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User's Guide for the Total Force Blue Line Model



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About This Tool

Aircrew management across the Total Air Force is complex and would benefit from greater coordination among the active and reserve components. To affect that coordination, the U.S. Air Force 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 these projections, RAND Project AIR FORCE developed a modeling capability, the Total Force Blue Line (TFBL), that projects rated inventories for the Regular Air Force, Air Force Reserve, and Air National Guard. The model has been delivered to the TFAM office, and this document provides the information necessary for Air Force personnel to use the model.

The research reported here was commissioned by the Air Force Director of Operations Training and Readiness (AF/A3T) and conducted within the Workforce, Development, and Health Program of RAND Project AIR FORCE as part of a fiscal year 2021 project, “Aircrew Task Force and Total Force Aircrew Management Analytics and Web-Based Models/Tools.”

Information for Aircrew Managers

This user’s guide is for those who use the TFBL model. The organization of this guide is as follows: Chapter 1 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. It also provides a high-level model description. Chapter 2 generally describes the input data and uploading of the input data files into the web app. Chapters 3 through 6 explain how to generate more-complex data; solve the model; visually display the outputs, including the red-line/blue-line (RL/BL) charts; and download the model results. The appendix provides details for the model inputs and formats for the input files.

There are two implementations of the TFBL model: one at the major weapon system (MWS) level and one aircraft-level model at the mission design series (MDS) level. The MWS implementation is the original, intended version of the model and was used for past analyses in support of Air Force Operations, Training and Readiness (AF/A3T). However, the discussion and instructions in Chapters 2 through 6 are equally applicable for an MDS implementation. While the discussion in the appendix may seem to emphasize an MWS implementation in its examples and figures, the comments regarding the model inputs also broadly apply to an MDS implementation when inventory and requirement categories are formulated at the MDS rather than the MWS level (e.g., a subset of a fighter pilot requirement or inventory is reformulated as an F-15E requirement or inventory). We emphasize this in the text and footnotes.

Note that, because this model will reside with the Air Force, we do not indicate where it might be stored because those decisions will rest with the Air Force. Similarly, we are not able to

provide screenshots of the tool because we do not know where the model will reside or in what format (web app, jupyter notebook, etc.). We do provide office names for the sources of various input data, which include the RAND Project AIR FORCE Workforce, Development, and Health Program.

Information for Software Developers and Users

This document is intended as a user's guide for those wishing to use the TFBL model. The Headquarters of the Air Force Aircrew Task Force (HAF A3/ACTF) can be contacted to obtain the code and documentation. Please be aware that the user might have to initialize the provided software on a server to run the web app, in addition to fulfilling the other requirements that setting up a server might entail.

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We also thank our RAND colleagues Al Robbert and Jeremy Eckhause, whose reviews helped strengthen the tool, clarify its organization, and ultimately provide a more useful guide.

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Chapter 1. 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 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 dynamic means that the total number of personnel in the Air Force Reserve (AFR) must meet the total AFR demand, the total number of pilots must meet the total demand for pilots, and the supply of pilots must be distributed across major weapon systems, aircraft, and so on and so forth.

This task has become more urgent in recent years because the capability of the Air Force to train and season its pilots has decreased as the number of Air Force aircraft has decreased. Fewer aircraft mean fewer flying hours to train new pilots. As capacity to provide flying experience to pilots in the active component declines, the Air Force will need to use more of its Total Force capacity to train and season its new rated officers, potentially tapping into that of the Air Reserve Components (ARC). If it does, it will 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 supply and demand are out of balance, it can take a long time to restore the balance between them.

Recognizing that aircrew management throughout the Total Force would benefit from greater coordination among the active and reserve components, the Chief of Staff of the Air Force (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 the 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 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) called *red-line/blue-line (RL/BL) charts*, and assess the impact of policy changes on these projections.

General Overview of the Total Force Blue Line Model

The Air Force asked RAND Project AIR FORCE (PAF) to help by updating and improving RAND’s Total Force Blue Line (TFBL) model (see Terry et al., 2017, and Terry et al., 2019, for additional publications on the TFBL model), which predicts future inventory for the RegAF,

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

The TFBL model was designed to help the Air Force meet the rated management needs of the future more effectively. Because 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 the 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 TFBL model is to adopt a forward-looking perspective to identify the number of personnel to assign to requirements within a category. A *requirement* is defined by a rated category (e.g., pilot, combat systems officer [CSO], air battle manager [ABM], remotely piloted aircraft [RPA] pilot); a component (RegAF, ANG, or AFR); and a major weapon system (MWS) or an air force specialty (AFS) (e.g., fighter or mobility), or an aircraft or mission design series (MDS) (e.g., F-15E). The TFBL model finds the best solution such that the number of unfilled requirements is minimized and the number of officers assigned to a requirement is maximized while producing the fewest number of officers possible.

The TFBL model estimates future inventories by component (e.g., AFR), rated category or crew position (e.g., pilot), MWS (e.g., fighter) or MDS (e.g., F-15E), number of commissioned years of service (CYOS) completed, and fiscal year (FY) by trying to match inventory to requirements. The TFBL model can operate at the MWS (e.g., fighter) level or at the aircraft (e.g., F-15E) level for a given model run.

Think of predicted inventories as occupying cells in an array; each cell is identified by a component, a crew position, an MWS or an MDS, CYOS, and an FY. For each combination (of component, crew position, and MWS or MDS), the TFBL model calculates the inventory at (CYOS, FY) as the inventory at (CYOS-1, FY-1) plus production minus losses. User inputs specify some gains and losses directly (e.g., the number of mobility pilots trained to become special operations pilots, which would be a gain of special operations 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 to match inventories to requirements. (For example, when the user specifies maximum affiliation rates,¹ the model determines whether to affiliate rated officers at the maximum rate or at a different rate.)

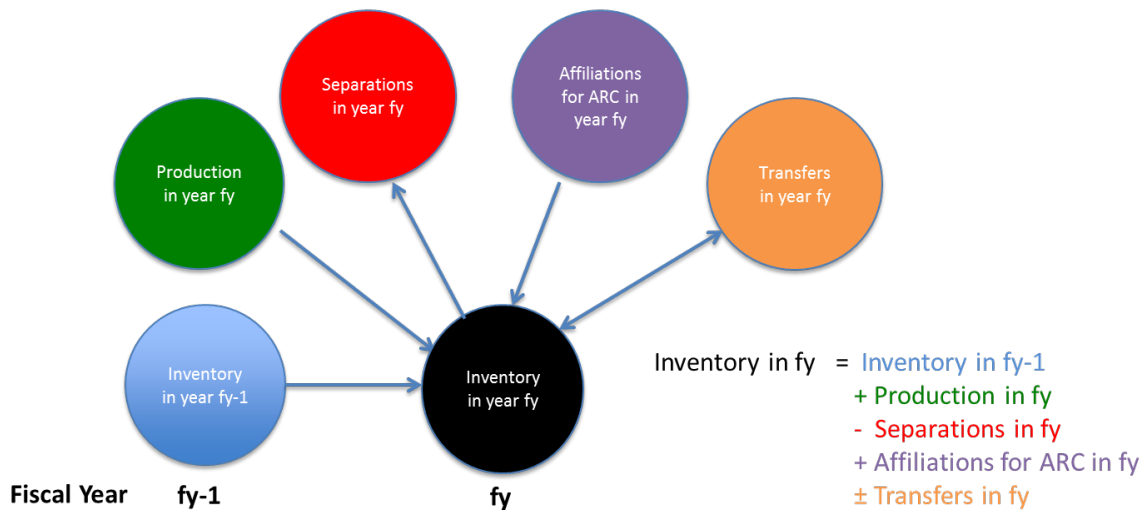
¹ A rated officer who separates from the RegAF and subsequently joins the AFR or the ANG as a rated officer and does not need to go through undergraduate flying training has *affiliated* with the AFR or ANG. The *affiliation rate* is the ratio of those affiliations to RegAF separations in a given FY.

Model Flow

The inventory of personnel assigned to a requirement for a particular FY is calculated as follows:

1. Starting with the inventory from the end of the previous FY, add the production of the current FY and subtract the number of personnel who have separated or are projected to separate during the current FY
2. Add in those who have affiliated (from the RegAF to the AFR or the ANG) and either add or subtract those personnel who have been transferred into or out of each category
3. Repeat that calculation for $fy+1$, $fy+2$, and so on across the timeline of interest. Figure 1.1 illustrates this calculation for the FY “ fy .”²

Figure 1.1. Inventory Flow Calculations



Several pieces of input data enable the calculation in Figure 1.1 to occur:

- the end-of-FY(XXXX-1) initial inventory of personnel (in the blue circle)
- the maximum number of personnel who will be produced and the number of prior-service personnel who enter the rated force (in the green circle)
- the loss rate applied to the end-of-FY inventory plus the number of reductions in force (RIFs), also known as *involuntary separations* (in the red circle)
- the maximum affiliation rate applied to the RegAF separations (in the purple circle)
- transfers of personnel from one category to another, including the ALFA tours in (the orange circle).³

² fy is used to denote the variable in the formula that represents the actual FY.

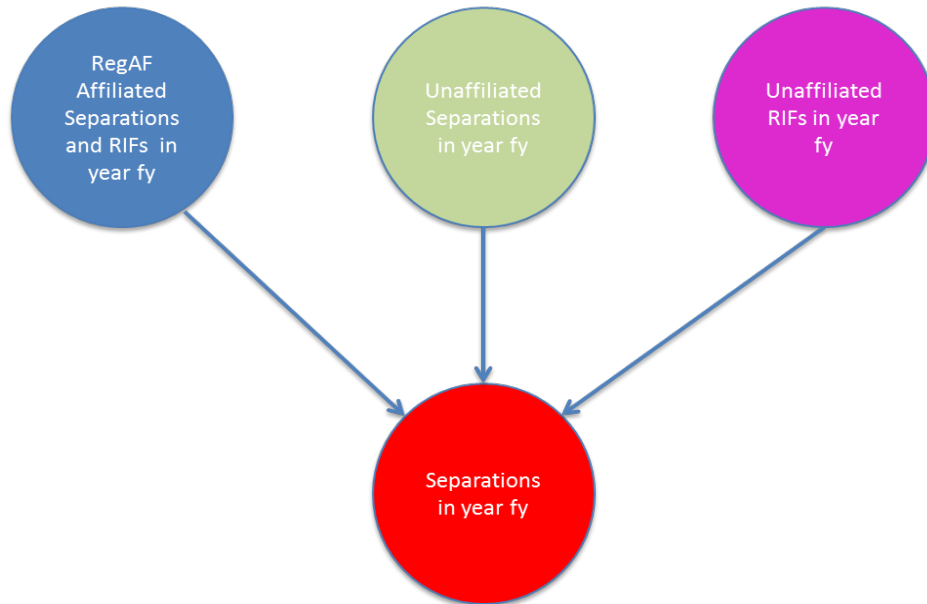
³ Though the origin dates to the Vietnam War era, the term *ALFA Tour* is still used to describe assignments that are “bills” to pay by the operational flying community (i.e., they are manned by experienced aviators). *ALFA* stands for ALO, LIFT, FAC, and ATC and is a holdover from years ago. See Air Force Instruction 11-412 (2020) for further explanation.

Figure 1.1 is the heart of the TFBL model. The user can solve this problem sequentially in that each future year can be solved by knowing or having solved the previous year(s), starting with the FY after the initial inventory is defined; this is one method for solving this problem. However, the optimization approach generally solves all variables simultaneously, so the optimization solver will not necessarily solve this problem sequentially.

Figure 1.2 hints at the complexity of bringing together the Total Force in this model. Affiliations to the ARC in each FY must first have separated or been involuntarily separated from the RegAF, as shown in the blue circle in Figure 1.2. When the model is determining RegAF losses, the blue and green circles will have nonzero values, which means that the user will have some separations affiliating to the ARC and some separations leaving the Air Force altogether that are then placed in the Unaffiliated Separations category (in the green circle). Those personnel who are involuntarily separated can affiliate as well and are included in the blue circle. Those personnel who are involuntarily separated and do not affiliate are captured in the pink circle. To determine ARC losses (whether they are ANG or AFR losses), the blue circle will be zero, the pink circle will capture all the RIFs, and the green circle will capture all remaining losses that do not result from involuntary separations.

The number of affiliations, in the blue circle, is bounded below by 0 and bounded above by a maximum percentage of losses based on historical data plus RIFs.

Figure 1.2. Different Types of Separations



$$\begin{aligned} \text{Separations} &= \text{Affiliated Separations from RegAF} \\ &+ \text{Unaffiliated Separations} \\ &+ \text{Unaffiliated Reductions in Force (RIF)} \end{aligned}$$

The last piece to understand is what is being optimized in the model. The TFBL model is designed to minimize the following five items:

- the number of unfilled requirements, which can be thought of as providing an incentive to minimize the number of requirements for which there is no matching inventory
- the number of unassigned personnel, which can be thought of as providing an incentive to minimize the number of personnel in excess of requirements (assuming one person can be assigned to one requirement and one requirement can only have one person assigned to it)
- the number of officers produced, which can be thought of as providing an incentive to minimize the number of pilots who need to be produced each year to meet requirements across the time horizon of the model. While cost is not factored into the model, this optimization goal was included to indirectly factor in the high cost of training for each pilot produced
- the number of affiliations short of affiliations calculated using the historical affiliation rate, which can be thought of as providing an incentive to maximize model affiliations up to the number of affiliations calculated using the historical affiliation rate

- the number of affiliations in excess of affiliations calculated using the historical affiliation rate, which can be thought of as providing an incentive to minimize model affiliations above the number of affiliations calculated using the historical affiliation rate.

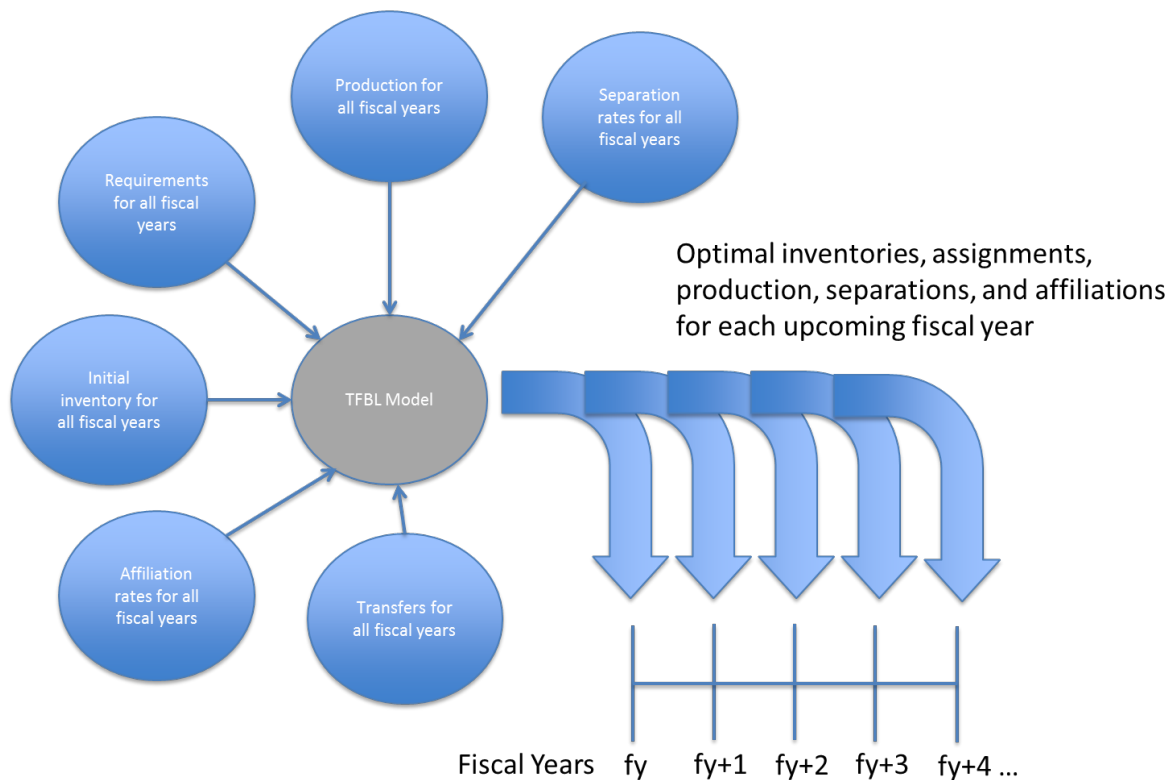
Note that the first two items result in the objective to have the inventory match the requirements exactly and the last two items result in the objective to have the affiliations match the affiliations derived from multiplying losses by the historical affiliation rate.

Mathematically, the number of personnel that the model assigns to a requirement plus the number of requirements left unfilled will equal the number of requirements of the Air Force. For example, if the Air Force 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 assignments 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 assignments is three.

Lastly, the inputs discussed and shown in Figure 1.1 are input into the TFBL model, and the model produces optimized inventories, assignments, production (when $npslb < 1.0$),⁴ losses, and affiliations for each future FY. Figure 1.3 provides an overview of the model that shows the inputs into the model and the projected and optimized output for each future FY.

⁴ See the appendix for a definition of *npslb*.

Figure 1.3. General Overview of the TFBL Model



General Overview of the Required Data

Before running the model, it is necessary to understand the data required to run it, the level of granularity at which the model operates, and the kinds of output that can be obtained from the model. To this end, we describe the input data, the different categories that define the input and output data, and the output data. This information should match the user’s intuition of the data that are required to do Total Force inventory projections given a red-line requirement while making assumptions about maximum production, target affiliation rates, and loss rates. To better understand the examples provided for each of the input categories, the user can reference the Divisions of Data section and the appendix, which contains detailed tables of all valid inputs for each input file.

Input Data

The model accepts the following general inputs:

- **Valid requirement categories** are the actual career fields that the user is allowed to input as requirements. For example, in an MWS implementation, RegAF Plt Ftr, AFR CSO

Mob, or ANG ABM JSTARS may be career fields of interest.⁵ For an MDS implementation, categories may be formulated at the aircraft level (e.g., RegAF Plt F-22, AFR CSO 12M, or ANG ABM E-8).

- **Requirements** are the number of individuals required to meet demands by component, by rated category, by MWS or MDS, and by FY, for the current and projected FYs.
- **Valid inventory categories** are the actual kinds of officers that exist in the model (e.g., RegAF Plt Ftr, AFR CSO Mob, or ANG ABM JSTARS or RegAF Plt F-15C/D, AFR CSO 12M, or ANG ABM E-8 in an MDS implementation).
- **Initial inventory** is the inventory of officers at the start of the first FY specified for this run of the model defined by component, rated category, MWS or MDS, FY, and CYOS.
- **Assignment options** specify which inventory categories can fill which requirement categories. For example, a RegAF mobility pilot (or a pilot for a mobility airframe, such as the C-17) can fill a RegAF mobility pilot (C-17) requirement or a RegAF “unspecified” pilot requirement.
- **Production** is the projected number of officers who will successfully complete undergraduate flying training (i.e., earn wings) in each FY.
- **Additional gains outside the usual production channels** is the projected number of officers who will enter the rated force already having earned wings in CYOS 0 (for example, helicopter pilots from a sister service).
- **Distribution of production entries by CYOS.** As officers earn their wings, they do not all enter the rated force in CYOS 0 because the CYOS clock starts upon commissioning. Historically, officers graduate from undergraduate flying training and enter the rated force between zero and six CYOS, so we have a distribution that states, for example, that 5 percent enter CYOS=0, 25 percent enter CYOS=1, 35 percent enter CYOS=2, etc.
- **Loss rate** is the fraction of rated officers in each component and MWS or MDS who cease to be rated officers in that component and major MWS or MDS by the end of the next FY (the circumstances of ceasing to be a rated officer consist of promotions to O-6, groundings, and retirements, among others).
- **Projection of aggregate pilot loss rates** is based on the influence of major airline hiring on Air Force pilot losses.
- **Affiliation rate** is the maximum rate at which officers who separate from the RegAF can affiliate with the AFR or ANG and do not require undergraduate flying training.
- **Affiliation options** specify which AFR and ANG crew positions and MWS or MDS can affiliate with each RegAF crew position and MWS or MDS. For example, a RegAF fighter pilot can affiliate with AFR or ANG as an 11F (fighter pilot) or an 11K (trainer pilot). Similarly, in an MDS implementation, a RegAF F-22 pilot can affiliate with the ANG as an F-22 pilot.
- **RIF** is the number of officers planned or programmed to be involuntarily separated in the current and future years.
- **Force transfer of officers that mimics being reclassified into another primary AFS** states how many officers of a certain kind are going to be reclassified as another (for example, RegAF mobility pilots being reclassified as RegAF special operations pilots). The purpose of this file is to count the individuals in the community in which they reside

⁵ *JSTARS* stands for Joint Surveillance Target Attack Radar System.

and are filling requirements. For several years, the mobility community transferred pilots to go be special operator pilots. Additionally, this input is where the model allows the user to mimic the assignments of the RPA ALFA tour pilot. The model allows the user to loan manned pilots to the RPA community, have the pilots serve one or two tours in the RPA community, and then return them back to the pilot community. Although these pilots were RPA ALFA tour pilots, they needed to be counted in the unmanned pilot or RPA community and not in the manned pilot community, as counting them in the manned pilot community distorted inventory levels, hid the manned pilot shortage, and showed a greater RPA pilot shortage than what truly existed.

Divisions of Data

It is important to know the categories of concern because all the input data mentioned previously are defined across several dimensions, such as (component, rated category, major weapon system, cyos) or (component, rated category, aircraft, cyos) in an MDS implementation. For example, at the end of FY 20, there were 193 RegAF fighter pilots in CYOS 4.⁶ The data are defined across the following dimensions:

- Component
 - RegAF
 - AFR
 - ANG
- FY from last completed FY to however many years into the future the user wishes to model, but generally 30 years
- CYOS from 0 to 35
- Category of rated career field
 - Pilot (Plt)
 - Combat systems officer (CSO)
 - Air battle manager (ABM)
 - Remotely piloted aircraft (RPA) pilot
- MWS and MDS for RegAF pilots and CSOs
 - Bomber (Bmb)
 - B-1
 - B-2
 - B-52
 - Command, control, intelligence, surveillance, and reconnaissance (C2ISR)
 - E-3
 - E-8
 - EC-130
 - RC/WC-135

⁶ This information was provided to the authors by HAF/A3 ACTF and was current as of September 30, 2020.

- RC-26
- U-2/TR-1
- Combat search and rescue (CSAR)
 - HC-130s
 - UH-1N
 - HH-60
- Fighter (Ftr)
 - A-10
 - F-15C/D
 - F-15E
 - F-16
 - F-22
 - F-35
- Mobility (Mob)
 - C-5
 - C-17
 - C-130
 - KC-135
 - KC-10
 - KC-46
 - 12M5F⁷
- Special operations (SO)
 - MC-130s
 - AC-130s
 - CV-22
 - NSAv
 - U-28
- RPAs
 - Only applicable to CSO RPAs
- MWS and MDS for RegAF ABMs
 - Airborne warning and control system (AWACS)
 - E-3
 - Joint surveillance target attack radar system (JSTARS)
 - E-8
 - Ground
 - Ground/other

⁷ For an MDS implementation, although categories usually correspond to specific airframes, there may be cases in which this is not appropriate for aircrew management. For example, aircrew managers in the ARC may treat requirements for mobility CSOs collectively as 12Ms but treat other CSO requirements at the airframe level (e.g., a B-52 CSO). This nuance can be accommodated in an MDS implementation of TFBL by treating 12M as an MDS category despite the category not corresponding to a specific airframe.

- MWS for RegAF RPA pilots
 - RPA11 (unmanned pilots)
 - RPA12 (RPA CSOs)
 - RPA18 (RPA pilots)
- MDS for RegAF RPA18 pilots
 - 18A
 - 18R
 - 18S
- AFS for AFR and ANG pilots (11-series), CSOs (12-series), ABMs (13Bs), and RPA pilots⁸
 - 11B/12B (aligns with RegAF Bmb)
 - 11E (AFR only)
 - 11F/12F (aligns with RegAF Ftr)
 - 11G/12G
 - 11H/12H (aligns with RegAF CSAR)
 - 11K/12K
 - 11M/12M (aligns with RegAF Mob)
 - 11R/12R (aligns with RegAF C2ISR)
 - 11S/12S (aligns with RegAF SO)
 - 13B (aligns with summation of RegAF AWACS, JSTARS, and Ground)
 - 11U/12U/18X (aligns with RegAF RPA11, RPA12, and RPA18, respectively).

Output Data

Lastly, it is important to understand the model outputs to complete analysis with a correct interpretation. The model creates the following outputs:

- projected inventories for all components, rated categories, MWS or MDS, CYOS, and FY
- assignments of inventories to requirements, including unassigned inventories and unfilled requirements
- production used in the model in each FY
- projected number of losses in each FY
- projected affiliations to the AFR and the ANG in each FY.

⁸ In this case, *AFS* is synonymous with *MWS*. For the sake of consistency with prevailing usage by the RegAF, we will use *MWS* to mean *major weapon system* for the RegAF and *AFS* for the AFR and ANG.

Chapter 2. Input Files and Uploading Input Files

This chapter discusses the input files with general descriptions for the types of data found in each file. The appendix contains a more detailed description of the data used in the model, the combination of categories that are allowed to be in the file, and the general format for the file. Additionally, this chapter discusses how to upload the input files to the web app to run the optimization model. This chapter, as well as Chapters 3 through 6, assumes that the reader will have obtained access to the web app and model from Headquarters of the Air Force Aircrew Task Force (HAF A3/ACTF), the owner of the code and documentation. RAND PAF cannot speak for HAF A3/ACTF regarding where the model (code) resides, where the data are stored, which format the model code is in (e.g., web app or jupyter notebook), or how to access the web app, if that is the format chosen by HAF A3/ACTF. For this document, we assume a web app format, which is a user-friendly website that, once the user successfully signs in, can be used to upload data, solve the model, visualize the output, and download the output data.

Input Data List

This section will help the user prepare the necessary input files to run the model. The ******* in the following file names denotes a suffix that will be appended to the file based on the naming convention presented in the next section. In the web app, there are templates for each input file that match the names listed and state which types of data need to be filled in. The templates will align with Tables A.2 through A.16 in the appendix for the categories, and the user will need to fill in the user-specified values (the production level, affiliation rates, and loss rates, etc.).

1. **BVLD_SAS***.xlsx**: This file contains the list of requirement categories considered by the model from the requirements perspective. Adding a new requirement category requires adding a new line that defines the rated category, component, and MWS requirement category (bcat) (or MDS [bcat] in an MDS implementation).
2. **IVLD_SAS***.xlsx**: This file contains the list of inventory categories considered by the model from the inventory (or personnel) perspective. Adding a new inventory category requires adding a new line that defines the rated category, component, and MWS inventory category (icat) (or MDS [icat] in an MDS implementation).
3. **PREF_ASGN_SAS***.xlsx**: This file contains the list of valid assignments of an officer, in the inventory found in **IVLD_SAS***.xlsx**, to a requirement in **BVLD_SAS***.xlsx**. This file represents the general rule set to follow given the primary career field of the officer, what jobs that officer could perform, and the career fields in which those jobs reside.
4. **ALLOW_TRANS_SAS***.xlsx**: This file specifies the allowed affiliations; it explicitly states that officers separating from specific RegAF inventory categories can affiliate into specific AFR or ANG inventory categories. For example, a RegAF fighter pilot can separate and affiliate into the ANG as an 11F, but a RegAF mobility pilot is not allowed

to separate and affiliate into the ANG as an 11F. This file simultaneously provides historical counts for each allowed affiliation in the past. When uploaded to the web app, a historical affiliation distribution from each RegAF category to each component will be calculated to provide bounds for the affiliation behavior in the model. When considering one RegAF category, such as RegAF fighter pilots, the model will sum all historical affiliations of RegAF fighter pilots as the denominator; for each allowed affiliation, the numerator is the provided historical count. This ratio gives the user the historical distribution affiliation rate. This ensures that RegAF fighter pilots do not all affiliate to AFR or ANG 11Ks (training pilots), for example, which would not align with historical affiliations. As one might suspect, RegAF fighter pilots usually affiliate to become AFR or ANG fighter pilots, and this historical distribution helps maintain that behavior in the model.

5. **FORCE_TRANS***.xlsx**: This file contains the number of officers who are being pulled from one inventory category in a specific FY and CYOS value and reclassified into another inventory category in the model in the same FY and CYOS value.
6. **RIF_VERSION***.xlsx**: This file contains the number of officers who are being involuntarily separated from the inventory in a specific component, rated category, MWS, FY, and CYOS.
7. **CYOS0INV***.xlsx**: This file contains the number of prior-service officers that are entering the rated force in a specific inventory category and FY at CYOS=0 and will bypass the undergraduate training pipeline.
8. **ALL_DIST_ENT_SAS***.xlsx**: This file specifies the distribution of nonprior service (NPS) production into CYOS 0–6 for each inventory category that is considered by the model in **IVLD_SAS***.xlsx**.
9. **ALL_REQUIREMENTS_SAS***.xlsx**: This file contains the number of requirements for each career field considered by the model in **BVLD_SAS***.xlsx** for each FY.
10. **ALL_INITIAL_INVENTORY***.xlsx**: This file contains the initial inventory for each career field considered by the model in **IVLD_SAS***.xlsx** by CYOS.
11. **ALL_DISTRO_SAS***.xlsx**: This file specifies the NPS production for each inventory category considered by the model in **IVLD_SAS***.xlsx** for each FY.
12. **LOSS_RATES***.xlsx**: This file specifies the loss rates for each inventory category considered by the model in **IVLD_SAS***.xlsx** for each FY and CYOS.
13. **AFIL_SAS***.xlsx**: This file specifies the historical affiliation rates at which separating RegAF rated officers can affiliate into the AFR, the ANG, and the AFR and ANG total for each inventory category considered by the model in **IVLD_SAS***.xlsx** between 0 and 16 CYOS, as calculated from the personnel files. This file provides the aggregate affiliation rates of the percentage of RegAF losses that will affiliate to the AFR and ANG separately, as well as the percentage of each RegAF MWS portion of the losses.
14. **MAH_FACTORS***.xlsx**: This file provides the forecasted aggregate pilot loss rates by component and FY (the result of regression analysis between major airline hiring [MAH]) and Air Force pilot losses based on forecasted MAH.

Uploading Input Files

This section assumes that the user will have obtained permissions and instructions to access the web app from HAF A3/ACTF, will have created and filled out the necessary input files, and is ready to follow the instructions outlined in the next sections.

Steps for Uploading File(s)

The steps for uploading file(s) are as follows:

1. Click the “UPLOAD FILES” button on the Upload/Generate Inputs tab.
2. A window will pop up that will allow a user to navigate to the location of the file(s).
3. Select the file(s) to be uploaded.
 - To select a single file, either double-click the file name or select the file name, then click the “Open” button.
 - To select multiple files,
 - hold down the “control” or “shift” button
 - select the file names
 - click the “Open” button.
 - To select all the file names,
 - press “Ctrl” and “A” together
 - click the “Open” button.

Note that **BVLD_SAS***.xlsx** and **IVLD_SAS***.xlsx** must be uploaded first because these two files define the universe of all the requirement and inventory categories considered by the model and define how the remainder of the files get processed.

Upload Files Status and Message Box

After clicking the “Open” button to upload file(s), a message box titled “Upload Files” will pop up. This message box will indicate whether the upload of each file was successful or not. If the upload failed, a message stating the cause of the failure will be displayed after the file name. The user will be required to fix the error(s) and attempt to upload the file again. Templates for each file type are available via the Input File Templates box. The user can select the file name to download and click the “download template” button.

File Naming Conventions

There are two possible naming formats. The format is based on whether the file type requires a custom text identifier. If the file type requires a custom text identifier, then the format is file_type-run_group-year-custom_text.xlsx. If the file type does not require a custom text identifier, then the format is file_type-run_group-year.xlsx. The components of these file names must adhere to the following conventions:

- “file_type” can only be one of the following names:
 - AFIL_SAS
 - ALL_DIST_ENT_SAS
 - ALL_DISTRO_SAS
 - ALL_INITIAL_INVENTORY
 - ALL_REQUIREMENTS_SAS
 - ALLOW_TRANS_SAS
 - BVLDD_SAS
 - CYOS0INV
 - FORCE_TRANS
 - IVLDD_SAS
 - LOSS_RATES
 - MAH_FACTORS
 - PREF_ASGN_SAS
 - RIF_VERSION.
- “run_group” can only take on the value of “FALL” or “SPRING.”
- “year” must be a four-digit year and can range from 2015 to the current FY plus 1 (i.e., 2015–2023), if the current FY is 2022. If the user is performing a current run (versus a past run), the year used should match the current calendar year. For instance, the most recent fall run that occurred in November 2020 used FALL-2020 in the file name even though it was FY 2021.
- “custom_text” can only contain numbers, letters, and underscores. The MAH_FACTORS file type falls into this category, and the custom_text helps inform which version of the data is being used.

Chapter 3. Generating Major Airline Hiring Loss Rates from the Web App

Steps for Generating MAH Loss Rates in the Web App

There are seven steps to follow to generate MAH loss rates in the web app:

1. Navigate to the “Upload/Generate Inputs” tab.
2. Click the “Refresh Parameter” button.
3. Click the drop-down arrow to display a list of available parameters (model inputs) to generate.
4. Select a parameter to generate. The drop-down parameters are generated based on previously uploaded input files.
5. When the user chooses a parameter to generate, the box below the buttons will provide a list of required files and the status of each file. The “Generate” button will remain unavailable until all required files are uploaded.
6. When the “Generate” button is available, click “Generate.” If one of the required files is uploaded again, then any new data versions will become available again in the list of parameters.
7. The user must click the “Refresh Parameter” button before generating model inputs.

List of Model Inputs to Generate

Most model inputs are generated after the user uploads the corresponding input files, but there are three model inputs that are not automatically generated. These model inputs require more than one input file to be generated. The model inputs that are not automatically generated are

- RegAF MAH loss rates
- AFR MAH loss rates
- ANG MAH loss rates.

Note on Using MAH Loss Rates for an MDS Implementation

We recommend that the user generates and uses the MAH loss rates when running an MWS implementation of the model. However, some inventory categories at the aircraft or MDS level may have too few numbers within a given category to reliably extrapolate MAH-adjusted loss rates. To account for major airline hiring at the MDS level, we recommend first calculating the MAH-adjusted loss rates at the MWS level and then using the adjusted loss rates for each MWS for the corresponding MDS categories. These MAH-adjusted loss rates can then be used in place of the historical loss rates in the input file **LOSS_RATES***.xlsx** for an MDS implementation. For example, the historical loss rate in a given CYOS value for the fighter MWS may be 10

percent. We would recommend running the MWS implementation to obtain the MAH-adjusted loss rates for the fighter MWS, which could be, for example, 15 percent for the same CYOS value to reflect increased major airline hiring. We would next recommend applying the 15 percent figure to that CYOS value for all airframes within the fighter MWS community (e.g., F-15E, F-22) and using those MAH-adjusted loss rates in lieu of historical rates in an MDS implementation of the model.

Version Names for Generated MAH Loss Rates

When the user is choosing a model input to generate, a list of all options will be available from the drop-down menu based on the files already uploaded. Generation of the MAH loss rates requires the uploading of three files: **ALL_INITIAL_INVENTORY***.xlsx**, **LOSS_RATES***.xlsx**, and **MAH_FACTORS***.xlsx**. Once these files have been uploaded, then the combinations of the version names in each of these files are put together in the drop-down list for choosing which datasets (versions) to use to generate the MAH loss rates.

Each option in the drop-down menu will be a hyphenation of three version names, the first from **ALL_INITIAL_INVENTORY***.xlsx**, the second from **LOSS_RATES***.xlsx**, and the third from **MAH_FACTORS***.xlsx**. For example, to calculate the AFR MAH loss rates used in the fall 2020 run, we used version AFR200930 from **ALL_INITIAL_INVENTORY-FALL-2020.xlsx**, version AF200930_Baselinev2 from **LOSS_RATES-FALL-2020.xlsx**, and version AF200930v2 from **MAH_FACTORS-FALL-2020-AF200930v2.xlsx**. In the drop-down menu, to generate this AFR MAH loss rate, the user can click on the “AFR200930-AF200930_Baselinev2-AF200930v2” option. If the list of required files shows “uploaded” as the status of each file, then the user can click “Generate.” Once the rate is successfully generated, the name chosen from the drop-down menu will be available on the “Solve” tab. This process is discussed in Chapter 4.

Chapter 4. Solving the Model in the Web App

Steps for Solving the Model in the Web App

The user can take the following steps to solve the model in the web app:

1. Navigate to the “Solve Model” tab.
2. Click the “Refresh Parameters” button, located in the bottom-right corner of the page.
3. Select a “Year” and “Run Group.”
 - a. Selecting a “Year” and “Run Group” will populate the “Existing Run Name” drop-down menu if there are any existing run names from previous uses of the web app.
 - b. Previously used run names can be selected from the drop-down list in the “Existing Run Name” field.
 - c. Selecting a run name under the “Existing Run Name” will populate all the remaining drop-down menus based on the parameters chosen when the user previously solved the model. Users can select an existing run name as a starting point and make the necessary changes for the new model run.
4. After selecting version names for the required datasets, enter a run name at the bottom of the page. This run name must be unique from all other run names stored on the database. The user must remember the run name they entered for future use in the visualization tabs and download tabs. Once all parameters are selected and a run name is entered, the “Solve Model” button will become available.
5. Click the “Solve Model” button.
 - a. The results of the model run will be displayed at the bottom of the “Solve” tab. The user can have more than one model run going simultaneously, and there is a bar that will tell the user how many runs have been submitted, are running, have resulted in an error, and have been successfully completed.
 - b. If the model results in an optimal solution, the results will be loaded in the database. The results can be found the “Visualization” tab and will be available to download.

Chapter 5. Exploring the Model Run Results

Six Tabs for Viewing the Model Run Results

The user can navigate to any of the following tabs to view the model run results:

- RED LINE/BLUE LINE
- PRODUCTION
- LOSSES
- AFFILIATIONS
- CYOS DISTRO BY YEAR
- LOSSES BY CYOS.

Viewing the Results

To view the model results, the user must take the following steps:

1. Click the “Refresh Parameters” button.
2. Select at least one Air Force component. Selecting more than one component will aggregate the results. The user can choose not to select a parameter inside the “Categories” and “RDTM” (rated distribution and training management) boxes. Not selecting a category serves the same function as selecting all the categories, and not selecting an RDTM serves the same function as selecting all the RDTMs. Selecting a parameter from the “Categories” and “RDTM” boxes acts as a filter, and only the results of the selected parameters will be aggregated.
3. Select at least one run name. Selecting more than one run name will allow the user to compare the results of each selected run name.
4. Click the “Visualize” button. Selections that the user has made on one tab will be reflected on all the other tabs.

Chapter 6. Downloading Charts or Data

Steps for Downloading Charts or Data

To download charts or data, the user must navigate to the “Download” tab, then

1. click the “Refresh Run Names” button
2. select the run name from the drop-down menu
3. click the button of the chart type or data type to be downloaded
4. save all charts and data downloaded, which will be packaged in a .zip file, to the user’s computer.

Input and Output Data

Input data are the post-processed data that are read into the model formulation. Each input file will be translated into its own .csv file. Output data are the data generated from the model run that is used in generating the charts. Output data for each chart will also be translated into their own .csv file.

Appendix. Detailed Description of Model Input and Data Used

The model requires a variety of input data, which are provided to the model in the form of Microsoft Excel (.xlsx) files. The sources, assumptions, and organization of those .xlsx files are discussed in the following sections. The variable fields appearing in the input data files are summarized in Table A.1. The following subsections describe in detail which input data files contain these variables.

In the following sections, *rated category* (rcat) and *crew position* are used interchangeably and correspond to a position for a pilot (Plt), a CSO, an ABM, or an RPA pilot. An inventory category represents the category of the officer, specifically the officer's career field. A requirement category represents the career field in which the requirement resides. For example, 11F (fighter) pilots typically fill 11F (fighter) pilot requirements. Likewise, in an MDS implementation, F-15E pilots typically fill F-15E pilot requirements. The inventory category (icat) of the pilot is fighter (e.g., F-15E); the requirement category (bcat) of the requirement is fighter (F-15E). In both cases, the MWS is fighter (and MDS is F-15E). MWS or MDS can mean either the inventory or the requirement category, and those meanings are context dependent.

Table A.1. Variable Explanations

Variable Name	Variable Meaning	Component	Allowed Range of Values
cyfirst	Lowest CYOS considered		[0, 1, . . . , 35]
cylast	Highest CYOS considered		[0, 1, . . . , 35]
fyfirst	First FY for the analysis		Any year
fylast	Last FY for the analysis		Any year
npslb	Lower bound on NPS production as a fraction of the maximum of NPS production allowed		[0,1]
rcat	Rated category or crew position		{Plt, CSO, ABM, RPA}
adsc	Active-duty service commitment		[0, 1, . . . , 30]
compo	Component		{RegAF, AFR, ANG}
icat	Inventory category or MWS or MDS	RegAF, AFR, ANG	See Table A.4
bcat	Requirement category or MWS or MDS	RegAF, AFR, ANG	See Table A.2
cyos, cy	CYOS		[0, 1, . . . , 35]
fy	FY under consideration		Any year
rqmt	Actual requirement		[0, infinity]
inven, asgn, prod, trans	Actual inventory, assigned inventory, production, and transfer amount		[0, infinity]

Variable Name	Variable Meaning	Component	Allowed Range of Values
percentage	Percentage of the population		[0, 1]
production	Actual NPS production		[0, infinity]
version	Unique name chosen by the user to represent data source or data		Any name up to 50 characters long

Requirements

There are two files associated with requirements: (1) one file that specifies all the requirement categories that will be considered by the model and (2) one file that provides the number of requirements per requirement category. In the following subsections, we explain these two files and provide descriptions of the most recent version of data used.

Requirement Categories

BVLD_SAS**.xlsx** specifies the valid requirement categories for a model run. The full set of valid requirement categories currently being used can be found in Table A.2. The first column specifies the rated category (rcat), the second column specifies the component (compo), and the third column specifies the MWS or MDS (bcat). The user determines which requirements are valid for the model runs. A template for input files and uploading files can be found in the web app, as noted in Chapter 2. If the MDS is blank, there is no equivalent category for that MWS.

Table A.2. Examples of Valid Requirement Categories for Major Weapon System or Mission Design Series Implementation

Rated Category (rcat)	Component (compo)	MWS (bcat)	MDS (bcat)
ABM	AFR	r13B	rE-3
ABM	AFR	r13B	rGround
ABM	ANG	r13B	rE-3
ABM	ANG	r13B	rE-8
ABM	ANG	r13B	rGround
ABM	RegAF	rAWACS	rE-3
ABM	RegAF	rGround	rGround
ABM	RegAF	rJSTARS	rE-8
ABM	RegAF	Unspec	
CSO	AFR	r12B	rB-1
CSO	AFR	r12B	rB-52
CSO	AFR	r12F	rF-15E
CSO	AFR	r12G	r12G
CSO	AFR	r12H	rHC-130

Rated Category (rcat)	Component (compo)	MWS (bcat)	MDS (bcat)
CSO	AFR	r12K	
CSO	AFR	r12M	r12M
CSO	AFR	r12R	rE-3
CSO	AFR	r12R	rEC-130
CSO	AFR	r12R	rRC/WC-135
CSO	AFR	r12R	rWC-130
CSO	AFR	r12S	rAC-130
CSO	AFR	r12S	rMC-130
CSO	AFR	r12S	rNSAv
CSO	AFR	r12S	rU-28
CSO	ANG	r12B	rB-52
CSO	ANG	r12F	rF-15E
CSO	ANG	r12G	r12G
CSO	ANG	r12H	rHC-130
CSO	ANG	r12K	r12K
CSO	ANG	r12M	r12M
CSO	ANG	r12R	rEC-130
CSO	ANG	r12R	rE-8
CSO	ANG	r12R	rRC/WC-135
CSO	ANG	r12R	rRC-26B
CSO	ANG	r12R	rWC-130
CSO	ANG	r12S	rAC-130
CSO	ANG	r12S	rMC-130
CSO	RegAF	rBmb	rB-1
CSO	RegAF	rBmb	rB-52
CSO	RegAF	rC2ISR	rE-3
CSO	RegAF	rC2ISR	rE-8
CSO	RegAF	rC2ISR	rEC-130
CSO	RegAF	rC2ISR	rRC/WC-135
CSO	RegAF	rCSAR	rHC-130
CSO	RegAF	rFtr	rF-15E
CSO	RegAF	rMob	r12M
CSO	RegAF	rRPA	
CSO	RegAF	rSO	rAC-130
CSO	RegAF	rSO	rMC-130
CSO	RegAF	rSO	rNSAv
CSO	RegAF	rSO	rU-28
CSO	RegAF	Unspec	

Rated Category (rcat)	Component (compo)	MWS (bcat)	MDS (bcat)
Plt	AFR	r11B	rB-1
Plt	AFR	r11B	rB-52
Plt	AFR	r11E	r11E
Plt	AFR	r11F	rA-10
Plt	AFR	r11F	rF-15E
Plt	AFR	r11F	rF-15C/D
Plt	AFR	r11F	rF-16
Plt	AFR	r11F	rF-22
Plt	AFR	r11F	rF-35
Plt	AFR	r11G	r11G
Plt	AFR	r11H	rHC-130
Plt	AFR	r11H	rHH-60
Plt	AFR	r11H	rUH-1N
Plt	AFR	r11K	r11K
Plt	AFR	r11M	rC-130E/H
Plt	AFR	r11M	rC-130J
Plt	AFR	r11M	rC-17
Plt	AFR	r11M	rC-21
Plt	AFR	r11M	rC-40
Plt	AFR	r11M	rC-5
Plt	AFR	r11M	rKC-135
Plt	AFR	r11M	rKC-10
Plt	AFR	r11M	rKC-46
Plt	AFR	r11R	rE-3
Plt	AFR	r11R	rE-8
Plt	AFR	r11R	rWC-130
Plt	AFR	r11R	rU-2
Plt	AFR	r11S	rAC-130
Plt	AFR	r11S	rMC-130
Plt	AFR	r11S	rNSAv
Plt	AFR	r11S	rU-28
Plt	ANG	r11B	rB-1
Plt	ANG	r11B	rB-2
Plt	ANG	r11F	rA-10
Plt	ANG	r11F	rF-15C/D
Plt	ANG	r11F	rF-16
Plt	ANG	r11F	rF-22
Plt	ANG	r11F	rF-35
Plt	ANG	r11G	r11G

Rated Category (rcat)	Component (compo)	MWS (bcat)	MDS (bcat)
Pit	ANG	r11H	rHC-130
Pit	ANG	r11H	rHH-60
Pit	ANG	r11H	rUH-1N
Pit	ANG	r11K	
Pit	ANG	r11M	rC-130E/H
Pit	ANG	r11M	rC-130J
Pit	ANG	r11M	rC-17
Pit	ANG	r11M	rC-21
Pit	ANG	r11M	rC-40
Pit	ANG	r11M	rC-5
Pit	ANG	r11M	rKC-135
Pit	ANG	r11M	rKC-46
Pit	ANG	r11R	rE-3
Pit	ANG	r11R	rE-8
Pit	ANG	r11R	rEC-130
Pit	ANG	r11R	rRC-26B
Pit	ANG	r11R	rRC/WC-135
Pit	ANG	r11S	rCV-22
Pit	RegAF	rBmb	rB-1
Pit	RegAF	rBmb	rB-2
Pit	RegAF	rBmb	rB-52
Pit	RegAF	rC2ISR	rE-3
Pit	RegAF	rC2ISR	rE-8
Pit	RegAF	rC2ISR	rEC-130
Pit	RegAF	rC2ISR	rRC/WC-135
Pit	RegAF	rC2ISR	rU-2
Pit	RegAF	rCSAR	rHC-130
Pit	RegAF	rCSAR	rHH-60
Pit	RegAF	rCSAR	rUH-1N
Pit	RegAF	rFtr	rA-10
Pit	RegAF	rFtr	rF-15C/D
Pit	RegAF	rFtr	rF-15E
Pit	RegAF	rFtr	rF-16
Pit	RegAF	rFtr	rF-22
Pit	RegAF	rFtr	rF-35
Pit	RegAF	rMob	rC-130
Pit	RegAF	rMob	rC-17
Pit	RegAF	rMob	rC-21

Rated Category (rcat)	Component (compo)	MWS (bcat)	MDS (bcat)
Plt	RegAF	rMob	rC-5
Plt	RegAF	rMob	rKC-10
Plt	RegAF	rMob	rKC-135
Plt	RegAF	rMob	rKC-46
Plt	RegAF	rSO	rAC-130
Plt	RegAF	rSO	rCV-22
Plt	RegAF	rSO	rMC-130
Plt	RegAF	rSO	rNSAv
Plt	RegAF	rSO	rU-28
Plt	RegAF	Unspec	
RPA	AFR	r18X	r18A
RPA	AFR	r18X	r18R
RPA	ANG	r18X	r18A
RPA	RegAF	rRPA	r18A
RPA	RegAF	rRPA	r18R
RPA	RegAF	rRPA	r18S
RPA	RegAF	Unspec	
ABM	AFR	r13B	rE-3
ABM	AFR	r13B	rGround
ABM	ANG	r13B	rE-3
ABM	ANG	r13B	rE-8
ABM	ANG	r13B	rGround
ABM	RegAF	rAWACS	rE-3
ABM	RegAF	rGround	rGround
ABM	RegAF	rJSTARS	rE-8
ABM	RegAF	Unspec	
CSO	AFR	r12B	rB-1
CSO	AFR	r12B	rB-52
CSO	AFR	r12F	rF-15E
CSO	AFR	r12G	r12G
CSO	AFR	r12H	rHC-130

Programmed Requirements

ALL_REQUIREMENTS_SAS*.xlsx** specifies the programmed requirements for the categories of interest specified in **BVLD_SAS***.xlsx**. The programmed requirements are typically supplied by the aircrew managers (HAF/A3 ACTF Rated Management for the RegAF, NGB/A21 TFI/Rated Management for the ANG, and HQ AFRC/A3RB Aircrew Management for the AFR). The user can download a template in the web app for input files and uploading input

files, as mentioned in Chapter 2, and have the respective aircrew managers provide the requested data. The first column in **ALL_REQUIREMENTS_SAS***.xlsx** specifies the data source (version), the second column specifies the rated category (rcat), the third column specifies the component (compo), the fourth column specifies the major weapon system (bcat) in an MWS implementation or mission design series/aircraft in an MDS implementation, the fifth column specifies the FY (fy) for the inventory, and the sixth column specifies the requirement (rqmt). The input file processing assumes that all other possible entries not submitted in the **ALL_REQUIREMENTS_SAS***.xlsx** file will have a value of zero. An example of the input found in **ALL_REQUIREMENTS_SAS***.xlsx** is shown in Table A.3.

Table A.3. Examples of Requirements

version	rcat	compo	bcat	fy	rqmt
AFR200930Fall	ABM	AFR	r13B	2024	87
AFR200930Fall	CSO	AFR	r12B	2020	77
ANG200930Fall	RPA	ANG	r18X	2021	736

NOTE: Example bcat categories are for an MWS implementation.

Inventory

There are two files associated with inventory: (1) one file that specifies all the inventory categories that will be considered by the model and (2) one file that provides the number of personnel per inventory category. In the following subsections, we explain these two files in detail and provide descriptions of the most recent versions of data used.

Inventory Categories

IVLD_SAS*.xlsx** specifies the valid personnel (inventory) categories for a particular model run. The full set of valid personnel categories can be found in Table A.4. The first column specifies the rated category (rcat), the second column specifies the component (compo), and the third column specifies the MWS (icat) or aircraft or MDS (icat) in the MDS implementation. The user determines which inventory categories are valid for the model runs, and a template for input files and uploading files can be found in the web app, as noted in Chapter 2.

Table A.4. Examples of Valid Inventory Categories for Either Major Weapon System or Mission Design Series Implementation

Rated Category (rcat)	Component (compo)	MWS (icat)	MDS (icat)
ABM	AFR	13B	E-3
ABM	AFR	13B	E-8
ABM	AFR	13B	Ground

Rated Category (rcat)	Component (compo)	MWS (icat)	MDS (icat)
ABM	ANG	13B	E-3
ABM	ANG	13B	E-8
ABM	ANG	13B	Ground
ABM	RegAF	AWACS	E-3
ABM	RegAF	Ground	Ground
ABM	RegAF	JSTARS	E-8
CSO	AFR	12B	B-1
CSO	AFR	12B	B-52
CSO	AFR	12F	F-15E
CSO	AFR	12G	12G
CSO	AFR	12H	HC-130
CSO	AFR	12K	12K
CSO	AFR	12M	C-130E/H
CSO	AFR	12M	12M
CSO	AFR	12R	E-3
CSO	AFR	12R	EC-130
CSO	AFR	12R	RC/WC-135
CSO	AFR	12R	WC-130
CSO	AFR	12R	RC-26B
CSO	AFR	12S	AC-130
CSO	AFR	12S	MC-130
CSO	AFR	12S	U-28
CSO	AFR	12S	CV-22
CSO	ANG	12B	B-1
CSO	ANG	12B	B-52
CSO	ANG	12F	F-15E
CSO	ANG	12G	12G
CSO	ANG	12H	HC-130
CSO	ANG	12K	12K
CSO	ANG	12M	C-130E/H
CSO	ANG	12M	KC-135
CSO	ANG	12M	12M
CSO	ANG	12R	EC-130
CSO	ANG	12R	E-3
CSO	ANG	12R	E-8
CSO	ANG	12R	RC/WC-135
CSO	ANG	12R	RC-26B
CSO	ANG	12R	WC-130
CSO	ANG	12S	AC-130

Rated Category (rcat)	Component (compo)	MWS (icat)	MDS (icat)
CSO	ANG	12S	U-28
CSO	ANG	12S	MC-130
CSO	RegAF	Bmb	B-1
CSO	RegAF	Bmb	B-52
CSO	RegAF	C2ISR	E-3
CSO	RegAF	C2ISR	E-8
CSO	RegAF	C2ISR	EC-130
CSO	RegAF	C2ISR	RC/WC-135
CSO	RegAF	CSAR	HC-130
CSO	RegAF	Ftr	F-15E
CSO	RegAF	Mob	12M
CSO	RegAF	RPA	CSORPA
CSO	RegAF	SO	AC-130
CSO	RegAF	SO	MC-130
CSO	RegAF	SO	NSAv
CSO	RegAF	SO	U-28
Plt	AFR	11B	B-1
Plt	AFR	11B	B-2
Plt	AFR	11B	B-52
Plt	AFR	11E	11E
Plt	AFR	11F	A-10
Plt	AFR	11F	F-15E
Plt	AFR	11F	F-15C/D
Plt	AFR	11F	F-16
Plt	AFR	11F	F-22
Plt	AFR	11F	F-35
Plt	AFR	11G	11G
Plt	AFR	11H	HC-130
Plt	AFR	11H	HH-60
Plt	AFR	11H	UH-1N
Plt	AFR	11K	11K
Plt	AFR	11M	C-130E/H
Plt	AFR	11M	C-130J
Plt	AFR	11M	C-17
Plt	AFR	11M	C-21
Plt	AFR	11M	C-40
Plt	AFR	11M	C-5
Plt	AFR	11M	KC-135
Plt	AFR	11M	KC-10

Rated Category (rcat)	Component (compo)	MWS (icat)	MDS (icat)
Plt	AFR	11M	KC-46
Plt	AFR	11R	E-3
Plt	AFR	11R	E-8
Plt	AFR	11R	EC-130
Plt	AFR	11R	RC/WC-135
Plt	AFR	11R	WC-130
Plt	AFR	11R	U-2
Plt	AFR	11S	AC-130
Plt	AFR	11S	MC-130
Plt	AFR	11S	NSAv
Plt	AFR	11S	U-28
Plt	ANG	11B	B-1
Plt	ANG	11B	B-2
Plt	ANG	11B	B-52
Plt	ANG	11F	A-10
Plt	ANG	11F	F-15C/D
Plt	ANG	11F	F-15E
Plt	ANG	11F	F-16
Plt	ANG	11F	F-22
Plt	ANG	11F	F-35
Plt	ANG	11G	11G
Plt	ANG	11H	HC-130
Plt	ANG	11H	HH-60
Plt	ANG	11H	UH-1N
Plt	ANG	11K	11K
Plt	ANG	11M	C-130E/H
Plt	ANG	11M	C-130J
Plt	ANG	11M	C-17
Plt	ANG	11M	C-21
Plt	ANG	11M	C-40
Plt	ANG	11M	C-5
Plt	ANG	11M	KC-135
Plt	ANG	11M	KC-46
Plt	ANG	11R	E-3
Plt	ANG	11R	E-8
Plt	ANG	11R	EC-130
Plt	ANG	11R	RC-26B
Plt	ANG	11R	RC/WC-135
Plt	ANG	11R	WC-130

Rated Category (rcat)	Component (compo)	MWS (icat)	MDS (icat)
Plt	ANG	11S	CV-22
Plt	ANG	11S	MC-130
Plt	ANG	11S	AC-130
Plt	ANG	11S	U-28
Plt	RegAF	Bmb	B-1
Plt	RegAF	Bmb	B-2
Plt	RegAF	Bmb	B-52
Plt	RegAF	C2ISR	E-3
Plt	RegAF	C2ISR	E-8
Plt	RegAF	C2ISR	EC-130
Plt	RegAF	C2ISR	RC/WC-135
Plt	RegAF	C2ISR	U-2
Plt	RegAF	CSAR	HC-130
Plt	RegAF	CSAR	HH-60
Plt	RegAF	CSAR	UH-1N
Plt	RegAF	Ftr	A-10
Plt	RegAF	Ftr	F-15C/D
Plt	RegAF	Ftr	F-15E
Plt	RegAF	Ftr	F-16
Plt	RegAF	Ftr	F-22
Plt	RegAF	Ftr	F-35
Plt	RegAF	Mob	C-130J
Plt	RegAF	Mob	C-12
Plt	RegAF	Mob	C-17
Plt	RegAF	Mob	C-21
Plt	RegAF	Mob	C-5
Plt	RegAF	Mob	KC-10
Plt	RegAF	Mob	KC-135
Plt	RegAF	Mob	KC-46
Plt	RegAF	SO	AC-130
Plt	RegAF	SO	CV-22
Plt	RegAF	SO	MC-130
Plt	RegAF	SO	NSAv
Plt	RegAF	SO	U-28
RPA	AFR	18X	18A
RPA	AFR	18X	18R
RPA	ANG	18X	18A
RPA	RegAF	RPA	18A
RPA	RegAF	RPA	18R

Rated Category (rcat)	Component (compo)	MWS (icat)	MDS (icat)
RPA	RegAF	RPA	18S

Initial Inventory

ALL_INITIAL_INVENTORY*.xlsx** specifies the actual initial inventory for the categories of interest specified in **IVLD_SAS***.xlsx**. The actual September 30 end-of-FY inventory data are typically supplied by the aircrew managers (AFPC/DYSA for the RegAF, NGB/A21 TFI/Rated Management for the ANG, and HQ AFRC/A3RB Aircrew Management for the AFR). The user can download the template for input files and uploading files in the web app, as noted in Chapter 2, and respective aircrew managers can provide the requested data. The first column in **ALL_INITIAL_INVENTORY***.xlsx** specifies the data source (version), the second column specifies the rated category (rcat), the third column specifies the component (compo), the fourth column specifies the major weapon system (icat) (or *aircraft/mission design* series in an MDS implementation), the fifth column specifies the CYOS (cy) for the inventory, and the sixth column specifies the inventory (inven). The input file processing assumes that all other possible entries not submitted in the **ALL_INITIAL_INVENTORY***.xlsx** file will have a value of zero. An example of the input found in **ALL_INITIAL_INVENTORY***.xlsx** is shown in Table A.5.

Table A.5. Examples of Initial Inventory

version	rcat	compo	icat	cy	inven
RegAF200930	Plt	RegAF	Ftr	2	262
RegAF200930	Plt	RegAF	Ftr	3	208
RegAF200930	Plt	RegAF	Ftr	4	193

NOTE: Example icat categories are for an MWS implementation.

Valid Assignments

PREF_ASGN_SAS*.xlsx** specifies the valid requirement categories to which inventory categories can be assigned, which are determined solely by the user. As an example, for the MWS implementation, a person with a rated category (rcat) of “Plt,” a component (compo) of “RegAF,” and an MWS (icat) of “Bmb” may be assigned to a requirement category of “Plt” (rcat), “RegAF” (compo), “rBmb” (bcat). The first three columns specify the actual category of the person, and the following three columns specify the requirement to which a person with that inventory category type could be assigned. For each kind of requirement that an officer can fill, there must be a row in this file to represent that assignment. Example lists of valid assignments contained in **PREF_ASGN_SAS***.xlsx** are shown in Table A.6 for MWS implementation and Table A.7 for MDS implementation, respectively. If an assignment is not listed in

PREF_ASGN_SAS*.xlsx**, it will not be allowed to occur in the model. A template for input files and uploading files can be found in the web app, as noted in Chapter 2.

Table A.6. Current Valid Assignments of Inventory Categories to Requirement Categories (MWS Implementation)

Inventory Categories			Requirement Categories		
rcat	compo	icat	rcat	compo	bcat
ABM	AFR	13B	ABM	AFR	r13B
ABM	ANG	13B	ABM	ANG	r13B
ABM	RegAF	AWACS	ABM	RegAF	rAWACS
ABM	RegAF	AWACS	ABM	RegAF	rGround
ABM	RegAF	AWACS	ABM	RegAF	Unspec
ABM	RegAF	Ground	ABM	RegAF	rGround
ABM	RegAF	Ground	ABM	RegAF	Unspec
ABM	RegAF	JSTARS	ABM	RegAF	rJSTARS
ABM	RegAF	JSTARS	ABM	RegAF	rGround
ABM	RegAF	JSTARS	ABM	RegAF	Unspec
CSO	AFR	12B	CSO	AFR	r12B
CSO	AFR	12F	CSO	AFR	r12F
CSO	AFR	12G	CSO	AFR	r12G
CSO	AFR	12H	CSO	AFR	r12H
CSO	AFR	12K	CSO	AFR	r12K
CSO	AFR	12M	CSO	AFR	r12M
CSO	AFR	12R	CSO	AFR	r12R
CSO	AFR	12S	CSO	AFR	r12S
CSO	ANG	12B	CSO	ANG	r12B
CSO	ANG	12F	CSO	ANG	r12F
CSO	ANG	12G	CSO	ANG	r12G
CSO	ANG	12H	CSO	ANG	r12H
CSO	ANG	12K	CSO	ANG	r12K
CSO	ANG	12M	CSO	ANG	r12M
CSO	ANG	12R	CSO	ANG	r12R
CSO	ANG	12S	CSO	ANG	r12S
CSO	RegAF	Bmb	CSO	RegAF	rBmb
CSO	RegAF	Bmb	CSO	RegAF	Unspec
CSO	RegAF	C2ISR	CSO	RegAF	rC2ISR
CSO	RegAF	C2ISR	CSO	RegAF	Unspec
CSO	RegAF	CSAR	CSO	RegAF	rCSAR
CSO	RegAF	CSAR	CSO	RegAF	Unspec

Inventory Categories			Requirement Categories		
rcat	compo	icat	rcat	compo	bcat
CSO	RegAF	Ftr	CSO	RegAF	rFtr
CSO	RegAF	Ftr	CSO	RegAF	Unspec
CSO	RegAF	Mob	CSO	RegAF	rMob
CSO	RegAF	Mob	CSO	RegAF	Unspec
CSO	RegAF	SO	CSO	RegAF	rSO
CSO	RegAF	SO	CSO	RegAF	Unspec
CSO	RegAF	RPA	CSO	RegAF	rRPA
CSO	RegAF	RPA	CSO	RegAF	Unspec
Plt	AFR	11B	Plt	AFR	r11B
Plt	AFR	11E	Plt	AFR	r11E
Plt	AFR	11F	Plt	AFR	r11F
Plt	AFR	11G	Plt	AFR	r11G
Plt	AFR	11H	Plt	AFR	r11H
Plt	AFR	11K	Plt	AFR	r11K
Plt	AFR	11M	Plt	AFR	r11M
Plt	AFR	11R	Plt	AFR	r11R
Plt	AFR	11S	Plt	AFR	r11S
Plt	ANG	11B	Plt	ANG	r11B
Plt	ANG	11F	Plt	ANG	r11F
Plt	ANG	11G	Plt	ANG	r11G
Plt	ANG	11H	Plt	ANG	r11H
Plt	ANG	11K	Plt	ANG	r11K
Plt	ANG	11M	Plt	ANG	r11M
Plt	ANG	11R	Plt	ANG	r11R
Plt	ANG	11S	Plt	ANG	r11S
Plt	RegAF	Bmb	Plt	RegAF	rBmb
Plt	RegAF	Bmb	Plt	RegAF	Unspec
Plt	RegAF	C2ISR	Plt	RegAF	rC2ISR
Plt	RegAF	C2ISR	Plt	RegAF	Unspec
Plt	RegAF	CSAR	Plt	RegAF	rCSAR
Plt	RegAF	CSAR	Plt	RegAF	Unspec
Plt	RegAF	Ftr	Plt	RegAF	rFtr
Plt	RegAF	Ftr	Plt	RegAF	Unspec
Plt	RegAF	Mob	Plt	RegAF	rMob
Plt	RegAF	Mob	Plt	RegAF	Unspec
Plt	RegAF	SO	Plt	RegAF	rSO
Plt	RegAF	SO	Plt	RegAF	Unspec
RPA	AFR	11U	RPA	AFR	r18X

Inventory Categories			Requirement Categories		
rcat	compo	icat	rcat	compo	bcat
RPA	AFR	12U	RPA	AFR	r18X
RPA	AFR	18X	RPA	AFR	r18X
RPA	ANG	11U	RPA	ANG	r18X
RPA	ANG	12U	RPA	ANG	r18X
RPA	ANG	18X	RPA	ANG	r18X
RPA	RegAF	RPA11	RPA	RegAF	rRPA
RPA	RegAF	RPA12	RPA	RegAF	Unspec
RPA	RegAF	RPA12	RPA	RegAF	rRPA
RPA	RegAF	RPA13	RPA	RegAF	Unspec
RPA	RegAF	RPA18	RPA	RegAF	rRPA
RPA	RegAF	RPA19	RPA	RegAF	Unspec

Table A.7. Current Valid Assignments of Inventory Categories to Requirement Categories (MDS Implementation)

Inventory Categories			Requirements Categories		
rcat	compo	icat	rcat	compo	bcat
ABM	AFR	E-3	ABM	AFR	rE-3
ABM	AFR	E-3	ABM	AFR	rGround
CSO	AFR	12G	CSO	AFR	r12G
CSO	AFR	12M	CSO	AFR	r12M
CSO	AFR	AC-130	CSO	AFR	rAC-130
CSO	AFR	B-1	CSO	AFR	rB-1
CSO	AFR	B-52	CSO	AFR	rB-52
CSO	AFR	E-3	CSO	AFR	rE-3
CSO	AFR	F-15E	CSO	AFR	rF-15E
CSO	AFR	HC-130	CSO	AFR	rHC-130
CSO	AFR	MC-130	CSO	AFR	rMC-130
CSO	AFR	RC/WC-135	CSO	AFR	rRC/WC-135
CSO	AFR	U-28	CSO	AFR	rU-28
CSO	AFR	WC-130	CSO	AFR	rWC-130
CSO	AFR	EC-130	CSO	AFR	rEC-130
RPA	AFR	18A	RPA	AFR	r18A
RPA	AFR	18R	RPA	AFR	r18R
Plt	AFR	11E	Plt	AFR	r11E
Plt	AFR	11G	Plt	AFR	r11G
Plt	AFR	11K	Plt	AFR	r11K
Plt	AFR	A-10	Plt	AFR	rA-10

Inventory Categories			Requirements Categories		
rcat	compo	icat	rcat	compo	bcat
Plt	AFR	AC-130	Plt	AFR	rAC-130
Plt	AFR	B-1	Plt	AFR	rB-1
Plt	AFR	B-52	Plt	AFR	rB-52
Plt	AFR	C-130E/H	Plt	AFR	rC-130E/H
Plt	AFR	C-130J	Plt	AFR	rC-130J
Plt	AFR	C-17	Plt	AFR	rC-17
Plt	AFR	C-40	Plt	AFR	rC-40
Plt	AFR	C-5	Plt	AFR	rC-5
Plt	AFR	E-3	Plt	AFR	rE-3
Plt	AFR	E-8	Plt	AFR	rE-8
Plt	AFR	F-15C/D	Plt	AFR	rF-15C/D
Plt	AFR	F-15E	Plt	AFR	rF-15E
Plt	AFR	F-16	Plt	AFR	rF-16
Plt	AFR	F-22	Plt	AFR	rF-22
Plt	AFR	F-35	Plt	AFR	rF-35
Plt	AFR	HC-130	Plt	AFR	rHC-130
Plt	AFR	HH-60	Plt	AFR	rHH-60
Plt	AFR	KC-10	Plt	AFR	rKC-10
Plt	AFR	KC-135	Plt	AFR	rKC-135
Plt	AFR	KC-46	Plt	AFR	rKC-46
Plt	AFR	MC-130	Plt	AFR	rMC-130
Plt	AFR	NSAv	Plt	AFR	rNSAv
Plt	AFR	U-2	Plt	AFR	rU-2
Plt	AFR	U-28	Plt	AFR	rU-28
Plt	AFR	UH-1N	Plt	AFR	rUH-1N
Plt	AFR	WC-130	Plt	AFR	rWC-130
Plt	AFR	C-21	Plt	AFR	rC-21
ABM	ANG	E-3	ABM	ANG	rE-3
ABM	ANG	E-8	ABM	ANG	rE-8
ABM	ANG	Ground	ABM	ANG	rGround
CSO	ANG	12G	CSO	ANG	r12G
CSO	ANG	12K	CSO	ANG	r12K
CSO	ANG	12M	CSO	ANG	r12M
CSO	ANG	AC-130	CSO	ANG	rAC-130
CSO	ANG	B-52	CSO	ANG	rB-52
CSO	ANG	E-8	CSO	ANG	rE-8
CSO	ANG	EC-130	CSO	ANG	rEC-130
CSO	ANG	F-15E	CSO	ANG	rF-15E

Inventory Categories			Requirements Categories		
rcat	compo	icat	rcat	compo	bcat
CSO	ANG	HC-130	CSO	ANG	rHC-130
CSO	ANG	MC-130	CSO	ANG	rMC-130
CSO	ANG	RC/WC-135	CSO	ANG	rRC/WC-135
CSO	ANG	RC-26B	CSO	ANG	rRC-26B
CSO	ANG	WC-130	CSO	ANG	rWC-130
RPA	ANG	18A	RPA	ANG	r18A
Pit	ANG	11G	Pit	ANG	r11G
Pit	ANG	A-10	Pit	ANG	rA-10
Pit	ANG	B-1	Pit	ANG	rB-1
Pit	ANG	B-2	Pit	ANG	rB-2
Pit	ANG	C-130E/H	Pit	ANG	rC-130E/H
Pit	ANG	C-130J	Pit	ANG	rC-130J
Pit	ANG	C-17	Pit	ANG	rC-17
Pit	ANG	C-40	Pit	ANG	rC-40
Pit	ANG	C-5	Pit	ANG	rC-5
Pit	ANG	CV-22	Pit	ANG	rCV-22
Pit	ANG	E-3	Pit	ANG	rE-3
Pit	ANG	E-8	Pit	ANG	rE-8
Pit	ANG	EC-130	Pit	ANG	rEC-130
Pit	ANG	F-15C/D	Pit	ANG	rF-15C/D
Pit	ANG	F-16	Pit	ANG	rF-16
Pit	ANG	F-22	Pit	ANG	rF-22
Pit	ANG	F-35	Pit	ANG	rF-35
Pit	ANG	HC-130	Pit	ANG	rHC-130
Pit	ANG	HH-60	Pit	ANG	rHH-60
Pit	ANG	KC-135	Pit	ANG	rKC-135
Pit	ANG	KC-46	Pit	ANG	rKC-46
Pit	ANG	RC/WC-135	Pit	ANG	rRC/WC-135
Pit	ANG	RC-26B	Pit	ANG	rRC-26B
Pit	ANG	UH-1N	Pit	ANG	rUH-1N
Pit	ANG	C-21	Pit	ANG	rC-21
ABM	RegAF	E-3	ABM	RegAF	rE-3
ABM	RegAF	E-8	ABM	RegAF	rE-8
CSO	RegAF	12M	CSO	RegAF	r12M
CSO	RegAF	AC-130	CSO	RegAF	rAC-130
CSO	RegAF	B-1	CSO	RegAF	rB-1
CSO	RegAF	B-52	CSO	RegAF	rB-52
CSO	RegAF	E-3	CSO	RegAF	rE-3

Inventory Categories			Requirements Categories		
rcat	compo	icat	rcat	compo	bcat
CSO	RegAF	E-8	CSO	RegAF	rE-8
CSO	RegAF	EC-130	CSO	RegAF	rEC-130
CSO	RegAF	F-15E	CSO	RegAF	rF-15E
CSO	RegAF	HC-130	CSO	RegAF	rHC-130
CSO	RegAF	MC-130	CSO	RegAF	rMC-130
CSO	RegAF	NSAv	CSO	RegAF	rNSAv
CSO	RegAF	RC/WC-135	CSO	RegAF	rRC/WC-135
CSO	RegAF	U-28	CSO	RegAF	rU-28
RPA	RegAF	18A	RPA	RegAF	r18A
RPA	RegAF	18R	RPA	RegAF	r18R
RPA	RegAF	18S	RPA	RegAF	r18S
Plt	RegAF	A-10	Plt	RegAF	rA-10
Plt	RegAF	AC-130	Plt	RegAF	rAC-130
Plt	RegAF	B-1	Plt	RegAF	rB-1
Plt	RegAF	B-2	Plt	RegAF	rB-2
Plt	RegAF	B-52	Plt	RegAF	rB-52
Plt	RegAF	C-130J	Plt	RegAF	rC-130
Plt	RegAF	C-17	Plt	RegAF	rC-17
Plt	RegAF	C-21	Plt	RegAF	rC-21
Plt	RegAF	C-5	Plt	RegAF	rC-5
Plt	RegAF	CV-22	Plt	RegAF	rCV-22
Plt	RegAF	E-3	Plt	RegAF	rE-3
Plt	RegAF	E-8	Plt	RegAF	rE-8
Plt	RegAF	EC-130	Plt	RegAF	rEC-130
Plt	RegAF	F-15C/D	Plt	RegAF	rF-15C/D
Plt	RegAF	F-15E	Plt	RegAF	rF-15E
Plt	RegAF	F-16	Plt	RegAF	rF-16
Plt	RegAF	F-22	Plt	RegAF	rF-22
Plt	RegAF	F-35	Plt	RegAF	rF-35
Plt	RegAF	HC-130	Plt	RegAF	rHC-130
Plt	RegAF	HH-60	Plt	RegAF	rHH-60
Plt	RegAF	KC-10	Plt	RegAF	rKC-10
Plt	RegAF	KC-135	Plt	RegAF	rKC-135
Plt	RegAF	KC-46	Plt	RegAF	rKC-46
Plt	RegAF	MC-130	Plt	RegAF	rMC-130
Plt	RegAF	NSAv	Plt	RegAF	rNSAv
Plt	RegAF	RC/WC-135	Plt	RegAF	rRC/WC-135
Plt	RegAF	U-2	Plt	RegAF	rU-2

Inventory Categories			Requirements Categories		
rcat	compo	icat	rcat	compo	bcat
Plt	RegAF	U-28	Plt	RegAF	rU-28
Plt	RegAF	UH-1N	Plt	RegAF	rUH-1N

Forced Transfers and Reductions

There are two kinds of movements of personnel that occur outside the normal assignment process: force transfers and RIFs. Force transfers are useful to capture those movements of personnel from one inventory category to another that cannot be captured by such assignments as leaving one AFS and reclassifying into another AFS. RIFs are meant to capture policy changes in end strength that dictate abnormal losses that are not captured through the historical patterns of separations and retirements in which personnel are involuntary separated from the Air Force. In the following subsections, we explain these two files in detail and provide descriptions of the most recent version of data used.

Force Transfers

FORCE_TRANS*.xlsx** specifies programmed transfers from one rated category to another by CYOS and FY. The first column in **FORCE_TRANS***.xlsx** specifies the original rated category (rcat), the second column specifies the original component (compo), the third column specifies the original MWS or MDS (icat), the fourth column specifies the new rated category (rcat), the fifth column specifies the new component (compo), the sixth column specifies the new MWS or MDS (icat), the seventh column specifies the CYOS (cy), the eighth column specifies the FY of transfer (fy), and the ninth column specifies the number of personnel transferring (inven). The user must define any force transfers that cannot be handled by assignments. A template for input files and uploading files can be found in the web app, as noted in Chapter 2. Table A.8 shows examples of RPA ALFA tour pilots returning to their manned pilot communities, which are the only force transfers currently modeled. The input file processing assumes that all possible entries not submitted in the **FORCE_TRANS***.xlsx** file will have a value of zero.

Table A.8. Examples of Force Transfers

From Inventory			To Inventory			cy	fy	inven
rcat	compo	icat	rcat	compo	icat			
RPA	RegAF	RPA11	Plt	RegAF	C2ISR	9	2021	1
RPA	RegAF	RPA11	Plt	RegAF	Mob	10	2021	5
RPA	RegAF	RPA11	Plt	RegAF	Mob	11	2021	4

NOTE: Example icat categories are for an MWS implementation.

Reductions in Force

RIF_VERSION*.xlsx** 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 scenarios. The first column in **RIF_VERSION***.xlsx** specifies the reduction case (version), the second column specifies the rated category (rcat), the third column specifies the component (compo), the fourth column specifies the MWS or aircraft or MDS (icat), the fifth column specifies the CYOS (cyos), the sixth column specifies the year (fy), and the seventh column specifies the reduction amount (inven). It is up to the user to define any programmed reductions as inputs into the model, and a template for input files and uploading files can be found in the web app, as noted in Chapter 2. Currently, there are no RIF scenarios modeled, and the only valid input would match the first row of Table A.9. This file assumes that all other possible entries not submitted in **RIF_VERSION***.xlsx** will have a value of zero for force transfers.

Table A.9. Examples of Reductions in Force

version	rcat	compo	icat	cyos	fy	inven
NoRIF	Plt	RegAF	Bmb	6	2020	0
RIF	ABM	RegAF	AWACS	6	2014	17
RIF	CSO	RegAF	Bmb	12	2014	1

NOTE: Example icat categories are for an MWS implementation.

Production

There are three files associated with production: (1) one file that specifies the CYOS distribution of NPS production based on historical data for each career field, (2) one file that specifies the programmed NPS production across the Future Years Defense Program, and (3) one file that specifies the number of officers entering the Air Force in CYOS 0. In the following subsections, we explain these three files in detail and provide descriptions of the most recent version of data used.

Distribution of NPS Production Across CYOS

ALL_DIST_ENT_SAS*.xlsx** specifies the distribution of NPS production at entry across CYOS 0 through 6. As an example, if there are ten rated officers produced for a specific inventory category 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), then there will be one person who accesses with zero CYOS, two people who access with one CYOS, etc. The first column in **ALL_DIST_ENT_SAS***.xlsx** specifies the data source (version), the second column specifies the rated category (rcat), the

third column specifies the component (compo), the fourth column specifies the MWS or aircraft/MDS (icat), the fifth column specifies the CYOS (cyos) for the distribution, the sixth column specifies the FY (fy), and the seventh column specifies the percentage (percentage) of the production that goes to each CYOS. The distribution should add up to 1. The input file processing assumes that all other possible entries not submitted in the

ALL_DIST_ENT_SAS*.xlsx** file will have a value of zero. These data can be provided by AFPC/DSYA for RegAF or by the RAND PAF Workforce, Development, and Health Program, which calculates these model inputs from historical data provided to RAND PAF by the Air Force under a memorandum of agreement. A template for input files and uploading files can be found in the web app, as noted in Chapter 2. An example of this production distribution can be found in Table A.10.

Table A.10. Example of Production Distribution Across Early CYOS

version	rcat	compo	icat	cyos	fy	percentage
AF20201111 2006-2020	Plt	ANG	11M	0	2021	0.0
AF20201111 2006-2020	Plt	ANG	11M	1	2021	0.095621
AF20201111 2006-2020	Plt	ANG	11M	2	2021	0.634495
AF20201111 2006-2020	Plt	ANG	11M	3	2021	0.226988
AF20201111 2006-2020	Plt	ANG	11M	4	2021	0.023235
AF20201111 2006-2020	Plt	ANG	11M	5	2021	0.007149
AF20201111 2006-2020	Plt	ANG	11M	6	2021	0.012511

NOTE: Example icat categories are for an MWS implementation.

Nonprior Service Production

ALL_DISTRO_SAS*.xlsx** specifies the NPS production for each category for each future year from *fyfirst* through *fylast*. The first column in **ALL_DISTRO_SAS***.xlsx** specifies the data source (version), the second column specifies the rated category (rcat), the third column specifies the component (compo), the fourth column specifies the MWS or MDS (icat), the fifth column specifies the year (fy), and the sixth column specifies the production (production). The processing assumes that any possible inventory categories not submitted in the production file will have zero production. If there is a nonzero value submitted for a category for any FY and if that FY is the last FY read in for that inventory category, then that value is the production used for each subsequent FY that is modeled. These production values can be determined by the user but can also be provided by HAF/A3 ACTF Rated Management for the RegAF, NGB/A21 TFI/Rated Management for the ANG, and HQ AFRC/A3RB Aircrew Management for the AFR. A template for input files and uploading files can be found in the web app, as noted in Chapter 2. Examples of production are shown in Table A.11.

Table A.11. Examples of Production

version	rcat	compo	icat	fy	production
FY21Fall_1480Prodv11	Plt	RegAF	Bmb	2021	55
FY21Fall_1480Prodv11	Plt	RegAF	Ftr	2022	300
FY21Fall_1480Prodv11	Plt	RegAF	Mob	2023	445

NOTE: Example icat categories are for an MWS implementation.

CYOS 0 Entries

CYOS0INV*.xlsx** specifies the number of officers entering an AFSC at CYOS 0.⁹ This allows for entries into the model in a specified CYOS that will not be distributed among CYOS 0 to 6 like NPS produced officers per the distribution in **ALL_DIST_ENT_SAS***.xlsx**. The first column in **CYOS0INV***.xlsx** specifies the data source (version), the second column specifies the rated category (rcat), the third column specifies the component (compo), the fourth column specifies the MWS or aircraft or MDS (icat), the fifth column specifies the year (fy), and the sixth column specifies the inventory (inven). The input file processing assumes that any possible inventory categories not submitted in this file will have zero CYOS 0 entries. These data are specified by the user, and a template for input files and uploading files can be found in the web app, as noted in Chapter 2. An example of the inputs found in **CYOS0INV***.xlsx** is provided in Table A.12.

Table A.12. Example of CYOS 0 Entry

version	rcat	compo	icat	fy	inven
AF200930	Plt	RegAF	CSAR	2021	0

NOTE: Example icat categories are for an MWS implementation.

Losses

There are two files associated with losses: (1) one file that specifies the baseline loss rates (or historical loss rates) and (2) one file that specifies MAH influence on aggregate Air Force pilot losses.¹⁰ In the following subsections, we explain these files in detail and provide descriptions of the most recent version of data used.

⁹ Accessing any service member with prior service in a sister branch and entering that member into the model at CYOS 0 distorts future losses, should the member be credited with more experience. This feature was originally built to account for an Army-to-Air Force transfer of helicopter pilots on the order of ten pilots per year who did not require undergraduate training. However, this transfer has not been modeled since that relationship ceased. Historically, the number of such gains is small and modeling these relationships does not materially distort the projected inventories.

¹⁰ This section emphasizes the MAH adjustments to the baseline losses in an MWS implementation. Please refer to Chapter 3 for more information on how to implement MAH adjustments to the baseline losses in an MDS implementation.

Baseline Loss Rates

LOSS_RATES*.xlsx** specifies the loss rates for each inventory category for each CYOS and each FY. The loss rates differ by CYOS to ensure that the model mimics actual circumstances in which there are essentially zero losses while under the initial active-duty service commitment (ADSC). For example, for pilots, there are larger losses in the years immediately after their initial ADSCs end, larger losses again after the five-year follow-on ADSCs expire, and then again at CYOS 19 and 20 to account for retirement losses.

There are two kinds of loss rates used: (1) a baseline loss rate (or the historical average) and (2) MAH loss rates. Moreover, for an MDS version, the baseline loss rate can represent the historical average or the MAH-adjusted loss rates imputed after MAH-adjusted loss rates have been calculated from an MWS implementation.¹¹ The baseline loss rates are provided by the RAND PAF Workforce, Development, and Health Program, which calculates these model inputs from historical data provided to RAND PAF by the Air Force under a memorandum of agreement. A template for input files and uploading files can be found in the web app, as noted in Chapter 2. **LOSS_RATES***.xlsx** typically contains only the baseline loss rates, although it is possible for the user to provide any kind of loss rate in this file for use in the modeling.

The first column in **LOSS_RATES***.xlsx** specifies the data source (version), the second column specifies the rated category (rcat), the third column specifies the component (compo), the fourth column specifies the MWS or MDS (icat), the fifth column specifies the CYOS (cy), the sixth column specifies the FY (fy), and the seventh column specifies the loss rate (percentage). Examples are shown in Table A.13.

Table A.13. Examples of Loss Rates for Inventory Categories by Fiscal Year and CYOS

version	rcat	compo	icat	cy	fy	percentage
AF200930_Baselinev2	ABM	AFR	13B	10	2021	0.094339623
AF200930_Baselinev2	ABM	AFR	13B	11	2021	0.136363636

NOTE: Example icat categories are for an MWS implementation.

Major Airline Hiring Factors

The MAH loss rates require a baseline loss rate with which to initialize the calculations, as described in Chapter 3. Thus, the MAH loss rates are typically not included in the **LOSS_RATES***.xlsx** file, as the MAH loss rates can be generated in the web app, usually for an MWS implementation.

The **MAH_FACTORS***.xlsx** file specifies the forecasted aggregate pilot loss rate per FY for each component based on the statistically significant relationship between major airline

¹¹ This section emphasizes the MAH adjustments to the baseline losses in an MWS implementation. Please refer to Chapter 3 on how to implement MAH adjustments to the baseline losses in an MDS implementation.

hiring and Air Force pilot losses. These data are provided by the RAND PAF Workforce, Development, and Health Program, which calculates these model inputs from historical data provided to RAND PAF by the Air Force under a memorandum of agreement. A template for input files and uploading files can be found in the web app, as noted in Chapter 2.

The first column in **MAH_FACTORS***.xlsx** specifies the component, and every column after specifies a particular FY. The cells in the body of the table contain the aggregate pilot loss rate for each component and FY. Examples are shown in Table A.14.

Table A.14. Examples of Aggregate Pilot Loss Rates by Component and Fiscal Year

Component	FY21	FY22	FY23	FY24	FY25	FY26
RegAF	0.04443	0.07079	0.08512	0.08822	0.09267	0.09395
AFR	0.0702858	0.0755630	0.0806158	0.0817049	0.0832732	0.0837248
ANG	0.0594219	0.0633424	0.0670963	0.0679053	0.0690704	0.0694059

Affiliations

There are two files associated with affiliations: (1) one file that specifies the kinds of affiliations that are allowed (e.g., a RegAF fighter pilot can affiliate to the ANG as an 11F) and provides data for the input processing to determine the historical distribution of these allowed affiliations and (2) one file that specifies the maximum affiliation rate that is allowed in the model from each RegAF inventory category. In the following subsections, we explain these files in detail and provide descriptions of the most recent version of data used.

Allowed Affiliations

ALLOW_TRANS_SAS*.xlsx** specifies the allowed affiliations from the RegAF to the ANG and AFR. As an example, in an MWS implementation, for a data source (version), a person in the category “ABM” (rcat), “RegAF” (compo), “AWACS” (icat) could affiliate to the category “ABM” (rcat), “AFR” (compo), “13B” (icat). The file also specifies the number of times that this affiliation has occurred in the past (obs) over the length of time of the dataset from which the rates are being calculated. Once a person affiliates, they are bound by the rules of their new inventory category in terms of which requirements they can fill and their likelihood of separation. The user must specify which affiliations are allowed, but the historical data are provided by the RAND PAF Workforce, Development, and Health Program, which calculates these model inputs from historical data provided to RAND PAF by the Air Force under a memorandum of agreement. A template for input files and uploading files can be found in the web app, as noted in Chapter 2. The input file processing will calculate the distribution of affiliations, which is most easily explained through the following example: RegAF CSO Bmb will affiliate to AFR CSO 12B at 95 percent (76/80), 12G at 1.25 percent (1/80), 12K at 1.25 percent (1/80), and 12M at 2.5 percent (2/80). Using the maximum affiliation rate that is

discussed in the next section and the number of RegAF CSO Bmb losses, the distribution of those affiliations will match that 95 percent-1.25 percent-1.25 percent-2.5 percent distribution. Examples of the input from the file **ALLOW_TRANS_SAS***.xlsx** are shown in Table A.15.

Table A.15. Examples of Allowed Affiliations from Inventory Categories in the RegAF to Inventory Categories in the ARC

version	rcat	compo	icat	rcat	compo	icat	obs
AF200930Fall	CSO	RegAF	Bmb	CSO	AFR	12B	76
AF200930Fall	CSO	RegAF	Bmb	CSO	AFR	12G	1
AF200930Fall	CSO	RegAF	Bmb	CSO	AFR	12K	1
AF200930Fall	CSO	RegAF	Bmb	CSO	AFR	12M	2
AF200930Fall	CSO	RegAF	Bmb	CSO	ANG	12B	48
AF200930Fall	CSO	RegAF	Bmb	CSO	ANG	12K	3
AF200930Fall	CSO	RegAF	Bmb	CSO	ANG	12M	2

NOTE: Example icat categories are for an MWS implementation.

Maximum Affiliation Rates

AFIL_SAS*.xlsx** specifies the maximum rates at which RegAF rated officers can affiliate to the AFR, the ANG, and AFR+ANG by MWS (or aircraft in an MDS implementation) between zero and 16 CYOS. A distinction is made to provide a maximum affiliation rate to the ARC; this rate does not have to be the summation of the maximum affiliation rate allowed for the AFR and the ANG separately. (For example, the maximum AFR affiliation rate may be 0.20 and the maximum ANG affiliation rate may be 0.20, but AFR+ANG may be 0.30, which means that if the AFR had 20 percent of the RegAF affiliations, then the ANG could only have 10 percent of the RegAF affiliations.) The historical affiliation rate data are provided by the RAND PAF Workforce, Development, and Health Program, which calculates these model inputs from historical data provided to RAND PAF by the Air Force under a memorandum of agreement. A template for input files and uploading files can be found in the web app, as noted in Chapter 2.

The first column in **AFIL_SAS***.xlsx** specifies the data source (version), the second column specifies the rated category (rcat), the third column specifies the component (compo), the fourth column specifies the MWS or MDS (icat), the fifth column specifies the CYOS (cy), 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). We have not seen a case in which the maximum AFR+ANG affiliation rate constraint was binding because it was the summation of the individual AFR and ANG affiliation rate constraints, but we have not directly researched it. The maximum AFR+ANG affiliation rate constraint could likely be removed, but it would require parametric analysis to assess whether it is redundant. Examples are shown in Table A.16.

Table A.16. Examples of Maximum Affiliation Rates by FY and CYOS from RegAF to ARC Inventory Categories

version	rcat	compo	icat	cy	AFR percentage	ANG percentage	AFR+ANG percentage
AF200930	CSO	RegAF	Bmb	6	0.196078	0.117647	0.313725
AF200930	CSO	RegAF	Bmb	7	0.183333	0.2	0.383333
AF200930	CSO	RegAF	Bmb	8	0.341463	0.121951	0.463415
AF200930	CSO	RegAF	Bmb	9	0.221519	0.139241	0.360759
AF200930	CSO	RegAF	Bmb	10	0.238095	0.190476	0.428571
AF200930	CSO	RegAF	Bmb	11	0.221519	0.139241	0.360759

NOTE: Example icat categories are for an MWS implementation.

Abbreviations

ABM	air battle manager
ADSC	Active-duty service commitment
AFR	Air Force Reserve
AFS	air force specialty
ALFA	ALO, LIFT, FAC, and ATC
ANG	Air National Guard
ARC	Air Reserve Components
AWACS	Airborne Warning and Control System
bcat	requirement category
Bmb	bomber
C2ISR	command, control, intelligence, surveillance, and reconnaissance
compo	component
CSAF	Chief of Staff of the Air Force
CSAR	combat search and rescue
CSO	combat systems officer
CYOS	commissioned years of service
Ftr	fighter
FY	fiscal year
HAF A3/ACTF	Headquarters of the Air Force Aircrew Task Force
icat	inventory category
JSTARS	Joint Surveillance Target Attack Radar System

MAH	major airline hiring
MDS	mission design series
Mob	mobility
MWS	major weapon system
NPS	nonprior service
PAF	Project AIR FORCE
Plt	pilot
rcat	rated category
RDTM	rated distribution and training management
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

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