Study
Note
98-03

Design Considerations for the Enlisted Personnel Allocation System (EPAS) in its Interface with the Army Recruit Quota System (REQUEST)

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14. ABSTRACT *(Maximum 200 words)*:

The PC-Based Enlisted Personnel Allocation System (PC-EPAS) is an automated model designed to optimally match recruits into jobs by maximizing expected soldier performance subject to training management constraints. This report presents an overall concept of how EPAS optimal guidance would interface with the existing Army Recruit Quota System (REQUEST).

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Personnel and Training Analysis Activities

DESIGN CONSIDERATIONS FOR THE ENLISTED PERSONNEL ALLOCATION SYSTEM (EPAS) IN ITS INTERFACE WITH THE ARMY RECRUIT QUOTA SYSTEM (REQUEST)

EXECUTIVE SUMMARY

Research Requirement:

The objective of this study is to develop an overall concept of how EPAS optimal guidance would interface with the Army Recruit Quota System (REQUEST) and certain USAREC recruiting management control procedures.

Procedure:

We describe how REQUEST works, i.e. determining the applicant's dates of availability, identifying and ordering the MOS and corresponding class start dates from which the applicant can choose. We also describe how EPAS optimal guidance (EOG) is produced from the solution of the aggregate allocation model, and how an ordered list of MOS class start dates is developed for a specific applicant. We then develop a concept of how the two ordered lists might be merged, guided by the principle of "do not affect" the steps followed by guidance counselors in their interactions with applicants.

Findings:

Central to the concept is the continued primacy of the date-of-availability (DOA) window, as determined by applicant and guidance counselor. The REQUEST list is comprised of all MOS class start dates for which the applicant is qualified and which are open to the applicant (as determined by USAREC flow management controls). Within this DOA, we are proposing that the final candidates produced by the merge concept should be those MOS class start dates found on both the REQUEST list and the EOG list. Those MOS class start dates found on the REQUEST list but not on the EOG list are suboptimal, but would be permitted to appear on the final ordered list with zero weight (i.e., at the bottom). Those MOS class start dates found on the EOG list but not on the REQUEST list are deleted from further consideration. The presumption is that actual flow considerations dictate this, though attention should be given to modifying these controls so that they do not unnecessarily restrict the optimization gains made possible through EPAS. The merged list is presented to the applicant using the same series of screens on the guidance counselor's terminal. In what is now presented as an optional final step -- further investigation is underway -- the final candidates would in effect be reordered using REQUEST HIARCY weights appropriately modified.

Utilization of Findings:

As part of the ongoing EPAS development work (in moving toward a Functional Description), we will be conducting tests to confirm the efficacy of the proposed merged list concept in meeting operational recruiting management targets and constraints in an EPAS-enhanced system. This report also makes a case for coordination between EPAS and USAREC flow control procedures, and makes several specific suggestions. The coordination issue will require additional discussion with USAREC managers and possibly the emulation of these control procedures in the next phase of EPAS simulation mode testing.

DESIGN CONSIDERATIONS FOR THE ENLISTED PERSONNEL ALLOCATION SYSTEM (EPAS) IN ITS INTERFACE WITH THE ARMY RECRUIT QUOTA SYSTEM (REQUEST)

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DESIGN CONSIDERATIONS FOR THE ENLISTED PERSONNEL ALLOCATION SYSTEM (EPAS) IN ITS INTERFACE WITH THE ARMY RECRUIT QUOTA SYSTEM (REQUEST)

1. Purpose of the Study

"Proper enlistment screening and job placement are prerequisites for efficient training, retention of skilled personnel, and mission performance. Deficiencies in the selection and classification system lead to increased training times and cost, decreases in productivity and retention, and critical shortages in job-skilled manpower available to perform the mission. ... The military accession, training, and assignment of young unskilled people is an investment; the underlying purpose of the selection process is to reduce the risk that an investment will be made in persons who are unable (or unwilling) to perform their duty."[1]

The Army's procedures for classifying or assigning would-be recruits into their first MOS training makes limited use of available information about their capabilities, and is designed to meet minimum eligibility standards. EPAS is designed to address this shortcoming by formulating the classification procedure as an optimization problem,[2] and this study is focused on identifying the types of linkages needed between EPAS and REQUEST, the current Army assignment system.

The objective of this study is to depict the framework within which EPAS optimal guidance (EOG) would interface with REQUEST. How EPAS pushes REQUEST towards optimal assignments, including the continued key role of the date-of-availability (DOA) window, is described. The coordination of USAREC's Distribution of Quality (DQ) function and the RUDEP Delayed Entry Program (DEP) management controls with EPAS is also described.

2. How Army Recruiting Uses REQUEST

REQUEST, the Army's training reservation system, functions much like an airline or hotel booking system.

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[1] "Joint-Service Efforts to Link Enlistment Standards to Job Performance: Recruit Quality and Military Readiness," Report to the House Committee on Appropriations, Office of the Assistant Secretary of Defense (Force Management and Personnel), January 1989.

[2] EPAS research is described in Konieczny, Brown, Hutton, and Stewart (1990a, 1990b); Koneiczny, Brown, and Stewart (1992); Rudnik and Greenston (1995); and Schmitz and McWhite (1986).

2.1 Applicant Processing

Processing an Army applicant includes interviews and aptitude testing followed by a physical examination at a military entrance processing station (MEPS). The applicant next visits a guidance counselor who uses REQUEST to select an available MOS with associated training class start week (RECSTA week).[3]

Among other classification information, guidance counselors determine each applicant's DOA window to begin Army basic training (BT) and MOS advanced individual training (AIT). The applicant's DOA, among other factors such as gender, qualifications, graduation status, etc., determines the (up to) 25 MOS RECSTA dates that REQUEST recommends to each candidate.

Either before applicants arrive, or in their presence, guidance counselors run the REQUEST Search Mode. They create, internal to REQUEST, a file of all potentially available MOS RECSTA dates within the applicant's DOA. This file includes only MOS for which the applicant is qualified[4].

2.2 REQUEST HIARCY

REQUEST uses a hierarchical scoring structure, called HIARCY, to order its MOS training recommendations. The HIARCY program helps REQUEST managers build a master hierarchical scoring structure across MOS. This tree-like structure numerically weights and combines elements, such as MOS priority and current fill, that are important for REQUEST MOS recommendations. It can be applied to force placing certain[5] MOS RECSTA dates high on guidance counselors' classification screens.

2.21 HIARCY Design. As shown in Figure 1, the current REQUEST hierarchical structure has ten elements, with corresponding transformation functions and weights. The weighted outputs from these elements are combined to create elements representing applicant characteristics or qualifications and MOS status or Army needs. Outputs from these two elements are then weighted and combined to produce the HIARCY payoff. Elements can represent any item of REQUEST data. Transformation functions normalize an element's input data to a range from 0 to 1000. Each element's normalized output is weighted by a fraction representing its importance to the MOS assignment process.

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[3] MOS class start times are the dates that recruits report to a reception station (RECSTA) for processing before starting training. Recruiting managers use the term class start week or RECSTA week to denote the week in which the training starts, and class start month or RECSTA month to denote the month in which training starts. RECSTA weeks always start on Monday. On the following Friday recruits report to basic training (BT) or one-station unit training (OSUT), depending on their MOS choice.

[4] ASVAB scores, drivers license, color vision, specific high school courses, etc.

[5] Such as priority MOS.

The hierarchical structure supports adding, deleting, renaming or regrouping scoring elements. As will be discussed later, EPAS could use REQUEST's hierarchical structure to construct elements incorporating the EOG. The functions procedure assigns transformation functions and weights to the elements in a structure. These may be changed as Army policy and requirements dictate.

A transformation function is defined by creating a table of value/score pairs. The value is a possible value for the element, and the score is the grade given when the element has the specified value. The score must be an integer between 0 and 1000. The score represents the worth of the value of an MOS, with 1000 being the highest worth. For example, for MOS 11X, the AFQT element transformation function could assign an applicant's AFQT value of 95 a score of 950.

An element's weight determines how a given MOS RECSTA date will be ranked by the HIARCY payoff. Figure 1 represents the REQUEST hierarchial structure as it existed in March, 1996. The Intellectual and Physical Qualifications Elements are each weighted and then combined to create the Applicant Qualifications Element. This element is also weighted and combined with the weighted MOS Status Element to produce the HIARCY payoff. The *Weighted Values* column shows the weighted value or net weight of each element.

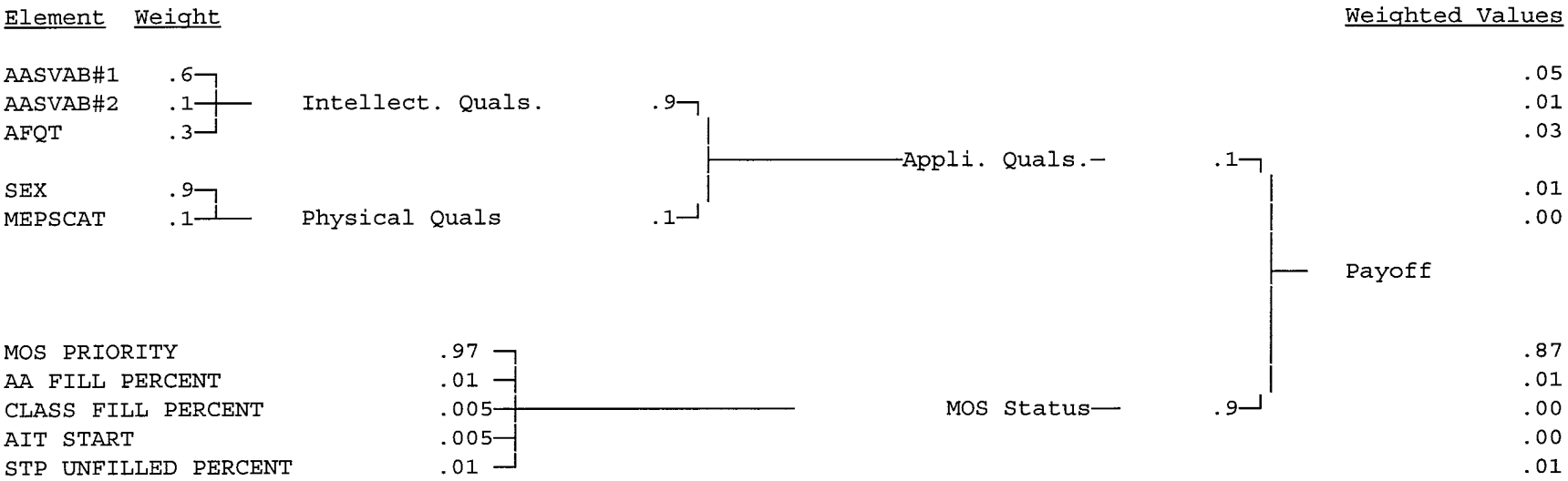
Next, for each MOS class start date, the assigned values are weighted and combined. For example, MOS Priority element values are weighted by 0.97, and the AA Fill values are weighted by 0.01. As can be seen from Figure 1, there can be multiple levels of weights. The weighted MOS class start dates are combined and then placed in numerical order. The resulting ordering of MOS class start dates constitute REQUEST's ordered list. Clearly, the MOS Priority element currently overrides all other elements in HIARCY.

2.22 REQUEST Applicant Processing Example. On 26 February 1997 applicant Todd Beal meets a recruiting battalion (Rtng Bn) guidance counselor (GC) at the nearest Military Entrance Processing Station (MEPS). He scores 68 on his AFQT and exceeding the qualifying (cut) scores for all MOS except for those requiring an ST score of 115 or greater. He did not pass the Defense Language Aptitude Battery (DLAB). Todd does not have an MOS preference but wants to join after his sister's wedding on 15 April.

The GC initially runs the REQUEST Search Mode with an availability window starting on the week of 21 April and extending through the week of 23 June. Predictably, (because of its high weight) only priority MOS were offered on the first two REQUEST screens. By now, Todd has changed his mind and wants to become a military policeman. The GC then runs the REQUEST Look-up Mode to find if any MOS 19X1 opportunities would be within Todd's window. None were available, so the GC suggested that Todd would have a better opportunity before 15 April. The GC opens Todd's availability window as early as possible, to 24 March 1997, and Todd agrees to accept a 7 April accession date for MOS 19X1.

FIGURE 1

CURRENT HIERARCHY STRUCTURE



3. EPAS Operational Mode

3.1 Overview of Methodology

If applicants would join the Army without MOS guarantees, recruits could be classified during BT by assigning the MOS that predicts their best performance consistent with Army requirements. However, the Army cannot direct MOS changes since recruits were guaranteed training in the MOS they chose. Therefore, any classification recommendations must be made prior to accession and without precise information on the large numbers of applicants that is necessary for optimal assignments.

In the absence of applicant information, EPAS uses supply groups (SG) forecasts as surrogates for individual applicants.[6] The SG are then optimally assigned to MOS class seat dates (months). At the time of applicant classification each SG assignment forms the basis for classifying applicants with similar characteristics. This approach comes as close as possible to optimally classifying large numbers of applicants.

The two major inputs to the EPAS optimization are gross contract forecasts by supply group, and requirements (demand) to meet FY MOS targets using the scheduled MOS[7] training seats at specified class start months. Using these data EPAS computes optimum SG to MOS class start month matches. Each has an explicit DEP represented by a SG's contract date and a recommended MOS class start month. The resulting mapping of SGs to the MOS where they will perform best[8] is the EPAS optimal guidance (EOG). It is an array of approximately 100 SGs with their optimal MOS class start months.

USAREC would run the Operational Mode at the end of each Recruiting Station Week[9] (RSW). The first step is solving the aggregate allocation problem to optimally assign applicant SGs to MOS class start months, and subsequently producing the EOG for the new week's expected

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[6] It is convenient to think of supply groups as defined by gender, education, and AFQT category, and within the groups so formed into clusters differentiated by their mean ASVAB test profiles. For example, SG = 23 represents those male, high school graduates in AFQT 1-3A with ASVAB test scores that are closely clustered around a particular set of means.

[7] EPAS aggregates MOS school (class) start dates into *clusters* of MOS with similar characteristics. After the optimal solution, MOS clusters are disaggregated to MOS school start dates. This report will use the term *MOS school (class) start date*s without reference to MOS clusters.

[8] EPAS leads to optimal feasible assignments for a cohort of candidates, not necessarily for each individual.

[9] USAREC assesses recruiting progress each Monday evening and updates controls. Early Tuesday it modifies recruiting systems to support the updated status. Four or 5 Tuesday to Monday RSWs comprise a recruiting station month (or RSM). In describing the EPAS operational mode, the RSM indicates when the SG members are forecasted to contract and the class start month or RECSTA month (or date) indicates when the recruits will begin training. DEP length is the time between those dates.

applicants. This is depicted to occur within the Quality Allocation Module (QAM) (see Figure 2). In the second step, the EOG and the initial REQUEST list are sent to the REQUEST Interface Module (RIM), where they are merged to create an ordered list of MOS RECSTA dates for the applicant in a format suitable for REQUEST. The proposed merger rules are described below. The merged list is effectively in order defined by the EOG, and this is the preferred recommendation at this time.

3.2 The QAM in the Operational Mode

The QAM computes an optimal time-phased allocation of applicant SGs to MOS class start months. From this solution the QAM creates ordered lists of recommended MOS cluster assignments for the 91 SGs. This procedure incorporates a post-optimality model that orders all feasible solutions by their reduced costs. This will be a set of each SG's best, next best, next next best, etc. MOS class start month assignments.

3.21 Rank Ordering the MOS Class Start Months Assigned to Each Supply Group. In general, the optimal solution for current contract period applicants -- AIT(i,j=1,k,ma) or OSUT (i,j=1,k,mu) -- will show positive flow from applicant SGs to an MOS class start month. [10] In the QAM, reduced costs represent the marginal change in the objective function value that would result from creating applicant flow from a supply group to an AIT and OSUT MOS class start month that had no flow in the original optimal solution. RAIT(i,j,k,ma) and ROSUT(i,j,k,mu) are the reduced costs for the corresponding applicant flow from SG(i,j=1) to MOS class start month (k,ma/mu). A rank ordering of each supply group's RAIT(i,j,k,ma) and ROSUT(i,j,k-2,mu) determines that supply group's MOS class start month recommendations in decreasing order of optimality.

3.22 Disaggregating MOS Clusters to Individual MOS RECSTA Months. Ordered lists of MOS clusters (ma/mu), each with a class start month k, are disaggregated to individual MOS with their associated RECSTA months. MOS RECSTA months in the same cluster are placed in reverse order of their MOS' current percent fill. Other criteria could place MOS in order of the number or percentage of unfilled class seats.

3.23 Optimal Ordered List Format. The current set of SG to MOS RECSTA months constitutes the set of ordered lists. Each ordered list has each of its MOS RECSTA months assigned a score from 0 to 1000 that represents its position on the ordered list. Further research is needed to determine a numbering scheme to map ordered list position. For example, MOS RECSTA months could be ordered as (position number) (score): 1-5: 1000; 6-10: 900; 11-15: 800; 16-20: 700; 21-25: 600.

3.24 Adjusting Monthly Forecasts to Weekly Operations. The QAM is a model built with a monthly perspective, tracking applicant supply and available training seats by month, but run on a

[10] Let i index SG, j index contract month, k index AIT class start month, and ma/mu index MOS. This notation is from Rudnik and Greenston (1995).

weekly basis. At the beginning of week 1 the QAM is run to produce an aggregate allocation with corresponding EOG for each supply group. To run QAM for week 2, the remaining part of the current month's forecast of applicant supply is adjusted to reflect the actual supply during week 1; training seat availability is also adjusted to reflect the past week's sales and any other changes. The same procedures are followed for weeks 3 and 4. It should also be noted that the applicant supply forecast procedure should err on the side of including too many rather than too few supply groups to ensure that EOG is created for any type individual showing up to contract that week.

3.3 The RIM in the Operational Mode

3.31 Determination of applicant's SG. REQUEST RIM parses candidates' characteristics (AFQT, education, composite scores, etc.) to determine the EPAS SGs that contain their EOG. Each SG has an appropriate sequence of MOS RECSTA months that constitute its optimal assignments. With this information, each candidate's applicable EPAS optimal guidance is known.

3.32 Creating merged ordered list, with applicant processing example. The EOG list of the applicant's ordered MOS RECSTA months is compared to the list of available MOS RECSTA dates that REQUEST had created for the applicant. The REQUEST list will include only the MOS RECSTA dates that fall within the DOA. As described, a comparison operation assures that only the MOS RECSTA dates that appear on *both* lists can appear on the merged list output.[11] Depending on the time span of the DOA, the DOA probably but not necessarily limits the gains that EPAS can make possible.

REQUEST received the week's EOG for expected applicants on the Tuesday before Todd Beal arrived at the MEPS. The GC told him that REQUEST would suggest some MOS where Todd would best perform, so he agreed to skip his sister's wedding if he was offered an attractive MOS. Either before or during the session, the GC ran the REQUEST Search Mode.

As in the previous example, REQUEST created a list of all MOS classes for which Todd qualified. RIM parsed Todd's demographic data and determined that he was a member of SG i, with the abbreviated EOG shown in Figure 3. RIM then compared the REQUEST Search sequence of MOS RECSTA dates with the EOG's MOS RECSTA months for Todd's SG.

The following rules determined how the EOG classes were merged with REQUEST Search's classes:

(a) If a MOS RECSTA month is on the EOG but does not appear on the REQUEST Search list, it is not listed on the merged list output (such as the MOS 27M1 June class).

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[11] This process uses REQUEST as a starting basis. The EPAS RIM cannot supply the RECSTA information needed if an MOS is in the EOG but not on the REQUEST search list. This could occur if RUDEP prevented REQUEST from listing an MOS RECSTA date.

(b) Even if a MOS RECSTA date from REQUEST search does not appear on the EOG, it is still listed on the merged list output with a zero score.
(c) MOS classes which appear on both the EOG and REQUEST search list retain their assigned score on the merged list.

Rule (a) limits MOS classes to the candidate's availability window, and also ensures that the MOS classes on the merged list output actually have vacancies. Rule (b) will let the candidate see available MOS classes even though they are not in the EOG.

MOS from the REQUEST Search list that are found on the candidate's EOG retain their EOG position score, and those not on the EOG have zero score. The result becomes the merged list output, and is sent back from the RIM to main REQUEST for display on the GC screen.

Continuing with the example, the merged list contained the following MOS classes in the first GC screens for Todd: 11X1 on 03, 10, 24 Feb; 31C1 on 21 April; and 74C1 on 7 April. Todd was interested in the Army College Fund so his GC received an exception authorization from USAREC for Todd to access to an 11X1 class on 21 April.

3.33 Alternative step: using HIARCY to create the merged, ordered list. An alternative step is possible, and this would in effect involve ordering of the merged list using HIARCY weights, appropriately modified to include an EOG element. In this alternative, the RIM would send the appropriate EOG to REQUEST HIARCY. The MOS recommendations from the initial REQUEST list would be weighted by their assigned HIARCY element weights, including the EOG element, and merged with other HIARCY weighted elements. See Figure 4. Since HIARCY has never been put to the test of reconciling competing priorities, its capabilities remain to be determined. We would argue for experimentation, initially giving a relatively large weight to the EOG element, e.g. 0.99. The advantage of this alternative step is that it would likely require fewer modifications to the existing software routines because the merging of the EOG and the REQUEST recommendations would be produced by HIARCY.

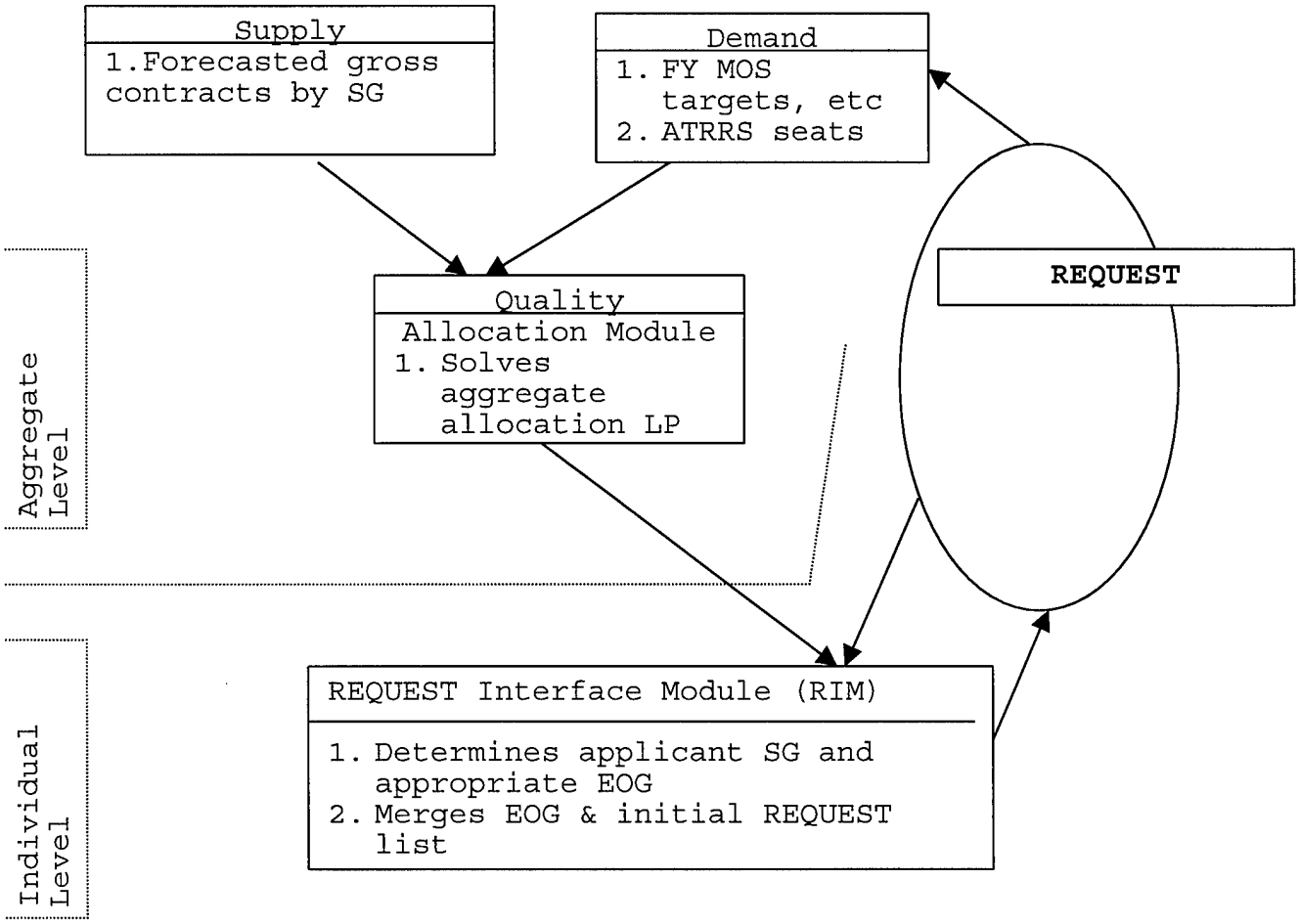


Figure 2
EPAS-RIM-REQUEST
Interface

FIGURE 3: EPAS INTERFACE FLOW EXAMPLE

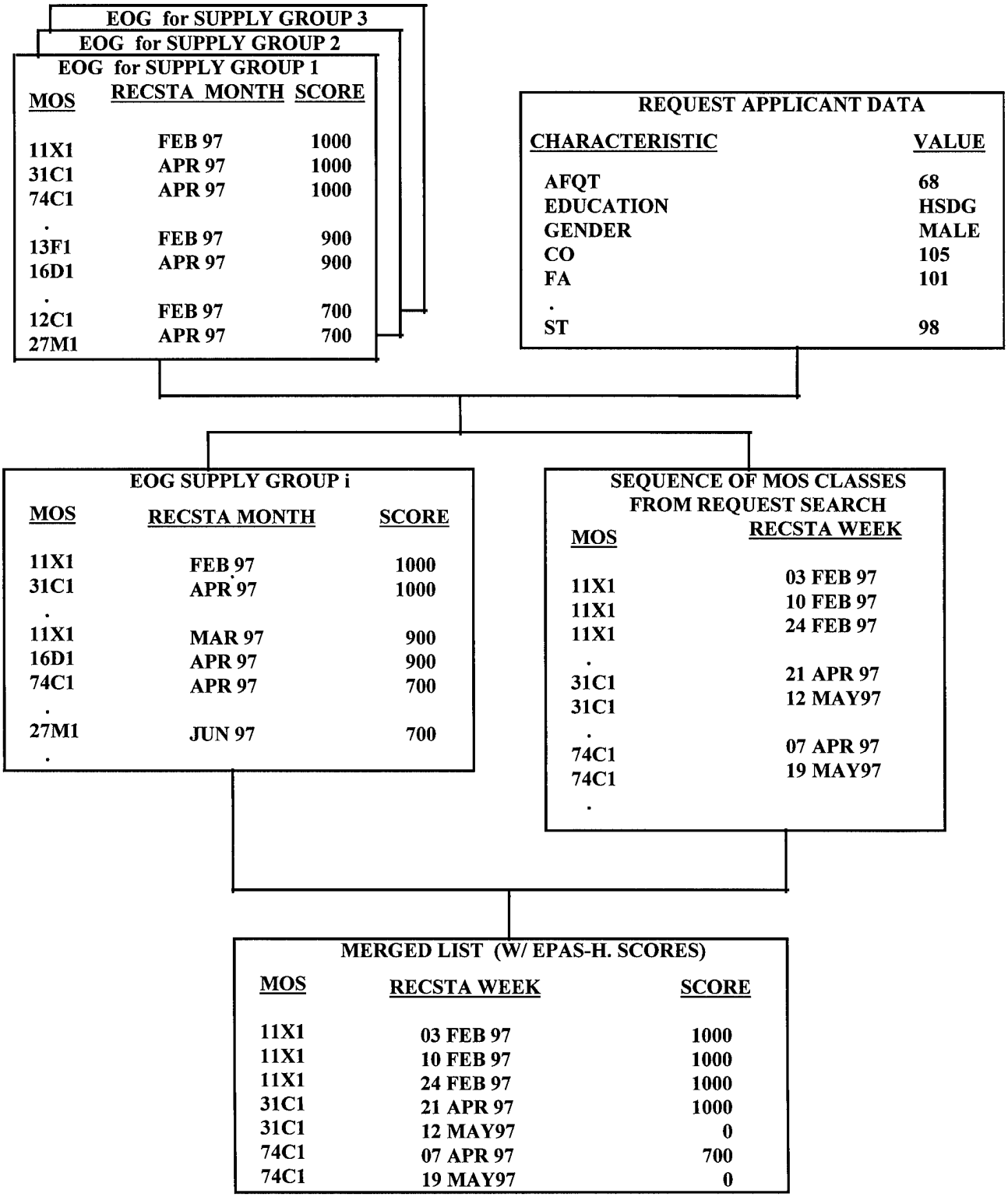
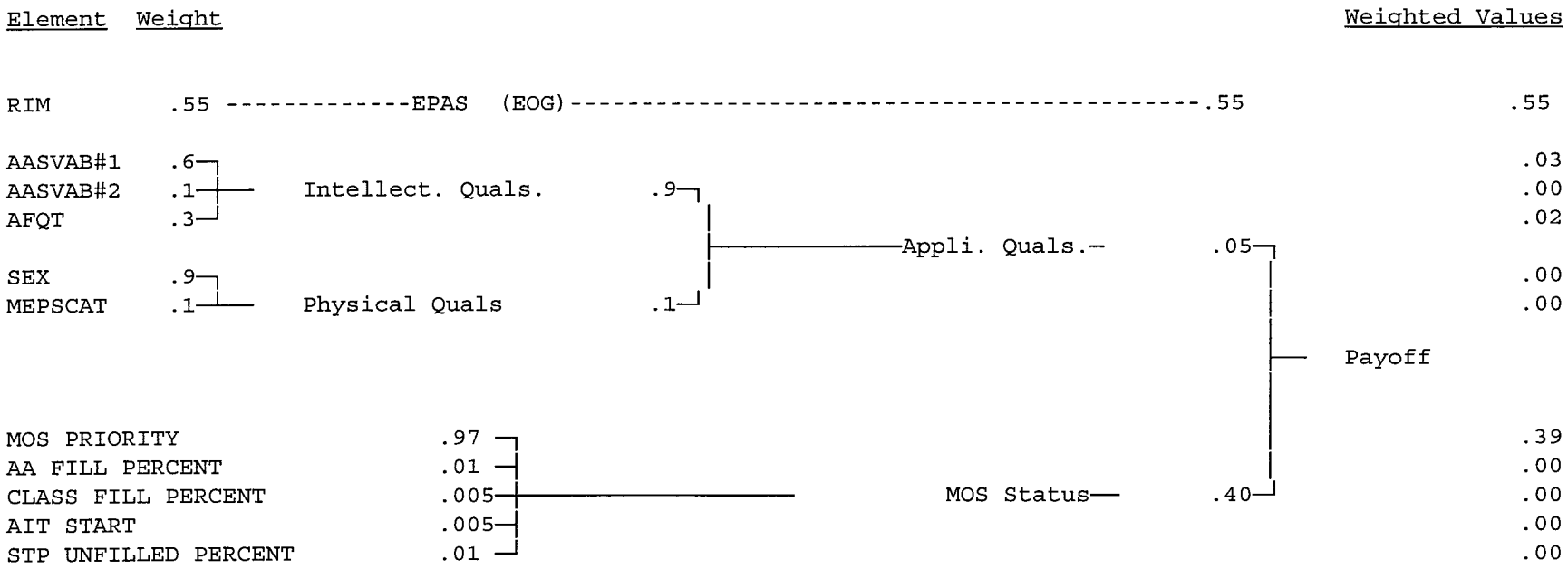


FIGURE 4: HIERARCHY STRUCTURE WITH EOG



4. Distribution of Quality (DQ) and Report/Update Delayed Entry Program (RUDEP) Control

The MOS recommendations conveyed to the applicant by REQUEST come about through the functioning of the DQ and RUDEP control procedures. The functioning of DQ control procedures is designed to maintain quality balance between MOS, and to avoid uneven quality allocations over the recruiting year within MOS. DEP control is used to channel applicants into those MOS and accession-months that best support recruiting management. These procedure controls must be understood because the successful functioning of EPAS will depend on appropriate settings of DQ and RUDEP procedures. In the EPAS-enhanced system, DQ and RUDEP can be viewed as shapers of the initial REQUEST list, and unless they are in-sync with EPAS settings the merging of EOG and initial REQUEST lists will not contain the envisioned variety of MOS.[12]

4.1 Distribution of Quality

4.11 Problems addressed. USAREC must meet overall and MOS-specific goals for accession of TSC I-IIIA recruits. Recruiters are missioned for overall TSC I-IIIA contracts, and the ROC must control quality flow to MOS. The ROC must ensure that MOS annual accessions meet stated goals for TSC I-IIIA's and do not exceed a stated ceiling on TSC IV's. A related objective is to have each MOS training class or STP[13] reflect its annual quality goals (and TSC IV limits).[14]

4.12 Rationale for DQ. HQ USAREC carefully monitors the quality in each MOS. Commanders of major branches, such as Armor and Artillery, are also quick to voice their concern about any failure to meet quality goals.

Quality management is made more difficult because high-quality recruits have attractive alternatives to Army service, such as college or semiskilled vocational employment. Incentives, such as the Army College Fund (ACF) and Enlistment Bonuses (EB), help the Army compete for these recruits. Congress and DOD have recognized this, and fund quality incentives. At the same time, Congress and DOD place strict limits on the total quality of manpower in the Army's mission. They believe that any quality recruited above the mission means that the Army has reduced the overall quality market and thereby increased recruiting costs for the other Services, and that the Army must have had more incentive funds then it needed. Therefore if Army accession quality exceeds the set limit, Congress and DOD might reduce the next year's incentive funds.

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[12] Both the DQ and RUDEP control by USAREC is complex and require the use of an expert system. USAREC DQ and RUDEP control are described by in McWhite and Hendriksma (1992) from which this section draws.

[13] Special Training Package. Applicants are grouped by destination.

[14] DQ is directly controlled for each STP class.

Because the total quality available in the recruiting market is limited, its allocation among MOS over the recruiting year is crucial. Uneven quality allocations during an FY risk: (a)

MOS with quality so low that their goals cannot be met by the end of the recruiting year; (b) An imbalance of low quality that would become severe if the MOS mission were reduced.; (c) A disproportionately low quality distribution in MOS classes risks a high fail rate; this effect is worse for STPs, as an entire unit could be affected either by the lower number of class graduates or by a lower overall capability of its cohort; (d)excess quality that leaves too few openings for the TSC IIIBs and IVs who must be recruited to make the end-strength mission; and (e) quality above some MOS requirements, meaning that other MOS will be short of needed quality.

4.13 Procedure for determining quality mission. (a) The proponent for each MOS proposes an unconstrained distribution of quality targets for that MOS; (b) these targets are reviewed by TRADOC, who introduces balance via constraints; (c) PERSCOM, ODCSPER, and HQ USAREC further review targets; they determine if DQ targets are reasonable, and if incentives are needed to meet targets; and (d) ODCSPER promulgates the DQ targets for implementation by USAREC.

4.14 The ROC's DQ methodology. RO developed the concept of selectively controlling *whether REQUEST can or cannot offer a class reservation to an applicant whose TSC or educational group percentage is above the target for that MOS.* This control is *accomplished by sets of REQUEST "switches"* for each MOS. *Each MOS has separate sets of DQ and education switches* for:

·Gender -- Males and females

·Type -- NPS and PS

The Accession Accounting Report (AAR), called file AAPROG UA, contains DQ and education switch settings. It is one way REQUEST determines whether or not to offer an MOS class to an applicant. As discussed in the following section on DEP Control, REQUEST switches are also used to enforce RUDEP controls.

Unlike the DEP control switches, DQ and education switches are permissive. REQUEST will always offer a class to an applicant of a given (quality or education) attribute when that MOS' attribute share is less than a specified target. Switch settings are "Y(es)" and "N(o)":

·"Y" tells REQUEST to *deny* offering any classes in that MOS if the target for the applicant's education or TSC (percentage) has been exceeded. For example, the deny TSC IIIBs and Ivs (DENY Yes) setting protects against overfill of TSC IIIBs-Ivs.

·"N" tells REQUEST *not to deny* that MOS to an applicant (of a specified quality or education). For example, with a not deny TSC I-IIIA (DENY No) setting, DQ targets will not stop a quality applicant from contracting for an MOS.

4.15 Considerations in DQ management.[15] The method currently used for determining the DQ status of an MOS is *based on percentage of MOS fill.* The formula used is:

DQ status = TSC I-IIIA fill percent - TSC I-IIIA target percent.

For example, when TSC I-IIIA fill is 75% and TSC I-IIIA target is 55%, then Deny Y(es).

Ideally, this scheme should help the ROC maintain quality along a glidepath throughout the recruiting year. However, quality fill is not even throughout the year. For example, some MOS will have a relatively high quality percentage in the Fall. This happens because TSC I-IIIAs are permitted to contract for desirable AIT MOS in the next FY while TSC IIIB-IVs are used to fill the OSUT[16] MOS and make end-strength for the current FY.

The above reasoning suggests a disadvantage of the percentage-based quality status method. The problem is that *a low fill of TSC IIIB-IVs can cause low total fill and thereby stop additional TSC I-IIIAs from entering.* Consider the hypothetical MOS in Table 1 at the end of November when the command or average fill is about 50%:

Table 1
Status Based on Percentage of MOS Fill

MOS			TSC I-IIIA			TSC IIIB-IV	
Goal	Fill	Fill%	Goal%	Fill	Fill%	Fill	Fill%
100	20	20	55	15	75	5	25

This MOS has started poorly with both quality and fill. However, since the TSC IIIB-IVs are so low in number, the quality percentage appears misleadingly high. The ROC should not close this MOS to TSC I-IIIAs now, but rather should keep the quality switch open so that more of them can enter.

An alternative methodology is based on the *quality numerical fill to date.* This alternative calculation would be:

DQ Status = TSC I-IIIA Fill - ANNPRO TSC I-IIIA Fill.

For example, when TSC I-IIIA fill is 15% and TSC I-IIIA target is 55%, then Deny N(o).

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[15] The Seabrook Report is critical to managing DQ. It provides each MOS DQ status and targets.

[16] Accessions to OSUT MOS are credited to the FY when they begin active duty. However, accessions to MOS using BT followed by AIT are not credited to FY until they start AIT. Since AIT starts 8 weeks or later after BT, contract opportunities for AIT MOS essentially close out by the end of July. (Contracts for MOS with longer AIT, such as CMFs 91 and 98, close out earlier.)

This method has the *advantage of not locking out high-quality applicants just because total fill is low.* However, it risks disproportionate fill during the year. If quality had been running high (but still below the numerical target), a decrease in ANNPRO could give very unbalanced fill, with no possibility of correction. Now consider the hypothetical MOS in Table 2.

Table 2
Status based on Quality of MOS Fill to Date

	MOS			TSC I-IIIA			TSC IIIB-IV	
Case	Goal	Fill	Fill%	Goal%	Fill	Fill%	Fill	Fill%
1	100	60	60	60	20	33	40	67
2	60	60	100	60	20	33	40	67

In case 1 TSC IIIB-IVs are at their numerical cap of 40 so their fill would appear reasonable if only numerical fill were considered. (Note that their percentage fill is very high.) Now suppose the ANNPRO were dropped to 60, as shown in Case 2. The MOS would be left with only 33 percent quality. Additionally, if the fill of class seats were proportionate to the quality percentage in the example, the early classes would produce low-quality graduates.

The ROC uses the first method, primarily because the percentage-based method gives the best hedge against the ever-present possibility of a cut in an MOS ANNPRO.

Other considerations in managing quality include:

- A proportional balance of quality is needed throughout the year to maintain the DQ of MOS classes.
- If many MOS are closed to TSC I-IIIAs, high-quality applicants will not have a broad choice of MOS.
- During the better recruiting months, attractive MOS should not take quality applicants from harder-to-fill MOS.
- During the slower recruiting months, easier-to-fill MOS should be filled with quality applicants.[17]
- Competition between MOS for quality should be recognized. DQ switches should keep MOS from getting more than their share of quality.
- It may be necessary to risk a quality imbalance to fill seats in class-constrained MOS.
- Many class-constrained MOS have Aptitude Area cut scores that are too high for most TSC IIIB-IVs. However, any TSC IIIB-IV who can qualify should be encouraged to contract in one of the MOS.
- DQ and RUDEP switches should be compared to avoid unintentional lockouts.[18]
- Education switches can also cause lockouts. The education categories are now so diverse that they make switch management difficult.

4.16 Necessary EPAS action? EPAS abides by quality constraints in solving the aggregate allocation problem, while DQ manages the actual daily flow of quality. It is anticipated that operational policies within EPAS and DQ would be coordinated.

EOG incorporates DQ by setting goals for quality (lower bounds) and limits for TSC IIIB (upper bounds). The model constraints are expressed using summations of the SG to AIT and SG to OSUT connections representing quality and IIIBs. There will be one set of summations for each AIT and each OSUT class start week with their respective quality lower bounds and IIIB upper bound.

TSC IVs and NHSDGs are *free goods*, with unlimited supply, but no demand. Any NHSDG are usually due to HSS who failed to graduate and had received a waiver or had incorrectly been

[17] The RUDEP process, discussed in the next section on DEP Control, regulates the flow to an MOS, by TSC and education, and by accession month.

[18] Switch settings unintentionally conflicting and preventing MOS fill.

scheduled to graduate. Consequently NHSDG are not modeled in the SGs and there are no TSC IV[19] and NHSDG limits or goals.

4.2 RUDEP Control Procedure

4.21 DEP Rationale. A DEP process is used by all Services to allow would-be recruits to contract or obligate themselves to enlist before the time they actually access. It has become an indispensable element of filling MOS training classes with the numbers and quality required. DEP control is a gatekeeper to nongraduate and TSC IIIB and IV Army accessions. It is the only process that can have total control of mission ceilings.

The rationale for restrictions on TSC IIIB-IVs was discussed in the section on Distribution of Quality, covering MOS-specific as well as total mission quality. The overriding rationale for limits on nongraduates is that they have poorer first-term attrition behavior than do high school diploma graduates.

The ROC uses DEP control (the expert system RUDEP process) to channel applicants into accession-months and MOS that best support recruiting management. Since June 1990 the ROC has operated this process with its microcomputer-based *RAMS-RUDEP System.* It addresses the considerations below while developing a weekly RUDEP strategy in a few hours.[20]

Problems addressed.

(1) As RUDEP constrains applicants to enlist for training opportunities in the accession month in which they are needed, its constraints on DEP cannot be so restrictive that they limit accessions overall.

(2) Being too restrictive can create an environment that will fail to attract enough recruits. On the other hand, not managing carefully will result in exceeding or failing to meet accession requirements.

(3) DQ supports MOS-specific allocations of quality; however, it cannot control the annual quality mission. Also DQ cannot accomplish monthly leveling of quality. The RUDEP process must accomplish this by directly controlling entry to the Army, by month, of TSC IIIB-IV accessions.

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[19] USAREC may permit 2 to 4 percent TSC IV for short periods. This category is still not modeled because they qualify for so few MOS that optimal allocation is not necessary.

[20] The steps required to operate RAMS-RUDEP are described in McWhite and Hendriksma (1992), pp. 30-34.

(4) Mission categories need strategic management. Because their availabilities to access are determined by graduation dates, HSSRs and CCs must have specific accession windows, while others may be needed to provide accessions during "slow" periods, such as March and April.

(5) Level loading training seats is needed to provide applicants varied opportunities.

Procedure for determining DEP control. AMB (PERSCOM Accession Management Branch) gives USAREC annual accession missions broken down by type (NPS or PS), gender, education, and TSC; ODCSPER gives overall (by type only) monthly accession targets. HQ USAREC's Missioning Branch develops monthly contract goals (as part of a quarterly process) based on recruiting resource constraints, and past and predicted achievements.

The ROC's DEP control methodology. The ROC continuously evaluates its ability to meet each month's mission and quality goals. Based on the current accession status, the ROC determines which month or months should be the target reception station month (RECSTA month) for each type, gender, and TSC. This starts the process that leads to the RUDEP program.

The ROC controls accessions to RECSTA months. Each day it updates the projected accessions from previous contracts. It then determines if the currently available RECSTA month(s) can support the day's floor count of applicants. If not, the RSM(s) is/are advanced one month.

It evaluates each RSM's fill status daily. Ideally an RSM will have achieved its accession mission (or be very close to it) at least 3 months in advance. Then the applicants who will accept a short DEP can replace DEP losses. Filling an RSM too full removes guidance counselors' flexibility. Some slack should always be allowed for the exceptions that will occur.

If RSM accession targets are not achieved, the ROC's procedures are based on the status of accession fill. The following actions are taken when an MOS *has not* met its RSM mission. Actions are listed in increasing order of effectiveness in helping an MOS meet its RECSTA month mission:

- Leave the current RECSTA month and next unfilled RECSTA month open for accessions. Ideally only those MOS that are in danger of losing critical seats would be available within the current RECSTA month. However, additional MOS may be presented in order to ensure achievement of the accession mission for that particular RECSTA month.
- That RECSTA month will remain open to all MOS, any future RECSTA months would be closed, and guidance counselors would be given the short-term requirement to access applicants into the current RECSTA month.
- Lock out the MOS in all other RECSTA months. A further step is to allow only the seat-critical MOS to show. Although drastic, this procedure quickly solves a short-

term problem involving a critical accession month or even a critical MOS, such as 11X, or an STP.

If an MOS accession mission *was* achieved, including predicted DEP losses, the RECSTA month will be closed to accessions. All subsequent applicants will access in a future RECSTA month.

4.22 RUDEP tables. One or more MOS are assigned to a RUDEP table which controls the applicant types, gender, education levels, and TSCs that can access during each of the next 25 months. The letters *X* and *C* denote that the RECSTA month for the Table's MOS is open or closed, respectively, to applicants with the indicated education and TSC attributes. RUDEP Tables 1 through 17 control the normal training seats while Tables 18-20 are reserved for the STPs discussed in the following section. Each MOS must be assigned to a table or it will be open to all categories in all months.

Each table consists of a series of RECSTA months, from the current RECSTA month through the next 24 months. Each RECSTA month in each table is initially closed to avoid oversights. As an RECSTA month is passed, REQUEST automatically removes it from the tables. The education codes and TSC combinations are displayed on the left side of the table and any eight (of 25) sequential RECSTA months are displayed across the top. At each intersection of the matrix, the default setting is closed (C). An open (X) setting allows REQUEST to offer the MOS controlled by that table to otherwise qualified recruits. (The DQ and education switches are a separate process which controls accessions for the remainder of a given fiscal year.)

RUDEP Table MOS Assignments. MOS are assigned to a table based on the kinds of control required (tables are set up for male and female, NPS and PS applicants). The ROC developed the following MOS Tables assignments for NPS applicants (males and females may have different target months):

Table 1. MOS that have only ten or less class starts during the year are Seldom Taught (ST). RO can't afford to miss class seats in these MOS. Missing significant number of seats risks missing the ANNPRO. The strategy is to leave all RECSTA months open from the current RECSTA month out to the Target RECSTA month(s). This allows DEP loss replacement and encourages early fill of classes. An OSUT MOS, 93B, is on this Table; the rest are also Hard To Qualify for (HTQ). However their ST categorization gives them priority over the other remaining HTQ on Table 7. In extreme cases, if the accession Target RECSTA month is in danger of being "missed", Table 1 MOS can be closed down to direct fill into the Target RECSTA month. However, this action increases the likelihood of missing ST class seats. Fill of these MOS at greater than the CMD AVG is not a concern, because many of these programs are small so a few enlistments will give a large percentage fill. Fill at less than the CMD AVG must be monitored. However this will usually be corrected as

soon as the next class becomes available. This Table is available to all categories that are open to stimulate fill. AMB provides the list of ST MOS.

Tables 2 & 3. MOS that are currently selling at the CMD AVG pace or better and are not classified as ST/HTQ. Both Tables are restricted to TSC I-IIIA's, thereby slowing fill. Table 2 will slow fill severely; Table 3 slows the fill moderately. To accomplish this, Table 2 is set open to Target RECSTA month-1 while Table 3 is open to the Target RECSTA month. Oversold MOS are assigned to either Table 2 or 3 based on the remaining unsold program. The remaining programs for these MOS are summed to yield the Tables 2 & 3 total unsold program. MOS are then ranked in ascending order of delta fill (amount ahead of CMD AVG) with the MOS that is most ahead of CMD AVG top ranked. Beginning at the top of this list, the remaining program is totaled MOS by MOS until the sum reaches 10% of the total unsold program for all the oversold MOS. These MOS are then placed on Table 2 to severely slow down their fill. The remaining MOS go on Table 3 which moderately slows down their fill while keeping 90% of the remaining unsold program available to all TSC I-IIIA's. In general Table 3 fills most of the Target accession RECSTA months.

Table 4. MOS that are currently below the CMD AVG fill and are not classified as ST/HTQ. It is available to all categories that are open to stimulate fill. It also has additional RECSTA month(s) open past the Target RECSTA month. If necessary, "out" RECSTA month(s) may be shut down to support the Target RECSTA month.

Tables 5 & 6. Special circumstances. They are used to close an MOS completely or treat a MOS in some manner that can not be handled on the other Tables. They can close down an MOS to COHORT only or open an MOS to a specific category with a specific time frame.

Table 7. HTQ MOS, except those that are ST. The strategy is to encourage fill for these MOS by making them available to all open categories and keeping RECSTA months open beyond the Target RECSTA month. The HTQ categorization justifies keeping these MOS at, or above, the CMD AVG fill and therefore overfilling or selling them out. Once full, applicants would be directed to slower filling MOS. This strategy also allows DEP loss to be replaced at any time and encourages fill into the most difficult programs. In extreme cases where the Target RECSTA month is in danger, the "out" RECSTA months on this Table may be closed down to support the Target RECSTA month. The following criteria exists for HTQ (unless ST):

APT SCORES OF 110 OR UP	APT SCORE OF 100 OR UP	TWO APT SCORES OF 100 OR UP
27E 29E 29J 29V 35G 36L 46Q 71D	29N 29S 42E	31C 31D 31F 36M 68X

Table 8. MOS that are Extremely Behind CMD AVG Fill. It is available to all open categories and generally open to Target RECSTA month+2 to stimulate fill. MOS are placed on, or removed from, Table 8 as required. The out RECSTA month(s) may be shut down to support the Target RECSTA month.

Tables 18 & 19. For the cohort/STP packages. Available to all open categories to stimulate fill. Generally the open RECSTA month(s) for these Tables are the Target RECSTA month(s).

4.23 Considerations in DEP management. The ROC must balance applicant availabilities with flow management. They cannot frequently shift RUDEP controls for TSC so they must anticipate recruiting success.

The ROC operates the RAMS-RUDEP expert system weekly to review MOS assignments among Tables 2, 3, 4, and 8. MOS assignments to other Tables are reviewed periodically. The RAMS-RUDEP System also recommends DQ switch settings to control MOS quality fill. All recruitable MOS are reviewed weekly regardless of their seat status or if they become frozen. This automatically places an MOS on the right Table if it becomes unfrozen or gets seats. It will then immediately start selling on the right Table.

ST, HTQ, and Extremely Behind Fill MOS are only a small percentage of USAREC's FY program for all MOS. Therefore any overfill resulting from having RECSTA months open beyond the Target RECSTA month will not endanger a given RECSTA month's accession mission.

The ROC uses the HSSR market to help fill difficult MOS. In late Spring, as students complete their junior year, open RECSTA months for HSSR are generally limited to OSUT MOS and MOS assigned to Tables 4, 7 and 8. This fills the Combat Arms, HTQ MOS and other MOS which the ROC anticipates having difficulty filling.

By procedure, only HSSRs and CCs can stay in DEP up to one year (365 days) before accession. They can enlist after graduation. This means that summer months are filled quickly with quality seniors. They are prone to DEP loss because of their long period of time in the DEP. Seniors must be evenly spread over the three summer months to preclude excessive DEP losses in any RECSTA month.

As HSSRs and CCs are the only applicants permitted advance fill for the summer months, the ROC must carefully control quality, as the DQ process will not be effective for these RECSTA months.[21] The ROC must consider other markets, such as HSDGs (who had not contracted as HSSRs), community college graduates, and college end-of-semester dropouts.

Controlling quality during the summer RECSTA months requires special attention. The ROC will not restrict fill for ST and HTQ MOS but will use the following procedures for other MOS.

- Limit each summer RECSTA month to about 45 percent of fill to ensure that individual MOS are not prematurely sold out for the year.
- The Accession + DEP Report tracks the summer fill for aggregate numbers. As an RECSTA month reaches the target percentage of fill, the ROC will change the RUDEP openings to the RECSTA month that has the lowest percentage of fill. When all summer months have been filled to 45 percent, they are selectively opened in order to ensure an even fill into all 3 months. This can happen several times as the summer months are evenly filled.

The ROC must maintain a consistent policy for the guidance counselors. For example, during the summer TSC IIIB-IVs are generally offered near-term OSUT MOS in the current FY. These are less desirable than the longer DEP to the next FY's AIT MOS that are offered to quality applicants. To maintain credibility, guidance counselors must be consistent in their actions. They cannot offer a near-term Combat Arms seat to one TSC IIIB (and imply "take it or leave it") and later offer an attractive AIT MOS to a comparable applicant.

4.24 Implementation. The RUDEP process is the most complex of the recruiting elements. It simultaneously controls:

- When a recruit can access to an MOS.
- What MOS he can join based on TSC and Education.[22]

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[21] During the summer volume fill has a higher priority than DQ control.

[22] RUDEP education controls can differentiate among alternative high school certification or equivalency programs. (See Appendix A.)

As discussed above, the RUDEP program implements DEP controls and acts like a gatekeeper to each MOS. Unless granted an override (see Duties section on Override RUDEP) no applicant can contract for an MOS unless he meets its RUDEP accession window and its education and quality requirements.

Although their effects overlap, the RUDEP controls on education and quality are distinct from the DQ and Education switches. RUDEP controls are not permissive; they are in force until modified. For each MOS, a RUDEP table will control the permitted accession months of applicants with a specified education level and TSC.

On the other hand, DQ and Education switches for an MOS are independent of accession date. As discussed in the section on DQ, these switches prevent a contract to an intended MOS only if set to "Deny - Yes" and the characteristic associated with the applicant is **above** its target in that MOS.

4.25 Necessary EPAS action. A critical RUDEP function is to establish target RECSTA month(s). From the above it is clear that RUDEP could severely constrain EPAS operations and limit the utility of EOG. For example too short a DEP would severely restrict EPAS's look-ahead capability. This is significant because an optimum DEP strategy is necessary to have the flexibility to recommend feasible person-job-matches. We suggest a transitional EPAS RUDEP strategy, covering early to late implementation stages.

Early implementation stage. Here USAREC RUDEP strategy would continue as before, but with exceptions permitted on a case basis. These cases reflect the RUDEP Tables (T):

- T1-Seldom Taught MOS. This Table covers the MOS with few class starts during the year. As such, missing a seat would risk missing the MOS annual program (ANNPRO). RUDEP will let these MOS fill up quickly, if possible. Also a robust DEP is critical to this process and such would not be in place early in EPAS implementation. We recommend that T1 continue.
- T2,3,4&8-Variable Table MOS. These MOS are not Seldom Taught or Hard to Qualify For (see T7). Their position on either of the four Tables reflects fill status relative to command average fill.[23] This RUDEP control assures a relatively even fill of MOS, with no MOS falling too far behind or filling up so quickly that later applicants would not see a variety of MOS. Using the RUDEP control does not require an established DEP so we recommend that USAREC not use these Tables.
- T5&6. These Tables are used for special circumstances, such as to force fill into specific MOS, such as priority MOS. We recommend evaluation with the EPAS

[23] The weighted average percent fill to date for all MOS.

Simulation Mode to assess how well EPAS can support special requirements, such as priority MOS.

- T7. This Table covers hard-to-qualify-for MOS. It is somewhat like T1 in that MOS on this Table are allowed to rapidly fill (if possible) and would never be held back to channel fill to other MOS. As long as RUDEP permitted sufficient DEP length for these MOS, RUDEP would have no effect.
- T18-19. These Tables cover special training packages whose use varies and are not implemented in EPAS.

Full implementation stage. This point will be reached when the HIARCY EPAS weight is at least 50 percent and the current DEP is similar to that shown during a Planning Mode run. USAREC will have a robust DEP and average estimated performance will be similar to that resulting from a corresponding Simulation Mode run.

We expect that the RUDEP Tables now will follow the EOG. The Tables must still be used, since EPAS will have no control over MOS assignments during the REQUEST Lookup Mode. Otherwise, for example, guidance counselors could contract a NHSDG IIIB to a desirable MOS . RUDEP would also be needed to actually stop accessions before or during a former Target RECSTA month.

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GLOSSARY

Acronym	Long Name
AA	Active Army
AA	Aptitude Area
AAR	Accession Accounting Report
AASVAB	Army ASVAB
ACF	Army College Fund
AFQT	Armed Forces Qualification Test
AIT	Advanced Individual Training
AMB	Accessions Management Branch (PERSCOM)
ANNPRO	Annual Program
ARI	**Army Research Institute**
ASVAB	**Armed Services Vocational Aptitude Battery**
BT	Basic Training
CC	Currently enrolled in college
CMD AVG	Command Average
CMF	Career Management Field
DCSPER	Deputy Chief of Staff for Personnel
DEP	Delayed Entry Program
DLAB	Defense Language Aptitude Battery
DOA	Date-of-Availability
DOD	Department of Defense
DQ	Distribution of Quality
EB	Enlisted Bonus
EOG	EPAS Optimal Guidance
EPAS	Enlisted Personnel Allocation System
FY	Fiscal Year
GC	Guidance Counselor
HIARCY	**Hierarchy**
HPM	
HQ	**Headquarters**
HSSR	**High school senior**
HTQ	Hard to Qualify
M	Million

Acronym	Long Name
MEPS	Military Entrance Processing Station
MEPSCAT	MEPS Category
MOS	**Military Occupation Specialty**
NHSDG	**Non-High-School Diploma Graduate**
NPS	**Non-Prior Service**
ODCSPER	Office of the DCSPER
OSUT	One-Station Unit Training
PC-EPAS	**Personal Computer Enlisted Personnel Allocation System**
PERSCOM	**[US Army] Personnel Command**
PS	Prior Service
QAM	Quality Allocation Module
RAMS	Recruit Allocation Management System
RECSTA	Receiving Station
REQUEST	Recruit Quota System
RIM	REQUEST Interface Module
RO	Recruiting Operations Directorate (USAREC)
ROC	REQUEST Operations Center
RECSTA month	Receiving station month (as in target RECSTA month)
RSM	Recruiting Station Month
RSW	Recruiting Station Week
Rtng Bn	Recruiting Battalion
RUDEP	Report/Update Delayed Entry Program
SG	Supply Group
ST	Seldom Taught
STP	**Special Training Package**
TRADOC	**[US Army] Training and Doctrine Command**
TSC	**Test Score Category**
USAREC	**United States Army Recruiting Command**