MODELING RECRUITMENT AND INITIAL TRAINING CAPACITY

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ABSTRACT

Recently, the US Army made a policy shift and decided to move away from its traditional "Recruit in the High Schools" policy toward a more mature, experienced force. This category of recruit is what they call a "Hi-Grad." Someone out of high school, with some college, that meets mental, physical, and morale requirements. While this policy shift is in effect, the question was asked, "What can we realistically expect this policy shift to do to the training base of the Army?" Using simulation and available data, this research was able to answer that question and validate the policy. Through this research, it was concluded that the policy is not only valid, but potentially has far-reaching beneficial effects for the military's budget and efficient use of scarce resources.

1 INTRODUCTION

One use of simulation is to predict future behavior from changes in the system.[1] Considering the accession system of the U. S. Army, One change contemplated is the increased concentration of recruitment from the High Grad market of people eligible for service in the Army. Theoretically, shifting to this market should result in a more even flow of soldiers to the training base because these individuals are not locked into the education year. If this theory can be proven valid and supportable, it could result in a more efficient use of military resources. This study uses inputs from recruiting records against the available resources of the Basic Combat Training (BCT), One-Station Unit Training (OSUT), and Advanced Individual Training (AIT) in terms of class schedules and available training seats.

2 BACKGROUND

The United States Army Recruiting Command (USAREC) operations may be modeled as a process flow. Recruiters in recruiting stations encouraging prospects to enlist in the Army. Recruiters take the prospects to the Military Entrance Processing Stations (MEPS) where they receive vocational ability, aptitude, and medical screening. Applicants passing the quality standards for the stated tests enter into the Delayed Entry Program (DEP) until a training class position is available. Training classes are at Basic Combat Training (BCT) followed by Advanced Individual Training (AIT) or the combined BCT/AIT called One Station Unit Training (OSUT).

Actual total capacities are difficult to ascertain because differing flow rates from applicant to soldier cause variations in the process. The Army seeks High School Diploma Graduates as the minimum educational requirement for enlistment in the Army, as do many businesses. However, the Army may contract enlistment with high school seniors during the school year. Most of these seniors will actually enter service during the summer months after their high school graduation which causes an overflow of students in the summer (more students than training seats). Also, the months preceding high school

graduation causes a deficit of students in the months of February, March, and April.

Another cause for variation in the process is the sheer variety of job training offered. Each job specialty has its own training requirements and class schedule to conduct that training. This training is the soldier's Advanced Individual Training (AIT). High density jobs occur frequently, as might be expected, but low density positions may occur as little as one class per fiscal year. Because recruits for particular Military Occupational Specialties (MOS) require these classes before performing as a soldier in their operational unit, the Army desires to minimize the non-productive time between entry into Basic Combat Training and entry into the Advanced Individual Training. The method used currently to minimize the non-productive time is to place a recruit into the Delayed Entry Program until they enter active service at a BCT class that ends just prior to the needed AIT class. The One Station Unit Training combines the BCT and AIT together to reduce non-productive time but only for combat arms MOSs. Analysis has shown that the length of time an applicant waits for entry into the Army the higher their probability of declining entry into the Army, becoming a "DEP loss." Therefore, it is in the Army's best interest to send contracted soldiers to training earlier rather than later.

Another impact in determining flows is the attrition rates from BCT, AIT, and OSUT. Recruits may not be able to adjust to the rigorous demands of occupational training classes or the Army lifestyle. Classes are not storable resources similar to transportation systems. Once the aircraft or bus leaves the terminal, empty seats are consumed resources without any value added to the system. Attrition during a class results in the same loss. If the value added is the total number of trained soldiers, then the question becomes how many extra or type of soldiers must be recruited to account for attrition in the process? Analysis has shown that the higher the quality (as tested by the ASVAB) of recruits, the less likely they are to attrit.

3 ASSUMPTIONS AND SIMPLIFICATIONS

The complexity of the model is immense. Over 70,000 to 90,000 recruits are accessed by the Army annually and pass through the training process. These recruits can enter training for 212 different Military Occupational Specialties. For each recruit entity a simulation would need to carry attributes that direct the correct training flow of the entity. Additionally, entities would need to process through classes in the correct batch sizes. As some of the classes, such as OSUT, can last up to four months, the simulation could be maintaining track of almost 40,000 entities with associated attributes at one time.

To facilitate the model used, we employed the following assumptions:

- All entities that arrive in a MEPS station on a given day will be processed through all stations on that day. Entities representing those applicants that are unqualified for military service or otherwise decide not to continue seeking enlistment in the military will exit the system after MEPS processing.
- Each different type of entrance entity has an identifiable entry distribution. These entities are independent of each other in the process. Entities will be High Grads (HG), Graduates (G), Seniors (S), and Other (O).
- The type of entity does not affect the probability of attrition from BCT, AIT, or OSUT courses.
- All entities are generated on the first day of the month.
- Any delay less than 1 months time (number of days dependant on the month being ran) is not considered delayed.
- The model will use a one-tenth scale of reality to decrease the number of entities that the simulation software must process.

4 MODEL STRUCTURE

The model was built in three parts using Arena? software. The first reads applicant entity

attributes from an extract of the actual applicant files for fiscal years 2000 and 2001. The attributes relate to the three main career divisions, career management fields (CMF), and and Military Occupational Specialties (MOS). This designation is necessary to determine which type of initial training the applicant receives. The second part processes the applicants through either OSUT or BCT initial training. The final processes the entity through the MOS-specific AIT with subsequent first duty assignment. Entities are now soldiers and exit the model.

4.1 Entity Generation

Applicants for recruitment in the U. S. Army were generated using an extract of the Enhanced Applicant File (EAF) maintained by the United States Army Recruiting Command (USAREC). The applicant file contains data on applicants since 1994 and contains data fields listing each applicant's enlistment by the career management field – Combat Arms (CA), Combat Support (CS), and Combat Service Support (CSS). Combat Arms can further devolve into Career Management Fields of Infantry, Field Artillery, Air Defense Artillery, and Armored Calvary. These CMFs separate into individual MOSs. Additionally, applicants are classified the by educational levels of Hi Grad (some college), SA (applicant in high school scoring above 50 on the Armed Forces Qualification Test(AFQT), GA (high school diploma graduate scoring above 50 on the AFQT, and other categorizations. The Hi Grad, SA, and GA levels are the major considerations for this study.

The cross-tabulation analysis revealed the count of applicants in career division, CMF, MOS and education categories. The educational categories exhibited seasonal surges in applicants and thus set the pattern for generating applicants entering the simulation. A data file extracted from the Enhanced Applicant File was created to give each entity Career Division, CMF, MOS, and Education attributes as they were generated. The EAF was based on FY00-01 applicants. The file has the ability to allow scenario changes that call for more soldiers in particular MOSs, like Fighting Vehicle Infantrymen. Varying seasonal entry of applicants into the system allow examination of changes in recruitment of applicants in particular educational categories.

Actual entity generation was by a triagonal distribution mirroring each educational category (GA, SA, Hi Grad, Other). Each category had an independent entity generation capability for each given month. All entities were generated for each category, and entered the system for follow-on processing. One replication of the simulation covers one year's processing with applicants still in training being held at that resource until complete and others being queued.

4.2 OSUT and BCT Representation

This starts the second phase of the simulation. An applicant was given the attribute of career division and career management field during the first stage of the simulation. These attributes are used to send Combat Arms entities to OSUT initial training, while Combat Support and Combat Service Support entities will go to BCT ('boot camp'). Schedules of each active initial entry training facility were obtained from the Army Training requirements and Resources System (ATRRS). Each schedule shows class frequency, maximum class size, and duration of training. In every case, the actual number of classes were used but spread evenly over a year. Not provided were rotational down times for instructors or range maintenance/instructor training. These were assumed to be during historically low periods for that CMF as depicted by the cross-tabulation in EAF. Additionally, if the schedule failed to account for a period during the year (in weeks), the missing number of weeks were programmed as 'down-time' for that course. All military schools have an 'exodus' during the Christmas holiday. This exodus lasts two weeks, however, it can not be assumed that this time is used for range maintenance or instructor training.

The Army Reserve historically has provided training capabilities during the "summer surge". The model simplifies the process by dividing the number of days in a year by the total number of classes then generating a class by that number of days.

4.3 AIT Processing

AIT processing is the final phase of the simulation. Upon completion, the soldier will end his "initial entry status" and become a permanent party soldier. During this phase in the simulation, the entity is assigned training in their specific MOS. This can be any one of over 212 specific jobs in the military. The entity then proceeds to the training class for that specific MOS and enters the next available training class (if space allows on a first come, first serve basis). Entities will remain in this phase for various lengths of time depending on their job. Some AIT's run for as little as a month, others can be as long as 6 months. Soldiers that attended OSUT in phase 2 do not enter this phase. They leave initial entry status on completion of OSUT.

4.4 CRITERION

The criterion for the model was a decrease in the average wait time for processing through a class. This was considered to be indicative of an even flow of applicants compared to surge demands on the system.

5 VERIFICATION AND VALIDATION

5.1 Verification

The model was verified using animation and statistic collection functions. Each submodel had specific entities created to test the logic flow of the entities through the network. Animation was used to observe the virtual movement of the entities while statistical functions verify wait times, resource utilizations, and branching probabilities.

5.2 Validation

Validation involved the comparison of actual data against the model output. Army accessions data for fiscal years 2000 and 2001 was reduced to the main attributes of career division, career management field, and military occupational specialty which was read into the model for each entity. Exact accession numbers per month were used in one run then compared with the triangular distribution generated applicant monthly inputs. Variation in the model output for educational categories was less than 3 percent from the observed data.

Initial runs indicated that very little wait times occurred with AIT classes but occurred frequently with the BCT/OSUT classes. The decision was made to remove the AIT classes from the simulation to decrease the run time and total number of entities in the system for better performance.

6 SIMULATION

The model had two sets of inputs. One input

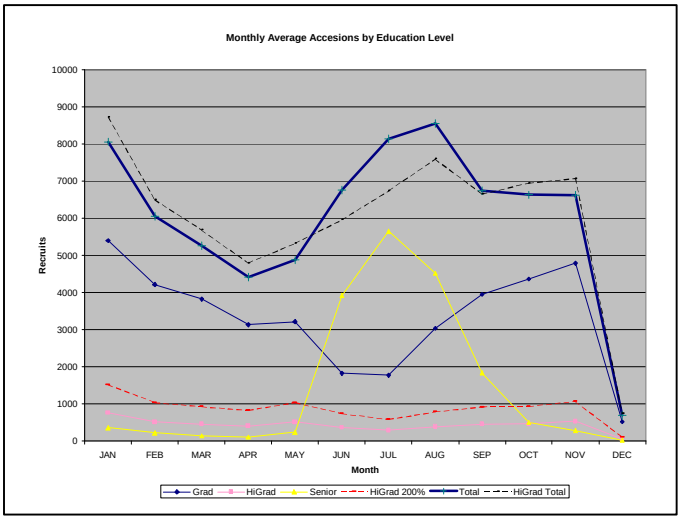

Figure 1 Monthly Accessions by Education Category

was the historical data for Fiscal Years 2000-2001. This input used the actual number of applicants per month by educational category. The other input was an increase by 200% of the Hi-Grad recruits. The Other category of recruits was reduced by the amount necessary to keep total accessions within limits set by the Department of the Army. Figure 1 shows that the resultant inputs shifted the total number of recruits per month away from the normal peak months of June and July and reduced the magnitude of the peak accessions months. Thirty replications were made for historical and HiGrad versions of the model for statistical purposes.

6.1 Outputs

The effect of the change in inputs generally showed a decrease in the wait times for BCT/OSUT training seats by using an increase in Hi-Grad applicants. Results are depicted in the table below.

	AVG-HiGrad	AVG-Hist	Difference	%time Saved
Infantry Heavy Antiarmor 11H OSUT	6.36148	6.960517	0.599037	8.61%
Knox Calvary Scout 19D OSUT	40.8383	75.69677	34.85847	46.05%
FT Knox BCT Hold	5.61915	6.373283	0.754133	11.83%
FT Jackson BCT Hold	3.197676667	3.34165	0.143973	4.31%
Internment Police Hold	12.90369667	16.48567	3.581973	21.73%
FT Sill BCT Hold	2.99883	3.966057	0.967227	24.39%
Indirect Fire Infantry OSUT	4.547956667	6.21245	1.664493	26.79%
Infantryman 11B Hold	25.59913333	55.64337	30.04423	53.99%
Combat Engineer Bridge Hold	11.29702333	17.68395	6.38693	36.12%
Abrams Crew 19K OSUT	87.91113333	119.8149	31.90377	26.63%
Fighting Vehicle Infantry 11M OSUT	9.85719	8.175367	-1.681823	-20.57%
Sill OSUT Cannon Crew 13B	26.57466667	40.2598	13.68513	33.99%
Ft L Wood BCT Hold	4.405443333	5.350647	0.945203	17.67%
Combat Engineer Hold	47.9956	79.16073	31.16513	39.37%
FT Benning BCT Hold	4.19882	3.543627	-0.655193	-18.49%
Military Police Hold	32.79263333	67.83427	35.04163	51.66%
Chemical Hold	15.46766667	46.57043	31.10277	66.79%

Table 1. Comparison of Average Wait Times for Class Queues for High Grad and Historical Inputs

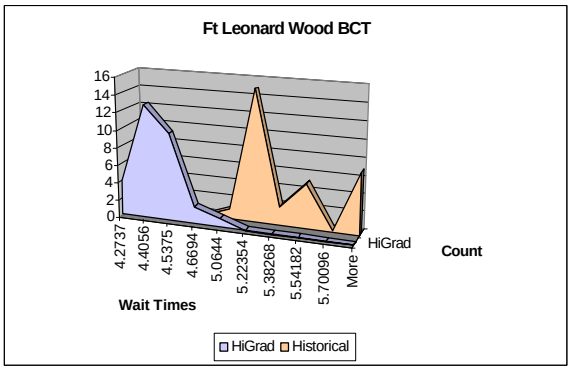

Figure 2. Simulation Result Comparison Between Historical Input and HiGrad Increase in Input for FT. Leonard Wood Basic Combat Training

7 CONCLUSIONS

With the exception of Ft. Benning BCT and Fighting Vehicle Infantry 11M OSUT, all training bases experienced a decrease in wait times, with a longer period of more effective utilization of the existing facilities. From this, the conclusion can be drawn that the shift to a policy of more Hi-Grad based enlistment would be a sound efficiency decision for military policy-makers. This will: 1) decrease length of time in the DEP program thereby increasing the chance of induction; 2) fill more seats throughout the year rather than surging on the training base requiring backfill by reserve personnel; and 3) decrease a soldiers wait time for seats leading to increased soldier satisfaction with military service. However, further investigation into Army Reserve accessions and training capabilities plus Army National Guard accessions, which were initially disregarded for simplification, is warranted.

8 FUTURE RESEARCH

While this study goes a long way to understanding the training process flow, many questions remain. More research is needed in the areas of training base attrition – percentages resold, when the training bases are closed, what happens

to a soldier when they do not leave military service when attritted from one course. This research could drastically improve the accuracy of a model similar to the one used here.

This same model can be used to determine the effects of large surge requirements in Army endstrength and the effect this surge would have on the military training base. That problem however, was outside the scope of this research.

REFERENCES

[1] Shannon, Robert E.; Systems Simulation: The Art and Science; Prentice-Hall, Inc., Englewood Cliffs, N. J.; 1975; p 2.

BIOGRAPHY

Major Jack Shacklett, US Air Force (RET), is an Operations Research Analyst with the Program Analysis and Evaluation Directorate of the United States Army Recruiting Command. He holds a Master's of Logistics Management from the Air Force Institute of Technology, a Master's of Public Administration from Troy State University, a Master's of Arts and Teaching from University of Louisville, and a Bachelors degree from the US Air Force Academy. He retired from the US Air Force as a command pilot.

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