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COST AND RETENTION IMPACTS OF THE NAVY'S CONUS RECREATION PROGR--ETC(U)
SEP 75 A P LALCHANDANI, T H HUMPHREYS N00014-75-C-0628
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control analysis corporation

headquarters - 800 welch road - palo alto, california - 94304
telephone (415) 326-2100
washington office - 8809 maxwell drive - potomac, maryland - 20854
telephone (301) 299-8488

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COSTS AND RETENTION IMPACTS OF THE NAVY'S CONUS RECREATION PROGRAM

September 30, 1975

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PRINCIPAL INVESTIGATORS:

Atam Lalchandani, Ph. D., Project Director
Richard C. Morey, Ph. D.

INVESTIGATORS:

Anthony B. deAndrade
Thomas H. Humphreys
David P. Snyder

CONTROL ANALYSIS CORPORATION
800 Welch Road
Palo Alto, California 94304
(415) 326-2100

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1.0 INTRODUCTION AND SUMMARY

1.1 Scope

The opportunity to use the Navy's Recreation Program represents a significant fringe benefit to Navy personnel, both on active duty and in retirement. The total expense incurred in operating these programs during 1974 was approximately $100 million. To justify this expenditure,[1] it has been argued that curtailment of this benefit would adversely impact on the morale and retention of the personnel affected. It is only recently that a rigorous approach for quantitatively assessing this impact has been shown to be feasible. A study[2] conducted at three Naval installations in Northern California measured the impact not only in terms of the lower operating costs associated with closure or a cutting back of certain types of recreation categories but also with the increased recruiting and training costs to be borne due to the resultant adverse effect on retention levels.

The approach found feasible in the above pilot study was implemented at sixteen diverse bases in CONUS to accurately ascertain the benefits and costs of the so-called Special Services activities (previously known as morale, welfare and recreation activities). This report presents the results of this national study in terms of not only the cost-effectiveness of the various Recreation Categories but also guides regarding the optimal mix of the various Recreation Categories to be provided. These categories include movies, hobby shops, bowling, golf facilities, etc.

A key element of this national study was the design and administration

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[1] A third of these expenses are covered by fees and charges levied on the users.

[2] See "The Net Cost Impacts of the Navy's Recreational Activities: A Pilot Evaluation," Control Analysis Corporation Report, March 1975.

of a comprehensive survey of eligible users[1] of the Recreation Program to determine the mix of users (their rank, marital status, term of service, etc.) as well as their perception of the dollar savings involved. Using the results of the survey (over 11,200 surveys, representing a 7.7% sample for the 16 bases studied), two scenarios have been examined for each type of Recreation Category as well as the Overall Recreation Program. These scenarios, which are analyzed by mission as well as by geographic grouping of bases, are:

1) The additional pay (either through higher compensation or allowances) required if it were desired to maintain the present retention rates while eliminating the recreational benefit currently provided; the key input here is that dollar increase in pay for which the sailor has stated he would be indifferent toward receiving or having the recreational benefit continued. The calculation has also been made using the individual's perceived savings[2] which in general tend to be lower than his indifference.

2) An assessment under the scenarios in which the recreational benefit is removed and no alternative compensation given, of the increased recruiting and training costs required (as a result of the lower retention rates)[3].

---

[1] Only active duty Navy personnel were surveyed; however, they were questioned regarding benefits to their dependents as well as future benefits to them during retirement.

[2] The sailor perceives his savings based on the frequency of use by him and his dependents as well as the existence and costs of alternative off-base facilities, as well as other factors (see Appendix A.2.5-1 for a copy of the questionnaire).

[3] Two scenarios are considered here; they differ in the estimation procedure for recruiting and training costs.

For each of the scenarios the mathematical models, utilizing as a key ingredient the established relationships between changes in income and changes in retention, are exercised using the results of the national survey. Key inputs were provided by the Special Services Division of the Navy's Bureau of Personnel as well as past studies by the Center for Naval Analyses, the Navy's Personnel Research and Development Laboratory, and the President's Commission on All-Volunteer Force. The methodology employed necessarily takes into account in an explicit way such accounts as billet costs, training and recruiting costs, tax rates, discount rates, salvage costs, depreciation, and actuarial tables (for use in the retirement benefit). As such, the analysis is geared towards an assessment of the additional manpower costs (MPN) to be incurred if recreational facilities, presently in place, are cut back or eliminated.

While considering expenses, care has been taken to include yearly apportionment of capital[1] expense in addition to the operating expense when establishing net expense of individual recreation categories. A distinction has been made between costs for initial acquisition and the replacement cost.[2] The replacement costs can be utilized to answer the question as to whether or not new recreation facilities are economically warranted.

The survey results reveal considerable variations in benefits perceived by the different demographic subgroups (e.g., enlisted, single, living on base) of the active duty population. Optimization models have been developed to provide guides for allocation of investment[3] dollars among the various Recreation Categories in order to achieve a balanced and equitable distribution of benefits across these demographic subgroups. These models allocate resources not only

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[1] This includes cost of equipment, buildings and land improvements. Costs of land are not included nor available.

[2] During the pilot evaluation, neither of these costs were available.

[3] The budget reduction problem is also analyzed.

with respect to cost-effectiveness of the Recreation Categories but also consider the sensitivity of the potential user to changes in the condition or quality of a particular Recreation Category.

The size and geographical representation of the sample has provided nationally representative results regarding the cost-effectiveness of the Navy's Recreation Program in CONUS. Also, valuable insights have been obtained for the analysis of Recreation Programs by various personnel and base groupings. In addition, the study has had valuable side effects as a public relations tool in that it has served to acquaint some of the personnel surveyed with benefits not previously known to them[1].

1.2 Summary of Findings from National Survey

The national survey consisted of administering in person a detailed questionnaire to 11,229 active duty personnel at sixteen bases.[2] The random sample (based on the last digit of the social security number) for the survey constituted 7.7% of the population at these bases, varying from a low of 4.5% at NS San Diego to a high of 39.8% at NF Lewes. These bases had populations varying from 113 at NF Lewes to over 40,000 at NS San Diego, as shown in Table 1.1. The bases varied in their functional roles (fleet support, air station, etc.) as well as their geographical location. They represent the home base for 145,112 people who constitute over 25% of the worldwide Naval active duty personnel. Table 1.1 also shows that seven of these sixteen bases had no afloat population, whereas the remaining bases had proportions of shipboard personnel varying from 23% at Pensacola to over 93% at San Diego and Mayport. Only 5.25% of the afloat population at all bases was sampled, whereas

[1] The surveys were helpful in this respect in that they provided capsule descriptions for each of the 16 bases as to the types of facilities available at that base, the hours, and fees. A number of the people writing comments indicated they had not been previously aware of the recreational facilities at their base.

[2] Base (or installation) is used to denote the geographical entity within one Recreation Fund.

TABLE 1.1

BASES USED FOR NATIONAL SURVEY

BASE	Functional Role	Geographical Location[1]	Total Population	% Afloat Population	% Population Surveyed
NAS Brunswick	Air Station	N/E	2,653	67.8	11.4
NF Cape Hatteras	Isolated	S/E	158	0.0	31.6
NS Charleston	Fleet Support	S/E	22,344	81.3	10.9
NRS Cutler	Isolated	N/E	121	0.0	37.2
NTC Great Lakes	Training Center	N/E	15,448	0.0	8.7
NF Lewes	Isolated	N/E	113	0.0	39.8
NSA Long Beach	Shipyard	S/W	7,828	78.1	7.1
NS Mayport	Fleet Support	S/E	14,173	93.1	8.9
NAS Memphis	Training Center	S/E	8,889	0.0	10.0
NAS Miramar	Air Station	S/W	9,068	50.9	6.9
NH Oakland	Hospital	S/W	1,482	0.0	8.4
NAS Oceana	Air Station	S/E	7,399	63.8	7.2
NAS Pensacola	Training Center	S/E	6,912	23.5	10.9
NH Portsmouth	Hospital	S/E	2,020	0.0	5.6
NSYD Puget Sound	Shipyard	N/W	6,445	91.0	5.7
NS San Diego	Fleet Support	S/W	40,059	93.1	4.5
		TOTAL:	145,112		7.7

[1] Each base has been classified once among North/South and once among East/West

10.4% of the ashore population was represented. The officers had a slightly higher representation than the enlisted (8.8% vs. 7.6%) in the survey sample.

Of the 11,229 survey responses, 9,551 were utilized[1] for the analyses. Table 1.2, Demographic Characteristics of Survey Sample, is displayed to allow the reader to gain some insight as to the character of this sample; also, since the sample was randomized, it may have some basic intrinsic interest as estimates for national statistics. Of the 9,551 active duty personnel, 5,160 were in their first term and a little under 89% were enlisted personnel. This is important since the relationship between changes in income and changes in retention rates is known to be most marked for first-term enlisted personnel and hence is the area to be most impacted by removal of benefits. Table 1.2 shows that about 44% of the people are single and a little over a third of the personnel live on base. Also, it is interesting to note that in this anonymous survey, over 12% of the first-termers stated that they would make the Navy their career, whereas about 30% were uncertain (compare this with the 23% reenlistment rate).

Before getting into the results of the survey, Figure 1.1 is presented summarizing the income and expenses at the sixteen bases. As seen in the Figure, 35% of the income comes from operating fees and charges, 7% from the Central Fund, 30% from the Navy Exchange and the rest, over 28%, is Appropriated Funds. Considering the large and diverse sample of bases, these numbers should be representative nationally. Looking at the operating expense part of Figure 1.1, one sees that about 19% of the expense is attributable to Special Services Headquarters. On a per person basis, the Recreation Program has a total operating expense of $134.33/year per active duty person, of which $37.79 comes

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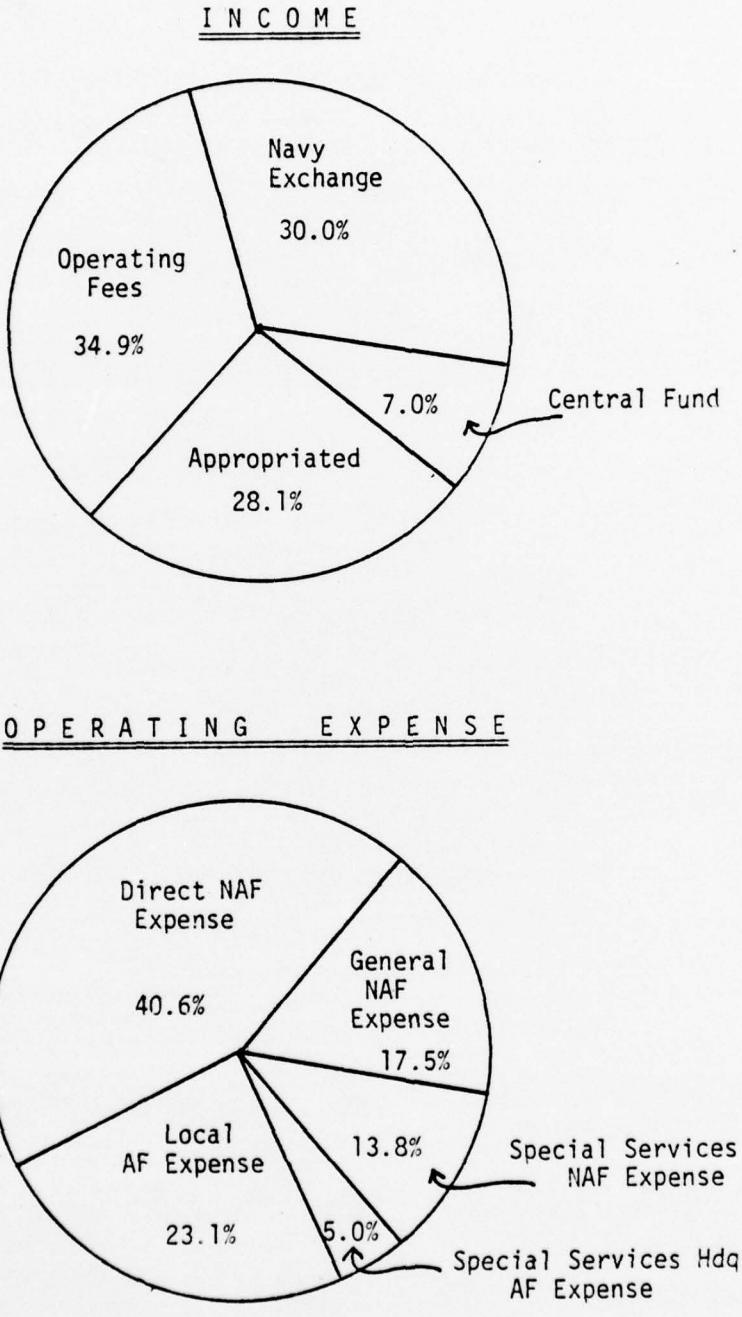
[1] The remaining 1,678 did not meet the requirements devised in the edit checks. See Section 4.0 for an account of these edits and the resultant quality of data.

TABLE 1.2

DEMOGRAPHIC CHARACTERISTICS OF SURVEY SAMPLE -- TOTALS FROM ALL BASES

		MARITAL STATUS				PROXIMITY TO BASE				RETIREMENT PLANS				
		SINGLE	MARRIED NO DEP.	MARRIED W/DEP.	NO RESPONSE	ON BASE	CLOSE TO BASE	FAR FROM BASE	NO RESPONSE	YES	NO	UNCERTAIN	NO RESPONSE	TOTAL
TERM OF MILITARY SERVICE	FIRST	3447	546	748	19	2520	570	1645	25	638	2946	1576	0	5160
	CAREER	706	635	3027	23	848	567	2539	37	3272	414	705	0	4391
	NO RESPONSE	0	0	0	0	0	0	0	0	0	0	0	0	0
PAY GRADE	ENLISTED	3894	1339	3220	41	3165	1743	3530	56	3266	3165	2063	0	8494
	WARRANT	8	3	56	0	19	9	38	1	66	0	1	0	67
	COMM. OFF.	251	239	499	1	184	185	616	5	578	195	217	0	990
	NO RESPONSE	0	0	0	0	0	0	0	0	0	0	0	0	0
DUTY STATION	SHIP	2287	810	1824	22	1620	941	2342	40	1662	2234	1047	0	4943
	SHORE	1866	771	1951	20	1748	996	1842	22	2248	1126	1234	0	4608
	NO RESPONSE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL:		4153	1581	3775	42	3368	1937	4184	62	3910	3360	2281	0	9551

FIGURE 1.1 - INCOME SOURCES AND OUTGOING EXPENSES



from Appropriated Funds, and $46.91 from fees and charges. These give rise (see Table 1.3) to a net annual operating expense of $87.42/person. As mentioned earlier, capital costs have been included in establishing expense for the Recreation Program. The yearly apportionment of capital cost/person is $12.69 if one considers the initial acquisition cost, and $55.05 if one uses the replacement cost. Consequently, the net expense/person under the two capital cost cases are $100.10 and $142.47 (see Table 1.3).

Figure 1.2 provides a graphical representation of the expense variations among the 14 different Recreation Categories that comprise the Recreation Program. There are three levels of expense shown in the figure, the lowest being where one considers only Net Operating Expense and the highest is where one looks at Net Operating Expense plus the yearly apportionment of the Replacement cost. The numbers in the Figure reflect the expenses at the 16 bases surveyed. It should be noted that even though Other Recreation Services has the highest Net Operating Expense, consideration of Replacement capital costs bring Informal Sports and Swimming Pools to the top.

Tables 1.3 through 1.6 present some of the results of the survey, as well as those of the econometric models utilized to analyze the data. Table 1.3 shows, besides the expense items, that the total savings from the Overall Recreation Program perceived by the active duty population at the sixteen bases is over $52 million, which is about one dollar a day per active duty person.[1] If the Recreation Program is eliminated, the same person wants $458.40 annually as an increase in pay for lost benefits.[2]

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[1] Compare this with $0.10/day/activy duty person which is the level of Appropriated Funds utilized for the Recreation Program.

[2] The difference between savings and increase in pay can be attributed to the intangible benefits from the Recreation Program, e.g., participating in sports may not have any savings associated with it but it definitely is a benefit.

TABLE 1.3

NET EXPENSE AND BENEFITS PER PERSON

TOTAL (in 000,s)		PER PERSON
	ANNUAL EXPENSE	
$12,686	Net Operating Expense (OPER)	$ 87.40
$14,526	Net Operating Expense + Apportioned Initial Acquisition (INA)	$100.10
$20,675	Net Operating Expense + Apportioned Replacement (REP)	$142.50
	ANNUAL BENEFIT (to individual)	
$52,675	Savings	$363.00
$66,476	Increase in Pay	$458.40

TOTAL ACTIVE DUTY POPULATION AT 16 BASES = 145,112

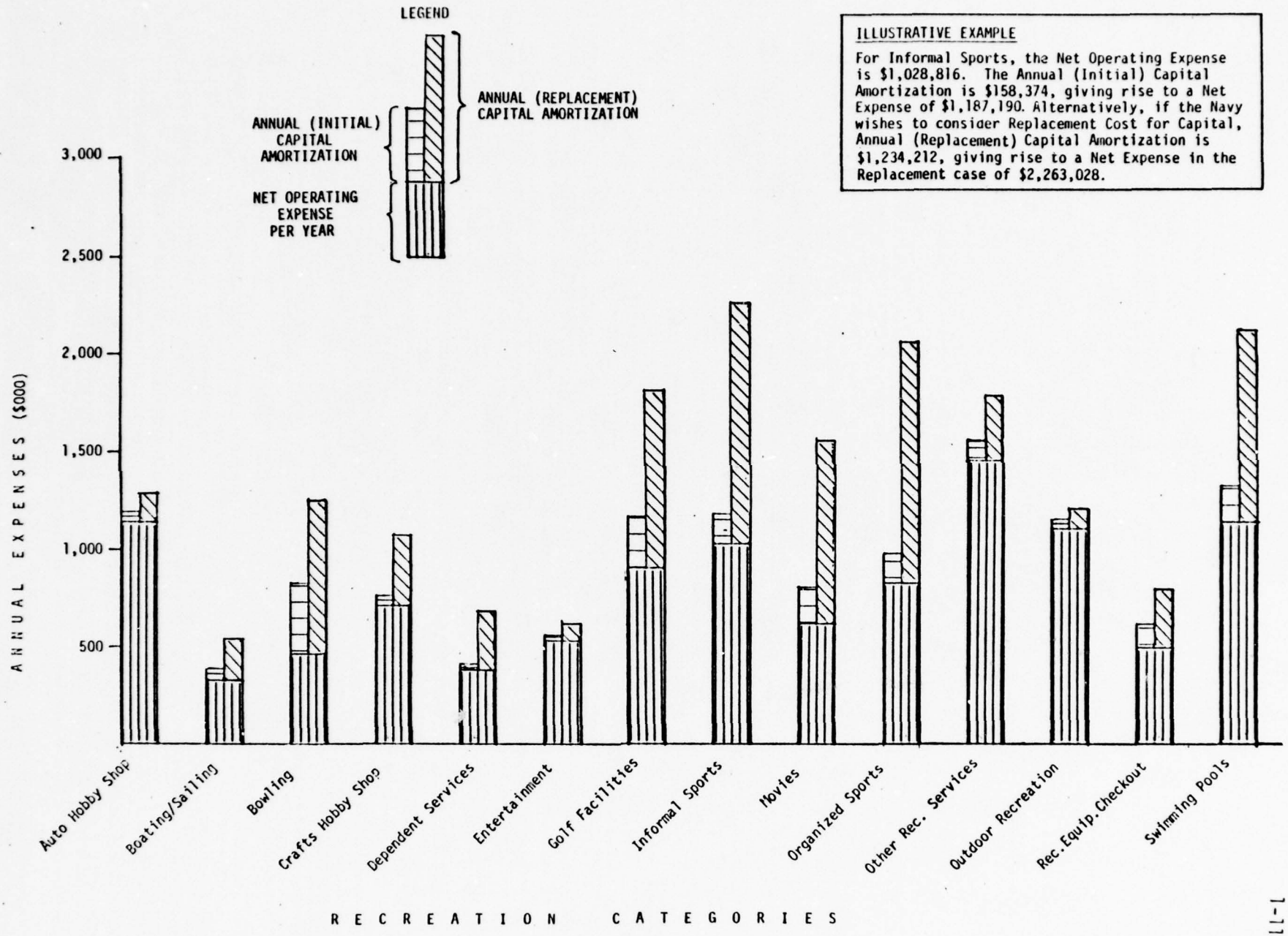


FIGURE 1.2 - SUMMARY OF VARIOUS ANNUAL EXPENSES - FY74 - ALL 16 BASES

Moving to Table 1.4, three rankings are provided over all sixteen bases of the fourteen Recreation Categories studied. Section 2 provides the detailed taxonomy utilized, description of the Recreation Categories at each of the bases, as well as the questionnaires employed. Note that the questions solicit information as to the perceived dollar savings as well as the size of the monthly pay increase required so that the individual would be indifferent toward having the benefit or the pay increase. Of interest in this Table is the fact that Golf Facilities are lowest on all three sets of rankings. Table 1.4 shows that Bowling is the most used Recreation Category; Auto Hobby Shop provides the most savings/person and also has the highest increase in pay/month required for indifference. The rankings based on Savings/Person and Increase in Pay/Person are very similar. Results of the analysis also show[1] that almost 35% of the people are extremely low users of the recreation facilities, whereas 13% are high users. In terms of savings, 40% of the people perceive low savings whereas 7% perceive high savings.

Another Table of interest, in terms of the increased compensation or allowances that would be necessary if it were desired to maintain the present retention rates and eliminate the recreational benefits, is presented in Table 1.5. This Table studies the 14 Recreation Categories on the basis of the ratio of cost savings to net expense at all of the bases. Two types of ratios are computed: the first based on the actual dollar savings perceived by the user, and the second based on his stated increase in pay so that he would be indifferent toward receiving the pay increase or having the recreational benefit continued. These numbers are based upon unmanipulated dollar savings (i.e., do not depend upon sophisticated mathematical models utilizing

[1] See Section 10.0 for discussion of results from cluster analysis of the data.

TABLE 1.4 - RECREATION CATEGORY RANKINGS: USAGE, SAVINGS, AND INCREASE IN PAY

	USAGE		SAVINGS		INCREASE IN PAY	
Rank	Category	%	Category	Annual $/person	Category	Annual $/person
1	Bowling	65	Auto Hobby Shop	$67.50	Auto Hobby Shop	$87.20
2	Movies	61	Rec Equipment Checkout	61.30	Rec. Equip. Checkout	78.90
3	Other Recreation Services	61	Bowling	60.70	Bowling	75.10
4	Outdoor Recreation	60	Other Recreation Services	58.80	Other Recreation Services	74.70
5	Informal Sports	57	Movies	55.90	Movies	72.70
6	Rec Equipment Checkout	55	Outdoor Recreation	53.10	Outdoor Recreation	69.60
7	Auto Hobby Shop	49	Informal Sports	50.10	Entertainment	66.80
8	Entertainment	48	Entertainment	47.00	Informal Sports	63.70
9	Swimming Pools	43	Boating/Sailing	34.00	Dependent Services	55.00
10	Organized Sports	41	Dependent Services	33.20	Boating/Sailing	50.70
11	Dependent Services	34	Crafts Hobby Shop	32.80	Swimming Pools	49.60
12	Crafts Hobby Shop	33	Swimming Pools	32.30	Craft Hobby Shop	48.70
13	Boating/Sailing	27	Organized Sports	31.90	Organized Sports	46.80
14	Golf Facilities	25	Golf Facilities	28.80	Golf Facilities	44.80

TABLE 1.5

COST EFFECTIVENESS OF INDIVIDUAL CATEGORIES (TOTAL OF ALL BASES) IF ALTERNATIVE COMPENSATION GIVEN TO MAINTAIN PRESENT RETENTION RATES

RECREATION CATEGORY	NET EXPENSE[1]	SAVINGS	C-E RATIOS BASED ON SAVINGS[3]	RANK	INCREASE IN PAY FOR INDIFFERENCE (BENEFITS)	C-E RATIO BASED ON DESIRED INCREASE IN PAY[4]	RANK
Auto Hobby Shop	$1,185,466	$9,551,048	8.1	6	$12,338,538	10.4	7
Boating/Sailing	390,845	3,140,580	8.0	7	4,683,159	12.0	6
Bowling	829,315	8,678,825	10.5	4	10,737,722	12.9	5
Crafts Hobby Shop	754,297	4,635,919	6.2	9	6,883,209	9.1	8
Dependent Activities/ Services	401,176	4,697,700	11.7	3	8,206,826	20.4	1
Entertainment	554,272	6,649,983	12.0	2	9,451,465	17.0	3
Golf Facilities	1,160,323	4,133,290	3.6	13	6,429,562	5.5	13
Informal Sports	1,187,190	7,270,111	6.1	10	9,243,634	7.8	10
Movies	808,444	8,111,761	10.0	5	10,549,642	13.0	4
Organized Sports	983,264	4,629,073	4.7	12	6,791,242	6.9	12
Other Recreation Services	1,551,554	8,532,586	5.5	11	10,839,866	7.0	11
Outdoor Recreation	1,154,836	7,598,185	6.6	8	9,959,203	8.6	9
Recreation Equipment Checkout	618,355	8,895,366	14.4	1	11,449,336	18.5	2
Swimming Pools	1,334,818	4,674,456	3.5	14	7,178,112	5.4	14
OVERALL RECREATION PROGRAM	$14,526,456[2]	$52,675,656	3.6	---	$66,519,340	4.6	---

[1] Net Expense = Net Operating Expense plus Annual (Initial) Capital Amortization

[2] Includes Miscellaneous Expenses of $1,612,301 Not Attributable to Any Particular Category

[3] C-E ratio is the ratio of Savings to Net Expense

[4] C-E ratio is the ratio of Increase in Pay to Net Expense

All Dollar Figures are Annual.

elasticities, actuarial tables, etc.) and as such have a certain basic appeal. Benefits described here are benefits to the individual rather than the Navy. Note that on this basis the most cost-effective categories are Recreation Equipment Checkout, Dependent Services and Entertainment. The least are Swimming Pools, Golf Facilities and Organized Sports. For the Overall Recreation Program, the cost-effectiveness ratios for the two cases are 3.6 and 4.6.

Finally, consider the scenario of perhaps most interest, i.e., the scenario in which the recreational benefits are removed and no compensating allowance or salary increases are given. Then the key issue is, "What will be the resulting increase in training and recruiting costs (i.e., MPN costs) to insure the same size Career Force?" Table 1.6 presents the results of two basic approaches for assessing the effects of eliminating various of the recreational benefits for Navy Personnel. In both of these approaches, which assume a decrease in total effective compensation, the general methodology is:

a) Estimate the benefits that are currently being perceived by various categories of eligible users (enlisted, officers, retired, etc.);

b) Determine how the loss or reduction in benefits is to be distributed over the eligible population;

c) Estimate the resulting reductions in retention rates;

d) Compare this increase in personnel costs with the reduction in costs for operating the Recreation Program.

The two approaches differ in the manner with which the reduction in retention rates are handled. The first approach, termed the Career Force

TABLE 1.6

COST EFFECTIVENESS OF INDIVIDUAL CATEGORIES (TOTAL OF ALL BASES) IF NO ALTERNATIVE COMPENSATION GIVEN , BUT ADDITIONAL MPN COST INCURRED TO MAINTAIN PRESENT SIZE OF CAREER FORCE

RECREATION CATEGORY	NET EXPENSE[1]	INCREASE IN MPN COST UNDER CAREER FORCE MODEL	C-E RATIO	RANK	INCREASE IN COSTS UNDER REPLACEMENT MODEL	C-E RATIO	RANK
Auto Hobby Shop	$1,185,466	$13,903	11.7	6	$6,959	5.9	7
Boating/Sailing	390,845	4,571	11.7	7	2,515	6.4	6
Bowling	829,315	11,457	13.8	5	6,042	7.3	4
Crafts Hobby Shop	754,297	7,258	9.6	8	3,972	5.3	8
Dependent Services/ Activities	401,176	8,422	21.0	1	4,781	11.9	1
Entertainment	554,272	10,682	19.3	3	5,264	9.5	3
Golf Facilities	1,160,323	6,481	5.6	14	3,720	3.2	13
Informal Sports	1,187,190	10,154	8.6	10	5,069	4.3	10
Movies	808,444	11,600	14.3	4	5,876	7.3	5
Organized Sports	983,264	7,244	7.4	12	3,838	3.9	12
Other Recreation Services	1,551,554	11,794	7.6	11	6,086	3.9	11
Outdoor Recreation	1,154,836	10,186	8.8	9	5,613	4.9	9
Recreation Equipment Checkout	618,355	12,333	19.9	2	6,448	10.4	2
Swimming Pools	1,334,818	7,626	5.7	13	4,035	3.0	14
OVERALL RECREATION PROGRAM	$14,526,456 [2]	$ 80,782 [3]	5.6	---	$37,250 [3]	2.6	---

[1] Net Expense = Net Operating Expense plus Annual (Initial) Capital Amortization

[2] Includes Miscellaneous Expense of $1,612,301 Not Attributable to Any Particular Category

[3] This Figure Does Not Equal the Sum Over the individual Recreation Categories due to scale variations between individual Recreation Categories and the Overall Recreation Program

All Dollar Figures are Annual

Model, estimates the added number of first-term personnel[1] such that the number of personnel continuing beyond the first term is the same after reduction in retention rates as it was before the reduction. The added costs for the Career Force Model are for recruiting and training the additional number of first-term personnel and for supporting this increased number during the first term. Hence, the goal of the approach is to insure that the same number of career enlisted personnel and career officers will be available after the reduction in recreation benefits.

The second approach (termed the Replacement Model) for handling the reduced retention resulting when lost recreational benefits are not replaced by alternative compensation assumes that any enlisted man, career as well as first-term, who does not reenlist is replaced by a new recruit. The replacement costs, covering recruiting costs and training costs at A and C schools (sufficient to replace the individual's primary NEC rating, but not including B school costs, on-the-job training, etc.) is based on a Naval Personnel Research and Development Laboratory Report, which shows that the average person not reenlisting at the end of the first term must ultimately be replaced by 3.2 persons. This is the method of computation utilized in the second approach for enlisted personnel; however, for officer personnel, the Career Force approach, i.e., increasing the number of first-termers to insure the same number of officers continuing into the Career Force, is retained. This is due to the increased emphasis put upon experience, rather than training, for officers, and the lack of any replacement cost data for officers. Upon inspection of the Table, we see that cost-effectiveness ratios are lower for the Replacement Model than

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[1] First-term officers are defined as those who have not yet completed their minimum service obligation.

for the Career Force Model. Furthermore, in terms of rankings, Table 1.6 shows, just as in Table 1.5, that Recreation Equipment Checkout, Dependent Services and Entertainment are the most cost-effective, whereas Swimming Pools, Golf Facilities and Organized Sports are the least.

Figure 1.3 is a graphic comparison of two cost-effectiveness ratios, one based on Savings (Table 1.5) and the other based on Career Force Model MPN costs (Table 1.6). This figure shows that the C-E ratios based on the two approaches are quite similar in their relative values among the Recreation Categories.

The cost-effectiveness ratios presented above can be instrumental in providing guidelines for investment or budget reduction decisions within the Navy's Recreation Program. An approach for such resource allocations has been developed[1] utilizing optimization models based on relationships between increase (or decrease) in Recreation Category costs and consequent changes in the quality of the facilities. These changes in quality are then related to changes in benefits utilizing the results from the survey. These optimization models allocate investment (or alternatively achieve budget reductions) among the different Recreation Categories in a manner which ensures a balanced and equitable distribution of benefit gains (or losses) across various demographic groups.[2] A key parameter considered within these optimization models is the maximum allowable increase (or decrease) in the costs of an individual Recreation Category. This Investment Constraint Parameter is an attempt to represent socio-political limitations on making drastic changes within a year in any one given Recreation Category. The results of these optimization models apply to decision making at the national level rather than at individual bases; they are summarized in Figures 1.4 and 1.5.

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[1] See Section 11.0 for details.

[2] Nine such groups are considered.

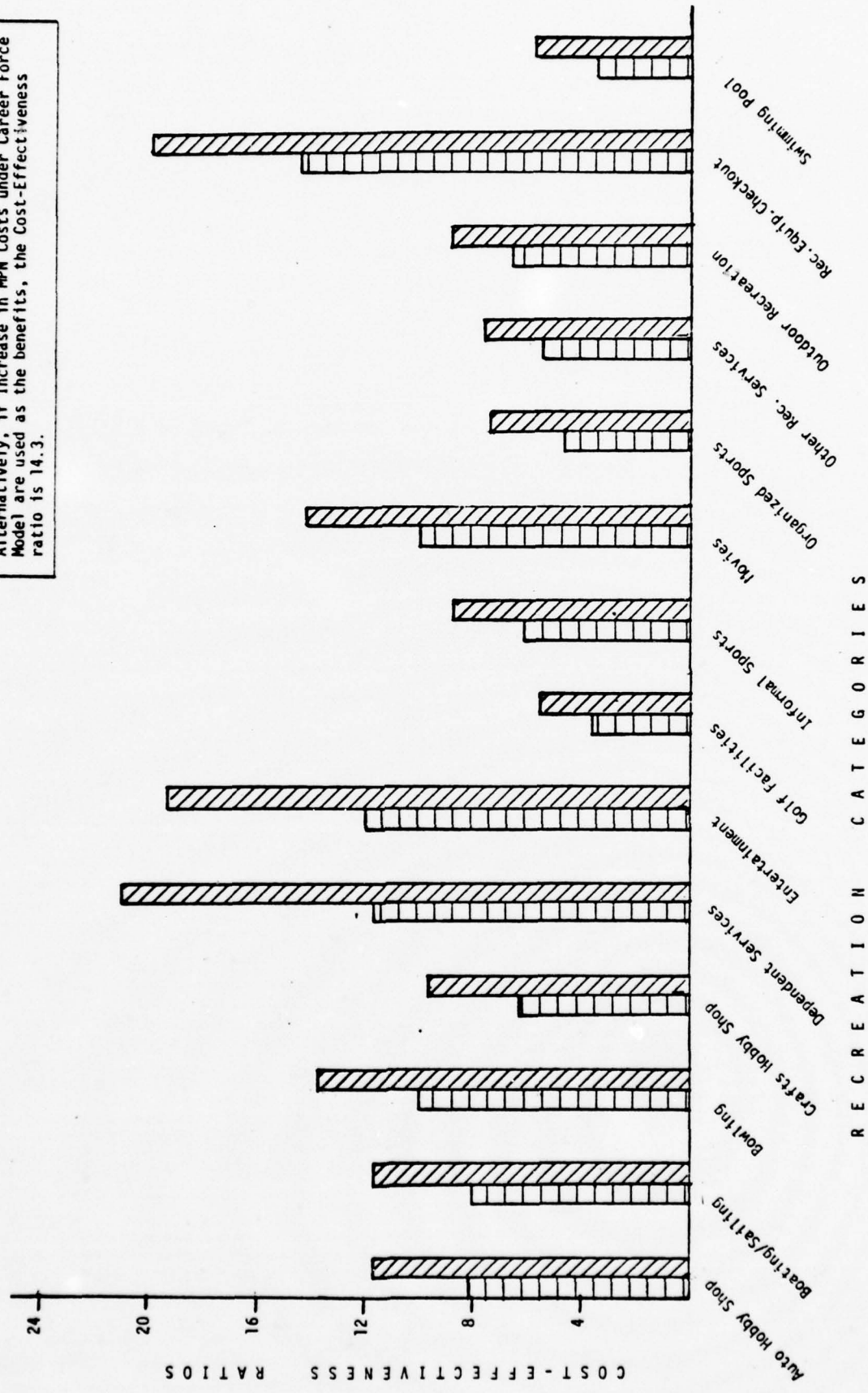


FIGURE 1.3 - COMPARISON OF COST-EFFECTIVENESS RATIOS USING SAVINGS AND CAREER FORCE MODEL MPN COSTS

Reading along the 15% Investment Constraint Parameter value in Figure 1.4, one interprets it as follows - if costs[1] in any given Recreation Category cannot be increased by more than 15% of its current costs, then a given investment should be distributed among Boating/Sailing (8.9%), Movies (20.9%), Bowling (22.1%), Dependent Services (10.4%), Entertainment (14.3%), Outdoor Recreation (7.0%), and Equipment Checkout/Rental (16.4%). If the Investment Constraint Parameter is limited to 12%, Auto Hobby Shop is added to the above list for an optimal allocation of investment. As one would expect, more Recreation Categories are invested in if there are tighter constraints on investment in each Recreation Category. The factor name to the right of Figure 1.4 is an indication of groupings[2] among the 14 Recreation Categories and demonstrates investment patterns by factor groupings rather than by individual Recreation Categories.

Similarly, Figure 1.5 is an indication of the breakdown of any budget reduction, e.g., if cost reductions in any given Recreation Category are limited to 15%, the reduction would come from Auto Hobby Shop (18.8%), Craft Hobby Shop (13.1%), Informal Sports (0.6%), Organized Sports (17.2%), Swimming (23.2%) and Other Recreation Services (27.1%).

Besides the various results summarized above, the data have been analyzed by various groupings of bases, e.g., missions and groupings of personnel, enlisted/officer, etc. The comparisons[3] therein demonstrate a number of intuitive as well as some non-intuitive results. As an example of some obvious results, Afloat personnel save almost 25% less than the Ashore personnel. Similarly, one finds that people on base save $421/year whereas people living further than ten minutes from base save only $328. However, the approximate

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[1] Net expense utilizing Annual (Initial) Capital Amortization is used in this analysis.
[2] See Section 11.0 for details of Factor Analysis results.
[3] See Section 9.0 for the details.

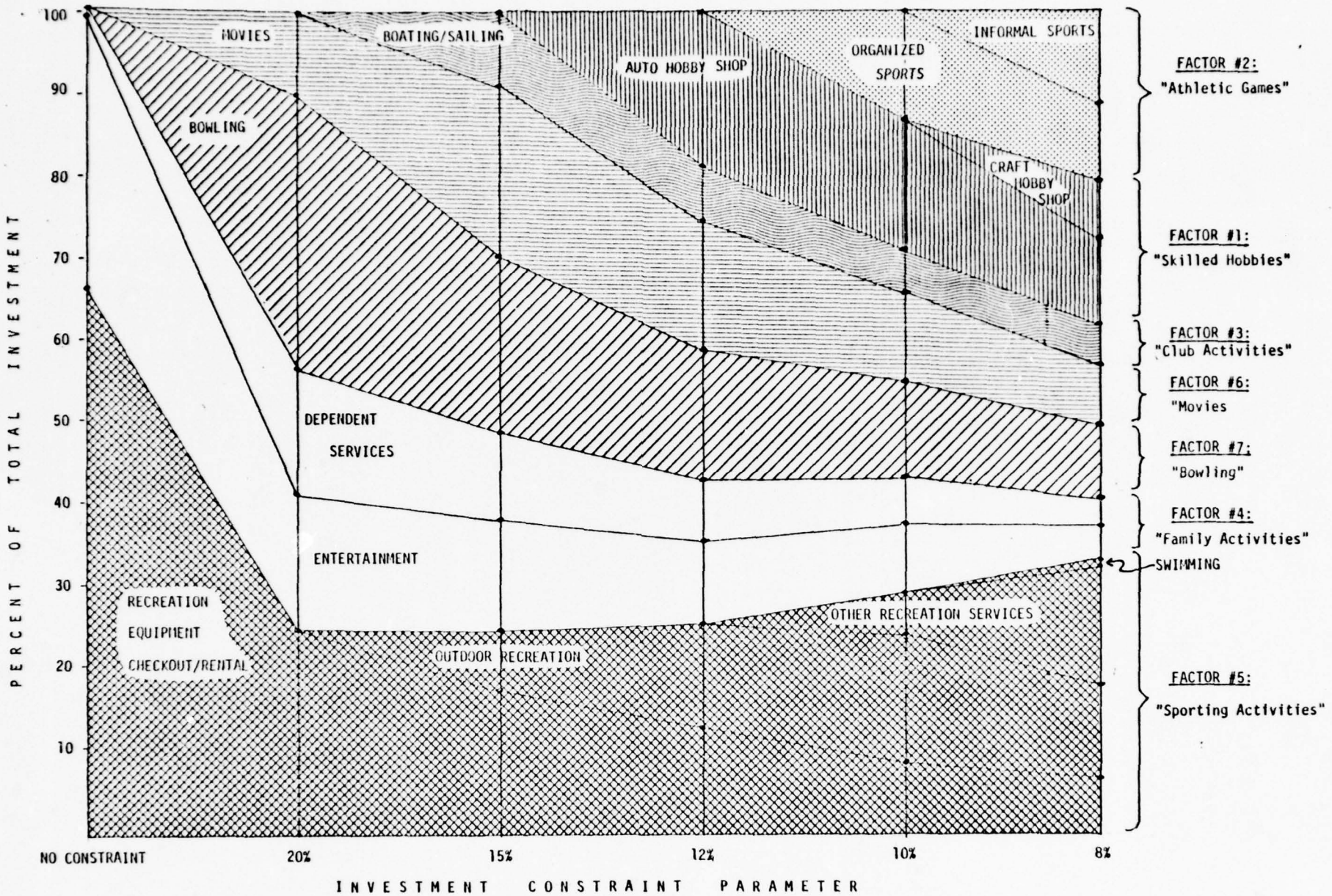


Figure 1.4 - Distribution of Investment Dollars

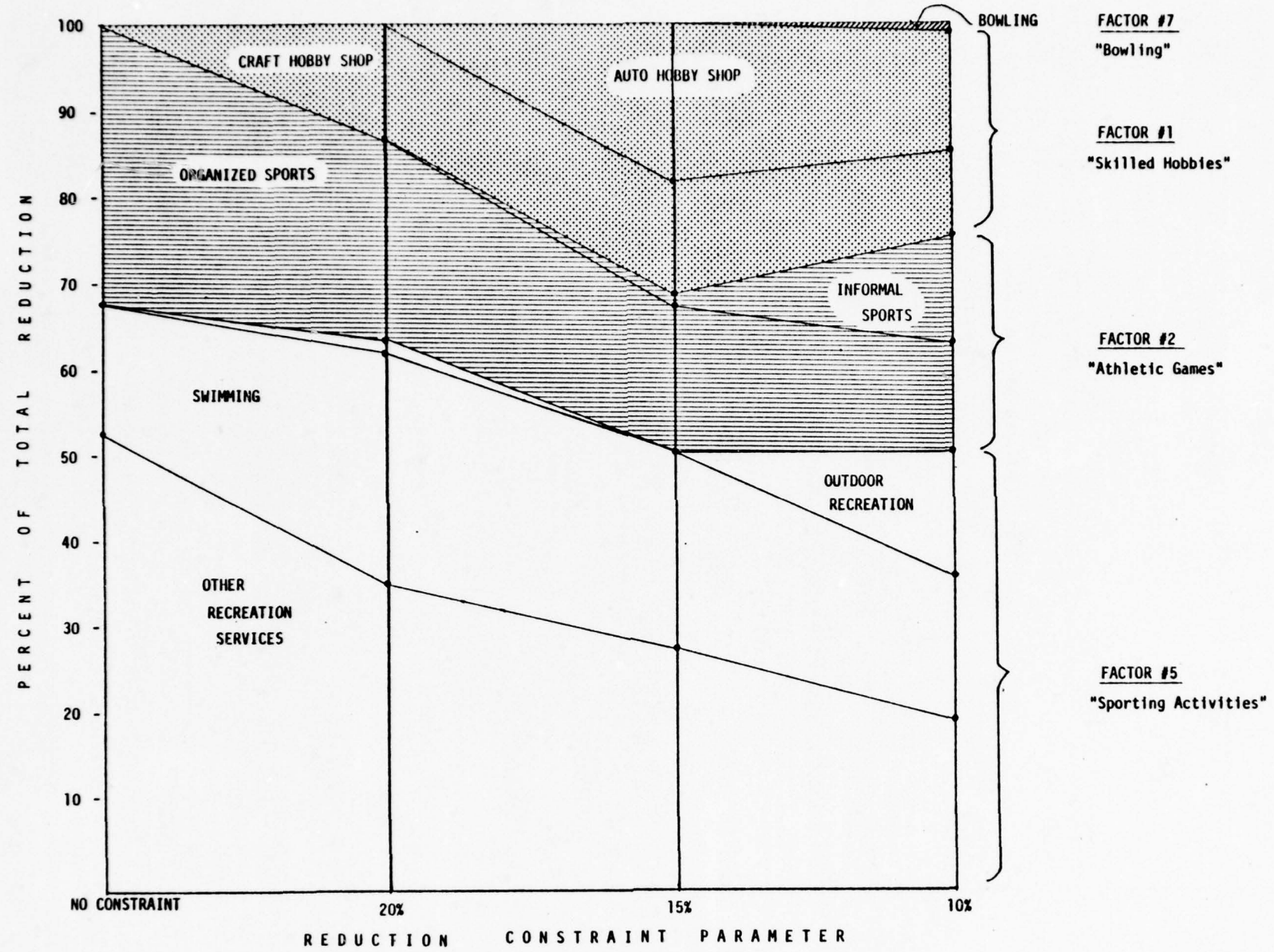


Figure 1.5 - Distribution of Budget Reduction Dollars

equal perception of savings from the Overall Recreation Program by enlisted and officer personnel ($361 to $382) as well as between first-termers and career personnel ($367 vs. $355) is not so intuitive. Looking at groupings by base, one finds that Fleet Support Installations are the most cost-effective whereas the Small Isolated Installations are the least cost-effective. In terms of savings from the Overall Recreation Program, people at Training Centers perceive the highest savings ($490/year) whereas those at the Hospitals[1] save the least ($267/year).

Sensitivity analyses with respect to the three parameters of the retention cost models -- billet costs, elasticities and discount rates -- was done within the Pilot Study mentioned earlier. Therein, these parameters were analyzed individually and also varied together so as to explore maximum or minimum values of cost-effectiveness. Since the same models have been utilized here, the reader is referred to the Pilot Study report (see footnote on p. 1-1) for those analyses.

1.3 Qualification to the Analyses

In assessing the results stated, the reader should be aware of the following:

1) All of the statistics such as reenlistment rates, elasticities, probabilities of retirement, etc., are based on the action of individuals who entered the Navy prior to the beginning of the all-volunteer armed force. These data are likely to change over the next few years, and it is not possible at this time to predict what these changes will be.

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[1] Possibly since the eligible active duty population at a Hospital is so different from other bases.

2) The models have been analyzed under the assumption that all active-duty recreational benefits at the bases are associated with Navy personnel, thus ignoring the fact that some are associated with personnel in other branches of service and some Navy personnel are utilizing other DoD facilities. For this reason, some of the increased manpower costs reported in this study may actually be for other service branches; at the same time, however, any budget reductions for Recreation Program by the other branches of service will result in increased Navy manpower costs.

3) The prorated Headquarters cost has included funds used to support rental of films shown both at shore bases (the ones of interest in this study) as well as on ships. This was necessary due to the difficulties associated with trying to separate out the ship's portion for this analysis. Thus, since the focus of this analysis is the cost-effectiveness of shore based facilities, the results should be viewed as conservative since the relevant Headquarters cost has been overestimated.

4) In order to permit such analyses, it has been necessary to ask the Navy personnel to quantify the perceived dollar value of the recreational benefits, both on active duty and expected future retirement benefits. Since the psychological mechanisms involved are highly complicated (especially with regard to retirement benefits) where one must consider the perceived likelihood of retirement, value of future money compared to current money, the effect of inflation, quantitative measures must be viewed with caution.

5) We have conservatively assumed that the reduction of the recreational benefits would have no effect on the ability of the Navy to recruit personnel; if such an effect does exist, this would result in the MPN's recruiting cost portion being even larger than stated.

6) When recreational benefits are reduced, the Navy must recruit more personnel than at present. However, the additional recruits are likely to be less desirable than existing recruits, e.g., lower aptitudes. Training costs for these additional recruits might be higher, and retention might be lower. No attempt has been made to quantify these effects.

7) The estimate of additional MPN costs are based on average recruiting and training costs, whereas marginal costs (not readily available) might be more appropriate. In this regard it might be noted that it is likely that the marginal recruiting cost would be higher than the average, whereas the marginal training cost (due to the larger numbers) is likely to be lower than the average. Hence, it is difficult to say what the net impact would be if marginal costs were available and utilized.

8) The following remarks apply to the so-called "Replacement Model", one of the two approaches used for assessing the higher MPN cost, (the other approach being termed the "Career Force Model").

   a. Enlisted personnel who do not reenlist are replaced by new first-term recruits. The result is a Navy force containing less senior and experienced personnel, a less effective force. At the same time the costs of maintaining less senior personnel may be less than the costs of maintaining more senior personnel, due to lower pay rates, lower probability of retirement, etc. We have thus not attempted to quantify

either of these considerations.

b. As new recruits replace enlisted personnel who do not reenlist, the result may be more rapid advancement of those personnel remaining; this more rapid advancement could have the effect of increasing the retention rates for those who remain. No attempt has been made to quantify any such effect.

c. In the Replacement costs, it was not possible to include estimates for on-the-job training, Class B school costs, and secondary NEC training costs. Thus, the Replacement costs, and hence the cost-effectiveness ratios, may be viewed as conservative.

9) It should be noted that reenlistment rates will vary depending upon the general economic conditions, especially employment opportunities. No attempt has been made to assess this impact on the analysis.

The remainder of this report is organized as follows. Section 2 discusses the considerations involved for the design of the survey. Section 3 deals with the administration of the survey. Section 4 discusses the quality of the quantitative data obtained, whereas Section 5 summarizes the qualitative (comments) data from the survey questionnaire. Section 6 addresses the question of income and expenses for the Recreation Program. Sections 7 and 8, respectively, describe the retention cost models and estimation of parameters therein. Section 9 outlines the detailed results from the analysis. Section 10 discusses the results of clustering analysis. Finally, Section 11 considers the Resource Allocation issues related to investment and budget reduction.

2.0 SURVEY DESIGN

This section describes the design considerations for the national survey. The rationales used in choosing the bases, developing the Recreation Categories and developing the questionnaires are described in the following subsections.

2.1 Choice of Bases

Sixteen bases were chosen for the purpose of conducting the national survey. These are listed in Table 2.1 along with their characteristics. The following four characteristics are used to classify the bases.

1) Functional Role: There are six groups of Navy installations based on their functional role. These are:

a) Air Station

b) Fleet Support

c) Hospital

d) Isolated Installation

e) Shipyard

f) Training Center

Note should be made of the fact that functional role could be different from the official title, e.g., NAS Pensacola is classified as a Training Center. Based on the above classification, the sample of sixteen bases consists of three Air Stations, three Fleet Support Activities, two Hospitals, three Isolated Installations, two Shipyards and three Training Centers.

2) Size: Navy installations are classified with three sizes based on the total active duty population homeported at the base. These are:

a) Small: (less than 1,000 people)

b) Medium: (1,000 to 5,000 people)

c) Large: (greater than 5,000 people)

In the sample of sixteen bases, there are nine large, four medium and three small installations.

TABLE 2.1 - BASES USED FOR NATIONAL SURVEY

BASE	Functional Role	Geographical Location	Total Population	% Afloat Population	% Population Surveyed
NAS Brunswick	Air Station	N/E	2,653	67.8	11.4
NF Cape Hatteras	Isolated	S/E	158	0.0	31.6
NS Charleston	Fleet Support	S/E	22,344	81.3	10.9
NRS Cutler	Isolated	N/E	121	0.0	37.2
NTC Great Lakes	Training Center	N/E	15,448	0.0	8.7
NF Lewes	Isolated	N/E	113	0.0	39.8
NSA Long Beach	Shipyard	S/W	7,828	78.1	7.1
NS Mayport	Fleet Support	S/E	14,173	93.1	8.9
NAS Memphis	Training Center	S/E	8,889	1.0	10.0
NAS Miramar	Air Station	S/W	9,068	50.9	6.9
NH Oakland	Hospital	S/W	1,482	0.0	8.4
NAS Oceana	Air Station	S/E	7,399	63.8	7.2
NAS Pensacola	Training Center	S/E	6,912	23.5	10.9
NH Portsmouth	Hospital	S/E	2,020	0.0	5.6
NSYD Puget Sound	Shipyard	N/W	6,445	91.0	5.7
NS San Diego	Fleet Support	S/W	40,059	93.1	4.5
		TOTAL:	145,112		7.7

3) Percentage of Afloat Population: The percentage of people whose duty station is afloat vary from 0% (at six of the sixteen bases) to over 90% (at NS San Diego, NS Mayport, and NSYD Puget Sound). In calculating this percentage, air squadrons are treated as afloat.[1]

4) Location: Of the 16 bases, 11 are in the East, five in the West, 11 are in the South and five are in the North. This is a random geographic representation of bases across the nation.

Based on the above characteristics, the sample of 16 bases chosen for the national study is representative of all types of Navy installations.

2.2 Eligible Population

Tables 2.2 and 2.3 summarize the total US Navy active duty population by pay-grade and by base at the 16 bases chosen for the survey. These figures were derived by summarizing data for individual UIC's at each of the bases.[2] As will be seen from Table 2.2, there is a total of 145,112 personnel; 9.2% of these are Commissioned Officers; 90.3% are Enlisted personnel and 0.5% are Warrant Officers. Of this total population, 93,036 (64.1%) are stationed afloat and 52,076 (35.9%) have shore duty stations. However, the officers are approximately equally assigned between afloat and ashore, whereas there are about twice as many enlisted afloat as there are ashore at these 16 bases.

Referrring to Table 2.1, Lewes, Delaware is the smallest base with a total population of 113, whereas San Diego, California is the largest base with a total population of 40,059. Six of the 16 bases have no afloat population, whereas San Diego, California has the largest afloat population among the remaining ten. Note should be made that the total population figure

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[1] Personnel aboard ship have reduced access to the recreation facilities on base. For the purpose of this study, the benefits for these people are handled separately. Air squadrons fall into this category.

[2] The list of UIC's homeported at a given base was put together by the Special Services Division (it turns out that this is a non-trivial task). A given base may have several commands deriving benefits from a consolidated Recreation Fund Account. The data and its processing were done by the Naval Personnel Research-Development Center (NPRDC), San Diego.

TABLE 2.2 - PAY-GRADE DISTRIBUTION BY DUTY STATION OF TOTAL POPULATION AT ALL 16 BASES

	Afloat	Ashore	Total
Enlisted			
E-1	3,316	2,954	6,270
E-2	15,652	9,252	24,904
E-3	17,809	9,603	27,412
E-4	20,531	6,657	27,188
E-5	13,400	6,084	19,484
E-6	9,567	6,161	15,728
E-7	4,344	3,021	7,365
E-8	1,028	863	1,891
E-9	350	411	761
Total Enlisted	85,997	45,006	131,003
Warrant Officers			
W-1	45	13	58
W-2	265	123	388
W-3	234	[illegible]	344
W-4	4	5	9
Total Warrant Off.	548	251	799
Commissioned Officers			
O-1	1,184	1,940	3,124
O-2	1,926	1,065	2,991
O-3	1,843	1,598	3,441
O-4	1,001	1,284	2,285
O-5	429	622	1,051
O-6	102	297	399
O-7[1]	6	8	14
O-8		4	4
O-9		1	1
O-10			
Total Comm. Officers	6,491	6,819	13,310
GRAND TOTAL:	93,036	52,076	145,112

[1] Pay grade O-7 is not active in USN, however it was reported by NPRDC.
Source: Individual UIC data listings furnished by NPRDC, San Diego

TABLE 2.3 - POPULATION BREAKDOWN BY BASE

BASE	AFLOAT			ASHORE			Grand Total
	Enlisted	Officers*	Total	Enlisted	Officers*	Total	
1. Brunswick, ME	1,437	362	1,799	754	100	854	2,653
2. Cape Hatteras, NC			0	145	13	158	158
3. Charleston, SC	16,807	1,361	18,168	3,438	738	4,176	22,344
4. Cutler, ME			0	112	9	121	121
5. Great Lakes, IL	33	7	40	14,675	733	15,408	15,448
6. Lewes, DE			0	100	13	113	113
7. Long Beach, CA	5,674	439	6,113	1,377	338	1,715	7,828
8. Mayport, FL	12,385	805	13,190	918	65	983	14,173
9. Memphis, TN	92		92	8,295	502	8,797	8,889
10. Miramar, CA	4,104	515	4,619	3,861	588	4,449	9,068
11. Oakland, CA			0	967	515	1,482	1,482
12. Oceana, VA	4,098	622	4,720	2,313	366	2,679	7,399
13. Pensacola, FL	1,552	74	1,626	3,089	2,197	5,286	6,912
14. Portsmouth, VA			0	1,428	592	2,020	2,020
15. Puget Sound, WA	4,990	393	5,383	903	159	1,062	6,445
16. San Diego, CA	34,825	2,461	37,286	2,631	142	2,773	40,059
TOTAL	85,997	7,039	93,036	45,006	7,070	52,076	145,112

* Including Warrant Officers

at the two hospitals, NH Oakland and NH Portsmouth do not include short-term patients.

2.3 Sampling Design

It was determined that a representative random sample would be obtained by surveying 10% of the total population (145,112) at the sixteen bases.[1] The last digit of an individual's social security number was used for ensuring the randomness of the sample. Selection of actual names was accomplished from the personnel lists (available by UIC) at NRPDC. Table 2.4 describes the actual digits chosen for the purpose of selection. The following three points are important in proper interpretation of this Table.

1) The use of a single last digit of the social security number gave less than 10% sample desired. This was due to the time lag between the 'as of date' of the NPRDC data lists (December 1974) and the planned dates of the survey (March-April 1975) and the impact of leaves, transfers, inaccuracy of data, etc. on those lists. Our selection further specified that personnel whose term of service expired before May 31, 1975 should not be picked for the sample.

2) Due to the unavailability of accurate ship schedules (at least for this study), it was assumed that only half of the afloat population would be in port during our survey. Hence, it was decided to obtain 20% sample lists of all afloat UIC's (including air squadrons) for the purpose of ensuring the 10% across-the-board sample.

The above two reasons explain the choice of two digits for ashore population and four digits for the afloat population shown in Table 2.4.

3) The survey samples at Great Lakes and Memphis were augmented in the following manner:

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[1] At the three small bases, Cape Hatteras, NC, Cutler, ME, and Lewes, DE, it was decided to obtain a larger proportion of the officers due to the extremely small populations.

TABLE 2.4 - LAST DIGITS OF SOCIAL SECURITY NUMBERS USED FOR RANDOM SAMPLING

BASE	AFLOAT		ASHORE		% Sample Requested	
	Enlisted	Officer	Enlisted	Officer	Afloat	Ashore
Brunswick, ME	5,6,7,8	5,6,7,8	5,7	5,7	31.4	13.8
Cape Hatteras, NC			5,6,7,8	All		39.2
Charleston, SC	5,6,7,8	5,6,7,8	5,7	5,7	28.6	13.8
Cutler, ME			5,6,7,8	All		38.0
Great Lakes, IL			5,7[1]	5,7		4.5
Lewes, DE			5,6,7,8	All		42.5
Long Beach, CA	5,6,7,8	5,6,7,8	5,7	5,7	25.0	10.0
Mayport, FL	5,6,7,8	5,6,7,8	5,7	5,7	23.7	14.1
Memphis, TN	5,6,7,8	5,6,7,8	5,7[2]	5,7	0.0	6.2
Miramar, CA	5,6,7,8	5,6,7,8	5,7	5,7	30.6	14.0
Oakland, CA			5,7	5,7		12.6
Oceana, VA	5,6,7,8	5,6,7,8	5,7	5,7	30.5	13.5
Pensacola, FL	5,6,7,8	5,6,7,8	5,7	5,7	19.2	15.2
Portsmouth, VA			5,7	5,7		11.6
Puget Sound, WA	5,6,7,8	5,6,7,8	5,6,7,8	5,6,7,8	--[3]	--[3]
San Diego, CA	5,6,7,8	5,6,7,8	5,7	5,7	25.9	10.1
Overall Sample					26.5[4]	9.6[4]

[1] This was augmented by students at the Recruit School whose last name began with the letters "E" and "J" and students at the Service Schools whose last name began with the letter "M".

[2] This was augmented by students at the Service Schools whose last name began with the letter "M".

[3] Due to a last minute increase in the population availabe for survey, Puget Sound Special Services personnel attempted to make as many people available as possible with the appropriate Social Security Number digit without reference to UIC rosters.

[4] Excludes Puget Sound.

To assure adequate representation of students (new enlistees) at the Recruit School at Great Lakes, all students whose last name began with the letters "E" and "J" were selected. In order to assure adequate representation of students (recent transfers and new enlistees) at the Service Schools at Great Lakes and Memphis all students whose last names began with the letter "M" were selected.

2.4 Recreation Categories

In the Pilot Evaluation of the Navy's Recreational Activities (conducted at three Navy bases), the Overall Recreation Program was subdivided into 13 activities. However, for the national study, conducted in diverse geographical locations, 14 Recreation Categories (RC's) were deemed necessary. These 14 RC's are:[1]

1) Auto Hobby Shop
2) Boating and Sailing
3) Bowling
4) Crafts Hobby Shop
5) Dependent Activities/Services
6) Entertainment
7) Golf Facilities
8) Informal Sports (Spontaneous)
9) Movies
10) Organized Sports
11) Other Recreation Services
12) Outdoor Recreation
13) Recreation Equipment Checkout/Rental
14) Swimming Pools

---

[1] These categories and their descriptions were developed by the Special Services Division.

Figure 2.1 presents the general descriptions developed for each of these RC's. The breakdown was developed with the following considerations in mind:

1) These would provide a common framework for the individual bases to develop descriptions of their Overall Recreation Program (ORP). This makes it easier to compare one base vs. another as to the extent of the ORP.

2) Survey respondents find it easier to answer questions about the individual RC's and then lead up to the ORP.

3) One of the goals of this study is to analyze the Overall Recreation Program as well as its components.

4) Accounting information should be easily obtainable by the Recreation Categories.

5) These categories are easily identifiable by the managers and users of the Recreation Services.

Each of the participating bases provided its own descriptions by appropriate additions and deletions to the descriptions in Figure 2.1. These descriptions as well as an overall summary are presented in Appendices A.2.4-1 - A.2.4-17.

2.5 Questionnaires

The questionnaire utilized for this national survey was quite similar to the one used in the Pilot Evaluation, and is presented in Appendix A.2.5-1. Following is the list of additions and deletions from the Pilot Evaluation Questionnaire:

Additions/Changes

1) Question 1 regarding Base

2) Categorization of Question 6, p. 1, limited to Afloat and Ashore only

3) Categorization of Question 7, p. 1, limited to two categories only, less than three months and more than three months.

4) Question 7(a), p. 17 on Overall Savings

5) Scales on Questions 7(a), (b) and (c) on p. 17 changed to go up to '$80 and over.'

FIGURE 2.1

GENERAL DESCRIPTION OF RECREATION CATEGORIES

1) AUTO HOBBY SHOP - Auto hobby shop facilities provide opportunities to perform general automotive repairs and preventive maintenance; utilize sophisticated equipment to conduct tests; and accomplish major work and repair such as engine analyzing, engine overhaul, auto body work and repair and painting.

2) BOATING/SAILING - Boating and sailing facilities support participation in water-oriented activities. Facilities and programs may include marinas, slip rental, boat repair, launching ramps, boat/motor rentals, water skiing, regattas and instructional classes. All boating (both sail and power) activities are included.

3) BOWLING - Includes both open and league bowling opportunities as well as other levels of competition such as intramural and intercommand. Also may include support services such as: shoe rental, locker storage, pro-shop resale and instruction.

4) CRAFTS HOBBY SHOP - Hobby shop programs may include: woodworking, photography, ceramics, lapidary, leather, boat building, model shops, electronics and resale outlets to support the general requirements of hobby enthusiasts.

5) DEPENDENT SERVICES - Recreation programs and services which are provided specifically to address the special interests and needs of all Navy dependents. Dependent activities may include the following: teen centers, youth summer programs, recreation instruction classes, excursions, scouting, field trips, child-care centers and social functions.

6) ENTERTAINMENT - Entertainment programs include those music/theater-oriented activities in which an individual may participate in either a passive (listening/spectator) or active capacity. The activities may include live entertainment programs, social activities, drama (little theater groups), music rooms/equipment, tape recording/listening and band activities.

7) GOLF FACILITIES - Golf activities available may include miniature, pitch-and-putt or regulation golf courses including associated services such as golf pro-shops, driving ranges, golf instruction, club rental/checkout, club storage, etc.

8) INFORMAL SPORTS - (Spontaneous) - Informal sports concern those recreational activities participated in by individuals within a self-directed environment. Participation is characterized as spontaneous use of facilities such as multi-purpose courts, gymnasiums, tennis courts, football/softball fields, in activity which is not formally organized. Utilization of athletic gear checkout is included.

9) MOVIES - Full length, color entertainment films at minimal expense.

10) ORGANIZED SPORTS - Organized Navy sports programs consist of broad-base participation in intramural, intercommand, area and All-Navy competitions which are formally conducted and supported by sponsoring commands. Spectator participation is also considered active involvement of significant value.

11) OTHER RECREATION SERVICES - To supplement facility and activity-oriented programs, Special Services normally provides general recreation information on community, state, federal and commercial recreation events, facilities and/or programs and often operates a special or discount ticket service (tours, shows, sporting events) for the convenience of patrons. Other services provided by Special Services may include special equipment rentals, television lounges, TV repair, assistance to special interest groups/clubs, and one-time recreation special events which may be associated with community relations.

12) OUTDOOR RECREATION - Programs may include picnic areas, camping, hiking, riding trails, and lake and beach-front activities.

13) RECREATION EQUIPMENT CHECKOUT - Equipment checkout may include: camping equipment, trailers, recreation games, automotive accessories, boats, fishing gear, water/snow skis, bicycles, etc. This equipment is available for checkout/rental with on and off-base recreational facilities and programs.

14) SWIMMING POOLS - The facilities provide the media for instructional, competitive and age-group events, synchronized swimming, water ballet and recreational swimming.

Deletions

1) Question on Number of Years of Active Duty

2) Question comparison of Recreation benefits to other fringe benefits

The above changes were made based on the experience from the Pilot Survey. Also, one of the overriding constraints was to limit information to an 80 column IBM card for ease of control and data processing.

To eliminate any serial effect between the fourteen Recreation Categories, four survey forms (S1, S2, S3 and S4) were utilized for the survey. Each of these contained the fourteen Recreation Categories in a different sequence. These sequences are presented in Table 2.5.

TABLE 2.5 - RECREATION CATEGORY SEQUENCE UTILIZED IN THE FOUR SURVEY FORMS

RECREATION CATEGORY	SURVEY FORM PAGE			
	S1	S2	S3	S4
Auto Hobby Shop	1	6	10	14
Boating/Sailing	2	7	8	13
Bowling	3	5	9	12
Crafts Hobby Shop	4	9	13	4
Dependent Services	5	10	14	1
Entertainment	6	11	11	2
Golf Facilities	7	8	12	3
Informal Sports	8	13	3	7
Movies	9	14	1	6
Organized Sports	10	12	2	5
Other Recreation Services	11	2	6	11
Outdoor Recreation	12	3	7	8
Rec. Equipment Checkout	13	4	4	9
Swimming Pools	14	1	5	10

3.0 SURVEY ADMINISTRATION

3.1 Basic Features

This survey was promulgated in response to CNO Objective No. 9, 1975, which calls for improvements in the quality of morale, welfare and recreation programs. Survey Control Number 5314-20 was established for the effort. This section discusses the effort involved in the administration of the survey, deviations from the original planning, and overall responsiveness to the survey.

3.1.1 Preliminary Effort

Upon determination of the sixteen participating U.S. Naval bases and selection of the fourteen Recreation Categories (as set forth in Section 2.0), the survey team established contact with the bases. On February 6, 1975, a letter was directed to the Commanding Officer of each base requesting their assistance in three major areas:

a) obtaining comprehensive descriptions of the individual recreation services provided at the base;

b) coordinating the scheduling and administration of the survey;

c) providing cost element breakdown of the various recreation categories.

The primary request of this letter was item a) above, obtaining Recreation Services descriptive matter. (Appendix A.3.1-1)

During this same time frame, the Chief of Naval Personnel, Washington, D.C., dispatched a message to each of the sixteen selected bases, outlining the survey and the reasons behind it. The message requested full cooperation and support to the Contractor. (Appendix A.3.1-2)

Each base responded fully to the request for comprehensive descrip-

tions of the individual recreation services available. The individual category description sheets were prepared, based upon the information received. Copies of these sixteen descriptive sheets are presented in Appendix A2.4-1.

A detailed schedule for the performance of the survey was developed by the Contractor based upon the following criteria:

a) The survey must be performed as close to March 31, 1975 as possible.

b) The number of personnel to be surveyed at each base (planned sample).

c) Local base requirements as to the availability of personnel, so as to mimimize the amount of impact upon daily base operations.

The bases were forwarded the schedule information on March 3, 1975 and were asked to confirm dates, times and places of the surveys. They were also informed that name listings of personnel to be surveyed, would be provided, on a UIC basis, to enable detailed scheduling to begin. (Appendix A.3.1-3)

On March 13, 1975, copies of personnel rosters were sent to each base (Appendix A.3.1-4). These rosters were provided the Contractor by NPRDC, San Diego, California. The assistance of the affected Afloat units in the survey was requested by Chief of Naval Personnel message 141700Z March 1975 (Appendix A.3.1-5).

On March 7, 1975 detailed information concerning the preparation and collection of cost information was sent to each base by the Contractor (Appendix A.3.1-6). Total Operating Income and Total Expense information for certain major cost categories was requested for expenses disbursed from Non-Appropriated and Appropriated Funds. The information required was for Fiscal Year 1974 and included, on the basis of the fourteen Recreation Categories:

a) Operating Income

b) Direct Expenses disbursed from Non-Appropriated Funds

c) General Expenses disbursed from Non-Appropriated Funds

d) Expenses disbursed from Appropriated Funds

e) Square Footage of all covered areas, i.e., buildings, sheds, golf shacks, etc.

3.1.2 Survey Performance

On March 25, 1975, the survey effort itself was begun, in accordance with the established schedules as outlined in 'National Recreation Survey Schedule,' Table 3.1.

Each survey session was prefaced with an introductory talk (Appendix A3.1-7) given by the Contractor's representative. A brief background description of the reasons for the survey was given and then the survey document itself was introduced and rapidly reviewed to acquaint the personnel with the document. The same introductory talk was given at all sessions at all bases.

The personnel were asked to complete the survey questionnaire and return it to the Contractor's representative. Respondents took anywhere from ten to 45 minutes to complete the questionnaire. Questionnaires were collected and returned to the Contractor's offices for processing.

3.1.3 Survey Processing

The questionnaires were processed at the Contractor's facility in a manner consistent with computer-oriented effort. Each questionnaire was coded and keypunched into standard computer input format. The results of the data processing and analysis are discussed in Section 4.0 and following.

Each questionnaire was screened for response to the final question which asked for 'comments, ideas, questions or observations.' The resulting analysis of these responses is discussed in Section 5.2.

3.2 Deviations

Departures of consequence from the planned administration of the survey were minimal. They occurred primarily in three areas:

a) Planned Sample - Revision of the planned sample size was necessary as follows:

TABLE 3.1 - NATIONAL RECREATION SURVEY SCHEDULE

Base	Inclusive Survey Dates (1975)
NAS, Brunswick, ME	3/25
NF, Cape Hatteras, Buxton, NC	3/27
NS, Charleston, SC	3/28-4/7
NRS Cutler, East Machias, ME	3/28
NTC, Great Lakes, IL	3/27-4/2
NF, Lewes, DE	3/20
NSA, Long Beach, CA	3/25-3/27
NS, Mayport, FL	4/1 - 4/7
NAS Memphis, Millington, TN	3/21-3/25
NAS Miramar, San Diego, CA	3/31-4/3
NRMC, Oakland, CA	3/20-3/27
NAS Oceana, Virginia Beach, VA	3/31-4/2
NAS, Pensacola, FL	3/25-3/27
NRMC, Portsmouth, VA	3/24
NSYD Puget Sound, Bremerton, WA	3/28, 4/14-4/17
NS, San Diego, CA	3/25-4/9

1) Naval Station, Charleston, NC - the sample size was reduced from 2200 to 1950 because over 250 people were located at the Weapons Center, 30 miles away, and were intentionally excluded. A reduction of 250 resulted.

2) Naval Training Center, Great Lakes, IL - the sample size of 2125 was based upon erroneous total population figures. This sample was reduced to 1450. A reduction of 675 resulted.

3) Naval Shipyard, Puget Sound, Bremerton, WA - the sample size of 55 was increased to 655. During the scheduled trip to the base it was recognized that approximately 90% of the base active duty population was derived from ships in overhaul. Since the original sampling plan excluded these ships, a sample from ships was deemed necessary. Approval of BUPERS was obtained and a second trip was accomplished. An increase of 600 resulted.

4) Naval Station, San Diego, CA - the sample size of 4000 included 350 personnel from the submarine base at Ballast Point. These personnel were withdrawn from the survey; as a result the sample size was reduced to 3650.

The net result of these changes reduced the total planned sample size from 14,395 to 13,720. Table 3.2 , 'Planned Survey Sample - Final' presents the final planned sample totals on a base-by-base basis.

TABLE 3.2 - SURVEY PLANNED SAMPLE -FINAL

Base	Final Planned Sample
NAS, Brunswick, ME	300
NF, Cape Hatteras, Buxton, NC	50
NS, Charleston, SC	1,950
NRS, Cutler, East Machias, ME	50
NTC, Great Lakes, IL	1,450
NF, Lewes, DE	50
NSA, Long Beach, CA	750
NS, Mayport, FL	1,400
NAS, Memphis, Millington, TN	800
NAS, Miramar, San Diego, CA	925
NRMC, Oakland, CA	120
NAS, Oceana, Virginia Beach, VA	700
NAS, Pensacola, FL	750
NRMC, Portsmouth, VA	120
NSYD, Puget Sound, Bremerton, WA	655
NS, San Diego, CA	3,650
TOTAL SAMPLE	13,720

b) Selection of personnel to be surveyed

1) The original sample selection criteria proved to be insufficient at Naval Training Center, Great Lakes, IL in that neither the Recruit Schools nor the Service Schools were represented. This was overcome by establishing the following sampling procedure: (Appendix 3.1-4 (3) and Appendix 3.1-4 (4)).

A) Recruit Schools - choose all students whose last names began with the letters 'E' and 'J'.

B) Service Schools - choose all students whose last names began with the letter 'M'.

2) The original sample selection criteria at Naval Training Center, Memphis, TN also proved to be insufficient in that the Service Schools were not represented. This was overcome in the same manner as at NTC, Great Lakes, i.e. by choosing all students whose last names began with the letter 'M'.

c) Number of people at a survey session - the bases whose population included substantial numbers of people assigned to an operational afloat command (ships and aircraft squadrons) were handled in a slightly different manner than the other bases. Due to the operational status of the afloat personnel, it was decided to increase the number of survey sessions at these bases and reduce the number of attendees at any one session. In some instances, it was found that scheduling survey sessions aboard individual ships, rather than combined groups at a central location, ensured efficient utilization of shipboard personnel time.

3.3 Overall Response

The overall response to the survey is considered to be reasonably successful. The actual sample totalled 11,229 people versus a planned sample of 13,720 (approximately 82%). Table 3.3, 'Survey Population Response' presents a comparison of responses versus the planned sample on a base-by-base basis.

TABLE 3.3 - SURVEY POPULATION RESPONSE

Base	Planned Sample	Actual Sample	Percent
NAS, Brunswick, ME	300	302[1]	100.6
NF, Cape Hatteras, Buxton, NC	50	50	100.0
NS, Charleston, SC	1,950	2,428	124.7
NRS, Cutler, East Machias, ME	50	43	86.0
NTC, Great Lakes, IL	1,450	1,338[2]	92.3
NF, Lewes, DE	50	45	90.0
NSA, Long Beach, CA	750	556	74.1
NS, Mayport, FL	1,400	1,254	89.6
NAS, Memphis, Millington, TN	800	885	110.6
NAS, Miramar, San Diego, CA	925	625	67.6
NRMC, Oakland, CA	120	125[3]	104.2
NAS, Oceana, Virginia Beach, VA	700	531[4]	75.9
NAS, Pensacola, FL	750	751[5]	100.1
NRMC, Portsmouth, VA	120	114[6]	95.0
NSYD, Puget Sound, Bremerton, WA	655	370	56.5
NS, San Diego, CA	3,650	1,809[7]	49.6
TOTAL	13,720	11,229[8]	81.8 %

1 Included 5 questionnaires which were incomplete, therefore practically useless

2 Included 158 recruits plus 25 Marines

3 Included 8 questionnaires which were independently completed

4 Included 74 questionnaires which were independently completed

5 Included 230 questionnaires plus 5 Marines completed at two satellite installations

6 Included 31 quesitonnaires which were independently completed

7 Included 225 questionnaires completed aboard three ships at North Island

8 Includes 3 questionnaires lacking base designation

Most of the Recreation Services Directors and the Base Commanding Officers provided excellent assistance and support in making the survey a success. In many instances, an individual was assigned from the Recreation Services staff to assist on a full-time basis. This was particularly true at the larger installations. Minor problems arose, as was anticipated for a task of this magnitude, which were resolved as they occurred. The single major reason for most of the problems was the short time span between the planning and implementation of the survey.

The collection of cost-data went smoothly with few exceptions. The major exception occurred concerning Appropriated Funds; the total amount allocated to each base and to the various Recreation Categories within that total. The distribution of Appropriated Funds to the appropriate Recreation Categories at each base is nebulous in some cases. In these cases, the Recreation Services Director provided a "best estimate" breakdown. The distribution of Non-Appropriated Funds General Expenses to the appropriate Recreation Categories was also a problem area. These problems seem more prevalent at the smaller bases where one person carries responsibility for most or all of the administrative functions of Recreation Services. It also appears that some of the appropriate information is not disseminated to these people and/or the Base Comptrollers by BUPERS or the USN Comptroller. NAVSOP-2460, 'Centralized Accounting Handbook for Recreation Funds' provides a guideline that the maintenance of a subsidiary ledger for the detailing of Non-appropriated Fund General Expenses is <u>not</u> required. As a result some bases are unable to accurately categorize these expenses.

4.0 DATA QUALITY

The credibility of survey results is obviously dependent upon the quality of the data collected. To a great extent, this depends on the design of the questionnaire. For example, Section 2.5 mentions how four different question sequences were designed to minimize possible serial effects in the data. In this section, further efforts to maintain quality are discussed. Appendix A.4.0-1 discusses the data processing and computer programs utilized in this study.

4.1 Data Editing

"Unsatisfactory" survey responses were generated in several ways. There was the accidental omission or inconsistency from the otherwise conscientious respondent who, through either carelessness or misunderstanding, made an honest mistake in answering the questionnaire. A typical mistake of this type was skipping a page in the survey booklet, thereby leaving two adjacent pages entirely blank. There was also the intentionally misleading or false statement from the dishonest respondent who attempted to thwart or poke fun at the system. These responses ranged from submission of a completely blank questionnaire to submission of one in which all responses were maximal. Finally, there was the possibility of survey processing errors committed during the manual coding or keypunch/verification phases.

The solution to this problem was approached in two stages. First, "unsatisfactory" responses were defined and methods developed for their detection. Missing data or out-of-range responses were obviously unsatisfactory. Dependency edits to uncover logically impossible relationships between two or more responses were devised. Finally, responses which were theoretically possible, but highly improbable, were identified. Having detected an "unsatisfactory" response, the next stage was naturally some form of corrective action -- basically a decision between data rejection or data enhancement. In some cases this decision involved an attempt to determine the cause -- whether

accidental or intentional -- as discussed above; but in all cases it was guided by the dual goals of affecting the data base as little as possible while insuring its integrity.

Table 4.1 presents a summary of survey form rejection by base. As mentioned in Section 3.0, the total survey sample consisted of 11,229 active duty Navy personnel at the 16 bases. Of these, 43 were not coded due to various reasons (e.g., 30 were filled out by Marines). This left 11,186 prior to editing, as shown in Table 4.1. A total of 1,004 (8.98%) rejections during the edit process left 10,182 survey forms, including 631 listed under "special groups" and described earlier in the footnotes to Table 3.3. (It is significant to note that in the Oceana and Portsmouth special groups, where no survey administrator was present, the rejection rate was unacceptably high.) Eliminating the special groups left a final data base consisting of 9,551 questionnaires on which the survey analysis was performed.

4.1.1 Data Rejection

Table 4.2 presents the criteria used for total rejection of a survey questionnaire and the frequencies with which these criteria were satisfied during the editing process. The first three criteria involve data elements which were critical to the stratification scheme on which all statistics were developed. The next four deal with extreme values of the ratios of the overall program savings, increase in pay, and increase in pension responses to their corresponding sums taken over the individual recreation categories. These criteria were developed with the aid of frequency histograms, and are essentially a check on how well the responses are coordinated.

Note that rejection was made only when all three of the ratios were on the extreme fringe of the histogram curves simultaneously. For example,

TABLE 4.1

REJECTION OF SURVEY FORMS BY BASE

	BASE	NUMBER PRIOR TO EDIT	NUMBER OF REJECTS	NUMBER POST EDIT	PERCENTAGE OF REJECTS
1.	NAS Brunswick	297	22	275	7.41%
2.	NAVFAC Cape Hatteras	50	2	48	4.00
3.	NS Charleston	2428	211	2217	8.69
4.	RADSTA Cutler	43	5	38	11.63
5.	NTC Great Lakes	1155	84	1071	7.27
6.	NAVFAC Lewes	45	1	44	2.22
7.	NSA Long Beach	556	44	512	7.91
8.	NS Mayport	1254	149	1105	11.88
9.	NAS Memphis	885	57	828	6.44
10.	NAS Miramar	625	46	579	7.36
11.	NH Oakland	117	5	112	4.27
12.	NAS Oceana	457	31	426	6.78
13.	NAS Pensacola	516	58	458	11.24
14.	NH Portsmouth	83	8	75	9.64
15.	NSYD Puget Sound	370	37	333	10.00
16.	NS San Diego	1584	154	1430	9.72
	SPECIAL GROUPS HANDLED SEPARATELY:				
1.	NTC Great Lakes	158	13	145	8.23
2.	NAS Oceana	74	21	53	28.38*
3.	NAS Pensacola	230	23	207	10.00
4.	NH Portsmouth	31	9	22	29.03*
5.	NS San Diego	225	21	204	9.33
	TOTAL	11,183	1,001	10,182	
	REJECTS FOR UNDETERMINED BASE	3	3		
		11,186	1,004	10,182	8.98%

* CAC Survey Administrator was not present.

TABLE 4.2

CRITERIA FOR REJECTION OF SURVEY FORMS AND FREQUENCIES EXPERIENCED

	CRITERIA FOR REJECTION OF FORM	FREQUENCY	PERCENTAGE OF ALL FORMS
1.	Base response (question#1) is blank.	3	*
2.	Pay grade (question #2) is blank or	231	2.07%
	out-of-range.	1	*
3.	Duty station/length of stay (questions #6, #7) is blank or	5	*
	out-of-range	12	*
4.	Overall Recreation Program savings, increase in pay, and increase in pension questions are all $0, while the sums are all greater than $30.	39	.03
5.	Overall Recreation Program savings, increase in pay, and increase in pension questions are all > $30, while the sums are all $0.	4	*
6.	The Overall to Sum ratios for savings, increase in pay, and increase in pension questions are all <.2874 = $\frac{\text{max overall response}}{\text{max sum response}}$.	463	4.14
7.	The Overall to Sum ratios for savings, increase in pay, and increase in pension questions are all > 3.3334 = $\frac{\text{min overall response} \neq 0}{\text{min sum response} \neq 0}$.	14	*
8.	After editing each page of recreation category responses, half or more of the available category pages have been rejected.	232	2.07
	TOTAL REJECTED FORMS:	1004	8.97%

* Percentage is insignificant with respect to 11,186 forms.

criterion #6 in Table 4.2 rejected questionnaires when all three ratios were less than .2874. This cutoff point was determined by dividing the maximum overall response by the maximum sum response. Any ratio less than this number was usually an indication of maximal responses for every recreation category, i.e., over $20 saved in all 14 categories per month, or $294 per month, or $3,528 per year. Some modification in this analysis is necessary when less than 14 categories are available, but in reviewing printouts of the rejected questionnaires, it was generally found that this type of edit did produce the desired result.

The last questionnaire rejection criterion (#8) is based on the number of recreation category-pages which were rejected by the criteria presented in Table 4.3. These "category" edits determined whether incomplete or erroneous data warranted rejection on a category-by-category basis within individual questionnaires. If rejected, a special code placed in the unsatisfactory category precluded the use of that "page" of data in all further processing. If half or more of the available category-pages were rejected, the questionnaire was rejected entirely. However, if less than half of the available category-pages were rejected, the questionnaire was retained and the acceptable category data used in the survey analysis. In this way it was possible to salvage many questionnaires which might otherwise have been rejected. A total of 4,201 category-pages were rejected out of a possible 153,127. Less than 700 or 6.9% of all survey forms had one or more categories rejected. From Table 4.2, 232 of these had half or more of all their available category-pages rejected and were subsequently rejected in toto.

4.1.2 Data Enhancement

Table 4.4 displays criteria which were used in enriching the data

TABLE 4.3

CRITERIA FOR REJECTION OF RECREATION CATEGORY DATA AND FREQUENCIES EXPERIENCED

	CRITERIA FOR REJECTION OF PAGE	FREQUENCY	PERCENTAGE OF ALL CATEGORIES
1.	Every question on the page is blank (i.e., recreation category is available but entire page of questions was skipped).	1245	0.81%
2.	Usage response (question #1) is out-of-range and not blank.	12	*
3.	Quality response (question #2) is out-of-range and not blank.	7	*
4.	Increase in pay response (question #4) is blank.	2937	1.92
	TOTAL CATEGORY-PAGES REJECTED:	4201**	2.74%

* Percentage is insignificant with respect to 153,127 category-pages.

** Less than 700 or 6.9% of all survey forms are affected. From Table 4.2, 232 of these had half or more of the available category pages rejected and were subsequently rejected in toto.

TABLE 4.4

CRITERIA FOR DATA ENHANCEMENT AND FREQUENCIES EXPERIENCED

	CRITERIA	ACTION TAKEN	FREQUENCY
	I. DEMOGRAPHIC RESPONSES		
1.	Term of service (question #3)		
	... is blank.	Assign based on pay grade*.	41
	... is out-of-range.	Assign based on pay grade*.	3
2.	Retirement (question #8)		
	... is blank.	Assign as "UNCERTAIN".	142
	... is out-of-range.	Assign as "UNCERTAIN".	3
	SUBTOTAL		189
	II. OVERALL PROGRAM RESPONSES		
3.	Overall savings (question #7a) is blank.	Assign as sum of savings for available categories.	156
4.	Overall increase in pay (question #7b) is blank.	Assign as sum of pay for available categories.	69
5.	Overall increase in pension (question #7c) is blank.	Assign as sum of pension for available categories.	92
	SUBTOTAL		317
	III. CATEGORY DATA		
6.	Usage response (question #1) is blank.	Assign as "NEVER".	83
7.	Quality response (question #2) is blank.	Assign as "DON'T KNOW".	154
8.	Savings response (question #3) is blank and value of Usage response is "NEVER"	Assign as "$0".	203
9.	Savings response (question #3) is blank and valve of Usage response is <u>not</u> "NEVER".	Assign the value given for Increase in Pay	473
10.	Increase in pension (question #5) is blank.	Assign the value given for Increase in Pay	499
	SUBTOTAL		1,412
	TOTAL OF "ARTIFICIAL" ENTRIES:		1,918
	TOTAL DATA ITEMS AFTER EDITS:		824,742

* Pay grade 01,02, and E1-E4 were considered to consist of first term personnel.

base, together with the frequencies with which these additions were made during the editing process. For example, in criterion #1, if the term of service -- either "first term" or "career" -- was missing, an assignment was made based on the response given to the paygrade question. According to national statistics (see Table 8.4) this assignment could be made with a relatively high degree of confidence. Another obvious assignment was that described by criterion #8 -- whenever 'Savings' was blank and 'Usage" was indicated as "NEVER", 'Savings' was assumed to be $0. It is of interest to note that the total of all "artificial" entries made amounted to .23 of one percent of all data entries.

4.2 Measures of Quality

Table 4.5 presents a list of statistics which might be thought of as indicators of data quality. To a great extent, the previous tables of rejection and enhancement statistics also measure the overall quality of the data base. Table 4.5, however, describes certain situations which did not demand rejection, but which were, nevertheless, very unlikely or counter-intuitive. For example, item #5 describes a situation where usage of a particular recreation category was given as "NEVER", but from which some positive savings per month were declared (less than 2% of all categories fit this situation). Since it was felt that the respondent in this case might have had in mind a particular activity which was not listed on the base recreation category description sheet which accompanied the questionnaire, rejection of this category could not be justified. Another situation of interest, and one which occurred with a higher frequency, is described in item #6: usage was given as "NEVER", and yet the increase in pay demanded for the loss of the opportunity to use this type of recreation was considerable. One of the categories which produced this sitaution most often was Dependent Services. This

TABLE 4.5

QUALITY OF DATA INDICATORS

INDICATOR	FREQUENCY MEASURE	PERCENTAGE OF TOTAL RESPONSES
I. OVERALL RECREATION PROGRAM		
1. Page 17 concerning the overall recreation program was skipped (→ questions 7a,b, and c were assigned as $0 during editing).	139	1.24%
2. Overall savings (question #7a) was originally $0 (i.e. not assigned $0 during editing) and value of sum is strictly positive.	902	8.06
3. Overall increase in pay (question #7b) was originally $0 (i.e. not assigned $0 during editing) and value of sum is strictly positive.	663	5.93
4. Overall increase in pension (question #7c) was originally $0 (i.e. not assigned $0 during editing) and value of sum is strictly postive.	696	6.22
II. CATEGORY DATA		
5. Usage (question #1) is "NEVER" and savings (question #3) is strictly positive.	2866	1.87
6. Usage (question #1) is "NEVER" and increase in pay (question #4) is ≥ $9/mo.	8164	5.33
7. Usage (question #1) is "NEVER" and increase in pension (question #5) is ≥ $9/mo.	9593	6.26
8. Usage (question #1) is "FREQUENTLY" and increase in pay (question #4) is $0.	999	.65
9. Usage (question #1) is "OCCASIONALLY" or "FREQUENTLY" and quality (question #2) is either "UNACCEPTABLE-WON'T USE" or "DON'T KNOW"	1595	1.04
10. Savings (question #3) is greater than increase in pay (question #4) by 3 or more response blocks (approx $7).	2177	1.42

TABLE 4.5 (Continued)

III. DEMOGRAPHIC DATA	Frequency Measure	Percentage of Total Responses
11. Marital/family status (question #4) is blank.	43	.38
12. Residence (question #5) is blank.	65	.58

might be explained by the case of the single or married man with no children who anticipates the possible use of this activity in the future when he finally does establish a family.

5.0 SURVEY RESPONSE

This Section discusses the responses to the survey questionnaire. Section 5.1 presents an analysis of the surveyed population. Section 5.2 summarizes the comments provided by the respondents.

5.1 Surveyed Population

As mentioned in Section 3.3, 11,229 active duty personnel were surveyed at the 16 bases. Table 5.1 presents the distribution by pay-grade of the total population at the bases. Personnel were randomly selected based upon the last digit of their Social Security Number as discussed in Section 2.3. The students at the Recruit School at Naval Training Center, Great Lakes, Illinois were considered eligible if their last name began with the letters "E" and "J". Students in the Service Schools at Naval Training Center, Great Lakes, Illinois and Naval Air Station Memphis, Millington, Tennessee, whose last names began with the letter "M" were considered eligible.

There were 9,551 survey quesitonnaires from the 16 bases which were utilized in the analysis. (See Section 4.1 for discussion of those questionnaires omitted). Table 5.2 presents the breakdown of these personnel by pay grade and duty station. Note that the overall response from Ashore duty stations was 8.98% compared to 5.47% response from Afloat duty stations. Also, comparing personnel in the Afloat column of Table 5.1, the officers were a little better in their turnout (6.48%) than the enlisted (5.39%). It is interesting to note that the percentage response is monotonic, increasing with pay grade (separately within enlisted and officers). It increases from 0.96% for E-1's to 9.93% for E-9's and from 6.31% for O-1's to 10.46% for O-6's (there are breaks at E-8 and O-5 in the two sequences, respectively).

Table 5.3 gives a demographic breakdown of the 9,551 survey respondents. Referring to this Table, one finds that 5,160 (54%) of the sample consisted of first-termers. Of these first-termers, 67% were single and 14% were married with children. On the other hand, only 16% of the career personnel were single and 69% were married with children.

TABLE 5.1 - PAY-GRADE DISTRIBUTION BY DUTY STATION OF TOTAL POPULATION AT ALL 16 BASES

	Afloat	Ashore	Total
Enlisted			
E-1	3,316	2,954	6,270
E-2	15,652	9,252	24,904
E-3	17,809	9,603	27,412
E-4	20,531	6,657	27,188
E-5	13,400	6,084	19,484
E-6	9,567	6,161	15,728
E-7	4,344	3,021	7,365
E-8	1,028	863	1,891
E-9	350	411	761
Total Enlisted	85,997	45,006	131,003
Warrant Officers			
W-1	45	13	58
W-2	265	123	388
W-3	234	110	344
W-4	4	5	9
Total Warrant Off.	548	251	799
Commissioned Officers			
O-1	1,184	1,940	3,124
O-2	1,926	1,065	2,991
O-3	1,843	1,598	3,441
O-4	1,001	1,284	2,285
O-5	429	622	1,051
O-6	102	297	399
O-7[1]	6	8	14
O-8		4	4
O-9		1	1
O-10			
Total Comm. Officers	6,491	6,819	13,310
GRAND TOTAL:	93,036	52,076	145,112

[1] Pay grade O-7 is not active in USN, however it was reported by NPRDC.

Source: Individual UIC data listings furnished by NPRDC, San Diego

TABLE 5.2 - PAY-GRADE DISTRIBUTION BY DUTY STATION OF SURVEYED PERSONNEL

	AFLOAT	ASHORE	TOTAL
Enlisted			
E-1			59 (0.96%)
E-2			814 (3.35%)
E-3			1,707 (6.38%)
E-4			1,950 (7.35%)
E-5			1,620 (8.52%)
E-6			1,398 (9.10%)
E-7			702 (9.76%)
E-8			170 (9.19%)
E-9			74 (9.93%)
Total Enlisted	4,510 (5.39%)	3,984 (8.99%)	8,494 (6.64%)
Warrant Officers			
W-1			
W-2			
W-3			
W-4			
Total Warrant Officers	28	39	67
Commissioned Officers			
O-1			193 (6.31%)
O-2			221 (7.60%)
O-3			260 (7.75%)
O-4			199 (8.91%)
O-5			75 (7.30%)
O-6			41(10.46%)
O-7			0 (0.00%)
O-8			1 (0.25%)
O-9			0 (0.00%)
O-10			0 (0.00%)
Total Commissioned Officers	405 (6.48%)	585 (8.67%)	990 (7.62%)
TOTAL	4,943 (5.47%)	4,608 (8.98%)	9,551 (6.74%)

TABLE 5.3

DEMOGRAPHIC CHARACTERISTICS OF SURVEY SAMPLE -- TOTALS FROM ALL BASES

		MARITAL STATUS				PROXIMITY TO BASE				RETIREMENT PLANS				
		SINGLE	MARRIED NO DEP.	MARRIED W/DEP.	NO RESPONSE	ON BASE	CLOSE TO BASE	FAR FROM BASE	NO RESPONSE	YES	NO	UNCERTAIN	NO RESPONSE	TOTAL
TERM OF MILITARY SERVICE	FIRST	3447	546	748	19	2520	570	1645	25	638	2946	1576	0	5160
	CAREER	706	635	3027	23	848	567	2539	37	3272	414	705	0	4391
	NO RESPONSE	0	0	0	0	0	0	0	0	0	0	0	0	0
PAY GRADE	ENLISTED	3894	1339	3220	41	3165	1743	3530	56	3266	3165	2063	0	8494
	WARRANT	8	3	56	0	19	9	38	1	66	0	1	0	67
	COMM. OFF.	251	239	499	1	184	185	616	5	578	195	217	0	990
	NO RESPONSE	0	0	0	0	0	0	0	0	0	0	0	0	0
CLTY STATION	SHIP	2287	810	1824	22	1620	941	2342	40	1662	2234	1047	0	4943
	SHORE	1866	771	1951	20	1748	696	1842	22	2248	1126	1234	0	4608
	NO RESPONSE	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL:		4153	1581	3775	42	3368	1937	4184	62	3910	3360	2281	0	9551

Table 5.3 also shows that over 57% of the first-termers do not plan to retire from the Navy, whereas over 74% of the career personnel do plan to retire from the Navy. It is interesting to note that 23.8% of this surveyed population was uncertain about their retirement plans.

Tables 5.4 and 5.5 present a comparison of surveyed personnel versus the total population at each base by personnel category by Afloat and Ashore duty stations. The First Term Officer - Ashore population (11) at NAS Brunswick is obviously lower than the actual number of personnel assigned, which is probably due to a delay in record maintenance at NPRDC. The overall totals of Tables 5.4 and 5.5 result in the following:

Total Analyzed - 9,551

Total Population - 145,112

Percent Analyzed - 6.58%

5.2 Analysis of Responses to Open Ended Question

At the conclusion of the questionnaire each respondent was asked for "comments, ideas, questions or observations." During the introductory talk, the respondents were encouraged to express their satisfaction and dissatisfactions with the recreation programs and facilities at their particular base. Some individuals declined to comment but many did so.

The comments were analyzed with respect to content. Various categorizations were developed as the result of reading the individual comments. The Recreation Services Director at each of the bases was sent a summary of the comments and a listing of the various categorizations of comments as they pertained to the base. Copies of actual comments found to be interesting were also sent to each base.

Two major categorizations which have been developed are:

1) Those of a broad, general nature which reflect personnel morale, facilities management, price, general condition, etc., and

TABLE 5.4 - COMPARISON OF SURVEYED PERSONNEL VS. TOTAL POPULATION BY PERSONNEL CATEGORY AT EACH BASE - AFLOAT

BASE	ENLISTED						OFFICERS *					
	Surveyed	Total Pop.	%	Surveyed	Total Pop.	%	Surveyed	Total Pop.	%	Surveyed	Total Pop.	%
Brunswick, ME	18	776	2.32	43	661	6.51	12	156	7.69	16	206	7.77
Cape Hatteras, NC	-	-	-	-	-	-	-	-	-	-	-	-
Charleston, SC	932	10,105	9.22	698	6,702	10.41	79	545	14.50	79	816	9.68
Cutler, ME	-	-	-	1	-	0.00	-	-	-	-	-	-
Great Lakes, IL	6	6	100.00	2	27	7.41	-	3	0.00	-	4	0.00
Lewes, DE	-	-	-	-	-	-	-	-	-	-	-	-
Long Beach, CA	247	4,011	6.16	148	1,663	8.90	13	176	7.39	19	263	7.22
Mayport, FL	619	8,888	6.96	305	3,497	8.72	23	300	7.67	33	505	6.53
Memphis, TN	4	78	5.13	4	14	28.57	-	-	-	-	-	-
Miramar, CA	27	2,502	1.08	43	1,602	2.68	3	145	2.07	7	370	1.89
Oakland, CA	-	-	-	-	-	-	-	-	-	-	-	-
Oceana, VA	28	2,549	1.10	45	1,549	2.91	12	175	6.86	24	447	5.37
Pensacola, FL	2	1,211	0.17	-	341	0.00	1	24	4.17	-	50	0.00
Portsmouth, VA	-	-	-	-	-	-	-	-	-	-	-	-
Puget Sound, WA	141	4,709	2.99	87	281	30.96	7	260	2.69	11	133	8.27
San Diego, CA	708	23,961	2.95	402	10,864	3.70	45	978	4.60	49	1,483	3.30
TOTAL	2,732	58,796	4.65	1,778	27,201	6.54	195	2,762	7.06	238	4,277	5.56
TOTAL ENLISTED/OFFICER				4,510	85,997	5.24				433	7,039	6.15

* Includes Warrant Officers

TABLE 5.5 - COMPARISON OF SURVEYED PERSONNEL VS. TOTAL POPULATION BY PERSONNEL CATEGORY AT EACH BASE - ASHORE

BASE	ENLISTED						OFFICERS*					
	Surveyed	Total Pop.	%	Surveyed	Total Pop.	%	Surveyed	Total Pop.	%	Surveyed	Total Pop.	%
Brunswick, ME	68	317	21.45	79	437	18.08	24	11	218.18	24	89	16.85
Cape Hatteras, NC	19	86	22.09	21	59	35.59	2	8	25.00	6	5	12.00
Charleston, SC	131	1,457	8.99	222	1,981	11.21	19	182	10.44	57	556	10.25
Cutler, ME	10	43	23.26	21	69	30.44	3	3	100.00	3	6	50.00
Great Lakes, IL	650	11,402	5.71	365	3,273	11.15	12	211	5.69	36	522	6.90
Lewes, DE	20	49	40.82	15	51	29.41	6	8	75.00	3	5	6.00
Long Beach, CA	20	776	2.58	46	601	7.65	1	81	1.23	18	257	7.00
Mayport, FL	28	255	10.98	87	663	13.12	2	14	14.29	8	51	15.69
Memphis, TN	372	5,479	6.79	379	2,816	13.46	18	103	17.48	51	399	12.78
Miramar, CA	232	2,063	11.25	217	1,798	11.79	19	170	11.18	36	418	8.61
Oakland, CA	31	695	4.46	22	272	8.09	29	120	24.17	30	395	7.59
Oceana, VA	140	1,215	11.49	136	1,098	12.39	15	123	12.20	26	243	10.70
Pensacola, FL	179	1,874	9.55	137	1,215	11.28	57	1,399	4.07	82	798	10.28
Portsmouth, VA	32	953	3.36	11	475	2.32	17	166	10.24	15	426	3.52
Puget Sound, WA	31	795	3.90	45	108	41.67	1	78	1.28	10	81	12.35
San Diego, CA	45	1,831	2.46	173	800	22.25	--	29	0.00	3	113	2.65
TOTAL	2,008	29,290	6.86	1,976	15,716	12.57	225	2,706	8.31	399	4,364	9.14
TOTAL ENLISTED/OFFICER				3,984	45,006	8.85				624	7,070	8.83

* Includes Warrant Officers

2) Those which relate to a particular facility.

Table 5.6 presents an overall summary of the comments received from the bases surveyed with respect to management, morale, price, condition, etc. Table 5.7 presents the number of comments received in various categories. Table 5.8 presents a total count of the comments by recreational facility. Very few comments of a positive nature were provided by the respondents.

TABLE 5.6 - SUMMARY OF COMMENTS FROM NATIONAL RECREATION SURVEY OF ALL BASES

Morale

The greatest number of comments, in one form or another, concerned the poor morale of the enlisted personnel in regard to their opinion of the Recreational Facilities. That is, they felt that though the existing facilities often were not adequate, removing or cutting back the recreational facilities and other Navy benefits would lower morale even more to the point,in some cases, of leaving the Navy.

Management

Management by civilian rather than military personnel brought many comments -- that the civilian personnel didn't care, were rude and "ran things their own way" -- regarding service and hours that facilities stayed open.

Hours

The hours that facilities are open was a common comment -- personnel simply cannot use them because they are not open long enough. Those living on base without transportation also said weekends were particularly hard because practically no facilities were open.

Price

There were many comments on "why does the Navy have to pay for its facilities -- when it's free in the other services" (particularly Air Force). That prices were too high on rental equipment - sometimes as high as civilian rentals "when outside equipment is in so much better shape."

Not Aware

"The greatest thing this survey did was to make me aware of all these facilities." Many said they simply were unaware of where facilities were and what the hours were -- requesting that information be posted in a convenient location on base.

Transportation

Transportation was an issue at all bases -- personnel couldn't use facilities because they couldn't get to them. At the larger bases (San Diego and Charleston in particular) lack of a good base bus service was more of a problem. Many requested that facilities should be centralized so that "things were not so strung out" and hard to get to.

Dependents

"Competing with dependents" brought many comments -- that dependents should be disciplined better and have separate facilities or special hours at existing facilities so that personnel were not crowded out of their usage.

Condition of Facilities

The general run-down condition and unattractiveness of facilities was commented on to the effect that personnel would not take their wives or dates (particularly to the theater, bowling alley or EM Club) to on-base activities. Commenting that if the condition of facilities were more attractive and managed better (controlling "lewd" behavior) they definitely would use the facilities. Many said that it was worth the extra money to "go civilian" for recreational activities.

Throughout all the bases the Bowling Alley, Auto Shop, Hobby Shop, Theater, Gym, Pool, Handball Courts, Tennis Courts were the most popular facilities commented on and in the most need of repair. The Bowling Alley was the facility that brought the most comments - that it was always full of league bowling and the Auto Hobby Shop was a very good facility to have but was 1) overcrowded, 2) needed more tools and equipment and 3) that the personnel who ran the shops often didn't know much about cars and often wouldn't help in repairing their cars and 4) there seemed to be an existing "clique of people" who "got all the attention and tools."

TABLE 5.7 - TOTAL COUNT OF COMMENTS BY CATEGORY OF ALL BASES

CATEGORY		
MORALE of personnel	Facilities important for morale of personnel--reimbursement or pay raise would NOT offset loss of facilities.	879
NOT AWARE of Recreational Facilities	Post information on facilities -- when and where they are	385
LIVE OFF BASE - Don't Use Facilities	Use private, other Navy or Air Force facilities.	346
NOT ENOUGH TIME to use Recreational Facilities	AFLOAT - cannot use facilities - need ON Board facilities. Job leaves no time for recreational activities In School full-time - cannot use facilities	164 78 70 312
POOR CONDITION of Facilities	Recreational Facilities and Equipment generally unattractive and in poor condition	254
MANAGEMENT of Recreational Facilities	Better management of facilities needed by persons who are willing to help and have positive attitude -- by military personnel.	245
PRICE of Facilities	Prices too high -- should either be cheaper or free.	218
HOURS of Facilities	Recreational facilities not open long enough -- cannot use	208
CROWDED Facilities	Facilities too crowded to use	174
CLUBS & MESSES	Need better bands, expansion, improvement, longer hours, and better management to control rowdy behavior in clubs	108
TRANSPORTATION	Can't get to facilities - need base line - centralize facilities	102
NEW ON BASE	Have not been on base long enough to use facilities.	92
CHECK-OUT Equipment	Not enough check-out and rental equipment and in poor condition.	91
NEED SEPARATE FACILITIES for Personnel with Dependents	Dependents cause overcrowding of facilities -- have more and separate programs for dependents only	85
WOULD LIKE MONEY in Exchange for Facilities	Would like money - increase in salary - in exchange for facilities	76
Too Much MILITARY REGULATION	Don't use facilities -- too many military regulations (dress codes and other restrictions)	74
Would Rather be OFF BASE	Don't use facilities -- would rather be off base in free time	61
CHILD CARE	Child Care Center needs better help, open longer; more and better facilities needed on base for children.	59
PRIORITY BY OFFICERS	Officers should not have priority over Enlisted Men in using recreational facilities	53
WEATHER Conditions Limit Use of Out-Door Facilities	Weather does not permit use of many facilities during year -- More indoor recreational facilities needed.	51
EXCHANGE & COMMISSARIES	Prices too high.	45
HOUSING	More and better housing needed on base	33
PARKING	Base parking needs to be enlarged and improved.	17

TABLE 5.8

TOTAL COUNT OF COMMENTS
BY FACILITIES
OF ALL BASES

BOWLING ALLEY	
Enlarge and repair	172
Need more open (non-league)bowling	129
	301
AUTO SHOP	
Enlarge and have more tools	200
Need people who know cars and are willing to help	52
	252
THEATER	
Have first-run movies	102
Clean and renovate theater	93
	195
POOL	
Too small and in poor condition	103
Indoor pool needed and have open year-round	78
	181
GYM	
Enlarge and improve equipment	182
TENNIS	
Repair existing courts and add more courts	159
HANDBALL COURTS	
Repair existing courts and add more courts	141
CAMPING	
More equipment needed and More camping areas needed	106
HOBBY SHOP	
Needs improvement and expansion	105
GOLF COURSE	
Repair course--in poor condition	56
Too much money spent for few who use course	76

6.0 OPERATING INCOME AND EXPENSES

This Section discusses the summary estimation of the operating income and expenses for Fiscal Year 1974, for 16 bases surveyed. The values are estimated on a total program basis as well as for each of the 14 Recreation Categories encompassed in this study. Subsection 6.1 presents the estimation of Operating Income and Expenses, for the Overall Recreation Program. Subsection 6.2 discusses Capital Expenses. Subsection 6.3 presents the Net Expense discussion. Subsection 6.4 presents the estimation of income and expenses, separately, for each of the Recreation Categories.

6.1 Operating Income and Expense for the Overall Recreation Program

Table 6.1 presents the summary grand total of the Operating Income and Expense data for Fiscal Year 1974 for the 16 bases surveyed. Figure 6.1 depicts both Operating Income and Expense and the major components of each on a percentage basis. Table 6.2 presents Operating Income and Expense information on a dollars per person basis by functional role and geographical location.

All Operating Income and Expense data discussed were provided by the various Recreation Program organizations at each of the bases surveyed. The data is based upon the individual Recreation Fund Summary Operations Statements and Departmental Operations Statements for Fiscal Year 1974. As necessary, data was also generated through the Public Works Office and Controller's organization at the bases through the Recreation Program organization.

6.1.1 Operating Income

Operating Income is that income derived directly from the operation of the various activities which comprise the Recreation Program at each base; such as golf course green fees, bowling line fees, etc. Excluded from this definition are all sums received as a percentage of the profits allocated by Navy Exchange, Commissary, Package Store, or Open and Closed Mess

activities, as well as grants and other Central Fund disbursements.

Referring to Table 6.1 and Figure 6.1, the total operating income of the bases surveyed is $6,807,757 or $46.91 per person per year. This comprised 34.9% of the total income to the Recreation Program. The balance of the income is derived from profits of the Navy Exchange System, Clubs and Messes, Package Stores, all of which are discretionary to the individual Base Commanders, and Central Fund grants. These sources provide 37.0% of the total income. The balance of the income, 28.1%, is provided by Appropriated Funds.

Table 6.2 includes a summary of Operating Income of the surveyed bases, on an annual dollars per person basis, by major functional role, and geographical location. Income varies from a low of $10.90 per person at the Hospitals to $81.78 per person at the Air Stations.

It should be noted that the Operating Income per capita at the Northern bases of $25.45 is substantially lower than the average income for all bases and for the other geographical segregations. This appears to be due somewhat to the seasonality of many of the activities within the Program due to climate in this geographical area.

The functional role of the individual bases and the resulting mix of population also appear to have an impact on income. The Hospitals are located in major urban centers which provide a broad range of alternate facilities. The Recreation Programs at the Hospitals are curtailed; only seven of the 14 Categories are available at one Hospital and eight of the 14 are available at the other. The usage of the facilities at the Hospitals is low in general. Hospital personnel also perceive the lowest Annual Savings per person of all mission-oriented activities ($266.70).

6.1.2 Operating Expense

The Total Operating Expenses of the 16 bases surveyed is $9,493,273 or $134.33 per active duty Navy person assigned. This is com-

TABLE 6.1 - OPERATING INCOME AND BREAKDOWN OF OPERATING EXPENSE - ALL BASES

FISCAL YEAR 1974

OPERATING INCOME			
Income from Operations			$ 6,807,757
OPERATING EXPENSE			
Non-Appropriated Fund Expense			
Direct Expense			
Cost of Sales	$ 1,705,625		
Salaries	4,196,755		
Facility Maintenance	428,596		
Other	1,589,863		
Total NAF Direct Expense		$ 7,920,839	
General Expense			
Salaries	$ 1,241,040		
Other	2,154,812		
Total NAF General Expense		3,395,852	
Total Special Services Headquarters Expense		2,692,263	$14,008,954
Appropriated Fund Expense			
MPN	$2,004,319		
O&MN (including civilian salaries)	2,504,040	$4,508,359	
Total Special Services Headquarters Expense		975,957	5,484,316
TOTAL OPERATING EXPENSE			$19,493,270
NET OPERATING EXPENSE			$12,685,513

FIGURE 6.1 - INCOME SOURCES AND OUTGOING EXPENSES

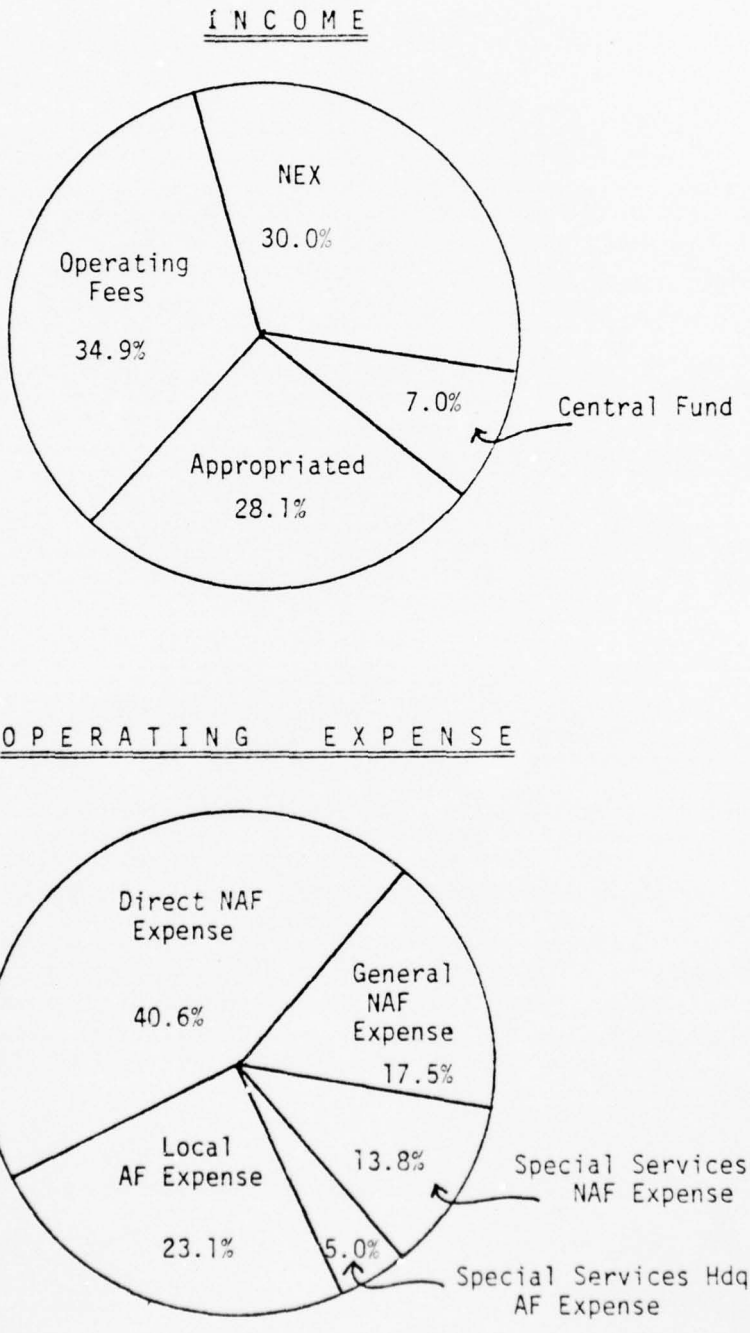


TABLE 6.2 - SELECTED ANNUAL INCOME AND EXPENSES (DOLLARS PER PERSON)

	Population	Operating Income	NAF Expense	AF Expense	Total Operating[1] Expense	Net Operating[1] Expense
All Bases (16)	145112	$46.91	$ 96.54	$37.79	$134.33	$ 87.42
Air Stations (3)	19120	81.78	139.70	44.11	183.81	102.02
Shipyards (2)	14273	78.76	137.53	18.73	156.26	77.50
Training Centers (3)	31249	68.58	143.85	79.55	233.40	154.82
Isolated (3)	392	41.10	220.23	93.50	313.73	272.63
Fleet Support (3)	76576	25.11	58.57	21.69	80.26	55.15
Hospitals (2)	3502	10.90	88.18	54.26	142.44	131.54
Northern Bases (5)	24780	25.45	79.31	70.79	150.10	124.65
Southern Bases (11)	120332	51.33	100.09	31.00	131.09	79.75
Eastern Bases (11)	80230	43.56	96.31	49.80	146.12	102.56
Western Bases (5)	64882	51.06	96.82	22.94	119.76	68.70

[1] Excludes all capital expense

prised of two major categories:

a) Non-Appropriated Fund Expense - $14,008,957 (71.9%), and

b) Appropriated Fund Expense - $5,484,316 (28.1%). (Table 6.1 and Figure 6.1)

Non-Appropriated Fund (NAF) Expense: The major components of this Expense are:

a) Direct Expense - Those expenses directly attributable to a specific Recreation Category at each base,

b) General Expense - Those expenses which are of a general overhead nature to the Overall Recreation Program at the base, and

c) Special Services Headquarters Expense - Those expenses of an overhead nature at Special Services Headquarters, Washington, D.C. The majority of funds to support these expenses are monies generated internally at each base from the Navy Exchange, Clubs and Messes, Package Stores, etc., which are discretionary to the Base Commander and are not appropriated through Congress. Referring to Table 6.1, the total NAF Expense for the surveyed bases is $14,008,957; of which $7,920,839 is Direct Expense. $3,395,852 is General Expense and $2,692,266 is Special Services Headquarters Expense. All Special Services Headquarters Expenses have been apportioned to the individual bases in direct proportion to the active duty Navy personnel assigned to the base.

It is of interest that salaries, totaling $5,437,795, comprise 38.8% of the total NAF Expense and that the Special Services Headquarters Expense is 19.2% of the total NAF Expense.

Referring to Table 6.2, it is noted that the three Isolated Bases have the highest NAF Expense per capita at $220.23 and the three Fleet Support Activities are lowest at $58.57 per person.

Appropriated Fund (AF) Expense: These expenses are comprised of:

a) Local Expenses, those expenses generated at the individual bases in salaries of military and permanent civil service personnel associated with the Recreation Program and O & MN appropriations, and

b) Special Services Headquarters Expense which has been apportioned to the individual bases in direct proportion to the active duty Navy personnel assigned to the base. These funds are received from Congressionally appropriated Command funds at the individual bases as well as appropriated funds for the Special Services Division at Bureau of Personnel, Department of the Navy.

It should be noted that the salaries of Naval personnel in the amount of $2,004,319 comprise 36.5% of the total AF Expense and that the Special Services Headquarters Expenses is 17.8% of the total AF Expense.

Table 6.2 indicates that the three Isolated bases have the highest AF Expense on a per capita basis ($93.50) and the two Shipyards the lowest ($18.73).

6.1.3 Net Operating Expense

Total Operating Expenses for Fiscal Year 1974, the sum of NAF and AF Expenses, are seen to be $19,493,273 (Table 6.1). Net Operating Expenses, the difference between Operating Income and Total Operating Expense, are $12,685,516 or approximately $.24 per person per day.

Referring to Table 6.2, it is noted that the three Isolated Bases have the highest Total Operating Expense per person ($313.73) as well as the highest Net Operating Expense per person ($272.63) among the functional role breakdown. The Fleet Support activities rank lowest in these totals ($80.26 and $55.15, respectively).

6.2 Capital Expense

Capital Expense is defined as the expense associated with equipment and Class I and II real property utilized for the Recreation Program. Since these expenses are associated with fixed assets, a yearly apportionment of these expenses is an appropriate measure to be included in estimating costs of recrea-

tion categories. Two different approaches have been utilized in listing capital expense:

1) The costs incurred at the time of initial acquisition are apportioned to find capital expense, and

2) The costs necessary to replace all equipment and real property are apportioned to estimate capital expense. The second approach, necessarily, gives rise to a higher expense. The derivation of these yearly apportionments from the equipment and Class I and II costs are described in Appendices A.6.2-1 and A.6.2-2. The subsections 6.2.1 and 6.2.2 discuss the equipment and Class I and II costs respectively. Subsection 6.2.3 discusses the yearly apportionments of these costs.

6.2.1 Equipment Expense

The original equipment cost information was obtained from the general ledger Plant Account 161 -- Fixed Assets for each base surveyed. Referring to Table 6.3, the total Equipment Expense for the surveyed bases is $6,999,833, which is the initial acquisition cost of equipment. The replacement value, based upon an annual inflation rate of 8%, assuming an average life of ten years, is $15,701,000.

6.2.2 Class I and Class II Property

Class I and Class II property are the two categories of real property encompassed in this study. Class I property is that property which is Government-owned (or permanently controlled) and permanently assigned to the Navy. Class II property is that property not owned or permanently controlled by the Government or has been assigned to the Navy on a less than permanent basis. The cost of raw land is excluded from all data, as it is unknown. Therefore, the real property values are those appropriate costs associated with land clearing, preparation, landscaping and all improvements thereon.

TABLE 6.3

CAPITAL EXPENSE - FY1974
ALL BASES

EQUIPMENT	$ 6,999,833
CLASS I AND CLASS II PROPERTY	
Initial Acquisition Cost	14,131,700
Replacement Cost	75,589,000
YEARLY APPORTIONMENT OF CAPITAL EXPENSE	
Initial Acquisition Cost Basis	1,840,941
Replacement Cost Basis	7,988,987

Improvements include utilities installation, structures, paving, special equipment installation, etc. The data was compiled from FASCO Report 22AXR01 as of 30 June 1974, dated 10 April 1975. If a variance appeared between this data and information available at an installation, the installation data prevailed.

Referring to Table 6.3, the total Initial Acquisition cost for the surveyed bases is $14,131,700 and the total Replacement Cost value is $75,589,000. The total Replacement Cost of Class I and Class II Property and Equipment is $90,701,000.

6.2.3 Net Capital Expense

Net Capital Expense is the Yearly Apportionment appropriate for Equipment Expense plus Class I and Class II Property Expense. As is presented in Table 6.3, the Net Capital Expense for all bases surveyed based on Initial Acquisition Cost is $1,840,940 and on Replacement Cost is $7,988,997. Table 6.4 presents Net Capital Expense figures for both cost bases by functional role and geographical location, in both total amounts and annual dollars per person. Referring to Table 6.4, the highest cost per person for the Initial Acquisition Cost basis is at the Isolated Bases, $117.72, and the lowest at the Hospitals, $6.13. On a Replacement Cost basis, the highest is at the Isolated Bases, $223.03, and the lowest at the Fleet Support facilities, $25.40.

6.3 Net Expense

Net Expense is the summation of Net Operating Expense (Section 6.1.3) and Net Capital Expense (Section 6.2.3). Since Net Capital Expense is derived on two separate bases, Net Expense is similarly derived. Table 6.5 summarizes the Net Expense for all the bases surveyed, as well as summation by functional role and geographical location. The Table also presents the information on an annual cost per person basis.

Referring to Table 6.5, the highest total Net Expense, based on Initial Acquisition Cost, is found at the Training Centers, $5,255,435, which is 36.2% of the total of all the bases surveyed and the lowest is at the Isolated Bases,

TABLE 6.4

NET CAPITAL EXPENSE -SUMMARY-FY 1974

		NET CAPITAL EXPENSE		ANNUAL DOLLARS/PERSON	
	POPULATION	INITIAL ACQUISITION	REPLACE-MENT	INITIAL ACQUISITION	REPLACE-MENT
All Bases (16)	145,112	$1,840,940	$7,988,987	$ 12.69	$ 55.05
Air Stations (3)	19,120	584,791	1,461,089	30.59	76.42
Fleet Support (3)	76,576	560,169	1,945,015	7.32	25.40
Hospitals (2)	3,502	21,462	234,181	6.13	66.87
Isolated (3)	392	46,148	87,429	117.72	223.03
Shipyards (2)	14,273	211,046	1,551,122	14.79	108.68
Training Centers (3)	31,249	417,325	2,710,151	13.35	86.73
Northern Bases (5)	24,780	289,282	2,197,567	11.67	88.68
Southern Bases (11)	120,332	1,551,658	5,791,420	12.89	48.13
Eastern Bases (11)	80,230	1,235,766	4,859,131	15.40	60.57
Western Bases (5)	64,882	605,175	3,129,856	9.33	48.24

TABLE 6.5

NET EXPENSE-SUMMARY-FY 1974

	POPULATION	NET OPERATING EXPENSE		NET CAPITAL EXPENSE				NET EXPENSE			
				INITIAL ACQUISITION		REPLACEMENT		INITIAL ACQUISITION		REPLACEMENT	
		TOTAL	$/PERSON	TOTAL	$/PERSON	TOTAL	$/PERSON	TOTAL	$/PERSON	TOTAL	$/PERSON
All Bases (16)	145,112	$12,685,513	$ 87.42	$1,840,941	$ 12.69	$7,988,987	$ 55.05	$14,526,454	$100.11	$20,674,500	$142.47
Air Stations (3)	19,120	1,950,689	102.02	584,791	30.59	1,461,089	76.42	2,535,480	132.61	3,411,778	178.44
Fleet Support (3)	76,576	4,223,009	55.15	560,169	7.32	1,945,015	25.40	4,783,178	62.46	6,168,024	80.55
Hospitals (2)	3,502	460,664	131.54	21,462	6.13	234,181	66.87		137.67	694,845	198.41
Isolated (3)	392	106,872	272.63	46,148	117.72	87,429	223.03	153,020	390.35	194,301	495.67
Shipyards (2)	14,273	1,106,172	77.50	211,046	14.79	1,551,122	108.68	1,317,218	92.29	2,657,294	186.18
Training Centers (3)	31,249	4,838,110	154.82	417,325	13.35	2,710,151	86.73	5,255,435	168.18	7,548,261	241.55
Northern Bases (5)	24,780	3,088,938	124.65	289,283	11.67	2,197,567	88.68	3,378,221	136.33	5,286,505	213.34
Southern Bases (11)	120,332	9,596,575	79.75	1,551,658	12.89	5,791,420	48.13	11,148,233	92.65	15,387,995	127.88
Eastern Bases (11)	80,230	8,228,299	102.56	1,235,766	15.40	4,859,131	60.57	9,464,065	117.96	13,087,430	163.12
Western Bases (5)	64,882	4,457,124	68.70	605,175	9.33	3,129,856	48.24	5,062,389	78.02	7,587,070	116.94

$153,019, or 1.1% of the total. The Isolated Bases are the highest in annual per capita expense, $390.35 and the lowest are the Fleet Stations, $62.46.

Utilizing the figures set forth in Table 6.5 the Net Operating Expense of the Overall Recreation Program is $.24 per person per day; the Net Expense on the Initial Acquisition Cost basis is $.27 per person per day; and the Net Expense on the Replacement Cost basis is $.39 per person per day.

6.4 Income and Expense by Recreation Category

Tables 6.6 presents the summary Operating Income and Operating Expense data for the surveyed bases by Recreation Category. Table 6.7 presents various comparisons of Income versus Major Operating Expenses. Appendices A6.4-1 through A6.4-6 present the Operating Income and Expense for the bases on a functional role basis. Appendices A.6.4-7 through A.6.4-10 present the information on a geographical location basis.

The following paragraphs highlight some of the salient figures from these Tables.

6.4.1 Operating Income

Table 6.6 shows that 37.5% of the total Operating Income was derived from the Golf Facilities. Bowling provides 21.2% of the total Income. Each of the remaining Categories individually provided less than 10% of the Income. The lowest producer of income is Organized Sports at 0.1% of the total.

Referring to Appendices A.6.4-1 through A.6.4-6, the major producers are:

Appendix	Functional Role	Category	% Total
A.6.4-1	Air Stations	Golf Facilities	30.3
A.6.4-2	Fleet Support	Golf Facilities	49.6
A.6.4-3	Hospitals	Bowling	33.4
A.6.4-4	Isolated Bases	Bowling	48.3

TABLE 6.6

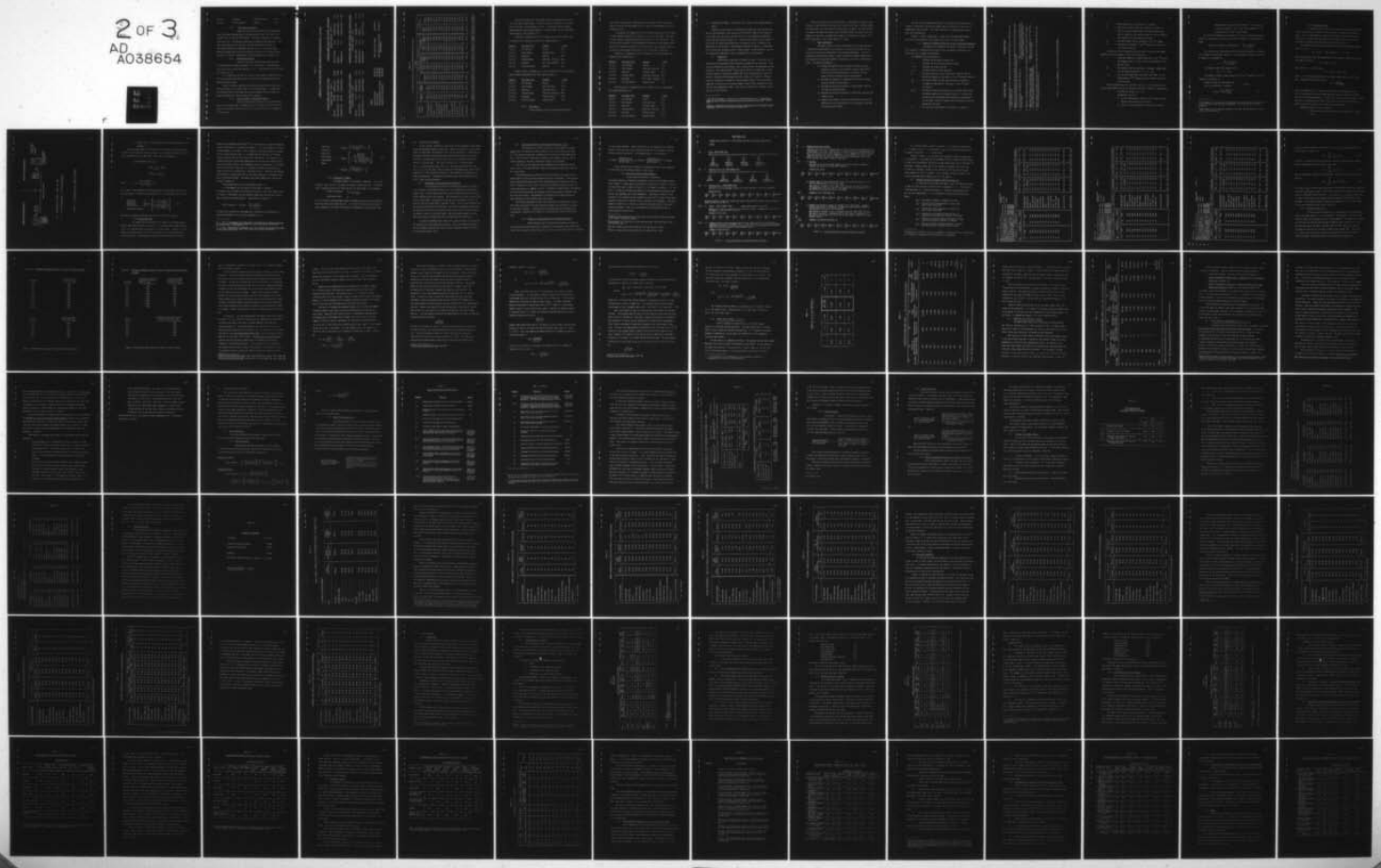
ANNUAL OPERATING INCOME & EXPENSE (IN DOLLARS) BY INDIVIDUAL RECREATION CATEGORIES FOR FY 1974

ALL BASES

RECREATION CATEGORY	OPERATING INCOME	OPERATING EXPENSE								NET OPERATING EXPENSE
		NON-APPROPRIATED FUNDS EXPENSE				APPROPRIATED FUNDS EXPENSE				
		DIRECT EXPENSE	GENERAL EXPENSE	SP. SVCS. HDQTRS.	SUB-TOTAL (2+3+4)	LOCAL	SP. SVCS. HDQTRS.	SUB-TOTAL (6+7)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)
AUTO HOBBY SHOP	179523	357578	127828	88531	574337	652728	102481	755209		1150023
BOATING/SAILING	108762	109995	72020	40115	222130	175684	31814	207498		320866
BOWLING	1444175	1025237	342365	221345	1588951	256781	75562	332343		477119
CRAFT HOBBY SHOP	420471	569463	173519	107491	850473	222789	46622	269411		699413
DEPENDENT SRVCS	489271	476743	136395	86701	699839	137641	31203	168844		379412
ENTERTAINMENT	137628	215133	117375	163775	496283	119347	58538	177885		536540
GOLF FACILITIES	2551807	2384271	419740	329152	3133163	255764	63921	319685		901041
INFORMAL SPORTS	49088	315726	240807	129197	685730	310124	68669	378793		1015435
MOVIES	242890	281155	108319	120124	507598	266088	90842	356930		621648
ORGANIZED SPORTS	8459	169365	222802	172545	564732	206844	66713	273557		829830
CEN REC SERVICES	374205	606396	296686	288366	1191448	539473	95955	635428		1452671
OUTDOOR REC	362320	531631	297165	228745	1057541	319775	90176	409951		1105172
REC EQUIP CHKOUT	139606	228861	141177	87277	455315	154250	29546	183796		499505
SWIMMING POOL	86476	334038	160963	174818	669819	493434	61644	555078		1138421
MISCELLANEOUS	213086	316827	540691	454077	1311595	397637	62271	459908		1558417
TOTALS	6807757	7926839	3395852	2692263	14008954	4508359	975957	5484316		12685513

AD-A038 654 CONTROL ANALYSIS CORP PALO ALTO CALIF F/G 5/11
COST AND RETENTION IMPACTS OF THE NAVY'S CONUS RECREATION PROGR--ETC(U)
SEP 75 A P LALCHANDANI, T H HUMPHREYS N00014-75-C-0628
UNCLASSIFIED NL

2 OF 3
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A.6.4-5	Shipyards	Golf Facilities	61.5
A.6.4-6	Training Centers	Bowling	22.6

6.4.2 Total Operating Expense

Referring to Table 6.6, Golf Facilities and Bowling have the greatest expenditures of Non-Appropriated Funds, 22.4% and 11.3%, respectively, of the total NAF Expense. The lowest expenditure is Boating/Sailing at 1.6%. The greatest expenditures of Appropriated Funds are t the Auto Hobby Shops, 13.8% of the total and Other Recreation Services, 11.' The lowest expenditure is Dependent Services at 3.1%. In terms of Total Operating Expense, Golf Facilities and Bowling account for the highest expenditures, 17.7% and 9.9%, respectively, and Boating/Sailing the lowest, 2.2%.

6.4.3 Net Operating Expense

Table 6.6 indicates that Other Recreation Services has the largest Net Operating Expense, 11.4% of the total. The Auto Hobby Shop has the next largest Net Expenses, at 9.1%. Boating/Sailing has the lowest Net Expense at 2.5%.

It is noted that the Golf Facilities at the Shipyards, Appendix A.6.4-5, is the only Recreation Category which is totally self-supporting at the Net Operating Expense level.

Table 6.7 presents comparisons of Operating Income versus various major expense components on a summary basis for the surveyed bases. In each case, the national average is provided and the three highest and three lowest Recreation Categories are then compared to this average.

6.4.4 Capital Expense by Recreation Category

Table 6.8 presents the summary of the Capital Expense data of the surveyed bases. Appendices A.6.4-11 through A.6.4-16 present the data on a functional role basis and A.6.4-17 through A.6.4-20 on a geographical location basis.

TABLE 6.7

COMPARISONS OF INCOME AND VARIOUS MAJOR EXPENSES BY RECREATION ACTIVITY - ALL BASES

OPERATING INCOME VERSUS DIRECT EXPENSE

National Average - 85.95%

Bowling	140.86%	Swimming Pools	25.89%
Golf Facilities	107.03%	Informal Sports	15.55%
Dependent Serv.	102.63%	Organized Sports	4.99%

OPERATING INCOME VERSUS TOTAL EXPENSE (REPLACEMENT)

National Average - 24.77%

Golf Facilities	58.51%	Swimming Pools	3.94%
Bowling	53.16%	Informal Sports	2.14%
Dependent Serv.	42.17%	Organized Sports	0.41%

OPERATING INCOME VERSUS TOTAL OPERATING EXPENSE

National Average - 34.92%

Bowling	75.16%	Swimming Pools	7.06%
Golf Facilities	73.90%	Informal Sports	4.61%
Dependent Services	56.32%	Organized Sports	1.00%

APPROPRIATED FUNDS EXPENSE VERSUS TOTAL OPERATING EXPENSE

National Average - 28.13

Auto Hobby Shop	56.80%	Dependent Serv.	19.44%
Boating/Sailing	49.30%	Bowling	17.30%
Swimming Pools	45.32%	Golf Facilities	9.26%

TOTALS:

Operating Income	$6,807,757
Direct Expense	$7,920,839
Non-Appropriated Fund Expense	$14,008,954
Appropriated Fund Expense	$5,484,316
Total Operating Expense	$19,493,270
Total Yearly Capital Expense (Replacement)	$27,482,257

TABLE 6.8

NET EXPENSE (IN DOLLARS) BY INDIVIDUAL RECREATION CATEGORY FOR FY 1974

ALL BASES

RECREATION CATEGORY	OPERATING INCOME (1)	NET OPERATING EXPENSE (2)	CAPITAL EXPENSE					NET EXPENSE	
			EQUIPMENT (3)	INITIAL ACQUISITION CLASS I & II (4)	INITIAL ACQUISITION YEARLY APPORT. (5)	REPLACEMENT CLASS I & II (6)	REPLACEMENT YEARLY APPORT. (7)	INITIAL ACQ. (8)	REPLAC. (9)
AUTO HOBBY SHOP	179523	1150023	209204	253200	40117	1284000	152872	1190140	1302895
BOATING/SAILING	108762	320866	448949	298700	64550	1206000	191591	385416	512457
BOWLING	1444175	477119	1876285	2439800	374730	4979000	795331	851849	1272450
CRAFT HOBBY SHOP	420471	695413	160962	436600	52163	3780000	363552	751575	1062965
DEPENDENT SRVCS	489271	375412	82376	159600	21071	3133000	291621	400483	671033
ENTERTAINMENT	137628	536540	168821	23500	16446	489000	75169	552985	611709
GOLF FACILITIES	2551807	901041	1050075	1889500	255877	8049000	908643	1156918	1809684
INFORMAL SPORTS	49088	1015435	274963	1532200	158374	13418500	1234212	1173809	2249547
MOVIES	242880	621648	148466	1942500	183740	10199000	926580	805383	1548228
ORGANIZED SPORTS	8459	829830	231932	1531800	154674	13418500	1226028	934504	2055858
OTH REC SERVICES	374205	1452671	896105	262200	59422	1862000	334396	1552093	1787067
OUTDOOR REC	362320	1105172	230639	351900	50637	606000	97227	1155809	1202399
REC EQUIP CHKOUT	139606	499505	500530	856500	121597	2326000	300048	621102	799553
SWIMMING POOL	86476	1138421	93960	2107800	193659	10829000	971706	1332080	2110127
MISCELLANEOUS	213086	1558417	626546	5900	53884	10000	120011	1612301	1678428
TOTAL	6807757	12685513	6999833	14131700	1840941	75589000	7988987	14526454	20674500

Referring to Table 6.8, the greatest Capital Expense-Initial Acquisition Cost Yearly Apportionment is found to be Bowling at 20.4% of the total and the smallest is Entertainment at 0.9% The greatest Capital Expense-Replacement Cost Yearly Apportionment is Informal Sports, 15.4% of the total. Entertainment is the smallest at 0.9%.

Referring to Appendices A.6.4-11 through A.6.4-16, the greatest Capital Expense-Initial Acquisition Cost Yearly Apportionment is:

Appendix	Functional Role	Category	% Total
A.6.4-11	Air Stations	Movies	28.4
A.6.4-12	Fleet Support	Swimming Pools	17.7
A.6.4-13	Hospitals	Bowling	28.7
A.6.4-14	Isolated Bases	Other Rec. Services	46.0
A.6.4-15	Shipyards	Rec. Equip.Checkout	32.7
A.6.4-16	Training Centers	Bowling	24.7

Referring again to Appendices A.6.4-11 through A.6.4-16, the greatest Capital Expense-Replacement Cost Yearly Apportionment is:

Appendix	Functional Role	Category	% Total
A.6.4-11	Air Stations	Movies	31.7
A.6.4-12	Fleet Support	Golf Facilities	18.5
A.6.4-13	Hospitals	Informal Sports	31.8
A.6.4-14	Isolated Bases	Other Rec. Services	44.1
A.6.4-15	Shipyards	Informal Sports	29.4
A.6.4-16	Training Centers	Swimming Pools	15.6

6.4.5 Net Expense

The Net Expense, the sum of Net Operating Expense

plus Capital Expense-Yearly Apportionment is presented on both the Initial Acquisition basis and Replacement basis in Table 6.8 and Appendices A.6.4-11 through A.6.4-16.

The greatest Net Expense on the Initial Acquisition basis for all bases is Other Recreation Services, $1,552,093, or 10.7% of the total. The smallest Net Expense is Boating and Sailing, $385,416 or 2.7% of the total. The Informal Sports Category has the greatest Net Expense on a Replacement value basis for all bases at $2,249,647, or 10.9% of the sum total and again Boating and Sailing, the smallest at $512,457 or 2.5% of the total (Table 6.8).

Referring to Appendices A.6.4-11 through A.6.4-16, the greatest Net Expense-Initial Acquisition is:

Appendix	Functional Role	Category	% Total
A.6.4-11	Air Stations	Bowling	12.7
A.6.4-12	Fleet Support	Other Rec. Services	11.7
A.6.4-13	Hospitals	Informal Sports	29.9
A.6.4-14	Isolated Bases	Other Rec. Services	28.7
A.6.4-15	Shipyards	Rec. Equip. Checkout	14.2
A.6.4-16	Training Centers	Swimming Pools	13.5

Referring again to Appendices A.6.4-11 through A.6.4-16, the greatest Net Expense-Replacement is:

Appendix	Functional Role	Category	% Total
A.6.4-11	Air Stations	Movies	16.0
A.6.4-12	Fleet Support	Golf Facilities	10.8
A.6.4-13	Hospitals	Informal Sports	31.2
A.6.4-14	Isolated Bases	Other Rec. Services	31.6
A.6.4-15	Shipyards	Informal Sports	21.9
A.6.4-16	Training Centers	Swimming Pools	14.4

7.0 RETENTION COST MODELS: (Estimating Cost Increases from Lowered Retention Rates)

Personnel participating in the Recreation Program may find that they are able to take advantage of the various activities which comprise the Program at a cost lower than the same or similar activity in the commercial marketplace, such as bowling, boating, movies, etc. They may also be able to participate in activities not otherwise available, such as Organized Sports. Therefore, the opportunity to participate in the Recreation Programs represents a fringe benefit to active duty personnel and to a lesser extent, retired personnel. Loss of this opportunity represents a loss of compensation to the personnel.

7.1 Elasticity

People making a decision of whether to remain in the Navy are influenced by the compensation that they perceive themselves as receiving. (They are also affected by other factors, such as opportunities for employment outside the Navy.) Two recent studies[1,2] have used the notion of "elasticity" to estimate the numerical relationship between the level of compensation a person receives in the Navy and the probability that a person will reenlist. More abstractly, elasticity is defined as "the percentage change in the reenlistment rate that is caused by a one percent change in the military compensation, holding civilian compensation fixed." This notion of elasticity is central to this part of our cost analysis.

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[1] "Navy Re-enlistments: The Role of Pay and Draft Pressure," in Studies Prepared for the President's Commission on an All-Volunteer Armed Force, November 1970.

[2] Summary of Econometric Analysis of Factors Influencing First-Term Reenlistment Decisions, Center for Naval Analyses, March 1972.

Elasticity allows us to relate reduction in Recreational Programs to the increase in recruiting and training costs incurred by the Navy. When the retention rates drop, the recruiting and training costs increase. Decisions focused on economic considerations need to have information about the overall cost consequences of decisions to reduce Navy support of its Recreation Program. The models developed in this section address this need.

7.2 Model Development

Two models, Career Force and Replacement, which relate reduction in Recreation Program benefits to increases in the costs associated with recruiting and training are developed in the following paragraphs. The basic assumption underlying both models is that the Recreation Program benefits are not replaced with equivalent benefits, resulting in a decline in reenlistment rates. The general methodology is:

a) Estimate the benefits that are being received by various groupings of users of the Recreation Program, specifically the first-term enlisted personnel, first-term officers, career enlisted personnel and retired personnel;

b) Estimate the reduction in compensation relative to average after-tax income for each group;

c) Estimate the resulting reductions in reenlistment rates for the three active duty groups;

d) Estimate the resulting increases in recruiting, training, and support costs;

e) Compare the increase in personnel associated costs with the reduction of costs associated with a curtailment of portions of the Recreation Program.

The only variation between the models is the method of estimating the increases in recruiting, training and support costs resulting from a reduction in compensation (Step d above). Each model developed is predicated upon a particular set of assumptions.

Figure 7.1, "Basic Assumptions -- Career Force and Replacement Models," sets forth the assumptions, both common and particular for both models.

7.2.1 Reduction in Retention Rate Due to Loss of Recreation Benefits

The equation for estimating the number of personnel lost due to a reduction in compensation resulting from a curtailment of Recreation Program activities is common to both models.

The parameters which are used are:

i indicates the personnel groupings and

$i = 1$ indicates the first-term enlisted personnel

$i = 2$ indicates first-term officers

$i = 3$ indicates career enlisted personnel

B_i = The perceived annual active duty benefit derived from the Recreation Program by individuals in the i^{th} group (in dollars)

${}_rB_i$ = The annual benefit derived from the Recreation Program in retirement as perceived by individuals in the i^{th} group (in dollars)

$d_i(\delta)$ = The factor by which to multiply ${}_rB_i$ to discount these future retirement benefits (by a discount rate of δ) to obtain the annual value of discounted future benefits as perceived by an individual in the i^{th} category who has decided to continue beyond the first term

T_i = Tax rate after reenlistment for personnel in category i

CAREER FORCE MODEL	REPLACEMENT MODEL
a) Recreation Program benefits are reduced and not replaced by equivalent benefits, resulting in a decreased retention rate.	
b) Number of first-term officers will be increased so that the number of first-term reenlistments would be the same prior to and after the reduction in retention rates.	
c) Enlisted personnel are handled the same way as officers above.	c) There is no increase in the enlisted force size, but instead, an enlisted man who quits is immediately replaced by a new recruit.
d) Reduction in Recreation Program activities results in decrease in operating costs of the program.	
e) Added costs resulting are for recruiting, training and support associated with the added number of first-term personnel, both enlisted and officer.	e) Added costs resulting are for recruiting, training and support.
f) Compare increase in personnel costs with the savings in operating costs associated with the reduction in the Recreation Program activities.	

Figure 7.1 - Basic Assumptions -- Career Force and Replacement Models

s_i = Reenlistment salary for personnel in category i

e_i = Elasticity of reenlistment for personnel in category i; that is, the percentage change in the reenlistment rate that is caused by a one percent change in military compensation, holding civilian compensation fixed

R_i = The reenlistment rate for personnel in the i^{th} category

U_i = The number of personnel in the i^{th} category eligible to reenlist within one year

In addition, the following variables are useful in deriving the needed equations but do not appear in the final expressions:

ε = Fractional reduction in reenlistment rate in the i^{th} personnel category; that is, $\varepsilon_i R_i$ is the actual reduction in the retention rate

R_i' = The retention rate for personnel in category i after reduction of recreation benefits. $R_i' = (1 - \varepsilon_i)R_i$

ΔU_i = The increase needed under the Career Force Model in first-term personnel (i^{th} category) who are eligible to reenlist within one year

The first expression to be derived is that for ε, the fractional reduction in reenlistment rate due to fractional reduction in after-tax compensation.

The after-tax income is $(1 - T)s$.

The benefits lost are:

1) B_i, for those benefits from loss of the use of the Recreation Program while on active duty.

2) ${}_rB_i d_i(\delta)$, for those benefits from loss of the use of

the Recreation Program during retirement.[1] The factor $d_i(\delta)$ is used to discount at rate δ these future benefits to perceived benefits at time of reenlistment.

The total[2] lost benefits are therefore $B_i + {}_rB_i d_i(\delta)$, and the fractional reduction in compensation is the ratio of the total benefits to the after-tax income:

$$\text{Fractional reduction in compensation} = \frac{(B_i + {}_rB_i d_i(\delta))}{(1 - T_i)s_i}$$

The elasticity e_i allows the use of the fractional reduction in compensation to obtain the fractional reduction ε_i in reenlistment (retention) rate due to reduction in compensation,

$$\varepsilon_i = e \frac{(B_i + {}_rB_i\, d_i(\delta))}{(1 - T_i)\, s_i}$$

The retention rate after reduction is R_i' ,

$$R_i' = (1 - \varepsilon_i)R_i$$

The number of potential reenlistees lost in the i^{th} category due to this reduction in retention is:

$$\text{Number of potential reenlistees lost due to the reduction in retention} = (\varepsilon_i R_i)U_i \ .$$

$$= R_i U_i e_i \frac{B_i + {}_rB_i d_i(\delta))}{(1 - T_i)s_i} \qquad (7.1)$$

---

[1] The viewpoint is that these are fringe benefits accrued during active duty and as such are part of active duty compensation. A full discussion is given in Section 8.

[2] These benefits can be analyzed separately and then combined because of the linearity of the elasticity.

7.2.2 Career Force Model

As stated earlier, the goal is to maintain the number of personnel in the Career Force at a constant level regardless of reduction in retention rates. This is accomplished by increasing the number of first-term personnel. Figure 7.2 illustrates that the reduction in retention rate from R_i to R_i' is countered by increasing the pool of first-term eligibles by ΔU_i.

The condition to be satisfied, expressed in the variables established in Section 7.1, is:

$$(U_i + \Delta U_i)R_i' = U_i R_i, \text{ where } R_i' = (1 - \varepsilon_i)R_i \quad .$$

Using this equation allows the determination of the number of additional personnel needed, as follows:

$$(U_i + \Delta U_i)R_i' = U_i R_i \quad ,$$

substituting $(1 - \varepsilon_i)$ for R_i' gives:

$$(U_i + \Delta U_i)(1 - \varepsilon_i)R_i = U_i R_i$$

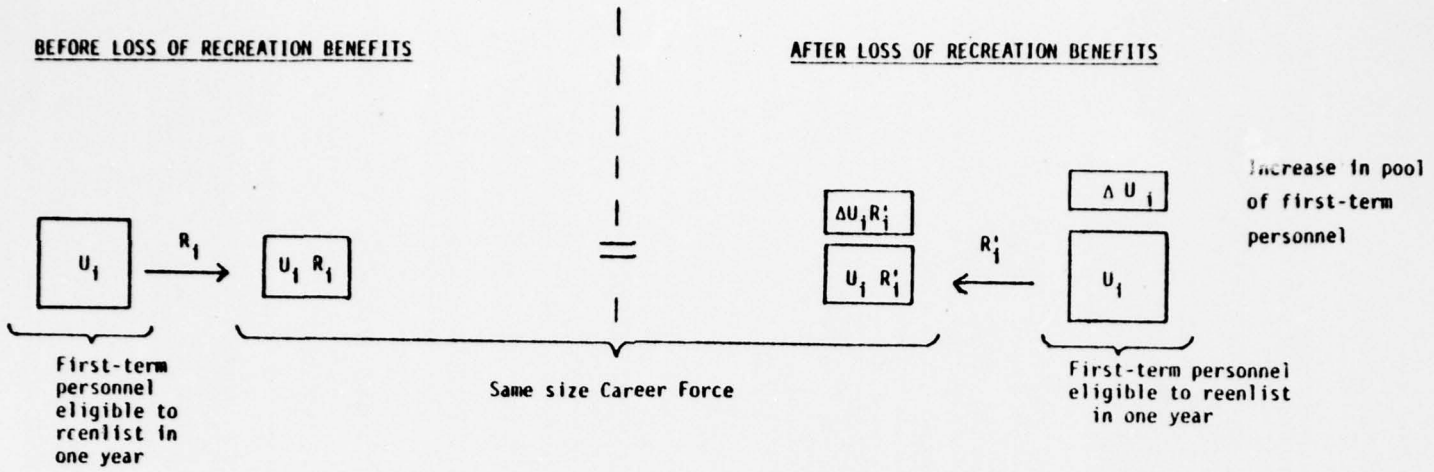
where ε_i is the fractional reduction in the reenlistment rate in the i^{th} categroy. Algebraic manipulation leads to

$$\Delta U_i = \frac{\varepsilon_i R_i U_i}{(1 - \varepsilon_i)R_i}$$

where the redundant R_i/R_i is retained to help intuitive understanding since $\varepsilon_i RU_i$ is the number of potential reenlistees lost due to a reduction in retention rate while the denominator $(1 - \varepsilon_i)R_i = R_i'$, is the new reduced retention rate. Thus εRU_i is multiplied by the factor $(1/R_i')$ to take into account that for ΔU_i people recruited only $R_i'\Delta U_i$ will be added to the Career Force.

Parameters peculiar to this model are:

h_i = Average annual first-term billet cost for personnel in category i.



R_i = Retention rate for category i before; R_i', after

i = 1 for first-term enlisted; i = 2 for first-term officers

FIGURE 7.2 - ILLUSTRATION OF THE CAREER FORCE MODEL

t_i = Average time in billet during the first term for personnel in category i.

The ΔU_1 people added to the first-term enlisted and the ΔU_2 people added to the first-term officers cost an average of h_i each year and serve in that billet an average time of t_i years each. Thus, the cost increase is:

$$(\text{Cost Increase})_i = h_i t_i \Delta u_i$$

$$= h_i t_i \frac{1}{R'_i} U_i R_i \varepsilon i$$

$$= h_i t_i U_i \frac{\varepsilon_i}{1 - \varepsilon_i}$$

where $$\varepsilon_i = e_i \frac{(B_i + {}_rB_i d_i(\delta))}{(1 - T_i)s_i}$$

or in terms of the parameters, estimating directly, and summing over both first-term enlisted (i = 1) and first-term officers (i = 2), the total cost increase is

$$\begin{matrix}\text{Total Cost Increase in Recruiting and Training} \\ \text{(Career Force Model)}\end{matrix} = \sum_{i=1}^{2} h_i t_i U_i \left[\frac{e_i \frac{B_i + {}_rB_i d_i(\delta)}{(1 - T_i)s_i}}{1 - e_i \frac{B_i + {}_rB_i d_i(\delta)}{(1 - T_i)s_i}} \right] \qquad (7.2)$$

Note that the retention rate does not enter into this final equation.

7.2.3 Replacement Model

As stated earlier, the goal of this model is to replace each potential reenlistee lost with a new recruit. In the Career Force Model (Section 7.2.2), it is assumed that no personnel can be substituted. Instead, it is necessary to increase the pool of first-term personnel so as to retain the same size Career Force. In two manpower studies performed by the Naval Personnel

Research and Development Laboratory[1,2] it was assumed that a career enlisted man could be replaced by a first-term enlisted man. This same assumption is used in the development of this Model. Thus, whenever an enlisted position is vacated due to a lower retention rate, it is assumed that the position is filled by either promoting a man of lower rank or by a new recruit. This results in increased recruiting, training and support cost but the total enlisted force remains at the same strength. Since judgement based upon experience is an integral aspect of an officer's position, it is deemed unreasonable to assume that a career officer can be replaced by a first-term officer. Therefore, the replacement assumption is applicable only to first-term (Category 1) and career (Category 3) enlisted personnel. The Career Force Model approach will be used for officers (Category 2).

The parameter peculiar to the Replacement Model is:

H_i = Replacement cost per person for personnel in category i.

This model uses an estimate H_i of the cost to recruit, train, and support (cost to replace) a replacement for each potential reenlistee lost due to a curtailment in Recreation Program benefits. Substituting in Equation 7.1:

$$\text{(Cost Increase)} = H_i R_i U_i e_i \quad \frac{(B_i + {}_r B_i d_i(\delta))}{(1 - T_i)s_i}$$

The total cost increase for the categories of personnel, using Equation 7.2 (Career Force Model) for all officers (Category 2), is:

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[1] G. L. Henry, The Manpower Cost Implications Associated With Changes in Navy Reenlistment Rates: A Methodology, WRM 71-2, July 1970, DDC No. AD-710-392.

[2] G. L. Henry, Determination of Manpower Costs Implications Associated With Change in Navy Reenlistment Rates, WRM 71-30, March 1971, DDC No. AD-724-657.

$$\text{Total Cost Increase in Recruiting and Training (Replacement Model)} = H_I R_1 U_1 e_1 \left(\frac{B_1 + {}_rB_1 \; d_1(\delta)}{(1-\bar{T}_1)s_1} \right) + h_2 t_2 U_2 \left[\frac{e_2 \frac{B_2 + {}_rB_2(\delta)}{(1-\bar{T}_2)s_2}}{1 - \left(e_2 \frac{B_2 + {}_rB_2 \; d_2(\delta)}{(1-\bar{T}_2)s_2} \right)} \right] + H_3 R_3 U_3 e_3 \left(\frac{B_3 + {}_rB_3 \; d_3(\delta)}{(1-\bar{T}_3)s_3} \right) . \quad (7.3)$$

7.2.4 Differences in Models

The common element of both models is apparent. This is the estimate $\varepsilon R_i U_i$, which is the number of potential reenlistees lost. The difference in computing the cost of replacing the lost reenlistees is also apparent.

Career Force Model: $h_i t_i \frac{1}{(1 - \varepsilon_i)R_i}$

Replacement Model: H_i

It is of note that the Replacement Model accommodates career enlisted personnel, which the Career Force Model does not. It is also of note that the increase in costs computed by the Career Force Model are independent of the retention rate.

8.0 ESTIMATION OF PARAMETERS

In this section, estimation of the values of the parameters of the Career Force and Replacement Models is discussed. Referring to Section 7, where these models are described, the parameters fall into two categories -- those that are estimated individually for each base and those that are common to all bases. The former includes benefit B_i and ${}_rB_i$ as well as U_i, personnel eligible to reenlist within one year. The latter include $d_i(\delta)$ - discount factor, (s_i, T_i) - salary and tax rates, (R_i, e_i) - retention and elasticities, and (h_i, t_i, H_i) - billet costs, time in billet and replacement costs, respectively. Subsection 8.1 deals with the rationale for the breakdown of parameters into these two categories. The remaining subsections deal with the actual estimation of these various parameters.

8.1 Parameters - Local and National Estimation

For the purpose of exercising the models described in Section 7, it is necessary to consider estimates of all the parameters for a common geographic area. A Navy installation (base) under one Recreation Fund was chosen as most appropriate for this purpose. The parameters B_i, ${}_rB_i$ and U_i were calculated for each base. The benefits B_i and ${}_rB_i$, were calculated utilizing the data from the survey described in Sections 2 and 3. The U_i's were obtained from the pay grade distribution at each base. The remaining parameters were estimated based on national data, and these national values were utilized throughout the analysis, even for individual bases. Obtaining these parameters by each individual base was infeasible as well as unwarranted for the analysis.

To obtain cost-effectiveness ratios for a group of bases, the recruiting and training costs were added over the bases. Also, the income and expenses for the recreation program were added to obtain comparable numbers for obtaining cost-effectiveness ratios.

8.2 Active Duty Benefits and Retirement Benefits (B_i, $_rB_i$)

The retention-cost models of Section 7 require data on the perceived value of recreation to Navy personnel, since in using the elasticities it is the perceived reduction in compensation that affects reenlistment decisions. In this section, values of B_i, the active duty benefit, and $_rB_i$, the retirement benefit of the Navy's Recreation Program, are estimated.

The survey by which these data were gathered has been described in Sections 2 and 3. This data provides a basis for estimating B_i and $_rB_i$ at each of the sixteen bases.

The questionnaire was structured to allow estimation of B_i and $_rB_i$ for a random sample of the active duty population at each of the bases. This questionnaire asked questions about each of the fourteen Recreation Categories (see pp. 39-52 in Appendix A.2.5-1 as well as the Overall Recreation Program (see pp. 53 of the questionnaire in Appendix A.2.5-1). Estimates of these benefits are required for each of the three groups of personnel: first-term enlisted, career-enlisted and first-term officer. The demographic information on the questionnaire allowed segregation of data among these three groups.

Since afloat personnel are away from the base for a good portion of their time, their perception of the base recreation benefits are different from those of the ashore personnel. Subsection 8.2.1 describes how this difference was incorporated. Subsection 8.2.2 deals with the active duty and retirement benefits.

8.2.1 Afloat vs. Ashore Perceptions of Recreation Benefits

Afloat personnel tend to perceive the Recreation Program as less valuable than Ashore personnel. Furthermore, the analyzed survey sample (see Table 5.2) obtained for Afloat personnel was 5.47%, much lower than the 8.98% obtained

for the Ashore personnel. Hence, calculation of the benefits[1] for a group of people[2] at the base had to be a weighted combination of the benefits for the Afloat and Ashore population. The weighted benefit is calculated as:

$$B_i \text{ (base)} = \left\{\begin{array}{l}\text{proportion of}\\ \text{Afloat person-}\\ \text{nel at base}\end{array}\right\} \times B_i \text{ (Afloat)} + \left\{\begin{array}{l}\text{proportion of}\\ \text{Ashore person-}\\ \text{nel at base}\end{array}\right\} \times B_i \text{ (Ashore)}$$

The B_i (Afloat) and B_i (Ashore) are obtained from the survey responses of the Afloat and the Ashore personnel, respectively.

8.2.2 Active Duty and Retirement Benefits

In the survey questionnaire, respondents were asked questions by Recreation Categories as well as on the Overall Recreation Program. A sample page on the Recreation Categories is shown in Figure 8.1 and the overall page is shown in Figure 8.2. The answer to Question 4 in Figure 8.1 is taken as the perceived benefit from the appropriate recreation category by the respondent and his/her dependents. There are ten blocks for the response to this question and the midpoint of each block[3] is taken as the single numerical value for the 'Increase in Pay' desired by the respondent. Similarly, answers to question b in Figure 8.2 provide an estimate of B_i for the overall Recreation Program. Here, also, the midpoints of the blocks[4] are used as single numerical values for B_i.

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[1] Benefits can be retired or active duty, and for individual Recreation Category or the Overall Recreation Program.

[2] Group denotes any group such as first-term enlisted, career enlisted, first-term officers, etc.

[3] $21.50 is taken as the single value for the '$20 and over' block.

[4] $85.00 is taken as the single value for the '$80 and over' block.

AUTO HOBBY SHOP

PLEASE READ DESCRIPTION 1 ON ATTACHED RECREATION CATEGORY DESCRIPTION SHEET.

(7) 1. Use of AUTO HOBBY SHOP

Which of the following categories best describes how often you and your dependents use this activity?

☐ (0)	☐ (1)	☐ (2)	☐ (3)
NEVER (Do not use on this base)	INFREQUENTLY (Less than once/month)	OCCASIONALLY (1-2 times per month)	FREQUENTLY (3 or more times per month)

(8) 2. Condition or quality of AUTO HOBBY SHOP

Please check the category that best describes the condition or quality of this activity.

☐ (0)	☐ (1)	☐ (2)	☐ (3)	☐ (4)
DONT KNOW	UNACCEPTABLE (Will not use)	UNATTRACTIVE (Dislike using)	ACCEPTABLE (OK to use)	ATTRACTIVE (Pleasure to use)

(9) 3. Savings by using AUTO HOBBY SHOP

How much do you save now per month by having this activity available to you and your dependents?

SAVINGS PER MONTH:

☐ $0 (0) ☐ $1-2 (1) ☐ $3-4 (2) ☐ $5-6 (3) ☐ $7-8 (4) ☐ $9-10 (5) ☐ $11-13 (6) ☐ $14-16 (7) ☐ $17-19 (8) ☐ $20 or Over (9)

In answering the next two questions, consider your answers to the above three questions, as well as the more general considerations on page two.

(10) 4. Suppose AUTO HOBBY SHOP were no longer available for your use.

What monthly increase in pay feels FAIR (to both you and to the Navy) in compensation for your loss of the opportunity to use this kind of activity?

INCREASE IN PAY PER MONTH:

☐ $0 (0) ☐ $1-2 (1) ☐ $3-4 (2) ☐ $5-6 (3) ☐ $7-8 (4) ☐ $9-10 (5) ☐ $11-13 (6) ☐ $14-16 (7) ☐ $17-19 (8) ☐ $20 or Over (9)

(11) 5. Suppose you decide to remain in the Navy until retirement. Suppose the Navy no longer offered to retired people the use of AUTO HOBBY SHOP. What monthly increase in your retirement pension seems FAIR (to both you and to the Navy) in compensation for your loss of the opportunity to use this kind of activity during retirement? (Dollars at present value.)

INCREASE IN PENSION PER MONTH:

☐ $0 (0) ☐ $1-2 (1) ☐ $3-4 (2) ☐ $5-6 (3) ☐ $7-8 (4) ☐ $9-10 (5) ☐ $11-13 (6) ☐ $14-16 (7) ☐ $17-19 (8) ☐ $20 or Over (9)

FIGURE 8.1 - Survey Questionnaire, Sample Recreation Category

7. OVERALL RECREATION PROGRAM

Look back over the last fourteen pages in which you have considered specific recreational activities. Reflect on the value to you and your dependents of all of these activities taken together -- of the overall recreation program. Take into account you and your dependents' use of these activities, their condition and quality, what you save using base recreational facilities. Also, consider the items listed on Page Two.

(77) a. Savings

How much do you save now per month by having the overall recreation program available to you and your dependents?

SAVINGS PER MONTH:

☐ $0 (0) ☐ $1-9 (1) ☐ $10-19 (2) ☐ $20-29 (3) ☐ $30-39 (4) ☐ $40-49 (5) ☐ $50-59 (6) ☐ $60-69 (7) ☐ $70-79 (8) ☐ $80 and Over (9)

b. Suppose none of these recreational activities were available for you and your dependents to use on this base.

What monthly increase in pay feels FAIR (to both you and to the Navy) in compensation for your loss of the opportunity to use recreational activities during active duty on this base.

(78) INCREASE IN PAY PER MONTH OF:

☐ $0 (0) ☐ $1-9 (1) ☐ $10-19 (2) ☐ $20-29 (3) ☐ $30-39 (4) ☐ $40-49 (5) ☐ $50-59 (6) ☐ $60-69 (7) ☐ $70-79 (8) ☐ $80 and Over (9)

c. Suppose you decide to remain in the Navy until retirement. Suppose, at the time of your retirement, the Navy no longer offers the use of recreational services to retired people.

What monthly increase in your retirement pensions feels FAIR (to both you and to the Navy) in compensation for your loss of opportunity to use these recreational activities during retirement? (Dollars at their present value.)

(79) INCREASE IN PENSION PER MONTH OF:

☐ $0 (0) ☐ $1-9 (1) ☐ $10-19 (2) ☐ $20-29 (3) ☐ $30-39 (4) ☐ $40-49 (5) ☐ $50-59 (6) ☐ $60-69 (7) ☐ $70-79 (8) ☐ $80 and Over (9)

FIGURE 8.2 - Survey Questionnaire, Overall Recreation Program

In a similar fashion, answers to question 5 in Figure 8.1 and question c in Figure 8.2 are taken as estimates of $_rB_i$ for the Recreation Category and the Overall Recreation Program, respectively.

Tables 8.1 through 8.3 show some of the summaries of data as they relate to the benefits. They summarize the responses of the Enlisted First-Term Afloat, Enlisted First-Term Ashore, and Officer Career Afloat sample at NS, San Diego, respectively. Reading across the row for Recreation Category 'Golf Facilities' in Table 8.1, the mean 'Increase in Pay' desired by the First-Term Enlisted Afloat sample was \$2.90 per month. Also, the mean 'Increase in Pension' desired by the same group of people was \$3.70 per month.

8.3 Personnel Eligible to Reenlist Within One Year (U_i)

In this section we estimate the number, U_{ib},[1] of personnel eligible to reenlist within one year for each of the i categories (i = 1: first-term enlisted personnel; 2: first-term officers; 3: career enlisted personnel) at each of the sixteen bases, b. It is convenient to define the following parameters:

N_{gb} = the number of people in paygrade g at base b

y_{1g} = fraction of enlisted personnel in grade g who are in their first term

y_{2g} = fraction of officer personnel in grade g who are in their first term

z_{1g} = fraction of first-term enlisted personnel in grade g who are eligible to reenlist in one year

z_{2g} = fraction of first-term officer personnel in grade g who are eligible to reenlist in one year

z_{3g} = fraction of career enlisted personnel in grade g who are eligible to reenlist within one year

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[1] Throughout this section we use U_{ib} to emphasize this application to sixteen bases. U_i is identical in meaning with the subscript "b" suppressed.

SAMPLE SIZE = 708

BASE---------- NS SAN DIEGO
RANK---------- ENLISTED
PAYGRADE----------ENTIRE SAMPLE
TERM OF MILITARY SERVICE---------- 1ST TERM
NUMBER OF YEARS OF ACTIVE DUTY-----ENTIRE SAMPLE
PRESENT DUTY STATION---------- AFLOAT
RESIDENCE----------ENTIRE SAMPLE
MARITAL STATUS----------ENTIRE SAMPLE
DURATION OF STAY AT PRESENT BASE---ENTIRE SAMPLE
PLAN TO RETIRE WITH NAVY----------ENTIRE SAMPLE
USERS/NONUSERS OF ACTIVITIES-------ENTIRE SAMPLE

TABLE 8.1

L-S-A-G-E		Q-U-A-L-I-T-Y		A-C-T-I-V-I-T-Y	SAVINGS($/MO)			INC IN PAY($/MO)			INC IN PEN($/MO)		
%GE-OF	MEDIAN USERS	%GE-WHO	MEDIAN KNOW		MEAN	S.D.	MED	MEAN	S.D.	MED	MEAN	S.D.	MED
46	NEVR	45	UNKN	AUTO HOBBY SHOP	6.4	8.4	0.0	8.1	8.8	5.5	8.3	8.9	5.5
				BOATING/SAILING	NOT AVAILABLE AT THIS BASE								
62	INFR	63	ACCE	BOWLING	4.4	5.7	1.5	6.2	6.9	3.5	6.7	7.5	3.5
32	NEVR	32	UNKN	CRAFT HOBBY SHOP	2.4	4.8	0.0	4.0	6.4	0.0	4.5	6.9	0.0
27	NEVR	26	UNKN	DEPENDENT SRVCS	2.0	4.7	0.0	4.5	7.1	0.0	5.7	8.1	0.0
60	INFR	59	ACCE	ENTERTAINMENT	4.5	6.1	1.5	6.7	7.4	3.5	7.6	8.0	5.5
21	NEVR	23	UNKN	GOLF FACILITIES	1.5	4.1	0.0	2.9	5.9	0.0	3.7	6.8	0.0
55	INFR	55	UNAT	INFORMAL SPORTS	3.2	5.0	0.0	4.8	6.5	1.5	5.1	6.9	1.5
76	INFR	78	ACCE	MOVIES	5.4	6.0	3.5	6.8	6.9	5.5	7.3	7.4	5.5
40	NEVR	41	UNKN	ORGANIZED SPORTS	2.3	4.5	0.0	3.8	6.3	0.0	4.1	6.7	0.0
70	INFR	68	ACCE	OTH REC SERVICES	5.1	6.2	3.5	6.9	7.2	5.5	7.8	7.8	5.5
54	INFR	53	UNAT	OUTDOOR REC	3.5	5.7	0.0	5.3	6.9	1.5	6.1	7.5	1.5
52	INFR	52	UNAC	REC EQUIP CHKOUT	4.5	6.4	0.0	6.4	7.5	3.5	7.0	7.9	3.5
51	INFR	53	UNAT	SWIMMING POOL	2.0	4.2	0.0	3.8	5.7	1.5	4.9	6.8	1.5
				SUM OF ACTIVITIES	47.2	72.0	10.0	70.2	89.4	31.5	78.7	97.1	33.5
				OVERALL REC PROG	28.7	25.4	24.5	37.8	28.0	34.5	40.4	30.2	34.5

SAMPLE SIZE = 45

BASE---------- NS SAN DIEGO
RANK---------- ENLISTED
PAYGRADE----------ENTIRE SAMPLE
TERM OF MILITARY SERVICE---------- 1ST TERM
NUMBER OF YEARS OF ACTIVE DUTY-----ENTIRE SAMPLE
PRESENT DUTY STATION---------- ASHORE
RESIDENCE----------ENTIRE SAMPLE
MARITAL STATUS----------ENTIRE SAMPLE
DURATION OF STAY AT PRESENT BASE---ENTIRE SAMPLE
PLAN TO RETIRE WITH NAVY----------ENTIRE SAMPLE
USERS/NONUSERS OF ACTIVITIES-------ENTIRE SAMPLE

TABLE 8.2

U-S-A-G-E		Q-U-A-L-I-T-Y		A-C-T-I-V-I-T-Y	SAVINGS($/MO)			INC IN PAY($/MO)			INC IN PEN($/MO)		
%GE -OF	MEDIAN USER	%GE -WHO	MEDIAN KNOW-		MEAN	S.D.	MED	MEAN	S.D.	MED	MEAN	S.D.	MED
29	NEVR	38	UNKN	AUTO HOBBY SHOP	2.8	6.6	0.0	3.2	6.8	0.0	3.5	6.9	0.0
				BOATING/SAILING	NOT AVAILABLE AT THIS BASE								
69	INFR	64	ACCE	BOWLING	4.3	5.9	1.5	4.9	7.1	1.5	5.5	7.8	1.5
16	NEVR	22	UNKN	CRAFT HOBBY SHOP	0.5	1.6	0.0	1.3	3.8	0.0	1.8	4.8	0.0
20	NEVR	23	UNKN	DEPENDENT SRVCS	1.3	3.0	0.0	2.2	4.8	0.0	2.9	6.1	0.0
44	NEVR	49	UNKN	ENTERTAINMENT	2.4	4.4	0.0	3.8	6.3	0.0	3.8	6.4	0.0
18	NEVR	23	UNKN	GOLF FACILITIES	1.0	2.5	0.0	1.3	3.8	0.0	1.8	4.8	0.0
33	NEVR	36	UNKN	INFORMAL SPORTS	2.2	4.5	0.0	2.6	5.5	0.0	3.1	6.1	0.0
74	INFR	72	ACCE	MOVIES	5.3	5.6	3.5	5.6	6.9	1.5	6.0	7.1	1.5
30	NEVR	27	UNKN	ORGANIZED SPORTS	2.0	5.1	0.0	2.7	5.9	0.0	3.1	6.5	0.0
67	INFR	64	ACCE	OTH REC SERVICES	3.9	5.2	1.5	5.4	7.0	1.5	5.8	7.2	1.5
47	NEVR	47	UNKN	OUTDOOR REC	1.9	4.2	0.0	2.1	4.0	0.0	3.0	5.5	0.0
51	INFR	51	UNAT	REC EQUIP CHKOUT	2.7	5.6	0.0	4.0	6.2	0.0	4.1	6.8	0.0
49	NEVR	49	UNKN	SWIMMING POOL	1.9	4.2	0.0	3.9	6.3	0.0	4.5	6.6	1.5
				SUM OF ACTIVITIES	32.3	58.6	6.5	43.1	74.5	4.5	48.9	82.5	5.0
				OVERALL REC PROG	19.6	18.7	14.5	25.8	24.4	24.5	27.9	26.6	24.5

SAMPLE SIZE = 49

BASE---------- NS SAN DIEGO
RANK---------- OFFICER
PAYGRADE----------ENTIRE SAMPLE
TERM OF MILITARY SERVICE---------- CAREER
NUMBER OF YEARS OF ACTIVE DUTY-----ENTIRE SAMPLE
PRESENT DUTY STATION---------- AFLOAT
RESIDENCE----------ENTIRE SAMPLE
MARITAL STATUS----------ENTIRE SAMPLE
DURATION OF STAY AT PRESENT BASE---ENTIRE SAMPLE
PLAN TO RETIRE WITH NAVY----------ENTIRE SAMPLE
USERS/NONUSERS OF ACTIVITIES-------ENTIRE SAMPLE

TABLE 8.3

U-S-A-G-E		Q-U-A-L-I-T-Y		A-C-T-I-V-I-T-Y	SAVINGS($/MO)			INC IN PAY($/MO)			INC IN PEN($/MO)		
%GE-O F	MEDIAN USERS	%GE-W H O	MEDIAN KNOW-		MEAN	S.D.	MED	MEAN	S.D.	MED	MEAN	S.D.	MED
23	NEVR	25	UNKN	AUTO HOBBY SHOP	2.7	5.2	0.0	4.8	6.5	0.0	4.9	6.4	1.5
				BOATING/SAILING	NOT AVAILABLE AT THIS BASE								
47	NEVR	51	ACCE	BOWLING	2.3	3.7	0.0	4.1	5.7	1.5	4.4	5.7	1.5
31	NEVR	33	UNKN	CRAFT HOBBY SHOP	1.3	2.6	0.0	3.4	5.1	1.5	3.7	5.3	1.5
31	NEVR	27	UNKN	DEPENDENT SRVCS	1.8	4.3	0.0	4.5	6.9	0.0	5.1	7.4	0.0
55	INFR	51	UNAT	ENTERTAINMENT	2.7	4.4	1.5	4.6	6.4	1.5	4.6	6.4	1.5
46	NEVR	48	UNKN	GOLF FACILITIES	4.3	6.7	0.0	6.9	8.0	1.5	7.9	8.9	1.5
45	NEVR	45	UNKN	INFORMAL SPORTS	3.1	4.9	0.0	4.8	6.7	1.5	5.0	7.1	1.5
47	NEVR	49	UNKN	MOVIES	2.7	3.8	0.0	4.6	6.0	3.5	4.8	6.1	3.5
33	NEVR	33	UNKN	ORGANIZED SPORTS	1.3	2.9	0.0	3.0	5.8	0.0	3.0	5.7	0.0
71	INFR	65	ACCE	OTH REC SERVICES	4.2	5.8	1.5	6.8	7.6	3.5	6.9	6.9	5.5
55	INFR	55	UNAT	OUTDOOR REC	2.6	4.0	0.0	4.4	5.8	1.5	4.8	6.2	1.5
44	NEVR	46	UNKN	REC EQUIP CHKOUT	2.7	4.7	0.0	4.8	6.1	1.5	5.6	6.1	3.5
35	NEVR	39	UNKN	SWIMMING POOL	1.6	3.6	0.0	4.9	6.6	1.5	5.1	6.5	3.5
				SUM OF ACTIVITIES	33.2	56.6	3.0	61.4	83.1	19.0	65.6	84.8	26.5
				OVERALL REC PROG	24.4	25.3	24.5	37.0	29.5	34.5	41.9	31.3	44.5

In terms of these parameters, the number of first-term enlisted personnel eligible to reenlist at base b are:

$$U_{1b} = \sum_{g = E1}^{E9} N_{gb} Y_{1g} Z_{1g} \qquad (8.1)$$

Similarly, the number of first-term officers eligible to complete their minimum service requirements within one year at base b are:

$$U_{2b} = \sum_{g = 01}^{010} N_{gb} Y_{2g} Z_{2g} \qquad (8.2)$$

Finally, the number of career enlisted personnel eligible to reenlist within one year are:

$$U_{3b} = \sum_{g = E1}^{E9} N_{gb} (1-Y_{1g}) Z_{3g} \qquad (8.3)$$

The values of N_{gb} for the 16 bases are shown in the Individual Base Data Volume. The values of y_{1g} and y_{2g} are given in Table 8.4 and these were estimated using data supplied by the Bureau of Naval Personnel. The values of z_{1g}, z_{2g} and z_{3g} are given in Table 8.5 and these were estimated from data supplied by the Bureau of Naval Personnel. Using these parameter values and the equations 8.1 - 8.3, the values for U_{ib} were computed and are given in Table 8.6

8.4 Discount Factor ($d_i(\delta)$)

In this section we estimate $d_i(\delta)$, the factor by which the annual future retirement benefit is to be discounted. The parameter δ is the discount rate for computing the present value of future benefits. The factor $d_1(\delta)$ applies to first term enlisted who have decided to reenlist; $d_2(\delta)$ applies to a first term officer who has decided to continue past the first term; $d_3(\delta)$ applies to career enlisted who have decided to reenlist for another term. The factor $d_i(\delta)$ when multiplied by ${}_rB_i$ gives the current expected value of the entire future retirement recreation benefits, amortized over the remaining

TABLE 8.4 - FRACTION OF PERSONNEL WHO ARE IN THEIR FIRST TERM, BY GRADE

Enlisted	Fraction In Their First Term (y_{1g})
E-1	.998
E-2	.997
E-3	.949
E-4	.834
E-5	.351
E-6	.002
E-7	.000
E-8	.000
E-9	.000
E-10	.000

Officer	Fraction In Their First Term (y_{2g})
O-1	.886
O-2	.719
O-3	.109
O-4	.000
O-5	.000
O-6	.000

Source: Estimated from data supplied by Bureau of Naval Personnel.

TABLE 8.5 - FRACTION OF PERSONNEL WHO ARE ELIGIBLE TO REENLIST WITHIN ONE YEAR, BY GRADE

Enlisted	Fraction of First-Term Enlisted Eligible to Reenlist (z_{1g})	Fraction of Career Enlisted Eligible to Reenlist (z_{3g})
E-1	.006	.063
E-2	.024	.036
E-3	.053	.024
E-4	.438	.065
E-5	.981	.104
E-6	1.000	.226
E-7	1.000	.283
E-8	1.000	.304
E-9	1.000	.311

Officer	Fraction of First-Term Officers Eligible to Continue (z_{2g})
O-1	.007
O-2	.408
O-3	.782
O-4	.500
O-5	1.000
O-6	1.000

Source: Estimated from data supplied by Bureau of Naval Personnel.

years to retirement as perceived by a person in the i^{th} personnel category who has decided to reenlist.

Use of Recreation Categories gives two types of benefits to active duty personnel: current savings from using the recreation activities while on active duty, and future savings from using the recreation activities during retirement. We take the viewpoint that this latter benefit is a fringe benefit that is accrued during active duty; for it is only by completing the prescribed active service requirements that an individual would become eligible for retirement recreation privileges. However, these accrued retirement benefits are neither present payments to active duty personnel nor are they current budget costs; rather, the present value to active personnel of these retirement recreation benefits must be estimated using actuarial techniques. The estimate obtained by this method is sensitive to the assumptions on which it is based: interest rates, mortality tables, retention rates, force sizes, etc.

In Section 7, $_{r}B_{i}$, the average annual retirement benefit per person is estimated. The $_{r}B_{i}$ specific to the base we are considering would be used in calculating increases in cost due to lowered retention resulting from reduced compensation. Since these benefits are received each year, the total retirement benefits are a function of the life expectancy of a retiree. According to the 1974 Military Market Facts Book[1], the average age at retirement (for all services) is 41.5 years. The 1972 Life Insurance Fact Book[2] contains the set of mortality tables that are currently being used by commercial life insurance companies. It has been found that individuals who receive annuities have a longer life expectancy than those who do not; thus separate mortality tables are given for these two categories of indi-

[1] 1974 Military Market Facts Book, Army Times Publishing Company, 1973, page 106.
[2] 1972 Life Insurance Fact Book, Institute of Life Insurance, New York, page 108.

viduals. Since a military retiree does receive a pension, the annuity life expectancy would be appropriate in his case. According to this table, a military retiree could expect to live 34 years after retirement. Thus an estimate of the total retirement recreation benefit that an individual would receive is $34\ {}_{r}B_{i}$.

Because the retirement benefits are received over a number of years, it is unlikely that an individual would perceive the value of each year's savings as being the same. The discount rate, δ, is the premium that an individual would be willing to pay in order to convert future money into present money; or it can be thought of as an interest rate that a person is willing to pay on a loan that would be repaid out of assured future income.

Our task is to compute the expected present value of future retirement recreation benefits that result from service performed during one year of active duty. Because of the discount factor δ, the benefits received during the second year of retirement have a present value of only ${}_{r}B_{i}/(1+\delta)$ with respect to the first year of retirement; and the benefits received during the third year of retirement have a present value of only ${}_{r}B_{i}/(1+\delta)^{2}$ with respect to the first year of retirement. Thus the present value, with respect to the first year of retirement, of all benefits received over 34 years is given by

$$R = {}_{r}B_{i} + \frac{{}_{r}B_{i}}{(1+\delta)} + \frac{{}_{r}B_{i}}{(1+\delta)^{2}} + \ldots + \frac{{}_{r}B_{i}}{(1+\delta)^{33}}$$

$$= {}_{r}B_{i}\,(1+\delta)\,\frac{[1-(1+\delta)^{-34}]}{\delta}$$

Notice that the quantity R refers to the retirement benefits discounted to the first year of retirement; however, we are interested in computing the present value of benefits to someone still on active duty. Next, the formula for $d_1(\delta)$ will be derived, which was defined to be the discount factor for determining the annual discounted future retirement recreation benefits perceived per first-term enlistee who has decided to reenlist. The average number of years of active service at the time of retirement is 22.0 for enlisted men (all services), assuming non-disability retirements.[1] Our assumption is that reenlistment decisions are made after 4, 8, 12, and 16 years. Since $d_1(\delta)$ refers to the first reenlistment decision, the total retirement benefits discounted to the 4th year are $R/(1+\delta)^{18}$, where 18 is the average number of years of active service following the first reenlistment decision. However, the length of active service that is required for retirement eligibility is 20 years, or 16 years following the first reenlistment decision. Thus the average discounted retirement benefits per year or remaining required service is given by

$$\frac{R}{16(1+\delta)^{18}}$$

But not all enlistees will retire. According to data supplied by the Bureau of Naval Personnel, the average reenlistment rate for career enlisted men is .917. Thus the perceived probability that an individual who decides to reenlist after 4 years will eventually retire is $(.917)^3$. Thus the annual discounted retirement benefits perceived by a first-term enlistee who has

[1] 1974 Military Market Facts Book, page 106.

decided to reenlist is given by

$$r^{B_i} \cdot d_1(\delta) = \frac{R(.917)^3}{16(1+\delta)^{18}}$$

or

$$d_1(\delta) = (1+\delta) \frac{[1-(1+\delta)^{-34}]}{\delta} \cdot \frac{(.917)^3}{16(1+\delta)^{18}}$$

Next, the formula for $d_3(\delta)$ will be derived, which refers to career enlisted personnel. In this case, a career enlisted man would be making his reenlistment decision at either his 8th, 12th, or 16th year. First consider someone who has decided to reenlist after 8 years. The total retirement benefits discounted to the 8th year are $R/(1+\delta)^{14}$, where 14 is the average number of years of active service that remain. Because the remaining length of required service is 12 years, the average discounted benefits per year of remaining required service are

$$\frac{R}{12(1+\delta)^{14}}$$

Because reenlistment decisions will be made at 12 and 16 years, the perceived probability that an individual who reenlisted after eight years will retire is $(.917)^2$. Thus, the expected retirement benefits for someone who reenlists after eight years is

$$D(8) = \frac{R(.917)^2}{12(1+\delta)^{14}} .$$

Using similar arguments, the expected retirement benefits for someone who reenlists after 12 years is

$$D(12) = \frac{R(.917)}{8(1+\delta)^{10}} \quad ;$$

and the benefits for someone who reenlists after 16 years is

$$D(16) = \frac{R}{4(1+\delta)^6}$$

Thus the annual value of retirement recreation benefits per career enlistee who has decided to reenlist for another term is given by

$$_rB_3 \cdot d_3(\delta) = w(8)\, D(8) + w(12)\, D(12) + w(16)\, D(16),$$

so that

$$d_3(\delta) = (1+\delta)\, \frac{[1-(1+\delta)^{-34}]}{\delta} \left[\frac{w(8)(.917)^2}{12(1+\delta)^{14}} + \frac{w(12)(.917)}{8(1+\delta)^{10}} + \frac{w(16)}{4(1+\delta)^6} \right]$$

where w(8), w(12) and w(16) are the fractions of personnel at the 8, 12, and 16 year decision points, respectively. The following values were estimated using Bureau of Naval Personnel data: w(8) = .187, W(12) = .441, and w(16) = .372.

Next, the formula for $d_2(\delta)$ will be derived, which refers to first-term officers. The average number of years of active service at the time of retirement is 25.2 for officers (all services), assuming non-disability retirements.[1] Our assumption is that an officer completes his minimum service requirements after 5 years, and makes his decision on whether or not to continue at that time. The total retirement benefits discounted to the fifth year are $R/(1+\delta)^{20}$, where 20 is the average number of years of active service following the 5th year. However, the length of active service that is required for retirement eligibility is 20 years, or 15 years following the 5th year. Thus the average discounted retirement benefits per year of remaining required service is given by

$$\frac{R}{15(1+\delta)^{20}}$$

[1] 1974 Military Market Facts Book, page 106.

But not all officers will retire. Based upon data received from the Bureau of Naval Personnel, we estimated the probability to be .47 that an officer will retire given that he has decided to continue past his first-term. Thus the annual discounted retirement benefits perceived by a first-term officer who has decided to continue is given by

$$ {}_{r}B_2 \cdot d_2(\delta) = \frac{R(.47)}{15(1+\delta)^{20}} $$

and

$$ d_2(\delta) = (1+\delta)\ \frac{[1 - (1+\delta)^{-34}]}{\delta}\ \cdot \frac{(0.47)}{15(1+\delta)^{20}} $$

The foregoing formulas enable us to compute $d_i(\delta)$ for specific values of δ, the discount rate. These values of $d_i(\delta)$ are shown in Table 8.7 for[1] $\delta = 0, 0.04, 0.05, 0.06, \infty$.

8.5 Salary and Tax Rates (s_i, T_i)

Table 8.8 shows the calculation of s_1, the reenlistment salary for first-term enlisted personnel. The reenlistment salary includes total military compensation except retirement pay. It is based on a weighted average of compensation, by pay grade, for the period of time immediately following reenlistment.

The tax rate T_1 is computed as follows: The weighted average reenlistment base pay (from columns 2 and 4 of Table 8.8) is about $5500. For tax purposes, we assume that base pay is the great bulk of taxable wages and that the rate for a single person applies. If the enlistee were married with a working

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[1] $\delta = 0$ corresponds to no discounting of future benefits, whereas $\delta = \infty$ corresponds to no value for future benefits.

TABLE 8.7

VALUES OF $d_i(\delta)$ AS A FUNCTION OF δ

	$\delta = 0$	$\delta = 0.04$	$\delta = 0.05$ BASE CASE	$\delta = 0.06$	$\delta = \infty$
$d_1(\delta)$	1.638	0.455	0.3404	0.275	0
$d_2(\delta)$	1.065	.274	0.2007	0.149	0
$d_3(\delta)$	5.33	2.19	1.820	1.517	0

TABLE 8.8

CALCULATION OF REENLISTMENT SALARY s_1 (for first-term enlisted personnel)

(1) Pay Grade	(2) Fraction of First-term Reenlistment Eligibles in This Grade[1]	(3) Basic Monthly Pay in Years 5 - 6[2]	(4) =12x(3) Basic Annual Pay in Years 5 - 6	(5) Ratio of Total Compensation (Excluding Retirement) to Basic Pay[2]	(6) =(5)x(4) Annual Total Compensation	(7) =(2)x(6)
E-9	.000	$919	$11,028	1.338	$14,755	0
E-8	.000	771	9,252	1.393	12,888	0
E-7	.002	624	7,488	1.435	10,745	21.49
E-6	.020	550	6,600	1.505	9,933	198.66
E-5	.391	486	5,832	1.561	9,104	3,559.57
E-4	.496	473	5,676	1.568	8,900	4,414.38
E-3	.074	431	5,172	1.494	7,727	571.80
E-2	.015	363	4,356	1.388	6,046	90.69
E-1	.002	326	3,912	1.617	6,326	12.65
TOTAL	1.000					$8,869 = s_1

1 Based on data supplied by the Bureau of Naval Personnel

2 Source: 1974 Military Market Facts Book (published by Army Times Publishing Co.)

spouse, the result would be roughly comparable. If the spouse were not working, the result would change only slightly. Assuming $825 for a standard deduction and $750 for a personal exemption, the net taxable income is $3925, resulting in a Federal tax rate of 19%. Assuming about 1% for state income tax yields $T_1 = 20\%$.

The calculation of s_2, the salary for officers in the initial years following the minimum obligation, is based on pay data for grade O-3 with 5-6 years of service. The annual basic pay is $12,600 and the ratio of total compensation (excluding retirement) to basic pay is 1.385. Thus the total compensation s_2 is $17,451. The tax rate T_2 is computed analogously to T_1 and is found to be 27%.

Table 8.9 shows the calculation of s_3, the reenlistment salary for career enlisted personnel. It is based on a weighted average of compensation, by pay grade, for the period of time immediately following reenlistment. The tax rate T_3 is computed analogously to T_1 and is found to be 26%.

8.6 Retention and Elasticity (R_i, e_i)

The reenlistment rate R_1 for first-term enlisted personnel was .230 over the period July 1, 1972, to June 30, 1973. The reenlistment rate R_3 for career enlisted personnel was .917 over the same period of time. These figures were provided by the Bureau of Naval Personnel.

The elasticity of reenlistment is defined to be the percentage change in the reenlistment rate that is caused by a one percent change in military compensation, holding civilian compensation fixed. (For officers, the first-term reenlistment rate refers to the fraction who continue beyond the first-term, among those eligible to continue.) For our models, we need estimates for the three elasticities e_1, e_2, and e_3 for first-term enlisted personnel, first-term officers, and career enlisted personnel, respectively.

TABLE 8.9

CALCULATION OF REENLISTMENT SALARY s_3 (for career enlisted personnel)

(1) Pay Grade	(2) Fraction of Career Reenlistment Eligibles in This Grade[1]	(3) Likely Year of Reenlistment (Based on Average Length of Service)[2]	(4) Basic Monthly Pay After Reenlistment[2]	(5) =12x(4) Basic Annual Pay After Reenlistment	(6) Ratio of Total Compensation (Excluding Retirement) to Basic Pay[2]	(7) =(6)x(5) Annual Total Compensation	(8) =(2)x(7)
E-9	.029	25	$1,079	$12,948	1.338	$17,324	$ 502.40
E-8	.072	21	899	10,788	1.393	15,027	1,081.94
E-7	.270	17	761	9,132	1.435	13,104	3,538.08
E-6	.441	13	645	7,740	1.505	11,648	5,136.77
E-5	.154	9	539	6,468	1.561	10,096	1,554.78
E-4	.030	9	492	5,904	1.568	9,257	277.71
E-3	.004	9	431	5,172	1.494	7,726	30.90
E-2	.000	9	363	4,356	1.388	6,046	0
E-1	.000	9	326	3,912	1.617	6,325	0
TOTAL	1.000						$12,123 = s_3

1 Based on data supplied by the Bureau of Naval Personnel

2 Source: 1974 Military Market Facts Book (published by Army Times Publishing Co.)

There have been two recent studies which have used econometric methods in order to estimate e_1. These are reported in the following documents.

1. "Navy Re-enlistments: The Role of Pay and Draft Pressure", in Studies Prepared for the President's Commission on an All-Volunteer Armed Force, November 1970.
2. Summary of Econometric Analysis of Factors Influencing First Term Reenlistment Decisions, Center for Naval Analyses, March 1972.

The former study shows estimates for e_1 ranging from a low of 2.15 to a high of 4.91. The latter shows an estimate of e = 2.0. In an effort to be conservative, we have selected $e_1 = 2.0$ for this recreation program study, with the knowledge that all previous estimates have been at least this great.

There have been no studies made as to the magnitude of e_2 and e_3. It is felt that these are probably lower than e_1 because of the more professional calibre of the personnel concerned. For our purposes, estimates of $e_2 = e_3 = 1.0$ will be used as a base case and sensitivity analyses will be performed using higher and lower values.

8.7 Billet Costs and Replacement Costs (h_i, t_i, H_i)

The annual first-term enlisted billet cost h_1 is based on the report, Navy Military Billet Cost Data for Life Cycle Planning Purposes. This report gives billet cost as a function of pay grade and rating. These costs were weighted by the fraction of first-term personnel in each pay grade. An unweighted average was used in averaging over all of the ratings within a grade, as there was not significant variation between the different ratings. The result of these calculations is a billet cost of $13,707 which, multiplied by the length of time t_1 in a billet, yields the additional manpower cost associated with each additional first-term enlisted man. However, the

[1] Navy Military Manpower Billet Cost Data for Life Cycle Planning Purposes, NAVPERS 15163, Occupational Systems Branch, Personnel Plans Division, Bureau of Naval Personnel, Department of the Navy, July 1973.

addition of one first-term enlisted man may be of some monetary value to the Navy (e.g. as a substitute for a civilian employee) and this value should be deducted from the billet cost to yield a net cost for each additional enlisted man. The value to be deducted was assumed to be the average first-term compensation, estimated to be \$7141. This yields h_1 = \$13,707 - 7141 = \$6566.

The billet cost \$13,707 before the \$7141 credit would be appropriate if one assumes that additional first-term personnel serve no value other than to provide a pool of personnel who may continue into the career force.

The annual first-term officer billet cost h_2 is based on the same report given above. This report tabulates billet cost as a function of pay grade and officer designator. These costs were weighted by the fraction of first-term officers in each pay grade and designator, the appropriate fractions obtained from a special tabulation provided by the Bureau of Naval Personnel. The result of these calculations is a billet cost of \$35,301 which, multiplied by the length of time t_2 in a billet, yields the additional manpower cost associated with each additional first-term officer. However, the addition of one first-term officer may be of some monetary value to the Navy, and this value should be deducted from the billet cost. The value to be deducted was assumed to be the average first-term compensation, estimated to be \$13,201. This yields h_2 = \$35,301 - 13,201 = \$22,100. The higher cost \$35,301 is used in one of the sensitivity analyses of Section 9.0.

The average time in a billet during the first-term, for enlisted personnel and officers, respectively, is estimated to be t_1=3.06 years and t_2=3.43 years, based on data supplied by the Bureau of Naval Personnel.

The replacement cost per man, H_1, for first-term enlisted personnel is based on calculations performed in the report, Determination of Manpower Cost Implication Associated with Changes in Navy Reenlistment Rates,

Naval Personnel Research and Development Laboratory. March 1971. In this report, it is estimated that basic and training costs associated with replacing 942.2 men who do not reenlist are $14,683,934, or $15,585 per man. This cost is based on the assumption that a person reenlisting at the end of the first-term is expected to serve longer in the Navy than a new first-term replacement. Hence, each person not reenlisting must ultimately be replaced by more than one person (in fact a ratio of 3.2 to 1 is used).

The cost estimates in the above report are based on the July 1970 edition of Training Time and Costs for Navy Ratings and NECs, Naval Personnel Research and Development Laboratory. The May 1974 version of this latter report shows that basic costs have increased from $1656 to $2702, or by a factor of 1.632. This factor is multiplied by the replacement cost of $15,585 to obtain an updated H_1 = $25,428.

With regard to the above calculation of H_1, the reader should note the following:

1. The replacement cost is conservative in that it does not include on-the-job training costs, class B school costs, or costs associated with secondary NEC's. The report also states, "throughout the study a continued effort was made to avoid inflating the calculated costs. All of the reported costs are considered to be minimum estimates."
2. When a first-term person does not reenlist and is instead replaced by new recruits, there are certain savings such as reenlistment bonuses, additional dependents medical care, expected future retirement payments, and active duty pay (lower for new recruits than for a reenlistment). At the same time, however, there is a reduction in force effectiveness due to a force composition of

less experienced personnel. We assume in the Replacement Model that the above savings (due to a less senior, less experienced force) exactly compensate for the reduction in force effectiveness (due again to a less senior, less experienced force); that the Navy, in effect, "gets what it pays for." For this reason, we have not modified the replacement costs (downward) to reflect these various savings; at the same time, we have not attempted to place a monetary value on the reduction of force effectiveness.

The calculation for H_3, the career enlisted replacement cost, is analogous, yielding H_3 = $20,929.

9.0 DETAILED ANALYSIS AND RESULTS

This section uses the retention cost models of Section 7.0 and the parameter estimations of Section 8.0 to develop estimates of the increases in recruiting and training costs likely to be incurred if the Navy's Recreation Program were to be reduced in scope or closed. Cost-effectiveness ratios are then obtained utilizing the costs developed in Section 6.0. This section is divided into four major Subsections. Section 9.1 discusses the definitions of various cost-effectiveness ratios and other measures; Section 9.2 has the results for all the bases as one group, which has been termed the National results. Section 9.3 addresses the analysis and results for the various mission and geographical groupings of the bases, and Section 9.4 demonstrates and compares the results of various personnel groupings.

9.1 Basic Definitions

This section contains for the reader's convenience the definitions of the various measures resulting from the analysis.

9.1.1 Model Parameters

The equations utilized to estimate the cost increases in recruiting and training to the Navy resulting from reduced retention rates (following reduction in the Navy's Recreation Program) are:

Career Force Model:

$$\text{Cost Increase} = \sum_{i=1}^{2} \left(\frac{h_i \, t_i \, U_i \, e_i}{(1-\varepsilon_i)} \right) \left(\frac{(B_i + {}_rB_i \, d_i(\delta))}{(1-T_i) \, s_i} \right) \qquad (9.1)$$

Replacement Model:

$$\text{Cost Increase} = H_1 \, U_1 \, R_1 \, e_1 \left(\frac{(B_1 + {}_rB_1 \, d_1(\delta))}{(1-T_1) \, s_1} \right) \qquad (9.2)$$

$$+ \frac{h_2 \, t_2 \, U_2}{(1-\varepsilon_2)} \, e_2 \left(\frac{B_2 + {}_rB_2 \, d_2(\delta)}{(1-T_2) \, s_2} \right) + H_3 \, U_3 \, R_3 \, e_3 \left(\frac{B_3 + {}_rB_3 \, d_3(\delta)}{(1-T_3) \, s_3} \right)$$

where,

$$\varepsilon_i = e_i \frac{B_i + r B_i d_i(\delta)}{(1-T_i)s_i}$$

Table 9.1 contains the definitions and estimates for the parameters used in the two models above.

9.1.2 Cost-Effectiveness Ratios

Using the equations 9.1 and 9.2 and the estimated values of the parameters shown in Table 9.1, one is able to estimate the cost increase resulting from lowered retention that is itself a reaction to the reduction in implicit compensation resulting from closing all or part of the Navy's Recreation Program. In Section 6.0, the income and expenses of the Navy's Recreation Program and the various Recreation Categories have been estimated. Combining this cost information with the cost increase information developed here enables one to estimate the net cost impact in the form of cost-effectiveness (benefit-to-cost) ratios calculated using the following equation:

$$\text{Cost Effectiveness Ratio for a Recreation Category at a Base} = \frac{\text{Increase in Annual Retention Costs resulting from closing the Recreation Category at the base.}}{\text{Annual Net Expense saved due to the closure of this Recreation Category at the base.}}$$

TABLE 9.1

DEFINITIONS AND ESTIMATES FOR MODEL PARAMETERS

Parameter	Definition	Value(s)
h_1	Average annual first-term billet cost for enlisted personnel	$ 6,566
h_2	Average annual first-term billet cost for officers	22,100
t_1	Average time (years) in a billet during first term for enlisted personnel	3.06
t_2	Average time (years) in a billet during first term for officers	3.43
e_1	Elasticity of reenlistment for first-term enlisted personnel	2
e_2	Elasticity of reenlistment for first-term officers	1
e_3	Elasticity of reenlistment for career enlisted personnel	1
B_1	Yearly recreation benefit on active duty (excluding perceived future savings), for first-term enlisted personnel who will make their reenlistment decision within one year	Varies from base to base and category to category
B_2	Yearly recreation benefit on active duty (excluding perceived future retirement savings), for first-term officers who will make their continuation decision within one year	Varies from base to base and category to category
B_3	Yearly recreation benefit on active duty (excluding perceived future retirement savings), for career enlisted personnel who will make their reenlistment decisions within one year	Varies from base to base and category to category
$_rB_1$	Yearly recreation benefit in retirement for first-term enlisted personnel who will make their retirement decisions within one year	Varies from base to base and category to category
$_rB_2$	Yearly recreation benefit in retirement for first-term officers who will make their continuation decision within one year	Varies from base to base and category to category
$_rB_3$	Yearly recreation benefit in retirement for career enlisted personnel who will make their reenlistment decision within one year	Varies from base to base and category to category
$d_1(\delta)$	The discount factor, which when multiplied times $_rB_1$ yields current expected value of entire future retirement recreation benefits, ammortized over remaining years to retirement, perceived by a first-term enlisted man who has decided to reenlist	0.3404 (based on a 5% discount rate)

TABLE 9.1 (Continued)

Parameter	Description	Value(s)
$d_2(\delta)$	The discount factor which when multiplied times $_rB_2$ yields current expected value of entire future retirement recreation benefits, amortized over remaining years to retirement, perceived by a first-term officer who has decided to continue	0.2007 (based on a 5% discount rate)
$d_3(\delta)$	The discount factor which when multiplied times $_rB_3$ yields current expected value of entire future retirement recreation benefits, amortized over remaining years to retirement, perceived by a career enlisted man who has decided to reenlist	1.820 (based on a 5% discount rate)
U_1	Annual number of first-term enlisted personnel eligible to reenlist (estimated for each base)	See Table 8.6
U_2	Annual number of first-term officer personnel eligible to reenlist (estimated for each base)	See Table 8.6
U_3	Annual number of career enlisted personnel eligible to reenlist (estimated for each base)	See Table 8.6
T_1	Tax rate after reenlistment by first-term enlisted personnel	.20
T_2	Tax rate for officers in first years following minimum obligation	.27
T_3	Average tax rate after reenlistment by career enlisted personnel	.26
s_1	Reenlistment salary for first-term enlisted personnel	$ 8,869
s_2	Salary for officers in first years following minimum obligation	$17,451
s_3	Average reenlistment salary for career enlisted personnel	$12,123.
H_1	Replacement cost per man for first-term enlisted personnel	$25,428 [2]
H_3	Replacement cost per man for career enlisted personnel	$20,929 [2]
R_1	Reenlistment rate for first-term enlisted personnel	.230
R_3	Reenlistment rate for career enlisted personnel (average probability of reenlistment for third term or above)	.917

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[1] Both B_i and $_rB_i$ are estimated with respect to a specific base and a specific activity or set of activities. The specific values are given in the body of the text. See Section 6.1.

[2] This cost is based on the assumption that a person reenlisting is expected to serve longer in the Navy than a new first-term replacement. Hence, each person not reenlisting must ultimately be replaced by more than one person.

The cost-effectiveness ratio for the Overall Recreation Program would be similar by considering the net expenses and increase in retention costs for the total Recreation Program at the base.

In obtaining cost-effectiveness ratios for a group of bases, one utilizes the sum of net expenses for the appropriate Recreation Category at these bases and the sum of the increase in retention costs from closing the Recreation Category at all these bases.

Furthermore, when considering increases in annual retention cost, there are two possible models, Career Force and Replacement, giving rise to two different cost-effectiveness measures.

Also, while considering net expense, there are two different levels, as discussed in Section 6.0. One level includes the Net Operating Expense plus a yearly apportionment of Initial Acquisition cost (INA). The second utilizes a yearly apportionment of the Replacement (REP) cost along with the Net Operating Expense. The cost-effectiveness ratios based on the latter costs are naturally lower. They reflect the economic feasibility of building new facilities at current costs.

Table 9.2 is a sample output of the cost-effectiveness calculations for Golf Facilities at all bases. It has been numbered down the left-hand side of the page for ease of exposition. Line 1 identifies the specific Recreation Category and the group of bases at which consideration for elimination is made. Lines 2 and 3 identify the appropriate costs. Line 4 indicates the section where the model parameter values are provided. Lines 5 through 7 contain the information on cost impact by personnel category, model and source of benefit (active or retired), e.g., the total increase in annual retention costs due to the effect on first-term officers is $544,200 under the Career Force Model. Line 8 provides the totals of these costs impacts. Line 9 gives the cost-effectiveness ratios by model and type of expense, i.e., 5.586 is the ratio of

TABLE 9.2

TOTAL INCREASE IN ANNUAL RETENTION COSTS (IN $ 000'S) RESULTING FROM CLOSING GOLF FACILITIES AT ALL BASES

ANNUAL NET OPERATING EXPENSE PLUS APPORTIONED INITIAL ACQUISITION COSTS (IN 000'S) = $ 1160.3
ANNUAL NET OPERATING EXPENSE PLUS APPORTIONED CURRENT REPLACEMENT COSTS (IN 000'S) = $ 1813.1

VARIABLE PARAMETER VALUES:

ENLISTED FIRST TERM	OFFICER FIRST TERM	ENLISTED CAREER
ANNUAL BILLET COST=$ 6566.	ANNUAL BILLET COST=$22100.	-- .
REENL ELASTICITY= 2.0	REENL ELASTICITY= 1.0	REENL ELASTICITY= 1.0

RETIREMENT BENEFITS DISCOUNTED @ 5% IN BOTH MODELS FOR ALL THREE CATEGORIES

PERSONNEL CATEGORY	CAREER FORCE MODEL			REPLACEMENT MODEL		
	ACTIVE	RETIRED	TOTAL	ACTIVE	RETIRED	TOTAL
ENLISTED FIRST TERM	4251.5	1685.6	5937.2	1217.2	482.6	1699.8
OFFICER FIRST TERM	443.3	100.9	544.2	443.3	100.9	544.2
ENLISTED CAREER				488.5	987.6	1476.1
TOTAL	4694.8	1786.6	6481.4	2149.1	1571.1	3720.1
COST EFFECTIVENESS RATIOS INA:	5.586			3.206		
COST EFFECTIVENESS RATIOS REP:	3.575			2.052		

AVERAGE BENEFITS LOST PER PERSON PER YEAR RESULTING FROM ABOVE CLOSURE (IN DOLLARS)

PERSONNEL CATEGORY	ASHORE		AFLOAT		WEIGHTED AVERAGE	
	ACTIVE	RETIRED	ACTIVE	RETIRED	ACTIVE	RETIRED
ENLISTED FIRST TERM	48.	57.	38.	44.	41.	48.
OFFICER FIRST TERM	71.	81.	64.	75.	67.	78.
ENLISTED CAREER	54.	59.	39.	44.	44.	49.

ENL 1ST ASHORE= 28301. ENL 1ST AFLOAT= 57659. TOTAL ENL 1ST= 85960.
OFF 1ST ASHORE= 2535. OFF 1ST AFLOAT= 2635. TOTAL OFF 1ST= 5170.
ENL CAREER ASHORE= 15638. ENL CAREER AFLOAT= 28338. TOT ENL CAREER= 43976.

$6,481,400 to $1,160,300. Lines 10 through 12 tabulate the average increase in pay values by various personnel classification and their weighted average by duty station. Lines 13 through 15 are the populations of the personnel categories at all bases which have Golf Facilities; these are the numbers used for obtaining the weighted average of Afloat and Ashore personnel.

Appendix 9.1-1 contains 14 tables, one for each Recreation Category at all bases.

9.1.3 Usage Percentage

In Question 1., asked for each Recreation Category (see Questionnaire in Appendix A.2.5-1) the surveyed people were asked to identify their (including dependents) level of usage of the recreation facilities. The scale for responses varied from 'Never' (do not use) to 'Frequently' (3 or more times per month). These responses have been consolidated to obtain the usage percentage, defined as follows.

$$\text{Usage percentage of a Recreation Category at a given base} = 1 - \frac{\text{Number of people in sample responding 'Never' to the Recreation Category.}}{\text{Total number of people in sample at that base.}}$$

When finding usage percentages for a Recreation Category at a group of bases, the numerator and denominator of the expression above are for those bases in the group of bases where the Recreation Category is available.

There was no question asked about the usage of the Overall Recreation Program. However, using cluster analysis,[1] some conclusions are drawn about the overall usage.

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[1] See Section 10.0

9.1.4 Annual Cost/Person

There are two types of capital costs considered in Section 6.0 on Income and Expenses. One considers the capital costs of Initial Acquisition whereas the other looks at capital costs for Replacement. These are estimated in addition to the Net Operating Expenses for individual Recreation Categories. Based on these two different estimates of capital costs, there are two distinct cost/person values. These are:

$$\text{Annual Cost/Person (INA) for a recreation category at a group of bases} = \frac{\text{Net annual operating expense + yearly apportionment of Initial Acquisition Cost for the Recreation Category at the group of bases.}}{\text{Eligible active duty personnel at the same group of bases.}}$$

and

$$\text{Annual Cost/Person (REP) for a recreation category at a group of bases} = \frac{\text{Net annual operating expense + yearly apportionment of Replacement cost for the Recreation Category at the group of bases.}}{\text{Eligible active duty personnel at the same group of bases.}}$$

Note that while finding the total personnel at the group of bases, the bases where the Recreation Category is not available are not counted.

Similar formulae as above are used for estimating cost/person for the Overall Recreation Program.

9.1.5 Annual Savings/Person and Annual Increase in Pay/Person

Annual Savings/Person defines the yearly savings from the recreation facilities as perceived by a member of the active duty personnel. This could be defined for a certain group of people at all bases, e.g., first-termers at all bases, or for all people at a group of bases, e.g., all people at Air Stations.

The annual savings/person for a Recreation Category is obtained by weighting appropriately the responses from eight different sample strata, i.e., the eight combinations obtained by Term of Service (First/Career), Duty Station (Afloat/Ashore) and Rank (Enlisted/Officer). The weighting is done based on the population in the eight different strata for the groups under consideration.

The savings response on the questionnaire (Appendix A.2.5-1) is the answer to Question 3 for each of the Recreation Category pages. When considering the Overall Recreation Program, the answer to Question 7a on p. 17 of the questionnaire is utilized.

The measurement of Annual Increase in Pay/Person is done similarly.

The increase in pay is the answer to Question 4 on each Recreation Category page of the questionnaire. For the Overall Recreation Program, answer to Question 7b is used.

9.2 *National (All Bases) Results*

In this section are the results of the analysis for the Overall Recreation Program and the individual Recreation Categories for all the 16 bases. Table 9.3 tabulates the cost-effectiveness for the Overall Recreation Program for various cases of benefit and costs. In this Table, there are four different benefits that are considered. These are:

1) Savings (individual): This is the total savings perceived by the active duty personnel at the 16 bases from the Overall Recreation Program.

2) Increase in Pay (individual): This is the total increase in pay desired by all active duty personnel at the 16 bases from the Overall Recreation Program.

3) Additional Recruiting and Training Costs - Career Force Model, for the 16 bases;

4) Additional Recruiting and Training Costs - Replacement Model, for the 16 bases.

TABLE 9.3

COST-EFFECTIVENESS
OF OVERALL RECREATION PROGRAM

		COSTS		
		OPER	INA	REP
BENEFITS	Savings (individual)	4.15	3.63	2.55
	Increase in Pay (individual)	5.24	4.58	3.22
	Additional Recruiting and Training - Career Force Model	6.33	5.56	3.91
	Additional Recruiting and Training - Replacement Model	2.94	2.56	1.80

There are three different levels of costs that are considered in Table 9.3:

1) OPER: This is the Net Operating Expense for the Overall Recreation Program.

2) INA: This is Net Operating Expense plus yearly apportionment of Initial Acquisition capital cost for the Overall Recreation Program.

3) REP: This is Net Operating Expense plus yearly apportionment of Replacement capital cost for the Overall Recreation Program.

The cost-effectiveness ratios in Table 9.3 are the ratios of benefit to cost. The ratios in the Table vary from 1.80 to 6.33. If one is looking for a single representative number, INA costs and Career Force Model Benefits is the case to consider. The cost-effectiveness ratio in that case is 5.56.

Table 9.4 provides a ranking of the 14 Recreation Categories based on four cost-effectiveness ratios formed by using the same four benefits and INA costs. This Table shows that Dependent Services, Recreation Equipment Check-out and Entertainment are the three highest in terms of cost-effectiveness ratios whereas Swimming Pools, Golf Facilities and Organized Sports are the lowest. This is consistent across the four different rankings. The cost-effectiveness ratios alongside Sum of Categories in Table 9.4 represent the ratios obtained by summing the benefits and costs over all categories. This is higher than the cost-effectiveness ratio for Overall Recreation Program since the sum of survey responses over all 14 Recreation Categories is higher than the response on the Overall Recreation Program.

Table 9.5 is similar to Table 9.4 except that the REP costs are used instead of INA costs. It is interesting to observe that the top three and the bottom three Recreation Categories are practically the same as in the previous set of rankings in Table 9.4.

DESCRIPTION: NATIONAL - ALL BASES

TOTAL POPULATION: 145112

RANKINGS OF COST-EFFECTIVENESS RATIOS
FORMED USING NET OPERATING EXPENSE PLUS APPORTIONED INITIAL ACQUISITION COSTS

RANK BY SAVINGS C-E RATIO		RANK BY BENEFITS C-E RATIO		RANK BY CF MODEL C-E RATIO		RANK BY RP MODEL C-E RATIO	
REC EQUIP CHKOUT	14.39	DEPENDENT SRVCS	20.43	DEPENDENT SRVCS	20.99	DEPENDENT SRVCS	11.92
ENTERTAINMENT	11.99	REC EQUIP CHKOUT	18.52	REC EQUIP CHKOUT	15.94	REC EQUIP CHKOUT	10.43
DEPENDENT SRVCS	11.72	ENTERTAINMENT	17.05	ENTERTAINMENT	15.27	ENTERTAINMENT	9.50
BOWLING	10.47	MOVIES	13.05	MOVIES	14.35	BOWLING	7.29
MOVIES	10.03	BOWLING	12.95	BOWLING	13.81	MOVIES	7.27
AUTO HOBBY SHOP	8.06	BOATING/SAILING	11.97	AUTO HOBBY SHOP	11.73	BOATING/SAILING	6.43
BOATING/SAILING	8.04	AUTO HOBBY SHOP	10.41	BOATING/SAILING	11.70	AUTO HOBBY SHOP	5.87
OUTDOOR REC	6.58	CRAFT HOBBY SHOP	9.12	CRAFT HOBBY SHOP	9.62	CRAFT HOBBY SHOP	5.27
CRAFT HOBBY SHOP	6.15	OUTDOOR REC	8.63	OUTDOOR REC	8.82	OUTDOOR REC	4.86
INFORMAL SPORTS	6.12	INFORMAL SPORTS	7.79	INFORMAL SPORTS	8.55	INFORMAL SPORTS	4.27
OTH REC SERVICES	5.50	OTH REC SERVICES	6.98	OTH REC SERVICES	7.60	OTH REC SERVICES	3.92
ORGANIZED SPORTS	4.71	ORGANIZED SPORTS	6.90	ORGANIZED SPORTS	7.37	ORGANIZED SPORTS	3.90
GOLF FACILITIES	3.56	GOLF FACILITIES	5.34	SWIMMING POOLS	5.71	GOLF FACILITIES	3.21
SWIMMING POOLS	3.50	SWIMMING POOLS	5.37	GOLF FACILITIES	5.59	SWIMMING POOLS	3.02
SUM OF CATEGORIES	7.06	SUM OF CATEGORIES	9.66	SUM OF CATEGORIES	15.08	SUM OF CATEGORIES	5.48
OVERALL REC PROGM	3.63	OVERALL REC PROGM	4.58	OVERALL REC PROGM	5.56	OVERALL REC PROGM	2.56

TABLE 9.4

DESCRIPTION: NATIONAL - ALL BASES

TOTAL POPULATION: 145112

RANKINGS OF COST-EFFECTIVENESS RATIOS
FORMED USING NET OPERATING EXPENSE PLUS APPORTIONED CURRENT [illegible] COSTS

RANK BY SAVINGS C-E RATIO		RANK BY BENEFITS C-E RATIO		RANK BY CC MODEL C-E RATIO		RANK BY PP MODEL C-E RATIO	
REC EQUIP CHKOUT	11.17	ENTERTAINMENT	15.41	ENTERTAINMENT	17.43	ENTERTAINMENT	8.59
ENTERTAINMENT	10.64	REC EQUIP CHKOUT	14.37	REC EQUIP CHKOUT	15.48	REC EQUIP CHKOUT	8.09
AUTO HOBBY SHOP	7.36	DEPENDENT SRVCS	12.22	DEPENDENT SRVCS	12.54	DEPENDENT SRVCS	7.12
DEPENDENT SRVCS	7.00	AUTO HOBBY SHOP	9.50	AUTO HOBBY SHOP	10.71	AUTO HOBBY SHOP	5.36
BOWLING	6.95	BOATING/SAILING	9.04	BOWLING	9.17	BOATING/SAILING	4.86
OUTDOOR REC	6.32	BOWLING	8.59	BOATING/SAILING	8.83	BOWLING	4.83
BOATING/SAILING	6.07	OUTDOOR REC	8.29	OUTDOOR REC	8.48	OUTDOOR REC	4.67
MOVIES	5.23	MOVIES	6.80	MOVIES	7.48	MOVIES	3.79
OTH REC SERVICES	4.77	CRAFT HOBBY SHOP	6.45	CRAFT HOBBY SHOP	6.81	CRAFT HOBBY SHOP	3.73
CRAFT HOBBY SHOP	4.35	OTH REC SERVICES	6.07	OTH REC SERVICES	6.60	OTH REC SERVICES	3.41
INFORMAL SPORTS	3.21	INFORMAL SPORTS	4.09	INFORMAL SPORTS	4.49	INFORMAL SPORTS	2.24
GOLF FACILITIES	2.28	GOLF FACILITIES	3.54	SWIMMING POOLS	3.61	GOLF FACILITIES	2.05
ORGANIZED SPORTS	2.25	SWIMMING POOLS	3.39	GOLF FACILITIES	3.57	SWIMMING POOLS	1.91
SWIMMING POOLS	2.21	ORGANIZED SPORTS	3.30	ORGANIZED SPORTS	3.53	ORGANIZED SPORTS	1.87
SUM OF CATEGORIES	4.80	SUM OF CATEGORIES	6.57	SUM OF CATEGORIES	10.25	SUM OF CATEGORIES	3.73
OVERALL REC PROGM	2.55	OVERALL REC PROGM	3.22	OVERALL REC PROGM	3.91	OVERALL REC PROGM	1.80

TABLE 9.5

Table 9.6 provides an interesting economic evaluation of the Overall Recreation Program at the 16 bases. The total investment in replacing the recreational facilities at these bases is over $90 million (see Section 6.0). If one considers savings of over $52 million as a return on the Navy's investment, Table 9.6 shows that the Navy obtains a return on investment of over 44%. This is a significantly high number.

9.3 Groupings of Bases

The 16 bases have been grouped by geographical areas (North/South and East/West) and by missions (six altogether). Table 2.1 indicates where each base belongs in these groupings. There are five bases in the Northern group, 11 in the Southern group; five in the Western group and 11 in the Eastern. Furthermore, in the sample of 16 bases, there are 3 Air Stations, 3 Fleet Support Installations, 2 Hospitals, 2 Shipyards, 3 Small Isolated Installations, and 3 Training Centers. This section discusses and compares some of the results for each of these distinct groupings of bases.

Table 9.7 compares Savings, Increase in Pay and Cost/Person across the various groups. This Table shows that people at Training Centers perceive the highest Savings ($490.10) and those at the Hospitals perceive the lowest ($266.70) from the Overall Recreation Program. The annual Increase in Pay/Person follows the same pattern as the Savings/Person. In terms of Cost/Person, the Fleet Support Installations are the lowest and the Small Isolated Installations the highest. This is very likely due to the larger population at the Fleet Support Installations and the small populations at the Small Isolated Installations. Among the geographical groupings, the Northern bases cost more per person than the Southern bases and also people save more at the Northern bases. In the East/West comparison, the Eastern bases cost more per person than the Western bases. Note should be made of the fact that there are interacting effects between geography of a

TABLE 9.6

RETURN ON INVESTMENT

Investment	$ 90.701M
Income From Fees and Charges	6.808M
Savings (To Individual)	52.676M
Expenses	19.493M
Net Return (Income & Savings - Expenses)	$ 39.991M

RETURN ON INVESTMENT = 44.09%

TABLE 9.7

ANNUAL SAVINGS, INCREASE IN PAY & COST/PERSON IN DOLLARS - BY GROUPS OF BASES

FOR OVERALL RECREATION PROGRAM

BASE	Annual Savings/Person	Annual Increase in Pay/ Person	Annual Cost/Person (INA)	Annual Cost/Person (REP)
NATIONAL.....	$363.00	$458.40	$100.10	$142.47
GEOGRAPHICAL AREAS:				
NORTH.....	431.40	505.00	136.33	213.34
SOUTH.....	348.90	448.80	92.65	127.88
EAST.....	387.80	476.10	117.96	163.12
WEST.....	332.20	436.50	78.02	116.94
MISSIONS:				
AIR STAIONS.....	371.60	445.10	132.61	178.44
FLEET SUPPORT.....	317.00	431.10	62.46	80.55
HOSPITALS.....	266.70	367.50	137.67	198.41
SHIPYARDS.....	342.70	446.80	92.29	186.18
SMALL ISOLATED.....	372.90	476.20	390.37	495.67
TRAINING CENTERS.....	490.10	548.60	168.18	241.55

base and its mission but our sample of bases is not large enough to identify and isolate this interaction.

Tables 9.8 through 9.12 compare groups of bases by individual Recreation Categories[1]. Table 9.8 compares the usage patterns across the 6 different missions. The highest usage percentages are at Small Isolated Installations, as one would expect since they are the farthest from commercial alternatives. The lowest usage is at Fleet Support Installations, possibly because these bases have the largest afloat populations. Golf Facilities and Boating/Sailing are the two least-used Recreation Categories across all missions.

Table 9.9 shows the annual Savings/Person by individual Recreation Category. This Table shows that people at Training Centers and Small Isolated Installations perceive the highest savings from the Recreation Categories. Of all the Recreation Categories, Outdoor Recreation has the largest variation in Savings across missions, from a high of $78.00 at Training Centers to a low of $32.30 at Hospitals. Shipyards and Hospitals have the lowest perception of savings.

Table 9.10 tabulates the cost-effectiveness for Recreation Categories based on the Career Force Model and INA costs. Fleet Support Installations have the highest cost-effectiveness for 8 of the 14 Recreation Categories. The only Recreation Category having cost-effectiveness less than one (0.68) is Other Recreation Services at Small Isolated Installations. There are two categories, Dependent Services at Small Isolated Installations and Golf Facilities at Shipyards that are self-supporting, i.e., the fees for these categories exceed their expense.

Table 9.11 compares the Eastern bases vs. the Western bases in terms of Savings, INA costs and cost-effectiveness. Costs/person are about 50% higher in the East than in the West ($117.96 to $78.02) for the Overall Recreation

[1] The reader is urged to refer to the base Recreation Category description sheets of Appendix A.2.4 when analyzing these results. For example, at large bases Golf Facilities actually includes a golf course, while at some small bases it only involves golf club rental or discount tickets for civilian courses.

TABLE 9.8

USAGE PERCENTAGE BY RECREATION CATEGORIES - BY MISSION OF BASE

RECREATION CATEGORY	Air Stations	Fleet Support Install.	Training Centers	Hospitals	Shipyards	Small Isolated Install.
Auto Hobby Shop	57	46	52	N.A.	46	65
Boating/Sailing	31	20	38	N.A.	19	52
Bowling	67	62	72	44	62	77
Crafts Hobby Shop	39	27	45	N.A.	27	59
Dependent Services	33	31	43	N.A.	32	51
Entertainment	47	44	60	N.A.	38	85
Golf Facilities	28	21	33	12	19	25
Informal Sports	61	49	69	63	58	73
Movies	67	55	72	69	50	84
Organized Sports	43	37	45	55	41	79
Other Recreation Services	63	57	67	76	56	65
Outdoor Recreation	62	54	71	62	54	71
Recreation Equipment Checkout	60	49	63	58	55	69
Swimming Pools	43	35	62	52	32	N.A.

N.A. - Not available

TABLE 9.9

ANNUAL SAVINGS/PERSON BY RECREATION CATEGORY - BY MISSION OF BASE

RECREATION CATEGORY	Air Stations	Fleet Support Install.	Training Centers	Hospitals	Shipyards	Small Isolated Install.
Auto Hobby Shop	$ 71.00	$ 63.70	$ 79.00	N.A.	$ 58.10	$ 84.60
Boating/Sailing	26.00	25.80	49.90	N.A.	25.40	59.60
Bowling	65.30	54.90	76.70	37.00	53.00	73.40
Crafts Hobby Shop	34.40	28.30	45.50	N.A.	27.30	48.50
Dependent Services	27.90	28.70	48.30	N.A.	31.80	41.00
Entertainment	38.10	42.80	68.80	N.A.	32.90	86.10
Golf Facilities	32.80	23.20	43.70	20.30	22.30	17.40
Informal Sports	53.80	37.30	75.80	50.70	57.70	34.80
Movies	53.90	50.10	76.90	50.00	44.70	74.90
Organized Sports	34.80	27.10	39.30	31.20	36.70	60.20
Other Recreation Services	58.20	54.20	73.20	51.50	54.40	52.60
Outdoor Recreation	50.30	45.80	78.00	32.30	43.20	64.30
Recreation Equipment Checkout	66.70	52.60	78.30	58.80	64.30	56.10
Swimming Pools	32.60	23.40	57.70	27.60	25.10	N.A.
Overall Recreation Program	$371.60	$317.00	$490.10	$266.70	$342.70	$372.90

N.A. - Not Available

TABLE 9.10

INA COST EFFECTIVENESS - CAREER FORCE MODEL BY INDIVIDUAL RECREATION CATEGORIES BY MISSION OF BASE

RECREATION CATEGORY	Air Stations	Fleet Support Install.	Training Centers	Hospitals	Shipyards	Small Isolated Install.
Auto Hobby Shop	10.84	30.23	4.14	N.A.	10.64	4.12
Boating/Sailing	14.48	21.90	7.20	N.A.	12.46	4.93
Bowling	6.33	24.95	11.78	1.62	20.12	1.99
Crafts Hobby Shop	8.80	16.66	4.30	N.A.	12.49	1.33
Dependent Services	13.78	49.42	9.53	N.A.	20.75	---
Entertainment	79.19	16.76	40.77	N.A.	9.86	3.92
Golf Facilities	4.71	8.84	2.41	111.59	---	5.73
Informal Sports	6.87	15.68	6.31	1.42	8.62	2.94
Movies	7.04	17.39	15.66	56.72	25.26	5.02
Organized Sports	7.89	9.89	4.03	5.17	7.59	3.68
Other Recreation Services	12.14	11.58	3.28	21.03	8.71	0.68
Outdoor Recreation	6.83	12.08	5.95	13.30	9.21	5.92
Recreation Equipment Checkout	28.05	54.47	13.85	4.84	7.00	1.97
Swimming Pools	9.22	9.55	2.32	9.11	10.60	N.A.
Overall Recreation Program	4.94	9.05	3.00	2.55	5.85	1.73

--- indicates self supporting
N.A. indicates not available

TABLE 9.11

EAST/WEST COMPARISON BY INDIVIDUAL RECREATION CATEGORIES

Recreation Category	Annual Savings/Person		INA - CF Cost-Effectiveness		Annual INA Cost/Person	
	East	West	East	West	East	West
Auto Hobby Shop	$ 69.50	$ 65.10	8.41	20.29	$ 10.70	$ 5.10
Boating/Sailing	35.60	25.40	11.57	12.46	4.12	.84
Bowling	66.50	53.70	14.80	12.82	5.47	6.37
Crafts Hobby Shop	36.80	27.90	7.23	15.71	6.71	3.28
Dependent Services	38.30	27.00	17.92	26.25	3.15	2.28
Entertainment	49.70	43.60	41.21	12.23	1.66	6.47
Golf Facilities	33.60	22.70	4.78	7.21	9.62	5.93
Informal Sports	56.50	42.10	7.02	11.65	9.73	6.06
Movies	57.30	54.20	13.86	14.89	5.03	5.86
Organized Sports	33.20	30.20	5.69	11.09	8.47	4.70
Other Rec. Services	58.40	59.20	6.29	9.53	11.53	9.66
Outdoor Recreation	61.40	43.10	8.39	9.45	8.53	7.47
Rec. Equipment Checkout	64.60	57.30	19.64	20.29	4.12	4.48
Swimming Pools	39.70	23.20	3.98	12.55	13.24	4.15
Overall Rec. Program	$387.80	$332.20	4.54	7.48	$117.96	$78.02

Program. Auto Hobby Shop, Crafts Hobby Shop, Organized Sports and Swimming Pools cost considerably more per person in the East than in the West, whereas Entertainment is much higher in the West than the East ($6.47 to $1.66). Annual Savings perceived are only about 14% higher in the East than the West and consequently cost-effectiveness is only 4.54 in the East as vs. 7.48 in the West for the Overall Recreation Program.

Table 9.12 compares the Northern bases vs. the Southern bases in similar terms as Table 9.11. In terms of INA cost/person, Auto Hobby Shop, Crafts Hobby Shop, Other Recreation Services and Swimming Pools cost considerably more in the North than in the South, whereas Entertainment and Outdoor Recreation behave in a reverse manner. Overall cost-effectiveness is higher in the South (6.13) than in the North (3.69).

9.4 Personnel Categories

This section considers and compares various cross-sections of personnel in terms of their Savings, desired Increase in Pay and Usage of recreation facilities. In reviewing these results, the reader will find the breakdown of Table 5.3 (Demographic Characteristics) very helpful in delineating additional characteristics of the various cross-sections.

Table 9.13 compares Enlisted personnel vs. Officers by individual Recreation Categories as well as the Overall Recreation Program. This Table shows that 66% of the Enlisted utilize Bowling whereas only 23% use Golf Facilities. In terms of Officers, 69% of them use Informal Sports and only 42% use Boating/Sailing. Enlisted and Officers perceive about equal savings/person from the Overall Recreation Program. Enlisted perceive the highest saving from Auto Hobby Shop and the lowest from Golf Facilities. However, Officers perceive the most savings from Informal Sports and the lowest from Organized Sports ($63.30 to $26.30). Increase in Pay follows the same pattern as Savings.

TABLE 9.12

NORTH/SOUTH COMPARISON BY INDIVIDUAL RECREATION CATEGORIES

Recreation Category	Annual Savings/Person		INA - CF Cost-Effectiveness		Annual INA Cost/Person	
	North	South	North	South	North	South
Auto Hobby Shop	$ 71.20	$ 66.80	4.14	16.70	$ 19.13	$ 5.95
Boating/Sailing	43.80	30.50	16.21	10.61	2.85	2.62
Bowling	65.70	59.70	8.84	15.07	7.66	5.50
Crafts Hobby Shop	34.60	32.40	4.67	11.51	8.29	4.54
Dependent Services	39.50	31.90	10.47	25.23	4.62	2.38
Entertainment	52.30	45.80	32.54	18.14	1.71	4.24
Golf Facilities	38.20	26.90	3.92	6.10	10.94	7.36
Informal Sports	74.10	45.10	8.43	8.58	7.80	8.15
Movies	71.80	52.60	12.47	14.73	5.35	5.59
Organized Sports	36.40	31.00	6.39	7.55	6.29	6.89
Other Rec. Services	54.60	59.60	2.17	11.27	25.27	7.69
Outdoor Recreation	62.20	51.20	24.05	7.90	2.68	9.05
Rec. Equipment Checkout	73.80	58.80	13.09	22.03	5.93	3.94
Swimming Pools	45.90	29.50	2.17	8.11	21.64	6.61
Overall Rec. Program	$431.40	$348.90	3.69	6.13	$ 136.33	$ 92.65

TABLE 9.13

ENLISTED/OFFICER COMPARISONS BY RECREATION CATEGORIES

Recreation Category	SAVINGS		INCREASE IN PAY		USAGE %	
	Enlisted	Officer	Enlisted	Officer	Enlisted	Officer
Auto Hobby Shop	$ 69.20	$ 50.80	$ 89.20	$ 67.40	50	47
Boating/Sailing	32.10	50.90	49.10	65.00	25	42
Bowling	62.90	39.40	77.60	50.80	66	54
Crafts Hobby Shop	32.50	35.50	48.60	49.70	32	42
Dependent Services	32.70	38.20	57.80	59.40	33	43
Entertainment	48.50	31.60	68.80	47.10	48	46
Golf Facilities	26.20	53.40	42.30	68.50	23	45
Informal Sports	48.70	63.30	62.50	75.00	56	69
Movies	56.90	46.50	73.90	61.70	61	63
Organized Sports	32.50	26.30	47.60	39.00	40	47
Other Rec. Services	59.00	56.30	75.20	70.00	60	68
Outdoor Recreation	53.50	49.70	70.20	63.80	59	67
Rec. Equipment Checkout	62.00	54.70	79.90	70.20	54	60
Swimming Pools	31.10	43.30	48.30	61.20	42	55
Overall Rec. Program	$360.90	$381.90	$457.00	$471.30	----	----

Note: All dollar figures are in annual dollars/person

Table 9.14 compares the survey response of first-termers vs. career. The largest proportion of first-termers use Bowling and Movies (individually 67%) whereas Outdoor Recreation and Bowling are the two most used Recreation Categories by career personnel. First-termers perceive the most savings from Auto Hobby Shop ($72.50/year) and the least from Golf Facilities ($26.30/year). The high and low savers for career personnel are Bowling and Swimming Pools, respectively. It is interesting to note that the range from high to low savings per year for first-termers is quite a bit higher ($46.20) than that for career personnel ($29.40). Also, note that even though the percentage of first-termers and career personnel utilizing Auto Hobby Shops is the same (49%), the perceived savings are different ($72.50 vs. $58.90). This might reflect a higher number of miles driven by first-termers.

Table 9.15 compares responses of personnel depending on their duty station. From the Overall Recreation Program, Afloat personnel perceive a savings of $328/year vs. $425.40/year perceived by the Ashore personnel. The ratio of these savings is 1.297, which approximately reflects the fact of the Afloat personnel being away at sea about half of the time.[1] For obvious reasons, Boating/Sailing and Swimming Pools provide much lower savings for Afloat personnel than for Ashore personnel. Golf Facilities provide the lowest savings for both Ashore and Afloat personnel.

Table 9.16 compares responses of persons depending on where they live. Recall that there are three categories, On Base, Close to Base (within 10 minutes), and Far from Base (more than 10 minutes). As one would expect, Usage, Savings and Increase in Pay decrease as one goes farther from base for

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[1] The average number of dependents being 1.29, the ratio of benefits should be $\frac{1.29 + 1.00}{1.29 + 0.50} = 1.279$.

TABLE 9.14

FIRST TERM/CAREER COMPARISONS BY RECREATION CATEGORIES

Recreation Category	SAVINGS		INCREASE IN PAY		USAGE %	
	First Term	Career	First Term	Career	First Term	Career
Auto Hobby Shop	$ 72.50	$ 58.90	$ 91.70	$ 79.30	49	49
Boating/Sailing	35.40	31.70	52.00	48.40	27	28
Bowling	61.40	59.50	75.30	74.70	67	62
Crafts Hobby Shop	32.50	33.40	48.80	48.40	31	36
Dependent Services	29.10	40.40	55.20	62.80	28	42
Entertainment	51.30	39.40	71.60	58.40	53	43
Golf Facilities	26.30	33.20	42.70	48.40	22	28
Informal Sports	54.10	43.20	68.00	56.30	62	51
Movies	61.20	46.70	76.60	65.80	67	54
Organized Sports	31.90	31.80	47.20	46.00	41	41
Other Rec. Services	60.70	55.40	76.70	71.20	62	59
Outdoor Recreation	51.90	55.10	68.30	71.90	57	63
Rec. Equipment Checkout	63.60	57.50	80.80	75.70	55	55
Swimming Pools	33.60	30.10	50.90	47.30	46	40
Overall Rec. Program	$367.10	$355.90	$457.40	$460.10	----	----

Note: All dollar figures are in annual dollars/person

TABLE 9.15

AFLOAT/ASHORE COMPARISONS BY RECREATION CATEGORIES

Recreation Category	SAVINGS		INCREASE IN PAY		USAGE %	
	Afloat	Ashore	Afloat	Ashore	Afloat	Ashore
Auto Hobby Shop	$ 66.80	$ 69.00	$ 87.10	$ 87.40	48	51
Boating/Sailing	24.50	45.80	43.20	60.00	20	34
Bowling	56.40	68.70	72.80	79.40	62	68
Crafts Hobby Shop	28.40	41.30	45.90	54.00	27	41
Dependent Services	30.20	39.00	56.80	60.30	30	39
Entertainment	42.70	55.10	64.10	71.90	44	53
Golf Facilities	24.00	37.70	40.70	52.20	22	29
Informal Sports	41.90	64.80	57.00	75.80	52	63
Movies	49.60	67.10	67.80	81.50	55	67
Organized Sports	28.90	37.20	44.30	51.30	38	44
Other Rec. Services	55.40	64.70	72.60	78.40	58	64
Outdoor Recreation	47.00	64.30	64.90	78.30	54	66
Rec. Equipment Checkout	56.60	69.70	74.80	86.30	50	60
Swimming Pools	24.10	47.20	42.90	61.50	35	52
Overall Rec. Program	$328.00	$425.40	$434.70	$500.70	----	----

Note: All dollar figures are in annual dollars/person

TABLE 9.16

RESIDENCE COMPARISONS BY INDIVIDUAL RECREATION CATEGORIES

Recreation Category	Savings			Increase in Pay			Usage %		
	On Base	Close to Base	Far from Base	On Base	Close to Base	Far from Base	On Base	Close to Base	Far from Base
Auto Hobby Shop	$ 72.00	$ 70.80	$ 58.80	$ 91.20	$ 88.80	$ 80.40	50	55	46
Boating/Sailing	39.60	34.80	30.00	55.20	49.20	49.20	30	28	24
Bowling	69.60	63.60	52.80	81.60	76.80	69.60	71	68	59
Crafts Hobby Shop	37.20	37.20	32.40	50.40	51.60	50.40	34	36	31
Dependent Services	32.40	42.00	34.80	56.40	63.60	60.00	30	40	35
Entertainment	58.80	43.20	33.60	75.60	62.40	56.40	59	48	40
Golf Facilities	32.40	31.20	31.20	48.00	45.60	48.00	25	25	25
Informal Sports	64.80	52.80	40.80	75.60	64.80	56.40	66	60	49
Movies	70.80	51.60	42.00	84.00	69.60	63.60	74	61	50
Organized Sports	37.20	34.80	23.80	51.60	49.20	44.40	44	46	37
Other Rec. Services	66.00	57.60	50.40	79.20	70.80	69.60	65	62	57
Outdoor Recreation	61.20	55.20	51.60	75.60	70.80	70.80	62	61	57
Rec. Equip. Checkout	66.00	63.60	57.60	81.60	81.60	78.00	55	59	53
Swimming Pools	46.80	33.60	26.40	62.40	49.20	45.60	53	45	35
Overall Recreation Program	$421.20	$373.20	$328.80	$496.80	$472.80	$444.00			

Note: All dollar figures are in annual dollars/person

most Recreation Categories. However, in the case of Auto Hobby Shop, usage is 55% for Close to Base personnel and only 50% for On Base personnel. This may reflect the fact that a lower percentage of people on base have cars or the fact that the people on base don't have to drive to work. Also, usage for Dependent Services is the lowest (30%) for On Base personnel and this may be due to the fact that a larger proportion of base personnel may be single.

Table 9.17 compares responses from people depending on their retirement plans. This is important since in terms of increasing retention rates, one may wish to orient the Recreation Program toward those people who are uncertain of their retirement. For example, usage of Movie Facilities is dramatically higher among those who are uncertain of retirement from the Navy than among those who have made definite decisions, whether pro or con (71% vs. 58% or 57%). It also is interesting to note that Overall Savings/person are much lower ($279.60) for people who do not plan to retire from the Navy compared to the other two groups ($420).

TABLE 9.17

RETIREMENT PLANS COMPARISONS BY INDIVIDUAL RECREATION CATEGORIES

Recreation Category	Savings			Increase in Pay			Usage %		
	Yes	No	Uncertain	Yes	No	Unknown	Yes	No	Unknown
Auto Hobby Shop	$ 64.80	$ 58.80	$ 79.20	$ 85.20	$ 81.60	$ 94.80	51	46	52
Boating/Sailing	39.60	22.80	42.00	56.40	40.80	58.80	32	18	31
Bowling	68.40	46.80	69.60	82.80	62.40	82.80	65	60	72
Crafts Hobby Shop	40.80	25.20	39.60	55.20	42.00	55.20	39	24	37
Dependent Services	46.80	21.60	37.20	68.40	46.80	63.60	44	23	35
Entertainment	46.80	34.80	56.40	66.00	56.40	74.40	47	45	55
Golf Facilities	42.00	20.40	31.20	56.40	37.20	46.80	31	18	26
Informal Sports	54.00	40.80	63.60	67.20	56.40	75.60	55	53	66
Movies	56.40	43.20	66.00	74.40	62.40	82.80	58	57	71
Organized Sports	38.40	24.00	38.40	52.80	40.80	52.80	43	35	47
Other Rec. Services	61.20	45.60	67.20	78.00	63.60	80.40	61	56	67
Outdoor Recreation	66.00	38.40	62.40	82.80	57.60	78.00	66	50	63
Rec. Equip. Checkout	67.20	49.20	70.80	85.20	69.60	86.40	58	49	59
Swimming Pools	43.20	22.80	38.40	58.80	42.00	56.40	46	36	49
Overall Recreation Program	$420.00	$279.60	$420.00	$511.20	$394.80	$504.00			

Note: All dollar figures are in annual dollars/person

10.0 CLUSTER ANALYSIS

10.1 Introduction

Cluster analysis was used to determine whether Navy personnel fell into groups, each group having a common pattern of behavior in terms of the 14 Recreation Categories. The behaviors analyzed were Usage of the categories, Savings seen from the categories, and Increase in Pay as compensation for removal of the categories. For each of these behaviors, 5 or 6 groups or clusters were identified. An example of a cluster for usage of the activities is the group of individuals who use the Auto Hobby Shop heavily, the Crafts Shop some, and very little else.

The population was also divided up into 12 demographic groups, based upon pay grade, term of service, marital status, location, duty station, and length of time at the base, as discussed in Section 10.6 below. The percentage of people in each demographic group who fell into each cluster was then calculated.

The analysis was done only on the surveys taken at bases which had all 14 Recreational Categories.[1] Data from these bases were treated as a single collection of 7,225 surveys. Some of these surveys, however, were faulty -- e.g. with blank pages for some of the Recreational Categories. If a survey had even one page blank for a Recreational Category, it was considered unsuitable for the clustering analysis and rejected. There were 500 such rejected surveys, so that the sample size for the cluster analysis was 6,725.

A brief description of cluster analysis is given in Appendix A.10.1-1. The following sections describe the results for each of the behaviors, the relationship between the clusters from different behaviors, and the relationship between the demographic groups and the clusters.

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[1] These were Brunswick, Pensacola, Oceana, Memphis, Great Lakes, Mayport, Charleston, Long Beach and Puget Sound.

It should be pointed out that cluster analysis is an art as well as a science, so that interpretations made, names given to the clusters, and analysis of the results are subjective. This section should be read with this caution in mind.

10.2 Cluster Analysis of Usage

Six clusters were found. Each is identified by the average usages by the individuals in the cluster of each of the Recreational Categories. Each cluster is also identified by a name which attempts to describe the group of individuals with that particular pattern of usage. Table 10.1 displays the 6 clusters.

The survey form allowed four possible levels of usage:

0 = never

1 = infrequently (less than once per month)

2 = occasionally (1-2 times per month)

3 = frequently (3 or more times per month)

The usage values given in Table 10.1 are based on the same scale. A value of 1.5 in the Table, then, would mean a usage between infrequently and occasionally.[1]

Cluster 1, for example, is composed of 'low users.' All usages for this cluster are well below 1. Probably most of the 1,915 individuals in this cluster have 0 usage of most of the facilities and some infrequently use a few facilities, the average for all of them working out to the values shown in the Table.

The 'Athletes' cluster was so named because the average usage of Informal Sports and Organized Sports is much higher than usages of other categories. Of interest is that the cluster analysis shows the extent of the usage of these other activities by the 'athletes' -- for example, their usage of Bowling is 1.61 and of Swimming Pools only .7

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[1] Taking 1 to mean a usage of .5 times per month and 2 to mean 1.5 times per month, a usage of 1.5 would then be the average, or 1 time per month.

TABLE 10.1

USAGE CLUSTERS

USAGE[1] IN EACH CATEGORY FOR CLUSTER CENTERS[2]

NAME	NO. IN CLUSTER	AUTO HOBBY SHOP	BOATING & SAILING	BOWLING	CRAFTS HOBBY SHOP	DEP. ACTS./ SVCES.	ENTER-TAIN-MENT	GOLF	INFORMAL SPORTS	MOVIES	ORGANIZED SPORTS	OTHER REC. ACTS.	OUT-DOOR REC.	REC. EQUIP. CHECKOUT	SWIM-MING POOLS
LOW USAGE	2259	.41	.11	.27	.16	.22	.27	.14	.31	.36	.16	.34	.36	.34	.22
ATHLETES	894	.74	.32	1.61	.38	.54	.68	.91	(2.18)	.90	(2.39)	1.21	1.24	1.06	.70
HIGH USAGE	857	1.67	1.45	(2.33)	1.58	1.59	(2.01)	1.24	(2.45)	(2.32)	1.99	(2.20)	(2.38)	(2.18)	(2.22)
CASUAL USERS	1184	1.10	.58	1.35	.68	.19	1.18	.35	1.63	1.68	.34	1.54	1.47	1.24	1.26
DEPENDENT ACTIVITIES USERS	658	1.14	.57	1.78	.93	(2.37)	1.13	.69	1.36	1.48	.69	1.26	1.56	1.29	1.37
BOWLERS	873	.57	.18	(2.51)	.23	.36	.42	.34	.50	.67	.37	.62	.55	.46	.31

[1] SCALE: 0 = NEVER
1 = INFREQUENTLY (less than once per month)
2 = OCCASIONALLY (1-2 times per month)
3 = FREQUENTLY (3 or more times per month)

[2] USAGES BETWEEN 1.5 AND 2.0 ARE UNDERLINED. USAGES OVER 2.0 ARE CIRCLED.

The names given to the other clusters are self-explanatory, after looking at the usages in the clusters. The 'high usage' group uses everything at least once a month and often much more frequently. The 'casual users' have low to medium usages, the highest being in Informal Sports and Movies. The 'dependent activities users' show high usage of the Dependent Activities and Services and also medium usage of several other categories. The 'bowlers' use little besides Bowling.

Some comments about the results follow.

1) With 2,259 individuals in the 'low usage' cluster, only 4,466, or 66.4%, of the population in the cluster analysis make significant use of the facilities.

2) Use of Boating/Sailing and Golf Facilities is low for all groups -- as low as 1.45 and 1.24, respectively, even for the high users.

3) The highest average usage of the Auto Hobby Shop is only 1.67. However, this can be misleading -- very high savings and pay increase figures are found for the Auto Hobby Shop (as will be seen in Sections 10.3 and 10.4 below). This is an extreme example of differing dollar savings and pay increase versus usage appraisals for the different categories, i.e., much higher savings are seen per use of the Auto Hobby Shop than some of the other activities. These differences are one reason for clustering with usage having different patterns over the recreation categories than clustering with savings.

4) Table 10.1 can be used to analyze which categories are least 'important' in terms of usage. Considering any particular category, one could argue that if this category were removed it would not affect the 'high usage' group very much since they have high usage in other categories and would not feel the loss very much. The question then is -- would the other groups be affected by removal of this category and how much? A measure of

this is the highest usage of the category by any of the groups other than the 'high usage' group. Arranging the categories in increasing order of this highest usage they are:

Boating/Sailing	.58
Golf Facilities	.91
Crafts Hobby Shop	.93
Auto Hobby Shop	1.14
Entertainment	1.18
Recreation Equipment Checkout	1.29
Swimming Pools	1.37

with other categories having higher values.

This list shows that of all the categories, removing Boating/Sailing would have the least effect on all the groups other than the 'high usage' group, and so is in some sense the least 'important.'

10.3 Cluster Analysis of Savings

Six clusters were found. Each is identified by the average savings seen by the individuals in the cluster from each of the Recreational Categories. Each cluster is also identified by a name which attempts to describe the group of individuals with that particular pattern of savings. Table 10.2 displays the 6 clusters.

The survey form allowed 10 possible levels of savings, on a scale from 0 ($0 savings) to 9 ($20 or over savings). The scale is given as Footnote 1 to Table 10.2. The savings values used in the clustering and in Table 10.2 are based on this scale. A value of 2.25 in the Table, then, would mean a savings of between $3-4 and $5-6 per month.

The names of the clusters are self-explanatory. The Auto Hobby Shop is an important category here, with one group being very selective and seeing savings from the Auto Hobby Shop only, and another group having a very different pattern of savings but also seeing their savings from the Auto Hobby

TABLE 10.2

SAVINGS CLUSTERS

SAVINGS[1] IN EACH CATEGORY FOR CLUSTER CENTERS[2]

NAME	NO. IN CLUSTER	AUTO HOBBY SHOP	BOATING & SAILING	BOWLING	CRAFTS HOBBY SHOP	DEP. ACTS./ SVCES.	ENTER-TAIN-MENT	GOLF	INFORMAL SPORTS	MOVIES	ORGANIZED SPORTS	OTHER REC. ACTS.	OUT-DOOR REC.	REC. EQUIP. CHECKOUT	SWIM-MING POOLS
LOW SAVINGS	2692	.41	.25	.64	.27	.36	.49	.37	.56	.60	.22	.60	.58	.67	.32
CASUAL SAVERS	1024	.81	2.00	3.07	1.57	2.23	2.76	2.25	4.23	3.29	2.50	3.72	4.00	4.14	2.68
HIGH SAVINGS	457	(6.37)	(5.96)	(6.67)	(5.52)	(5.61)	(6.28)	4.78	(6.90)	(6.56)	(5.93)	(6.96)	(7.41)	(7.57)	(6.16)
AUTO HOBBY SHOP ONLY	987	(6.29)	.88	2.15	1.45	1.07	1.30	.90	1.62	1.70	.84	1.86	1.81	2.14	.94
AUTO HOBBY SHOP & OTHER	755	(7.23)	2.85	4.31	3.79	3.09	3.34	1.90	4.18	4.12	2.21	4.49	4.99	(5.72)	2.90
BOWLERS	810	.67	.61	(5.16)	.73	1.15	1.30	1.17	1.52	2.34	1.07	1.91	1.48	1.36	1.10

[1] SCALE: 0 : $0 savings; 1 : $1-2; 2 : $3-4; 3 : $5-6; 4 : $7-8; 5 : $9-10; 6 : $11-13; 7 : $14-16; 8 : $17-19; 9 : $20 or over (all savings per month)

[2] SAVINGS BETWEEN 3.5 AND 5.0 ARE UNDERLINED. SAVINGS OVER 5.0 ARE CIRCLED.

Shop as significantly higher than their other savings. The 'bowlers' see savings from little other than Bowling. The 'high savings' group saves a lot from all categories.

Comments follow:

1) 40% (those in the 'low savings' cluster) of the population in the clustering analysis see negligible savings from the Recreation Program.

2) The number of individuals in the 'high savings' cluster is only 457, compared to the 857 in the high usage cluster. 250 of the 857 were put in the Auto Hobby Shop and Other savings cluster; 186 were placed in the 'Casual Savers' cluster. (A few individuals from other usage clusters were put in the 'high savings' cluster.) This redistribtuion is partly[1] caused by the tendency to undervalue in terms of dollar savings the use of the facilities. This tendency is also shown by the higher number (2,692) in the 'low savings' cluster as compared to the 'low usage' cluster (2,259). Section 10.5 below discusses the correspondences between the usage, savings and pay increase clusters in more detail.

3) The individuals in the 'bowlers' cluster from usage are not the same as those in the 'bowlers' cluster from savings. Care should therefore be taken in discussing these clusters. The reasons for this disparity are discussed in 10.5.

4) The analysis in Comment 4) for the usage clusters can be done for the savings clusters. The high savings cluster is ignored -- the removal of a category affects the individuals in this cluster very little, since they can save from other categories. The measure of 'importance' of a

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[1] It is partly also caused by the 'high savings' cluster's being a more extreme clustering -- only individuals closer to the high end of the savings scale being included.

category is then taken to be the highest savings for that category in the clusters remaining. Arranged in increasing order of this measure are:

Golf Facilities	2.25
Organized Sports	2.50
Boating/Sailing	2.85
Swimming Pools	2.90
Dependent Services	3.09
Entertainment	3.34
Crafts Hobby Shop	3.79

with other categories having higher values.

Comparing the lists from Usage and from Savings, Boating/Sailing and Golf Facilities appear near the top of both lists and would by this definition be the least 'important.'

10.4 Cluster Analysis of Pay Increase

Five clusters were found. Each cluster is identified by the average pay increase required by the individuals in the cluster as compensation for removal of each of the Recreational Categories. Each cluster is also identified by a name which attempts to describe the group of individuals with that particular pattern of pay increase requirements. Table 10.3 displays the 5 clusters.

The survey form allowed 10 possible levels of pay increase on a scale from 0 ($0 pay increase) to 9 ($20 or over pay increase). The scale is given as Footnote 1 to Table 10.3. The pay increase values used in the clustering and in Table 10.3 are based on this scale. A value of 7.5 in the Table would then mean a pay increase of between $14-16 and $17-19 per month.

The names of the clusters are self-explanatory. The Auto Hobby Shop is an important category here, as for the savings clusters, with an'Auto Hobby Shop Only'cluster and an'Auto Hobby Shop and Other'cluster. For the other clusters, no particular activity or small subset of activities dominated

TABLE 10.3

PAY INCREASE CLUSTERS

PAY INCREASE[1] IN EACH CATEGORY FOR CLUSTER CENTERS[2]

NAME	NO. IN CLUSTER	AUTO HOBBY SHOP	BOATING & SAILING	BOWLING	CRAFTS HOBBY SHOP	DEP. ACTS./ SVCES.	ENTER-TAIN-MENT	GOLF	INFORMAL SPORTS	MOVIES	ORGANIZED SPORTS	OTHER REC. ACTS.	OUT-DOOR REC.	REC. EQUIP. CHECKOUT	SWIM-MING POOLS
VERY LOW PAY INCREASE	2474	.65	.28	1.07	.30	.52	.54	.41	.52	.74	.31	.60	.55	.59	.39
VERY HIGH PAY INCREASE	521	(8.02)	(7.55)	(7.82)	(7.50)	(7.66)	(7.96)	(6.88)	(8.06)	(7.76)	(7.59)	(7.89)	(8.07)	(8.27)	(7.47)
AUTO HOBBY SHOP ONLY	1134	(6.53)	1.49	2.80	1.90	2.02	1.96	1.15	1.80	2.45	1.03	2.33	2.34	2.91	1.41
AUTO HOBBY SHOP & OTHER	1253	(6.06)	4.06	5.14	4.03	4.45	4.44	3.24	5.00	5.05	3.50	5.41	5.98	(6.17)	4.23
CASUAL LOW	1343	1.12	1.52	3.26	1.38	2.20	2.52	2.29	3.40	3.33	2.15	3.02	3.28	3.45	2.25

[1] SCALE: 0 : $0 pay increase; 1 : $1-2; 2 : $3-4; 3 : $5-6; 4 : $7-8; 5 : $9-10; 6 : $11-13; 7 : $14-16; 8 : $17-19; 9 : $20 or over. (all pay increases per month)

[2] PAY INCREASES BETWEEN 3 AND 6 ARE UNDERLINED. PAY INCREASES OVER 6 ARE CIRCLED.

the pattern of pay increases and the more general names of 'very low,' 'very high' and 'casual low' pay increase were applicable.

Comments on the pay increase clusters:

1) 36.8% (those in the 'very low pay increase' cluster) of the population in the clustering analysis would require a negligible pay increase as compensation for removing any of the activities.

2) That individuals require a higher pay increase compensation than they see savings associated with any activity is seen by the fact that the 'high pay increase' and 'high savings' clusters have comparable numbers of individuals but pay increase averages are significantly higher.

3) There are only 5 clusters in this case because the pay increase data is more spread out and less amenable to being clustered. Trying 6 clusters does not result in significantly 'tighter' groupings or an intuitively meaningful sixth cluster.

4) The analysis in Comment 4) for both the Usage and Savings clusters is not so meaningful for the pay increase clusters. The 'Auto Shop and Other' pay increase cluster has at least medium values for most activities and the 'unimportant to all but high pay increase cluster' analysis can therefore point to few activities -- Golf has the lowest value at 3.24 (which is not very low).

10.5 Relationships Between Usage, Savings, and Pay Increase Clusters

Although a Usage cluster may have the same name as a Savings cluster, the individuals in the clusters may not be the same. The 'bowlers' Usage cluster, for example, consists of a different set of individuals than the 'bowlers' Savings cluster. Table 10.4 shows how many individuals in each Usage cluster belong to each Savings cluster (and, of course, vice versa). For example, of the 873 'bowlers' in usage, 345 are in 'low savings,' 28 in

TABLE 10.4

CORRESPONDENCE BETWEEN USAGE AND SAVINGS CLUSTERS[1]

	SAVINGS CLUSTERS						
USAGE CLUSTERS	LOW SAVINGS	CASUAL SAVERS	HIGH SAVINGS	AUTO HOBBY SHOP ONLY	AUTO HOBBY SHOP & OTHER	BOWLERS	TOTAL IN USAGE CLUSTER
LOW USAGE	1836	65	20	266	22	50	2259
ATHLETES	216	261	20	147	91	159	894
HIGH USAGE	8	186	353	28	250	32	857
CASUAL USERS	213	286	28	293	216	148	1184
DEP. ACTS. USERS	74	198	29	105	161	91	658
BOWLERS	345	28	7	148	15	330	873
TOTAL IN SAVINGS CLUSTER	2692	1024	457	987	755	810	

[1]This table shows how many individuals in each usage cluster were assigned to each of the savings clusters. Total number in cluster analysis = 6725.

'casual savers,' 7 in 'high savings,' 148 in 'Auto Hobby Shop Only,' 15 in 'Auto Hobby Shop and Other' and 330 in 'bowlers.'

There are similar anomalies for other clusters. The discussion of the anomaly for the 'bowlers' is applicable to other clusters as well. The basic idea is that the individuals who use Bowling only do not necessarily see savings from Bowling only as well. In fact, 345 of them do not see significant savings even from their use of Bowling and are placed in the 'low savings' cluster. 148 of them apparently see savings from their relatively low usage of the Auto Hobby Shop and very little from their use of Bowling so that they are placed in the 'Auto Hobby Shop Only' savings cluster. Small numbers (the 28, 7 and 15) in other clusters are the result of a random effect due to the fact that there are so many categories and in assigning an individual to a cluster, his pattern in all the categories is considered simultaneously. For some individuals there is ambiguity about which clusters their patterns are most similar to, ambiguity which may be resolved in different ways in forming the usage clusters as compared to the savings clusters.

A similar analysis may be made with the usage clusters that the 810 individuals in the 'bowlers' savings cluster are assigned to. The 91 'Dependent Services users,' 148 'casual users,' 32 'high users,' 159 'athletes,' and 50 'low users' see more savings from their use of Bowling than other activities. This result emphasizes the fact that savings is a subjective evaluation and different savings may be seen from the same level of usage in different groups.

Table 10.5 shows the correspondence between the usage clusters and the pay increase clusters. There are no surprises in these numbers, especially since the usage clusters are described by different names than the pay increase clusters.

TABLE 10.5

CORRESPONDENCE BETWEEN USAGE AND PAY INCREASE CLUSTERS[1]

	PAY INCREASE CLUSTERS					
USAGE CLUSTERS	VERY LOW PAY INCREASE	VERY HIGH PAY INCREASE	AUTO HOB-BY SHOP ONLY	AUTO HOB-BY SHOP & OTHER	CASUAL LOW PAY INCREASE	TOTAL IN USAGE CLUSTER
LOW USAGE	1461	114	325	152	207	2259
ATHLETES	227	47	129	173	318	894
HIGH USAGE	25	227	61	415	129	857
CASUAL USERS	208	57	318	259	342	1184
DEP. ACTS. USERS	76	37	144	195	206	658
BOWLERS	477	39	157	59	141	873
TOTAL IN PAY INCREASE CLUSTER	2474	521	1134	1253	1343	

[1]This table shows how many individuals in each usage cluster were assigned to each of the pay increase clusters. Total number in cluster analysis = 6725.

Table 10.6 shows the correspondence between the savings and pay increase clusters. There is a good correspondence -- of the 755 in the 'Auto Hobby Shop and Other' savings cluster, for example, 659 are in the two 'Auto Hobby Shop' pay increase clusters. The lack of total correspondence between clusters of the same name is, again, due mainly to different subjective evaluations of savings versus pay increase for different categories leading to different overall patterns.

10.6 Demographic Groups

The demographic information for each individual was his rank, duty station, proximity of residence to the base, marital status and duration at the base. This could give rise to 828 groups if each rank, each duty station, etc., were combined separately. The demographics of 2,274 individuals were analyzed to arrive at a smaller number of groups including all of the population. Table 10.7 shows the demographic characteristics defining each of the 12 groups. It also shows how many and what percentage of the 2,274 individuals fell into each group.

Group 1 consists of those individuals who have been at their present base less than 3 months, regardless of their other demographic characteristics. All those who have been at the base more than 3 months fall into one of the other groups.

Rank is used only to divide individuals into enlisted groups and officer groups. There are 7 enlisted and 4 officer groups.

The 3 possible residence types -- 'On Base', 'Close to Base' and 'Far from Base' -- were condensed to 'On Base' and 'Off Base'and used to divide the 7 enlisted groups into 2 sets of groups. The residence information was not used with the officer groups.

The Duty Station was used with all but two of the groups, to get two sets of groups, one of personnel 'Ashore', the other 'Afloat', with otherwise

TABLE 10.6

CORRESPONDENCE BETWEEN SAVINGS AND PAY INCREASE CLUSTERS[1]

	PAY INCREASE CLUSTERS					
SAVINGS CLUSTERS	VERY LOW PAY IN-CREASE	VERY HIGH PAY IN-CREASE	AUTO HOB-BY SHOP ONLY	AUTO HOB-BY SHOP & OTHER	CASUAL LOW PAY INCREASE	TOTAL IN SAVINGS CLUSTER
LOW SAVINGS	2010	112	193	114	263	2692
CASUAL SAVINGS	31	57	46	265	625	1024
HIGH SAVINGS	5	257	2	188	5	457
AUTO HOBBY SHOP SAVINGS ONLY	149	26	638	112	62	987
AUTO HOBBY SHOP & OTHER SAVINGS	8	49	143	516	39	755
BOWLERS	271	20	112	58	349	810
TOTAL IN PAY INCREASE CLUSTER	2474	521	1134	1253	1343	

[1]This table shows how many individuals in each savings cluster were assigned to each of the pay increase clusters. Total number in cluster analysis = 6725.

TABLE 10.7

DEMOGRAPHIC GROUPS

	RANK		DUTY STATION		RESIDENCE		MARITAL STATUS		DURATION AT PRESENT BASE		Number in Group	Percentage
	Enlisted	Officers	Ashore	Afloat	On Base	Off Base	Single or Married W/O Children	Single or Married With Children	Greater than 3 Months	Less than 3 Months		
1										x	152	6.68
2	x		x			x	x		x		244	10.73
3	x		x			x		x	x		249	10.95
4	x			x		x	x		x		409	17.98
5	x			x		x		x	x		395	17.37
6	x		x		x		x		x		208	9.15
7	x			x	x		x		x		208	9.15
8	x				x			x	x		84	3.69
9		x	x				x		x		40	1.76
10		x	x					x	x		44	1.94
11		x		x			x		x		111	4.88
12		x		x				x	x		130	5.72
											2274	100.0

identical demographics. Group 1 is independent of duty station, and so is group 8 -- i.e. enlisted personnel residing on base and with children are not divided into ashore and afloat groups.

The 3 possible marital status types -- 'Single,' 'Married, no Children' and 'Married (or single) with Dependent Children' -- were condensed to 'Without Children' and 'With Children.' This information was then used to form 2 sets of groups. The only exception is that the 'With Children' counterparts to Groups 6 and 7 were combined into Group 8 (so that Group 8 makes no use of Duty Station).

Table 10.8 identifies the characteristics of each group using a different format.

This set of demographic groups is small enough to keep analysis feasible, includes all of the Navy personnel, insures each group is not negligibly small, and provides meaningful classification (e.g. into 'less than 3 months at this base' group and all others, or into enlisted and officer groups).

By examining the behavior patterns (of usage, savings, pay increase in different categories) of these groups separately, a more detailed analysis is possible, and the extension of the results to other bases or new bases made more accurate by allowing consideration of the possibly different demographic mix at these bases.

10.7 The Breakdown of Demographic Groups Into Usage Clusters

The 12 demographic groups discussed above are used in this Section. Of the 6,725 surveys used in the cluster analysis, 48 had incomplete demographic information so that 6,677 were available for the analysis of this section. Table 10.9 gives the number in each demographic group and the percentage of these individuals in each of the 6 usage clusters. The demographic groups have different breakdowns -- to be expected since an individual's use of the

TABLE 10.8

IDENTIFICATION OF DEMOGRAPHIC GROUPS IN SURVEY

Group No.	Description
1	Persons with less than three months at base.
2	Enlisted persons, stationed ashore, residing off-base, single or married without children, and with greater than three months duration at present base.
3	Enlisted persons, stationed ashore, residing off-base, single or married, with children, and with greater than three months duration at present base.
4	Enlisted persons, stationed aboard ship, residing off-base, single or married without children, and with greater than three months duration at present base.
5	Enlisted persons, stationed aboard ship, residing off-base, single or married, with children, and with greater than three months duration at present base.
6	Enlisted persons, stationed ashore, residing on base, single or married without children, and with greater than three months duration at present base.
7	Enlisted persons, stationed aboard ship, residing on base, single or married without children, and with greater than three months duration at present base.
8	Enlisted persons, residing on base, single or married, with children, and with greater than three months duration at present base.
9	Officers, stationed ashore, single or married without children, and with greater than three months duration at present base.
10	Officers, stationed ashore, single or married, with children, and with greater than three months duration at present base.
11	Officers, stationed aboard ship, single or married without children, and with greater than three months duration at present base.
12	Officers, stationed aboard ship, single or married, with children, and with greater than three months duration at present base.

TABLE 10. 9

PERCENTAGE BREAKDOWN OF DEMOGRAPHIC GROUPS INTO USAGE CLUSTERS

DEMOGRAPHIC GROUP	NO. IN GROUP	PERCENTAGE IN CLUSTER					
		LOW USAGE	ATHLETES	HIGH USAGE	CASUAL USERS	DEP. ACTS USERS	BOWLERS
1. Less than 3 months at present base	695	25.9%	8.3%	20.6%	24.3%	10.2%	10.6%
2. Enlisted, offbase, Ashore, no children	618	35.1	16.2	11.8	17.2	4.9	14.9
3. Enlisted, offbase, Ashore, with children	836	34.7	12.2	13.2	14.6	14.4	11.0
4. Enlisted, offbase, Afloat, no children	953	45.6	13.7	6.2	13.5	5.5	15.4
5. Enlisted, offbase, Afloat, with children	986	43.7	10.1	7.8	9.9	11.7	16.7
6. Enlisted, on base, Ashore, no children	735	15.8	11.7	23.4	33.7	7.2	8.2
7. Enlisted, on base, Afloat, no children	833	32.2	16.7	7.8	20.6	4.2	18.5
8. Enlisted, on base, Ashore or afloat, with children	361	23.3	13.3	21.1	9.7	22.4	10.2
9. Officers, Ashore, no children	128	34.4	20.3	13.3	19.5	3.9	8.6
10. Officers, Ashore, with children	241	29.9	14.5	14.1	14.1	19.5	7.9
11. Officers, Afloat, no children	143	38.5	22.4	7.0	20.3	3.5	8.4
12. Officers, Afloat, with children	148	31.1	20.3	10.1	8.1	25.7	4.7
TOTAL NO.	6677	2238	887	851	1179	652	870

facilities depends heavily on his proximity to the base, his duty station (afloat or ashore), his marital status and his rank.

1) The results mostly correspond to expectations, e.g. Afloat groups have higher percentages in 'low usage' and lower percentages in 'high usage' than corresponding Ashore groups.

Groups with children have much higher percentages in 'Dependent Services Users' than groups with no children.[1]

Groups on base have more usage than groups off base.

Groups with no children have higher percentages among 'athletes' than groups with children.

2) Groups 4 and 5 make the least use of the facilities. They have the highest percentages in the 'low usage' cluster and group 4 has the lowest percentage in the 'high usage' cluster.

3) Comment 2 does not mean that enlisted groups make less use of the facilities than officer groups -- group 6 makes most use of the facilities, with the lowest percentage in 'low usage' and the highest percentage in 'high usage.'

4) Group 1 shows unexpectedly high usage of the facilities, since they have been at the base less than 3 months. They have the third lowest percentage in 'low usage' and the third highest percentage in 'high usage.'

They have the smallest percentage of 'athletes' -- perhaps athletes among them have not had a chance to get into it yet.

5) Higher percentages of enlisted personnel bowl than of officers.

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[1] The small percentages in 'Dependent Services Users' from groups with no children are the result of the random effect discussed in Section 10.5. In this case these users are close enough in their use of the other activities to the usage pattern of the 'Dependent Services Users' to overshadow their dependent activities usage of 0.

6) Officer groups with children make much higher use of Dependent Services than enlisted groups.

7) The highest percentages of athletes are among officers -- those without children, whether Ashore or Afloat, and those with children, if Afloat. Perhaps officers Afloat look foward to resuming their athletic interest when back at base. This is not true for enlisted personnel.

8) Enlisted groups Afloat use only Bowling more than corresponding groups Ashore.

10.8 The Breakdown of Demographic Groups Into Savings Clusters

Table 10.10 shows how many of the 6,677 surveys available for this analysis fell into each of the 12 demographic groups and the percentage breakdowns into the 6 savings clusters.

1) As for the usage clusters the results mostly correspond to expectations.

2) There are much higher percentages in 'low savings' than there were in 'low usage.' As mentioned when discussing the savings clusters, less savings are seen than one would be led to expect from the usages given. This is especially true for officer groups. Officers seem to value their usage less than enlisted personnel.

3) Group 6 has the lowest percentage in 'low savings' and the highest percentage in 'high savings' (as for as usage).

4) As for the usage clusters, Group 1 shows unexpectedly high savings from use of the facilities. They have the third lowest percentage in 'low savings' and the second highest percentage in 'high savings.'

5) Afloat groups have higher percentages in the two 'Auto Hobby Shop' savings clusters than ashore groups. There is little difference between officers and enlisted in Auto Hobby Shop savings.

TABLE 10.10

PERCENTAGE BREAKDOWN OF DEMOGRAPHIC GROUPS INTO SAVINGS CLUSTERS

DEMOGRAPHIC GROUP	NO. IN GROUP	PERCENTAGE IN CLUSTER					
		LOW SAVINGS	CASUAL SAVERS	HIGH SAVINGS	AUTO HOBBY ONLY	AUTO HOBBY & OTHER	BOWLERS
1. Less than 3 months at present base	695	31.9%	18.6%	10.8%	10.8%	17.6%	10.4%
2. Enlisted, offbase, Ashore, no children	618	41.6	15.0	4.5	15.0	10.2	13.6
3. Enlisted, offbase, Ashore, with children	836	39.5	15.8	8.7	11.7	10.2	14.1
4. Enlisted, offbase, Afloat, no children	953	48.3	8.8	4.7	18.5	10.5	9.2
5. Enlisted, offbase, Afloat, with children	986	47.5	9.9	5.0	15.1	10.5	12.0
6. Enlisted, on base, Ashore, no children	735	24.6	23.1	10.9	12.7	15.8	12.9
7. Enlisted, on base, Afloat, no children	833	42.5	12.0	4.9	18.6	7.7	14.3
8. Enlisted, on base, Ashore or Afloat, with children	361	28.8	18.8	8.9	16.6	13.3	13.6
9. Officers, Ashore, no children	128	47.7	20.3	6.3	8.6	7.8	9.4
10. Officers, Ashore, with children	241	41.1	27.4	5.8	10.4	5.4	10.0
11. Officers, Afloat, no children	143	49.0	11.9	2.8	18.2	9.1	9.1
12. Officers, Afloat, with children	148	43.2	23.0	3.4	13.5	6.8	10.1
TOTAL NO.	6677	2670	1017	454	981	748	807

6) While enlisted groups afloat use bowling only more than corresponding ashore groups, this does not hold true for savings predominantly from bowling.

10.9 The Breakdown of Demographic Groups Into Pay Increase Clusters

Table 10.11 gives the percentage breakdown of demographic groups into the 5 pay increase clusters.

1) As for the usage and savings clusters, the results mostly correspond to expectations.

2) The percentages in 'very low' pay increase are more like the percentages in 'low usage' than in 'low savings' -- although savings are sometimes not seen from usage a pay increase for denying usage is requested.

3) There are higher percentages in 'Auto Hobby Shop Only' pay increase as compared to 'Auto Hobby Shop Only' savings and some much higher percentages in 'Auto Hobby Shop and Other' pay increase as compared to 'Auto Hobby Shop and Other' savings. Individuals see high savings from the Auto Hobby Shop and even higher value for its removal.

10.10 Summary

Each Recreational Category can be analyzed separately, as done in other sections of this report. To consider all of the categories simultaneously, however, would be difficult unless patterns could be observed and the very many different ways the categories could interact reduced to a few. This was the purpose of the cluster analysis and of significant interest is that meaningful clusters could be found.

Six clusters were found for Usage and Savings and 5 for Pay Increase. The Pay Increase data is more spread out and less amenable to being clustered. Trying 6 clusters does not result in significantly 'tighter' groupings or an intuitively meaningful sixth cluster.

TABLE 10.11

PERCENTAGE BREAKDOWN OF DEMOGRAPHIC GROUPS INTO PAY INCREASE CLUSTERS

DEMOGRAPHIC GROUP	NO. IN GROUP	PERCENTAGE IN CLUSTER				
		VERY LOW	VERY HIGH	AUTO HOB-BY ONLY	AUTO HOB-BY & OTHER	CASUAL LOW
1. Less than 3 months at present base	695	29.4%	9.5%	15.5%	26.3%	19.3%
2. Enlisted, offbase, Ashore, no children	618	38.4	6.1	18.3	16.3	20.9
3. Enlisted, offbase, Ashore, with children	836	36.7	7.5	15.8	18.3	21.7
4. Enlisted, offbase, Afloat, no children	953	42.1	8.4	18.9	14.9	15.7
5. Enlisted, offbase, Afloat, with children	986	42.8	8.0	17.5	16.4	15.2
6. Enlisted, on base, Ashore, no children	735	23.8	10.1	15.8	26.8	23.5
7. Enlisted, on base, Afloat, no children	833	40.6	7.4	18.6	14.3	19.1
8. Enlisted, on base, Ashore or Afloat, with children	361	31.0	6.9	16.6	24.9	20.5
9. Officers, Ashore, no children	128	41.4	9.4	10.2	10.2	28.9
10. Officers, Ashore, with children	241	39.0	3.3	11.2	16.6	29.9
11. Officers, Afloat, no children	143	38.5	3.5	20.3	13.3	24.5
12. Officers, Afloat, with children	148	39.2	3.4	12.2	16.9	28.4
TOTAL NO.	6677	2456	517	1124	1244	1336

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Observing the breakdown of the demographic groups into the clusters helps identify who is using what categories and thereby helps efforts to increase participation in recreation and to provide the facilities desired.

Significant percentages of the personnel make little use of the facilities -- 33.6% are in the 'low usage' cluster, 40% in the 'low savings' cluster, and 36.8% in the 'very low pay increase' cluster.

Boating/Sailing and Golf Facilities appear to be the least 'important' of the categories, in the sense that none of the other clusters besides the 'high usage' and 'high savings' clusters see significant usage or savings in Boating/Sailing or Golf. Individuals in the 'high usage' and 'high savings' clusters see high usage and high savings in all other categories as well, and so would not be hurt by cutbacks in any one category.

The highest percentages of the 'Athletes' cluster is among officers -- those without children, whether Ashore or Afloat, and those with children, if Afloat. Perhaps officers Afloat look forward to resuming their athletic interest when back at base. This is not true for enlisted personnel.

Expectations about user behavior were met in the demographic group/cluster analysis, e.g.:

Afloat groups have higher percentages in the 'low usage' cluster and lower percentages in the 'high usage' cluster than corresponding Ashore groups.

Groups on base have more usage than groups off base.

Groups with children have much higher percentages in 'Dependent Services Users' than groups with no children.

Groups with no children have higher percentages among 'Athletes' than groups with children.

11.0 RESOURCE ALLOCATION

The ranking of Recreation Categories by cost-effectiveness ratios in Tables 9.4 and 9.5 provides useful economic guidelines for investment decisions at the national level. However, in order to promote the development of a balanced and equitable recreation program, these guidelines should be augmented to account for the distinct recreational preferences exhibited by various demographic subgroups of the active duty population. Similarly, budget reductions among Recreation Categories should not be based on economics alone, but should be accomplished in a manner which distributes the resulting loss of benefits uniformly over all segments of the user population. The analysis of this chapter integrates the concepts of cost-effectiveness and demographic preference and develops resource allocation schemes which meet the above goals. In section 11.1, factor analysis is used to group Recreation Categories which produce similar benefit patterns. Section 11.2 defines nine demographic groups and explores variables which contribute to their average perceived benefits. In Section 11.3, the concept of a demographic group is refined, and then several investment and budget reduction models are derived. Finally, in Section 11.4, the results of various model scenarios are presented and analyzed.

11.1 Factor Analysis of Benefits

As part of an initial investigation into benefit patterns, factor analysis[1] of responses to the Increase-in-Pay questions for each of

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[1] Factor analysis is a statistical technique which allows one to determine whether some underlying pattern of relationships exists between a number of variables such that the data may be "rearranged" or "reduced" to a smaller set of factors that account for the observed interrelations in the data. Each of the original variables "loads" a certain weight on the factors according to the amount of its variation which that factor "explains." The factors are extracted so as to be independent of each other and thus can be conceived of as measuring different dimensions.

the 14 Recreation Categories was performed.[1] The results are presented in Table 11.1. As shown, all 14 categories load heavily on at least one of seven factors. The factor associations among categories have been characterized by the subjective labels given to each factor. For example, Auto Hobby Shop and Craft Hobby Shop are strongly associated by their heavy loadings on Factor One. This is intuitively acceptable, since both are "Skilled Hobbies" which require mechanical or manual dexterity and independent participation; as such, it is expected that they would have some similarity of appeal. Boating/Sailing and Golf Facilities, categories which appeal strongly to Officer personnel, are associated through Factor Three and might be thought of as country or yacht "club" type activities. Both Movies and Bowling have such broad appeal that they display no significant relationship with any other category.

One might conjecture at this point that if development of the national Recreation Program is to be accomplished in a balanced way, then investment decisions made with respect to factors rather than to individual Recreation Categories might be a promising approach. Although the factor analysis results will not play any direct role in the model development which follows, they will serve to help interpret model results and confirm intuitive expectations. Apart from this, the results are interesting in their own right and might provide the basis for organizational or reporting changes. For example, at the local base level the Recreation Services Director (or Officer) might find that dividing management responsibilities by Factor groupings would

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[1] The analysis was performed on 3805 surveys, each of which contained data on all 14 Recreation Categories, i.e., no category had been rejected during editing and all Recreation Categories were always available. The bases involved were NAS Brunswick, NTC Great Lakes, NAS Pensacola, NS Mayport, NAS Oceana, and NAS Memphis.

TABLE 11.1 - FACTOR ANALYSIS OF BENEFITS (INCREASE-IN-PAY RESPONSES)

FACTOR NUMBER:	1	2	3	4	5	6	7
SUBJECTIVE LABEL:	SKILLED HOBBIES	ATHLETIC GAMES	CLUB ACTIVITIES	FAMILY ACTIVITIES	SPORTING ACTIVITIES	MOVIES	BOWLING
CATEGORY:							
1. Auto Hobby Shop	.5402 *	.1312	.1502	.1894	.2852	.2046	.0699
2. Boating/Sailing	.3440	.1457	.4543 *	.1676	.3708	.1454	-.0416
3. Bowling	.2448	.2075	.3237	.1831	.2789	.3204	.3062 *
4. Craft Hobby Shop	.4883 *	.1870	.2675	.3417	.2444	.1362	.0727
5. Dependent Services	.2592	.2263	.2307	.5299 *	.1898	.0941	.0844
6. Entertainment	.1896	.1768	.1463	.5734 *	.2603	.3703	.0110
7. Golf Facilities	.1447	.2503	.4458 *	.1910	.1546	.1289	.0831
8. Informal Sports	.2130	.4968 *	.2151	.1394	.3282	.2645	-.0294
9. Movies	.2338	.2468	.1799	.2293	.2698	.6196 *	.0648
10. Organized Sports	.1485	.5916 *	.2428	.2733	.2467	.1796	.1078
11. Other Rec. Services	.2454	.2170	.1463	.2295	.5520 *	.2082	.2165
12. Outdoor Sports	.2300	.2184	.2341	.2565	.6232 *	.1955	.0637
13. Equip.Checkout/Rent.	.3471	.2605	.2049	.1548	.5785 *	.1996	-.0196
14. Swimming Pools	.1548	.2214	.3075	.2258	.4215 *	.2425	.0792

* Most significant factor loadings

encourage his employees to specialize in recreational areas rather than individual facilities and thus orient his organizational structure more toward the user.

11.2 The Benefit Function

The benefit perceived from having a certain Recreation Category available is actually a function of many variables. This section begins by defining population subgroups based on demographic parameters and then explores this benefit function in terms of these groups.

11.2.1 Definition of Demographic Groups

Table 11.2 defines nine demographic groups which partition the national active duty population based on rank (officer/enlisted), duty station (afloat/ashore), residence (on-base/off-base) and dependent status (with children/without children). These represent a consolidation of the 12 groups used for the clustering analysis in Section 10.0 (see Table 10.8). The old group one-personnel with less than three months duration at their present duty station-was combined with the other groups since its members would eventually migrate to their permanent groups within three months. In addition, classification of officer groups by duty station was eliminated to provide more reliable sample sizes during subsequent stratifications. An inspection of the pay increase clusters for those groups in Table 10.11 suggests that little was lost by this consolidation. The resource allocation schemes developed in the following sub-sections will identify and address the distinct recreational preferences exhibited by each of the nine remaining groups.

11.2.2 Variables Influencing Benefits

At the base level, each demographic group perceives a certain average benefit from having a particular Recreation Category available. This benefit was measured by the "Increase-in-Pay" question for each

TABLE 11.2 - DEFINITION OF DEMOGRAPHIC GROUPS

GROUP NUMBER	DESCRIPTION
1	Enlisted personnel, stationed Ashore, residing off-base, without children.
2	Enlisted personnel, stationed Ashore, residing off-base, with children.
3	Enlisted personnel, stationed Afloat, residing off-base, without children.
4	Enlisted personnel, stationed Afloat, residing off-base, with children.
5	Enlisted personnel, stationed Ashore, residing on-base, without children.
6	Enlisted personnel, stationed Afloat, residing on-base, without children.
7	Enlisted personnel, residing on-base, with children.
8	Officer personnel, with children.
9	Officer personnel, without children.

category in the survey questionnaire (Appendix A.2.5-1). For each demographic group, the average perceived benefit is actually a function of many variables. The following list describes the most important of these:

1. Physical Condition - of the facility and/or equipment in Recreation Category c (c=1,...,14) at base i (i=1,...,16).
2. Availability - of the facility and /or equipment in Recreation Category c at base i relative to its current size (e.g., a crowded swimming pool has low availability).
3. Scope - or variety within Recreation Category c at base i (e.g., variety or items included in Equipment Checkout/ Rental).
4. Fees Charged - for use of Recreation Category c at base i.
5. Management - of Recreation Category c at base i, including scheduling of activities and hours of operation, advertising, Command interest, etc.
6. Civilian Alternatives - to Recreation Category c at base i, including their proximity and overall attractiveness.
7. Climatic/Geographical - condition at base i for the use of Recreation Category c (e.g., with respect to outdoor Swimming Pools or Boating/ Sailing).
8. Inherent Interest - of demographic group d (d=1,...,9) in using Recreation Category c.
9. Anticipated Future Use - of Recreation Category c by demographic group d (e.g., single persons anticipate use of Dependent Services).

For a given demographic group d and Recreation Category c, the first seven items are variables whose values depend on the particular base with which the demographic group is associated. The last two items do not vary from base to base, but rather depend only on the chosen values of d and c. The first three variables - Physical Condition, Availability and Scope - define the overall quality of Category c at base i. These variables were measured jointly by the national survey through the question dealing with the "Condition or Quality" of each Recreation Category at each base.[1] The remaining variables - numbers four through seven - were not measured by the survey.[2]

It is reasonable to assume that by spending additional funds to improve the Physical Condition, to increase the Availability, and/or to broaden the Scope of Recreation Category c at base i, the average benefit perceived by demographic group d at that base could be increased. (The same should be true if additional funds were spent to lower the Fees Charged or change certain resource-related Management practices; however, since the survey did not accumulate data on these variables, the following analysis will concentrate only on the three quality variables). In order to quantify this relationship between average benefit and the level of quality, the values of the unmeasured variables in the benefit function have to be controlled - their effect on average benefit has to be removed in some way so that the effects of quality changes alone become apparent. This was done in an approximate way by using the entire survey sample to compute national average benefits, by demographic group, at each of the five possible levels of quality presented in

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[1] See the survey questionnaire in Appendix A.2.5-1

[2] A simulataneous study under the sponsorship of the Special Services Division is concerned with Fees Charged and Civilian Alternatives and may possibly provide additional data which could be used to refine the analysis of this section in the future.

the questionnaire.[1] For example, those individuals in (national) demographic group d who felt that Recreation Category c at their base was of "UNATTRACTIVE" quality, were combined and their average benefit statistic computed. All those who answered "ATTRACTIVE" were handled in a similar fashion. Assuming that the bases comprising the national survey reflect a representative cross section of all Navy bases and therefore all the different levels of Fees Charged and types of Management, Civilian Alternatives and Climatic/Geographical conditions, this method of computation tended to average the effects of the unmeasured variables.[2] As expected, the average benefit for a demographic group proved to be approximately a monotonically increasing function of the level of quality, other variables being taken at roughly their national average values.[3]

11.3 Model Formulation

11.3.1 Partitioning of Demographic Groups

At this point, a refinement in the concept of a demographic group is desirable. As illustrated in Figure 11.1, for each of the 14 Recreation Categories the members of each demographic group may be separated into subsets of users and non-users, based on the survey results. Effectively, all of the users and some of the non-users always indicate they know about the quality of a Recreation Category. The non-users in this group include those who, finding the quality of a particular Recreation Category

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1 The five possible responses to the quality question were: (1) DON'T KNOW, (2) UNACCEPTABLE, (3) UNATTRACTIVE, (4) ACCEPTABLE, (5) ATTRACTIVE.

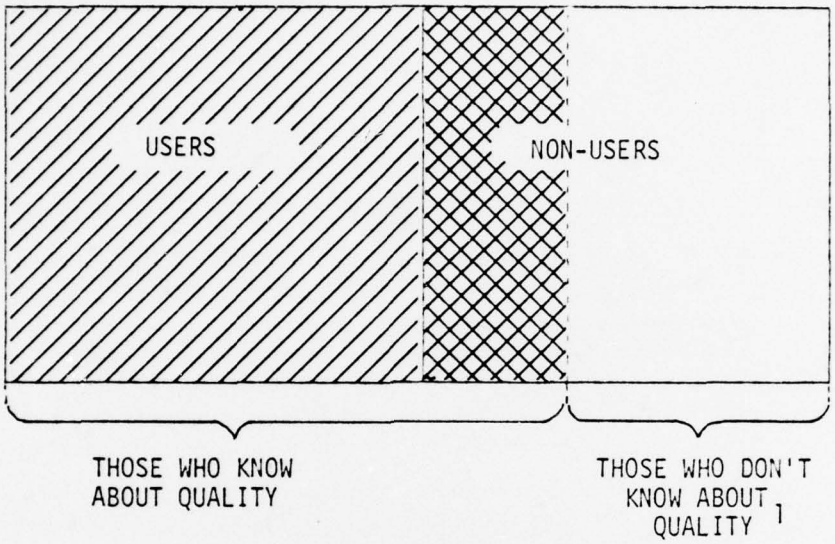
2 Obtaining a representative cross-section of the entire Navy with respect to personnel, location, mission and size of installation, etc. was a major goal of the survey design as described in Section 2.0.

3 In fact, for all nine demographic groups and 14 Recreation Categories, the average benefit perceived from a category rated "ATTRACTIVE" was always higher than when that same category was found "ACCEPTABLE" by members of the same group.

Figure 11.1

Partitioning of Each Demographic Group
for Each Recreation Category

(Based on Usage and Quality Responses)



SUBSET	MODEL ASSUMPTIONS
▨	- Benefits can be influenced by changes in quality - high interest group.
▩	- Benefits can be influenced by changes in quality - includes those who perceived quality as "UNACCEPTABLE - will not use".
□	- Benefits cannot be influenced by changes in quality - no potential interest in using this activity.

1 Some users did not in fact know about quality; however, based on Indicator 9 of Table 4.5, the number of individuals involved is less than 1% and can be disregarded.

"UNACCEPTABLE," refuse to use the facility and either turn to civilian alternatives or prefer to forego that activity altogether. If the level of quality were improved, it is most likely that this group of non-users would then use that activity and experience an increase in average benefit along with former users. The remaining non-users who do not know about the quality - as indicated by their survey responses - are primarily those individuals who have no interest in that activity whatsoever. The average benefit (if any) of this type of non-user is not likely to change no matter how much the quality improves. For purposes of influencing the average benefit, therefore, the most relevant partioning of each demographic group with respect to each Recreation Category is that which distinguishes "those who know" (whose average benefit may be increased by improvement in the level of quality) from "those who don't know" (whose average benefit will remain constant as quality is changed).

11.3.2 Rates-of-Return

Based on the partitioning discussed above, this section derives an expression for the rate-of-return of perceived dollar benefits for an investment made to improve the quality of an existing Recreation Category. Let d be one of the 9 demographic groups and c one of the 14 Categories.

Let b'_{dc} = the current average benefit from Recreation Category c perceived by a person in demographic group d who knows about the quality of Category c;

and n'_{dc} = the number of persons in demographic group d who know about the quality of Category c.

Similarly, b''_{dc} = the current average benefit from Recreation Category c perceived by a person in demographic group d who does not know about the quality of Category c;

and n''_{dc} = the number of persons in demographic group d who do not know about the quality of Category c.

Clearly, the total number of persons in demographic group d who have the opportunity to use Recreation Category c is then given by $(n'_{dc} + n''_{dc})$[1], and the current perceived average benefit for the group as a whole is $(n'_{dc}\, b'_{dc} + n''_{dc}\, b''_{dc})/(n'_{dc} + n''_{dc})$.

Suppose that the current nationwide average quality of Recreation Category c is rated "ACCEPTABLE"[2] and that an investment is made to improve this quality level. For a given demographic group d, the average benefit for those n''_{dc} individuals "who do not know" about the current quality should not change from their current b''_{dc}, according to the assumptions of the preceding section. However, those n'_{dc} individuals "who know" about the current quality should perceive an increase in their current average benefit, b'_{dc}. The amount of this change will depend significantly on the following three factors:

(1) the magnitude of their perceived current average benefit;

(2) the magnitude of the change in quality; and

(3) the sensitivity of their perceived current average benefit to changes in quality.

The change in total benefits for the demographic group might be expressed, therefore, as follows:

$$\text{(Change in total benefits)}_{dc} = n'_{dc} \cdot \text{(change in current average benefit)}_{dc}$$

$$= n'_{dc} \cdot \left(\begin{array}{c}\text{magnitude of current}\\ \text{average benefit}\\ \text{at current quality}\end{array}\right)_{dc} \left(\begin{array}{c}\text{magnitude of}\\ \text{quality change}\end{array}\right)_{c} \left(\begin{array}{c}\text{sensitivity of}\\ \text{benefit to changes}\\ \text{in quality}\end{array}\right)_{dc} \quad (1)$$

---

[1] Note that this sum is dependent on the Recreation Category c. This is necessary since not all bases have all Recreation Categories available. For example, in the sample for group 1, this sum was 815 for Boating/Sailing (available at 11 of 16 bases surveyed) and 1176 for Equipment Checkout/Rental (available at all 16 bases).

[2] For all 14 Recreation Categories, the mode of the quality responses for those who knew about quality was, in fact, "ACCEPTABLE." This was not always true at individual bases, however.

An estimate for each of the factors in equation (1) is developed below, with an emphasis on finding relative rather than absolute measures:

Current Average Benefit

The magnitude of the perceived current average benefit is just b'_{dc}. This factor includes all the influences of the variables in the benefit function discussed in Section 11.2.2.

Quality Change

Let $\$c$ = the FY74 national Net Operating Expense plus annually apportioned Initial Acquisition costs[1] for Recreation Category c from Table 6.8; and

X_c = the amount of investment to be made nationally to improve the quality of Recreation Category c.

If we assume that there is some linear relationship between quality, Q_c, and expenditure, the magnitude of the change in quality from making an investment of X_c in Recreation Category c is derived as follows:

current quality: $Q = A_c \cdot \$_c$, for some constant A_c

improved quality:
$$Q' = A_c \cdot (\$_c + X_c)$$
$$= A_c \$_c + A_c X_c$$
$$= Q + A_c X_c$$

proportional increase in quality:
$$\frac{Q'-Q}{Q} = \frac{Q + A_c X_c - Q}{Q}$$
$$= \frac{Q + A_c X_c - Q}{A_c \$_c}$$
$$= \frac{X_c}{\$_c}$$

[1] Alternatively, Current Replacement costs could have been used.

It is assumed here, then, that changes in quality are proportional to changes in total expense.

Sensitivity to Quality Changes

Figure 11.2 graphically displays the monotonically increasing relationship discovered between benefit and quality, as discussed at the end of Section 11.2.2. If, in addition, this relationship is assumed to be linear over the "ACCEPTABLE" to "ATTRACTIVE" quality range, the proportional change in current perceived average benefit for each demographic group may be computed from the survey data as follows:

$$\frac{b'_{dc}{}^{ATT} - b'_{dc}{}^{ACC}}{b'_{dc}{}^{ACC}} = P_{dc} \quad .$$

Let $\overline{P}_c$ represent the average value of this change for all nine demographic groups, i.e.,

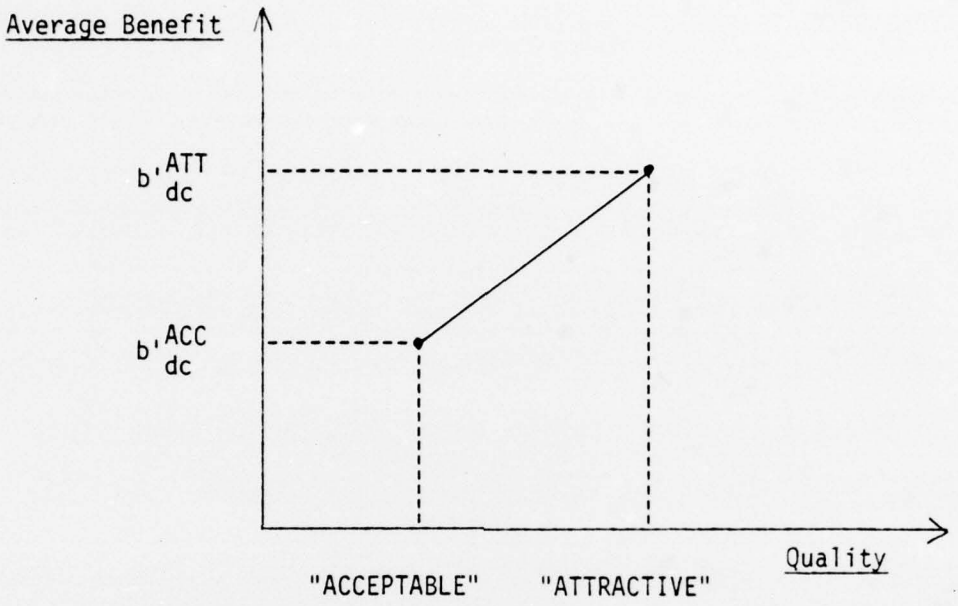
$$\overline{P}_c = \frac{1}{9} \sum_d P_{dc} \quad .$$

Then $\frac{P_{dc}}{\overline{P}_c}$ is a measure of the relative benefit sensitivity of demographic group d to quality changes in Recreation Category c, as compared to the other demographic groups.

Substituting these values for the three factors in equation (1), we obtain the rate-of-return for demographic group d with respect to investments in Recreation Category c as follows:

Figure 11.2

Average Benefit versus Quality for
"Those Who Know" About Quality



b'^{ATT}_{dc} = Average benefit perceived by those who rated quality "ATTRACTIVE"

b'^{ACC}_{dc} = Average benefit perceived by those who rated quality "ACCEPTABLE"

$$(\text{Change in total benefits})_{dc} = n'_{dc}\left(b'_{dc}\right)\left(\frac{X_c}{\$_c}\right)\left(\frac{P_{dc}}{\bar{P}_c}\right)$$

$$= X_c\left(\frac{n'_{dc} \cdot b'_{dc}}{\$_c}\right)\left(\frac{P_{dc}}{\bar{P}_c}\right) \qquad (2)$$

$$= X_c \ (\text{rate-of-return})_{dc}$$

Note that $\frac{n'_{dc} \cdot b'_{dc}}{\$_c}$ is essentially a benefit-cost ratio by "those who know" in each demographic group.

As a consequence of linearity assumptions on the relationship between benefits and quality and between quality and funds invested, we have also assumed a linear relationship between perceived benefits and funds invested. The constant rate-of-return coefficient of X_c in equation (2) defines the slope of this line. The true rate-of-return undoubtedly prescribes some type of curvilinear relationship which tends to flatten out as funds are invested beyond a certain level. This suggests that the amount of funds invested in any one recreation category should be constrained to some small fraction, say θ_c, of the current total expense. Specifically, if

$$X_c \leq \theta_c \cdot \$_c \text{ for all } c,$$

the error of prediction should in most cases be smaller than when $X_c > \theta_c \cdot \$_c$.

Table 11.3 presents rankings of the Recreation Categories by rates-of-return computed for each demographic group, based on the nationwide survey sample of 9551 active duty personnel. The order of the rankings is quite

TABLE 11.3

RECREATION CATEGORIES RANKED BY RATE-OF-RETURN FOR EACH DEMOGRAPHIC GROUP

GROUP # 1 ENLISTED, OFF-BASE, W/O, ASHORE		GROUP # 2 ENLISTED, OFF-BASE, WITH, ASHORE		GROUP # 3 ENLISTED, OFF-BASE, W/O, AFLOAT		GROUP # 4 ENLISTED, OFF-BASE, WITH, AFLOAT	
Equipment Checkout/Rental	.107	Dependent Services	.251	Entertainment	.139	Dependent Services	.180
Movies	.106	Equip. Checkout/Rental	.137	Dependent Services	.117	Equip. Checkout/Rental	.136
Bowling	.105	Movies	.102	Bowling	.106	Bowling	.123
Auto Hobby Shop	.081	Boating/Sailing	.099	Equip. Checkout/Rental	.105	Entertainment	.116
Dependent Services	.078	Entertainment	.086	Boating/Sailing	.088	Outdoor Recreation	.081
Entertainment	.076	Outdoor Recreation	.081	Movies	.074	Auto Hobby Shop	.073
Informal Sports	.074	Craft Hobby Shop	.079	Auto Hobby Shop	.064	Movies	.073
Other Rec. Services	.054	Bowling	.072	Outdoor Recreation	.052	Boating/Sailing	.062
Outdoor Recreation	.052	Auto Hobby Shop	.070	Organized Sports	.051	Organized Sports	.050
Boating/Sailing	.049	Other Rec. Services	.060	Informal Sports	.048	Informal Sports	.049
Swimming Pools	.049	Informal Sports	.047	Other Rec. Services	.047	Craft Hobby Shop	.047
Craft Hobby Shop	.046	Organized Sports	.045	Craft Hobby Shop	.044	Other Rec. Services	.043
Organized Sports	.038	Golf Facilities	.028	Golf Facilities	.031	Swimming Pools	.035
Golf Facilities	.016	Swimming Pools	.022	Swimming Pools	.016	Golf Facilities	.034

(Table continued on next page...)

TABLE 11.3 (continued)

GROUP # 5 ENLISTED, ON-BASE, W/O, ASHORE		GROUP # 6 ENLISTED, ON/BASE, W/O, AFLOAT		GROUP # 7 ENLISTED, ON-BASE, WITH		GROUP # 8 OFFICERS, WITHOUT		GROUP # 9 OFFICERS, WITH	
Entertainment	.179	Bowling	.133	Equip. Chkout/Rent.	.057	Equip. Chkout/Rent.	.071	Dependent Services	.105
Boating/Sailing	.176	Equip. Checkout/Rental	.105	Dependent Services	.054	Entertainment	.066	Equip.Chkout/Rental	.065
Equip. Checkout/Rental	.148	Entertainment	.104	Bowling	.037	Boating/Sailing	.065	Bowling	.046
Dependent Services	.137	Movies	.083	Movies	.036	Craft Hobby Shop	.053	Golf Facilities	.042
Bowling	.133	Auto Hobby Shop	.061	Entertainment	.034	Movies	.052	Movies	.039
Movies	.125	Boating/Sailing	.061	Outdoor Recreation	.032	Informal Sports	.041	Boating/Sailing	.036
Informal Sports	.095	Informal Sports	.060	Boating/Sailing	.022	Dependent Services	.027	Swimming Pools	.034
Outdoor Recreation	.090	Craft Hobby Shop	.052	Auto Hobby Shop	.021	Organized Sports	.027	Outdoor Recreation	.032
Auto Hobby Shop	.078	Outdoor Recreation	.045	Other Rec. Services	.021	Auto Hobby Shop	.026	Entertainment	.031
Other Rec. Services	.077	Other Rec. Services	.044	Craft Hobby Shop	.020	Outdoor Recreation	.024	Auto Hobby Shop	.031
Craft Hobby Shop	.067	Dependent Services	.042	Swimming Pools	.020	Golf Facilities	.022	Informal Sports	.028
Organized Sports	.063	Organized Sports	.041	Organized Sports	.015	Other Rec. Services	.022	Organized Sports	.021
Swimming Pools	.058	Swimming Pools	.030	Informal Sports	.015	Swimming Pools	.009	Other Rec. Services	.018
Golf Facilities	.054	Golf Facilities	.028	Golf Facilities	.012	Bowling	.008	Craft Hobby Shop	.016

dissimilar in many cases. Compare, for example, the position of Bowling in group six (first position) with that in group eight (last position).[1] A ranking by the entire sample - all demographic groups - is obtained by adding the rates-of-return assigned by the individual groups for each Recreation Category. Table 11.4 displays this result. Comparing this to the benefit cost-effectiveness ratios (using INA costs) in Table 9.4 reveals only minor differences.

11.3.3 Investment Models

The most elementary investment policy would be to maximize the change in total benefits for a given total investment, say L dollars, without concern for the preferences of the different demographic groups. The following model reflects this policy:

$$\text{(Model B)} \qquad \text{maximize} \quad \sum_d \sum_c \left(\frac{n'_{dc}\, b'_{dc}}{S_c}\right)\left(\frac{P_{dc}}{\bar{P}_c}\right) X_c$$

---

[1] As an illustration, this result is supported by the actual calculations below:

(Bowling/Group 6 Rate-of-Return) > (Bowling/Group 8 Rate-of-Return)

$$\left(\frac{n'_{6,2} \cdot b'_{6,2}}{S_c}\right)\left(\frac{P_{6,2}}{\bar{P}_2}\right) > \left(\frac{n'_{8,2} \cdot b'_{8,2}}{S_c}\right)\left(\frac{P_{8,2}}{\bar{P}_2}\right)$$

$$\left(\frac{896 \cdot \$95.3}{\$851,849}\right)\left(\frac{.4066}{.3066}\right) > \left(\frac{255 \cdot \$77.7}{\$851,849}\right)\left(\frac{.1107}{.3066}\right)$$

$$\left(.1002\right)\left(1.3262\right) > \left(.0233\right)\left(.3611\right)$$

$$.133 > .008$$

TABLE 11.4

CATEGORIES RANKED BY RATE-OF-RETURN OVER ALL DEMOGRAPHIC GROUPS

1)	Dependent Services	.991
2)	Equipment Checkout/Rental	.931
3)	Entertainment	.831
4)	Bowling	.763
5)	Movies	.690
6)	Boating/Sailing	.648
7)	Auto Hobby Shop	.505
8)	Outdoor Sports	.489
9)	Informal Sports	.457
10)	Craft Hobby Shop	.424
11)	Other Recreation Services	.386
12)	Organized Sports	.351
13)	Swimming Pools	.273
14)	Golf Facilities	.267

subject to:

$$(1) \quad \sum_c X_c \leq L \qquad C = 1, \ldots, 14$$

$$(2) \quad X_c \geq 0 \qquad C = 1, \ldots, 14$$

A more balanced investment scheme is one which attempts to increase the total benefits of each demographic group by a certain fraction, α_d, of their current benefits, and to accomplish this for minimal cost:

(Model A1: $\alpha_d = .05$)[1] minimize $\sum_c X_c$

(Model A2: $\alpha_d = .10$) subject to:

$$(1) \quad \sum_c \left(\frac{n'_{dc}\, b'_{dc}}{\$_c}\right)\left(\frac{P_{dc}}{\bar{P}_c}\right) X_c \geq \alpha_d \sum_c \left(n'_{dc}\, b'_{dc} + n''_{dc}\, b''_{dc}\right) \qquad d = 1, \ldots, 9$$

$$(2) \quad X_c \geq 0 \qquad c = 1, \ldots, 14$$

As indicated by the discussion at the end of Section 11.3.2, it is theoretically desirable to limit the level of investment in any one particular Recreation Category. It might also prove desirable from a practical or political standpoint. The following model is a modification of the previous one which includes such a constraint:

(Model C1: $\alpha_d = .05$; $\theta_c = .20$)[2]

(Model C2: $\alpha_d = .05$; $\theta_c = .15$)

(Model C3: $\alpha_d = .05$; $\theta_c = .12$)

(Model C4: $\alpha_d = .05$; $\theta_c = .10$)

(Model C5: $\alpha_d = .05$; $\theta_c = .08$)

---

[1] Note that a different value of α_d could have been selected for each group d.

[2] Note that a different value of θ_c could have been selected for each category c.

$$\text{minimize} \quad \sum_c X_c$$

subject to:

$$(1) \quad \sum_c \left(\frac{n'_{dc}\, b'_{dc}}{\$_c} \right) \left(\frac{P_{dc}}{\overline{P}_c} \right) X_c \geq \alpha_d \sum_c \left(n'_{dc}\, b'_{dc} + n''_{dc}\, b''_{dc} \right) \qquad d = 1, \ldots, 9$$

$$(2) \quad X_c \leq \theta_c \cdot \$_c \qquad c = 1, \ldots, 14$$

$$(3) \quad X_c \geq 0 \qquad c = 1, \ldots, 14$$

11.3.4 Budget Reduction Models

Each of the linear investment programs in Section 11.3.3 can be "reversed" to become disinvestment or budget reduction models in an obvious way. Simply redefine the X_c decision variables to be the amount of reduction in current funds allocated to Recreation Category c. A parallel to unconstrained investment Model B can then be written as:

$$\text{(Model B')} \quad \text{minimize} \quad \sum_d \sum_c \left(\frac{n'_{dc}\, b'_{dc}}{\$_c} \right) \left(\frac{P_{dc}}{\overline{P}_c} \right) X_c$$

subject to:

$$(1) \quad \sum_c X_c \geq L \qquad c = 1, \ldots, 14$$

$$(2) \quad X_c \geq 0 \qquad c = 1, \ldots, 14$$

where L now represents the overall budget reduction to be made and the objective is to minimize the overall decrease in benefits that results.

Again, a more equitable plan can be devised which, in the case of

budget reduction, would limit the loss in benefits for each demographic group to a certain fraction α_d of their current benefits, while reducing the overall budget by as much as possible. The following analog to investment Models A1 and A2 accomplishes this objective:

(Model A1': $\alpha_d = .05$)

(Model A2': $\alpha_d = .10$)

$$\text{maximize } \sum_c X_c$$

subject to:

$$(1) \quad \sum_c \left(\frac{n'_{dc}\, b'_{dc}}{\$_c}\right)\left(\frac{P_{dc}}{\bar{P}_c}\right) X_c \leq \alpha_d \sum_c \left(n'_{dc}\, b'_{dc} + n''_{dc}\, b''_{dc}\right) \qquad d = 1, \ldots, 9$$

$$(2) \quad X_c \geq 0 \qquad c = 1, \ldots, 14$$

A constraint on the allowed values of X_c is again desirable for the reasons given in Section 11.3.2. In this case, the above model is altered to limit the budget reduction for any particular Recreation Category to no more than some small fraction, θ_c, of current expenditures:

(Model C1': $\alpha_d = .05$; $\theta_c = .20$)

(Model C2': $\alpha_d = .05$; $\theta_c = .15$)

(Model C4': $\alpha_d = .05$; $\theta_c = .10$)

$$\text{maximize } \sum_c X_c$$

subject to:

$$(1) \quad \sum_c \left(\frac{n'_{dc}\, b'_{dc}}{\$_c}\right)\left(\frac{P_{dc}}{\bar{P}_c}\right) X_c \leq \alpha_d \sum_c \left(n'_{dc}\, b'_{dc} + n''_{dc}\, b''_{dc}\right) \qquad d = 1, \ldots, 9$$

$$(2) \quad X_c \leq \theta_c \cdot \$_c \qquad c = 1, \ldots, 14$$

(3) $X_c \geq 0$ $\qquad\qquad$ $c = 1, \ldots, 14$

11.4 Model Results

11.4.1 Investment Plans

The three investment models derived in Section 11.3.3 were exercised in eight runs using the parameter settings (α_d, θ_c) and model designations indicated there. Table 11.5 presents the resulting values of the X_c decision (investment) variables for each Recreation Category and Table 11.6 presents the corresponding increase in benefits realized by each demographic group. Note that the benefits in Table 11.6 represent only those associated with the sample size of 9551. The national total can be estimated by noting the size of the active duty population (145,112) and then multiplying by a factor of (145,112/9551) = 15.1934. This was done in computing the benefit-cost ratio associated with each investment plan in Table 11.6.

Table 11.5 shows that under Model A1, to increase the benefits perceived by each demographic group by at least 5% with unconstrained investment requires a minimum of $494,401 distributed over three recreation categories. Over 66% of the entire investment is in Equipment Checkout/Rental, representing an increase in expenditures of over 52% for that category. If the same amount of money is invested under Model B (L = $494,401) with the objective of maximizing overall benefits, the entire investment is made in Dependent Services, the category with the highest overall rate-of-return, as shown in Table 11.4. For this case the resulting increase in benefits is unevenly distributed over the demographic groups, ranging from a low of 2.0% to a high of 12.3% (see Table 11.6).

Model A2 illustrates the effects of raising the benefit increase parameter, α_d, in Model A1 from 5% to 10%, for all demographic groups. The re-

TABLE 11.5 - INVESTMENT PLANS UNDER VARIOUS MODELS

	(1)		(2)			(3)		
RECREATION CATEGORY	CURRENT EXPENSE AMOUNT	% DISTRIB.	MODEL A1: NO CONSTRAINT; 5% BENEFIT INCREASE INVEST.	% OF (1)	% DISTR.	MODEL B: MAXIMIZATION; BUDGET CONSTRAINT INVEST.	% OF (1)	% DISTR.
1. Auto Hobby Shop	$1,190,140	9.2						
2. Boating/Sailing	385,416	3.0						
3. Bowling	851,849	6.6						
4. Craft Hobby Shop	751,576	5.8						
5. Dependent Services	400,483	3.1	$ 7,970	1.9	1.6	$494,401	123.5	100.0
6. Entertainment	552,986	4.3	161,404	29.2	32.6			
7. Golf Facilities	1,156,918	9.0						
8. Informal Sports	1,173,809	9.0						
9. Movies	805,388	6.2						
10. Organized Sports	984,504	7.6						
11. Other Rec. Activities	1,552,093	12.0						
12. Outdoor Sports	1,155,809	8.9						
13. Equip. Checkout/Rental	621,102	4.8	325,027	52.3	66.8			
14. Swimming Pools	1,332,080	10.3						
TOTAL:	$12,914,153	100.0	$494,401	3.8	100.0	$494,401	3.8	100.0

(Table continued on next page...)

TABLE 11.5 (Continued)

RECREATION CATEGORY	(4) MODEL A2: NO CONSTRAINT; 10% BENEFIT INCREASE			(5) MODEL C1: 20% CONSTRAINT; 5% BENEFIT INCREASE			(6) MODEL C2: 15% CONSTRAINT; 5% BENEFIT INCREASE		
	INVEST.	% OF (1)	% DISTR.	INVEST.	% OF (1)	% DISTR.	INVEST.	% OF (1)	% DISTR.
1. Auto Hobby Shop									
2. Boating/Sailing							$ 51,757	13.4	8.9
3. Bowling				$170,369	20.0	32.5	127,777	15.0	22.1
4. Craft Hobby Shop									
5. Dependent Services	$ 15,940	3.8	1.6	80,096	20.0	15.3	60,072	15.0	10.4
6. Entertainment	322,808	58.4	32.6	92,146	16.6	17.6	82,948	15.0	14.3
7. Golf Facilities									
8. Informal Sports									
9. Movies				56,943	7.0	10.9	120,808	15.0	20.9
10. Organized Sports									
11. Other Rec. Activities									
12. Outdoor Sports							40,695	3.5	7.0
13. Equip. Checkout/Rental	650,054	104.6	66.8	124,220	20.0	23.7	93,165	15.0	16.4
14. Swimming Pools									
TOTAL:	$988,802	7.6	100.0	$523,774	4.1	100.0	$577,222	4.5	100.0

(Table continued on next page...)

TABLE 11.5 (Continued)

RECREATION CATEGORY	(7) MODEL C3: 12% CONSTRAINT; 5% BENEFIT INCREASE			(8) MODEL C4: 10% CONSTRAINT; 5% BENEFIT INCREASE			(9) MODEL C5: 8% CONSTRAINT; 5% BENEFIT INCREASE		
	INVEST.	% OF (1)	% DISTR.	INVEST	% OF (1)	% DISTR.	INVEST.	% OF (1)	% DISTR.
1. Auto Hobby Shop	$127,397	10.7	19.6	$119,014	10.0	16.3	$ 95,211	8.0	11.5
2. Boating/Sailing	46,250	12.0	7.1	38,542	10.0	5.3	30,833	8.0	3.7
3. Bowling	102,222	12.0	15.7	85,185	10.0	11.7	68,148	8.0	8.2
4. Craft Hobby Shop							60,126	8.0	7.2
5. Dependent Services	48,058	12.0	7.4	40,048	10.0	5.5	32,039	8.0	3.9
6. Entertainment	66,358	12.0	10.2	55,299	10.0	7.6	44,239	8.0	5.3
7. Golf Facilities									
8. Informal Sports							88,619	7.6	10.7
9. Movies	96,647	12.0	14.9	80,539	10.0	11.0	64,431	8.0	7.8
10. Organized Sports				94,234	9.6	12.9	78,760	8.0	9.4
11. Other Rec. Activities				38,032	2.5	5.2	124,167	8.0	15.0
12. Outdoor Sports	88,697	7.7	13.6	115,581	10.0	15.9	92,465	8.0	11.1
13. Equip. Checkout/Rental	74,532	12.0	11.5	62,110	10.0	8.5	49,688	8.0	6.0
14. Swimming Pools							1,374	0.1	.2
TOTAL:	$650,161	5.0	100.0	$728,584	5.6	100.0	$830,100	6.4	100.0

TABLE 11.6 - INCREASE IN BENEFITS REALIZED UNDER VARIOUS INVESTMENT MODELS

DEMOGRAPHIC GROUPS	% DISTR. OF SAMPLE	(1) CURRENT BENEFITS OF SAMPLE[1] AMOUNT	% DISTR.	(2) MODEL A1: NO CONSTRAINT; 5% BENEFIT INCREASE INCREASE	ACTUAL % INCREASE	(3) MODEL B: MAXIMIZATION; BUDGET CONSTR. INCREASE	ACTUAL % INCR.
1. Enlisted, Off-Base, W/O, Ashore	12.4	$ 946,360	11.4	$ 47,666	5.0	$ 38,563	4.1
2. Enlisted, Off-Base, With, Ashore	14.1	1,208,200	14.6	60,410	5.0	124,095	10.3
3. Enlisted, Off-Base, W/O, Afloat	14.7	1,149,900	13.9	57,495	5.0	57,845	5.0
4. Enlisted, Off-Base, With, Afloat	14.8	1,172,440	14.1	64,361	5.5	88,992	7.6
5. Enlisted, On-Base, W/O, Ashore	14.8	1,479,640	17.9	78,087	5.3	67,733	4.6
6. Enlisted, On-Base, W/O, Afloat	13.2	1,024,980	12.4	51,249	5.0	20,765	2.0
7. Enlisted, On-Base, With	4.9	457,840	5.5	24,445	5.3	26,698	5.8
8. Officer, W/O	5.3	426,300	5.1	33,945	8.0	13,349	3.1
9. Officer, With	5.8	421,240	5.1	26,967	6.4	51,912	12.3
SAMPLE TOTAL	100.0	$8,286,900	100.0	$444,625	5.4	$489,952	5.9
NATIONAL BENEFIT/COST[2]		9.75[3]		13.66		15.06	

(Table continued on next page...)

1 Benefits shown are those associated with the survey sample of 9551 from a total population of 145,112.

2 Benefit/Cost ratios shown are the product of scaling the ratio experienced by the sample by a factor of (145,112/9551) = 15.1934.

3 Compares favorably to 9.66 in Table 9.4 where total benefits were determined by stratifying total population on Rank, Term of Service and Duty Station.

TABLE 11.6 - (Continued)

DEMOGRAPHIC GROUPS	% DISTR. OF SAMPLE	(4) MODEL A2: NO CONSTRAINT; 10% BENEFIT INCR. INCREASE	(4) ACTUAL % INCREASE	(5) MODEL C1: 20% CONSTRAINT; 5% BENEFIT INCR. INCREASE	(5) ACTUAL % INCR.	(6) MODEL C2: 15% CONSTRAINT; 5% BENEFIT INCR. INCREASE	(6) ACTUAL % INCREASE	(7) MODEL C3: 12% CONSTRAINT; 5% BENEFIT INCR. INCREASE	(7) ACTUAL % INCR.
1. Enlisted, Off-Base, W/O, Ashore	12.4	$ 95,332	10.1	$ 50,467	5.3	$ 51,833	5.5	$ 54,942	5.8
2. Enlisted, Off-Base, With, Ashore	14.1	120,820	10.0	63,121	5.2	64,918	5.4	65,879	5.5
3. Enlisted, Off-Base, W/O, Afloat	14.7	114,990	10.0	57,495	5.0	57,495	5.0	57,495	5.0
4. Enlisted, Off-Base, With, Afloat	14.8	128,722	11.0	67,112	5.7	64,146	5.5	65,465	5.6
5. Enlisted, On-Base, W/O, Ashore	14.8	156,174	10.6	75,629	5.1	81,216	5.5	80,766	5.5
6. Enlisted, On-Base, W/O/ Afloat	13.2	102,498	10.0	53,376	5.2	52,942	5.2	52,947	5.2
7. Enlisted, On-Base, With	4.9	48,890	10.7	22,892	5.0	22,892	5.0	22,892	5.0
8. Officer, W/O	5.3	67,890	15.9	21,388	5.0	25,356	6.0	25,260	5.9
9. Officer, With	5.8	53,934	12.8	29,399	7.0	28,689	6.8	28,872	6.9
SAMPLE TOTAL	100.0	$889,250	10.8	$440,879	5.3	$449,487	5.4	$454,518	5.5
NATIONAL BENEFIT/COST[2]		13.66		12.79		11.83		10.62	

TABLE 11.6 - (Continued)

DEMOGRAPHIC GROUPS	% DISTR. OF SAMPLE	(8) MODEL C4: 10% CONSTRAINT; 5% BENEFIT INCR. INCREASE	(8) ACTUAL % INCREASE	(9) MODEL C5: 8% CONSTRAINT; 5% BENEFIT INCR. INCREASE	(9) ACTUAL % INCR.
1. Enlisted, Off-Base, W/O, Ashore	12.4	$ 54,627	5.8	$ 58,283	6.2
2. Enlisted, Off-Base, With, Ashore	14.1	65,696	5.4	67,279	5.6
3. Enlisted, Off-Base, W/O, Afloat	14.7	57,495	5.0	57,495	5.0
4. Enlisted, Off-Base, With, Afloat	14.8	65,214	5.6	63,587	5.4
5. Enlisted, On-Base, W/O, Ashore	14.8	80,923	5.5	84,696	5.7
6. Enlisted, On-Base, W/O/ Afloat	13.2	52,318	5.1	54,602	5.3
7. Enlisted, On-Base, With	4.9	22,892	5.0	22,892	5.0
8. Officer, W/O	5.3	25,765	6.0	29,598	6.9
9. Officer, With	5.8	28,455	6.8	28,012	6.7
SAMPLE TOTAL	100.0	$453,385	5.5	$466,444	5.6
NATIONAL BENEFIT/COST[2]		9.46		8.54	

sult is a proportional increase in both the required investment and resulting benefits, with both distributed in the same proportions as before.

Models C1 through C5 show the progressive effects of placing an investment constraint on each Recreation Category, and then tightening that constraint from 20% down to 8% of the current expenditures in that Category. As this constraint is applied, more and more Categories are selected for investment in an order based upon their rates-of-return as seen by those particular demographic groups still shy of their 5% benefit increase. Groups three and seven appear to be the most difficult to satisfy in each case - they are always the last to reach the 5% level. As the investment constraint tightens, two significant trends occur. In Table 11.5, the total amount of the required investment increases from 4.1% to 6.4% of the total current expense, reflecting the cost of increased diversification of investments. At the same time, benefits are growing much slower. The result, in Table 11.6, is a decreasing benefit-cost ratio for each investment plan, from a (national) ratio of 12.79 to 8.54. These trends are illustrated graphically in Figures 11.3 and 11.4, respectively. The choice of an appropriate level of investment constraint, therefore, is not only a question of minimizing error caused by the linear rate-of-return assumption, but also involves a trade-off between diversification and cost-effectiveness.

Figure 11.5 illustrates the changing distribution of investment dollars among the various Recreation Categories as the investment constraint is tightened. The shadings represent the Benefit Factors discussed in Section 11.1. Note that once a category or Factor enters this investment "stream", it remains there even though progressively diminished by the tightening investment constraint and additional investments. As the percentage investment in one Factor begins to diminish, another category belonging to that same Factor tends to enter the investment plan to strengthen its position (e.g.,

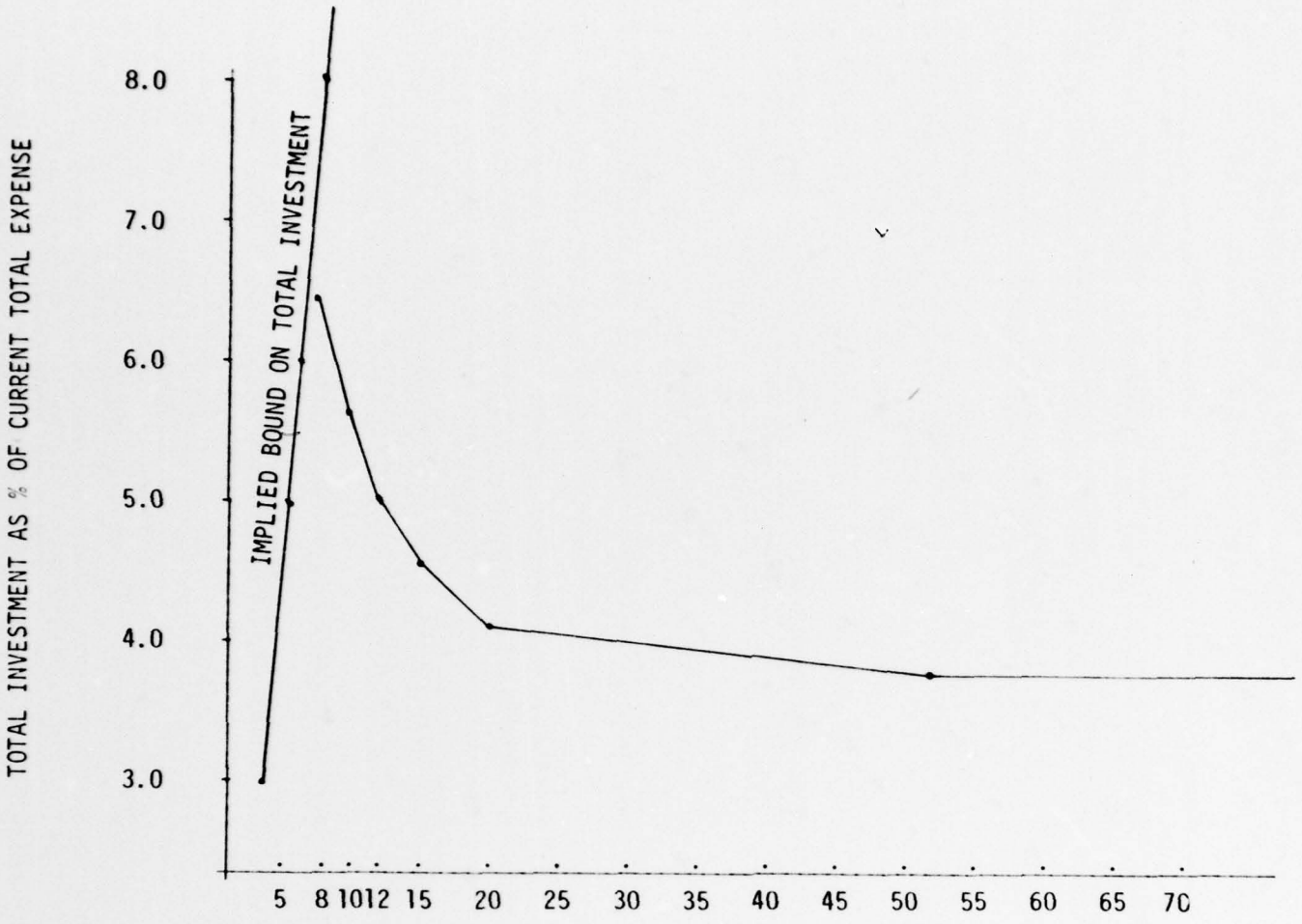


Figure 11.3 - Investment Constraint vs. Total Investment

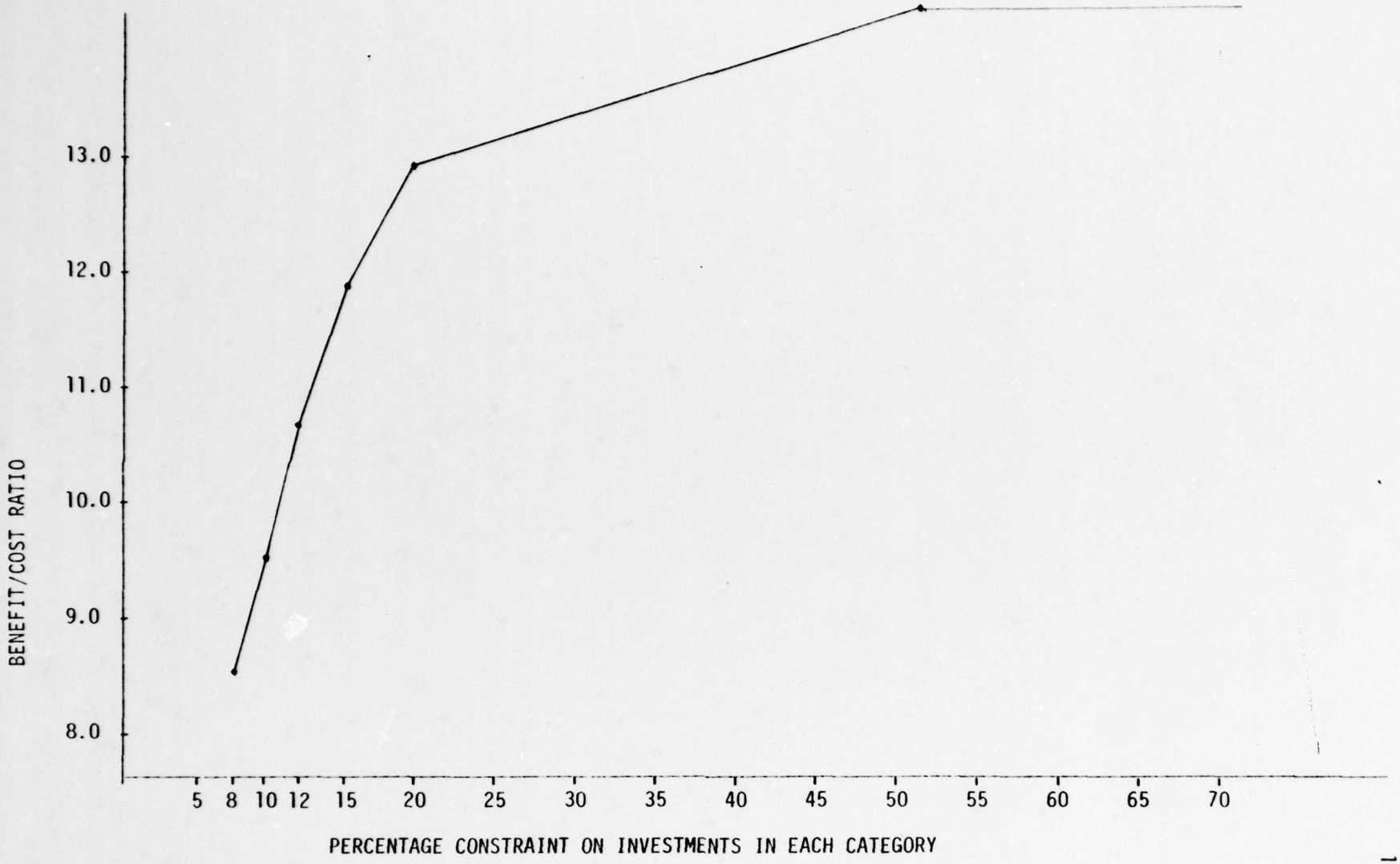


Figure 11.4 - Investment Constraint vs. Benefit/Cost Ratio

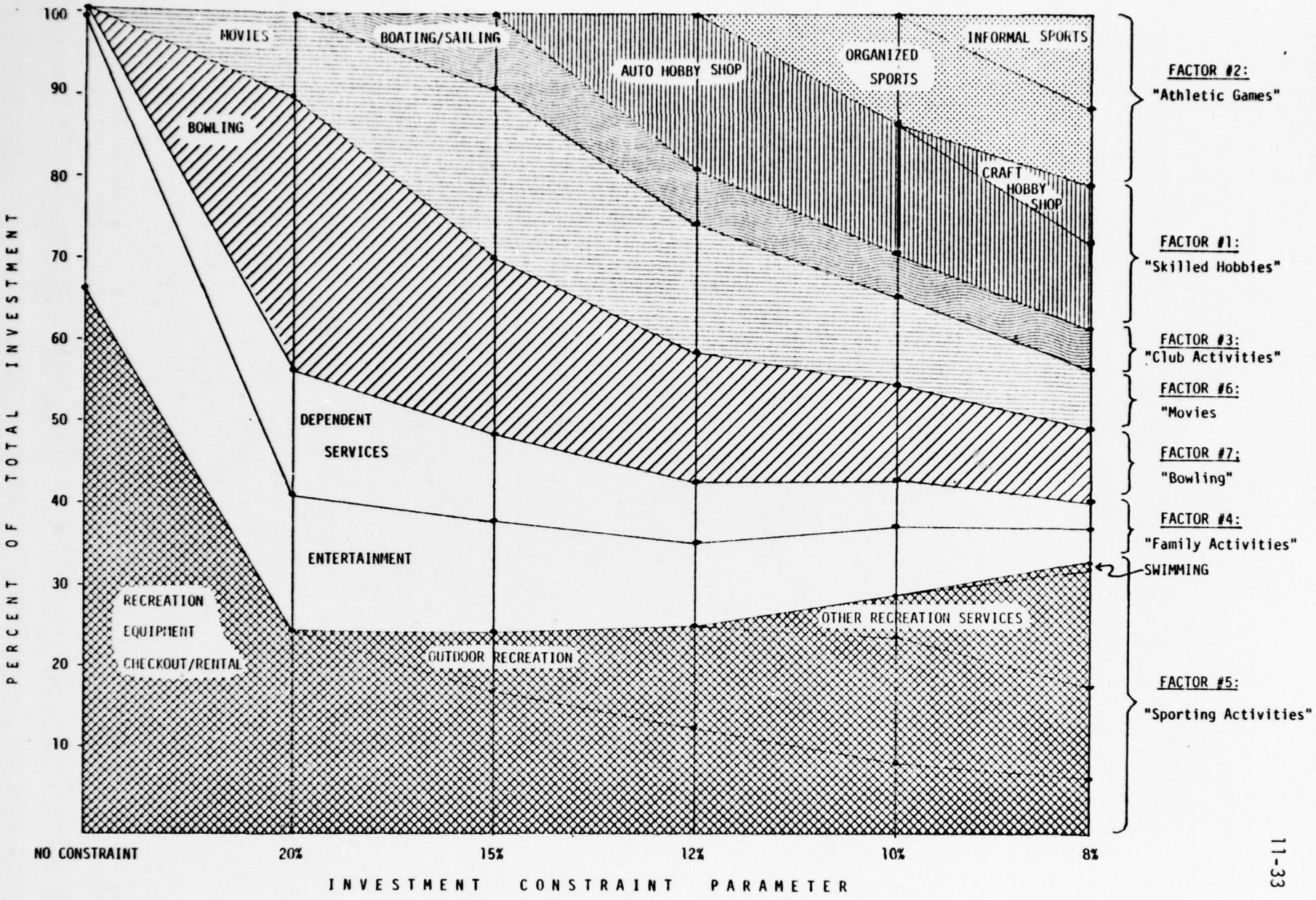


Figure 11.5 - Distribution of Investment Dollars

the entrance of Informal Sports, Craft Hobby Shop, and Other Recreation Services). At the 12% constraint level, only eight categories are present in the investment plan, and yet six of the seven Factors are present, representing all but two of the 14 Categories. It would appear that investment is occuring with respect to Factors, as conjectured in Section 11.1.

Notice that Golf Facilities are never invested in, even at the 8% level. The rather limited appeal and high cost of this activity, along with the early appearance of Boating/Sailing from the same Factor help to explain this absence.

In order to illustrate the use of Table 11.5 as a tool in investment decisions, suppose $100,000 were available for investment. First, an investment constraint level must be selected, say 12%. The prescribed investments and amounts are then determined from the percentage distribution of the total investment given for Model C3. For example, 19.6% of $100,000, or $19,600, would be invested in Auto Hobby Shops, 7.1% in Boating/Sailing, etc. Note that the amount to be invested (as in this example) must be less than the total investment called for by the model ($650,161) in order for the percentage constraint to be met. The increase in benefits will be realized in the same distribution among demographic groups as shown for the appropriate model (C3) in Table 11.6. In this case, the actual percentage increase realized by each demographic group will be ($100,000/$650,161) = .154 of that experienced under Model C3 in Table 11.6.

11.4.2 Budget Reduction Plans

The three budget reduction models derived in Section 11.3.4 were exercised in six runs using the parameter settings (α_d, θ_c) and model designations indicated there. Table 11.7 presents the resulting values of the X_c decision (budget reduction) variables for each Recreation Category

TABLE 11.7 - BUDGET REDUCTION PLANS UNDER VARIOUS MODELS

	(1)		(2)			(3)		
RECREATION CATEGORY	CURRENT EXPENSE AMOUNT	% DISTRIB.	MODEL A1' 100% CONSTRAINT; 5% BENEFIT DECREASE REDUCTION	% OF (1)	% DISTR.	MODEL B': MINIMIZATION; REDUCTION GOAL REDUCTION	% OF (1)	% DISTR.
1. Auto Hobby Shop	$ 1,190,140	9.2						
2. Boating/Sailing	385,416	3.0						
3. Bowling	851,849	6.6						
4. Craft Hobby Shop	751,576	5.8						
5. Dependent Services	400,483	3.1						
6. Entertainment	552,986	4.3						
7. Golf Facilities	1,156,918	9.0				$984,505	85.1	100.0
8. Informal Sports	1,173,809	9.0						
9. Movies	805,388	6.2						
10. Organized Sports	984,504	7.6	$318,755	32.4	32.4			
11. Other Rec. Activities	1,552,093	12.0	516,694	33.3	52.5			
12. Outdoor Sports	1,155,809	8.9						
13. Equip. Checkout/Rental	621,102	4.8						
14. Swimming Pools	1,332,080	10.3	149,056	11.2	15.1			
TOTAL:	$12,914,153	100.0	$984,505	7.6	100.0	$984,505	7.6	100.0

(Table continued on next page...)

TABLE 11.7 - (Continued)

RECREATION CATEGORY	(4) MODEL A2': 100% CONSTRAINT; 10% BENEFIT DECR. REDUCTION	% OF (1)	% DISTR.	(5) MODEL C1': 20% CONSTRAINT; 5% BENEFIT DECREASE REDUCTION	% OF (1)	% DISTR.	(6) MODEL C2': 15% CONSTRAINT; 5% BENEFIT DECREASE REDUCTION	% OF (1)	% DISTR.	(7) MODEL C4': 10% CONSTRAINT; 5% BENEFIT DECREASE REDUCTION	% OF (1)	% DISTR.
1. Auto Hobby Shop							$162,024	13.6	18.8	$119,014	10.0	14.8
2. Boating/Sailing												
3. Bowling										5,395	0.6	0.7
4. Craft Hobby Shop				$123,430	16.4	13.6	112,736	15.0	13.1	75,158	10.0	9.4
5. Dependent Services												
6. Entertainment												
7. Golf Facilities												
8. Informal Sports							5,367	0.4	0.6	101,188	8.6	12.6
9. Movies												
10. Organized Sports	$ 637,510	64.8	32.4	196,901	20.0	21.7	147,676	15.0	17.2	98,450	10.0	12.3
11. Other Rec. Activities	1,033,388	66.6	52.5	310,419	20.0	34.2	232,814	15.0	27.1	155,209	10.0	19.3
12. Outdoor Sports				9,587	0.8	1.1				115,581	10.0	14.4
13. Equip. Checkout/Rental												
14. Swimming Pools	298,113	22.4	15.1	266,416	20.0	29.4	199,812	15.0	23.2	133,208	10.0	16.6
TOTAL:	$1,969,010	15.2	100.0	$906,753	7.0	100.0	$860,429	6.7	100.0	$803,203	6.2	100.0

and Table 11.8 presents the corresponding decrease in benefits suffered by each demographic group.

Table 11.7 shows that under Model A1' to decrease the benefits perceived by each demographic group by no more than 5% with unconstrained budget reduction requires a total maximum reduction of $984,505 distributed over three Recreation Categories. Over 52% of the entire reduction is accomplished in Other Recreation Services, representing a decrease of over 33% in that category's current budget. If the same total reduction is applied under Model B' (L = $684,505) with the objective of minimizing the overall loss of benefits, the entire reduction is made in Golf Facilities, the category with the lowest overall rate-of-return, as was shown in Table 11.4. For this case, the resulting decrease in benefits is unevenly distributed over the demographic groups, ranging from a low of 1.7% to a high of 9.8% (see Table 11.8).

Model A2' illustrates the effects of raising the benefit decrease parameter, α_d, in Model A1' from 5% to 10%, for all demographic groups. The result is a proportional increase in both the required budget reduction and resulting benefit loss, with both distributed in the same proportions as before.

Models C1', C2', and C4' show the progressive effects of placing a budget reduction constraint on each Recreation Category, and then tightening that constraint from 20% down to 10% of the current expenditures in that Category. The groups which are most easily hurt in each case appear to be the Officer classifications, groups eight and nine.

Figure 11.6 illustrates the changing distribution of budget reduction dollars among the various Recreation Categories as the budget reduction constraint is tightened. As in Figure 11.5, the shadings represent the Factors discussed in Section 11.1. Note that only three Factors are present to any appreciable degree throughout all constraint levels. Optimal budget reduction

TABLE 11.8 - DECREASE IN BENEFITS SUFFERED UNDER VARIOUS BUDGET REDUCTION MODELS

DEMOGRAPHIC GROUPS	% DISTR. OF SAMPLE	(1) CURRENT BENEFITS OF SAMPLE[1] AMOUNT	% DISTR.	(2) MODEL A1': 100% CONSTRAINT: 5% BENEFIT DECR. DECREASE	ACTUAL % DECREASE	(3) MODEL B': MINIMIZATION: REDUCTION GOAL DECREASE	ACTUAL % DECREASE
1. Enlisted, Off-Base, W/O, Ashore	12.4	$ 946,360	11.4	$47,318	5.0	$ 15,752	1.7
2. Enlisted, Off-Base, With, Ashore	14.1	1,208,200	14.6	48,625	4.0	27,566	2.3
3. Enlisted, Off-Base, W/O, Afloat	14.7	1,149,900	13.9	42,926	3.7	30,520	2.7
4. Enlisted, Off-Base, With, Afloat	14.8	1,172,440	14.1	43,373	3.7	33,473	2.9
5. Enlisted, On-Base, W/O, Ashore	14.8	1,479,640	17.9	68,512	4.6	53,163	3.6
6. Enlisted, On-Base, W/O, Afloat	13.2	1,024,980	12.4	40,275	3.9	27,566	2.7
7. Enlisted, On-Base, With	4.9	457,840	5.5	18,613	4.1	11,814	2.6
8. Officer, W/O	5.3	426,300	5.1	21,315	5.0	21,659	5.1
9. Officer, With	5.8	421,240	5.1	21,062	5.0	41,349	9.8
SAMPLE TOTAL	100.0	$8,286,900		$352,019	4.2	$262,862	3.2
NATIONAL BENEFIT/COST[2]		9.75[3]		5.43		4.06	

1 Benefits shown are those associated with the survey sample of 9551 from a total population of 145,112.

(Table continued on next page...)

2 Benefit/Cost ratios shown are the product of scaling the ratio experienced by the sample by a factor of (145,112/9551) = 15.1934.

3 Compares favorably to 9.66 in Table 9.4 where total benefits were determined by stratifying total population on Rank, Term of Service, and Duty Station.

TABLE 11.8 (Continued)

DEMOGRAPHIC GROUPS	% DISTR. OF SAMPLE	(4) MODEL A2': 100% CONSTRAINT; 10% BENEFIT DECR.		(5) MODEL C1': 20% CONSTRAINT; 5% BENEFIT DECR.		(6) MODEL C2': 15% CONSTRAINT; 5% BENEFIT DECR.		(7) MODEL C4': 10% CONSTRAINT; 5% BENEFIT DECR.	
		DECREASE	ACTUAL % DECREASE	DECREASE	ACTUAL % DECREASE	DECREASE	ACTUAL % DECREASE	DECREASE	ACTUAL % DECREASE
1. Enlisted, Off-Base, W/O, Ashore	12.4	$ 94,636	10.0	$ 43,476	3.6	$ 46,681	3.9	$ 45,812	3.8
2. Enlisted, Off-Base, With, Ashore	14.1	97,250	8.1	43,874	3.6	45,510	3.8	45,448	3.8
3. Enlisted, Off-Base, W/O, Afloat	14.7	85,852	7.5	34,824	3.0	37,258	3.2	36,810	3.2
4. Enlisted, Off-Base, With, Afloat	14.8	86,745	7.4	39,095	3.3	41,778	3.6	43,463	3.7
5. Enlisted, On-Base, W/O, Ashore	14.8	137,025	9.3	60,892	4.1	59,520	4.0	60,931	4.1
6. Enlisted, On-Base, W/O/ Afloat	13.2	80,550	7.9	36,574	3.6	38,361	3.7	38,020	3.7
7. Enlisted, On-Base, With	4.9	37,226	8.1	17,576	3.8	16,838	3.7	16,819	3.7
8. Officer, W/O	5.3	42,630	10.0	21,315	5.0	21,315	5.0	21,315	5.0
9. Officer, With	5.8	42,125	10.0	21,062	5.0	21,062	5.0	21,062	5.0
SAMPLE TOTAL	100.0	$704,039	8.5	$318,688	3.8	$328,323	4.0	$329,680	4.0
NATIONAL BENEFIT/COST[2]		5.43		5.34		5.80		6.24	

[2] Benefit/Cost ratios shown are the product of scaling the ratio experienced by the sample by a factor of (145,112/9551) = 15.1934.

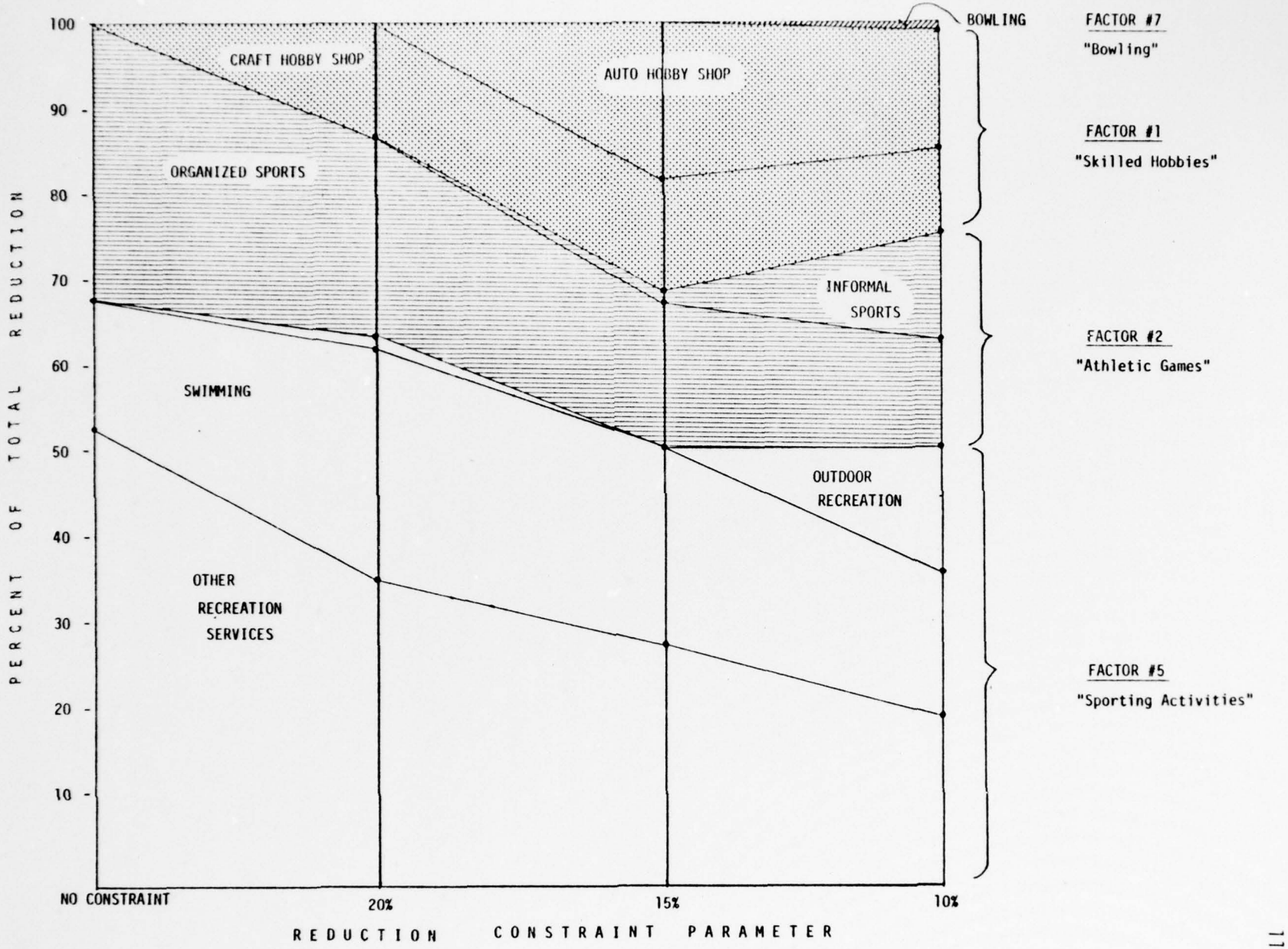


Figure 11.6 - Distribution of Budget Reduction Dollars

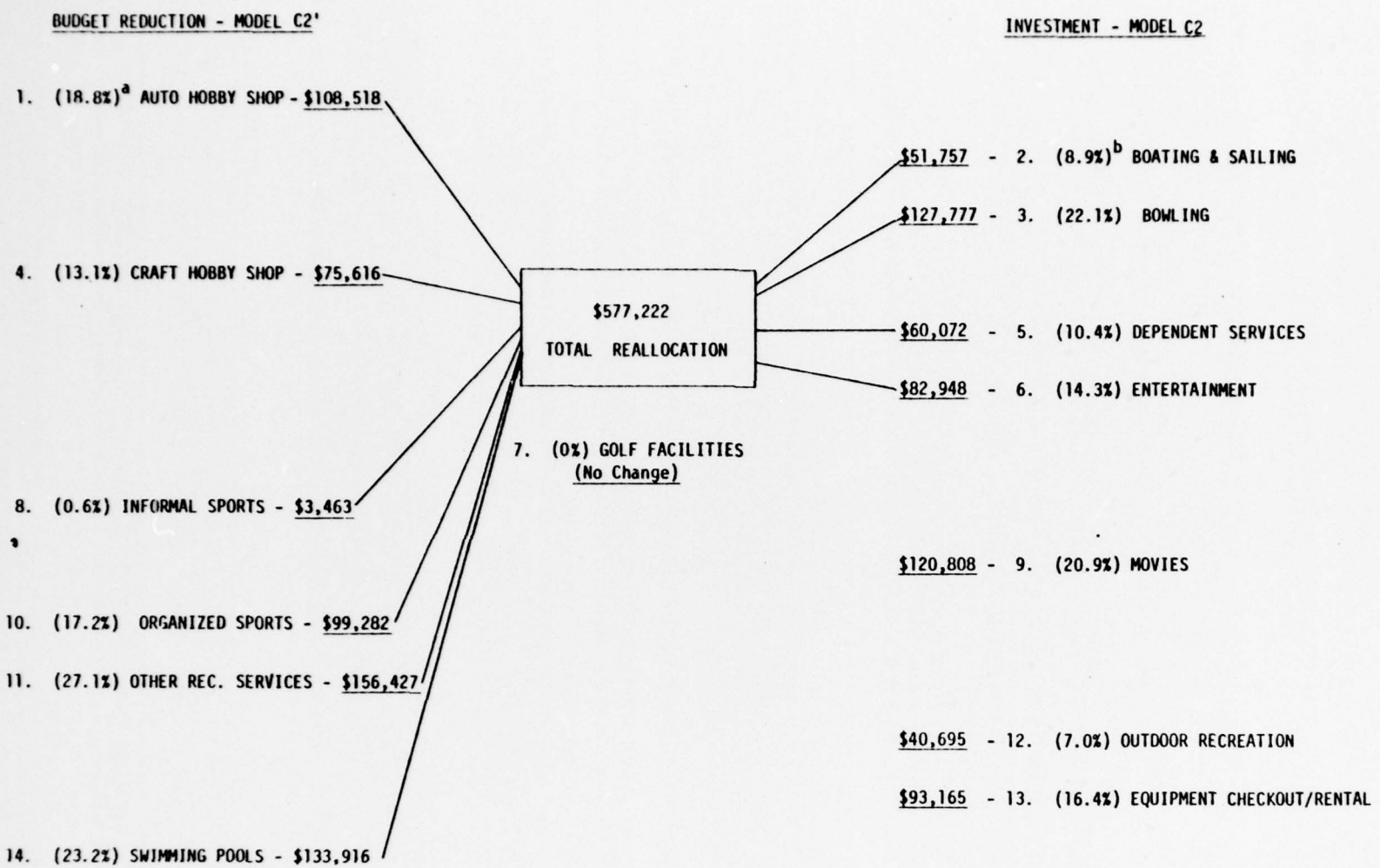
appears to involve as few Factors as possible.

As in the investment runs, Golf Facilities again present an interesting case. Although this activity has the lowest overall rate-of-return shown in Table 11.4, a budget reduction is never prescribed - even at the tightest constraint level examined. The explanation seems to lie in the high ranking which group nine assigns to Golf Facilities in Table 11.3. Golf Facilities, therefore, appears to be uniquely at an optimal level of funding - neither investment nor budget reduction is called for.

Use of Table 11.7 for accomplishing an actual budget reduction is completely analogous to that of Table 11.5 for investments. A budget reduction constraint is selected, say 15%. The prescribed budget reductions are then given by the percentage distribution of the overall reduction given for that model.

11.4.3 Reallocation of Current Resources

The apparent equilibrium position enjoyed by Golf Facilities suggests that by coordinating the application of both the investment and budget reduction processes, a reallocation of current resources might be effected which would tend to bring additional Recreation Categories closer to their optimal funding levels. Investment Model C2 and its corresponding budget reduction Model C2' (both at the 15% constraint level) together define two mutually exclusive sets of Recreation Categories: those in which investments should be made and those in which budget reductions should be made. Figure 11.7 illustrates how these two models might be used in conjunction to recover and reallocate the $577,222 investment required by Model C2. This particular reallocation of current resources would yield a $3,482,783 increase in overall benefits of the 16 surveyed bases, or about $24 per person per year.



[a] Percentage of total reduction coming from this category.

[b] Percentage of total investment going into this category.

Figure 11.7 - Reallocation of Current Resources

(Based on Models C2 and C2' - 15% constraint level)

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COST AND RETENTION IMPACTS OF THE NAVY'S CONUS RECREATION PROGRAM (3 VOLUMES)

#20

This study is an evaluation of the benefits and costs associated with the Navy's shore-based Recreation Program. The evaluation is achieved by determining the cost effectiveness of the Overall Recreation Program as well as that for the fourteen individual Recreation Categories. A significant by-product of the cost-effectiveness has been the estimation of income from and costs (operating as well as capital costs) of individual Recreation Categories.

The results are based on extensive information gathered from over 11,000 active duty eligible users as well as the managers of the Recreation Program at 16 diverse Navy Installations in CONUS. The Recreation Program has been evaluated not only in terms of its benefits to the Navy individual and dependents but also with respect to its overall impact on the Navy in terms of maintaining retention rates. This evaluation has been accomplished utilizing econometric models that take into account established relationships between changes in income and changes in retention. Other key ingredients of these models are estimates of recruiting and training costs utilized in the retention cost calculations. In addition, optimization models for resource allocation across the Recreation Categories have been developed. These models ensure the uniform distribution of benefits to the various demographic groups. Finally, the methodical pretesting of the survey instruments and the statistical randomness, size and geographical representation of the survey sample utilized in this study ensure the reliability of the results.