RESEARCH MEMORANDUM

ESTABLISHING THE UPPER-MENTAL-GROUP GOAL

Gary F. Johnson, Cdr., USN

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Establishing the Upper-Mental-Group Goal

This research memorandum discusses the purpose of the upper-mental-group (UMG) requirement in Navy recruiting. A model is described that simulates the recruiting process and calculates the optimum UMG requirement. Findings are given for FY 1986.
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Robert F. Lockman
Director
Manpower Program

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ESTABLISHING THE UPPER-MENTAL-GROUP GOAL

Gary F. Johnson, Cdr., USN
Naval Planning, Manpower, and Logistics Division
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INTRODUCTION

In recruiting enlisted personnel, the Navy tries to balance two interests. One is the need to ensure that the mental abilities of its recruits match the demands of the jobs they will be expected to learn and perform. The second is the need to achieve efficiency in recruiting efforts by contacting as few candidates as possible to recruit the needed number. To help strike this balance, the Navy translates the prerequisites for all ratings (occupational fields) into what is termed an "upper-mental-group goal." This goal is then used by recruiters to target their efforts. It is also used for Congressional monitoring of recruit quality. Although a systematic methodology for determining the goal has not been established, the trend has been to increase the upper-mental-group (UMG) goal each year. This paper develops a procedure for establishing the UMG goal that is based upon the Navy's requirements and the availability of recruits in the youth cohort.

BACKGROUND

Recruit Ability Testing

The Armed Services Vocational Aptitude Battery (ASVAB) is administered to all candidates for enlistment in the armed forces. The Navy uses the results of the ASVAB to establish eligibility for enlistment and to classify enlistees into the various ratings. The ASVAB consists of ten tests measuring verbal, mathematical, technical, and speed factors [1]. The Navy uses composites of the ten tests to measure aptitudes for different ratings and to determine qualification for A-school, where initial occupational training takes place. Each rating requires a minimum composite score or a set of minimum composite scores. The ASVAB is taken prior to enlistment, and applicants who qualify may be guaranteed a rating and an A-school before they enlist.

Navy recruiting stations are connected to a national computerized monitoring and reservation system called CLASP, which contains the qualification standards and the number of A-school seats available in each rating. After initial recruiting, a classifier, using the CLASP system, matches the potential recruit's qualifications with the Navy's needs. This procedure allows the Navy to recruit to specific requirements. For this system to work

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1. The composite scores used by the Navy are detailed in appendix A.
efficiently, field recruiters must focus their efforts on the specific recruiting markets—high school graduates, for example—that are the best sources of recruits who will qualify for the openings. The Navy guides its recruiters in this effort by establishing an upper-mental-group goal. Since mental groups do not translate directly into rating entry requirements (ASVAB composite scores), it is worthwhile to review the current scheme.

Mental Groups

The Armed Forces Qualification Test (AFQT) was developed during World War II to determine the eligibility of recruits for military service. At that time, the classification testing to determine job placement was not conducted until the recruit was in basic training. Thus, it was necessary that the AFQT accurately predict performance on subsequent classification tests, and the test was structured to do so.

The mental-group categories are based on percentiles of the AFQT. There are eight mental groups (MGs) ranging from MG I to MG V. Mental group III is broken into Upper (U) and Lower (L) segments and mental group IV into A, B, and C segments. All applicants in MG I, MG II, and MG IIIU are classified as upper mental group.

The establishment of Department of Defense testing facilities in the seventies allowed administration of the ASVAB prior to enlistment, so the separate AFQT was no longer needed. The AFQT percentile is still required for mental-group classification, however, to allow Congress to monitor mental-group standards in the services. Currently, the AFQT is computed from selected ASVAB subtests and used to determine the composition of the mental groups.

Classification

Because the CLASP system that places recruits into ratings uses up-to-the-minute Navy requirements as well as composite scores, it would be a cumbersome tool for field recruiters to use. A measure that is more general, a summary ability index, is needed to provide the field recruiters with a yardstick to use in seeking out qualified applicants. Currently, this yardstick is the UMG goal, which tells the individual recruiter what percentage of his recruits must be in the upper-mental-group categories. The UMG goal requires the recruiter to focus upon markets that contain the people most
likely to meet current requirements when they go through the classification process. It is therefore important that the UMG goal be as sensitive as possible to the composite ASVAB scores the Navy requires for each rating.

Previous Work

A method of relating entry-level school requirements to ASVAB composite scores and subsequently to an upper-mental-group goal was developed at CNA [2]. Inherent to [2] was a discretionary rule for apportioning the number of school seats for each rating between upper and lower mental groups. Although the approach used was reasonable and the discretionary rule appropriate, the procedure did not adequately address the sensitivity of goal determination. Sensitivity in this context means the effect of changing the UMG goal on meeting end-strength requirements for recruits and on filling the school seats.

Since the UMG goal is at best an instrumental goal, it should be set to enhance the probability that the Navy will meet its two main recruiting objectives. The first is obtaining the required number of recruits who are qualified by their composite scores for each of the many A-schools. The second objective is meeting the end-strength requirement, in particular the total number of male recruits without military experience, known as New Accession Males (NAMs).

If the Navy sets a UMG goal that is too low, it may meet the NAM goal but fail to fill all its A-school seats. A UMG goal that is too high, on the other hand, can have a number of possible consequences, such as:

- The Navy makes its NAM goal and UMG goal. All school seats are filled with the best possible recruits. The general-detail (Gendet) population has a large number of upper-mental-group members.

- The Navy makes its UMG goal but fails to make its NAM goal. This case leaves the Navy short of its total requirements unnecessarily because qualified recruits in the lower mental groups were rejected so that the UMG goal could be met.

- The Navy does not make either goal, and as a result neither the A-school requirements nor the total requirements are met. In this
situation the Navy would be short of both the A-school graduates and the general-detail recruits needed to man the fleet.

In all cases, if the UMG goal is too high, many well-qualified, highly motivated, high school diploma graduates in the lower mental groups may be rejected for service, which would be very costly. The correct approach appears to be a narrow range of percentages, one that lies between the two extremes and satisfies both A-school and end-strength requirements.

Recruit Choice

In an all-volunteer force, it is essential that the recruiter and classifier be able to accommodate a recruit's choice of occupation. At the same time it is necessary to meet the Navy's needs for personnel skills. Although some potential recruits have a strong propensity to enlist in the Navy, most young men who want to serve in the military have not narrowed their choice down to only one of the four branches of service. If the Navy cannot offer such recruits their choice of occupation, they may well enlist in another service. From the Navy's viewpoint, someone who enlists in another branch of service is a more significant loss than someone who never intended to join any branch of military service.

Most recruits will be qualified for more than one school.\(^1\) If the UMG goal is set too close to the minimum overall requirements, however, the recruiter's ability to place a recruit into a rating will be limited not by the availability of school seats, but by the necessity to place each recruit in the most demanding school for which he qualifies. Thus, the UMG goal should be sufficiently higher than the minimum UMG requirement to allow the recruiter the flexibility to offer recruits occupational choices.

SIMULATION MODEL

Introduction

The method selected to establish the recruit quality goal was simulation of the recruiting process. A model of the way in which recruits (including Gendets) are classified and assigned to schools was constructed using the

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1. In this context, a school defines a Navy rating
FORTRAN programming language. The actual coding for the model is contained in appendix B. To use the model it is necessary to estimate the population of potential recruits, the number of recruits required for each particular school, and the probability of a recruit’s being qualified for a particular school. The procedures used in arriving at each estimate are presented next, followed by a general description of the model.

Estimating the Population of Potential Recruits

The procedure used to estimate the population of potential recruits is outlined in table 1. We begin with projections of the number of 17- to 23-year-old males in FY 1986.¹ These estimates are based on the 1980 census [3, 4]. This total number is then divided into mental groups based on the AFQT percentiles. This procedure is possible because the AFQT is constructed to contain the same number in each percentile. The next step is to subtract all those in mental group IVB and below and the non-high school diploma graduates (NHSDGs) in mental groups IIIIL and IVA because the Navy does not enlist these people.

To obtain the population of potential recruits, the number remaining in each mental-group category is multiplied by that category’s propensity to enlist. The propensities are based on a series of questions in the Profile of American Youth survey [1].² This calculation gives the population of 17- to 23-year-old potential recruits in each mental-group category, one of the key factors in the simulation model.

Establishing the Number of A-School Vacancies

The A-school loading plan includes quotas for New Accession Males (NAMs); these quotas must be adjusted to account for attrition from A-school. To calculate the number of seats to use in determining the composite score quotas, historical attrition rates specific to each school are used as follows:

\[
\text{Loading} / (1 - \text{attrition}) = \text{Required input}
\]

¹ Because the Navy has not had trouble meeting quotas for females, females were not included in the analysis.
² Kyle Johnson of the Defense Data Manpower Center provided the tabulations of enlistment propensity by mental group.
TABLE 1

CALCULATING THE POPULATION OF POTENTIAL RECRUITS
Male youth population: 13.4 million

<table>
<thead>
<tr>
<th>Procedure</th>
<th>I/II</th>
<th>IIIU</th>
<th>III L</th>
<th>IVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage in MG</td>
<td>35</td>
<td>15</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Number in MG (millions)</td>
<td>4.69</td>
<td>2.01</td>
<td>2.68</td>
<td>1.34</td>
</tr>
<tr>
<td>NHS DG percentage of MG</td>
<td>n/a</td>
<td>n/a</td>
<td>24.5</td>
<td>41.5</td>
</tr>
<tr>
<td>Number in MG (millions)</td>
<td>4.69</td>
<td>2.01</td>
<td>2.02</td>
<td>7.839</td>
</tr>
<tr>
<td>Propensity to enlist (%)</td>
<td>13.06</td>
<td>26.18</td>
<td>26.18</td>
<td>40.77</td>
</tr>
<tr>
<td>Potential recruits (thousands)</td>
<td>612</td>
<td>526</td>
<td>527</td>
<td>319</td>
</tr>
</tbody>
</table>

The required input is then aggregated for all schools selected by the same composite score. For example, the composite score VE + AR = 103 qualifies a recruit for 12 different A-schools. The required inputs for all 12 are combined to make a loading for the composite score. This procedure yields 25 separate aggregations, or rating groups, as there are 25 distinct composite score cutoffs. The summation of the 25 rating groups gives the number of NAMs that are to attend A-school. This number is subtracted from the total NAM requirement and the remainder is the quota for the "school" created for the Gendet population. As a result, the simulation will have 26 aggregations and estimate the entire NAM recruit quality result.

School Qualification Probabilities

The simulation determines qualifications for assignment to A-schools by using conditional probability: the probability that a recruit is qualified for a particular school, given that he is a member of a particular mental-group category. The probabilities are conditioned on the mental-group categories I/II, IIIU, III L, and IVA. The National Opinion Research Center (NORC) data base was used as the data input stream and an SPSS-X program generated the frequencies for each qualifying composite score, given the individual was in
the specified mental-group category. The probabilities are detailed in appendix A.

General Description

The model generates a potential recruit and first determines which mental group he is in. The determination is probabilistic, and as such, it depends on the distribution of mental groups in the population of potential recruits. The choices are the four mental-group categories noted above. If the recruit is in the upper mental groups (I, II, IIIU) the model proceeds directly to the classification process.

Should the recruit be in the lower mental groups, the first step is to determine if the Navy's limit on MG IVAs has been reached; by Navy policy, no more than 12 percent of the recruits may be IVAs in any one year. If the limit has been reached, the individual is not recruited. If the cap has not been reached, the MG IVA recruit is treated in the same way as the MG IIILs. For recruits in the lower mental groups, the next step is to compare the UMG goal with the percentage of recruits in the upper mental groups recruited so far. If the goal is achieved, the processing of the recruit moves to the classification step. Should the UMG goal not be achieved, the recruit is not hired.

For each mental group, the conditional probabilities have been calculated to determine the probability that the recruit is qualified for the ith school, given that he is a member of that mental group. For each mental group the schools are ranked from the hardest to qualify for to the easiest (Gendet in all cases). At the first school for which the recruit is qualified, the model determines if there are any vacancies. If there is one, the recruit is assigned to that school. Should there not be a vacancy, the model continues to the next school and so on. It is possible that the recruit can be rejected because all the schools for which he is qualified are full. Because the model includes Gendets, however, which all recruits are eligible to become, this type of rejection is not expected to happen often.

The model stops processing when all the requirements have been met or when 100,000 applicants have been tested. Upon completion of a run, the

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[1] The NORC data base comes from a nationally representative sample of American youth who were given the ASVAB battery. General results are described in [1]; [5] provides more detail on the sample.
number of recruits assigned to each school category is counted, and the percentage in the upper mental groups is determined. The number from each mental group who were rejected for service due to non-qualification or full quotas is also tallied. The final statistics are the number of recruits in the lower mental groups who were rejected due to the UMG goal and the number of MG IVAs rejected due to the cap on that mental group. Appendix C gives two examples of the model’s output.

FINDINGS

The simulation model was run many times; both the random-number seed and the analytical inputs (the mental-group distribution of the population of potential recruits and the Navy’s UMG goal) were varied. Each time the model was run, the number of potential recruits rejected (because of the UMG goal or because the recruit was not qualified for any of the remaining school seats) was tabulated.

From these attempts to explore the sensitivity of the model, an overall finding was that the model’s output was dependent upon the definition of the population of potential recruits. In particular, changing the mental-group distributions within the recruitable population caused significant changes in the mental-group distribution of recruits. For example, even a population having only 20 percent in the upper mental groups could fill school seats—even using fairly low UMG goals. The school seats were filled, however, by testing (and rejecting) many individuals. The main point here is that since there is a positive probability (albeit sometimes a very small one) that a recruit in the lower mental groups can qualify for every Navy school, by testing enough people in the lower mental groups one could—theoretically—fill almost all the Navy schools with recruits from the lower mental groups. The testing would, of course, be prohibitively expensive, but this finding emphasized the importance of correctly defining the population of potential recruits.

As described above, the final step in defining the mental-group distribution of the population of potential recruits involved propensity to enlist: removing individuals from the pool if they indicated on the Profile of American Youth survey that they would “definitely not” or “probably not” serve in the armed forces. Thus, the percentage of the population in each mental group who indicated that they “definitely would” or “probably would” serve was multiplied by the number of people remaining in the mental group.
after the earlier adjustments had been made. Although this approach (detailed in table 1) seemed correct, it was decided that since the simulation model was so sensitive to the mental-group distribution of the population of potential recruits, it would be worthwhile to explore other ways of constructing the population.

The most sensible alternative to using propensity to enlist appeared to be removing full-time college students from the population because they are not likely to enlist. The NORC data base was used to determine the percentage of full-time college students in each mental group, and another estimate of the population of potential recruits was obtained. This method produced a mental-group distribution for the population that was virtually equivalent to that detailed in table 1. The similar results of the two methods generated confidence that the population had been correctly defined.

As noted above, the model was run with several different UMG goals. Using the FY 1986 A-school loading plan and the FY 1986 projected youth cohort, the model indicated that the optimum UMG goal would be 56 or 57 percent. "Optimum" here means that the goal is high enough that school seats are filled even if all recruits do not select the most difficult school for which they qualify, but not so high as to incur excessive recruiting costs from rejecting qualified recruits in the lower mental groups. Based on repeated simulations, a UMG goal of 56 to 57 percent would yield a recruited UMG percentage of about 60 percent. Raising the UMG goal to 59 percent yields a UMG achievement of 61 percent, but 1,700 otherwise qualified recruits in the lower mental groups are turned away. At an average cost of $330 to test a potential recruit [5], the added cost to the Navy of the higher goal (for testing alone) amounts to about $500,000.

CONCLUSION

Thus, the conclusion of the analysis is that an upper-mental-group goal of 56 to 57 percent is optimal for FY 1986. A lower goal would sacrifice available quality, and a higher one would needlessly cause qualified people in the lower mental groups to be rejected because the overall UMG goal had not been met.
REFERENCES


APPENDIX A

INDEX TO COMPOSITE SCORES AND PROBABILITIES OF QUALIFICATION
APPENDIX A

INDEX TO COMPOSITE SCORES AND PROBABILITIES OF QUALIFICATION

This appendix displays the composite scores used by the Navy in determining A-school qualifications. In all there are 26 combinations of the 10 basic composites shown in table A-1. Table A-2 gives the composite, minimum qualifying score, and probability of qualification, given mental group, for each of the 26 combinations, or rating groups. For example, seven rating groups use the composite C1 with minimum cutoff scores varying between 89 and 113.

<table>
<thead>
<tr>
<th>Composite</th>
<th>ASVAB tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>VE + AR</td>
</tr>
<tr>
<td>C2</td>
<td>AR + 2MK + GS</td>
</tr>
<tr>
<td>C3</td>
<td>AR + MK + El + GS</td>
</tr>
<tr>
<td>C4</td>
<td>AR + MC + AS</td>
</tr>
<tr>
<td>C5</td>
<td>VE + MC + AS</td>
</tr>
<tr>
<td>C6</td>
<td>MK + AS</td>
</tr>
<tr>
<td>C7</td>
<td>VE + NO + CS</td>
</tr>
<tr>
<td>C8</td>
<td>VE + AR + NO + CS</td>
</tr>
<tr>
<td>C9</td>
<td>VE + MK + GS</td>
</tr>
<tr>
<td>C10</td>
<td>MK + El + GS + AR</td>
</tr>
</tbody>
</table>

VE = Verbal  
AR = Arithmetic Reasoning  
MK = Math Knowledge  
GS = General Science  
CS = Coding Speed  
NO = Numerical Operations  
AS = Auto-Shop  
MC = Mechanical Comprehension  
El = Electronic Information
### TABLE A-2

**PROBABILITY OF QUALIFICATION, GIVEN MENTAL GROUP**

<table>
<thead>
<tr>
<th>Rating group</th>
<th>Composite</th>
<th>Minimum score</th>
<th>Mental-group categories</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>I/II</td>
</tr>
<tr>
<td>1</td>
<td>C1</td>
<td>89</td>
<td>1.000</td>
</tr>
<tr>
<td>2</td>
<td>C1</td>
<td>90</td>
<td>1.000</td>
</tr>
<tr>
<td>3</td>
<td>C1</td>
<td>96</td>
<td>1.000</td>
</tr>
<tr>
<td>4</td>
<td>C1</td>
<td>97</td>
<td>1.000</td>
</tr>
<tr>
<td>5</td>
<td>C1</td>
<td>103</td>
<td>1.000</td>
</tr>
<tr>
<td>6</td>
<td>C1</td>
<td>108</td>
<td>0.967</td>
</tr>
<tr>
<td>7</td>
<td>C1</td>
<td>113</td>
<td>0.815</td>
</tr>
<tr>
<td>8</td>
<td>C2</td>
<td>196</td>
<td>0.984</td>
</tr>
<tr>
<td>9</td>
<td>C2</td>
<td>206</td>
<td>0.945</td>
</tr>
<tr>
<td>10</td>
<td>C3</td>
<td>190</td>
<td>0.998</td>
</tr>
<tr>
<td>11</td>
<td>C3</td>
<td>200</td>
<td>0.989</td>
</tr>
<tr>
<td>12</td>
<td>C3</td>
<td>204</td>
<td>0.981</td>
</tr>
<tr>
<td>13</td>
<td>C3</td>
<td>207</td>
<td>0.971</td>
</tr>
<tr>
<td>14</td>
<td>C4</td>
<td>161</td>
<td>0.919</td>
</tr>
<tr>
<td>15</td>
<td>C4</td>
<td>167</td>
<td>0.864</td>
</tr>
<tr>
<td>16</td>
<td>C5</td>
<td>155</td>
<td>0.947</td>
</tr>
<tr>
<td>17</td>
<td>C5</td>
<td>163</td>
<td>0.874</td>
</tr>
<tr>
<td>18</td>
<td>C5</td>
<td>173</td>
<td>0.698</td>
</tr>
<tr>
<td>19</td>
<td>C6</td>
<td>98</td>
<td>0.985</td>
</tr>
<tr>
<td>20</td>
<td>C7</td>
<td>144</td>
<td>0.982</td>
</tr>
<tr>
<td>21</td>
<td>C7</td>
<td>160</td>
<td>0.773</td>
</tr>
<tr>
<td>22</td>
<td>C8</td>
<td>202</td>
<td>0.990</td>
</tr>
<tr>
<td>23</td>
<td>C9</td>
<td>141</td>
<td>1.000</td>
</tr>
<tr>
<td>24</td>
<td>C10(^a)</td>
<td>218</td>
<td>0.964</td>
</tr>
<tr>
<td>25</td>
<td>NF(^b)</td>
<td></td>
<td>0.761</td>
</tr>
<tr>
<td>26</td>
<td>Gendet</td>
<td></td>
<td>1.000</td>
</tr>
</tbody>
</table>

---

\(^a\) MK + EI + GS must equal at least 156; with the addition of AR, the total must sum to 218.

\(^b\) The requirements for nuclear field are as follows:

- C1 ≥ 113
- C2 ≥ 200
- C6 ≥ 98
- C10 ≥ 218; see note a.
APPENDIX B

RECRUIT-QUALITY SIMULATION PROGRAM (FORTRAN)
APPENDIX B

RECRUIT-QUALITY SIMULATION PROGRAM (FORTRAN)

This appendix contains the detailed listing of the FORTRAN coding used in the Recruit Quality Goal Simulation Model. The program is designed to run on the VAX version 4.1; some modifications may be required if a different computer system is used.

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1. The programming detailed in this appendix was done by George Corliss of the Center for Naval Analyses.
RECRUIT QUALITY SIMULATION PROGRAM (FORTRAN)

IMPLICIT NONE

REAL PCT12(26), PCT3L(26), PCT3U(26), PCT4(26), SUM,
  UMGPCT, FIXPCT, X.R, RU.RL, GGBF5, DOM, PCT12T,
  PCT3UT, PCT3LT, TIME, SSEATS, P12, P3U, P3L, P4, PCT4T

DOUBLE PRECISION SEED(10)

INTEGER NOSEATS(26), CLASSCNT(26), CCNT12(26),
  CCNT3L(26), I1, I2, I3, K, UMG, NOTQ, NR, SUMT,
  LOSS, TOT, SUMQ, COLL, M, N, SEED11(10),
  SEED12(10), SEED13(10), LO12, LO3U, LO3L, LO4,
  NEWCNT(26), C2, C1, NUM, NEW2(26), SUB4(26),
  SUB3(26), SUB3U(26), SUB12(26), CCNT4(26),
  I4, I5, SUM12, SUM3L, SUM3U, SUM4, CCNT3U(26),
  LMG3L, LMG4, LOSS88

DATA PCT12/1.00, 1.00, 1.00, 1.00, 1.00, 0.967, 0.815,
  0.984, 0.945, 0.998, 0.989, 0.981, 0.971,
  0.919, 0.864, 0.947, 0.874, 0.696, 0.985,
  0.982, 0.773, 0.990, 1.000, 0.964, 0.761,
  1.000/

DATA PCT3T/1.000, 1.000, 1.000, 0.999, 0.841, 0.389,
  0.116, 0.812, 0.614, 0.964, 0.851, 0.775,
  0.726, 0.710, 0.571, 0.832, 0.662, 0.597,
  0.919, 0.866, 0.273, 0.776, 0.942, 0.653,
  0.076, 1.000/

DATA PCT3L/0.959, 0.935, 0.677, 0.615, 0.149, 0.019,
  0.000, 0.348, 0.162, 0.717, 0.457, 0.333,
  0.241, 0.427, 0.293, 0.628, 0.457, 0.218,
  0.710, 0.581, 0.093, 0.199, 0.742, 0.257,
  0.000, 1.000/

DATA PCT4/0.379, 0.307, 0.020, 0.015, 0.000, 0.000,
  0.000, 0.041, 0.002, 0.260, 0.091, 0.054,
  0.036, 0.189, 0.081, 0.311, 0.180, 0.042,
  0.393, 0.133, 0.007, 0.007, 0.231, 0.004,
  0.000, 1.000/

DATA SEED/2116429302D, 683743814D, 96433174D0,
  1217426631D0, 618433579D0, 1157240309D0,
  15726055D0, 48108509D0, 1297920909D0,
  477424540D0/

DATA NOSEATS/2246, 719, 1012, 705, 5964, 927, 133, 2967,
  225, 2518, 1323, 2045, 124, 205, 1791, 1063,
  2569, 122, 3705, 2997, 1116, 344, 4238,
  15203, 7323, 12166/
DATA SUB12:18,25,21,7,15,17,14,9,16,24,6,13,12,20,8,19,11,22,10,23,5,4,3,2,1,26
DATA SUB3U:25,7,21,6,15,18,9,24,17,14,13,12,22,8,16,5,11,20,19,23,10,4,3,2,1,26
DATA SUB3L:25,7,6,21,5,9,22,18,13,24,15,12,8,14,17,11,20,4,16,3,19,10,23,2,1,26
DATA SUB4:25,7,6,5,9,24,22,21,4,3,13,8,15,12,11,20,17,14,23,10,2,16,1,19,26
DATA SEED11:1,2,3,4,5,6,7,8,9,10
DATA SEED12:2,3,4,5,6,7,8,9,10,1
DATA SEED13:3,4,5,6,7,8,9,10,1,2

C
WRITE (6,10)
10 FORMAT ('1', '***** INPUT THE UMG GOAL *****')
READ (5,*) FIXPCT

WRITE (6,20)
20 FORMAT ('0', '***** INPUT SEED TO USE FOR TEST *****')
READ (5,*) I1
WRITE (6,30)
30 FORMAT ('0', '***** INPUT SEED TO USE FOR I/II *****')
READ (5,*) I2
WRITE (6,40)
40 FORMAT ('0', '***** INPUT SEED TO USE FOR IIIU *****')
READ (5,*) I3
WRITE (6,45)
45 FORMAT ('0', '***** INPUT SEED TO USE FOR IIIL *****')
READ (5,*) I4
WRITE (6,50)
50 FORMAT ('0', '***** INPUT SEED TO USE FOR IV *****')
READ (5,*) I5

COLL = 0
SUM = 0.0
TOT = 0
LOSS = 0
LO4 = 0
LO3L = 0
LO3U = 0
LO12 = 0
NOTQ = 0
SSEATS = 0.0

DO 88 K = 1,26
CLASSCNT(K) = 0
CCNT4(K) = 0
CCNT3U(K) = 0
CCNT3L(K) = 0

B-3
CONTINUE
T0T = T0T + 1
X = GGUBFS (SEED(I1))

IF (X .LE. 0.308) THEN
RU = GGUBFS (SEED(I2))
CALL MG(CLASSCNT,PCT12,NOSEATS,CCNT12,RU,
SUM,UMG,LO12,SUB12)
UMGPCT = UMG/SUM
ELSE
IF (X .LE. 0.572) THEN
RL = GGUBFS (SEED(I3))
CALL MG(CLASSCNT,PCT3U,NOSEATS,
CCNT3U,RL,SUM,UMG,LO3U,
SUB3U)
UMGPCT = UMG/SUM
ELSE
IF (X .LE. 0.638) THEN
IF (FIXPCT .LT. UMGPCT) THEN
RL = GGUBFS (SEED(I4))
CALL MG(CLASSCNT,PCT3L,
NOSEATS,CCNT3L,
RL,SUM,LMG3L,
LO3L,SUB3L)
ELSE
LOSS = LOSS + 1
ENDIF
ELSE
IF (FIXPCT .LT. UMGPCT) THEN
IF (LMG4 .LT. 8800) THEN
RL = GGUBFS (SEED(I5))
CALL MG(CLASSCNT,PCT4,
NOSEATS,CCNT4,RL,
SUM,LMG4,LO4,SUB4)
ELSE
LOSS88 = LOSS88 + 1
ENDIF
ELSE
LOSS = LOSS + 1
ENDIF
ENDIF
ENDIF

END IF

125 IF (SUM .LT. 73750 .AND. TOT .LT. 100000) GOTO 100
155 CONTINUE .

WRITE (6,130) FIXPCT,I1,I2,I3,I4,I5
130 FORMAT(1//,** FIXED PCT. = F4.3,**
* TEST SEED = 'I2,' || II SEED = 'I2,'
* IIIU SEED = 'I2,' || IIII SEED = 'I2,'
B-4
IV SEED = ' ,I2)

WRITE (6,150)

SUMT = 0
SUM12 = 0
SUM3U = 0
SUM3L = 0
SUM4 = 0
SUMQ = 0

DO 200 K=1,26

SUMT = SUMT + CLASSCNT(K)
SUM12 = SUM12 + CNT12(K)
SUM3U = SUM3U + CNT3U(K)
SUM3L = SUM3L + CNT3L(K)
SUM4 = SUM4 + CNT4(K)
SUMQ = SUMQ + NOSEATS(K)

DOM = CLASSCNT(K)

IF (DOM .GT. 0) THEN
  P12 = CNT12(K)/DOM
  P3U = CNT3U(K)/DOM
  P3L = CNT3L(K)/DOM
  P4 = CNT4(K)/DOM
END IF

WRITE (6,300) K,CCNT12(K),CCNT3U(K),CCNT3L(K),
   CCNT4(K),CLASSCNT(K),NOSEATS(K),
   P12,P3U,P3L,P4
300 FORMAT (1X,'CLASS = ',12.6(5X,I5),4(5X.F5.3))

200 CONTINUE

DOM = SUMT

IF (DOM .GT. 0) THEN
  PCT12T = SUM12/DOM
  PCT3UT = SUM3U/DOM
  PCT3LT = SUM3L/DOM
  PCT4T = SUM4/DOM
END IF

WRITE (6,400) SUM12,SUM3U,SUM3L,SUM4,SUMT,SUMQ,
   PCT12T,PCT3UT,PCT3LT,PCT4T
400 FORMAT ('0', 'TOTAL = ',6(4X,I6),4(5X,F5.3))

WRITE (6,550) LOSS
550 FORMAT ('0', 'NO. OF PEOPLE LOST DUE TO FIXED PERCENT = ',17)

B-5
WRITE (6,553) LOSS88
      FORMAT ('0', 'NO. OF IV'S LOST DUE TO 8800
             LEVEL = '.I7')

WRITE (6,555) LO12
555   FORMAT ('0', 'NO. OF I II PEOPLE LOST (NOT Q OR
             FULL CLASS) = '.I7')

WRITE (6,557) LO3U
557   FORMAT ('0', 'NO. OF IIIU PEOPLE LOST (NOT Q OR
             FULL CLASS) = '.I7')

WRITE (6,558) LO3L
558   FORMAT ('0', 'NO. OF IIII PEOPLE LOST (NOT Q OR
             FULL CLASS) = '.I7')

WRITE (6,559) LO4
559   FORMAT ('0', 'NO. OF IV PEOPLE LOST (NOT Q OR
             FULL CLASS) = '.I7')

WRITE (6,560) TOT
560   FORMAT ('0', 'NUMBER OF RECRUITS CONTACTED = ',
             I7///)

STOP
END
SUBROUTINE MG

SUBROUTINE MG(CLASSCNT, PCT, NOSEATS, CCNT, X, SUM, CNT, LO, SUB)

INTEGER CLASSCNT(26), NOSEATS(26), CCNT(26), K, I, CNT, LO, SUB(26)

REAL PCT(26), X, SUM, OPCT, SCPCT, DOM

OPCT = SUM / 73750.0

DO 100 K = 1, 26

DOM = NOSEATS(K)

SCPCT = CLASSCNT(K) / DOM

IF ((X .LE. PCT(SUB(K))) .AND. (CLASSCNT(SUB(K)).LT.NOSEATS(SUB(K)))) THEN

SUM = SUM + 1
CNT = CNT + 1
CLASSCNT(SUB(K)) = CLASSCNT(SUB(K)) + 1
CCNT(SUB(K)) = CCNT(SUB(K)) + 1
GOTO 200

END IF

100 CONTINUE

LO = LO + 1

200 RETURN

END
APPENDIX C

SIMULATION MODEL OUTPUT
APPENDIX C

SIMULATION MODEL OUTPUT

Tables C-1 and C-2 show output from the simulation model using upper-mental-group goals of 57 and 59 percent respectively. The composite scores shown correspond to the listing of conditional probabilities given in appendix A. The population of potential recruits used in these examples is the population detailed in table 1 of the main text.
### TABLE C-1

#### SAMPLE OUTPUT

UMG Goal = .57

<table>
<thead>
<tr>
<th>CLASS</th>
<th>II</th>
<th>IIIU</th>
<th>IIII</th>
<th>IVA</th>
<th>TOTAL QUOTA</th>
<th>I/II</th>
<th>IIIU</th>
<th>IIII</th>
<th>IVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1747</td>
<td>499</td>
<td>2246</td>
<td>0.000</td>
<td>0.000</td>
<td>0.778</td>
<td>0.222</td>
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<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>634</td>
<td>85</td>
<td>719</td>
<td>0.000</td>
<td>0.000</td>
<td>0.862</td>
<td>0.118</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>141</td>
<td>808</td>
<td>63</td>
<td>1012</td>
<td>0.000</td>
<td>0.139</td>
<td>0.798</td>
<td>0.002</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>331</td>
<td>335</td>
<td>39</td>
<td>705</td>
<td>0.000</td>
<td>0.470</td>
<td>0.475</td>
<td>0.055</td>
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<td>5</td>
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<td>3209</td>
<td>2494</td>
<td>0</td>
<td>5964</td>
<td>0.044</td>
<td>0.538</td>
<td>0.418</td>
<td>0.000</td>
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<td>76</td>
<td>57</td>
<td>0</td>
<td>0</td>
<td>133</td>
<td>0.000</td>
<td>0.798</td>
<td>0.202</td>
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<td>0.127</td>
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<td>2</td>
<td>225</td>
<td>0.498</td>
<td>0.134</td>
<td>0.599</td>
<td>0.210</td>
</tr>
<tr>
<td>9</td>
<td>1235</td>
<td>380</td>
<td>642</td>
<td>261</td>
<td>2518</td>
<td>0.490</td>
<td>0.151</td>
<td>0.255</td>
<td>0.104</td>
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<tr>
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<td>793</td>
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<td>1323</td>
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<td>0.134</td>
<td>0.599</td>
<td>0.210</td>
</tr>
<tr>
<td>11</td>
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<td>1132</td>
<td>625</td>
<td>87</td>
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<td>0.554</td>
<td>0.306</td>
<td>0.043</td>
</tr>
<tr>
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<td>69</td>
<td>11</td>
<td>124</td>
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<td>0.323</td>
<td>0.556</td>
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</tr>
<tr>
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<td>5</td>
<td>205</td>
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<td>0.239</td>
<td>0.429</td>
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<td>88</td>
<td>1791</td>
<td>0.275</td>
<td>0.573</td>
<td>0.102</td>
<td>0.049</td>
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<tr>
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<td>597</td>
<td>174</td>
<td>116</td>
<td>176</td>
<td>1063</td>
<td>0.562</td>
<td>0.164</td>
<td>0.109</td>
<td>0.166</td>
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<td>80</td>
<td>840</td>
<td>229</td>
<td>2569</td>
<td>0.553</td>
<td>0.031</td>
<td>0.327</td>
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<tr>
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<td>115</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>122</td>
<td>0.943</td>
<td>0.049</td>
<td>0.008</td>
<td>0.000</td>
</tr>
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<td>881</td>
<td>1348</td>
<td>374</td>
<td>3705</td>
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<td>0.364</td>
<td>0.101</td>
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<td>227</td>
<td>1955</td>
<td>391</td>
<td>2997</td>
<td>0.141</td>
<td>0.076</td>
<td>0.652</td>
<td>0.130</td>
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<tr>
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<td>319</td>
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<td>0.004</td>
<td>0.351</td>
<td>0.286</td>
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<td>9</td>
<td>315</td>
<td>10</td>
<td>344</td>
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<td>0.026</td>
<td>0.916</td>
<td>0.029</td>
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<tr>
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<td>1735</td>
<td>607</td>
<td>1275</td>
<td>633</td>
<td>4238</td>
<td>0.407</td>
<td>0.143</td>
<td>0.301</td>
<td>0.149</td>
</tr>
<tr>
<td>23</td>
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<td>6585</td>
<td>1222</td>
<td>29</td>
<td>15203</td>
<td>0.485</td>
<td>0.433</td>
<td>0.080</td>
<td>0.002</td>
</tr>
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<td>6727</td>
<td>596</td>
<td>0</td>
<td>0</td>
<td>7323</td>
<td>0.919</td>
<td>0.081</td>
<td>0.000</td>
<td>0.000</td>
</tr>
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<td>1526</td>
<td>3694</td>
<td>5370</td>
<td>12166</td>
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<td>0.126</td>
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<td>0.441</td>
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<td>73750</td>
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<td>0.278</td>
<td>0.278</td>
<td>0.119</td>
</tr>
</tbody>
</table>

#### NO. OF PEOPLE LOST DUE TO UMG GOAL

128

#### NO. OF IV’S LOST DUE TO CAP OF 8800

3623

#### NO. OF I/II PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)

0

#### NO. OF IIIU PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)

0

#### NO. OF I/II PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)

0

#### NO. OF IVA PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)

0

#### NUMBER OF RECRUITS CONTACTED

77501
### TABLE C-2

**SAMPLE OUTPUT**

| UMG Goal | .59 |

<table>
<thead>
<tr>
<th>CLASS</th>
<th>I/II</th>
<th>IIIU</th>
<th>IIIL</th>
<th>IVA TOTAL</th>
<th>QUOTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/II</td>
<td>0</td>
<td>0</td>
<td>1740</td>
<td>506 2246</td>
<td>2246</td>
</tr>
<tr>
<td>IIIU</td>
<td>0</td>
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<td>85</td>
<td>719 719</td>
<td>0.000</td>
</tr>
<tr>
<td>IIIL</td>
<td>0</td>
<td>149</td>
<td>802</td>
<td>61 1012</td>
<td>1012</td>
</tr>
<tr>
<td>IVA</td>
<td>0</td>
<td>342</td>
<td>325</td>
<td>36 705</td>
<td>705</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>506</td>
<td>149</td>
<td>1012 2246</td>
<td>2246</td>
</tr>
</tbody>
</table>

**NO. OF PEOPLE LOST DUE TO UMG GOAL**

- 1722

**NO. OF IV’S LOST DUE TO CAP OF 8800**

- 3207

**NO. OF I/II PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)**

- 0

**NO. OF IIIU PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)**

- 0

**NO. OF IIIL PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)**

- 0

**NO. OF IV PEOPLE LOST (NOT QUALIFIED OR FULL CLASS)**

- 0

**NUMBER OF RECRUITS CONTACTED**

- 78679

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C-3