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U.S. Army Task Organization Visualization Tool for Readiness

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Abstract: This paper provides stakeholders with two models that can be utilized in evaluating the impact on personnel readiness from task organization alternatives designed to mitigate the effects of decreasing recruitment and retention within the Army. We leveraged two methods to give stakeholders flexibility to test multiple data-driven courses of action with a holistic view. The first approach involved Python data analysis to identify the distribution of active-duty Army personnel. Redistribution alternatives are then used as input to a model by the USMA Operations Research Center (ORCEN), which creates a plan to maximize readiness. The second model was created through Vensim software with personnel data from the Vantage database and captures the complexities of Army personnel management. Our two models do not provide solutions to the recruitment and retention challenges but can be utilized as a tool to have a comprehensive view of the effects of task organization decisions on readiness.

Keywords: Readiness, Task-Organization, Vensim, DASD-FR, Projected End-Strength

1. Introduction

As the Army continues to face challenges in meeting recruitment goals, it is becoming increasingly vital to ensure that units throughout the organization are well-equipped to navigate the complexities of combat. With warfare continuously evolving, the Army must direct additional attention toward staying ahead of its peers. The Army has various broadening assignments that can temporarily reduce active units' readiness by pulling United States Army Forces Command (FORSCOM) personnel to fulfill the assignments. A potential method of increasing readiness for the future is to decrease the number of broadening assignments currently offered to or mandated for Army personnel. By reducing the number of broadening assignments, soldiers can remain in FORSCOM units for more optimal amounts of time. However, the scope of our two models does not account for the second and third-order effects of such changes. Therefore, the models do not aim to provide solutions to increase readiness or increase the personnel in FORSCOM units. Rather, they serve as a tool for DASD-FR to utilize to determine which assignments have the most significant effects on FORSCOM unit readiness. Using previous research done by the ORCEN, we have created a model that displays the FORSCOM readiness associated with the courses of action that are being tested (Pedersen, 2024). By providing this model, we offer DASD-FR a task organization visualization tool in the decision-making process for maximizing the readiness of FORSCOM units in the Army.

2. Literature Review

Many contributing factors cause the Army to reassign soldiers to other roles besides being in force elements. The primary purpose of our literature review was to find the different roles Active-Duty soldiers assume other than being in force elements. Those roles include but are not limited to recruiting units, officer professional military education (PME), enlisted PME, and drill sergeants.

As seen in AR 601-1, recruiters can be voluntarily or involuntarily selected. Involuntarily selected recruiters must serve a 3-year detail or may otherwise face separation (U.S. Department of the Army, 2023, 19). Upon completion of the 3-year detail, they may return to their previous MOS, reclassify as a 79R (recruiter MOS), or be separated from the Army (U.S. Department of the Army, 2023, 20).

Some sources indicate that the working conditions – the environment and requirements – of recruiters could be contributing to increased attrition rates. "Coping with recruiter stress: Hardiness, performance and well-being in US Army recruiters" outlines an experiment that aimed to determine which soldier characteristics are best suited for recruiting to decrease post-recruiter assignment attrition (Bartone and Bowles, "Coping with Recruiter Stress"). The study found a positive correlation between hardiness and recruiters' emotional well-being. Hardiness also influenced recruiter performance positively, as well as indicating a tendency to use problem-focused coping strategies.

The Army is also testing courses of action to encourage placement as a recruiter, such as a $5,000 bonus to those who volunteer (South, 2024). Overall, the information is partially inconclusive as to how assigning soldiers as recruiters affects attrition rates and whether assigning soldiers to recruiting positions to fix the recruiting problem could be worsening it by putting them in a position they find undesirable.

To become a drill sergeant, soldiers must first complete a 9-week training course (US Army Reserve.). Then, they spend an additional two years at BCT and AIT away from their original force units. Additionally, drill sergeants range from the rank of E-4 to E-7. Ranks in this range are heavily relied upon in their units. A study conducted at Fort Jackson shows that 24% of a sample of drill sergeants volunteered for the position while 68% were Department of the Army selected and did not volunteer (Cobb et al., 2009). If these results are representative of drill sergeants across the board, most soldiers (at least 68%) assigned to the position are assigned involuntarily.

The research in this area also indicates potential for a different system for selecting drill sergeants. Of the 4,000 drill sergeants in the Army, 1,665 are in the Army Reserve (*US Army Drill Sergeant of the Year 2024 Competition to Be Held at Fort Jackson*, 2024) (Tan, 2015). Another article explores the idea of using civilians or personnel in the Army Reserve to serve as drill sergeants instead of active-duty soldiers. Many have leadership experience and meet the physical demands of the job. There are 11,000 civilians in the Army Reserve who could potentially be used to test this theory (*About Us*, 2023).

For officers, the main assignments removing them from force units consist of Intermediate Level Education (ILE), Captain's Career Course (CCC), and teaching or personal education opportunities. There are three versions of ILE and different CCCs for each branch. Many officers also take positions to fulfill teaching or tactical officer roles at West Point. This could enable forces to retain their readiness level while also having officers fulfill their opportunities to complete their mandatory PME assignments.

Enlisted personnel are also being pulled out of force units for various reasons. The main courses pulling them out regularly are Basic Leader Course (BLC), Advanced Leader Course (ALC), and Senior Leader Course (SLC) (*Leadership Training*, 2024). These mandatory PME courses are solidified parts of the career progression for enlisted personnel. They do not pull NCOs from FORSCOM units for an excessive amount of time – it is typically only 2-5 weeks. BLC, which is for sergeants, corporals, and promotable specialists to hone their fundamental leadership skills and be provided with the tools necessary to be successful NCOs, is 22 academic days long (*Basic Leader Course*, n.d.). ALC for 19Ks, which is for transitioning NCOs from sergeant to staff sergeant, contains a 1 1-week-long Phase I and a 5-week and 3-day-long Phase II (Army Training Requirements and Resources System, 2024).

The main assignments pulling NCOs from FORSCOM units are the recruiting and drill sergeant broadening assignments referenced above, rather than enlisted PME, which are typically shorter time commitments. Additionally, the overall effectiveness of these courses is at an acceptable pace. In July 2012, the US Army Research Institute for the Behavioral and Social Sciences conducted a study on the effectiveness of infantry ALC. While infantry ALC is different from armor ALC, there are still infantry personnel in ABCT. Additionally, this project intends to apply our findings to any MOS, so the information is still relevant. The study found that while there are areas for improvement, the training value of ALC is above average, and the competency of NCOs significantly improves throughout the course. These findings indicate that ALC on the whole, is an effective enlisted PME assignment with some room for even more effectiveness (Pleban et al., 2012).

3. Methodology

3.1. Stakeholder Analysis

In our stakeholder analysis, we identified Army and DoD organizations that had an interest in matters concerning manning efficiency within the U.S. Army. Those of which included organizations such as personnel management, USAREC, HRC, ORCEN, the Office Secretary of Defense for Force Readiness, and U.S. Army Soldiers. We categorized the stakeholders into five types: Decision Authority, Client, User, Owner, and Interconnected. This classification is based on their roles in personnel retention including decision-making on requirements, product implementation, or overseeing the organization of the product.

We identified our stakeholders through meetings. Our first meeting was with a representative from IPPS-A. IPPS-A is the Army's online human resources (HR) system to streamline HR processes and improve the accuracy and efficiency of

personnel and pay procedures. One component of IPPS-A is the ability to track personnel sections. We identified through the meeting that they are an interconnected stakeholder. However, IPPS-A did not provide the specific flow of personnel data we were looking for. Our second meeting was with an associate with Vantage and extended data access. Vantage utilizes "artificial intelligence (AI)/machine learning (ML)-capable applications, Army Vantage improves and accelerates decisions on everything from personnel readiness to financial return on investment" ("Army Vantage | PEO Enterprise"). The Vantage associate is also an interconnected stakeholder regarding how our project explores the flow of personnel. During our meeting, we presented our research to clients, including members from the Office of the Deputy Assistant Secretary of Defense for Force Readiness, the Director of DASD FR, Readiness Reporting, Analytics, and Research, and the Director of Readiness Analytics. After presenting our research project to the clients, we received feedback from the stakeholders outlining their suggested areas of emphasis.

3.2. Solution Design and Development

The Deputy Assistant Secretary of Defense for Force Readiness (DASD-FR) created the Readiness Decision Impact Model (RDIM) which utilizes the "force provider readiness baselines to build a common framework to assess the magnitude of decision impacts on readiness over time" (Pedersen 2024). One limitation of the baselines currently provided by the Army is that they do not take into account the declines in end strengths projected by the Army HRC model "Inventory Projection Army Soldiers" (IPAS).

The Army HRC Enlisted Distribution Target Model (EDTM) currently uses IPAS to create monthly target fills for each UIC by MOS and grade. A simplified version of EDTM developed by the USMA Operations Research Center (ORCEN) creates a distribution plan using the IPAS projections, using a linear program that maximizes unit personnel readiness according to USR metrics (Pedersen 2024). However, one limitation to this model is that it does not take into account redistributions of personnel that might occur as end strength declines. Instead, it assumes that the number of personnel available to force elements (e.g. ABCTs) will decline at the same constant proportion. Our model will aim to enhance the ORCEN model by providing specific personnel data to use to analyze different redistribution alternatives.

Vensim is a "visual modeling tool that allows the user the ability to conceptualize, document, simulate, analyze, and optimize models of dynamic systems" (1 Introduction: User Guide - Vensim Tutorials & Introductions). Vensim builds simulation models from causal loop or stock and flow diagrams by connecting words with arrows. The relationships among system variables are entered and recorded as causal connections. This information is used by the Equation Editor to help the user form a complete simulation model. The user can analyze their model throughout the building process, looking at the causes and uses of a variable, and at the loops involving the variable. When the built model is simulated, Vensim lets you thoroughly explore the behavior of the model, giving the user the ability to change variables and view the model under time lapses.

3.2.1. Data Curation

The data curation pipeline started by receiving a data set of all active-duty personnel in the Army through our stakeholders on the Army's Vantage interface. The dataset included rank, MOS, current UIC code. The data was filtered and organized so that certain UICs are grouped into certain categories. The five categories we primarily focused on were FORSCOM, TRADOC, USAEUR-AF, HQDA STAFF, and everyone else. This dataset was used to find the same distributions for armor, engineer, field artillery, and infantry enlisted and officer personnel. Through these distributions separated by MOS and grade, we can utilize these data points as a basis for notional inputs into Vensim to simulate by producing a dynamic, stochastic environment that could later be used in the ORCEN Model. We also scoped the data by looking at E1-E7 pay grades for enlisted personnel and O1-O6 for officers. We further separated the TRADOC category into smaller subcategories like recruiting, ROTC instructors, and trainees to have a better understanding of where exactly everyone is located.

3.2.2. Model Building

To present unclassified information, the data used in the model and described below is notional. Our first methodology involved data analysis with Python in order to identify categories of assignments containing moderate numbers of personnel who could be redistributed to ABCTs. These identified quantities of personnel, by MOS and grade, are used as inputs into the ORCEN's distribution model to get readiness projections that show the readiness impacts of these redistribution alternatives. The diagram on the left shows the readiness status of 42 notional battalions in the Army on a month-by-month basis. At the current month, the notional data can support 14 P-1 units and 14 P-2 units, but due to decreasing force strength, after 15 months the number of P-2 units decreases by one every 1-2 months. The redistribution alternative we considered only added 10% more NCOs in the pay grades of E6 and E7, by pulling them from recruiting and

drill sergeant positions. It is assumed that they would be backfilled by contractors or other personnel at some cost. This alternative only increases the number of P-2 units by one (to most months). Decision makers would need to decide if that marginal increase in readiness is worth the cost. The purpose of the Python distribution model is to provide decision makers with a visual aid and quantitative metrics to enable more informed decisions on Army personnel redistribution based on impacts to readiness. The following data show in Figure 1 is notional, for illustration purposes only.

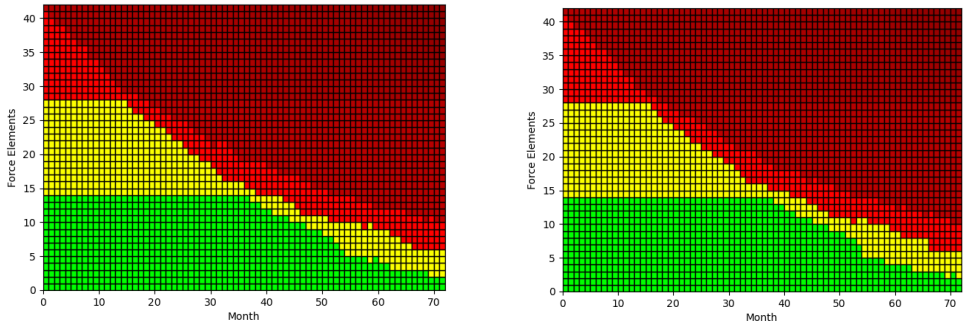

Figure 1: ORCEN distribution model projections: base case and with a redistribution alternative

The second methodology we used was through the Vensim software. The Vensim model offers a different approach which emphasizes other aspects than the Python model. This model considers complexities regarding Army personnel management which the Python model may not capture. The personnel flow of 19K MOS of Armor crew members within the Army is a complex system that involves recruitment, attrition, promotions, and transitions between various assignments. The authorized strength for 19K MOS personnel is set at 10,000 soldiers.

In developing our model, we prioritized identifying the most critical variables, particularly broadening assignments that remove 19K personnel from force-ready units. These assignments include drill sergeants, recruiters, and other FORSCOM roles such as ILE and PME. We utilized Vensim to analyze the enlisted aging chain and personnel assignments.

The Enlisted Aging Chain model begins with aggregated personnel data for initial calibration. Once calibrated, it expands into a stock-and-flow structure, incorporating exogenous variables that serve as policy adjustment levers. This structure captures how enlisted personnel progress through the ranks via promotions and attrition. Attrition rates for each rank were estimated based on research examining the number of soldiers leaving the Army at each level. Similarly, promotion rates were determined through historical data on average promotions over time.

Additionally, insights from Vantage informed the model by tracking personnel transitions from their primary MOS to secondary MOSs and broadening assignments within FORSCOM. The Personnel Assignment component of the model tracks soldier assignments and reallocations over time, integrating data from the enlisted aging chain to inform personnel movement. Exogenous variables enable the simulation of policy adjustments, providing insights into how external decisions and operational requirements influence assignments.

The initial entry point into the system is at the E1-E4 level, which notionally consists of 2,000 soldiers. This population experiences an attrition rate of 30%, resulting in an average monthly exit of 30 soldiers. As these soldiers leave the Army, a subset of those who remain will eventually become available for promotion to the E5-E7 ranks.

The transition from E1-E4 to E5-E7 occurs at a notional rate of approximately 50 soldiers per month. At any given time, a notional value of 6,000 E5-E7 soldiers is available for assignments. This number is influenced by multiple factors, including the return of drill sergeants, incoming personnel from other assignments (such as recruiters or other FORSCOM units), and attrition, which occurs at a notional rate of 30% annually.

Promotion within the senior NCO ranks follows a structured path. E7s are promoted at an estimated notional rate of 0.15 soldiers per month, while E8s are promoted at a rate of 0.02 soldiers per month. Simultaneously, E8 and E9 attrition rates are also estimated at 0.02 soldiers per month. This gradual transition ensures a steady flow of experienced personnel into higher leadership roles while accounting for expected attrition.

Soldiers rotate through various assignments, including serving as drill sergeants, recruiters, or positions in Force Ready ABCTs. The system accounts for the following transitions: 10 soldiers per month are assigned to Drill Sergeant duty, with an expected service duration of 36 months before rotating back into the available force; 10 soldiers per month transition into Force Ready ABCT units; 10 soldiers per month move to other assignments within FORSCOM; 10 soldiers per month are reassigned as recruiters, with a service duration of 36 months before returning.

The Force Ready ABCTs currently maintain a strength of 3,000 soldiers. New personnel enter these units at a rate of 10 soldiers per month, while those completing their service duration transfer out at a rate dependent on the total personnel divided by their time in service. Other FORSCOM units hold an additional 400 soldiers, while 500 soldiers serve as recruiters. The number of drill sergeants fluctuates based on the transition rates, with a baseline of 6 currently accounted for.

The difference between the authorized 10,000 personnel and the actual number serving in Force Ready ABCTs represents a key challenge in force management. This "gap" is monitored continuously, as maintaining optimal personnel levels is essential for operational effectiveness. The personnel flow model operates over a simulated time frame of 10 months, with updates occurring in steps of 120 months. Service durations for various assignments range from 30 to 36 months, ensuring that personnel rotations occur in a structured manner.

This system captures the dynamics of the 19K personnel lifecycle, balancing recruitment, training, assignments, and promotions to sustain force readiness and operational capability.

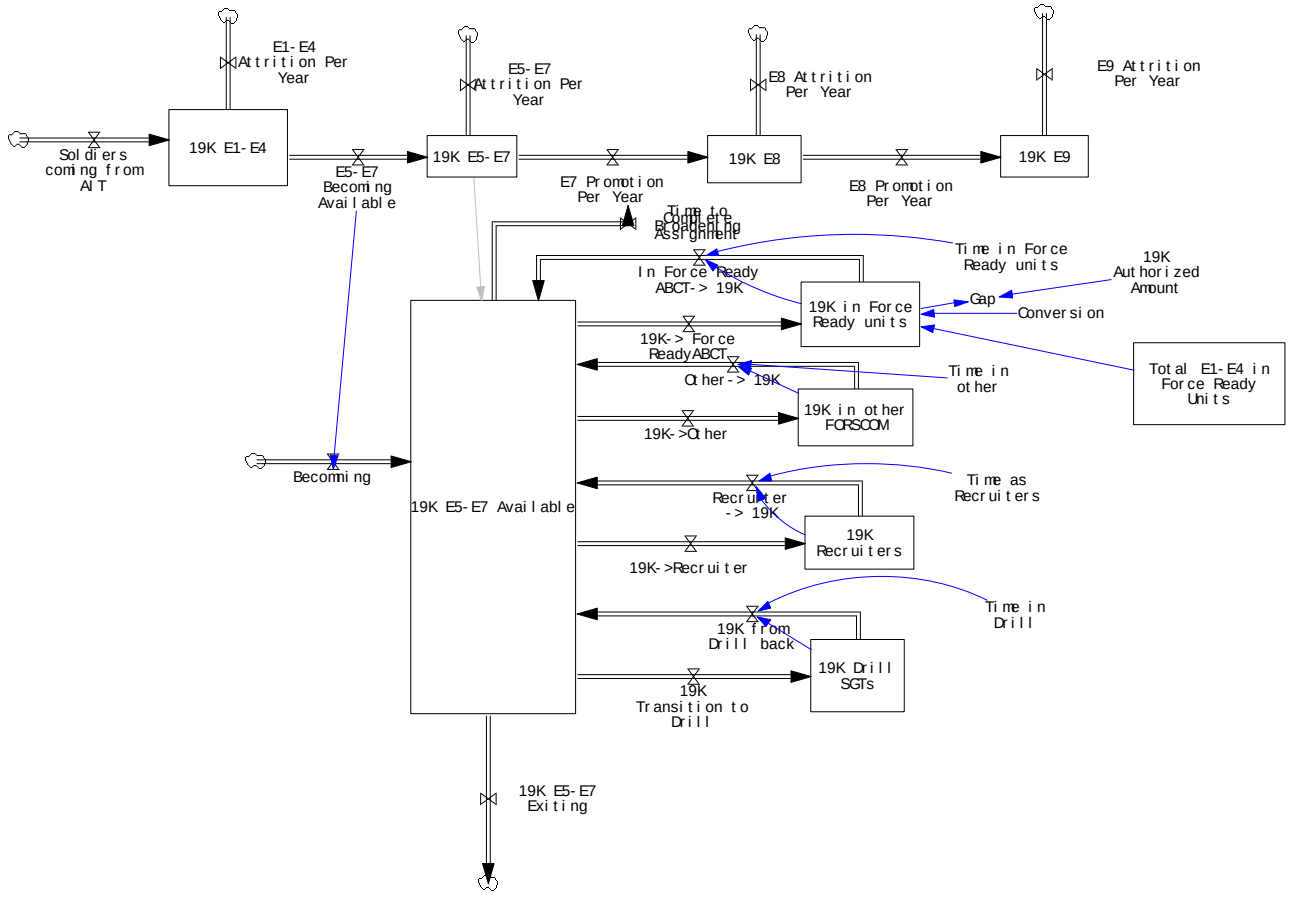

Figure 2. Aging Chain and Soldier Assignments

4. Conclusion

In addressing the Army's ongoing challenges with recruitment and operational readiness, our research centers around providing tools to test alternative courses of action for optimizing personnel allocation to FORSCOM units. Our framework can be used to analyze potential personnel decisions to understand the impact they may have on personnel readiness. Our stakeholder analysis identifies key organizations and individuals invested in improving personnel management. Through collaborative meetings, we explored existing tools such as IPPS-A and Vantage, recognizing their limitations in tracking and forecasting personnel movements comprehensively. Our methodology incorporated data curation and model building to simulate personnel flows and created a tool to assess the readiness of notional data based on potential courses of action. By

utilizing Python and Vensim software, we developed two different models with different approaches. The primary purpose of the Python data analysis approach is to provide input data for the existing distribution model created by USMA ORCEN. The Vensim model simulates enlisted aging chains, transition rates, and personnel assignments, capturing the complexities of Army personnel management, something that the Python model may overlook. These tools offer a forum to simulate and screen courses of action to predict readiness outcomes, providing potentially actionable insights for decision-makers. By creating a tool that observes the flow of personnel between FORSCOM and broadening assignments, we offer DASD-FR a tool set for navigating the challenges of manning inefficiencies and maintaining the U.S. Army's operational edge through future warfare.

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