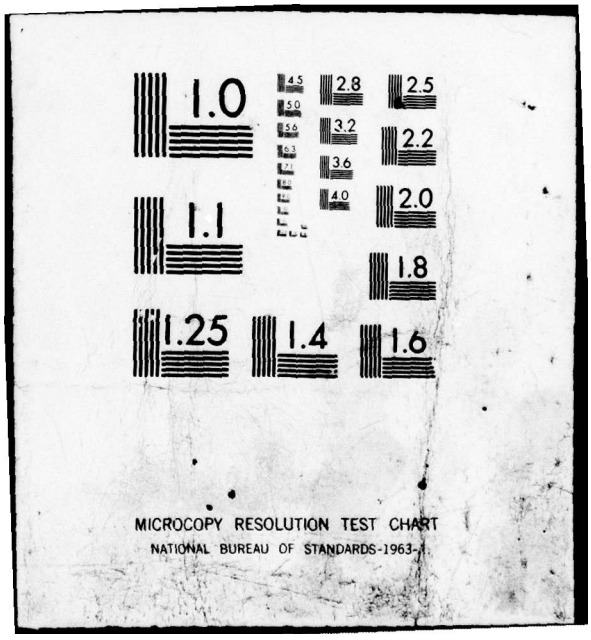
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(6) ANALYSIS OF CLOSURE ALTERNATIVES FOR NAVAL STATIONS AND NAVAL AIR STATIONS

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PREFACE

The three papers presented here are reprints from "Hearing before the Subcommittee on Military Construction of the Committee on Armed Services," U.S. Senate, 93rd Congress, 1st Session, Part 2, June 22, 1973, pp. 468-517. They were provided by Secretary of the Navy John W. Warner as part of the response to the Subcommittee's request for the material on which Navy closure decisions were based.

CENTER FOR NAVAL ANALYSES,
Arlington, Va., February 17, 1972.

Arlington, Va. February 17, 1972.
Memorandum for Capt. Mazzolini, OP—405C.
From: R. Kuzmack and K. Wiedemann.

Subject: Utilization of Capacity at Naval Stations and Naval Air Stations by Forces Planned for FY-74 (U).

Reference: (INS) 0080-72, (RAD) 9-72, "Closure of Naval Stations and Naval Air Stations (U)," SECRET of 22 December 1971.

1. This paper compares the demand for support resources at Naval Stations and Naval Air Stations by ship and aircraft loadings planned for FY-74 with the support actually provided in FY-69. We find that many stations have the capacity to support additional ships and aircraft at standards no worse than those that prevailed in FY-69.

2. The comparisons proceeded in four steps. First, demand for each support resource is determined by applying the models described in reference (a) to the base loadings of FY-69 and planned FY-74. Next, for each resource the FY-74 demand is taken as a percent of the FY-69 demand, and the most constraining (highest percentage) resource is considered as the rate of capacity utilization. For those stations with unused capacity the total demand which could be satisfied at FY-69 standards is then determined by dividing the total base loading by the rate of capacity utilization. Finally, this total demand is translated into t he number of additional ships aircraft which could be homeported or assigned by applying the reciprocal of the deployment factors.

3. Two points should be noted about our interpretation of capacity, which we assume to be the amount of support provided in a previous year (FY-69) of peak demand. First, a station which was overloaded by some other set of criteria would continue to be overloaded by those criteria at what we call 100% capacity utilization. Thus, if only a fraction of the P-80 standards for a resource was provided by an air station in FY-69, we allow for no more than that same fraction in FY-74. Similarly, if there were ships in the stream at the Naval Station in FY-69, we expect to have ships in the stream at a capacity loading of that Naval Station in FY-74. Second, we observe at the other extreme stations where the planned FY-74 demand is greater than 100% of the FY-69 demand. If the FY-74 plan is feasible, then either excess capacity existed at such stations in FY-69 or the Navy is implicitly or explicitly reducing the support standards below the FY-69 level at those stations. In either case our interpretation of capacity is not applicable.

4. Aircraft loadings for Naval Air Stations in FY-74 are from the Aircraft Program Data File dated 15 October 1971, while FY-69 loadings are based on the NAO of July 1968. The resources considered and the relative demand for each are shown by air station in table 1. Differences across resources at an air station reflect changes in mix between the two years of the types of aircraft in the base load. The demand for each resources has been standardized at FY-69 levels, as described in Appendix A of reference (a).

5. Table 2 summarizes the excess capacity which we found at Naval Air Stations in FY-74. The additional capacity is based on the assumption that the FY-69 deployment factor for a station could apply to these additional aircraft as well. For each station the principal types of aircraft it normally has assigned have been indicated.

6. In response to the question regarding the utilization of Naval Station capacity, a comparison was made between FY-69 and FY-74 peak loadings. Homeporting schedules were taken from Forecast of Homeports of Ships for Mid-Range Planning (March 1970) for FY-69 and from the Ships Planning System (October 1971) for FY-74. All active and NRT Ships were included with the exception of SSBN's. The method used to estimate peak simultaneous ship loadings from homeported schedules is described in reference (a).

7. The resources considered in this comparison are the total number of hulls seeking berthing facalities at peak deman dand the total number of men assigned to these hulls. These results are summaries in Table 3. Differences between the two resources utilization rates at a naval station reflect changes in the mix of ships at peak demand between FY-69 and FY-74.

8. To determine the number of additional ships necessary to achieve capacity loading in FY-74, the resource requiring the larger percentage of FY-69 resources was used. The division of number of hulls at peak demand in FY-74 by the larger percentage, results in the number of additional hulls necessary to achieve peak capacity loading in FY-74. Peak demand was converted to homeporting by means of the method referenced earlier. Table 4 summarizes these results, and indicates the principal types of additional ships that could be berthed at Naval Stations, based upon the FY-74 mix of ships. In the special case of carriers, the number of additional carriers that could be added without exceeding the FY-69 assignments is noted.

TABLE 1.—FISCAL YEAR 1974 DEMAND FOR A/C RESOURCES RELATIVE TO FISCAL YEAR 1969 DEMAND

[Fiscal year 1974 as percent of fiscal year 1969]

	Resources				
	Parking apron	Covered warehouse	Crew E/A	Hangar bay	Maintenance shop
Lant:					
Albany	40.7	41.5	54.6	50.2	54.4
Lakehurst	117.4	108.6	116.6	120.0	121.5
Key west	30.1	38.8	48.1	37.8	54.8
Quonset Point	61.3	58.4	69.7	65.2	77.3
Brunswick	106.2	104.4	102.8	103.4	108.2
Jacksonville	117.2	121.0	112.4	117.2	115.7
Cecil	86.7	86.5	78.2	79.4	88.5
Oceanana	122.9	127.2	124.8	125.7	126.5
Norfolk	59.0	59.1	64.3	60.0	73.4
PAC:					
Kodiak	68.8	66.9	89.9	72.7	95.4
El Centro	90.7	88.4	98.4	95.4	98.2
Imperial Beach	98.4	98.6	100.1	100.3	100.9
Adak	92.6	88.0	96.4	88.8	100.0
Barber's Point	83.4	84.8	86.1	84.9	90.9
Moffett	213.2	114.6	151.3	164.3	146.4
Whidbey	82.2	94.3	105.4	98.4	112.3
Alameda	53.6	66.3	60.0	64.7	53.2
Miramar	63.4	61.2	65.1	62.7	71.1
Lemoure	45.0	36.0	41.5	38.5	45.8
North Island	50.7	91.9	68.6	64.3	82.4
CNT:					
Ellyson	78.1	54.7	78.6	54.6	80.3
Saufley	71.7	73.6	80.3	76.3	86.1
Corpus Christi	71.7	68.1	74.0	70.8	79.3
Memphis	138.2	152.9	130.0	138.9	115.8
Dallas	106.1	113.5	109.8	108.0	108.7
New Orleans	100.4	100.2	98.2	100.0	98.2
Detroit	29.0	33.9	67.4	34.4	79.3
South Weymouth	67.4	66.6	77.3	69.2	82.4
Whiting	68.4	68.8	74.5	70.9	80.5
Glynco	82.3	92.6	103.7	97.9	98.9
Meridan	73.8	90.3	124.1	112.6	89.5
Willow Grove	110.3	140.7	117.8	117.4	106.3
Atlanta	63.0	86.1	90.9	89.0	92.2
Glenview	124.6	108.2	104.8	108.0	103.8
Pensacola	51.2	62.6	77.1	67.2	75.3
Olase	84.1	71.9	91.7	82.9	88.1
Kingsville	197.8	404.9	203.6	222.9	211.3

TABLE 2.—ADDITIONAL AIRCRAFT TO ACHIEVE CAPACITY LOADING IN FISCAL YEAR 1974

Stations [1]	Fiscal year 1969 capacity used in fiscal year 1974 (percent)	Additional capacity (number of assigned aircraft)	Principal types
Albany	84.6	26	RA5
Key West	84.3	22	F4, S2
Quonset Point	77.3	34	S2, H3
Cecil	96.7	12	A7, A4
Norfolk	73.4	52	S2, E2, H46
Barber's Point	98.9	7	P3
Alameda	86.3	65	A3, A4, A7
Miramar	71.1	106	F4, F14
Lemoore	46.8	252	A7
North Island	91.9	11	S2, S3, E1, E2
Ellyson	78.1	25	UH1, H17
Saufley	86.1	25	T34
Corpus Christi	78.3	42	T32, T34
Detroit	79.3	3	HH1
South Weymouth	82.4	7	P2, A4
Whiting	89.5	53	T28
Atlanta	92.2	3	H8, A4
Pensacola	77.1	25	T2, TF9
Chase	91.7	13	TA4, TF9, T2

[1] Naval air stations with fiscal year 1974 loadings equal to or in excess of fiscal year 1969 capacity loadings were excluded.

TABLE 3.—FISCAL YEAR 1974 PEAK DEMAND FOR SHIP BERTHING FACILITIES RELATIVE TO FISCAL YEAR 1969 PEAK DEMAND

Stations	Hulls (percent)	Men (percent)
LANT:		
Newport/Quonset	72.97	63.94
Charleston	57.14	90.97
New London/Groton	62.96	70.25
Key West	110.00	104.65
Mayport	90.48	98.06
Little Creek	82.14	61.77
Norfolk	74.14	75.96
PAC:		
Pearl Harbor	66.67	76.86
San Diego	55.55	70.93
Alameda	133.33	114.04
Long Beach	80.29	61.93

TABLE 4.—ADDITIONAL SHIPS TO ACHIEVE CAPACITY LOADING IN FISCAL YEAR 1974

Stations [1]	Fiscal year 1974 as percent of fiscal year 1969 capacity (percent)	Number additional homeported hulls	Principal types
Newport	74	17	Destroyers, cruisers, medium auxiliaries.
Charleston	91	3	Destroyers, submarines.
New London/Groton	70	7	Submarines, small auxiliaries.
Little Creek	82	8	Amphibious, small auxiliaries.
Norfolk	78	31	Destroyers, auxiliaries, small carrier amphibious.
Pearl Harbor	77	20	Submarines, destroyers, auxiliaries.
San Diego	71	45	Destroyers, amphibious, small auxiliaries, small carrier (1).
Long Beach	62	30	Destroyers, large auxiliaries, small carrier (5).

[1] Naval stations with fiscal year 1974 loadings equal to or in excess of fiscal year 1969 capacity loadings were excluded.

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CLOSURE OF NAVAL STATION AND NAVAL AIR STATIONS

INTRODUCTION

This paper discusses the effect of closing Naval Stations and Naval Air Stations on the capacity of the shore establishment to support Ships and aircraft. The activities considered are those 55 in the United StSates that are under the comman dof CINCPACFLT, CINCLANTFLT, and CNT.

This paper also demonstrates that a systematic methodology exists for estimating the effect of such closures. It can quickly be applied to closure alternatives not considered here or reapplied to the same alternatives using different planning factors.

OVERVIEW

Ship and aircraft force levels planned for FY-78 are significantly below recent levels. Despite the few closures that have taken place in the United States in the last few years (6 Naval Air Stations since FY-69), the remaining bases will still have significantly fewer forces to support.

Table 1 compares planned FY-78 force levels with past FY-69 levels for existing Naval Stations and Naval Air Stations in the United States. In FY-78, the number of ships homeported at these bases will be 28 percent below the number homeported there in FY-69; the number of aircraft will be 27 percent lower.

Tables 2, 3, and 4 show force levels at individual bases. The order in which these bases are listed in each table is the order in which each claimant would prefer to have them disestablished. These disestablishment priorities were developed by the claimants for the Navy's study to Restructure the Naval Shore Establishment.

These changes in total numbers of forces do not necessarily indicate how the total demand for support resources has changed. To the extent that newer ships and aircraft require more support per unit than older models, total demand for resources will decrease by a smaller amount—or may even increase.

Models exist to measure the effect of these changes in mix. Two such models—one for ships and one for aircraft—are used in this analysis. These models are used to measure the amounts of different resources that has been used in the past to support different types of ships and aircraft.

Final demand for resources in a future year is then calculated assuming force units of each type continue to be suported at past levels. Finally, this total demand for resources is compared with the existing supply.

SHIP BERTHING

This section estimates the demand for berthing expected from FY-78 ship forces. This demand is compared with the Navy's existing capacity to berth ships at major homeports in the United States. Base closure alternatives are then examined to determine their effect on demand satisfaction.

Methodology

Two berthing resources are considered: 1) the physical space needed alongside piers to accommodate the length, beam, and draft of ships, and 2) electricity. The methodology used to estimate and compare the supply and demand for these resources is briefly summarized in the next sections. A more detailed description is provided in appendix A.

Future Demand: Projections of future ship loads are obtained in the following way:

1. estimate the peak simultaneous ship loadings that have occurred in the past at major United States homeports, using data from the MOVEREP reporting system;
2. relate these loadings, by ship type, to the numbers of ships that were homeported at that time;
3. assume the relationship between peak simultaneous load and numbers homeported will be the same in the future as in the past; and

4. apply these relationships to the homeport schedules planned for the future.

This methodology is used to estimate peak simultaneous loadings in 1978, using 1968 relationships between peak loads and numbers homeported. The numbers of ships in the 1978 loading are translated into demand for berthing resources by categorizing each ship as one of 12 notional ship types, each of which is characterized by its length, beam, draft, and need for electricity.

Current Supply: The pier-side facilities assumed available are all "berthing" piers and wharves owned by Naval Stations and Naval Air Stations in the United States. This excludes all "supply" and "repair" piers and wharves; it also excludes all "berthing" facilities at shipyards.

Each slip is described by its physical dimensions (length, slip-width, and water depth), the amount of electricity available, and the type of normally berthed there.

Measurement of Demand Satisfaction: Each homeport is considered separately to compare its peak demand with its existing supply. Three states of demand satisfaction are considered: berthed with adequate electricity, berthed without adequate electricity, and not berthed.

Initially, the number of ships of each type that can fit into each slip is determined, using standard spacing factors from NAVPAC P-80 (except where typical berthing plans clearly indicate these standards are not adhered to) and accounting for limits on nesting. The number of ships whose electricity needs can be met is then computed.

The assignment of ship types to piers conforms to current pier dedications whenever enough piers of that type are available. Otherwise, assignments are made to maximize the number of men freed for liberty or maintenance, subject to certain priorities among ship types. This calculation uses the Cold Iron Study's estimates that 2/3 of a ship's crew is free when the ship is in the stream, 3/4 when it is berthed without utilities, and 5/6 when its is berthed with utilities.

Results

Current Homeported Plans: Demand satisfaction was measured for each homeport both for the estimated 1969 peak load and for the 1978 projection based on current homeport schedules. The results are compared in table 5 (A, B, and C).

Conditions at East Coast homeports (tables 5-A and 5-B) are generally good. All ships in the peak loads can be berthed at all ports, both in 1969 and 1078. All of the 1978 demand for electricity can be met in all East Coast homeports except at New London and Little Creek. (At New London, the drop is small relative to the accuracy of the model. Little Creek does have a relatively low supply of electricity, although the model appears to have exaggerated the deficiency somewhat.)

On the West Coast (table 5-C), demand satisfaction appears to be less. (Demand satisfaction is understated, however, to the extent that ships not accommodated at Naval Stations, Naval Bases, and Naval Air Stations are accommodated at shipyards and other activities. Although ships known to be berthed elsewhere—e.g., Concord and Mare Island—have been excluded from the peak load, some others may still be included.) However, relative to 1969 conditions, demand satisfaction is generally higher.

Closure Alternatives: This section demonstrates that certain bases on the East Coast can be closed without reducing satisfaction of demand for berthing below 1968 levels. Other functions of these bases (e.g., support of shore-based tenants) are not addressed. Closure alternatives on the West Coast are not evaluated.

Table 6 (A-D) shows the effects of alternative closures of NS Key West, NS Mayport, and NS Newport. These 3 bases rank the highest in CINCLANTFLT's disestablishment priorities. Table 6-A considers closing NS Key West and moving all ships to New London. The results show that demand satisfaction in 1978 would be unaffected. Alternatively, the same Key West ships could be moved to Charleston (table 6-B), also with no reduction in demand satisfaction.

Regardless of whether NS Key West is closed, it is also possible to close NS Newport without reducing the percentage of demand satisfied below 1969 levels. Table 6–C shows that this can be accomplished by moving ⅔ of Newport's ships to Norfolk and ⅓ to Mayport.

An alternative to closing Newport is to close Mayport. Table 6-D considers moving Mayport's carriers and cruisers and ½ its auxiliaries to Norfolk, and its destroyers and ½ its auxiliaries to Newport. The percentage of demand satisfied is about the same as in 1969.

AIRCRAFT SUPPORT

This section estimates the demand for Naval Air Station resources expected from FY-78 aircraft forces. This demand is compared with the Navy's existing Naval Air Station capacity. Base closure alternatives are then examined to determine their effect on demand satisfaction.

Methodology

These resources are considered: 1) parking apron; 2) POL storage; 3) covered warehouse; 4) area for maintenance crew, equipment, and administration; 5) maintenance hanger bay area; 6) maintenance shop space; and 7) runway length. The methodology used to estimate and compare the supply and demand for these resources is briefly summarized in the next sections. A more detailed description is provided in appendix B.

Future Demand: Estimates of future aircraft loads are obtained in the following way:

1. determine for each air base what proportion of Navy aircraft permanently assigned there are normally located there, using FY–69 data from the NAO and Bluebook;
2. assume this loading factor will be the same in the future as in the past;
3. apply this factor to planned 1978 assignments (Aircraft Program Data File, October 1971); and
4. add in the same number of non-Navy tenant aircraft as are there in 1969 (NAO).

These aircraft loadings are then translated into demands for sources as follows:

1. at each base, calculate the amount of each resource that would have been required by the 1969 loading had NAVFAC P-80 standards been maintained;
2. compare these requirements, by resource, with the amounts provided in 1969 to determine the standards actually maintained at each base; and
3. apply these 1969 standards to the 1978 loading to estimate the 1978 demand for resources.

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Table 7 shows how the demand for resources changes from FY-69 to FY-78. The absolute amounts for both years are based on 1969 standards and are lower than the corresponding amounts for P-80 standards; the percentage change however, is about the same for both standards. Although the number of aircraft decreases 28 percent, all the demands for resources decrease by a lesser amount, reflecting a change in mix toward aircraft types requiring greater support per unit. But despite this change in mix, there is a clear net reduction in demand.

Current Supply

Estimates of the resources currently available at each Air Station based on a detailed inventory of 1969 assets, modified by a 1969 forecast of construction through FY-72. These estimates are believed to be within one or 2 percent of the actual current inventory of resources.

Results

Current Assignment Plans: The 1978 demand for resources was calculated for each base using the 1969 standards for that base and the aircraft to be assigned there in 1978. These demands were compared with the amount of resources currenly available at each base to determine 1978 deficiencies.

These deficiencies are shown in table 8. All Air Stations not shown have enough of these resources to support their currently planned 1978 aircraft load. The deficiencies that do exist total a mere $2.4 million. If all air stations increased their standards to those of the P-80, total deficiencies of all Air Stations would be $37.6 million.

By showing only deficiencies, table 8 does not reflect the fact that most aircraft in the 1978 force will be supported at higher standards than prevailed in 1969 if all bases remain open. The next section demonstrates that several bases can be closed without lowering standards below 1969 levels.

Closure Alternatives: Each closure alternative is evaluated in following way:

1. determine the 1969 standards, by resource, that prevailed in 1969 at the base to be closed and at each base to which aircraft are to be transferred;
2. assume that each 1978 aircraft will be supported at the 1969 standards of the base to which it is currently planned to be assigned. (This allows for the possibility that different type sof aircraft are normally supported at different proportions of P-80 standards);
3. calculate 1978 demands at each base to which aircraft are transferred and compare this with the current supply at that base to determine deficiencies.

The results are shown in tables 9 and 10. Table 9 (A-D) shows that all of the following bases could be closed without requiring any additional amount of the resources considered:

1. close NAS Albany; move to NAS Cecil Field,
2. close NAS Lakehurst; move to NAS Norfolk,
3. close NAS Moffett; move to NAS Barbers Point.

Table 9-D shows that NAS Imperial Beach can also be closed and all its aircraft reassigned to NAS Alameda with only a 2 percent increase in maintenance shop space at Alameda. (Alternatively, standards could be reduced to 2 percent below those of 1969 and no construction would be required.)

Table 10 (A-D) evaluates closure alternatives that would require either some expansion of remaining bases or some reduction in standards.

Instead of closing Moffett and moving to Barbers Point, close Barbers Point and move to Moffett: table 10-A shows this would require an 18 percent increase in parking apron and a 63 percent in area for crew, equipment, and administration.

The cost of increasing these 2 resources is only $3.5 million. However, the demands for resources not considered in the model may also be increased above existing supplies, so the total expansion cost could be greater. To the extent that excesses and deficiencies of resources that are not included in the model are correlated with those of the resources that are included, the model is a good indicator of when capacity has been reached. However, when the model indicates that capacity has been exceeded, it probably understates the total cost of expansion.

Table 10-B considers closing NAS Corpus Christi, moving its TS-2's Chase Field, and the remainder of its aircraft to NAS Kingsville. The resulting demands for covered warehouse and crew, equipment, and administration space would exceed current supply by 12 to 13 percent, and hangar bay would barely be sufficient.

Table 10-C shows that if NAS Ellyson were closed and all its aircraft reassigned to NAS Whitting, parking apron at Whitting would be deficient (by 1969 standards) by 13 percent.

Table 10-D shows that if NAS Whidbey were closed and all its aircraft reassigned to NAS Lemoore, maintenance shop space would be deficient by 43 percent.

OPERATING COSTS

Introduction

This section discusses how much the aggregate operating costs of Naval Stations and Naval Air Stations can be reduced through consolidation. Due to the limited quality of available data, the quantitative analysis presented here is limited to estimating what proportion of each activity's total operating cost varies with the numbers of units homeported there, and what proportion does not.

That portion of costs that does not vary with homeported units includes the cost of 1) support of units not homeported, and 2) overload that is "fixed" in the short run. Costs that vary with units not homeported cannot be saved unless that support is no longer provided by the Navy. Merely transferring this support function to another base (assuming it has sufficient excess capacity) will not save this cost. (This disregards scale effects on variable costs, but these are probably small relative to the current amount of variable cost.)

Overhead costs can be saved by closing a base, assuming there is sufficient unused capacity (i.e., excess overhead) at the base to which the units formerly supported are transferred. If additional capacity is required at the new bases, there will occur not only the one-time cost of expanding capacity, but also a higher level of continuing overhead costs at the new bases.

Methodology

The support resources considered in this analysis are base personnel, operating TOA, and operating expenses. (In general, expenses exceed TOA by the amount that the base is reimbursed by other activities from their TOA.)

Regression equations based on FY–70 data were used to relate each of these resources to the numbers and types of units supported by each base. Appendix C describes these equations and how they were used to obtain the cost estimates presented next.

Data limitations necessitated aggregating all activities located within the same geographical complex. The complexes considered and the activities comprising them are identified in table 11. The activities considered are all Naval Bases, Naval Air Stations, Naval Stations, Public Works Centers, and Commissaries.

Complexes including Reserve Air Stations are excluded, no credible model could be developed for these bases.

Results

Table 12 shows what proportions of resources actually expended are estimated not to vary with the numbers of units homeported. The complexes are listed in order of decreasing size. In general, the smaller the complex the higher the proportion of costs that is not attributable to homeported forces. This tends to support the conclusion that larger complexes are more efficient.

K. GOUDREAU.
R. KUZMACK.

TABLE 1.—NAVY FORCES BY HOMEPORT—NAVY, RESERVE, AND MARINE CORPS FORCES AT NAVY AND RESERVE BASES EXCLUDING MARINE CORPS BASES

	Fiscal year			
	Ships		Aircraft	
	1969	1978	1969	1978
19 CINCPACFIT bases in United States	419	[Deleted.]	1,916	[Deleted.]
19 CINCLANTFLT bases in United States	429		1,479	
17 CNT bases in United States	3		2,122	
Subtotal	851		5,517	
All other in United States	90		----------	
Foreign	65		----------	
Total	1,006		----------	

Sources: Fiscal year 1969 aircraft: Naval Aeronautical Organization (NAO), July 1, 1969. Fiscal year 1978 aircraft: Aviation Program Data File (APDF), Oct. 15, 1971. Fiscal year 1969 ships: OPNAVNOTE 0011000, Forecast of Home Ports of Ships for Mid-range Planning, March 1970. Fiscal year 1978 ships: Ships Planning System, October 1971.

TABLE 2.—NAVY FORCES HOMEPORTED AT CINCPACFLT BASES IN UNITED STATES

		Fiscal year			
		Ships[1]		Aircraft	
Disestablishment priority	Homeport or permanent duty station	1969	1978	1969	1978
1	NS Kodiak	0	0	3	0
2	ALF Monterey	0	0	37	0
3	NS San Francisco	16	[Deleted]	0	0
4	NAF El Centro	0	0	9	[Deleted]
5	NS Long Beach	107	[Deleted.]	0	0
6	NAS Imperial Beach	0	0	125	
7	NS Adak	0	0	4	[Deleted.]
8	NAAS Fallon	0	0	0	
9	NS Pearl Harbor	69	[Deleted.]	0	0
10	NAS Barbers Point	0	0	100	
11	NAS Moffett	0	0	83	[Deleted.]
12	NAS Whidbey	0	0	169	
13	NAS Alameda	7	[Deleted.]	171	
14	NSB Pearl Harbor	28		0	0
15	NAS Miramar	0	0	426	[Deleted.]
16	NAB San Diego	54	[Deleted.]	0	0
17	NAS Lemoore	0	0	590	[Deleted.]
18	NAS North Island	0	0	198	
19	NS San Diego	138	[Deleted.]	0	0
	Total	419		1,916	[Deleted.

[1] Ship totals include a small but unknown number of ships (less than 5 percent) homeported at nearby shipyards, reserve training centers, and other activities.

Sources: Fiscal year 1969 aircraft: Naval Aeronautical Organization (NAO), July 1, 1969. Fiscal year 1978 aircraft: Aviation Program Data File (APDF), Oct. 15, 1971. Fiscal year 1969 ships: OPNAVNOTE 0011000, Forecast of Home Ports of Ships for Mid-range Planning, March 19. Fiscal year 1978 ships: Ships Planning System, October 1971. Priorities: CINCPACFLT 152001Z, November 1971.

TABLE 3.—NAVY FORCES HOMEPORTED AT CINCLANTFLT BASES IN UNITED STATES

Disestablishment priority	Homeport or permanent duty station	Fiscal year			
		Ships[1]		Aircraft	
		1969	1978	1969	1978
1	NS Brooklyn	6	2	0	0
2	NS Boston	7	0	0	0
3	NS Philadelphia	5	0	0	0
4	NAS Albany	0	0	80	
5	NS Key West	14		0	
6	NAS Lakehurst	0		75	
7	NS Mayport	35		3	
8	NS Newport	59		0	
9	NAS Key West	0		110	
10	NAS Quonset Point	2		177	
11	NAB Little Creek	44		0	
12	NAS Brunswick	0		57	
13	NAS Jacksonville	0	[Deleted.]	118	[Deleted.]
14	NAS Cecil Field	0		411	
15	NS Charleston	73		0	
16	NAS Oceana	0		223	
17	NSB New London	55		0	
18	NS Norfolk	129		0	
7	NAS Norfolk	0		225	
	Total	429		1,479	

[1] Ship totals include a small but unknown number of ships (less than 5 percent) homeported at nearby shipyards, reserve training centers, and other activities.

Sources: Fiscal year 1969 aircraft: Naval Aeronautical Organization (NAO), July 1, 1969. Fiscal year 1978 aircraft: Aviation program data file (APDF), Oct. 15, 1971. Fiscal year 1969 ships: OPNAVNOTE 0011000, Forecast of Home Ports of Ships for Mid-range Planning, Mar. 19. Fiscal year 1978 ships: Ships planning system, October 1971. Priorities: CINCLANTFLT 1316082, November 1971.

TABLE 4.—NAVY FORCES HOMEPORTED AT CNT BASES

Disestablishment priority	Homeport or permanent duty station	Fiscal year			
		Ships[1]		Aircraft	
		1969	1978	1969	1978
1	NAS Ellyson	0	0	126	
2	NAS Saufley	0	0	211	
3	NAS Corpus Christi	0	0	195	
4	NAS Memphis	0	0	34	
5	NAS Dallas	0	0	47	
6	NAS New Orleans	2	[Deleted]	33	
7	NAF Detroit	0	0	24	
8	NAS South Weymouth	0	0	53	
9	NAS Whiting	0	0	317	
10	NAS Glynco	0	0	205	[Deleted]
11	NAS Meridian	0	0	171	
12	NAS Willow Grove	0	0	55	
13	NAS Atlanta	0	0	36	
14	NAS Glenview	0	0	68	
15	NAS Pensacola	1	[Deleted]	140	
16	NAS Chase Field	0	0	202	
17	NAS Kingsville	0	0	205	
	Total	3	[Deleted.]	2,122	

[1] Ship totals include a small but unknown number of ships (less than 5 percent) homeported at nearby shipyards, Reserve training centers, and other activities.

Sources: Fiscal year 1969 aircraft: Naval Aeronautical Organization (NAO), July 1, 1969. Fiscal year 1978 aircraft: Aviation program data file (APDF), Oct. 15, 1971. Fiscal year 1969 ships: OPNAVNOTE 0011000, forecast of home ports of Ships for Midrange Planning, Mar. 19. Fiscal year 1978 ships: Ships planning system, October 1971. Priorities: CNTJ 291930Z, November 1971.

TABLE 5-A.—SATISFACTION OF PEAK SIMULTANEOUS DEMAND FOR SHIP BERTHING—FISCAL YEAR 1969 AND FISCAL YEAR 1978

	Key West		Mayport		Newport/Quonset	
	1969	1978	1969	1978	1969	1978
Number hulls homeported	14	[Deleted.]	35	[Deleted.]	61	[Deleted.]
Peak simultaneous demand:						
Number of hulls	10		21		37	
Number of men	2,150		7,725		13,450	
Total length (feet)	3,550		9,365		16,150	
Total electricity (100 kw)	36		167		226	
Amount of demand satisfied:						
Number of hulls berthed	10		21		37	
Number of men berthed	2,150		7,725		13,450	
Number of hulls with electricity	8		21		32	
Number of men with electricity	1,100		7,725		8,550	
Number of men ashore	1,701		6,438		10,772	
Percent of demand satisfied:						
Percent of hulls berthed	100		100		100	
Percent of men berthed	100		100		100	
Percent of hulls with electricity	80		100		86	
Percent of men with electricity	51		100		64	
Percent of men ashore	79		83		80	

TABLE 5.—SATISFACTION OF PEAK SIMULTANEOUS DEMAND FOR SHIP BERTHING—FISCAL YEAR 1969 AND FISCAL YEAR 1978

	Norfolk		Little Creek		Charleston [1]		New London [1]	
	1969	1978	1969	1978	1969	1978	1969	1978
Number of hulls homeported	128	[Deleted.]	44	[Deleted.]	65	[Deleted.]	35	[Deleted.]
Peak simultaneous demand:								
Number of hulls	58		28		42		25	
Number of men	23,500		7,000		7,750		3,350	
Total length (feet)	27,665		12,165		12,875		7,900	
Total electricity (100 kw)	488		212		161		62	
Amount of demand satisfied:								
Number of hulls berthed	58		28		42		25	
Number of men berthed	23,500		7,000		7,750		3,350	
Number of hulls with electricity	53		11		42		25	
Number of men with electricity	21,300		1,550		7,750		3,350	
Number of men ashore	19,335		--------		6,458		2,792	
Percent of demand satisfied:								
Percent of hulls berthed	100		100		100		100	
Percent of men berthed	100		100		100		100	
Percent of hulls with electricity	92		39		100		100	
Percent of men with electricity	91		22		100		100	
Percent of men ashore	82		77		83		83	

[1] SSBN's and SSBN berths are excluded.
[2] 29 patrol ships are to be homeported in 1978 although none were homeported in 1969. Peak load is arbitrarily assumed to include 20 of these ships.

TABLE 5-C.—SATISFACTION OF PEAK SIMULTANEOUS DEMAND FOR SHIP BERTHING—FISCAL YEAR 1969 AND FISCAL YEAR 1978

	Pearl		San Diego		Long Beach		San Francisco/ Alameda	
	1969	1978	1969	1978	1969	1978	1969	1978
Number of hulls homeported	97	[Deleted.]	192	[Deleted.]	107	[Deleted.]	21	[Deleted.]
Peak simultaneous demand:								
Number of hulls	48		90		68		27	
Number of men	12,750		30,525		22,600		10,962	
Total length (feet)	19,465		39,225		27,250		12,415	
Total electricity (100 kw)	259		695		458		214	
Amount of demand satisfied:								
Number of hulls berthed	47		90		51		13	
Number of men berthed	9,951		30,525		13,651		5,351	
Number of hulls with electricity	29		54		31		7	
Number of men with electricity	7,000		16,700		7,600		4,400	
Number of men ashore	9,434		24,231		16,843		8,519	
Percent of demand satisfied:								
Percent of hulls berthed	98		100		75		48	
Percent of men berthed	78		100		60		46	
Percent of hulls with electricity	62		60		46		26	
Percent of men with electricity	55		55		34		38	
Percent of men ashore	74		79		75		74	

TABLE 6-A.—EVALUATION OF ALTERNATIVE: CLOSE NS KEY WEST, MOVE TO NEW LONDON

	Key West plus New London forces		
	Key West open		Key West closed
	1969	1978	1978
Number of hulls homeported	49	[Deleted.]	Deleted.
Peak simultaneous demand:			
Number of hulls	35		
Number of men	5,500		
Total length (feet)	11,450		
Total electricity (100 kw)	98		
Amount of demand satisfied:			
Number of hulls berthed	35		
Number of men berthed	5,500		
Number of hulls with electricity	33		
Number of men with electricity	4,450		
Number of men ashore	4,493		
Percent of demand satisfied:			
Percent of hulls berthed	100		
Percent of men berthed	100		
Percent of hulls with electricity	94		
Percent of men with electricity	81		
Percent of men ashore	82		

TABLE 6-B.—EVALUATION OF ALTERNATIVE: CLOSE NS KEY WEST, MOVE TO CHARLESTON

	Key West plus Charleston forces		
	Key West open		Key West closed
	1969	1978	1978
Number of hulls homeported	79	[Deleted.]	[Deleted.]
Peak sumultaneous demand:			
Number of hulls	52		
Number of men	9,900		
Total length (feet)	16,425		
Total electricity (100 kw)	197		
Amount of demand satisfied:			
Number of hulls berthed	52		
Number of men berthed	9,900		
Number of hulls with electricity	50		
Number of men with electricity	8,850		
Number of men ashore	8,159		
Percent of demand satisfied:			
Percent of hulls berthed	100		
Percent of men berthed	100		
Percent of hulls with electricity	97		
Percent of men with electricity	89		
Percent of men ashore	82		

TABLE 6-C.—EVALUATION OF ALTERNATIVE: CLOSE NEWPORT, MOVE TWO-THIRDS TO NORFOLK, MOVE ONE-THIRD TO MAYPORT

	Newport plus Norfolk plus Mayport forces		
	Newport open		Newport closed
	1969	1978	1978
Number of hulls homeported	225	[Deleted.]	[Deleted.]
Peak simultaneous demand:			
Number of hulls	116		
Number of mon	44,675		
Total length (feet)	53,180		
Total electricity (100 kw)	881		
Amount of demand satisfied:			
Number of hulls berthed	116		
Number of men berthed	44,675		
Number of hulls with electricity	106		
Number of men with electricity	37,575		
Number of men ashore	36,545		
Percent of demand satisfied:			
Percent of hulls berthed	100		
Percent of men berthed	100		
Percent of hulls with electricity	91		
Percent of men with electricity	84		
Percent of men ashore	82		

TABLE 6-D.—EVALUATION OF ALTERNATIVE: CLOSE MAYPORT, MOVE CARRIERS, CRUISERS, AND ONE-HALF AUXILIARIES TO NORFOLK; MOVE DESTROYERS AND ONE-HALF AUXILIARIES TO NEWPORT

	Newport plus Norfolk plus Mayport forces		
	Mayport open		Mayport closed
	1969	1978	1978
Number of hulls homeported	225		
Peak simultaneous demand:			
Number of hulls	116		
Number of men	44,675		
Total length (feet)	53,180		
Total electricity (100 kw)	881		
Amount of demand satisfied:			
Number of hulls berthed	116		
Number of men berthed	44,675	[Deleted.]	[Deleted.]
Number of hulls with electricity	106		
Number of men with electricity	37,575		
Number of men ashore	36,545		
Percent of demand satisfied:			
Percent of hulls berthed	100		
Percent of men berthed	100		
Percent of hulls with electricity	91		
Percent of men with electricity	84		
Percent of men ashore	82		

TABLE 7.—AGGREGATE DEMAND FOR AIRCRAFT SUPPORT RESOURCES AT AIR STATIONS IN THE UNITED STATES—FISCAL YEAR 1969 AND FISCAL YEAR 1968

	1969	1978	Percent change
Navy aircraft assigned	5,617		
Demand for resources (fiscal year 1969 standards):			
Parking apron (square yards)	6,575,009		
10-day POL supply (gallons)	28,329,506	[Deleted.]	[Deleted.]
Covered warehouse (square feet)	1,675,812		
Crew and equipment administration (square feet)	2,140,849		
Hangar bay (square feet)	4,695,995		
Maintenance Shop (square feet)	1,648,623		

TABLE 8.—1978 DEFICIENCIES AT AIR STATIONS BASED ON 1969 STANDARDS

Location	Resource	Amount (in square feet)	Percent of existing	Cost to eliminate (in millions of dollars)
Brunswick	Maintenance shop	2,926	8	0.1
Quonset Point	Maintenance shop	449	1	
Imperial Beach	Covered warehouse	426	3	.2
	Hangar bay	2,897	4	.2
	Maintenance shop	1,377	4	.2
Whidbey Island	Crew, equipment, administration	802	1	.3
	Maintenance shop	6,830	7	.3
Memphis	Crew, equipment, administration	6,120	17	.6
	Hangar bay	12,555	35	.6
Dallas	Crew, equipment, administration	1,002	6	.2
	Hangar bay	2,264	4	.2
	Maintenance shop	4,248	14	.2
Willow Grove	Parking apron	[1] 14,077	9	1.0
	Covered warehouse	6,637	15	1.0
	Hangar bay	14,310	16	1.0
	Maintenance shop	963	5	1.0
Pensacola	Hangar bay	2,385	2	.1
Fallon	Maintenance shop	415	1	
Total				2.4
Total 1978 deficiencies based on P-80 standards				37.6

[1] Square yards.

TABLE 9-A.—EVALUATION OF ALTERNATIVE: CLOSE NAS ALBANY, MOVE TO NAS CECIL FIELD

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)		Fiscal year 1978 total deficiencies			
			Albany open	Albany closed		
	Albany	Cecil Field	Amount	Amount	Percent of existing at Cecil Field	Cost to eliminate (in millions of dollars)
Parking apron	1.00	1.00	0	0	0	0
Covered warehouse	1.00	1.00	0	0	0	0
Crew and equipment/ administration	1.00	.85	0	0	0	0
Hangar bay	1.00	1.00	0	0	0	0
Maintenance shop	1.00	1.00	0	0	0	0

NOTE.—Cecil Field runway longer than Albany runway.

TABLE 9-B.—EVALUATION OF ALTERNATIVE: CLOSE NAS LAKEHURST, MOVE TO NAS NORFOLK

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)		Fiscal year 1978 total deficiencies			
				Lakehurst closed		
	Lakehurst	Norfolk	Lakehurst open—amount	Amount	Percent of existing at Norfolk	Cost to eliminate (in millions of dollars)
Parking apron	0.16	1.00	0	0	0	0
Covered warehouse	1.00	1.00	0	0	0	0
Crew and equipment/ administration	1.00	.76	0	0	0	0
Hangar bay	1.00	1.00	0	0	0	0
Maintenance shop	1.00	1.00	0	0	0	0

NOTE.—Norfolk runway longer than Lakehurst runway.

TABLE 9-C.—EVALUATION OF ALTERNATIVE: CLOSE NAS MOFFETT, MOVE TO NAS BARBERS POINT

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)		Fiscal year 1978 total deficiencies			
				Moffett closed		
	Moffett	Barbers Point	Moffett open—amount	Amount	Percent of existing at Barbers Point	Cost to eliminate (in millions of dollars)
Parking apron	1	1	0	0	0	0
Covered warehouse	1	1	0	0	0	0
Crew and equipment/ administration	1	1	0	0	0	0
Hangar bay	1	1	0	0	0	0
Maintenance shop	1	1	0	0	0	0

NOTE.—Although Moffett Field has a longer runway than Barbers Point (9,200 vice 8,400), Barbers Point runway exceeds the P-80 requirement of all aircraft at Moffett Field.

TABLE 9-D.—EVALUATION OF ALTERNATIVE: CLOSE NAS IMPERIAL, MOVE TO NAS ALAMEDA

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)		Fiscal year 1978 total deficiencies			
			Imperial open—Amount	Imperial closed		
	Imperial	Alameda		Amount	Percent of existing at Alameda	Cost to eliminate (in millions of dollars)
Parking apron	1.00	1.00	0	0	0	0
Covered warehouse	.73	1.00	0	0	0	0
Crew and equipment/ administration	1.00	.83	0	[1] 79	----------	.003
Hangar bay	.62	1.00	0	0	0	0
Maintenance shop	.63	.46	0	[1] 1,241	2	.042

[1] Square feet.

NOTE.—Alameda runway longer than Imperial Beach runway.

TABLE 10-A.—EVALUATION OF ALTERNATIVE: CLOSE NAS BARBERS POINT, MOVE TO NAS MOFFETT

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)		Fiscal year 1978 total deficiencies			
			Barbers point open—Amount	Barbers Point closed		
	Barbers Point	Moffett		Amount	Percent of existing at Moffett	Cost to eliminate (in millions of dollars)
Parking apron	1	1	0	[1] 72,546	18	1.7
Covered warehouse	1	1	0	0	0	0
Crew and equipment/ administration	1	1	0	[2] 47,437	63	1.8
Hangar bay	1	1	0	0	0	0
Maintenance shop	1	1	0	0	0	0

[1] Square yards.
[2] Square feet.

NOTE.—Moffett Field runway longer than Barbers Point runway.

TABLE 10-B.—EVALUATION OF ALTERNATIVE: CLOSE NAS CORPUS CHRISTI, MOVE TS2'S TO NAS CHASE FIELD AND REST TO NAS KINGSVILLE

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)			Fiscal year 1978 total deficiencies			
				Corpus Christi open—amount	Corpus Christi closed		
	Corpus Christi	Kingsville	Chase Field		Amount[1]	Percent of existing at Chase Field	Cost to eliminate (in millions of dollars)
Parking apron	0.71	1	1	0	0	0	0
Covered warehouse	1.00	1	1	0	[2] 9,038	12	.1
Crew and equipment/ administration	.56	1	1	0	[2] 8,327	13	.3
Hangar bay	1.00	1	1	0	[2] 2,114	----------	.1
Maintenance shop	1.00	1	1	0	0	0	0

[1] All deficiencies are at Chase Field.
[2] Square feet.

NOTE.—Chase Field and Kingsville runways are the same length as the Corpus Christi runway.

TABLE 10-C.—EVALUATION OF ALTERNATIVE: CLOSE NAS ELLYSON FIELD, MOVE TO NAS WHITING FIELD

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)		Fiscal year 1978 total deficiencies			
			Ellyson open—	Ellyson closed		
	Ellyson	Whiting	Amount	Amount	Percent of existing at Whiting	Cost to eliminate (in millions of dollars)
Parking apron	1.00	1.00	0	[1] 48,562	13	1
Covered warehouse	.80	1.00	0	0	0	0
Crew and equipment/ administration	.13	.48	0	0	0	0
Hangar bay	.31	.69	0	0	0	0
Maintenance shop	.32	1.00	0	0	0	0

[1] Square yards.

NOTE.—Whiting Field runway longer than Ellyson Field runway.

TABLE 10-D.—EVALUATION OF ALTERNATIVE: CLOSE NAS WHIDBEY ISLAND, MOVE TO NAS LEMOORE

Resource	Fiscal year 1969 support level (fraction of NAVFAC P-80)		Fiscal year 1978 total deficiencies			
			Whidbey open—	Whidbey closed		
	Whidbey	Lemoore	Amount	Amount	Percent of existing at Lemoore	Cost to eliminate (in millions of dollars)
Parking apron	1.00	1.00	0	0	0	0
Covered warehouse	1.00	1.00	0	0	0	0
Crew and equipment/ administration	.99	1.00	0	0	0	0
Hangar bay	.97	.93	0	0	0	0
Maintenance shop	.84	.86	0	[1] 40,602	43	1.4

[1] Square feet.

NOTE.—Lemoore runway longer than Whidbey Island runway.

TABLE 11.—NAVAL COMPLEXES USED IN REGRESSION ANALYSIS

Complex:	*Activities within complex*
Adak	NA Adak, Commissary.
Albany	NAS Albany.
Brunswick	NAS Brunswick.
Charleston	NS Charleston, Commissary.
Chase Field	NAS Chase Field, Commissary.
Corpus Christi	NAS Corpus Christi, Commissary.
Glynco	NAS Glynco.
Jacksonville	NAS Jacksonville, NAS Cecil, NS Mayport, Commissary.
Key West	NAS Key West, NS Key West, Commissary.
Kingsville	NAS Kingsville, Commissary.
Kodiak	NS Kodiak, Commissary.
Lakehurst	NAS Lakehurst.
Lemoore	NAS Lemoore, Commissary.
Memphis	NAS Memphis, Commissary.
Meridian	NAS Meridian, Commissary.
New London	NSB New London.
Newport	NS Newport, Naval Base, NAS Quonset, Commissary.
Norfolk	NAS Norfolk, NAS Oceana, NS Norfolk, NAB Little Creek, PWC, Commissary.
Pearl Harbor	NAS Barbers Pt., NS Pearl Harbor, NSB Pearl Harbor, PWC, Commissary.
Pensacola	NAS Pensacola, NAS Saufley, NAS Ellyson, NAS Whiting, PWC, Commissary.
San Diego	NAS North Island, NAS Imperial Beach, NAS Miramar, NS San Diego, NSB San Diego, PWC, Commissary.
San Francisco	NAS Alameda, NAS Moffett, NS San Francisco, PWC, Commissary.

TABLE 12.—BASE PERSONNEL AND OPERATING COSTS NOT ATTRIBUTABLE TO HOMEPORTED FORCES, FISCAL YEAR 1970

Complex	Personnel			Operating TOA (dollars in millions)			RMS operating costs (dollars in millions)		
		Not attributable			Not attributable			Not attributable	
	Total	Amount	Percent	Total	Amount	Percent	Total	Amount	Percent
Pensacola	8,610	5,344	62.1	$85.6	$48.0	56.0	$68.8	$46.6	67.8
San Diego	8,535	3,705	43.4	84.4	33.0	39.1	119.9	38.4	32.9
Norfolk	8,127	3,713	45.7	82.5	33.6	40.7	102.8	35.5	34.5
San Francisco	5,705	3,[illegible]6	59.7	49.5	27.4	55.2	65.6	31.4	48.0
MAS Jacksonville	5,238	3,[illegible]7	62.8	41.9	24.3	58.0	62.4	30.1	48.2
Pearl Harbor	5,038	3,308	65.7	56.3	34.5	61.3	62.3	34.2	55.0
Newport	4,151	2,487	59.9	36.7	20.1	54.7	43.8	21.2	48.3
NAS Corpus Christi	2,859	1,639	57.3	26.8	13.7	51.0	25.8	17.1	66.5
Key West	2,066	1,584	76.6	18.2	13.4	73.6	26.4	17.2	65.1
MSB New London	1,760	841	47.8	14.7	6.3	42.6	19.7	7.4	37.7
NAS Memphis	1,728	1,032	60.0	15.1	8.7	57.1	16.5	9.7	58.6
NAS Glynco	1,461	1,321	90.4	10.8	9.7	89.3	13.2	11.9	90.0
NAS Lemoore	1,437	891	62.0	12.5	7.5	59.6	19.3	8.2	42.5
NAS Meridian	1,271	739	58.2	12.2	6.2	51.1	8.3	5.6	67.6
NAS Kingsville	1,267	677	53.4	12.2	5.7	46.4	12.6	8.0	63.2
NAS Chase Field	1,234	650	52.7	12.0	5.5	45.5	11.5	7.2	62.5
NAS Albany	1,186	923	77.8	10.8	8.2	75.9	16.1	9.9	61.5
NAS Brunswick	1,053	931	88.4	8.9	7.7	87.2	10.4	8.0	77.3
NS Adak	987	926	93.9	8.6	8.0	93.4	8.1	7.5	93.3
NAS Lakehurst	843	753	89.4	7.5	6.6	88.5	9.8	8.2	74.5
NS Charleston	838	275	33.0	8.4	2.3	27.5	10.4	2.4	22.8
NS Kodiak	742	711	95.9	6.6	6.3	95.5	8.0	7.6	95.4

APPENDIX A—METHODOLOGY FOR COMPARING SUPPLY AND DEMAND FOR SHIP BERTHING

CLASSIFICATION OF SHIPS

To simplify the calculations, all ships in the Navy are grouped into 12 groups of notional ships. These groups are identified in table A–1. The characteristics of each group are shown in table A–2. The limits on maximum nests are purposely somewhat stringent. With these limits the results of the analysis indicate the Navy has more than enough space in which to berth its ships; allowing even greater nesting would only strengten this conclusion.

ESTIMATION OF PEAK SIMULTANEOUS LOAD

The MOVEREP system was sampled at 10-day intervals during 1969 to determine the location of all ships in the Navy. These data were used to calculate the average and the maximum numbers of ships, by type and in the aggregate, that were located at each homeport during the year.

The peak simultaneous load in 1969 was estimated by assuming 1) that the number of hulls in this load equals the maximum number of hulls located there during the year, and 2) that the mix of ships in the peak load is the same as the mix in the average load. The first assumption is made to account for the fact that the peak simultaneous load is *not* equal to the sum of the peak loads of the separate ship types, because those separate peaks did not all occur simultaneously. The second assumption is made to yield a statistically more reliable estimate of the expected mix at the peak than the alternative assumption that it is the same as the mix of the individual peaks.

Table A–3 illustrates for the homeport of Charleston how the MOVEREP data were used to estimate the peak 1969 load and shows how that load was projected to 1978. As shown at the top of the table, the maximum number of hulls during the year was 46, the average was 34.4, so the peak load is assumed to be $\frac{46.0}{34.4} = 1.4$ times the average load.

The average 1969 load, shown in the first column, when multiplied by 1.4, yields the estimated 1969 peak simultaneous load as shown in column 2. The numbers homeported in 1969 and 1976 are shown in columns 3 and 4. The 1969 peak load is divided by the 1969 numbers homeported, as shown in column 5, yielding a ratio that is assumed to hold in 1978. Multiplying this by the 1978 numbers homeported yields the estimated 1978 peak load, shown in the last column.

Table A–4 shows for each port the homeport schedule and the estimated peak simultaneous load for 1969 and 1978.

SUPPLY OF BERTHING FACILITIES

Table A–5 summarizes all piers and wharves owned by the Navy in CONUS and Hawaii. The piers and wharves assumed in this analysis to be available are those with a "berthing" function that are owned by Naval Stations, Bases, and Air Stations. The possibility of homeporting ships at shipyards has not been examined.

RULES FOR FILLING SHIPS

Slip capacity

Prior to assigning ships to slips, the capacity of each slip is determined in terms of the number of ships of each type that can fit into the slip and the number whose electrical needs can be met.

The following rules are followed to ensure adequate spacing between ships. Along the length of pier, a 50-foot space is provided between ships. If the ships are nesting there must also be a 35-foot space at each end of the pier. If the ships are not nesting, no space is required at one end of the pier and 10 percent of the ship length is allowed to hang over the end of the pier. (This last rule was adopted because typical berthing plans clearly indicate that this policy is followed in certain ports.)

Nesting of ships is always limited by the maximum nesting factor (table A–2) even though the slip is wide enough to permit more. Nesting is also constrained by the need for a clear passageway in the middle of the slip at least as wide as the widest nest in the slip.

Assignment of ships

Ships are assigned to slips, where they fit, in accordance with explicit priorities. These priorities are shown in table A–6. Each slip is assumed to be "dedicated" to that type of ship shown in the Navy's typical berthing plan for that slip. Whenever possible, ships are assigned to piers dedicated to that type of ship. Only when this is not possible are lower priority assignments made.

TABLE A-1.—NOTIONAL SHIP GROUPS

Ship group	Ship type
1. Large carriers	CVA, CVAN, CVT, CV, BB, CVN
2. Small carriers	CVS, LPH, LHA
3. Cruisers/frigates	CA, CG, CGN, CLG, CC, CAG, DL, DLG, DLGN
4. SSBN	SSBN
5. Subs	AGSS, SS, SSN, LPSS, ATSS
6. Destroyers	DD, DDG, DE, DEG, DER, DDR, AGDE, SCS
7. Amphibious	LCC, LPR, LKA, LPA, LPD, LPR, LSD, LST
8. Minesweeping/patrol	MCS, MHC, MSC, MSCO, MSF, MSI, MSO, PC, MSH, PCE, PCER, PCH, PCS, PF, PG, PGH, PHM, PTF
9. Tenders	AD, AS, AR
10. Large auxiliary	AOE, AFS, AO, AOR
11. Medium auxiliary	AE, AG, AGB, AGF, AGMR, ARG, AGS, AGSC, AGTR, AV, AVB, AVM, AVP
12. Small auxiliary	ADG, AF, AGEH, AGER, AH, AK, AKL, ANL, AOG, APB, ARC, ARG, ARL, ARS, ARSD, ASR, ATA, ATF, ATS, IX

TABLE A-2.—CHARACTERISTICS OF NOTIONAL SHIP TYPES

Ship group	Characteristics					
	Length	Beam	Draft	Complement	Electricity (100 kw)	Maximum nest [1]
1. Large carriers	1,050	120	36	2,800	40	1
2. Small carriers	800	100	32	1,700	20	1
3. Cruisers/frigates	600	60	29	500	20	2
4. SSBN	425	33	32	140	7	1
5. Subs	300	30	20	100	2	4
6. Destroyers	400	42	20	250	5	4
7. Amphibious	500	65	20	350	10	4
8. Minesweeping/patrol	165	30	10	50	2	4
9. Tenders	600	85	28	950	10	1(+4)
10. Large auxiliary	650	80	30	450	8	4
11. Medium auxiliary	500	60	25	275	6	4
12. Small auxiliary	350	40	20	100	4	4

[1] Including pierside ships.

ESTIMATION OF PEAK SIMULTANEOUS SHIP LOADS IN FISCAL YEAR 1969 AND FISCAL YEAR 1978 AT CHARLESTON

$$\frac{\text{Maximum number of hulls in 1969}^{a}}{\text{Average number of hulls in 1969}^{a}} = 46.0 \div 1.4$$

Ship type	Average 1969 load [a]	Estimated 1969 peak	Homeported 1969 [b]	Homeported 1978 [c]	1969 peak divided by 1969 homeported	Estimated 1978 peak
Large carriers	0.9×1.4=	0.0	0	[Deleted.]	0	[Deleted.]
Small carriers	0.0×1.4=	0.0	0		0	
Cruisers/frigates	0.9×1.4=	1.3	0		(1)	
SSBN	4.2×1.4=	5.9	8		×.74=	
Submarines	7.1×1.4=	9.9	14		×.71=	
Destroyers	6.7×1.4=	9.4	17		×.55=	
Amphibious	0.0×1.4=	0.0	0		0	
Minesweeping/patrol	10.4×1.4=	14.6	25		×.58=	
Tenders	1.9×1.4=	2.7	3		×.90=	
Large auxiliary	0.0×1.4=	0.0	0		0	
Medium auxiliary	0.2×1.4=	0.3	1		×.30=	
Small auxiliary	2.5×1.4=	3.5	5		×.70=	
Total	34.4	46.0 [a]	73			

[1] Peak load in 1978 assumed equal to peak load in 1969 when none are homeported in either year.

Sources:
[a] MOVEREP reporting system.
[b] OPNAVNOTE 0011000, March 1970.
[c] Ships Planning System, October 1971.

HOMEPORT SCHEDULES AND PEAK SIMULTANEOUS LOADS

Homeport	Year	Large carriers	Small carriers	Cruisers/ frigates	SSBN	Sub- marines	De- stroyers	Am- phibious	Mine- sweeping/ patrol	Tenders	Large auxil- iaries	Medium auxil- iaries	Small auxil- iaries	Total
Key West	1969:													
	Homeported	0	0	0	0	10	2	0	0	1	0	0	1	14
	Peak load	0	0	0	0	6	2	0	0	1	0	0	1	10
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Mayport	1969:													
	Homeported	2	1	4	0	0	20	0	0	1	2	1	4	35
	Peak load	1	0	2	0	0	11	0	1	0	1	1	4	21
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Newport	1969:													
	Homeported	0	0	0	0	0	46	0	0	5	5	0	3	59
	Peak load	0	0	0	0	0	30	0	0	2	1	0	2	35
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Quonset	1969:													
	Homeported	0	2	0	0	0	0	0	0	0	0	0	0	2
	Peak load	0	2	0	0	0	0	0	0	0	0	0	0	2
	1978:													
	Homeported	0	0	0	0	0	0	0	0	0	0	0	0	0
	Peak load	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Creek	1969:													
	Homeported	0	0	0	0	0	0	31	0	0	0	0	13	44
	Peak load	0	0	0	0	0	0	17	1	0	0	0	10	28
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Charleston	1969:													
	Homeported	0	0	0	8	14	17	0	25	3	0	1	5	73
	Peak load	0	0	1	6	10	9	0	15	3	0	0	4	48

	1978:													
	Homeported	[Deleted.]												
	Peak load													
New London/Groton	1969:													
	Homeported	0	0	0	20	30	1	0	0	1	0	0	3	55
	Peak load	0	0	0	2	22	0	0	0	1	0	0	2	27
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Norfolk	1969:													
	Homeported	5	4	12		10	38	24	0	6	13	6	8	129
	Peak load	1	2	5	0	5	18	10	1	3	5	2	6	58
	1978:													
	Homeported	[Deleted.]												
	Peak load													
San Francisco	1969:													
	Homeported	0	0	0	0	0	2	0	1	1	4	1	7	14
	Peak load	0	0	1	0	6	4	1	1	1	2	4	4	24
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Alameda	1969:													
	Homeported	4	0	0	0	0	0	0	0	1	0	0	2	7
	Peak load	2	0	0	0	0	0	0	0	0	0	0	1	3
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Long Beach	1969:													
	Homeported	2	5	4	0	0	37	12	27	3	15	1	1	107
	Peak load	1	2	3	0	0	26	8	20	2	6	0	0	68
	1978:													
	Homeported	[Deleted.]												
	Peak load													
Pearl Harbor	1969:													
	Homeported	0	0	0	8	21	31	0	5	1	4	2	25	97
	Peak load	1	0	0	0	9	17	2	1	1	3	2	12	48
	1978:													
	Homeported	[Deleted.]												
	Peak load													
San Diego	1969:													
	Homeported	2	4	14	0	29	52	49	6	8	0	2	26	192
	Peak load	1	2	8	0	13	25	20	5	4	1	1	10	90
	1978:													
	Homeported	[Deleted.]												
	Peak load													

TABLE A-5.—NAVY-OWNED PIERS AND WHARVES IN CONUS AND HAWAII

[In thousands of feet of berthing]

Berth function	Activity type					
	Air stations, naval stations naval bases	Shipyards	Supply depots	NRTC's	Other	Total
Berthing	175	77	20	12	40	424
Supply (includes ammo & fuel)	19	1	58		28	106
Repairs (includes fitting out)	14	87				101
Total	208	165	78	12	68	531

Note.—Excludes Marine Corps activities, inactive ship maintenance facilities, and private shipyards.

Source: 1971 real property inventory.

TABLE A-6.—PRIORITIES FOR ASSIGNING SHIPS TO PIERS

Pier dedication	Carriers	Cruisers/frigates	SSBN	Submarines
Priority:				
1	Large Carriers	Cruisers/Frigates	SSBN	Subs (and tenders).
2	Small Carriers	Amphibious	Submarines	Destroyers.
3	Large Auxiliaries	Destroyers	Large Auxiliaries	Large Auxiliaries.
4		Large Auxiliaries	Medium Auxiliaries	Medium Auxiliaries.
5		Medium Auxiliaries	Small Auxiliaries	Small Auxiliaries.
6		Small Auxiliaries		Minesweeping/Patrol.
7		Minesweeping/Patrol		

	Destroyers	Amphibious	Minesweeping/patrol	Auxiliaries
Priority:				
1	Destroyers (and tenders).	Amphibious	Minesweeping/Patrol	Large Auxiliaries.
2	Cruisers/Frigates	Cruisers/Frigates	Large Auxiliaries	Medium Auxiliaries.
3	Amphibious	Destroyers	Medium Auxiliaries	Small Auxiliaries.
4	Large Auxiliaries	Large Auxiliaries	Small Auxiliaries	Minesweeping/Patrol.
5	Medium Auxiliaries	Medium Auxiliaries		
6	Small Auxiliaries	Small Auxiliaries		
7	Minesweeping/Patrol	Minesweeping/Patrol		

NOTES

1. All ship assignments are subject to space constraints.
2. A ship type not listed under a pier type is never assigned to that pier type.
3. A ship will always be assigned to a pier that is dedicated to its type unless all such piers are filled by ships of that type.
4. A pier will always hold the type of ships to which it is dedicated unless all ships of that type are berthed at other piers of that type.

APPENDIX B—METHODOLOGY FOR COMPARING SUPPLY AND DEMAND FOR AIRCRAFT SUPPORT RESOURCES

AIRCRAFT SUPPORT RESOURCES

The station resources used to support aircraft are limited in the comparisons to the space devoted to parking aprons, POL storage, covered warehouse, runway length, and maintenance areas. The latter are further broken out to crew and equipment/administration space, hangar bay space, and intermediate maintenance shop space. The requirements of each type/model aircraft for each resource are initially based on the NAVPAC P-80, "Facility Planning Factors for Naval Shore Activities." These factors are shown in table B-1. The availability of these resources at the LANT, PAC, and CNT air stations in the United States is presented in tables B-2 through B-4.

DEMAND BY P-80 STANDARDS

The initial calculation of demand is based on the NAVPAC P-80 and the aircraft located at each air station in FY-69. The computations basically consist of taking the product of the number of aircraft of each type/model in the base load and the corresponding factor for each resource. The following additional requirements are calculated:

(1) the need for hangar bay space is double for cargo/patrol aircraft at foul weather stations,

(2) stations with jet shops require maintenance shop space in proportion to the sum of the total number of aircraft in the base load and the total number of jet engines on aircraft in the base load,

(3) the requirement for runway is taken as that of the aircraft in the base load with the longest runway requirement, and

(4) each station is allowed a station baseline of maintenance spaces.

These requirement calculations are consistent with those used by OP-05 in the "Worldwide Review of the Naval Aviation Shore Establishment," in 1970 with one exception. The exception is that we have used "per-aircraft" factors instead of the "modular" factors in the determination of the requirements for maintenance spaces.

CALIBRATION OF DEMAND TO CURRENT STANDARDS

These initial estimates of resource requirements at each air station are next compared with the quantities of support resources actually provided by that station in FY-69. Tables B-5 through B-7 indicate the proportion of P-80 standards achieved. The requirements generated by the P-80 factors are deflated by these fractions in subsequent calculations.

ESTIMATION OF FISCAL YEAR 1978 LOADINGS

The estimation of station aircraft loads in FY-78 are based upon the deployment patterns observed in FY-69 and the aircraft assignments planned for FY-78. As shown in tables B-8 through B-10, we start with FY-69 assignments for Navy aircraft and subtract deployed aircraft; the loading factor is the ratio of the number of Navy aircraft located at a station and the number of Navy assigned. Non-Navy tenant aircraft are added to Navy located aircraft to obtain the total load.

Table B-11 shows how we have used the loading factors just calculated to estimate FY-78 loads. For simplicity we assumed that all aircraft (squadron and station aircraft) have the same deployment pattern. To the extent that the mix of Navy deployable and Navy non-deployable aircraft is the same in FY-78 as it was in FY-69 we will obtain the proper relative demand for aircraft support. A level projection is used for any non-Navy tenant aircraft present in FY-69.

TABLE B-1.—P-80 RESOURCE REQUIREMENTS BY AIRCRAFT TYPE

Aircraft	Parking apron (square yards)	10-day POL (1,000 gal)	Covered warehouse (square foot)	Intermediate maintenance: Crew equipment and administration (square foot)	Intermediate maintenance: Hangar bay (square foot)	Intermediate maintenance: Shop (square foot)	Runway length (1,000 foot)	Number jet engines
A-3	2,250	16	400	800	1,280	666	10	2
A-4	725	6	400	400	853	133	10	1
A-5	1,540	18	400	800	1,280	666	10	2
A-6	1,400	14	400	800	1,280	666	10	2
A-7(AV-8/X)	1,000	11	400	400	853	133	10	1
F-4	1,040	15	375	400	853	133	10	2
F-8 (F-10/102)	975	7	375	400	853	133	10	1
F-9	940	7	375	200	533	83	10	1
F-14	1,200	16	375	400	853	133	10	2
E-1	1,620	2	900	480	1,280	200	8	0
E-2	1,970	5	900	480	1,280	200	8	2
P-2	3,260	19	700	800	2,133	333	8	2
P-3	3,430	18	700	800	2,133	333	8	4
S-2	1,610	2	400	480	1,280	200	6	0
S-3	1,450	6	700	480	1,280	200	8	2
OV-10 (O-1)	940	2	400	400	853	133	6	2
U-11	850	0	175	480	1,280	200	6	0
U-16	2,580	1	350	480	1,280	200	6	0
T-1	1,075	4	375	200	533	83	10	1
T-2	950	6	375	200	533	83	5	2
T-28	710	1	175	200	533	83	5	0
T-33	930	3	375	200	533	83	10	1
T-34	520	0	175	200	533	83	3	0
T-39	960	4	375	200	533	83	8	2
C-1	1,520	2	350	480	1,280	200	6	0
C-2	1,970	7	525	480	1,280	200	8	2
C-54	3,840	9	525	800	2,133	333	8	0
C-117	2,420	3	350	800	2,133	333	8	0
C-118	4,050	15	525	800	2,133	333	8	0
C-119	3,380	5	350	800	2,133	333	8	0
C-121	4,430	17	900	800	2,133	333	8	0
C-130	4,580	28	525	800	2,133	333	8	4
C-131	3,130	5	350	800	2,133	333	8	1
H-1	1,800	1	175	400	800	167	1	0
H-2	1,260	1	250	400	800	167	1	1
H-3	2,030	2	250	480	1,280	333	1	2
H-34	1,660	1	250	480	1,280	333	1	0
H-46	1,940	2	250	480	1,280	333	1	2
H-53 (H-52)	2,350	2	250	480	1,280	333	1	2
H-57 (H-13/19/23)	4,700	0	175	400	800	167	1	1
Miscellaneous	3,000	3	400	480	1,280	200	6	0

TABLE B-2.—CHARACTERISTICS OF PAC AIR BASES IN UNITED STATES

	Parking apron (1,000 yd²)	POL (1,000 gal)	Covered warehouse (1,000 ft²)	Intermediate maintenance: Crew equipment and administration (1,000 ft)	Intermediate maintenance: Hangar bay (1,000 ft²)	Intermediate maintenance: Shop (square feet)	Runway (1,000 ft)	Jet shop	Foul weather	CVA loading
NS Adak	62	6502	488	12	71	24	7.8	No	Yes	No.
NAS Alameda	523	2703	554	102	273	53	8.0	Yes	No	Yes.
NAS Barbers Point	726	1701	296	136	287	110	8.4	Yes	No	No.
NAF El Centro	250	1410	157	14	39	40	9.5	No	No	No.
NAAS Fallon	268	2214	39	30	67	7	14.0	No	No	No.
NAS Imperial Beach	245	175	17	94	74	36	5.0	Yes	No	No.
NS Kodiak	88	3365	446	21	182	36	7.5	No	Yes	No.
NAS Lemoore	650	3184	272	204	319	94	13.5	Yes	No	No.
NAS Miramar	389	2568	310	288	266	169	12.0	Yes	No	No.
NAS Moffett	411	2728	233	75	580	120	9.2	Yes	No	No.
ALF Monterey	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
NAS North Island	2304	10480	1274	153	185	106	8.0	Yes	No	Yes.
NAS Whidbey	388	3582	313	126	222	99	8.0	Yes	No	No.

[1] Data not available.

TABLE B-3.—CHARACTERISTICS OF LANT AIR BASES IN UNITED STATES

	Parking apron (1,000 yd²)	POL (1,000 gal)	Covered warehouse (1,000 ft²)	Intermediate maintenance: Crew equipment and administration (1,000 ft)	Intermediate maintenance: Hangar bay (1,000 ft²)	Intermediate maintenance: Shop (square feet)	Runway (1,000 ft)	Jet shop	Foul weather	CVA loading
NAS Albany	494	3,500	216	167	185	118	12.1	Yes	No	No.
NAS Brunswick	471	2,618	78	72	199	35	8.0	Yes	Yes	No.
NAS Cecil Field	522	3,993	217	100	261	131	12.5	Yes	No	No.
NAS Jacksonville	606	4,284	1,706	182	401	85	8.0	Yes	No	No.
NAS Key West	428	149	121	95	87	60	10.0	Yes	No	No.
NAS Lakehurst	35	280	229	125	725	93	5.0	Yes	No	No.
NS Mayport	128	1,764	79	2	5	0	8.0	No	No	Yes.
NAS Norfolk	620	3,756	1,302	89	473	103	6.4	Yes	No	Yes.
NAS Oceana	443	3,633	203	131	224	198	12.0	Yes	No	No.
NAS Quonset Point	400	5,550	1,016	185	317	44	8.0	Yes	No	Yes.

TABLE B-4.—CHARACTERISTICS OF TRAINING AIR BASES IN UNITED STATES

				Intermediate maintenance						
	Parking apron (1,000 yd²)	POL (1,000 gal)	Covered warehouse (1,000 ft²)	Crew equipment and administration (1,000 ft)	Hangar bay (1,000 ft²)	Shop (square feet)	Runway (1,000 ft)	Jet shop	Foul weather	CVA loading
NAS Atlanta	87	420	42	13	36	20	10.0	No	No	No.
NAS Chase Field	348	2,935	77	62	203	108	8.0	Yes	No	No.
NAS Corpus Christi	250	1,352	758	63	465	86	8.0	Yes	No	No.
NAS Dallas	329	710	115	17	59	31	8.0	Yes	No	No.
NAF Detroit	113	3,104	21	8	76	20	9.0	No	Yes	No.
NAS Ellyson	358	316	23	9	49	17	3.1	No	No	No.
NAS Glenview	161	740	94	24	215	22	8.0	No	No	No.
NAS Glynco	136	880	113	26	32	20	8.0	No	No	No.
NAS Kingsville	292	2,885	135	68	168	68	8.0	Yes	No	No.
NAS Memphis	191	1,040	418	35	36	43	8.0	No	No	No.
NAS Meridian	288	3,495	69	30	77	28	8.0	Yes	No	No.
NAS New Orleans	247	1,470	87	50	36	24	8.0	No	No	No.
NAS Pensacola	309	3,164	789	134	109	72	8.0	Yes	No	Yes.
NAS Saulley	178	165	25	59	65	20	6.0	No	No	No.
NAS South Weymouth	97	945	49	17	112	44	7.0	No	No	No.
NAS Whiting	390	1,201	58	38	126	75	6.0	No	No	No.
NAS Willow Grove	151	420	43	87	91	18	8.0	No	No	No.

TABLE B-5.—PROPORTION OF P-80 STANDARDS PROVIDED AT PAC AIR STATIONS IN 1969

Location	Parking apron	POL capacity	Coverede warehous	Crew equipment/ administration	Hangar bay	Mainte-nance	Runway [1]
Kodiak	1.00	1.00	1.00	1.00	1.00	1.00	0.94
El Centro	1.00	1.00	1.00	.62	1.00	1.00	.95
Imperial Beach	1.00	1.00	.73	1.00	.62	.63	.83
Adak	1.00	1.00	1.00	.50	1.00	1.00	.97
Barbers Point	1.00	1.00	1.00	1.00	1.00	1.00	.84
Moffett Field	1.00	1.00	1.00	1.00	1.00	1.00	.92
Whidbey Island	1.00	1.00	1.00	.99	.97	.84	.80
Alameda	1.00	1.00	1.00	.83	1.00	.46	.80
Miramar	1.00	.86	1.00	1.00	1.00	1.00	1.00
Lemoore	1.00	1.00	1.00	1.00	.93	.86	1.00
North Island	1.00	1.00	1.00	1.00	.93	1.00	.80

[1] Based on aircraft with longest runway requirement.

TABLE B-6.—PROPORTION OF P-80 STANDARDS PROVIDED AT LANT AIR STATIONS IN 1969

Location	Parking apron	POL capacity	Covered warehouse	Crew equipment/ administration	Hangar bay	Mainte-nance	Runway [1]
Albany	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lakehurst	.16	1.00	1.00	1.00	1.00	1.00	.50
Mayport	1.00	1.00	1.00	.12	.29	.00	1.00
Key West	1.00	.19	1.00	1.00	.62	1.00	1.00
Quonset Point	1.00	1.00	1.00	1.00	1.00	.57	.80
Brunswick	1.00	1.00	1.00	1.00	1.00	.99	1.00
Jacksonville	1.00	1.00	1.00	1.00	1.00	1.00	.80
Cecil Field	1.00	1.00	1.00	.85	1.00	1.00	1.00
Oceana	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Norfolk	1.00	1.00	1.00	.76	1.00	1.00	.64

[1] Based on aircraft with longest runway requirement.

TABLE B-7.—PROPORTION OF P-80 STANDARDS PROVIDED AT CNT AIR STATIONS IN 1969

Location	Parking apron	POL capacity	Covered warehouse	Crew equipment/ administration	Hangar bay	Mainte-nance	Runway [1]
Ellyson Field	1.00	1.00	0.80	0.13	0.31	0.32	0.52
Saufley Field	1.00	1.00	.68	1.00	.51	.58	1.00
Corpus Christi	.71	1.00	1.00	.56	1.00	1.00	1.00
Memphis	1.00	1.00	1.00	1.00	.62	1.00	.80
Dallas	1.00	1.00	1.00	.40	.73	.95	.80
New Orleans	1.00	1.00	1.00	.86	.30	.70	.80
Detroit/Self AFB	1.00	1.00	1.00	.30	1.00	.88	.90
South	1.00	1.00	1.00	.41	1.00	1.00	.70
Whiting Field	1.00	1.00	1.00	.48	.69	1.00	1.00
Glynco	1.00	1.00	1.00	.74	.45	.80	.80
Meridian	1.00	1.00	1.00	.60	.72	.47	1.00
Willow Grove	.65	.76	1.00	1.00	.57	.45	.80
Atlanta	1.00	1.00	1.00	.40	.64	.87	1.00
Glenview	1.00	1.00	1.00	.47	1.00	.69	.80
Pensacola	1.00	1.00	1.00	1.00	.93	1.00	.80
Chase Field	1.00	1.00	1.00	1.00	1.00	1.00	.80
Kingsville	1.00	1.00	1.00	1.00	1.00	1.00	.80
Fallon	1.00	1.00	1.00	1.00	1.00	.42	1.00

[1] Based on aircraft with longest runway requirement.

TABLE B-8.—1969 LOADING FACTORS FOR PAC AIR STATIONS IN UNITED STATES

Station	(1) Navy assigned [1]	—	(2) Navy deployed [2]	=	(3) Navy located	(4) Loading factor (3)÷(1)	(5) Non-Navy located [1]	(6) Total load (3)+(5)
Kodiak	3		0		3	1.00	8	11
El Centro	9		0		9	1.00	9	18
Imperial Beach	126		33		93	.73	0	93
Adak	4		—9		13	[3] 2.50	0	13
Barbers Point	100		9		91	.91	0	91
Moffett	83		27		56	.67	20	76
Whidbey	169		27		142	.84	0	142
Alameda	171		15		156	.91	0	156
Miramar	426		132		294	.69	0	294
Lemoore	590		206		384	.65	0	384
North Island	198		53		145	.73	0	145

[1] NAO.
[2] Bluebook/NAO.
[3] Rotational squadron continually located.

TABLE B-9.—1969 LOADING FACTORS FOR LANT AIR STATIONS IN UNITED STATES

Station	(1) Navy assigned [1]	—	(2) Navy deployed [2]	=	(3) Navy located	(4) Loading factor (3)÷(1)	(5) Non-Navy located [1]	(6) Total load (3)+(5)
Albany	80		23		57	0.71	0	57
Lakehurst	75		27		48	.64	47	95
Mayport	3		0		3	1.00	0	3
Key West	110		0		110	1.00	0	110
Quonset Point	177		0		177	1.00	0	177
Brunswick	57		21		36	.63	3	39
Jacksonville	118		0		118	1.00	0	118
Cecil Field	411		152		259	.63	0	259
Oceana	223		88		135	.61	0	135
Norfolk	225		28		197	.88	0	197

[1] NAO.
[2] Bluebook/NAO.

TABLE B-10.—1969 LOADING FACTORS FOR TRAINING AIR STATIONS IN UNITED STATES

Station	(1) Navy assigned [1]	—	(2) Navy deployed [2]	=	(3) Navy located	(4) Loading factor (3)÷(1)	(5) Non-Navy located [1]	(6) Total load (3)+(5)
Ellyson	126		0		126	1.00	0	126
Saufley	211		0		211	1.00	0	211
Corpus Christi	195		0		195	1.00	7	202
Memphis	34		0		34	1.00	0	34
Dallas	47		0		47	1.00	11	58
New Orleans	33		0		33	1.00	53	86
Detroit	24		0		24	1.00	0	24
South Weymouth	53		0		53	1.00	0	53
Whiting Field	317		0		317	1.00	0	317
Glynco	285		0		285	1.00	0	285
Meridian	171		0		171	1.00	0	171
Willow Grove	65		0		65	1.00	28	93
Atlanta	36		0		36	1.00	0	36
Glenview	68		0		68	1.00	0	68
Pensacola	140		0		140	1.00	0	140
Chase Field	202		0		202	1.00	0	202
Kingsville	205		0		205	1.00	0	205

[1] NAO.
[2] Bluebook/NAO.

TABLE B-11.—ESTIMATION OF FISCAL YEAR 1978 BASE LOADINGS: NAS CECIL FIELD AND NAS MOFFETT FIELD

Aircraft type	1978 number assigned	× 1969 loading factor	= 1978 load
	NAS Cecil Field		
A-7	195	0.63	122.85
TA-4	15	.63	9.45
US-2	4	.63	2.52
T-39	1	.63	.63
C-1	1	.63	.63
Total	216		136.08
	NAS Moffett Field		
P-3	93	0.67	62.31
US-2	2	.67	1.34
Non-Navy	20	[1] 1.00	20.00
Total	115		83.65

[1] All non-Navy tenant aircraft are assumed to have a loading factor of 100 percent.

Appendix C.—Summary of Analysis of Operating Costs

Regression equations were developed to relate the amount of support resources expended at Naval Stations and Naval Air Stations to the numbers and types of units supported. The resources considered are base personnel, operating TOA, and operating expenses. Personnel and TOA are from the MCIS; operating expenses are from the Resource Management System (RMS). All data are for FY-70.

The following model was used for each support resource:

$$R = B_1 \cdot (N_{NAS}) \cdot B_2 \cdot (N_{NS}) + B_3 \cdot (PV_{NAS+NS}) + B_4 \cdot M_{SHIPS} + B_5 \cdot M_{FAC} + B_6 \cdot M_{TAC} + B_7 \cdot M_{-SHORE}.$$

where:

R = Total amount of the resource expended by all NAS's and NS's in a geographic area.

N_{NAS} = Number of (non-reserve) Air Stations in the area.

N_{NS} = Number of Naval Stations in the area.

PV_{NAS+NS} = Total 1970 replacement value of all real property owned by the Air Stations and Naval Stations.

M_{SHIPS} = Number of active Navy personnel on ships homeported in the area.

M_{FAC} = Number of active Navy personnel in fleet squadrons permanently assigned in the area.

M_{TAC} = Number of active Navy personnel in NATC squadrons assigned in the area.

M_{SHORE} = Number of active Navy personnel in shore units based in the area.

and the B_i $i = 1, \ldots 7$ are constants whose values are to be estimated.

Each equation was estimated through a weighted regression in which the standard error of the estimate was assumed proportional to the quantity being estimated (i.e., constant percentage error). Table C-1 summarizes these equations.

These equations were then used to obtain an initial estimate of that portion of resource usage that does not vary with home-ported units (the sum of terms 1, 2, and 3 in the equation) and that portion that does (the sum of terms 4 through 7). Each of these were then divided by estimated total resource usage to determine their proportions of the total.

Final estimates of each component were then made for each complex by multiplying these propostions by actual usage.

TABLE C-1.—REGRESSION EQUATIONS

Variable	Parameter	Support resource		
		Personnel	Operating TOA	Operating expense
NAS	B_1	569.000	4667.000	5591.000
NS	B_2	116.000	859.000	759.008
PV (millions of dollars)	B_3	2.800	25.070	27.480
MSHIPS	B_4	0.050	0.564	0.787
MFAC	B_5	0.079	0.747	1.739
MTAC	B_6	0.442	4.920	2.900
MSHORE	B_7	0.072	0.680	0.737
Standard error (percent)		25	22	24
Number of observations		22	22	22
Error degrees of freedom		15	15	15

[1] See the following formula:

$$\sqrt{\frac{1}{15}\sum_{i=1}^{22}\left[\frac{(\hat{Y}_i - Y_i)}{Y_i}\right]^2}$$

Estimated Fixed and Variable Costs for Naval Stations and Naval Air Stations

TYPES OF COSTS

The fixed costs of a station are those operating costs that do not change in the short run when the number of tenants supported by the station is changed. Variable costs are those that do change when tenants are changed.

Costs that are fixed in the short run can be saved in the long run by closing facilities. If the tenants of a closing station are either disestablished or transferred to a station with excess capacity, the fixed costs of other stations need not change. Total fixed costs can therefore be reduced by the amount of the fixed costs at the closing station.

Variable costs generally cannot be reduced unless tenants are disestablished. If tenants are merely transferred from one station to another, the variable costs of the gaining station will increase by roughly the same amount by which the variable costs of the losing station are decreased. This disregards possible scale effects on variable costs, but these are believed to be small and are ignored in this analysis.

ANALYSIS OF FISCAL YEAR 1970

Methodology

Estimates of the fixed and variable portions of station support resources were obtained by applying the statistical technique of multiple regression analysis (least squares) to relate station resources to the kind and size of units supported. These relationships were estimated from FY 70 data covering a cross-section of Naval Stations and Naval Air Stations in the U.S.

The station resources considered are station personnel (military plus civilian), operating total obligational authority (TOA) (MPN plus OMN), and operating expenses reported in the Navy's Resource Management System (RMS). Each resource is analyzed separately.

Each resource is related to the major sources of demand for that resource: ship forces, aircraft forces, shore-based tenants, and station facilities. Force and tenant units are measured by their on-board personnel. Facilities are measured by their dollar value (replacement cost).

The analysis was conducted in two parts: one dealing with data at the activity level, and the other at the complex level. The analysis at the activity level considers the support provided by each Naval Station and Naval Air Station. The analysis at the complex level aggregates all Naval Stations, Naval Air Stations, Naval Bases, Public Works Center, and Commissaries located within the same geographical area. The groupings of activities into complex are identified in table 1.

The two approaches were taken because of inherent advantages in each. The complex captures not only the individual activities comprising it, but also the interaction between these activities. It also allows for the inclusion of support-providing activities other than stations (PWC's, bases, and commissaries).

The generalized regression equation presented below illustrates the manner in which regression estimates were obtained for station personnel. Separate stimates of operating TOA and operating expenses were obtained in the same manner.

Generalized regression equation

$$\text{Station Personnel} = B_0 + B_1\,(\text{Facilities}) + B_2\,(\text{Ship Personnel}) + B_3\,(\text{Squadron Personnel}) + B_4\,(\text{Students}) + B_5\,(\text{Other Tenant Personnel})$$

We first hypothesize that station personnel vary with the factors shown above. The values of these factors are obtained directly from the data, such as 1000 station personnel, 5000 ship personnel, etc. Standard statistical techniques are then used to estimate the values of the parameters (B's) in the equation. These parameter values are then used to estimate the fixed and variable costs of each station.

The first term, B_0, represents that component that exists at all stations regardless of size. This could include such things as base command. The next term (B_1 times the replacement cost of the facilities) represents that component that exists because the facilities exist. This term is large for stations with large facilities. These first two terms together represent the fixed component of a station's resources.

The remaining terms in the equation represent the variable component of a station's resources. All ships are represented by the total number of men on board ships homeported at the station. Weighting each hull by the size of its crew in this way implicitly assumes that the amount of station resources required by a ship is proportional to its crew size. A similar procedure is used for aircraft, which are represented by total personnel in aircraft squadrons. Students and other tenants are treated in similar fashion.

An analogous equation was developed for the analysis at the complex level. The specific equations used in all analyses are described in Tab E.

These equations were used to estimate the percentage of total operating resources that are fixed. This percentage is obtained for each station by dividing the estimated amount fixed by the estimated total amounts.

Results

Estimates of the fixed proportions of operating resources were made for individual stations and for entire complexes. The results for individual stations are presented in tables 2 through 5.

Table 2 shows the results for Fleet Air Stations for each of the three station resources. These stations are listed in order of decreasing size (as measured by station personnel). The fixed proportion of each resource exhibits some tendency to increase as station size decreases. The results are similar for all three resources. This is not unexpected since personnel costs are the major component of operating resources.

Table 3 shows results for Training Air Stations. All stations have high fixed proportions for all resources. This means that once the correlation between facilities and operating resources is accounted for, there is little additional correlation between station resources and the number of students or tenant personnel.

Results for Reserve Air Stations are shown in table 4.

Results for Naval Stations are shown in table 5. Most stations have a very high fixed cost. These Naval Station models are considerably weaker than the other models presented. Fixed percentages equal to 100 reflect statistical difficulties in the data. They occur in those instances where the data comprising the variable component of demand is statistically "noisier" than the effect we sought to measure. The errors introduced by this statistical noise caused the fixed percentage to be 100. A correct interpretation would be that the fixed proportion of annual operating costs is very close to, but less than, 100 percent at these stations. Because of the magnitude of the standard error of demand, the exact proportion less than 100 percent cannot be determined with these models. A more detailed explanation of the models is provided in Tab E.

The results of the analysis at the complex level are shown in table 6. These results confirm those at the activity level in that they exhibit the same general relationships. First, there is the same overall result of high fixed cost. Second, there is the same tendency toward higher percentages fixed at the smaller complexes. Also, the high fixed cost of Pensacola, which is a "pure" training complex, reinforces the previous results showing high fixed costs for Training Air Stations.

There are some differences, however, between estimates for specific complexes and estimates for the specific stations comprising those complexes. But such differences are not inconsistent with the statistical uncertainties associated with these estimates. Specific values of the standard errors are tabulated in Tab E.

APPLICATION OF RESULTS TO FISCAL YEAR 1971 DATA

Methodology

The results of the previous section were applied to the station personnel and operating TOA resources for FY 71. For each station the quantity of these resources was multiplied by the corresponding fixed proportion estimated for FY 70. Data for station resources in FY 71 was taken from the Navy Cost Information System (NCIS), report MT06, dated 4 February 1972.

Results by station

The results for FY 71 by station are presented in tables 7 through 10, along with the resource totals.

TABLE 1.—GROUPINGS OF ACTIVITIES INTO COMPLEXES IN ANALYSIS AT THE COMPLEX LEVEL

Complex:	*Activities within complex*
Adak	NS Adak, Commissary.
Albany	NAS Albany.
Atlanta	NAS Atlanta.
Beeville	NAS Chase Field, Commissary.
Boston	NS Boston, NAS South Weymouth.
Brunswick	NAS Brunswick, Commissary.
Charleston	NS Charleston, Commissary.
Corpus Christi	NAS Corpus Christi, Commissary.
Dallas	NAS Dallas.
Glynco	NAS Glynco.
Great Lakes	NS Glenview, Commissary, PWC.
Jacksonville	NS Mayport, NAS Jacksonville, NAS Cecil Field, Commissary.
Key West	NS Key West, NAS Key West, Commissary, Naval Base.
Kingsville	NAS Kingsville, Commissary.
Kodiak	NS Kodiak, Commissary.
Lakehurst	NAS Lakehurst.
Lemoore	NAS Lemoore, Commissary.
Long Beach	NS Long Beach, NAS Los Alamitos, Commissary.
Memphis	NAS Memphis, Commissary.
Meridian	NAS Meridian, Commissary.
New London	NSB Groton.
New Orleans	NAS New Orlenas, Commissary.
Newport	NS Newport, Naval Base, NAS Quonset, Commissary, PWC.
New York	NS Brooklyn, NAS Brookyn.
Norfolk	NS Norfolk, NAB Little Creek, NAS Norfolk, NAS Oceana, PWC, Commissary.
Pearl Harbor	NAS Barbers Point, NS Pearl Harbor, NSB Pearl Harbor, PWC, Commissary.
Pensacola	NAS Pensacola, NAS Saufley Field, Commissary, NAS Ellyson Field, NAS Whiting, PWC.
Philadelphia	NS Philadelphia, NAS Willow Grove, Commissary.
San Diego	NAS North Island, NAS Imperial Beach, NAS Miramar, NS San Diego, NSB San Diego, Commissary, PWC, Exchange.
San Francisco	NAS Alameda, NAS Moffett, NS San Francisco, Commissary, PWC.
Seattle	NAS Seattle, NAS Whidbey, Commissary Bremerton, Commissary Seattle.

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TABLE 2.—FIXED PERCENTAGE OF FISCAL YEAR 1970 OPERATING COSTS—FLEET AIR STATIONS

Station	Station personnel (percent)	Operating TOA (percent)	Operating expense (percent)
North Island	33	38	28
Alameda	[1] 39	[1] 44	[1] 34
Jacksonville	43	48	37
Quonset Point	62	66	56
Norfolk	44	49	38
Miramar	45	47	35
Cecil Field	63	65	54
Oceana	60	63	51
Whidbey	59	61	50
Lemoore	41	44	32
Barbers Point	66	67	57
Albany	61	64	51
Moffett Field	71	73	62
Brunswick	74	77	66
Key West	60	64	50
Lakehurst	63	68	56
Imperial Beach	42	51	32
El Centro	85	89	81
Weighted average	52	56	44

[1] Includes portion attributable to ships.

Note.—Stations are listed from largest (North Island) to smallest (El Centro) based on fiscal year 1970 station personnel.

TABLE 3.—FIXED PERCENTAGE OF FISCAL YEAR 1970 OPERATING COSTS—TRAINING AIR STATIONS

Station	Station personnel (percent)	Operating TOA (percent)	Operating expense (percent)
Pensacola	93	81	79
Corpus Christi	98	92	88
Memphis	93	92	86
Glynco	97	92	93
Whiting Field	96	87	76
Kingsville	98	93	87
Chase Field	97	91	83
Meridian	96	86	74
Saufley Field	96	87	72
Ellyson Field	98	93	82
Weighted average	96	87	83

Note.—Stations are listed from largest (Pensacola) to smallest (Ellyson Field) based on fiscal year 1970 station personnel.

TABLE 4.—FIXED PERCENTAGE OF FISCAL YEAR 1970 OPERATING COSTS—RESERVE AIR STATIONS

Station	Station personnel (percent)	Operating TOA (percent)	Operating expense (percent)
Glenview	41	59	41
Willow Grove	40	59	41
Dallas	50	66	50
Brooklyn	67	79	66
South Weymouth	59	75	61
New Orleans	50	68	52
Detroit	58	77	60
Atlanta	31	50	27
Weighted average	49	67	50

Note.—Stations are listed from largest (Glenview) to smallest (Atlanta) based on fiscal year 1970 station personnel.

TABLE 5.—FIXED PERCENTAGE OF FISCAL YEAR 1970 OPERATING COSTS—NAVAL STATIONS

Station	Station personnel (percent)	Operating TOA (percent)	Operating expense (percent)
LANT:			
Norfolk	68	91	100
New London	86	98	100
Charleston	77	96	100
Little Creek	94	97	100
New York	99	99	100
Newport	93	91	100
Key West	98	99	100
Philadelphia	86	100	100
Mayport	99	92	100
Boston	91	99	100
PAC:			
San Diego	43	55	73
Long Beach	60	72	83
San Francisco	65	58	62
NS Pearl Harbor	70	59	60
Coronado	100	73	74
NSB Pearl Harbor	89	89	93
Adak	100	87	86
Kodiak	100	92	91
Weighted average:			
LANT	87	95	100
PAC	72	70	76

Note.—Stations within LANT and PAC are listed from largest (Norfolk and San Diego) to smallest (Boston and Kodiak) based on fiscal year 1970 station personnel.

TABLE 6.—FIXED PERCENTAGE OF FISCAL YEAR 1970 OPERATING COSTS—COMPLEXES

Complex	Base personnel percent)	Operating TOA (percent)	Operating expense (percent)
Pensacola	90	91	85
San Diego	47	49	44
Norfolk	48	48	43
San Francisco	60	60	55
Jacksonville	58	57	52
Pearl Harbor	69	70	65
Newport	60	60	54
Corpus Christi	89	89	81
Long Beach	48	47	42
Seattle	71	69	64
Key West	75	77	73
Great Lakes	70	93	90
New London	49	59	51
Memphis	87	96	93
Glynco	98	100	100
Lemoore	48	48	42
Meridian	90	91	83
Kingsville	88	88	79
Beeville	88	89	80
Albany	66	67	61
New York	92	88	84
Philadelphia	90	84	78
Brunswick	80	81	77
Adak	98	100	100
Boston	94	88	83
Lakehurst	89	88	84
Charleston	28	43	35
Dallas	98	86	81
Kodiak	99	100	100
New Orleans	95	87	82
Atlanta	98	89	85

Note.—Complexes are listed from largest (Pensacola) to smallest (Atlanta) based on fiscal year 1970 base personnel.

TABLE 7.—FIXED AMOUNT OF FISCAL YEAR 1971 OPERATING COSTS—FLEET AIR STATIONS

Station	Station personnel		Operating TOA (in millions of dollars)	
	Actual total	Estimated fixed	Actual total	Estimated fixed
North Island	2,971	961	23.2	8.8
Alameda	2,777	1,083	20.3	8.9
Jacksonville	2,443	1,050	20.1	9.6
Quonset Point	2,117	1,313	18.1	11.9
Norfolk	2,155	948	18.1	8.9
Miramar	1,328	598	13.7	6.4
Cecil Field	1,330	838	12.4	8.1
Oceana	1,435	861	13.5	8.5
Whidbey Island	1,440	850	13.6	8.3
Lemoore	1,226	593	11.6	5.1
Barbers Point	1,219	805	11.4	7.6
Albany	1,174	716	10.9	7.0
Moffet Field	1,007	715	9.8	7.2
Brunswick	1,019	754	9.1	7.0
Key West	843	506	8.5	5.4
Lakehurst	803	506	7.6	5.2
Imperial Beach	433	182	4.8	2.4
El Centro	390	332	3.6	3.2

TABLE 8.—FIXED AMOUNT OF FISCAL YEAR 1971 OPERATING COSTS—TRAINING AIR STATIONS

Station	Station personnel		Operating TOA (in millions of dollars)	
	Actual total	Estimated fixed	Actual total	Estimated fixed
Pensacola	2,831	2,633	27.8	22.5
Corpus Christi	2,280	2,234	20.7	19.0
Memphis	1,573	1,463	14.6	12.0
Glynco	1,484	1,439	11.4	10.5
Whiting Field	1,090	1,046	9.1	7.9
Kingsville	1,166	1,143	10.5	9.7
Chase Field	1,062	1,030	10.2	9.3
Meridian	986	947	8.6	7.4
Saufley Field	635	610	5.9	5.1
Ellyson Field	650	637	5.5	5.1

TABLE 9.—FIXED AMOUNT OF FISCAL YEAR 1971 OPERATING COSTS—RESERVE AIR STATIONS

Station	Station personnel		Operating TOA (in millions of dollars)	
	Actual total	Estimated fixed	Actual total	Estimated fixed
Glenview	698	286	7.1	4.2
Willow Grove	653	261	5.0	3.0
Dallas	638	319	8.3	4.1
South Weymouth	526	310	4.3	3.2
New Orleans	532	266	4.8	3.3
Detroit	337	199	2.0	1.6
Atlanta	427	132	3.9	2.0

TABLE 10.—FIXED AMOUNT OF FISCAL YEAR 1971 OPERATING COSTS—NAVAL STATIONS

Station	Station personnel		Operating TOA (in millions of dollars)	
	Actual total	Estimated fixed	Actual total	Estimated fixed
LANT:				
Norfolk	839	571	11.8	10.7
New London	1,795	1,544	15.1	14.8
Charleston	948	730	7.2	6.9
Little Creek	1,138	1,070	12.1	11.7
New York	407	403	3.3	3.2
Newport	1,100	1,023	11.4	10.4
Key West	928	909	8.3	8.2
Philadelphia	337	290	3.0	3.0
Mayport	600	594	6.6	6.1
Boston	158	144	1.7	1.7
PAC:				
San Diego	774	333	12.4	6.8
Long Beach	1,110	666	9.7	7.0
San Francisco	914	594	11.0	6.4
NS Pearl Harbor	1,088	762	14.9	8.8
Coronado	616	616	7.1	5.2
NSB Pearl Harbor	863	768	8.1	7.2
Adak	976	976	8.9	7.7
Kodiak	588	588	5.7	5.2

Detailed Methodology for Determining "Fixed" and "Variable" Costs for Naval Stations and Naval Air Stations

Two multiple regression analyses were performed that relate support resources to the number and type of units supported. One analysis recorded data at the complex level; the other at the activity level. The support resources considered in both analyses are base personnel, operating TOA and operating expenses. All data are for FY-70.

Complex Level

Regression Model

The following regression equation was used to relate each support resource of a complex to the number and type of units supported at that complex:

$$R = B_0 + B_1 \cdot (N_{\text{RES NAS}}) + B_2 \cdot (N_{\text{FLT NAS}}) + B_3 \cdot (N_{\text{TRG NAS}}) + B_4 \cdot (N_{\text{NS}}) + B_5 \cdot (PV_{\text{NAS+NS+PWC}}) + B_6 \cdot (M_{\text{SHORE}}) + B_7 \cdot (M_{\text{SHIP}}) + B_8 \cdot (M_{\text{AC}}) + B_9 \cdot (M_{\text{RES}})$$

where:

R = Total amount of support resource expended by all Naval Air Stations, Naval Stations, Naval Bases, Public Works Centers, and Commissaries in a geographical area (complex).

$N_{\text{RES NAS}}$ = Number of Reserve Air Stations in the complex.

$N_{\text{FLT NAS}}$ = Number of Fleet Air Stations in the complex.

$N_{\text{TRG NAS}}$ = Number of Training Air Stations in the complex.

N_{NS} = Number of Naval Stations in the complex.

$PV_{\text{NAS+NS PWC}}$ = Total 1970 replacement value for all real property owned by the Naval Air Stations, Naval Stations, and Public Works Centers in the complex.

M_{SHORE} = Number of active Navy Personnel in shore units based in the area.

M_{SHIP} = Number of active Navy personnel assigned to ships homeported in the area.

M_{AC} = Number of active Navy personnel in fleet and training squadrons assigned to the area.

M_{RES} = Number of Navy and Marine Corps reservists on ships or ashore in the area.

$(i = 0, \ldots, 9)$ = Constants whose values are to be estimated.

Naval Stations, Naval Air Stations, Naval Bases, Public Works Centers, and Commissaries were grouped into complexes as defined in table 1.

Data on base personnel (military plus civilian) and operating TOA are from the Navy Cost Information System (NCIS). Operating expenses are from the Resource Management System (RMS).

Total base personnel of a complex includes the personnel of Public Works Centers. However, total operating TOA and RMS for a complex do not include the NIF revenues of the PWC's; this was done because most of the funds transferred through the NIF are paid by the Naval Stations and Naval Air Stations and are already included in their TOA and RMS accounts.

The total 1970 replacement value for all real property owned by each activity is from the Detailed Inventory of Naval Shore Facilities (reference (f)). The replacement values for all activities within a complex were summed and recorded in millions of dollars.

The number of active Navy personnel assigned to each short unit is from the Navy Cost Information System (NCIS).

The number of active Navy personnel assigned to ships homeported at a complex was computed from the number of ships homeported, from the Ship Homeporting Forecast (reference (e)), by multiplying each ship type by a nominal complement and summing over ships.

The number of active Navy personnel assigned to each fleet and training squadron is from the NCIS; the assignment of squadrons to Air Stations is based on the Naval Aeronautical Organization (NAO), (reference (d)).

The number of reservists at each Naval Air Station is obtained directly from the NAO. The number of reservists at each Naval Station is computed from the number of NRT ships at the station from the Ship Homeporting Forecast, by multiplying each ship type by a nominal complement and summing over ships.[1] The reservists within a complex are then summed.

Other Variables

The number of civilians supported at each complex was also computed. This variable was not included in the final model because it has no explanatory effect on the support resources.

Fleet and training squadron personnel were initially treated as separate variables in the equation, but the results indicated an insignificant difference between them. Therefore, the final equation combines these personnel into one variable.

Results

Each support resource equation was estimated through a weighted regression in which the standard error of estimate was assumed to be proportional to the quantity of the resources being measured. Table 1 summarizes these equations.

The equations in Table 1 were used to estimate the amount of resource usage that does not vary with homeporting units (the sum of the first six terms in the equation) and the amount that does vary (the sum of terms 7 through 10). Each of these were then divided by the total estimated resource usage of a complex to determine their proportion of the total.

This percentage was then multiplied by the actual usage to obtain the final estimates of the amount fixed and the amount variable.

ACTIVITY LEVEL

Regression Model

Data analyzed at the activity level are divided into Fleet Air Stations, Training Air Stations, Reserve Air Stations, Naval Stations, LANT, and Naval Stations, PAC.

Fleet Air Stations. The following equation was used to relate base personnel, operating TOA and operating expenses of a Fleet Air Station to the number and type of units supported at that station.

$$R = B_0 + B_1(PV) + B_2(M_{FAS}) + B_3(M_T)$$

where:

R = Total amount of support resource expended by a Fleet Air Station.

PV = Total 1970 replacement value of all real property owned by a Fleet Air Station, adjusted to reflect geographical differences in construction costs (reference (g)).

M_{FAS} = Number of active Navy personnel in squadrons assigned to the Fleet Air Station.

M_T = Number of military and civilian tenant personnel assigned to shore units at the station.

$B_i i = 0, \ldots, 3$ = Constants whose values are to be estimated.

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[1] This method incorrectly assumes there is one Reserve crew per ship, whn, in fact, there are two. The amount of support required per Reservist aboard ship is therefore MRES/2.

Training Air Stations. The regression equation for Training Air Station is:

$$R = B_0 + B_1(PV) + B_2(M_S) + B_3(M_T)$$

where:

R = Total amount of support resource expended by a Training Air Station (minus students and student pay).

PV = Total 1970 replacement value of all real property owned by a Training Air Station, adjusted to reflect geographical differences in construction costs.

M_S = Number of students assigned to the training station.

M_T = Tenant personnel at Training Air Station (military and civilian).

$B_i i = 0, \ldots 2$ = Constants whose values are to be estimated.

Reserve Air Stations. The regression equation for Reserve Air Station is:

$$R = B_0 + B_1\ (PV) + B_2\ (W_{AC}) + B_3\ (M_T)$$

where:

R = Total amount of support resource expended by a Reserve Air Station.

PV = Total 1970 replacement value for all real property owned by a Reserve Air Station, adjusted.

W_{AC} = Amount of hangar bay and shop space required by the aircraft loading at the station.

M_T = Number of military and civilian tenant personnel assigned to shore units at the Reserve Air Station.

$B_i i = 0, \ldots, 3$ = Constants whose values are to be estimated.

Naval Stations. The regression equation relating Naval Stations support resources to the units support is:

$$R = B_0 + B_1 (PV) + B_2 (M_{SP}) + B_i (M_T)$$

where:

R = Amount of support resources expended at a Naval Station.

PV = Total 1970 replacement value of all real property owned by a Naval Station, adjusted.

M_{SP} = Number of active Navy personnel assigned to ships homeported at a Naval Station.

M_T = Number of military and civilian tenant personnel assigned to shore units at a Naval Station.

$B_i i = 0, \ldots, 4$ = Constants whose values are to be estimated.

Variables with weakly negative coefficient estimates in a particular model were dropped from that model, based on a lack of theoretical justification for negative values. None of the variables dropped in this manner have coefficient estimates "significantly different from zero" in classical (statistical) sense.

Data Sources. All equations used base personnel data from the Distribution of Manpower in the U.S. (reference (i)); operating TOA from the NCIS; operating expense from the Resources Management Systems. Base personnel are recorded in number of men; operating TOA and expense in thousands of dollars.

The total 1970 replacement values for real property obtained from the Detailed Inventory of Naval Shore Facilities (reference (f)) were deflated by the MILCON Cost Review Guide's FY 73 construction cost indices (reference (g)). The resulting figures were recorded in millions of dollars.

The number of active Navy personnel assigned to fleet squadrons was calculated through the use of NAO (reference (d)), to determine the number of men per squadron, and the Blue Book (reference (l)), to determine the assignment of squadrons to stations.

The number of students and the number of tenants, military and civilian, assigned to a station are from the Distribution of Manpower in the U.S.

The number of reserve station squadron aircraft from the NAO was weighted by NAVPAC P-80 (reference (m)) factors to determine the amount of hangar bay and shop space required by each squadron. The amount of space was recorded in thousands of square feet.

The number of ships homeported at a station was taken from the Ships Homeporting Forecast. These numbers were multiplied by a nominal complement of ship personnel assigned to each ship category to determine the number of men assigned to the homeported ships at a station.

In general, the regression equations relate the support resource usage to all the units supported at a station. The Training Air Station and Reserve Air Station models, however, are exceptions. The units supported by a training air station were initially assumed to be the station aircraft personnel, the military and civilian tenants at the station and the students. The number of station personnel and the number of tenants had no explanatory effect on support when the number of students at a station were considered. The final equation, therefore, only reflects the number of students supported at a Training Air Station.

The Reserve Air Station's model does not include the reservists because they had a small effect on the station's resources. The amount of hangar bay and shop space required by the reserve squadrons were found to explain a portion of the station's resources.

Results

Tables 2 through 5 describe the regression equation at the activity level.

RELIABILITY OF ESTIMATES

There exists no rigorous method of calculating the statistical reliability of the final estimates of fixed costs. However, some indications of this reliability can be inferred from the regression statistics. In the analysis at the complex level, the standard error of the "facilities" parameter is about 20 percent. In the analysis at the activity level, the corresponding error ranges from 10 percent to 80 percent.

These measures of reliability are valid in spite of the fact that the amount of facilities at a station is correlated with the number of tenants at that station. The presense of such multicolinearity results in larger standard errors of the parameters of the correlated variables than would otherwise exist. However, this effect is accounted for in the analysis.

TABLE 1.—REGRESSION EQUATIONS FOR COMPLEXES

[Dollar amounts in thousands]

Variable	Base personnel		Operating TOA		Operating RMS	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Constant [1]	−$210.9	$148.3	−$422.1	$1,185.8	−$1,056.8	$1,796.5
$N_{RES\ NAS}$	673.0	250.9	4,004.7	1,940.3	5,662.4	3,038.4
$N_{FLEET\ NAS}$	507.9	235.3	4,168.6	1,773.4	6,582.1	2,766.8
$N_{TRAINING\ NAS}$	1,214.7	196.2	10,605.5	1,549.7	9,213.1	2,194.5
N_{NS}	202.8	174.7	2,405.0	1,261.4	3,208.1	1,949.6
$PV_{NAS+NS+PWC}$	3.4	.7	22.3	4.3	23.2	6.2
M_{SHORE}	.02	.01	(2)	----------	(2)	----------
M_{SHIP}	.06	.01	.46	.09	.67	.14
M_{AC}	.11	.04	1.01	.36	1.66	.63
M_{RES}	.005	.06	.22	.40	.40	.63
Number of observations	31	----------	31	----------	31	----------
Error DF	21	----------	22	----------	22	----------
Standard error (percent) [3]	18.5	----------	16.9	----------	20.9	----------
Fixed percent	68.3	----------	70.3	----------	62.2	----------

[1] Negative values of the constant, BO, (that component that exists at all complexes regardless of size) have no physical interpretation. It is obvious from the relative magnitudes of the value of the constant and the standard error of the constant that this coefficient is, in reality, either zero or weakly positive.

[2] The coefficients for M_{SHORE} in the operating TOA and RMS equations were essentially zero. This term was therefore removed from the equation.

[3] Standard error = $\sqrt{\frac{1}{DF}\sum_{i=1}^{31}\left(\frac{Y_i-\hat{Y}_i}{Y_i}\right)^2}$

TABLE 2.—REGRESSION EQUATIONS FOR FLEET AIR STATIONS

Variable	Parameter	Resource (dependent variable)		
		Personnel	Operating TOA (in thousands of dollars)	Operating expense (in thousands of dollars)
Constant	Coefficient	212.13	2,871.75	2,293.09
	Standard error	189.67	1,487.74	2,418.69
Adjusted property value (in millions of dollars).	Coefficient	3.58	26.13	38.28
	Standard error	1.13	8.86	14.41
Squadron personnel	Coefficient	.149	1.29	2.496
	Standard error	.044	.35	.566
Tenant population	Coefficient	.194	1.26	2.484
	Standard error	.030	.24	.383
	R-Square	.92	.90	.92
	Standard error of estimate	250.8	1,967.5	3,198.7
	RMS percent error	23.4	25.0	27.6
	Error degrees of freedom	14	14	14

TABLE 3.—REGRESSION EQUATIONS FOR TRAINING AIR STATIONS

Variable	Parameter	Resource (dependent variable): Personnel	Operating TOA (in thousands of dollars)	Operating expense (in thousands of dollars)
Constant	Coefficient	373.05	2,382.56	1,741.40
	Standard error	147.37	1,736.91	2,604.44
Adjusted property value (in millions of dollars).	Coefficient	8.73	69.31	94.94
	Standard error	1.76	20.69	31.02
Student population	Coefficient	.078	2.07	5.51
	Standard error	.414	4.89	7.33
Tenant population	Coefficient	.015	.35	.35
	Standard error	.035	.41	.62
	R-Square	.94	.90	.89
	Standard error of estimate	226.6	2,671.0	4,005.2
	RMS percent error	16.0	33.5	30.7
	Error degrees of freedom	6	6	6

TABLE 4.—REGRESSION EQUATIONS FOR RESERVE AIR TRAINING STATIONS

Variable	Parameter	Resource (dependent variable): Personnel	Operating TOA (in thousands of dollars)	Operating expense (in thousands of dollars)
Constant	Coefficient	121.63	1,620.85	963.42
	Standard error	113.99	835.65	832.84
Adjusted property value (in millions of dollars).	Coefficient	4.64	44.30	57.74
	Standard error	1.25	9.16	9.13
Weighted aircraft (1,000 ft.[1])	Coefficient	2.20	10.84	21.87
	Standard error	.56	4.09	4.08
Tenant population	Coefficient	.266	1.59	3.40
	Standard error	.083	.61	.60
	R-Square	.88	.88	.95
	Standard error of estimate	68.8	504.5	502.8
	RMS percent error	10.8	8.4	7.2
	Error degrees of freedom	4	4	4

TABLE 5.—REGRESSION MODELS FOR NAVAL STATIONS

Variable	Parameter	Resource (dependent variable) and fleet: Personnel LANT	Personnel PAC	Operating TOA (in thousands of dollars) LANT	Operating TOA (in thousands of dollars) PAC	Operating expense (in thousands of dollars) LANT	Operating expense (in thousands of dollars) PAC
	Coefficient	624	959	1,532	5,401	2,363	9,616
	Standard error	185	112	1,156	1,337	1,513	2,650
Adjusted station property value (in millions of dollars.)	Coefficient	4.47	(1)	65.4	15.3	85.4	(1)
	Standard error	2.02	(1)	13.2	16.4	13.9	(1)
Ship personnel	Coefficient	(1)	0.029	0.032	0.118	(1)	0.063
	Standard error	(1)	0.006	0.057	0.039	(1)	0.101
Tenant population	Coefficient	0.071	(1)	(1)	0.913	(1)	1.42
	Standard error	0.039	(1)	(1)	0.377	(1)	1.08
R-Square		.72	.81	.86	.87	.82	.29
RMS percent error		14.6	18.9	19.3	14.9	28.5	30.9
Residual degrees of freedom		7	6	7	4	8	5

[1] See text.

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