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MANPOWER REQUIREMENTS DERIVATION FOR THE NAVY
COMPREHENSIVE COMPENSATION A. (U) CENTER FOR NAVAL
ANALYSES ALEXANDRIA VA NAVAL STUDIES GROUP

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PROFESSIONAL PAPER 385 / September 1982

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Bruce Angier
Kurt Driscoll
David Gregory

N00014-76-C-0001

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Naval Studies Group

CENTER FOR NAVAL ANALYSES

2000 North Beauregard Street, Alexandria, Virginia 22311

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A

MANPOWER REQUIREMENTS DERIVATION
FOR THE NAVY COMPREHENSIVE COMPENSATION AND SUPPLY STUDY

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Rating-specific manpower requirements are included in the NACCS optimization model as key constraints. The statement of manpower requirements used is basically that expressed in the U.S. Navy Enlisted Objective Force.(Op-120C: NMPC-1643, dated 15 April 1981). However, for application in NACCS, it was necessary to decompose the objective force into various subsets of requirements. This memorandum describes the procedures followed to create the NACCS requirements.

↑

The objective force is a statement of Navy total active enlisted manpower requirements by rating, paygrade, and length of service (LOS). Since the current version of NACCS addresses only USN 4Y0 non-prior service (NPS) males, manpower requirements in all other categories must be deleted from the objective force. Also, in that NACCS treats general detail (GENDET) personnel as a separate group, GENDET requirements must be factored out to arrive at true rating requirements in the objective force. We will discuss the rating requirements methodology and 4Y0 requirements in order. The computer program used to determine NACCS requirements is included as appendix A. Appendix B is a sample of the program output.

RATING REQUIREMENTS

The U.S. Navy Enlisted Objective Force includes requirements for GENDETs, but they are not explicitly stated in terms of a rating. Rather, they have been allocated to general and service ratings based on historical patterns of GENDET behavior in attaining rating designations. By removing these non-rated, non-designated requirements from the objective force, we create rating-specific requirements. The residual becomes GENDET requirements which we use as constraints for a separate GENDET "rating."

The algorithm used to allocate GENDETs to ratings before the creation of the objective force is implemented in a program called LOBAL (see appendix C for the Op-135D1/NMPC-1643 writeup). Because we are simply reversing this allocation, an understanding of what steps LOBAL performs is important. The steps listed below allocate the apprenticeship groups to given ratings, spread those individuals over LOS cells (consistent with the actual totals in each LOS cell), and generate rating totals (designated plus undesignedated) as input for developing the Objective Force. HMs and DTs, along with their apprenticeship groups, are input directly and will not be discussed here. For expository purposes, we have divided the process into six steps.

1. By convention, many individuals are assigned to the Seamen apprenticeship group until they find out what ratings they want to enter or will be allowed to enter. Therefore, examination of the inventories of the four apprenticeship groups (Seamen, Airmen, Firemen, Constructionmen) at any given time shows more SNs than expected based on rating requirements. The first step in LOBAL is to allocate some of these SNs to the other apprenticeship groups based on what has historically occurred during their progress toward being designated in a rating.

2. Some individuals listed in the apprenticeship groups are actually in formal school training for a rating. They are added to the striker population in the appropriate rating, and subtracted out of the apprenticeship pool.

3. If the total allocated at this point is not sufficient to meet minimum striker requirements for a given rating, an extra allocation is made. Also, at this point it is possible to intervene in the process to make some additional allocations based on information not contained in the model. (We were told this occurred for about 15 ratings in FY 1981.*)

4. The remaining individuals in each apprenticeship group are allocated to ratings for which they normally strike based on historical

* Conversation with CDR James Smith of NMPC-16.

data from E-4 advancement examinations (factors supplied by NPRDC). For example, the proportion of individuals taking the test for rating Y who are from apprentice group X becomes a factor for allocating additional unrated, undesignated Xs to rating Y.

5. The population of unrated, undesignated individuals that has been apportioned to each rating is then allocated across LOS cells within the rating, subject to the condition that the number of unrated, undesignated individuals allocated to any given LOS cell across all ratings matches the actual inventory for the apprenticeship group.

6. Finally, these rating-LOS totals (designated plus undesignated) are used as the input to the FAST model. FAST output is then used in goal development models that produce the Objective Force.

Our purpose here is to determine how many GENDETs have been allocated into a given LOS cell for a given rating, and subtract out that number to arrive at rating requirements. This procedure is relatively simple, given the output from the LOBAL program supplied to us by NMPC.

The first five steps above are performed within the LOBAL program. However, the results need two corrections. The first is a rounding correction, necessitated by performing calculations that result in numbers of "people" that are not integers. This rounding process occurs in steps four and five. The second correction involves taking into

account the increase or decrease needed in the LOBAL base inventory to size the objective force. For example, if a given LOS in a given rating has 90 designated individuals and is allocated 10 unrated, undesignated individuals by LOBAL, the total number passed to FAST is 100. If the resultant objective force figure is 110, we assume it is made up of 99 designated and 11 undesignated individuals based on the same proportions applied in LOBAL.

After performing these calculations, we are left with a set of rating-specific objective force requirements, as well as GENDET requirements. The next step is to estimate true 4YO requirements.

4YO REQUIREMENTS

The requirements derived above include manpower sources other than USN, 4YO, NPS males. Since there is no program analagous to LOBAL that would permit us to directly factor out the 4YOs, we had to scale down the requirements using historical data.

From the June 1980 EMR (used by NMPC to create the LOBAL base), we determined rating, LOS cell (through year 5), and length of obligation for the enlisted inventory. Women and prior service personnel were included by rating and LOS only. The basic procedure employed a combination of checks utilizing type of accession program, term and number of enlistments, rate code, EAOS, and extension data to estimate each

individual's obligation. The rating allocation of women, prior service, and USNR was quite straightforward. However, the allocation of 4, 5, and 6 year obligors was complicated by 'A' school attendance. Short of creating a separate cohort file, we made the following simplifying assumptions:

1. Non-rated individuals, regardless of LOS, retain their original obligations. For example, a Seaman in LOS 3 who entered as a Nuclear Field 6YO is assumed to remain a 6YO. In practice, had this individual been an academic failure from 'A' school, the obligation would likely have been reduced. On the other hand, if he were a disciplinary drop from 'A' school, or someone whose rating designation was removed for cause, the original obligation would probably remain.

2. Individuals in ratings with mixed 4 and 5 or 6 year obligations, who entered as 4YOs but incurred a 12 or 24 month school extension, are categorized as 5 or 6YOs, respectively. Thus, for example, an individual who entered through the S/A/F Program (4YO GENDET), but appears in LOS 2 as a designated ET striker with a 24 month school extension, is classified as a 6YO.

The latter assumption should give a reasonable estimate of the true 4YO population by rating. However, the first assumption probably underestimates true 4YO GENDETs, since a significant number of 'A' school drops are academic failures whose obligations would be reduced (in the

case of 5 and 6 YOs). We intend to perform sensitivity analyses to determine how increases in the proportion of 4YO GENDETs affect overall results.

The above computations gave us USN, 4YO, NPS males as a percent of the total inventory by rating for LOS 1-4 and LOS 5. We then directly applied these percentages to the rating requirements derived earlier and arrived at our estimate of 4YO requirements for LOS 1-4 and LOS 5.

In the aggregate, we estimate that 54 percent of LOS 1-4 requirements and 40 percent of LOS 5 requirements must be met by USN, 4YO, NPS males.

APPENDIX A
REQUIREMENTS PROGRAM

```

C=3SET LIST
$RESET FREE
FILE 1(KIND=DISK,TITLE='NACCS/LOBAL/RATECODES',FILETYPE=8)
FILE 2(KIND=DISK,TITLE='NACCS/LOBAL/INFUT',FILETYPE=8)
FILE 3(KIND=DISK,TITLE='NACCS/LOBAL/OBJECTIVE/CLEAN',
X FILETYPE=8)
FILE 4(KIND=DISK,TITLE='NACCS/LOBAL/ROUND/LOS',FILETYPE=8)
FILE 5(KIND=DISK,TITLE='NACCS/LOBAL/TOTAL/LOS',FILETYPE=8)
FILE 6(KIND=REMOTE,MAXRECSIZE=120)
FILE 7(KIND=DISK,TITLE='NACCS/LOBAL/AFTER/FLIPFLOP',FILETYPE=8)
FILE 8(KIND=DISK,TITLE='NACCS/OBJECTIVE/DATA',FILETYPE=8)
FILE 9(KIND=DISK,TITLE='NACCS/LOBAL/DES/UNDES/LOS',
X FILETYPE=8)
FILE 10(KIND=DISK,TITLE='NACCS/YO/COUNT/MATRIX',FILETYPE=8)
    DIMENSION ICODE(92),ADATA(92,5),ICODE(92),OFORCE(92),
X         IBCODE(92),IRCODE(92),IICODE(92),IOCODE(92),
X         BOATA(10,92),RDATA(10,92),TDATA(10,92),ODATA(92,6),
X         TMATRX(92,9,9)
C      READ ALL INPUT DATA
    READ(1,/)ICODE
    READ(2,/)ADATA
    READ(3,100)(ICODE(I),OFORCE(I),I=1,92)
100  FORMAT(I4,F6.0)
    READ(4,/)RDATA
    READ(5,/)TDATA
    READ(7,/)BOATA
    READ(8,800)(IOCODE(I),(ODATA(I,J),J=1,6),I=1,92)
    READ(10,1100)((TMATRX(I,J,K),K=1,9),J=1,9),I=1,92)
1100  FORMAT(1X,9I7)
C      WRITE ALL INPUT DATA TO CHECK FOR ERRORS
    WRITE(6,150)
150  FORMAT('OCODE      PREV      BETA      R/ROUND      ROUND',
X      '      TOT CODE      GFORCE')
    WRITE(6,200)(ICODE(I),(ADATA(I,J),J=1,5),ICODE(I),OFORCE(I),I=1,
X      92)
200  FORMAT(1X,15,5F10.2,15,F7.0)
    WRITE(6,300)
300  FORMAT('OROUNDED')
    WRITE(6,400)(ICODE(I),(RDATA(J,I),J=1,10),I=1,92)
    WRITE(6,500)
500  FORMAT('OTOTALS')
    WRITE(6,400)(ICODE(I),(TDATA(J,I),J=1,10),I=1,92)
    WRITE(6,600)
600  FORMAT('OFLIPFLOPPED')
    WRITE(6,400)(ICODE(I),(BOATA(J,I),J=1,10),I=1,92)
    WRITE(6,700)
700  FORMAT('OOBJECTIVE FORCE')
    WRITE(6,800)(IOCODE(I),(ODATA(I,J),J=1,6),I=1,92)
400  FORMAT(1X,15,10F10.1)
800  FORMAT(15,5F5.0,15,F5.0)
    WRITE(6,1300)
1300  FORMAT('OYO COUNT MATRIX')
    WRITE(6,1200)((TMATRX(I,J,K),K=1,9),J=1,9),I=1,3)
1200  FORMAT(1X,9I5,/)

```

```

C      DO FOR EACH OF 92 RATINGS
      DO 10 I=1,92
C      CHECK THAT DATA SETS CONFORM. IF NOT, STOP.
      IF (IICODE(I).EQ.IICODE(I)).AND.(ICODE(I).EQ.IOCODE(I)))
X      GO TO 20
      WRITE(6,900)ICODE(I),IICODE(I),IOCODE(I)
900      FORMAT('0***ERROR*** CODES DON'T MATCH;I,II,IO',3I6)

      STOP
20      CONTINUE
C      ACCUMULATE FIRST FOUR LOS CELLS FOR LOGAL AND OBJ FORCE
      RDATA4=0.0
      TDATA4=0.0
      BDATA4=0.0
      QDATA4=0.0
      DO 30 K=1,4
          RDATA4=RDATA4+RDATA(K,I)
          BDATA4=BDATA4+BDATA(K,I)
          TDATA4=TDATA4+TDATA(K,I)
          QDATA4=QDATA4+QDATA(I,K)
30      CONTINUE
C      IF NO UNRATED, UNDESIGNATED ARE IN LOS 1-9 OF RATING
      IF(CADATA(I,33).EQ.0.0) GO TO 40
C      THIS CODE PREVENTS ZERO DIVIDES
      FUDGE=0.0
      IF (BDATA4.NE.0.0) FUDGE=RDATA4/BDATA4
C      DETERMINE UNDESIGNATED IN EACH LOS, SCALING RATING
C      INPUTS TO OBJECTIVE FORCE/LOGAL INVENTORY RATIO
      UNDS4=FUDGE*QDATA4*RDATA4/TDATA4
      FUDGE=0.0
      IF (BDATA(5,I).NE.0.0) FUDGE=RDATA(5,I)/BDATA(5,I)
      UNDS5=FUDGE*QDATA(I,5)*RDATA(5,I)/TDATA(5,I)
      FUDGE=0.0
      IF (BDATA(9,I).NE.0.0) FUDGE=RDATA(9,I)/BDATA(9,I)
      UNDS9=FUDGE*QDATA(I,6)*RDATA(9,I)/TDATA(9,I)
C      ROUND, BREAKING AT .5
      IUNDS4=UNDS4+.5
      IUNDS5=UNDS5+.5
      IUNDS9=UNDS9+.5
C      BYPASS THE CONDITION "IF NO ONE IS IN LOS 1-9"
      GO TO 50
40      CONTINUE
C      IF NO UNRATED, UNDESIGNATED IN LOS 1-9
      IUNDS4=0
      IUNDS5=0
      IUNDS9=0
50      CONTINUE
C      CREATE "PURE" RATED OR DESIGNATED RATING
      IRATE4=QDATA4-IUNDS4
      IRATE5=QDATA(I,5)-IUNDS5
      IRATE9=QDATA(I,6)-IUNDS9
C      THE REST OF THE PROGRAM CREATES USN 4YD NPS MALE
C      REQUIREMENTS FOR LOS 1-4, 5 AND 9

```

```

T4Y0=0.0
P4Y0=0.0
P5Y0=0.0
P9Y0=0.0
RGHT4=0.0
RGHT5=0.0
RGHT9=0.0

C      DETERMINE LOS 1-4 4Y0 AND TOTAL INVENTORY
DO 60 J=1,4
      T4Y0=T4Y0+THATRX(I,4,J)
      DO 70 K=1,9
        P4Y0=P4Y0+THATRX(I,K,J)
70      CONTINUE
60      CONTINUE
C      DETERMINE LOS 5 AND LOS 9 TOTAL INVENTORY
DO 80 K=1,9
      P5Y0=P5Y0+THATRX(I,K,5)
      P9Y0=P9Y0+THATRX(I,K,9)
80      CONTINUE

C      SCALE DOWN RATING REQUIREMENTS BY PROPORTION
C      OF 4Y0'S IN EACH LOS GROUP
IF (P4Y0.NE.0.0) RGHT4=FLOAT(IRATE4)*T4Y0/P4Y0
IF (P5Y0.NE.0.0) RGHT5=FLOAT(IRATE5)*THATRX(I,4,5)/P5Y0
IF (P9Y0.NE.0.0) RGHT9=FLOAT(IRATE9)*THATRX(I,4,9)/P9Y0
C      ROUND RESULTS, BREAKING AT 0.5
      IRGHT4=RGHT4+0.5
      IRGHT5=RGHT5+0.5
      IRGHT9=RGHT9+0.5
      WRITE(6,1000) ICODE(I),BOATA4,IUNDS4,IRATE4,BOATA4,BOATA(5,I),
X      IUNDS5,IRATE5,BOATA(I,5),BOATA(9,I),
X      IUNDS9,IRATE9,BOATA(I,6),BOATA(I,6),
X      IRGHT4,IRGHT5,IRGHT9
1000  FORMAT(15,F8.0,2I6,2F8.0,2I6,2F8.0,2I6,2F8.0,3I6)
10      CONTINUE
C      CLOSE(9,DISP=CRUNCH)
      WRITE(6,1400)
1400  FORMAT('0*** LAST EXECUTABLE STATEMENT ***')
      STOP
      END

```

APPENDIX B
PROGRAM OUTPUT

LOS 1-4 Requirements				LOS 5 Requirements			USN 4YO NPS Requirements	
Rate Non-Code	Rated	Rated	Total	Non-Rated	Rated	Total	LOS 1-4	Los 5
100	12905	2564	15469.	297	831	1128.	1953	431
150	0	0	0.	0	0	0.	0	0
200	1128	2337	3465.	20	273	293.	1916	164
250	517	2028	2545.	12	246	258.	1494	136
300	1329	5307	6636.	24	622	646.	3812	380
350	249	812	1061.	5	222	227.	208	31
401	211	2365	2576.	4	545	549.	586	98
404	392	1239	1631.	7	275	282.	341	40
450	120	847	967.	3	105	108.	378	46
500	543	2061	2704.	10	344	354.	1476	209
600	0	0	0.	0	0	0.	0	0
601	241	850	1091.	3	125	128.	591	82
602	278	903	1161.	6	166	172.	690	118
604	1787	1787	3574.	29	291	320.	1341	157
900	0	0	0.	0	0	0.	0	0
801	549	1503	2054.	10	343	353.	352	92
802	263	1437	1700.	4	362	366.	329	80
803	94	332	426.	1	84	85.	22	14
810	177	613	790.	4	166	170.	22	32
900	35	262	297.	2	44	46.	145	28
1000	3166	7192	10358.	62	2065	2127.	406	388
1010	727	1028	1755.	18	343	361.	60	61
1100	171	218	389.	3	43	46.	172	11
1200	73	155	228.	1	22	23.	133	5
1400	0	0	0.	0	0	0.	0	0
1500	1796	8153	9949.	33	1262	1295.	4985	412
1611	129	756	885.	2	128	130.	373	58
1622	55	383	438.	1	79	80.	149	27
1633	187	707	894.	3	201	204.	46	64
1644	275	798	1073.	4	149	153.	379	78
1655	154	800	954.	2	132	134.	528	80
1666	414	238	652.	8	72	80.	197	48
1700	4647	4784	9431.	96	908	1004.	2340	363
1750	0	40	40.	0	35	35.	12	18
1800	2666	3015	5681.	63	637	700.	1539	219
1900	1657	1834	3491.	33	354	387.	254	111
2000	2529	3571	6100.	55	700	755.	2207	414
2100	962	900	1862.	25	193	218.	530	81
2200	3038	7780	10818.	70	1273	1343.	4872	671
2300	91	665	756.	1	59	69.	376	33
2400	1853	2307	4160.	38	306	344.	1836	178
2500	277	351	628.	5	74	79.	213	27
2600	371	371	742.	9	34	93.	58	23
2700	780	614	1394.	17	54	101.	438	47
3100	641	177	818.	14	53	67.	129	29
3200	487	140	627.	13	62	75.	77	21
3300	59	217	276.	1	58	59.	173	38
3700	4958	10923	15881.	79	2476	2555.	4243	814
3800	3183	4268	7449.	47	590	637.	3151	332

<u>LOS 1-4 Requirements</u>				<u>LOS 5 Requirements</u>			<u>USN 4YO NPS Requirements</u>	
<u>Rate Non-</u>	<u>Rated</u>	<u>Rated</u>	<u>Total</u>	<u>Non-</u>	<u>Rated</u>	<u>Total</u>	<u>LOS 1-4</u>	<u>Los 5</u>
<u>Code</u>				<u>Rated</u>				
3900	962	1241	2203.	11	178	189.	963	35
4000	2830	6243	9073.	38	833	871.	4466	496
4100	2946	5001	7947.	40	1177	1217.	2115	277
4200	2430	2619	5049.	28	521	549.	1356	187
4300	3360	6151	9511.	41	841	332.	4731	344
4400	0	0	0.	0	0	0.	0	0
4401	506	698	1206.	1	57	58.	262	24
4402	290	464	754.	2	93	85.	136	44
4500	52	88	140.	0	9	9.	57	6
4700	71	102	173.	2	9	11.	78	5
5100	26	125	153.	0	23	23.	11	10
5300	118	428	546.	0	98	98.	41	59
5410	78	968	1046.	0	99	99.	116	47
5500	87	602	689.	1	94	95.	47	41
5600	147	1030	1177.	1	169	170.	87	83
5700	47	488	535.	0	65	65.	52	40
5800	107	517	624.	1	99	90.	47	53
6200	2563	6047	8610.	61	837	948.	4074	462
6300	2224	3574	5798.	48	1164	1212.	1217	387
6310	217	662	879.	5	170	175.	199	17
6400	358	1252	1610.	6	235	241.	846	138
6500	1444	3220	4664.	28	461	489.	2185	291
6520	633	1266	1899.	15	389	404.	707	106
6600	444	1223	1667.	7	235	242.	604	72
6700	0	0	0.	0	0	0.	0	0
6704	779	1266	2045.	15	167	182.	1051	83
6705	861	1006	1867.	16	153	169.	754	92
6706	2549	1413	3962.	49	282	331.	1104	164
6800	2100	3717	5817.	36	542	578.	2843	353
6900	0	0	0.	0	0	0.	0	0
6901	2686	4020	6706.	47	534	581.	3116	326
6902	1397	2634	4031.	22	407	429.	1762	252
6903	109	1468	1577.	3	180	183.	1078	134
7000	72	1007	1079.	1	154	155.	602	65
7100	479	885	1364.	9	149	158.	471	75
7200	442	937	1379.	5	161	166.	416	85
7300	1820	1765	3585.	35	376	411.	376	106
7400	643	1489	2132.	0	273	273.	835	126
7500	0	0	0.	0	0	0.	0	0
7501	137	316	453.	2	57	59.	174	34
7502	108	362	468.	1	51	52.	264	39
7503	692	463	1155.	17	82	99.	300	28
7600	570	1030	1600.	12	185	197.	143	59

APPENDIX C
LOCAL METHODOLOGY

LOBAL

LOBAL reads the inventories for the apprenticeship groups AN, CN, FN, and SN. These are stored in an array which is dimensioned by apprenticeship, pay grade, and LOS. It then adjusts for laterals by taking those E1 Seamen in LOS cell 1 and distributing them to AN, CN, FN, and SN based on the distribution of the total E3 apprentices by apprenticeship. The inventories for the HM and DT apprenticeships are read directly into FAST and are not distributed as the other apprenticeships are.

The "unseen strikers" (A school students) are added in with the appropriate striker population and deducted from the non-designated population. When the combined number of strikers and unseen strikers in any rating is less than the striker requirement, non-designated personnel are allocated to that rating in order to bring all ratings up to the level of the striker requirements. The remaining non-designated personnel are allocated to ratings through the use of "beta factors."

After all of the non-designated personnel have been allocated to ratings, LOSAL distributes to LOS cells the number in each rating by using a weighted average of the LOS distribution of designated strikers and the LOS distribution of the appropriate apprenticeship. For each LOS, it then sums across ratings; this sum must equal the number in that same LOS of the appropriate apprenticeship group. Once the non-designated inventories have been allocated to ratings and LOS, LOBAL then rounds the numbers. The inventories are then sent to FAST and LOBAL.

LOBAL

- INPUTS:
1. ACTUAL END YEAR INVENTORY FROM TAFMS VIA FASTINV PROGRAM.
 2. BEGIN YEAR SCHOOL SITTERS FROM PROGRAM AUTO A.
 3. B3 DESIGNATED REQUIREMENTS FOR YEAR ONE FROM EPA.
 4. BETA FACTORS AS COMPUTED BY NPRDC, SAN DIEGO.

OF E4 TEST TAKERS FOR RATE CODE "R"
WHO CURRENTLY HAVE APPRENTICE
RATE CODE

BETA FACTOR =

B

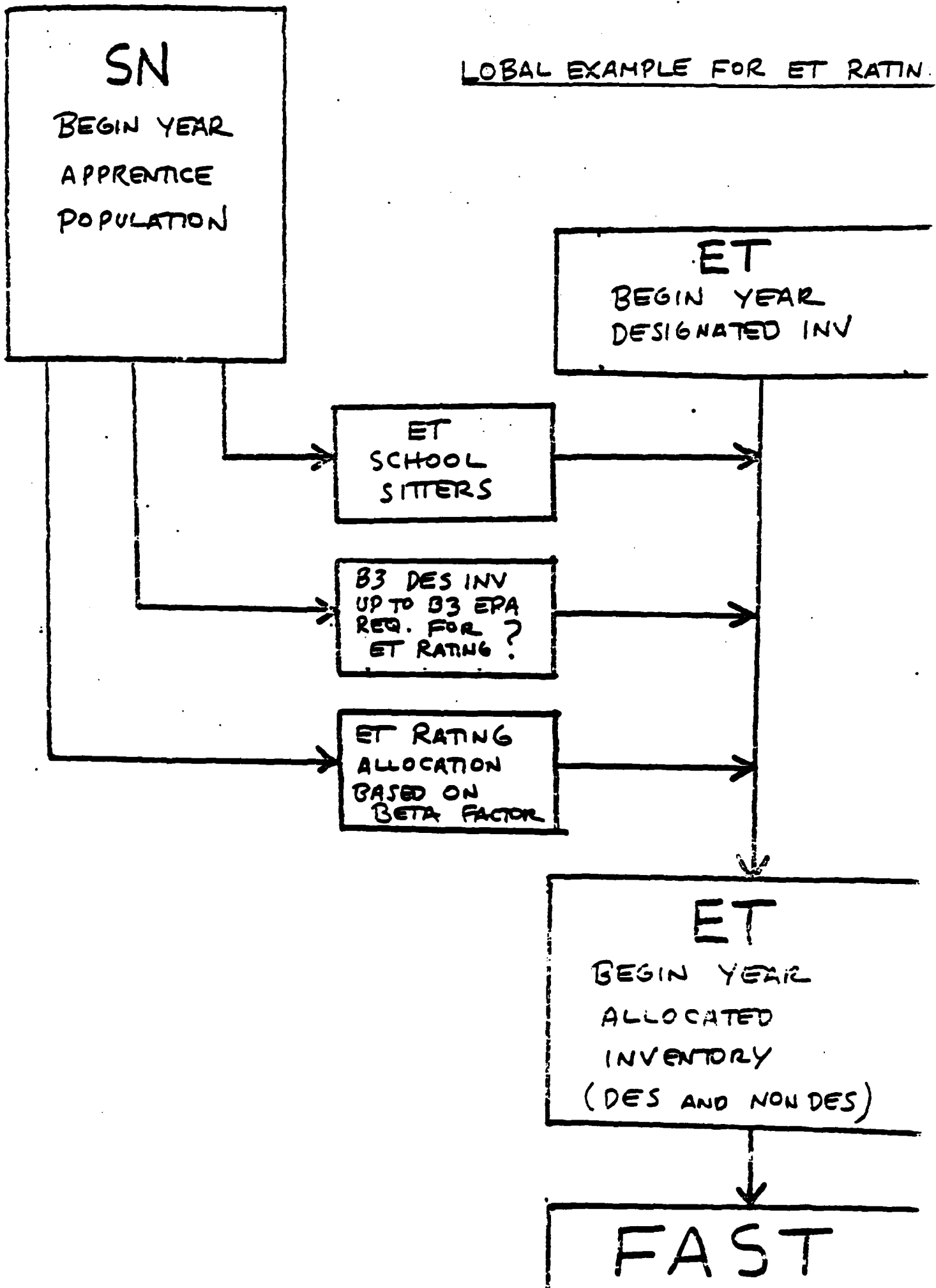
SUM OF E4 TEST TAKERS IN THE RATING
GROUP OF WHICH RATE CODE "R" IS A
MEMBER WHO CURRENTLY HAVE APPRENTICE
RATE CODE

PROCESS: DESIG INVENTORY + (B3 EPA - (BEGIN YR B3 DES POPULATION
+ SCHOOL SITTERS)) + SCHOOL SITTERS + (BETA FACTOR *
REMAINDER OF APPRENTICE GROUP).

THIS IS DONE FOR EACH APPRENTICE GROUP - SN, FN, CN, AN.

OUTPUT: AN ALLOCATED INVENTORY ADDING TO ALL NAVY FOR USE AS THE
FAST BEGIN INVENTORY IN YEAR ONE.

GLOBAL EXAMPLE FOR ET RATING



ONA PROFESSIONAL PAPERS - 1978 TO PRESENT*

- PP 211
Mizrahi, Maurice M., "On Approximating the Circular Coverage Function," 14 pp., Feb 1978, AD A034 429
- PP 212
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