OA 4202
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EXECUTIVE SUMMARY

BACKGROUND

Contrary to popular belief, the United States Navy does not look to recruit just any John or Sally for service to our country. Due to physical, moral, or aptitude issues, the eligible recruitable population constitutes just one third of the overall population in the target recruiting age window (17-34 years old).

Navy leadership believes we have the most technically adept enlisted force of all the services. Therefore, we compete with the other services to recruit and retain the highest quality young men and women to fill our force. With this competition factor taken into account, the labor pool available to the United States Navy is much more limited than one usually considers on first thought. Fortunately, the Navy is more than capable of recruiting the unskilled portion of that recruitable labor pool, and training each individual to be a "full-up-round sailor" ready to serve in our Global Force for Good.

Our network models the path of Navy recruits, from selecting their rating in the Navy, through their respective training pipelines, and into the fleet. Unfortunately for each recruit, not every Navy job is available to any recruit at any given moment. Ratings available to a recruit on the day he/she selects his/her rate are determined by needs of the Navy. A high qualifying score on the Armed Services Vocational Aptitude Battery (ASVAB) may make any rating a potential option for that Navy recruit, however the recruit's preferred rating may not be available to him/her when selection actually occurs.

This all too common situation places the United States Navy into a human capital dilemma, with many sailors employed in less than preferred ratings. Many technical ratings require a high ASVAB score and provide the sailor with an extensive technical education. As with all military training, each learner comes with a price tag. This training cost is seen as an investment by the Navy, and the return on that investment is 4 to 5 years of dedicated service by each highly trained sailor.

All enlisted personnel in the Armed Forces serve an enlistment contract. As each service-member's contract comes to an end, he/she has the option to sign an extension, sign a new contract, or allow the contract to expire and separate from the service. Some jobs in the service have an accepted high-turnover rate due to the relative low cost of training and low need for the service-member's skill set after the initial term of service is complete. However, given the time and funds required to recruit and train each sailor in technical ratings, it is in the best interest of the Navy to retain as many of these highly skilled technicians as possible.

Each sailor in these technical rates face the same decision when their obligated service is coming to an end: Stay Navy or move on. Each sailor possesses a technical skill set developed in class and honed in stressful environments. This is a marketable feature that can pay off in a comfortable post-Navy civilian career. If a sailor serves in a rating that was not his/her top priority, he/she may be more inclined to leave the Navy for a more preferred civilian career. This is why it is important for the Navy to develop a process that allows for the highest possible percentage of Navy recruits to be assigned their number one rating choice.

NETWORK SUMMARY

We develop a minimum-cost flow network model where the primary ‘cost’ is associated with the preference order of ratings for each recruit, prorated from first choice (-1) to fifth choice (-0.2). A recruit node is connected to the each schoolhouse node the recruit is eligible for that schoolhouse (based on randomly assigned AFQT score).

Between the schoolhouse and finished rating nodes, zero-cost arcs exist with upper capacities representing the number of seats available in each schoolhouse. The arcs from the finished rating nodes to the Fleet supersink node have zero cost, and the minimum and maximum flow on those arcs represent minimum and maximum demand in the fleet for the respective ratings.

Some assumptions are necessary for the formulation of this model. First, we model no attrition of recruits throughout the training pipeline. Also, AFQT scores are drawn from a triangular distribution from 50 to 99, with mode of 75. This choice ensures that all recruits considered for these technical rates meet the Navy’s standard for academic aptitude (‘high quality’).

RESULTS

The initial run results in approximately of 61% of 500 recruits earning their top rating choice. For the rest of the recruits in that group, 21.2% get their second choice job, 9.8% settle for their third through fifth choices. Overall, only 460 of the 500 recruits are assigned a job, because in some cases low ASVAB scores and schoolhouse capacity restrictions limit flow. In reality, the recruits not assigned a job in our model would be eligible for other less technical ratings. Recognizing the schoolhouse capacity limitation, the model is altered to maximize human capital with the introduction of Computer Based Training (CBT) augmentation courses.

The Naval Education and Training Command (NETC) is in the process of approving CBTs, where a newly accessed sailor can bypass the schoolhouse and report directly to the Fleet and complete the requisite training to earn their rating on the job. To model this scenario we add arcs starting at the schoolhouse nodes for the rates available for CBT training (ET, IT, OS, GSE, FC, CTT, EM) and proceeding directly to the Fleet (‘T') node. In effect, the schoolhouse capacity is relaxed by the addition of CBT options, and the Navy is capable of training up to the maximum demand for that specific rating. Importantly, there still remains a Fleet upper bound. Therefore, the combination of recruits attending formal schoolhouse training and recruits assigned CBT courses must not exceed the Fleet upper bound.

When we run our design scenario with successive numbers CBT design points available, we discover the first CBT course recommended by the model for the IT rating improves human capital substantially. At 3 CBT courses (IT, OS, GSE ratings) all 500 recruits are assigned a job and no recruit receives their fifth choice. The fourth CBT course added is for the EM rating. After 4 CBT courses, human capital no longer improves with the addition of more design points.

Another scenario we explore is a multi-commodity flow of different recruit batches through the network. In this scenario, the fixed capacity per schoolhouse is removed, but an aggregate constraint on total schoolhouse seating remains in place. 10 batches of 100 recruits are created, with ASVAB distributions and rating preferences varied between each batch. After running every batch through the network, the model recommends a proportion of seats that should be allocated for instruction to each rating. Using the model in this sense could provide

Navy Education and Training Command (NETC) with a better planning tool to allocate school seat quotas to better serve the Fleet.

IMPLICATIONS

Continued improvements and use of this network model could yield a useful tool to better assess Navy manpower requirements and could also be used to justify a more equitable way to match ratings to recruits via a draft-style matching process. Currently, Navy Recruiting Command makes ratings available to recruits at the beginning of each month. This results in a ‘first-come, first-serve’ situation where the beginning of each month is a mad dash for the more desired and less available rates. Recruits starting the process after the first few days of the month have to select less desirable ratings or wait for the opportunity to roll the dice at the beginning of the following month.

With this model in use, all recruits would have the opportunity to provide their rating preference list to a draft. Near the end of the month, all recruits could be matched to the available ratings (based on AFQT score, rating preference list, and any other factors deemed necessary by Navy Personnel Command).