).

Actual Requirements

The file **AllRqmtsSas14.csv** specifies the current and projected requirements for the categories specified in **blvdSas14.csv**. It is important to note that the actual requirements can come from a number of different potential data sources depending on what data the user has access to. The first column in **AllRqmtsSas14.csv** specifies the data source (version), the second column specifies the rcat, the third column specifies the component (compo), the fourth column specifies the MWS (bcat), the fifth column specifies the FY for the requirement (fy), and the sixth column specifies the requirement itself (rqmt). The most recent requirements data are explained here:

- AFR uses AFR151119: These requirements were provided by Lt Col Dawn Brindle (AF/A301) (**Tab 5 - AllRqmtsSAS15.csv**) and are accurate as of October 27, 2015.
- RegAF uses version AF151125TT or version AF151125IRTT: These requirements were provided by Capt Michael Thompson (AF/A1PF for the RegAF) (**FY16 RLBL - 20151102 (Sep 2015 Data) - with IR Req.xlsx**). The data for the non-IR¹ scenario are in the “Redline Conversion” tab. The IR requirement data can be calculated by adjusting these data with the factors in the “IR” tabs.

¹ IR means institutional requirements, which are USAF jobs that could be filled by any officer. Examples include recruiters, execs, instructors, etc. Previous requirement data sets did not factor in the rated tax for filling these USAF-wide requirements (hence labeled non-IR). As of November 2015, all requirements now include some proportion of IRs.

- ANG uses ANG151112: These requirements were provided by Lt Col Dawn Brindle for the ANG (NGB A1 Input - AllRqmtsSas14 (ANG).xlsx) and are accurate as of November 2, 2015.

If you are running the model using the SAS code method, to choose the appropriate data source for a particular model run, you must alter code found in **TFBL_Officer_vn_yymmdd.sas**. If you update the code, it is recommended that you change the date to match the current date of the excursion and make sure the appropriate version of the SAS code is being used. The specific code snippet that must be adjusted is highlighted below.

Code Excerpt 5.1, from TFBL_Officer_vn_yymmdd.sas

```
DATA Rqmts;
  LENGTH version $15 rcat compo bcat $8;
  INFILE "&folder\AllRqmtsSas14.csv" DELIMITER=', ' FIRSTOBS=2;
  INPUT version rcat compo bcat fy rqmt;
  IF (compo eq "RegAF") THEN DO;
    IF (version ne "AF151125TT") THEN DELETE;
  END;
  IF (compo eq "ANG") THEN DO;
    IF (version ne "ANG151112") THEN DELETE;
  END;
  IF (compo eq "AFR") THEN DO;
    IF (version ne "AFR151119") THEN DELETE;
  END;
  DROP version;
RUN;
```

If you add new requirements from different data sources to the file **AllRqmtsSas14.csv**, you should create a new corresponding version label in column one and can then use it in **TFBL_Officer_vn_yymmdd.sas** in the same manner. An example of the input found in **AllRqmtsSas14.csv** is seen in Table 5.3.

Table 5.3. Examples of Requirements

version	rcat	compo	bcat	fy	rqmt
R1404	ABM	AFR	r13B	2013	78
AF1308	ABM	AFR	r13B	2013	81
AF1409	ABM	AFR	r13B	2015	80

NOTE: Rqmt = requirement.

Inventory

There are two files associated with inventory: (1) the file that specifies all the inventory categories that will be considered by the model and (2) the file that actually provides the number of personnel per inventory category. We now explain these two files in detail, provide code excerpts where appropriate, and descriptions of the most recent version of data used.

Valid Inventory Categories

The file titled **ivldSas14.csv** specifies the valid personnel (inventory) categories for a particular model run. The full set of valid personnel categories can be found in Table 5.4. The first column specifies the rcat, the second column specifies the component (compo), and the third column specifies the MWS (icat).

Table 5.4. Current Valid Inventory Categories

Rated Category (rcat)	Component (compo)	Weapon System (icat)
ABM	AFR	13B
ABM	ANG	13B
ABM	RegAF	ABCCC
		AWACS
		Ground
		JSTARS
CSO	AFR	12B
		12F
		12G
		12H
		12K
		12M
		12R
		12S
CSO	ANG	12B
		12F
		12G
		12H
		12K
		12M
		12R
		12S
CSO	RegAF	Bmb
		C2ISR
		CSAR
		Ftr
		Mob
		SO
Plt	AFR	11B
		11E
		11F
		11G
		11H
		11K
		11M
		11R
		11S
Plt	ANG	11B
		11F
		11G
		11H
		11K
		11M
		11R
		11S
Plt	RegAF	Bmb
		C2ISR
		CSAR

Rated Category (rcat)	Component (compo)	Weapon System (icat)
		Ftr
		Mob
		SO
RPA	AFR	11U
		12U
		18X
RPA	ANG	11U
		12U
		18X
RPA	RegAF	RPA11 (Unmanned Plt)
		RPA12 (Unmanned CSO)
		RPA18 (18X)

NOTE: Gray shading represents a new category (rcat or component).

Actual Inventory

AllInitInvSas14.csv specifies the actual initial inventory for the categories of interest specified in **ilvdSas14.csv**. It is important to note that the actual inventory numbers can come from a number of different potential data sources depending on the data the user has access to. The first column in **AllInitInvSas14.csv** specifies the data source (version), the second column specifies the rcat, the third column specifies the component (compo), the fourth column specifies the MWS (icat), the fifth column specifies the CYOS for the inventory, and the sixth column specifies the inventory (inven).

If you are running the model using the SAS code method, to choose the appropriate data source for a particular model run, you must alter code found in **TFBL_Officer_vn_yymmdd.sas**. If you update the code, it is recommended that you change the date to match the current date of the excursion and make sure the appropriate version of the SAS code is being used. The specific code snippet that must be adjusted is highlighted below.

Code Excerpt 5.2, from TFBL_Officer vn_yymmdd.sas

```
DATA InitInv;
  LENGTH version $15 rcat compo icat $ 8;
  INFILE "&folder\AllInitInvSas14.csv" DELIMITER=',' FIRSTOBS=2;
  INPUT version rcat compo icat $ cy inven;
  IF (compo eq 'ANG') THEN DO;
    IF (version ne 'ANG151119') THEN DELETE;
  END;
  IF (compo eq 'AFR') THEN DO;
    IF (version ne 'AFR151119') THEN DELETE;
  END;
  IF (compo eq "RegAF") THEN DO;
    IF (version ne "AF160106") THEN DELETE;
  END;
  DROP version;
RUN;
```

If you add new inventories from different data sources to the file **AllInitInvSas14.csv**, you should create a new corresponding version label in column one and can then use it in

TFBL_Officer_vn_yymmdd.sas in the same manner. An example of the input found in AllInitInvSas14.csv is shown in Table 5.5.

Table 5.5. Examples of Initial Inventory

version	rcat	compo	icat	cyos	inven
R1401	Plt	RegAF	Bmb	0	0
R1401	Plt	RegAF	Bmb	1	9
R1401	Plt	RegAF	Bmb	2	40

Valid Assignments

PrefAsgnSas14.csv specifies the valid beat to which icat are allowed to be assigned, which is determined solely by the user. As an example, a person with an rcat of “Plt,” a component (compo) of “RegAF,” and an MWS (icat) of “Bmb” may be assigned to a beat of “Plt” (rcat), “RegAF” (compo), “rBmb” (beat). The first three columns specify the actual category of the person, and the following three columns specify the requirement to which that person could potentially be assigned. For each type of requirement that an officer can fill, there must be a row in this file to represent that assignment. The current list of valid assignments contained in **PrefAsgnSas14.csv** is shown in Table 5.6.

Table 5.6. Current Valid Assignments of Inventory Categories to Requirement Categories

Personnel Characteristics			Requirements Characteristics		
rcat	compo	icat	rcat	compo	beat
ABM	AFR	13B	ABM	AFR	r13B
ABM	ANG	13B	ABM	ANG	r13B
ABM	RegAF	ABCCC	ABM	RegAF	rABCCC
		AWACS	ABM	RegAF	Unspec
					rAWACS
					rGround
		Ground	ABM	RegAF	Unspec
					rGround
					Unspec
		JSTARS	ABM	RegAF	rJSTARS
					rGround
					Unspec
CSO	AFR	12B	CSO	AFR	r12B
		12F	CSO	AFR	r12F
		12G	CSO	AFR	r12G
		12H	CSO	AFR	r12H
		12K	CSO	AFR	r12K
		12M	CSO	AFR	r12M
		12R	CSO	AFR	r12R
		12S	CSO	AFR	r12S
CSO	ANG	12B	CSO	ANG	r12B
		12F	CSO	ANG	r12F
		12G	CSO	ANG	r12G
		12H	CSO	ANG	r12H
		12K	CSO	ANG	r12K

Personnel Characteristics			Requirements Characteristics		
rcat	compo	icat	rcat	compo	bcat
CSO	RegAF	12M	CSO	ANG	r12M
		12R	CSO	ANG	r12R
		12S	CSO	ANG	r12S
		Bmb	CSO	RegAF	rBmb
		C2ISR	CSO	RegAF	Unspec rC2ISR
		CSAR	CSO	RegAF	Unspec rCSAR
		Ftr	CSO	RegAF	Unspec rFtr
Plt	AFR	Mob	CSO	RegAF	Unspec rMob
		SO	CSO	RegAF	Unspec rSO
		11B	Plt	AFR	Unspec r11B
		11E	Plt	AFR	r11E
		11F	Plt	AFR	r11F
		11G	Plt	AFR	r11G
		11H	Plt	AFR	r11H
Plt	ANG	11K	Plt	AFR	r11K
		11M	Plt	AFR	r11M
		11R	Plt	AFR	r11R
		11S	Plt	AFR	r11S
		11B	Plt	ANG	r11B
		11F	Plt	ANG	r11F
		11G	Plt	ANG	r11G
Plt	RegAF	11H	Plt	ANG	r11H
		11K	Plt	ANG	r11K
		11M	Plt	ANG	r11M
		11R	Plt	ANG	r11R
		11S	Plt	ANG	r11S
		Bmb	Plt	RegAF	rBmb
		C2ISR	Plt	RegAF	Unspec rC2ISR
RPA	AFR	CSAR	Plt	RegAF	Unspec rCSAR
		Ftr	Plt	RegAF	Unspec rFtr
		Mob	Plt	RegAF	Unspec rMob
		SO	Plt	RegAF	Unspec rSO
		11U	RPA	AFR	Unspec r18X
		12U	RPA	AFR	r18X
		18X	RPA	AFR	r18X
RPA	ANG	11U	RPA	ANG	r18X
		12U	RPA	ANG	r18X
		18X	RPA	ANG	r18X
		RPA11	Plt	RegAF	Unspec
		RPA11	RPA	RegAF	rRPA
		RPA12	CSO	RegAF	Unspec
		RPA12	RPA	RegAF	rRPA
RPA	RegAF	RPA18	RPA	RegAF	rRPA

NOTE: Gray shading represents a new category (rcat or component).

Forced Transfers and Reductions

Two kinds of movements of personnel occur outside of the normal assignments process: force transfers and RIFs. The force transfers are useful to capture the movement of personnel from one icat to another that cannot be captured by assignments, such as leaving one AFSC and moving into another AFSC. The RIFs are meant to capture policy changes in the end strength that dictate abnormal losses not captured through the historical patterns of separations and retirements whereby personnel are forced to leave the USAF. We now explain these two files in detail, provide code excerpts where appropriate, and descriptions of the most recent version of data used.

Force Transfers

ForceTrans14.csv specifies programmed transfers from one rcat to another by CYOS and FY. The first column in **ForceTrans14.csv** specifies the version number, the second column specifies the original rcat, the third column specifies the original component (compo), the fourth column specifies the original MWS (icat), the fifth column specifies the new rcat, the sixth column specifies the new component (compo), the seventh column specifies the new MWS (icat), the eighth column specifies the CYOS, the ninth column specifies the FY of transfer, and the tenth column specifies the transfer amount (inven). It is up to the user to define any force transfers that cannot be handled by the assignment process within the model. The below list contains the important information about the current force transfer data used in the modeling:

- Version AF151125 is based on **20151109_ALFA_TFM_Project_Table.xlsx**. This version is updated to reflect both current ALFA tour numbers and to ensure that the return of these personnel to their home AFS is feasible within the TFBL model.
- The data contain 42 RegAF Plt Mob personnel transferring to RegAF Plt SO each year permanently distributed across CYOS 5 through CYOS 14 based on historical data. The historical data used to determine the distribution by CYOS came from **SOF Cross-flow FY10-FY14.xlsb**, which was provided by Lt Col Mark Wernersbach.
- Data contains RegAF Plt Mob transferring to RegAF RPA RPA11 at CYOS 5 for a four-year ALFA tour and then transferring back at CYOS 9 (subtracting any losses occurring during that time, if eligible, and the 10 percent of personnel likely to remain in RPA11 after the four-year tour). The data and computations that resulted in the Mob to RPA11 back to Mob transfers can be found in **A3OI Listing 6 Jan 15 v8.xlsx**. **A3OI Listing 6 Jan 15 v8.xlsx**² is a collaborative product that contains inventory information provided by Lt Col Dawn Brindle about the ALFA tour officers as of September 30, 2014, CYOS information pulled by RAND for each of these officers, and calculations to age and separate the officers to determine how many are transferred back.

² AF/A3XI Total Force Aircrew Management used to be AF/A3OI prior to the re-organization.

Table 5.7 shows a subset of the two kinds of transfers described above, which can be found in **ForceTrans14.csv**.

Table 5.7. Examples of Force Transfers

From Inventory				To Inventory					
version	rcat	compo	icat	rcat	compo	icat	cyos	fy	inven
AF151125	Plt	RegAF	Mob	Plt	RegAF	SO	5	2015	3
							6	2015	9
							7	2015	7
AF151125	Plt	RegAF	Mob	RPA	RegAF	RPA11	5	2015	110
								2016	100
								2017	88
AF151125	RPA	RegAF	RPA11	Plt	RegAF	Mob	9	2019	98
								2020	89
								2021	79

NOTE: Gray shading represents a new category (rcat or component).

Reductions in Forces

RiftotSas.csv specifies programmed RIFs, which are distributed to different CYOS in each FY. It is important to note that the model allows for different programmed reduction cases. The first column in **RiftotSas.csv** specifies the reduction case (version), the second column specifies the rcat, the third column specifies the component (compo), the fourth column specifies the MWS (icat), the fifth column specifies the CYOS, the sixth column specifies the FY, and the seventh column specifies the reduction amount (inven). It is up to the user to define any programmed reductions as input into the model. The reduction cases that have been defined so far and are contained in **RiftotSas.csv** are explained here:

- RIF: The 2014 defined reduction in forces.
- RIF v5: Implements a slightly revised version of RIF to eliminate an infeasibility in JSTARS.
- NoRIF: Do not implement the RIF in the current model run.

If you are running the model using the SAS code method, to choose the appropriate data source for a particular model run, you must alter code found in **TFBL_Officer_vn_yymmdd.sas**. If you update the code, it is recommended that you change the date to match the current date of the excursion and make sure the appropriate version of the SAS code is being used. The specific code snippet that must be adjusted is highlighted.

Code Excerpt 5.3 from _ TFBL_Officer vn_yymmdd.sas

```
DATA riftot;
  LENGTH version $15 rcat compo icat $8.;
  KEEP rcat compo icat cy fy riftot;
  INFILE "&folder\RiftotSas.csv" DELIMITER=',' FIRSTOBS=2;
  INPUT version rcat compo icat cy fy riftot;
  IF (version ne 'NoRIF') THEN DELETE;
RUN;
```

If you add new reduction cases to the file **RiftotSas.csv**, you should create a new corresponding label in column one and can then use it in **TFBL_Officer_vn_yymmdd.sas** in the same manner. A subset of the RIF data is shown in Table 5.8.

Table 5.8. Examples of RIF

version	rcat	compo	icat	cyos	fy	inven
NoRIF	Plt	RegAF	Bmb	6	2014	0
RIF	ABM	RegAF	AWACS	6	2014	17
RIF	CSO	RegAF	Bmb	12	2014	1

Production

Three files are associated with production: (1) the file that specifies into which CYOS each newly produced officer in each FY will be placed, (2) the programmed NPS production across the Future Years Defense Program, and (3) the number of officers entering the USAF with wings in CYOS 0 to match entering personnel accounted for by AFRAMS. We now explain these three files in detail, provide code excerpts where appropriate, and descriptions of the most recent version of data used.

Distribution of NPS Production Across CYOS

AllDstEntSas14.csv specifies the distribution of NPS production over CYOS at entry for CYOS 0 through 6.³ As an example, if there are ten rated officers produced for a specific icat and this file specifies that the distribution is 0.10 (0), 0.20 (1), 0.20 (2), 0.20 (3), 0.10 (4), 0.10 (5), 0.10 (6), there will be one person who accesses with 0 CYOS, two people who access with 1 CYOS, etc. The first column in **AllDstEntSas14.csv** specifies the data source (version), the second column specifies the rcat, the third column specifies the component (compo), the fourth column specifies the MWS (icat), the fifth column specifies the CYOS for the distribution, and the sixth column specifies the percentage of the accession that goes to this CYOS. The most recent production data are explained here:

- AF151124: This version is an update of previous versions and now contains FY 2014 and FY 2015 data that were added to the data set that is used to calculate the historical distribution of NPS production over CYOS at entry for CYOS 0 through 6.

³ This accounts for the time it takes to complete initial training and likely includes any other interruptions to the training pipeline that an individual might face. Historical data show that most officers complete the training and earn their wings before CYOS 4, but we include the full distribution through CYOS 6.

If you are running the model using the SAS code method, to choose the appropriate data source for a particular model run, you must alter code found in **TFBL_Officer_vn_yymmdd.sas**. If you update the code, it is recommended that you change the date to match the current date of the excursion and make sure the appropriate version of the SAS code is being used. The specific code snippet that must be adjusted is highlighted in Code Excerpt 5.4.

Code Excerpt 5.4, from TFBL_Officer vn_yymmdd.sas

```
DATA DstEnt;
  LENGTH version $15 rcat compo icat $ 8;
  INFILE "&folder\AllDstEntSas14.csv" DELIMITER=',' FIRSTOBS=2;
  INPUT version rcat compo icat $ cy frac;
  IF (compo eq "RegAF") THEN DO;
    IF (version ne "AF151124") THEN DELETE;
  END;
  IF (compo eq "ANG") THEN DO;
    IF (version ne "AF151124") THEN DELETE;
  END;
  IF (compo eq "AFR") THEN DO;
    IF (version ne "AF151124") THEN DELETE;
  END;
  DROP version;
RUN;
```

If you add new distributions from different data sources to the file **AllDstEntSas14.csv**, you should create a new corresponding label (version) in column one and can then use it in **TFBL_Officer_yymmdd.sas** in the same manner. A subset of the input data found in **AllDstEntSas14.csv** is shown in Table 5.9.

Table 5.9. Examples of Production Distribution Across Early CYOS

version	rcat	compo	icat	cyos	percentage
R1404	ABM	AFR	13B	0	0
R1404	ABM	AFR	13B	1	0.38028169
R1404	ABM	AFR	13B	2	0.23943662
R1404	ABM	AFR	13B	3	0.126761
R1404	ABM	AFR	13B	4	0.112676
R1404	ABM	AFR	13B	5	0.070423
R1404	ABM	AFR	13B	6	0.070423

NPS Production

AllDistroSas14.csv specifies the NPS production for each category for each year from *fyfirst* through *fylast*. The first column in **AllDistroSas14.csv** specifies the data source (version), the second column specifies the rcat, the third column specifies the component (compo), the fourth

column specifies the MWS (icat), the fifth column specifies the FY, and the sixth column specifies the production. The most recent production data are explained here:

- AFR uses AFR151120: These data reflect the AFR production available based on the low accessions available in the rated trained personnel requirement (TPR) in early FY 2016. The source file for these data is **TF_Production_Nov-2015vTPR.xls**.
- ANG uses ANG151120: These data reflect the ANG production available based on the low accessions available in the TPR in early FY 2016. The source file for these data is **TF_Production_Nov-2015vTPR.xls**.
- RegAF uses AF151120TPR or AF151124A3OI to result in two production excursions. AF151120TPR reflects RegAF production available based on the low accessions available in the TPR in early FY 2016. The FY 2016/2017 production numbers are adjusted to account for the number of individuals sitting in the Break-In-Training (BIT) pool. The source file for these data is **TF_Production_Nov-2015vTPR.xls**. AF151124A3OI reflects RegAF production available based on the AF/A3XI Total Force Aircrew Management expected production (as of November 2016). The FY 2016/2017 production numbers are adjusted to account for the number of individuals sitting in the break-in training (BIT) pool. The source file for these data is **TF_Production_Nov-2015vA3OI_2.xls**.

If you are running the model using the SAS code method, to choose the appropriate data source for a particular model run, you must alter code found in **TFBL_Officer_vn_yymmdd.sas**. If you update the code, it is recommended that you change the date to match the current date of the excursion and make sure the appropriate version of the SAS code is being used. The specific code snippet that must be adjusted is highlighted.

Code Excerpt 5.5, from **_ TFBL_Officer vn_yymmdd.sas**

```
DATA Distro;
  LENGTH version $15 rcat compo icat $ 8;
  INFILE "&folder\AllDistroSas14.csv" DELIMITER=', ' FIRSTOBS=2;
  INPUT version rcat compo icat fy prod;
  IF (compo eq "RegAF") THEN DO;
    IF (version ne "AF151120TPR") THEN DELETE;
  END;
  IF (compo eq "ANG") THEN DO;
    IF (version ne "ANG151120") THEN DELETE;
  END;
  IF (compo eq "AFR") THEN DO;
    IF (version ne "AFR151120") THEN DELETE;
  END;
  DROP version;
RUN;
```

If you add new production from different data sources to the file **AllDistroSas14.csv**, you should create a new corresponding label (version) in column one and can then use it in **TFBL_Officer_vn_yymmdd.sas** in the same manner. An example of the input found in **AllDistroSas14.csv** is shown in Table 5.10.

Table 5.10. Examples of Production

version	rcat	compo	lcat	fy	production
AF1308	Plt	RegAF	Ftr	2015	225
AF1308	Plt	RegAF	Ftr	2016	235
AF1308	Plt	RegAF	Ftr	2017	243

CYOS 0 Entries

CYOS0Inv.csv specifies the number of officers entering into an AFSC at CYOS 0. This allows for entries into the model in a specified CYOS that will not be distributed between CYOS 0 to 6 like NPS produced officers, which occurs in **AllDstEntSas14.csv**. As an example, AFRAMS results show ten officers each year entering the RegAF CSAR pilot AFS at CYOS 0 representing ten Army officers the USAF receives. The data contained in this file are intended to allow for entries coming from special programs and allow for a closer match to AFRAMS input data assumptions. The first column in **CYOS0Inv.csv** specifies the version name, the second column specifies the rcat, the third column specifies the component (compo), the fourth column specifies the MWS (lcat), the fifth column specifies the FY, and the sixth column specifies the inventory (inven). An example of the input found in **CYOS0Inv.csv** is shown in Table 5.11.

Table 5.11. Examples of CYOS 0 Entries

version	rcat	compo	lcat	fy	inven
AF151125	CSO	RegAF	Bmb	2022	2
AF151125	Plt	RegAF	CSAR	2020	10
AF151125	CSO	RegAF	C2ISR	2015	1

Losses

AllRateSas14.csv specifies the loss rate for each lcat (e.g. RegAF fighter pilot) for each CYOS. The loss rates differ by CYOS to ensure we mimic the real world, where:

- there are minimal losses while under the initial active duty service commitment (e.g., ten years for a pilot)
- large losses in the years immediately after the initial active duty service commitment ends
- larger losses again after the five-year follow-on active duty service commitment expires for pilots
- large losses at CYOS 19 and 20 to account for retirement losses.

There are two kinds of loss rates used: a baseline loss rate (or the base case) and the MAH loss rates (MAH excursions). The baseline loss rates used for the RegAF have been calculated using one of the two following methods:

- the average steady-state loss rates from an official AFRAMS model run where the average steady-state loss rate (for the last 15 years of the AFRAMS projected inventory and losses) is used for each year the TFBL model runs, or
- the exact AFRAMS loss rates for each FY for some number of years in the beginning (FYs 2016–2022 in recent runs) and then the average steady-state loss rate used for the later years (FY 2023 and onward in recent runs).

The MAH loss rates used for the RegAF have been calculated as described in the MAH excursions section in Chapter Four. However, the MAH loss rates require a baseline loss rate upon which to initialize the calculations. Thus, as there are two kinds of baseline loss rates described, there is a corresponding MAH loss rate: a MAH loss rate based on the average steady-state AFRAMS loss rate and a MAH loss rate based on the exact AFRAMS loss rates for FYs 2016–2022 and then the average steady-state AFRAMS loss rate for FY 2023 and onward.

The first column in **AllRateSas14.csv** specifies the data source (version), the second column specifies the rcat, the third column specifies the component (compo), the fourth column specifies the MWS (icat), the fifth column specifies the CYOS, the sixth column specifies the FY, and the seventh column specifies the loss rate (percentage). The most recent loss rate data are explained here:

- AF160106BLTPR: This version contains the loss rates for the RegAF for the baseline loss rates based on the Trained PR production projected by Total Force Strategic Studies and Officer Force Management (AF/A1PF). The AFRAMS output files that were used to calculate the loss rates are dated December 10, 2015, and were provided by Capt Michael Thompson (**AFRAMS_RPA_151210_TPR.xlsx**, **AFRAMS_PLT_151210_TPR.xlsx**, **AFRAMS_NAV_151210_TPR.xlsx**, and **AFRAMS_ABM_151210_TPR.xlsx**).
- AF160106BLA3O: This version contains the loss rates for the RegAF for the baseline loss rates based on the AF/A3XI-requested production. The AFRAMS output files that were used to calculate the loss rates are dated December 10, 2015, and were provided by Capt Michael Thompson (**AFRAMS_RPA_151210_A3.xlsx**, **AFRAMS_NAV_151210_A3.xlsx**, **AFRAMS_PLT_151210_A3.xlsx**, and **AFRAMS_ABM_151210_A3.xlsx**).
- AF160108MAHTPR: This version contains the MAH loss rates for the RegAF based on the TPR scenario projected by AF/A1PF. These loss rates use **AFRAMS_PLT_151028 TPR exact AFRAMS LRs 160106.xlsx** to determine the factor that should multiply the baseline loss rate so that the aggregate loss rate for that FY matches McGee’s projected percent separation. When performing a MAH model run, this rate should be used for RegAF pilots and AF160106BLTPR should be used for RegAF non-pilots.
- AF160108MAHA3O: This version contains the MAH loss rates for the RegAF based on the AF/A3XI-requested production. These loss rates use **AFRAMS_PLT_151028 A3O exact AFRAMS LRs 160106.xlsx** to determine the factor that should multiply the baseline loss rate so that the aggregate loss rate for that FY matches McGee’s projected percent separation. When performing a MAH model run, this rate should be used for RegAF pilots and AF160106BLA3O should be used for RegAF non-pilots.
- AF160114: This version contains the loss rates for AFR and ANG. This version reflects the inclusion of FY 2014 and FY 2015 data to calculate the historical loss rates.

- AF160122MAH: This version contains the loss rates for AFR and ANG reflecting the MAH scenario. These loss rates use **AFR_ANG TPR LRs MAH 160122.xlsx** to determine the factor that should multiply the baseline AFR and ANG loss rates so that the aggregate loss rate for that FY matches McGee's projected percent separation. When performing a MAH model run, this rate should be used for AFR and ANG pilots and AF160114 should be used for AFR and ANG non-pilots.

If you are running the model using the SAS code method, to choose the appropriate data source for a particular model run, you must alter code found in **TFBL_Officer_vn_yymmdd.sas**. If you update the code, it is recommended that you change the date to match the current date of the excursion and make sure the appropriate version of the SAS code is being used. The specific code snippet that must be adjusted is highlighted in Code Excerpt 5.6 and this code represents a base case run.

Code Excerpt 5.6, from TFBL_Officer vn_yymmdd.sas

```
DATA Lrate;
  LENGTH version $20 rcat compo icat $ 8;
  INFILE "&folder\AllLrateSas15correct.csv" DELIMITER=', ' FIRSTOBS=2;
  INPUT version rcat compo icat $ cy fy rate;
  IF ((compo eq "RegAF") and (rcat eq "Plt")) THEN DO;
    IF (version ne "AF160108MAHTPR") THEN DELETE;
  END;
  ELSE IF ((compo eq "RegAF") and (rcat ne "Plt")) THEN DO;
    IF (version ne "AF160106BLTPR") THEN DELETE;
  END;
  ELSE IF (compo in ("AFR", "ANG")) THEN DO;
    IF (version ne "AF160114") THEN DELETE;
  END;
  DROP version;
RUN;
```

Note the first highlighted section is the version to use for the RegAF pilot categories. This is where you would enter in a MAH excursion version name and make sure the second highlighted section is the corresponding baseline loss rate for the non-pilots (CSO, ABM, RPA). If you are doing a base case run, the first and second highlighted sections should be the same. If you add new loss rates from different data sources to the file **AllLrateSas14.csv**, you should create a new corresponding label (version) in column one and can then use it in **TFBL_Officer_vn_yymmdd.sas** in the same manner. An example of the input found in **AllLrateSas14.csv** is shown in Table 5.12.

Table 5.12. Examples of Loss Rates for Inventory Categories by FY and CYOS

version	rcat	compo	icat	cyos	fy	percentage
Hhigh	Plt	RegAF	Bmb	3	2014	0.01227
Hhigh	Plt	RegAF	Bmb	4	2014	0.007143

Affiliations

There are three files associated with affiliations. Two of them are very similar and differ only by one column of additional data. One file specifies the kinds of affiliations that are allowed (e.g., a RegAF fighter pilot is allowed to affiliate to the ANG as an 11F), and the other similar file specifies the same kinds of allowed affiliations but also includes the total number of observed affiliations of that kind from FYs 1996–2015. The third file specifies the maximum affiliation rate allowed in the model. We will now explain these three files in detail, provide code excerpts where appropriate, and descriptions of the most recent version of data used.

Allowed Affiliations

These two files define from which RegAF icat officers are allowed to affiliate and to which AFR or ANG icat. **AllowTrans14.csv** is the original version of the file that is compatible with versions one through six of **TFBL_Officer vn_yymmdd.sas**. **AllowTrans14MW.csv** was created to provide the model with historical affiliation data for each of these allowed affiliations so that the model affiliation results would align more closely with historical affiliations. As an example, in the results that pertain to **2015-04-16_MARCH RUN_v3**, RegAF Plt Ftr affiliated mostly to AFR Plt 11K, when historically RegAF Plt Ftr affiliated mostly to AFR Plt 11F.

AllowTrans14MW.csv addresses this concern and is to be used with **TFBL_Officer vn_yymmdd.sas**.⁴ Please see the description in Chapter Four for more detail about these differences and the impact on the model run outputs.

AllowTrans14.csv specifies the allowed affiliations from the active component to the ARC. As an example a person in the category “ABM” (rcat), “RegAF” (compo), “AWACS” (icat) may be able to affiliate to the category “ABM” (rcat), “AFR” (compo), “13B” (icat) within the model run. Once a person affiliates, they are bound by the rules of their new icat in terms of which requirements they can fill and the likelihood of separation. The user must specify which affiliations are allowed. An example of the input from the file **AllowTrans14.csv** appears in Table 5.13.

⁴ Please note that you should either use **AllowTrans14.csv** with **TFBL_Officer vn_yymmdd.sas** for versions six or earlier or use **AllowTrans14MW.csv** with **TFBL_Officer vn_yymmdd.sas** for versions eight or later. You cannot use both and the AllowTrans file must coordinate with the .sas file.

Table 5.13. Examples of Allowed Affiliations from Inventory Categories in RegAF to Inventory Categories in the ARC

rcat	compo	icat	rcat	compo	icat
CSO	RegAF	Bmb	CSO	ANG	12B
CSO	RegAF	Bmb	CSO	AFR	12G
CSO	RegAF	Bmb	CSO	ANG	12G

AllowTrans14MW.csv specifies the allowed affiliations from the active component to the ARC and the number of times an affiliation of that kind occurred in the historical data from FY 1996 to FY 2015. As an example, an officer in the category “ABM” (rcat), “RegAF” (compo), “AWACS” (icat) is able to affiliate to the category “ABM” (rcat), “AFR” (compo), “13B” (icat), and this occurred 59 times. Once a person affiliates, they are bound by the rules of their new icat in terms of which requirements they can fill and the likelihood of separation. The user must specify which affiliations are allowed and incorporate the historical data. An example of the input from the file **AllowTrans14MW.csv** appears in Table 5.14.

Table 5.14. Examples of Allowed Affiliations from Inventory Categories in RegAF to Inventory Categories in the ARC with Historical Affiliations

version	rcat	compo	icat	rcat	compo	icat	obs
AF151125	CSO	RegAF	Bmb	CSO	ANG	12B	50
AF151125	CSO	RegAF	Bmb	CSO	AFR	12G	3
AF151125	CSO	RegAF	Bmb	CSO	AFR	12B	67
AF150525	ABM	RegAF	AWACS	ABM	AFR	13B	59

Maximum Affiliation Rates

AfilSas14.csv specifies the maximum rates at which RegAF rated officers can affiliate to AFR, ANG, and AFR+ANG by MWS between CYOS 0 and 16. A distinction is made to provide a maximum affiliation rate to the ARC, which does not have to be the summation of the maximum affiliation rate allowed for AFR and ANG separately (e.g., the maximum AFR affiliation rate may be 0.20 and ANG may be 0.20, but AFR+ANG may be 0.30. This means that if AFR had 20 percent of the RegAF affiliations, ANG could only have 10 percent of the RegAF affiliations). The first column in **AfilSas14.csv** specifies the data source (version), the second column specifies the rcat, the third column specifies the component (compo), the fourth column specifies the MWS (icat), the fifth column specifies the CYOS, the sixth column specifies the maximum AFR affiliation rate (percentage), the seventh column specifies the maximum ANG affiliation rate (percentage), and the eighth column specifies the maximum AFR+ANG affiliation rate (percentage). The available method that has been used to determine affiliation rates that have been placed in **AfilSas14.csv** to date are explained here:

- AF151124: These affiliation rates were calculated by RAND from the personnel files. These rates are an update to the previous versions as the data range from FY 1996 through FY 2015. Also, RAND updated the logic in calculating the historical affiliation rates to get more CYOS-specific affiliation patterns by using the rule of 30. If there were 30 or more affiliations in history for that specific CYOS, a CYOS-specific rate was used. If there were 29 or fewer affiliations, the rate used was the average affiliation rate across all CYOS.

If you are running the model using the SAS code method, to choose the appropriate data source for a particular model run, you must alter code found in **TFBL_Officer_vn_yymmdd.sas**. If you update the code, it is recommended that you change the date to match the current date of the excursion and make sure the appropriate version of the SAS code is being used. The specific code snippet that must be adjusted is highlighted.

Code Excerpt 5.8, from TFBL_Officer vn_yymmdd.sas

```
DATA arate;
  LENGTH version $15 rcat compo icat $8;
  INFILE "&folder\AfilSas14.csv" DELIMITER=',' FIRSTOBS=2;
  INPUT version rcat compo icat cy afilr afilg afiltot;
  IF (version ne 'AF151124') THEN DELETE;
  DROP version;
RUN;
```

If you add new affiliation rates from different methods to the file **AfilSas14.csv**, you should create a new corresponding label (version) in column one and can then use it in **TFBL_Officer_vn_yymmdd.sas** in the same manner. An example of the input found in **AfilSas14.csv** is shown in Table 5.15, which assumes AFR first, then ANG, and finally AFR+ANG for the percentages columns.

Table 5.15. Examples of Maximum Affiliation Rates by FY and CYOS from RegAF to ARC Inventory Categories

version	rcat	compo	icat	cyos	percentage	percentage	percentage
AVERAGE	Plt	RegAF	Bmb	11	0.38964	0.198198	0.587838
AVERAGE	Plt	RegAF	Ftr	12	0.358704	0.392615	0.751319

SAS Model Code

As the model evolves and additional capabilities are added, there is a need to create newer versions of the SAS model code. This section describes the versions of the SAS code for **TFBL_Officer_vn_yymmdd.sas** where *n* is a number and defines the version of the SAS code and ultimately the capabilities that you would like to include in the model.

- Version 1: Original version of the TFBL model. This version has the parameter *npslb* set equal to zero, meaning the production was being optimized in each model run.
- Version 2: This is identical to version 1 with the exception that *npslb* is set equal to one, forcing production to match the input data specified by the version name in **AllDistroSas14.csv**.
- Version 4: There was no loss rate being specified for RegAF non-pilots in version 2, so there were no losses for RegAF CSO, ABM, or RPA. The version 2 code was changed to allow specification of a loss rate version to use for RegAF non-pilots.
- Version 6: Changed the formula for how separations were calculated. Versions 4 and earlier have a separation calculation as follows: $v_sep[ri,ci,si,cy,fy] = v_inv[ri,ci,si,cy-1,fy-1]*(1-p_surv[ri,ci,si,cy-1,fy-1]) + v_rif[ri,ci,si,cy,fy]$. The separation calculation was changed to the following: $v_sep[ri,ci,si,cy,fy] = v_inv[ri,ci,si,cy-1,fy-1]*(1-p_surv[ri,ci,si,cy,fy]) + v_rif[ri,ci,si,cy,fy]$. The newer formula has loss rates consistent with the FY and CYOS in which the losses are realized.
- Version 8: Modified version 6 code to read in a new file called **AllowTrans14MW.csv** and changed the objective function to add the capability to encourage the affiliations happening in the model to occur, much like affiliations have in the past in terms of which ARC AFS officers affiliated into and the historical rates.
- Version 10: Modified version 8 code to read in a new file called **CYOS0Inv.csv** and set the appropriate inventory variables to the values read in from this file.
- Version 12: Modified version 10 code to address a second-order effect from the version 10 change to address non-zero affiliations in the CYOS 0 year group.
- Version 12: Modified version 12 code to add version name read-in capabilities to **AllowTrans14MW.csv** and **ForceTrans14.csv** input files and modified the code to allow different loss rate versions for the ARC to include the capability for MAH loss rates.

Chapter Six. Model Outputs

The Mercier Tool Method, as described in Chapter Two, produces one Excel workbook and one PowerPoint file. The Excel workbook contains a worksheet (or tab) for each of the output files discussed below when running the model using the SAS Code Method. Please refer to the discussion below to learn in more detail about each of the worksheets contained in the Excel workbook. When running the TFBL model using the SAS Code Method, there are a variety of output data created in the form of .csv files. The details of these .csv files are discussed below.

Output Files That Echo Input Files

It is often necessary to have the model echo or output several of the input data to ensure that the correct data are being entered and used in the modeling. In this section, we will provide details on each file that is a replica or echo of input files.

Production

The file titled “**goodprod.csv**” shows which of the input production numbers were treated as valid production numbers. This file should be an exact replica of the input file production rates that were chosen for this particular model run (i.e., a replicate of the version that was chosen). If any production numbers appear to be incorrect or missing from this file, it is a sign that you should check **AllDistroSas14.csv** for errors in the production numbers (e.g., make sure the categories match valid categories in **ivldSas14.csv**). The first column in **goodprod.csv** specifies the rcat of the personnel produced, the second column specifies the component (compo), the third column specifies the MWS (icat), the fourth column specifies the FY, and the fifth column specifies the actual production amount (prod). An example of the output found in **goodprod.csv** is displayed in Table 6.1.

Table 6.1. Valid Input Production

rcat	compo	icat	fy	prod
Pit	AFR	11M	2014	78
Pit	AFR	11M	2015	99

Requirements

goodrqmts.csv shows which of the input requirements were treated as valid requirements. This file should be an exact replica of the input file requirements that were chosen for this particular model run (i.e., a replica of the version that was chosen). If any requirements appear to be missing from this file, it is a sign that you should check **AllRqmtsSas14.csv** for errors in the

requirements (e.g., make sure the categories match valid categories in **bvldSas14.csv**). The first column in **goodrqmts.csv** specifies the rcat of the requirement, the second column specifies the component (compo), the third column specifies the MWS (bcat), the fourth column specifies the FY, and the fifth column specifies the actual requirement amount (rqmt). An example of the output found in **goodrqmts.csv** is shown in Table 6.2.

Table 6.2. Valid Input Requirements

rcat	compo	bcat	fy	rqmt
ABM	AFR	r13B	2014	83
ABM	AFR	r13B	2015	79

Force Transfers

ptrans.csv shows which of the forced transfers were executed. This file should be an exact replica of the input forced transfers that were used for this particular model run (i.e., a replica of **ForceTrans14.csv**). If any forced transfers appear to be missing from this file, it is a sign that you should check **ForceTrans14.csv** for errors in the way forced transfers were input. The first column in **ptrans.csv** specifies the original rcat (ri0) of the personnel, the second column specifies the original component (ci0), the third column specifies the original MWS (si0), the fourth column specifies the new rcat (ri1) of the personnel, the fifth column specifies the new component (ci1), the sixth column specifies the new MWS (si1), the seventh column specifies the CYOS (cy) of the personnel being transferred, the eighth column specifies the FY of the transfer, and the ninth column specifies the amount transferred (trans). An example of the output found in **ptrans.csv** is shown in Table 6.3.

Table 6.3. Number of Forced Transfers Executed

ri0	ci0	si0	ri1	ci1	si1	cy	fy	trans
RPA	RegAF	RPA11	Plt	RegAF	Bmb	5	2013	3
RPA	RegAF	RPA11	Plt	RegAF	Bmb	6	2013	3

RIFs

vrifs.csv shows which of the RIFs were executed. This file should be an exact replica of the input RIFs that were used for this particular model run (i.e., a replica of **RiftotSas.csv**, assuming that version = RIF). If any RIFs appear to be missing from this file, it is a sign that you should check **RiftotSas.csv** for errors in the way RIFs were input. The first column in **vrifs.csv** specifies the rcat (ri) of the personnel being reduced, the second column specifies the component (ci), the third column specifies the MWS (si), the fourth column specifies the CYOS (cy) of the personnel being reduced, the fifth column specifies the FY of the reduction, and the sixth column specifies the actual reduction (rifs). An example of the output found in **vrifs.csv** is shown in Table 6.4.

Table 6.4. Reductions in Force

ri	ci	si	cy	fy	rifs
CSO	RegAF	Bmb	6	2014	4.285714
CSO	RegAF	Mob	6	2014	17.14286

Survival Rates

svall.csv shows the survival rates (1 – loss rates) for all of the categories in each CYOS for each FY. This file should be an exact replica of the input loss rates (but survival instead of loss) that were used for this particular model run (i.e., a replica of version that was chosen). If any survival rates appear to be missing or incorrect from this file, it is a sign that you should check **AllRateSas15correct.csv** for errors in the way losses were input. The first column in **svall.csv** specifies the rcat of the category, the second column specifies the component (compo), the third column specifies the MWS (icat), the fourth column specifies the CYOS (cy), the fifth column specifies the FY, and the sixth column specifies the survival rate (surv1). An example of the output found in **svall.csv** is shown in Table 6.5.

Table 6.5. Pilot Survival Rates by Year

rcat	compo	icat	cy	fy	surv1
Plt	AFR	11F	11	2014	0.925589
Plt	AFR	11F	11	2015	0.925589

Model Output

Each of the following files results from running the TFBL model and optimizing the following variables: inventory levels, production (when $npslb < 1.0$), losses, affiliations, and assignments given the values contained in each input file discussed in Chapter Five.¹

Projected Inventory

vinven.csv specifies the projected inventory of personnel in each future FY. The first column in **vinven.csv** specifies the rcat (ri) of the personnel, the second column specifies the component (ci), the third column specifies the MWS (si), the fourth column specifies the CYOS (cy), the fifth column specifies the FY, and the sixth column specifies the actual inventory amount (inven). An example of the output found in **vinven.csv** is shown in Table 6.6.

¹ As a reminder, we are using a linear programming model, thus we have solutions that represent less than or more than a whole person.

Table 6.6. Inventory of Personnel by Commissioned Year of Service

ri	ci	si	cy	fy	inven
Plt	AFR	11F	1	2014	0.93424
Plt	AFR	11M	1	2014	7.813769

Projected Production

ventry.csv specifies the projected production of personnel that occurred in each future FY. The first column in **ventry.csv** specifies the rcat (ri) of the personnel produced, the second column specifies the component (ci), the third column specifies the MWS (si), the fourth column specifies the FY, and the fifth column specifies the actual production amount (entry). An example of the output found in **ventry.csv** is shown in Table 6.7.

Table 6.7. Year-to-Year Pilot Production

ri	ci	si	fy	entry
Plt	AFR	11M	2015	99
Plt	AFR	11M	2016	105

Projected Losses

vseps.csv specifies the projected separations (or losses) of personnel that occurred in each future FY. The first column in **vseps.csv** specifies the rcat (ri) of the personnel that separated from the force, the second column specifies the component (ci), the third column specifies the MWS (si), the fourth column specifies the CYOS (cy), the fifth column specifies the FY, and the sixth column specifies the actual separation amount (seps). An example of the output found in **vseps.csv** is shown in Table 6.8.

Table 6.8. Personnel Separations

ri	ci	si	cy	fy	seps
Plt	RegAF	Ftr	13	2015	45.63707
Plt	RegAF	Mob	13	2015	66.32371

Projected Affiliations

allafil.csv specifies the projected affiliations that will occur from one component to another by CYOS, FY, rcat, and icat. The first column in **allafil.csv** specifies the CYOS (cy), the second column specifies the FY of affiliation, the third column specifies the affiliation rate (afil), the fourth column specifies the original rcat (rcat1), the fifth column specifies the original component (comp1), the sixth column specifies the original MWS (icat1), the seventh column specifies the new rcat (rcat2), the eighth column specifies the new component (comp2), and the

ninth column specifies the new MWS (icat2). An example of the output found in **allafile.csv** is shown in Table 6.9.

Table 6.9. Affiliations by Component

cy	fy	afil	rcat1	comp1	icat1	rcat2	comp2	icat2
5	2017	0.208239	CSO	RegAF	Bmb	CSO	AFR	12B
5	2018	0.272251	CSO	RegAF	Bmb	CSO	AFR	12B

Projected Assignments

allasgn.csv specifies the actual assignments of personnel that occurred from year to year to requirements. Note that there are officers in the inventory that are not assigned to a requirement because there are more officers than requirements in a particular FY or icat, e.g., RegAF mobility pilots. The first column in **allasgn.csv** specifies the FY of assignment, the second column specifies the number of personnel assigned (asgn), the third column specifies the personnel rcat (rcati), the fourth column specifies the component of the personnel (compi), the fifth column specifies the MWS of the personnel (icat), the sixth column specifies the requirement rcat (rcatb), the seventh column specifies the requirement component (compb), and the eighth column specifies the requirement MWS (bcat). An example of the output found in **allasgn.csv** is shown in Table 6.10.

Table 6.10. Active Component Assignments, FY 2014

fy	asgn	rcati	compi	icat	rcatb	compb	bcat
2014	853	Plt	RegAF	Bmb	Plt	RegAF	rBmb
2014	40	Plt	RegAF	Bmb	Plt	RegAF	Unspec

Appendix A. Model Components

This appendix describes the sources of various model components, including actual USAF requirements and inventory; production, loss, and affiliation rates; and the distribution of NPS rates across CYOS.

Actual Requirements

- R1404: These requirements were extracted by RAND from the **mpw201309.sas7bdat** file under the control of the RAND data center managed by Susan Adler (adler@rand.org). The requirements were extracted using a SAS program developed by Jim Bigelow (Bigelow@rand.org), **allcompo_rated_MPW_140404.sas**, which produced an excel file **ratedplus2013_140404.xlsx**. **ratedplus2013_140404.xlsx**, along with **blvdSas14.csv**, were used to construct **RqmtsFY2013_140407**. Assumptions that were made (e.g., to inflate certain requirements for those who are students, transients, and personnel holdees [STP]) can be found in **RqmtsFY2013_140407** along with the final values they lead to, which are then found in **AllRqmtsSas14.csv**. These requirements are available for all three components and can be used for any run.
- AF1308: These requirements were extracted from the official August 2013 Red Line from the AFRAMS run in the file **130823_PIL_Final.xls** (we were unable to locate the specific file for the source data, but the data can also be viewed in **RqmtsFY2013_140407** in the tab “RLBL Apr 2013”). These requirements are only available for RegAF.
- ANG.80: These requirements are only for ANG pilots and are simply 80 percent of the R1404 ANG pilot values.
- FH140430: These requirements were provided by Frank Harris, NGB A3, on April 30, 2014, and are for the ANG as of April 21, 2014.
- LG140429: These requirements were provided by Laura Guay, HQ USAF/REPX, on April 29, 2014, and are for the AFR.
- TW140502: These requirements were provided by Tom Winslow, AF/A3XI, on May 2, 2014, and are RegAF requirements with students set at one-year production from **RedlineModel_140502.xlsx** on the tab “Redline.”
- AF1410: These requirements were provided by Laura Guay, HQ USAF/REPX, for the AFR (**Rated auth asgn 201408.xlsx**), Lt Col Dawn Brindle, AF/A3XI, for the ANG (**RL All pilots ANG.xls**, **ALL ABM (ANG).xls**, and **ALL CSO (ANG).xls**), and by Maj Joseph Van Kuiken, AF/A1PF, for the RegAF (**RLBL Results 140910 1100.xlsx**).
- AF141123: These requirements were provided by Lt Col Dawn Brindle, AF/A3XI, for the RegAF, AFR, and ANG (**RegAF RL Data.xlsx** and **ARC RL Data.xlsx**) and are accurate as of September 30, 2014.
- AF150131: These requirements were provided by Lt Col Dawn Brindle, AF/A3XI, for the RegAF, AFR, and ANG (**Jan 2015 All Rqts.xlsx**) and are accurate as of January 31, 2015.

- AF150416: These requirements were provided by Mike Torino, AF/A3XI, for the RegAF (**Redline_31_Mar_15.xlsx**). Due to issues with the March 7, 2015 run, Mike needed to perform a new redline build. The requirements increased from the AF150131 run.
- AF150430: These requirements were provided by Lt Col Dawn Brindle, AF/A3XI, for the ANG (**Jan 2015 All Rqts – 29 Apr.xlsx**) to fix the AF150131 redline requirements pull to make the ANG data consistent with AFR. Originally, the ANG was supplying primary AFSC and then ANG learned that the AFR was supplying duty AFSC. This data set rectifies that difference by providing the ANG data by duty AFSC to match AFR.

Actual Inventory

- R1401: These inventories were extracted by RAND from the **bae1996_rand.sas7bdat**, **bae201309_rand.sas7bdat**, **bre1996_rand.sas7bdat**, **bre201309_rand.sas7bdat**, and **bge1996_rand.sas7bdat**, **bge201309_rand.sas7bdat** files that are under the control of the RAND data center managed by Susan Adler (adler@rand.org). The inventories were extracted using a SAS program developed by Jim Bigelow (whom has since retired from RAND), **AllComp_Rated_140128.sas**, which produced an Excel file **Rated_96to13_140128.xlsx**. These inventories are available for all three components and can be used for any run.
- AF1308: These inventories were extracted from the official August 2013 Blue Line (**AFRAMS_ABM_130823.xlsx**, **AFRAMS_CSO_130823.xlsx**, **AFRAMS_Plt_130823.xlsx**, and **AFRAMS_RPA_130823.xlsx**). These inventories are only available for RegAF.
- AF1410: These inventories were provided by Laura Guay, HQ USAF/REPX, for the AFR (**Rated auth asgn 201408.xlsx**); Lt Col Dawn Brindle, AF/A3XI, for the ANG (**ANG AUTH_ASGN_201407_RL_BL.xlsx**); and by Maj Joseph Van Kuiken, AF/A1PF, for the RegAF (**RLBL Results 140910 1100.xlsx**). Note that for ANG the duty AFSC is used to determine the assigned personnel and not the control AFSC.
- AF141123: These inventories were provided by Lt Col Dawn Brindle, AF/A3XI, for the RegAF (**RegAF BL data from AFRAMS 141014.xlsx**), AFR (**AFR BL Data.xlsx**), and ANG (**AUTH_ASGN RL-BL (201409) (3).xlsx**) and were accurate as of September 30, 2014.
- AF150121: These inventories were provided by Maj Joseph van Kuiken for the RegAF (**ARAMS input data (EoFY14 consolidated 150121.xlsx)** [sic]) and were meant to correct the initial inventory used for all runs done prior to AF150121. The first year of AFRAMS output is already a projection. Need to specifically ask for the initial inventory used for each AFRAMS run to be consistent for RegAF.
- AFR and ANG use AF150417: The RegAF inventories were created from the AF150121 version, but ALFA tours (from **A3OI Listing 6 Jan 15 v8.xlsx**) were removed from their home AFSC and counted in the RPA18 category to avoid the double counting that occurred in previous runs. The **A3OI Listing 6 Jan 15 v8.xlsx** file is a mixture of data provided by Lt Col Dawn Brindle to capture the ALFA tour personnel on September 30, 2014, and a RAND data pull to get each officer's CYOS. The AFR and ANG inventories were provided by Lt Col Dawn Brindle (**NEW ARC BL data.csv**), which now contain the ARC inventory data by duty AFSC.

- RegAF uses AF150430: These inventories were recalculated from the AF150417 version to address the fact that ALFA tours should have been added to the RPA11 category, not the RPA18 category.

Production

- AF160222ABM1: This production file mirrors the AF151124A3OI file, except with the ABMs. ABM production is increased to a total of 125 in FY 2018 and then reduced (and flat-lined) to 115 in FY 2019. We based these numbers on the AF/A3XI analysis of future ABM requirements. The source file for this data is **TF_Production_Feb-2016vABM1.xls**.
- AF160222ABM2: This production file mirrors the AF151124A3OI file, except with the ABMs. ABM production is increased (and flat-lined) to a total of 142 in FY 2018. We based these numbers on the AF/A3XI analysis of future ABM requirements. The source file for this data is **TF_Production_Feb-2016vABM2.xls**.
- AF150430: Update of AF150408 created from the file **TF Production Mar-2015v3.xlsx** provided by Lt Col Mark Wernersbach, AF/A3XI. This updates RegAF CSO production (decreasing bomber and C2ISR CSO production post-FY 2018) so that total CSO production is 225 per year to match the TPR. This update also makes Air Force Reserve Command (AFRC) C2ISR pilot and CSO production .2 per year. AFRC C2ISR is represented in a single unit that primarily accesses through affiliations and usually does not request training slots. When they need one, they pick up a fall-out slot; therefore, their production is not appropriately reflected in the Graduate Program Guidance Letter/ Graduate Program Requirements Document (GPGL/GPRD). Production is also added .2 per year for AFRC ABMs in the “out-years.”
- AF150911: Update of AF150430 for the RegAF meant to correct RegAF ABM production to reflect a higher production level—up to 125 total, 100 for AWACS and 25 for JSTARS in 2017 and onward. Data provided verbally by Lt Col Mark Wernersbach.
- AF1308: These productions were extracted from the official August 2013 Blue Line (**AFRAMS_ABM_130823.xlsx**, **AFRAMS_CSO_130823.xlsx**, **AFRAMS_Plt_130823.xlsx**, and **AFRAMS_RPA_130823.xlsx**). These productions are only available for RegAF.
- LEGACY: These productions were extracted from a data set by Robbie Robinson, AETC/A3R, on December 16, 2009.
- FY16POM: These productions were extracted from **FY 16 POM GPRD 16 Jan 14.xlsx**, provided by John “Worm” Wigle, AF/A3XI.
- FY16ADJ: These productions were extracted from **FY 16 POM GPRD 16 Jan 14.xlsx**, provided by John “Worm” Wigle, but are adjusted to eliminate shutdowns of some rcat.
- FY16-A10: These productions were extracted from **FY 16 POM GPRD 16 Jan 14.xlsx**, provided by John “Worm” Wigle, but with A-10 pilot production eliminated.
- FY16ADJ2: These productions were extracted from **FY 16 POM GPRD 16 Jan 14.xlsx**, provided by John “Worm” Wigle, and are the same as FY16ADJ, except RegAF CSO Mob straight lines at five officers produced instead of 35, and ANG CSO 12M straight lines at 11 instead of zero.
- FY16ADJ3: These productions are the same as FY16-A10, except for RegAF CSO Mob and ANG CSO 12M are as they were in FY16ADJ2.

- FY16ADJ4: Same as FY16ADJ2 except there is increased selected production capacities to make requirements sustainable.
- FY16ADJ5: Same as FY16ADJ3 except there is increased selected production capacities to make requirements sustainable.
- AF1410: These production numbers were extracted from **TF Production #s Aug-2014v2.xlsx**, provided by John “Worm” Wigle.
- AF150323: Production created from the file **TF Production Mar-2015.xlsx** provided by Lt Col Mark Wernersbach, AF/A3XI, and derived from GPGL and GPRD inputs. This data set is not usable in the model based on incorrect data being pulled by SAS (e.g., certain cells were truncated so “RegAF” was input as “Reg.” Production for RegAF was also incorrect. Use the AF150408 version in lieu of this one.
- AF150408: Update of AF150323 created from the file **TF Production Mar-2015v2.xlsx** provided by Lt Col Mark Wernersbach. The update adjusts RegAF production to match inputs submitted to A1PF for the AFRAMS run. It generally matches the FY 2015/2016 GPGL for FY 2015 production; the FY 2016/2017 GPGL for FY 2016 and FY 2017 production; and the FY 2016–2021 GPRD for FY 2018–2021. Production is flat-lined after FY 2021; some adjustments were made based on expected accessions available (e.g., extra production is added to mobility pilots to absorb the excess pilot production).
- AF150505A1PTPR: Update of AF150430 created from the file **TF_Production_Mar-2015vA1PTPR.xlsx** provided by Lt Col Mark Wernersbach. This file reduces pilot (mobility, C2ISR, and CSAR) and CSO production (bomber, CSAR, C2ISR, and SO) to reflect the overall numbers of pilots and CSOs produced in A1PFs recommended TPR.
- AF150505LowProd: Update of AF150430 created from the file **TF_Production_Mar-2015vA1PTPR.xlsx** provided by Lt Col Mark Wernersbach. This file reduces pilot (mobility, C2ISR, CSAR, and SO) and CSO production (bomber, CSAR, C2ISR, and SO) to reflect the overall numbers of pilots and CSOs produced in A1PFs recommended TPR. This version flat-lines total pilot production at 712 and CSO production at 225.

Loss Rates

- AF150511exactv1: These loss rates contain the exact AFRAMS loss rates from FYs 2015–2021 and then use a steady-state AFRAMS loss rate (calculated as last 15 years of AFRAMS projection) for FYs 2022 and beyond. These loss rates represent the baseline loss rate and were extracted from the official Blue Line (**AFRAMS_ABM_150414.xlsx**, **AFRAMS_NAV_150414.xlsx**, **AFRAMS_PLT_150413 (BL).xlsx**, and **AFRAMS_RPA_150414 (BL).xlsx**). These loss rates include the following assumptions input into AFRAMS: a 51-percent aggregate bonus take-rate in FY 2015 decremented by 2 percent each FY through FY 2021 and then flat-lined; of those that take the bonus, 75 percent take the nine-year bonus and 25 percent take the five-year bonus.
- AF150515exactv2: These loss rates are the MAH loss rates for RegAF pilots that correspond to the baseline loss rates in AF150511exactv1. These loss rates use **AFRAMS_PLT_150413 (BL) exact AFRAMS LR 150512.xlsx** to determine the factor that should multiply the baseline loss rate so that the aggregate loss rate for that FY matches McGee’s projected percent separation. When performing a MAH model run, this

rate should be used for RegAF pilots and AF150511exactv1 should be used for RegAF non-pilots.

- ARC150515: These loss rates correct the ARC loss rates from previous version ARC1501. Essentially, the loss rates are the same except CYOS 0 has loss rates = 0 and all other loss rates are shifted to one higher CYOS. This is to match the new formula for calculating losses and inventory in the inventory flow constraint. These loss rates are the baseline rates for the AFR and ANG.
- ARC150515MAH: These loss rates are calculated using the same methodology, except it concentrates on the data from 1996–2002 to capture the AFR and ANG MAH loss patterns. These loss rates are used only during a MAH excursion and are to be paired with AF150515exactv2 or AF150515exactv4 (which are the RegAF loss rates used in a MAH excursion).
- Hhigh: These loss rates were developed by RAND from the file **Rated_96to13_140128.xlsx** (see section **AllInitInvSas14.csv** for information on the construction of this file). The process to determine these loss rates can be observed in the file **LossesFY2013_140406.xlsx**. Information from **Rated_96to13_140128.xlsx** was used to populate **LossesFY2013_1404060.xlsx**.
- Havg: These loss rates were developed by RAND from the file **Rated_96to13_140128.xlsx** (see section **AllInitInvSas14.csv** for information on the construction of this file). The process to determine these loss rates can be observed in the file **LossesFY2013_140406.xlsx**. Information from **Rated_96to13_140128.xlsx** was used to populate **LossesFY2013_1404060.xlsx**.
- Hlow: These loss rates were developed by RAND from the file **Rated_96to13_140128.xlsx** (see section **AllInitInvSas14.csv** for information on the construction of this file). The process to determine these loss rates can be observed in the file **LossesFY2013_140406.xlsx**. Information from **Rated_96to13_140128.xlsx** was used to populate **LossesFY2013_1404060.xlsx**.
- AF1308: These loss rates were extracted from the official August 2013 Blue Line (**AFRAMS_ABM_130823.xlsx**, **AFRAMS_CSO_130823.xlsx**, **AFRAMS_Plt_130823.xlsx**, and **AFRAMS_RPA_130823.xlsx**). These loss rates are only available for the RegAF.
- McGee: These loss rates were extracted from **McGee Data.xlsx**.
- AF1409: These loss rates were extracted from the official August 2014 Blue Line (**AFRAMS_ABM_140912.xlsx**, **AFRAMS_CSO_140912.xlsx**, **AFRAMS_Plt_140912.xlsx**, and **AFRAMS_RPA_140912.xlsx**). The loss rate is computed as the average loss rate from FYs 2029–2043.
- AF1410: Description of loss rates seems to be missing. Best explanation is the loss rates extracted from the official August 2014 Blue Line run are based on the AFRAMS 141014 run. Loss rate is likely the average loss rate from FYs 2029–2043.
- AF1411: These loss rates were extracted from the official August 2014 Blue Line (**AFRAMS_ABM_141014.xlsx**, **AFRAMS_CSO_141014.xlsx**, **AFRAMS_Plt_141014.xlsx**, and **AFRAMS_RPA_141014.xlsx**). The loss rate is computed as the average loss rate from FYs 2029–2043. The version was called AF1411 because a model run using these rates was performed in November 2014.
- McGee1411: These loss rates are the MAH loss rates for RegAF pilots that correspond to the baseline loss rates in AF1411. These loss rates use **AFRAMS_Plt_141014v2.xlsx**,

provided by McGee to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and AF1411 should be used for RegAF non-pilots.

- AF150123: These loss rates are the corrected baseline loss rates using initial inventory version AF150121 for distributing losses across CYOS. These were never used in an official run and were eventually replaced by newAF1410.
- Audries4: These loss rates are for a MAH excursion based on the Audries' prediction for major airline hires between FYs 2014 and 2028 and correspond to the baseline loss rates in newAF1410. We disregard the FY 2014 data since end-of-FY 2014 is when the model time frame starts. These loss rates use **AFRAMS_Plt_141014_Newloss_v2_150203.xlsx** provided by McGee, tab titled "Calc MAH Loss Rates K7:X10," to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and newAF1410 should be used for RegAF non-pilots.
- NewMcGee4: These loss rates are for a MAH excursion based on McGee's prediction for major airline hires between FYs 2015 and 2028 and correspond to the baseline loss rates in newAF1410. Once FY 2014 losses were known, McGee updated the regression analysis to incorporate actual FY 2014 losses. These loss rates use **AFRAMS_Plt_141014_Newloss_v2_150203.xlsx** provided by McGee, tab titled "Calc MAH Loss Rates K7:X10," to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and newAF1410 should be used for RegAF non-pilots.
- OldMcGee4: These loss rates are for a MAH excursion based on McGee's prediction for major airline hires between FYs 2014 and 2028 and correspond to the baseline loss rates in newAF1410. We disregard the FY 2014 data since end-of-FY 2014 is when the model time frame starts. These loss rates use **AFRAMS_Plt_141014_Newloss_v2_150203.xlsx** provided by McGee, tab titled "Calc MAH Loss Rates K7:X10," to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and newAF1410 should be used for RegAF non-pilots.
- UND4: These loss rates are for a MAH excursion based on UND's prediction for major airline hires between FYs 2014 and 2028 and correspond to the baseline loss rates in newAF1410. We disregard the FY 2014 data since end-of-FY 2014 is when the model time frame starts. These loss rates use **AFRAMS_Plt_141014_Newloss_v2_150203.xlsx** provided by McGee, tab titled "Calc MAH Loss Rates K7:X10," to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and newAF1410 should be used for RegAF non-pilots.
- newAF1410: These loss rates were calculated to correct the steady-state loss rate calculation due to a formula error in an excel file that served as a template for steady-state loss rate calculations for version AF150121.
- ARC1501: These loss rates were calculated to provide more fidelity to the Guard and Reserve loss rates. Historical data (1996–2013) from RAND, contained in **LossesFY2013_140406.xlsx**, were used to calculate historical losses (by reat, component, icat, and CYOS) whenever there were 30 or more observations in those categories. A method for aggregating the data to provide more-reliable loss rates can be

found in **Specific AFR and ANG LossRates 150114.xlsx** whenever there were not 30 observations available by following the logic of the formulas.

- AF150416BL: These loss rates represent the steady-state baseline loss rate and were extracted from the official Blue Line (**AFRAMS_ABM_150414.xlsx**, **AFRAMS_NAV_150414.xlsx**, **AFRAMS_PLT_150413 (BL).xlsx**, and **AFRAMS_RPA_150414 (BL).xlsx**). These loss rates include the following assumptions input into AFRAMS: a 51-percent aggregate bonus take-rate in FY 2015 decremented by 2 percent each FY through FY 2021 and then flat-lined; of those that take the bonus, 75 percent take the nine-year bonus and 25 percent take the five-year bonus. These loss rates were calculated using **MAHAutomation.jar**.
- AF150417MAH(BL): These loss rates are the MAH loss rates for RegAF pilots that correspond to the baseline loss rates in AF150416BL. These loss rates use **AFRAMS_PLT_150413 (BL).xlsx**, tab titled “MAH Loss,” provided by McGee to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and AF150416BL should be used for RegAF non-pilots. These loss rates were calculated using **MAHAutomation.jar**.
- AF150417McGeeTR: These loss rates represent the steady-state baseline loss rate and were extracted from the official Blue Line (**AFRAMS_ABM_150414.xlsx**, **AFRAMS_NAV_150414.xlsx**, **AFRAMS_PLT_150413 (TFAM).xlsx**, and **AFRAMS_RPA_150414 (TFAM).xlsx**). These loss rates include using McGee’s bonus take-rates that start at 48 percent in FY 2015 and decrease with the lowest bonus take-rate of 35 percent. Even though McGee’s projections go through FY 2028, AFRAMS flat-lined a bonus take-rate of 36 percent from FY 2022 and onward (the average of FYs 2022–3028). This run also includes the assumption that of those that take the bonus, 75 percent take the nine-year bonus and 25 percent take the five-year bonus. These loss rates were calculated using **MAHAutomation.jar**.
- AF150417MAH-MAH: These loss rates are the MAH loss rates for RegAF pilots that correspond to the baseline loss rates AF150417McGeeTR. These loss rates use **AFRAMS_PLT_150413 (TFAM).xlsx**, tab titled “MAH Loss,” provided by McGee to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and AF150417McGeeTR should be used for RegAF non-pilots. These loss rates were calculated using **MAHAutomation.jar**.
- AF150430BL: These loss rates are a correction to the AF150417BL as RegAF CSO Mob and RPAs had erroneous rates due to incorrect inputs in the **MAHConfiguration.txt** file. These loss rates represent the steady-state baseline loss rate and were extracted from the official Blue Line (**AFRAMS_ABM_150414.xlsx**, **AFRAMS_NAV_150414.xlsx**, **AFRAMS_PLT_150413 (BL).xlsx**, and **AFRAMS_RPA_150414 (BL).xlsx**). These loss rates include the following assumptions input into AFRAMS: a 51-percent aggregate bonus take-rate in FY 2015 decremented by 2 percent each FY through FY 2021 and then flat-lined; of those that take the bonus, 75 percent take the nine-year bonus and 25 percent take the five-year bonus. These loss rates were calculated using **MAHAutomation.jar**.
- AF150430MAH(BL): These loss rates are a correction to the AF150417MAH(BL) as RegAF CSO Mob and RPAs had erroneous rates due to incorrect inputs in the

MAHConfiguration.txt file. These loss rates are the MAH loss rates for RegAF pilots that correspond to the baseline loss rates in AF150430BL. These loss rates use **AFRAMS_PLT_150413 (BL).xlsx**, tab titled “MAH Loss,” provided by McGee to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and AF150430BL should be used for RegAF non-pilots. These loss rates were calculated using **MAHAutomation.jar**.

- AF150430McGeeTR: These loss rates are a correction to the AF150417McGeeTR as RegAF CSO Mob and RPAs had erroneous rates due to incorrect inputs in the **MAHConfiguration.txt** file. These loss rates represent the steady-state baseline loss rate and were extracted from the official Blue Line (**AFRAMS_ABM_150414.xlsx**, **AFRAMS_NAV_150414.xlsx**, **AFRAMS_PLT_150413 (TFAM).xlsx**, and **AFRAMS_RPA_150414 (TFAM).xlsx**). These loss rates include using McGee’s bonus take-rates that start at 48 percent in FY 2015 and decrease with the lowest bonus take-rate of 35 percent. Even though McGee’s projections go through FY 2028, AFRAMS flat-lined a bonus take-rate of 36 percent from FY 2022 and onward (the average of FYs 2022–2028). This run also includes the assumption that of those that take the bonus, 75 percent take the nine-year bonus and 25 percent take the five-year bonus. These loss rates were calculated using **MAHAutomation.jar**.
- AF150430MAH-MAH: These loss rates are a correction to the AF150417MAH-MAH as RegAF CSO Mob and RPAs had erroneous rates due to incorrect inputs in the **MAHConfiguration.txt** file. These loss rates are the MAH loss rates for RegAF pilots that correspond to the baseline loss rates in AF150430McGeeTR. These loss rates use **AFRAMS_PLT_150413 (TFAM).xlsx**, tab titled “MAH Loss,” provided by McGee to determine the percentage of officer separations that will occur in a given FY. When performing a MAH model run, this rate should be used for RegAF pilots and AF150417McGeeTR should be used for RegAF non-pilots. These loss rates were calculated using **MAHAutomation.jar**.
- AF150511exactv3: These loss rates contain the exact AFRAMS loss rates from FYs 2015–2021 and then use a steady-state AFRAMS loss rate (calculated as the last 15 years of AFRAMS projection) for FYs 2022 and beyond. These loss rates represent the baseline loss rate and were extracted from the official Blue Line (**AFRAMS_ABM_150414.xlsx**, **AFRAMS_NAV_150414.xlsx**, **AFRAMS_PLT_150413 (TFAM).xlsx**, and **AFRAMS_RPA_150414 (TFAM).xlsx**). These loss rates include using McGee’s bonus take-rates that start at 48 percent in FY 2015 and decrease with the lowest bonus take-rate of 35 percent. Even though McGee’s projections go through FY 2028, AFRAMS flat-lined a bonus take-rate of 36 percent from FY 2022 and onward (the average of FYs 2022–2028). This run also includes the assumption that of those that take the bonus, 75 percent take the nine-year bonus and 25 percent take the five-year bonus.
- AF150515exactv4: These loss rates are the MAH loss rates for RegAF pilots that correspond to the baseline loss rates in AF150511exactv3. These loss rates use **AFRAMS_PLT_150413 (TFAM) exact AFRAMS LRs 150512.xlsx** to determine the factor that should multiply the baseline loss rate so that the aggregate loss rate for that FY matches McGee’s projected percent separation. When performing a MAH model run, this

rate should be used for RegAF pilots and AF150511exactv3 should be used for RegAF non-pilots.

Affiliation Rates

- **AVERAGE:** These affiliation rates were developed by RAND from the file **Rated_96to13_140128.xlsx** (see section **AllInitInvSas14.csv** for information on the construction of this file). The process to determine these loss rates can be observed in the file **AffilsFY2013_140407.xlsx**. Information from **Rated_96to13_140128.xlsx** was used to populate **AffilsFY2013_140407.xlsx**. They are the average affiliation rates over FYs 1997–2013. ABM and RPA are averages over all MWS in the rcata, and CSO and Plt are averages for specific MWS. Only RegAF losses with CYOS between 0 and 16 can contribute to affiliations.
- **AVG+20:** These affiliation rates are the same as AVERAGE with an additional 20 percent added on.
- **r10g10t8:** These affiliation rates allow AFR+ANG to hire up to 80 percent of RegAF losses between CYOS 0 and 16 distributed any way at all between AFR and ANG. That is $AFR = 0.80$, $ANG = 0.80$, and $AFR+ANG = 0.80$.
- **CSO=Plt:** Same as AVERAGE, but the Plt affiliation rates are used for CSO.

Distribution of NPS Production across CYOS

- **R1404:** These distributions were developed by RAND from the file **Rated_96to13_140128.xlsx** (see section **AllInitInvSas14.csv** for information on the construction of this file). The process to determine these distributions can be observed in the file **DistroFY2013_140408.xlsx**. Information from **Rated_96to13_140128.xlsx** was used to populate **DistroFY2013_140408.xlsx**.
- **AF1308:** These distributions were developed from the August 2013 Blue Line (**AFRAMS_ABM_130823.xlsx**, **AFRAMS_CSO_130823.xlsx**, **AFRAMS_Plt_130823.xlsx**, and **AFRAMS_RPA_130823.xlsx**). These distributions are only available for RegAF.

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