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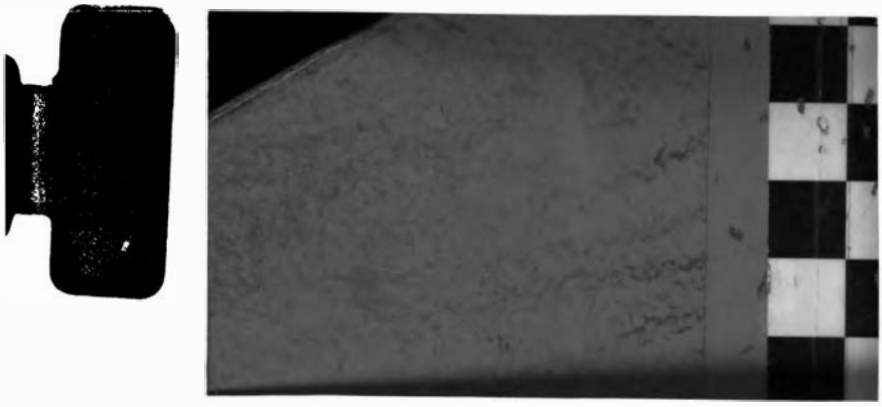

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Technical Report

No. 85

Procedures Used By Federal Agencies To Prepare Budget Estimates for Construction

Federal Construction Council
Consulting Committee on Cost Engineering

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1987

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INTRODUCTION

In broad terms, a construction project involves three stages:* preliminary planning, during which the need for a proposed facility is established and the general nature of the facility to be constructed to meet that need is determined; design, during which the detailed plans and specifications for the facility are developed; and construction, during which the facility is built. In terms of expenditure, the construction stage is by far the most important stage; approximately 90 percent of total project funding** is spent during construction whereas only about 8 percent is spent during the design stage and only about 2 percent during the preliminary planning stage. With respect to the critical decisions that affect the design and cost of a facility, however, the preliminary planning stage is by far the most important stage.

The preliminary planning stage (also referred to as the programming stage) is so important in the decision-making process because it is during this stage that the initial decision to proceed with the project is made, the size, function, general character, and location of the proposed facility are determined, and the preliminary budget is set. Once even preliminary decisions are made on these matters, the nature and cost of the facility are virtually predetermined.

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*A construction project may involve either new construction or major rehabilitation work.

**The expenditures on a project are assumed to include both contract costs and in-house agency expenditures that are directly attributable to a project.

Various agencies carry out the preliminary planning stage differently; however, in most agencies it involves several steps beginning with identification of a facility need by an operational activity and ends with the development of a preliminary cost estimate, which is used to prepare a funding request to Congress. In between these two points, various analyses are made to determine, for example, if the requested facility is really needed, whether the need might be met in a more cost-effective manner by some means other than a construction project, the relative importance of the project compared to other proposed projects, the best location for the proposed facility, the relative merits of various design concepts, and the projected cost of the selected concept.

While the nature and purpose of the preliminary planning process vary from project to project and from agency to agency, all preliminary planning efforts have one thing in common: they involve the development and use of cost estimates. Cost estimates are of vital importance in the preliminary planning stage because almost every major decision made during that stage--including the basic decision to undertake a proposed project--is based at least in part on economic considerations. And, of course, one of the end products of the preliminary planning effort is an estimate of costs that is used to prepare a request to Congress for an appropriation and authorization.

In most agencies, several estimates are prepared during the preliminary planning stage. For the purpose of this report all of these estimates are considered budget estimates, because they are based on incomplete information about the facility to be constructed. In reality, the amount of information available to estimators about a proposed project increases in the course of the preliminary planning process; consequently, budget estimates prepared at the end of the preliminary planning stage should be considerably more accurate than estimates prepared earlier. However, regardless of when budget estimates are prepared, they are inevitably based on incomplete information, and ensuring their accuracy is a challenging task.

In spite of the importance of budget estimates and the difficulties associated with developing them, agencies have seldom exchanged information about the data and techniques used in their preparation. To correct this situation, the Program Committee of the Federal Construction Council asked the FCC Consulting Committee

on Cost Engineering to undertake the study reported here. Specifically, the committee was asked to summarize the practices and procedures used by various agencies to prepare budget estimates (e.g., how costs are determined, at what point in the design process budget estimates are prepared, and how estimates are documented and evaluated), and to report on the results of any studies that have been made of the relative accuracy of estimates prepared using different procedures.

To carry out its assignment, the committee held a symposium at which seven of the agencies represented on the committee presented papers describing their policies and procedures regarding the preparation of budget estimates. Because different agencies have different definitions of budget estimates, the committee asked the agencies to put special emphasis on the earliest estimates prepared during the preliminary planning (programming) stage of a project that serves as a constraint on the ultimate design and cost of a facility. Synopses of the papers presented by the agencies are included as Chapters 2 through 8 of this report. A summary of the information provided by the various agencies is presented in Chapter 9.

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BUDGET ESTIMATING IN THE AIR FORCE

JOHN F. HEISE
Headquarters
U.S. Air Force Logistics Command

This paper on budget estimating is prepared from the perspective of one of the major commands in the Air Force, the Air Force Logistic Command (AFLC), and its subordinate bases. The base level is where it all begins. Budget prices can be adjusted at other levels in the organization, but if estimates do not have some degree of accuracy when first prepared, it is doubtful if accuracy will ever be obtained.

Construction budget estimates are prepared for two major programs. The first is the Military Construction Program (MCP), which averages about $200 million annually in the AFLC. The MCP involves large dollar projects and requires the preparation of formal estimates. The second program is Base Operations and Maintenance (O&M) program, which includes facility and system maintenance and repair and minor construction projects. The O&M budget, which totals about $120 million annually in the AFLC, covers several hundred small projects that require budget estimates.

MILITARY CONSTRUCTION PROGRAM

When development of the MCP for a specific year is started, the Department of Defense indicates the total amount of funding that will be available. Since the amount is always limited, some requested projects always have to be omitted from the program. If the cost of high-priority projects is over estimated, some lower priority projects will be omitted from the program that could otherwise have been included. It is important, therefore, that project cost estimates not be too high. On the other hand, if the cost of a project is under

estimated, there may not be enough money to construct a high quality, usable, efficient facility. Thus, it is important that budget estimates be neither too high nor too low.

Prices must correspond to Department of Defense (DoD) and Air Force (AF) pricing guidelines. If unit costs for a project vary too much from these standards, the cost variances must be completely justified; otherwise the project will be deleted or its budget considerably reduced.

It is essential to understand what is to be built before beginning the budget estimating process. Developing design criteria, knowing what the function is, and understanding user requirements are of paramount importance. Once all these data are available, the estimating process can begin. The starting point is the DoD/AF pricing guide. Using this guide, the average unit cost of a facility similar to the one to be constructed is determined. This figure is then adjusted to reflect differences between the assumed facility and the actual facility. The result is a cost for the basic structure. It is then necessary to add the supporting utilities and site condition costs. The normal value for these costs is 15 percent of the building cost; if site conditions are unusual or an excessive amount of utilities are required, the 15 percent figure must be adjusted.

A total project cost estimate is now available. The total cost then is analyzed on the basis of engineering experience to determine whether it seems reasonable based on what is needed. If the price appears to be too low or too high, other pricing guides and manuals (e.g., Means, Dodge, Richardson) are consulted. Past bid prices and local conditions also are considered. All reasons for the cost difference from DoD/AF pricing guides also are documented.

Budget cost information obtained from the DoD/AF pricing guides works well on typical administration and operational type buildings. The cost data are very accurate for utility systems, runways, and roads. However, the data are not accurate for nonstandard facilities, and this can cause budget estimating problems. For example, use of pricing guide data for large industrial plants can result in budget estimates much lower than actual construction prices. If the estimate is not adjusted during budget preparation, both design features and scope will have to be reduced prior to construction.

An informal study has been conducted to determine how budget estimates for the AFLC MCP compare with actual bid prices. On average, the actual cost of the total program has been close to the budget estimate for the total program. About 70 percent of projects are within acceptable limits of cost estimating. Of the remainder, about half of the estimates were excessively high and half were excessively low. The 15 percent of the projects whose costs have been significantly under estimated cause serious problems; facilities are delayed, important mission functions are not effectively accomplished, and considerable effort is required to salvage these projects. [The 15 percent of the projects whose costs have been significantly over estimated present a much less serious problem.]

BASE O&M PROGRAM

As noted above, the AFLC Base O&M Program has an annual budget of approximately $120 million and includes about 400 projects. These projects generally involve fewer items than the MCP projects. Frequently projects such as roof repair, road resurfacing, and painting can be budgeted using only one or two unit costs. Bases have developed historical data on unit cost prices from actual bids, and it is these costs that are generally used. The readily available price manuals such as Means and Dodge effectively supplement locally developed unit prices. Unit prices used for budget purposes on the O&M program improve as a local data base expands. The track record on estimating O&M projects is quite similar to the record for the Military Construction Program.

CONCLUSION

In general, AF budget estimating procedures must be improved. Many excellent data are available but they frequently need to be modified to fit unique and local conditions. The experience of the estimator is of crucial importance and can mean the difference between good and bad estimates. Some cost figures still must be obtained by "educated guesses." Until improvements such as expanded data bases, parametric cost estimating, and other procedures are refined and made available to AF bases, problems will occur on an unacceptable percentage of construction budget estimates.

CONSTRUCTION PROJECT BUDGET ESTIMATING in the DEPARTMENT OF ENERGY

Joseph Bozik
Project and Facilities Management
Department of Energy

The construction projects managed by the Department of Energy (DoE) cover a tremendously broad range of sizes and types, from relatively low-cost conventional projects like warehouses, dormitories, and laboratories to high-cost projects involving such recent technologies as coal gasification, magnetic fusion, and laser isotope separation.

DoE categorizes projects as "Major System Acquisitions," "Major Projects," or "Other Projects" on the basis of such factors as:

a. Cost - (Projects Costing more than $200 million are usually classified as Major System Acquisitions; projects costing between $50 million and $200 million are usually classified as Major Projects; and projects costing less than $50 million are usually classified as Other Projects).
b. Importance and visibility
c. Size and complexity
d. Degree of DoE control required
e. Who has recommended them (e.g., the office of the Secretary of DoE, an assistant secretary for a major program, or a field office manager).

The lower-cost projects generally are constructed with off-the-shelf equipment, materials and skills and are relatively simple to construct. However, the high-cost projects often are state-of-the-art, one-of-a-kind projects, and are relatively complex to construct. Most DoE projects require conventional construction and estimating methods; however, certain product-assembly-line items such as heliostat and gas

centrifuges require industrial and learning curve cost estimating methods.

Major planning decisions often are made prior to conceptual design when little design detail is available to support the estimate. Program and project managers need estimates for source evaluation, project baselining, budgeting, and project management and control. Planners need estimates in order to weigh the benefits of various technologies, programs, and projects and to establish DoE energy priorities.

Seven general types of cost estimates are developed and used by DoE throughout the life of a construction project. Identification of an estimate by type denotes a certain level of accuracy and confidence in the estimate. Cost estimates are often compared to the actual cost of the project to judge the success of the management effort.

The seven types of estimates are:

- Planning estimates
- Budget or conceptual design estimates
- Title I (preliminary design estimates)
- Title II (detailed design estimates)
- Government (architect-engineer) estimates
- Current working estimates
- Independent cost estimates

As a project evolves from planning through conceptual design, and Title I and Title II design, more details are available and are used to prepare the estimate.

The focus of this paper is the DoE planning estimate, which is the earliest estimate that puts constraints on the ultimate size, design, and cost of a project. A planning (feasibility study) estimate is normally prepared either by one of DoE's Operations Offices (which are staffed with government personnel) or by a DoE operating contractor. It is usually prepared for a proposed project prior to the accomplishment of conceptual design. Planning estimates are used for scoping studies and for preparing preliminary budget estimates of total project costs. Planning estimates for construction projects are presented on a Short Form Data Sheet. (Figure 1 is a sample.)

A planning estimate is an order-of-magnitude estimate. It can be given in terms of dollars per square foot, per linear foot, per cubic yard, per kilowatt, or some other unit. On many projects, the available data

Submission Date 2-1-83

SHORT FORM DATA SHEET
Fiscal Year 1986

Operations Office
Oak Ridge

Program
Enthalpy Research

Laboratory and Production Facility
for Prototype Devices

Design Start
11-15-84
Construction complete
10-1-87

Oak Ridge National Laboratory
Oak Ridge, Tennessee

TEC 30,000,000
Estimate date 1-15-83

EXAMPLE

1. Mission Requirements: Project supports new mission involving research on and production of prototype devices for the enhancement of heat recovery from various bodies. Project is required to meet the national urgency needs as described in the Enthalpy Research program plan. Need exists from [illegible] research and validated need for increased energy recovery. Complete justification for project and historical data are contained in Enthalpy Research program plan.

2. This represents a new mission for the Oak Ridge Laboratories. Current and future programmatic needs occupy 100 percent of available lab space and requirements exist for 2 million square feet of additional space for existing programs during the next 10 years. Details are provided in FY 83-88 Institutional Plan of 11-1-82 and current Oak Ridge Lab Site Development Plan with 5-year plan of 6-1-82.

3. If this facility is not operational on 10-1-87 the enthalpy research program needs will be met with temporary facilities such as trailers and program milestones will slip a minimum of 12 months. In addition the program plan will require modification with certain research and production postponed until completion of adequate facilities for these programs.

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FIGURE 1 Example of a DoE Short Form Data Sheet

Date 2-1-83 FY 1986
Page 2

SHORT FORM DATA SHEET
Laboratory and Production Facility
for Prototype Devices

4.	Total Estimated Cost (TEC)		30,000,000
	a. Engineering (Titles I through III)	(4,000,000)	
	b. Construction	(22,000,000)	
	c. Contingency	(4,000,000)	
5.	Other Costs		
	a. Conceptual Design	(240,000)	
	b. R&D necessary to complete const.	(2,000,000)	

6. Tentative Schedule	Start	End
Conceptual Design	4-1-83	2-1-84
Title I	11-1-84	3-1-85
Title II	4-1-85	3-1-86
Construction	11-1-86	10-1-87
Operation	11-1-87	- - -

EXAMPLE

7. Due to urgency of meeting operational date request FY 85 PE&D Funds of 1,200,000 for accomplishment of Title I and 40 percent of Title II design. These design funds will allow sufficient design to be completed during FY 85 so that construction can begin during the 1st quarter of FY 86. Failure to provide these funds will delay construction start one year from date contained in proposed schedule. This requirement is currently included in item 4a. If approved, CPDS submission will indicate reduction of TEC for PE&D Funds. If project is not considered in FY 86 budget, PE&D request for FY 85 should still be supported since project is urgent and validated requirement.

FIGURE 1 Continued

may be minimal, and the criteria provided can range from the functional/operational requirements to a brief description. This description may be supplemented with a sketch, briefings, a tour of the proposed project site, or references to similar projects that already exist.

Planning estimates are based on the following:

- Past cost experience with similar facilities if available. (DoE's Operations Offices and DoE operating contractors normally rely on their own historical data to develop the planning estimates.)
- Order-of-magnitude estimates in the absence of previous cost experience.
- Parametric estimating (cost estimating relationships) when program definition is vague or incomplete or as a doublecheck against another estimate.

Engineering costs in planning estimates generally are based on a percentage of estimated construction costs, and consideration is given to the complexity of the project in establishing the percentage to be used. Similarly, an allowance for contingency is included in the total project estimate using a percentage of total engineering and construction costs established on the basis of complexity and uncertainties of the component parts of the project.

DoE provides its Operations Offices the following guides to assist in estimate preparation:

- Cost Estimating Manual--a compilation of cost estimating procedures
- Cost Guides--in 6 volumes, as follows
  Volume 1, Economic Analysis: Methods, Procedures, Life-Cycle Costing, and Cost Reviewing/Validating
  Volume 2, Standard Procedures for Determining Revenue Requirements (Product Cost)
  Volume 3, Cost Factors: Capital and Operations and Maintenance Factors of Representative Energy Systems and Facilities
  Volume 4, Cost Data and Cost Estimating Relationships: Process Equipment, Bulk Materials, Facilities and Packaged Units
  Volume 5, How to Construct and Use Economic Escalation Indices
  Volume 6, Cost Estimating Methods and Techniques

- Cost Estimating Guide for the Application of Contingency
- Guidelines for Defining and Accounting for Engineering, Design and Inspection Costs
- Economic Escalation Rates for DoE Construction Projects

The following additional tools are used by some of DoE's operating contractors:

- Computer cost programs such as the Dodge Design Estimator and the Freiman Analysis of Systems Technique (FAST)
- Estimating manuals such as Dodge, Means and Richardson

Separate planning estimates for engineering, construction, and contingency costs are shown on the Short Form Data Sheet. Field offices prepare these sheets for identified projects and submit them to the appropriate DoE Headquarters program office for review. The headquarters program office selects those projects that will be supported in the budget requests for funding for the performance of conceptual design work. Thus, the Short Form Data Sheet for each project also must include an estimate of funds required and a schedule for the performance of conceptual design.

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COST ENGINEERING POLICIES AND PROCEDURES of the CORPS OF ENGINEERS

John Reimer
U.S. Army Corps of Engineers
Washington, DC

Cost estimates for Corps of Engineers construction projects are prepared at various stages in the planning, design, and construction process. Generally, these estimates are referred to as current working estimates (CWEs) to reflect the fact that the actual cost of a facility is never certain until all the work has been completed, the facility has been accepted by the government, and all outstanding claims have been settled. A CWE includes the estimated cost of construction plus allowances for contingencies, supervision and inspection, and government overhead. Of course, the accuracy of CWEs improves as more information is obtained in the course of the planning, design and construction process. To reflect this fact, the Corps of Engineers classifies CWEs as follows:

Code A - Less than concept design completed
Code B - Concept design only completed
Code C - Final design - including drawings and specifications in progress or completed*
Code D - Bids opened and lowest responsible bidder determined
Code E - Construction contract awarded
Code F - Construction 100% complete

This paper will discuss the development and use of Code A and Code B CWEs. The Code B CWE is also referred to as the "budget estimate"; it is prepared when the design of a project is approximately 35 percent

*Code C CWEs are commonly referred to as "government estimates."

complete. The budget estimate is very important because it is the estimate that is submitted to the Congress for appropriation and authorization. It should be noted that all Code A and Code B CWEs are of a parametric nature (e.g., in terms of dollars per square feet). CWEs for all projects over $200,000 ultimately are presented on Department of Defense Form DD 1391 (see Figure 2).

The initial CWE for a project is prepared by the facility engineer at the installation on which the project will be carried out (the field activity). The initial CWE is developed only after the project has been authorized by the Department of the Army (DA). The development of this CWE is fully automated through the DD 1391 Processor. The Processor, which is available to Army installations world wide, is an interactive computer program that assists users in preparing, submitting, reviewing, correcting, printing, and archiving 1391 forms and associated data. The Processor was developed by Army's Construction Engineering Research Laboratory in 1976. It underwent initial field testing in 1979 by the Army's Huntsville Engineer Division and it has been available to the Army community at large since 1980. The Processor's main functions are to:

1. Provide interactive teleprocessing assistance in preparing and editing forms, as well as submitting and distributing them electronically;
2. Calculate space allowances, estimate the cost for primary facilities and verify project requirements using data files stored in the system;
3. Provide for on-line retrieval and updating of background data files;
4. Provide a single source of official forms for all concerned organizations from the installations to the staff and secretariat level of the Department of the Army;
5. Facilitate the preparation, submission, and review of the form throughout the Army.

The Processor prompts users to insert information regarding the requirements and functional aspects of the facility to be constructed (i.e., number of persons, number of vehicles, category code, size, need for cranes, lifts, etc.). Empirical pricing data are inserted automatically once the category code, size, location, and program year is selected. The Processor then prompts the

AR 415-15 1 December 1980

1. COMPONENT: ARMY | FY 1982 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE: 03 DEC 80

3. INSTALLATION AND LOCATION: Fort Sill, Oklahoma | 4. PROJECT TITLE: Trainee Barracks

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
	721 81	265000	24,553

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
PRIMARY FACILITY				17,791
ENL Bks w/Mess	SF	171,610	56.40	(9,679)
Seismic Zone 1 (Add 1.0%)				(97)
Enl Pers Dine	SF	16,700	147.21	(2,458)
Adm & Sup Bldg	SF	13,500	75.57	(1,020)
Bn Admin & Clrm	SF	18,945	73.00	(1,383)
Covered Training Area	SF	24,000	89.81	(2,150)
Addn to Central Energy Plant	SF	2,880	348.64	(1,004)
SUPPORTING FACILITIES				4,479
Electrical	LS	--	--	(389)
Water Lines	LS	--	--	(134)
Total from Continuation Page				(3,956)
SUBTOTAL				22,270
CONTINGENCY PERCENT (5.00%)				1,114
TOTAL CONTRACT COST				23,384
SUPERVISION INSP & OHEAD (5.00%)				1,169
TOTAL REQUEST				24,553
INSTALLED EQUIPMENT-OTHER APPROP				(0)

10. DESCRIPTION OF PROPOSED CONSTRUCTION

The primary facility is permanent reinforced concrete and masonry construction. The work is new construction, site adapted from two similar buildings on the installation. The structure is noncombustible housing barracks for 1100 trainees and 36 enlisted personnel. In addition, the complex will include classrooms; administration and storage; dining facility; battalion headquarters; covered training areas and an addition to the central energy plant. The central energy plant will be coal fired providing high temperature hot water heating systems and 480 tons chilled water air conditioning. The project will include required utilities services, communications, fire protection and alarm systems, paving, walks, curbs, gutters, storm drainage and site improvements. Not sited in a flood plain. Demolition of existing buildings is not required for site clearance. Accessibility for the handicapped will be provided.

11. REQUIREMENT: 8,383PN ADEQUATE: 2,504PN SUBSTD: 6,893PN

PROJECT :
Construction of a 1100 trainee barracks with dining, admin and classroom facilities at Fort Sill, Oklahoma.

DD FORM 1 DEC 78 1391 PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED PAGE NO.

FOR OFFICIAL USE ONLY
(WHEN DATA IS ENTERED)

7-10

FIGURE 2 Sample of a DD Form 1391 Filled Out

1. COMPONENT: ARMY | FY 19[85] MILITARY CONSTRUCTION PROJECT DATA | 2. DATE: 30 JUL 82, 03 DEC 80

3. INSTALLATION AND LOCATION
Fort Sill
Oklahoma

4. PROJECT TITLE: Trainee Barracks | 5. PROJECT NUMBER: 265XXX

9. COST ESTIMATES (CONTINUED)

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
SUPPORTING FACILITY (TOTAL CONTINUED)				3,956
Gas Distribution	LS	--	--	(8)
Sanitary Sewer	LS	--	--	(53)
Chilled Water Lines (8")	LF	2,000	59.23	(118)
High Temp Water Lines	LS	--	--	(478)
Fuel Storage	EA	2	62142.	(124)
Roads and Parking	LS	--	--	(670)
Railroad Spur	LF	6,500	88.31	(574)
Walks	[illegible]	[illegible]	3.82	(44)
Curb and [illegible]	[illegible]	[illegible]	11.31	(102)
Storm Drainage	LS	--	--	(162)
Drilled P[illegible]	[illegible]	[illegible]	9.54	(533)
Site Work	LS	--	--	(610)
Communications	LS	--	--	(431)
Demolition	LS	--	--	(47)

REQUIREMENT :
This project is required to provide the third increment of adequate housing and support facilities for Basic Combat Trainees. This installation has been assigned the mission of training BCT companies which started in 1975. Adequate permanent facilities are not available to support this mission.

CURRENT SITUATION :
Trainees are currently housed in inadequate permanent and temporary World War II mobilization buildings. These existing temporary barracks and support buildings lack the most minimal amenities such as adequate lighting, heating, and mechanical ventilation. Latrine facilities for more than one-half of the existing barracks are located in separate buildings. The physical condition of these wood frame barracks, which were constructed in 1941, has deteriorated greatly so that constant and excessive maintenance is required.

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7-11

FIGURE 2 Continued

user to insert information regarding supporting facilities requirements (i.e., water, gas, sewer, electricity, roads, parking, demolition, site improvements, etc.). The Processor also prompts the user to insert empirical prices for these items. Users are provided pricing data for such items via newsletters. Finally, the user is prompted to insert justification data and an economic analysis. The CWE is electronically submitted to the major command and Corps of Engineers headquarters for review and approval.

When the project review and approval process is complete, a directive is sent to the field activity authorizing the initiation of design work. When the design concept has been developed (at the 35 percent design point), the Code B CWE (budget estimate) is prepared and submitted to Corps of Engineers headquarters. This CWE is submitted on Corps of Engineers Form 3086 (see Figure 3).

In the past, form 3086 was manually transmitted in hard copy. Beginning this year, field activities can access the DD 1391 Processor and input the CWE in the "ENG Form 3086" file and electronically transmit the cost estimate to Corps of Engineers headquarters. This step greatly decreases the time required for review and approval because all principal review agencies can instantaneously read the latest CWE. Comments can be written by all reviewers, and Corps of Engineers headquarters can authenticate the scope of work, current and forecast prices, and the justification for added requirements. When this review is completed, the ENG Form 3086 file is automatically transferred to the DD Form 1391 file.

FIGURE 3 Example of a Form 3086

Revised: 11 Sep 84

CURRENT WORKING ESTIMATES FOR BUDGET PURPOSES (For use of this form, see ER 415-345-42) | FISCAL YEAR 86 | DATE PREPARED 2 August 1984 | PAGE 2 of 2 PAGES | RESUBMISSION #

THRU: CDR USACE, ATTN: DAEN-ECC-A, WASH DC 20314
TO: CDR USACE (DAEN-ECE-S), WASH DC 20314
FROM: CDR USAED MOBILE, ATTN: SAMEB-PM, MOBILE, AL 36628
NAME AND ADDRESS OF A/E:
BASIS OF ESTIMATE: Bid Experience
A/E FEE:
NAME AND LOCATION OF INSTALLATION: Anniston Army Depot
TYPE OF CONSTRUCTION:
STATUS OF DESIGN: Concept ___ % Complete; Final 60 % Complete
PROJECT NUMBERING: 103
DESCRIPTION OF FACILITY: Machine Shop
FINAL DESIGN COMPLETION DATE:

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTALS ($000)
h. Communications		ls		44.0
Sub-Total				44.0
i. Steam Distribution				
Line, Valves, Supports - Comp.	450	lf	101.77	45.8
Sub-Total				46.0
Total Support Facilities Cost				681.0
1. Estimated Contract Cost				2,861.0
2. Contingencies at 5%				143.0
3. S&A at 5½%				165.0
4. Estimated Project Cost				3,169.0
5. Cost Growth				
Cost Base of Estimate (Mid-Point) Apr 85				
Construction Start Jun 86				
Construction Mid-Point Sep 86				
Construction Completion Jun 87				
Cost Growth = Mid-Point Constr = Sep 86 = 1537 = 1.0756				
Mid-Point Est Apr 85 1429				
6. Design				

Note:

1. Communications @ $44 M is based on estimate from Carl C. Hall, USACEHIA-CONUS 84-0419.
2. Other cost based on estimated project cost of 60% design drawings. Copy of estimate is attached.
3. Coolant recovery system is omitted from this 3086. This work will be accomplished with equipment funds. Estimate will be revised at 95% design review.

ENG FORM 1 MAY 78 3086 EDITION OF 1 OCT 71 MAY BE USED. (REVERSE SIDE MAY BE USED FOR REMARKS) (TRANSLUCENT)

FIGURE 3 Continued

Revised: 11 Sep 84

CURRENT WORKING ESTIMATES FOR BUDGET PURPOSES
For use of this form, see ER 415-345-42

FISCAL YEAR: 86 | DATE PREPARED: 2 August 1984 | PAGE 1 of 2 PAGES | RCS DAEN MCE 2

THRU: CDR USACE, ATTN: DAEN-ECC-A, WASH DC 20314
TO: CDR USACE (DAEN-ECE-S), WASH DC 20314
FROM: CDR USAED MOBILE, ATTN: SAMEN-DM, MOBILE, AL 36628
NAME AND ADDRESS OF A/E:
BASIS OF ESTIMATE: Bid Experience
A/E FEE:
NAME AND LOCATION OF INSTALLATION: Anniston Army Depot
TYPE OF CONSTRUCTION:
STATUS OF DESIGN: Concept ___ % Complete Final 60 % Complete
PROJECT NUMBERING: 103
DESCRIPTION OF FACILITY: Machine Shop
FINAL DESIGN COMPLETION DATE:

DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTALS ($000)
1. Building Construction - Machine Shop				
General Construction	28,144	sf	37.86	1,065.5
Fire Protection	28,144	sf	6.02	169.4
Plumbing	28,144	sf	.43	12.1
HVAC	28,144	sf	15.71	442.1
Electrical	28,144	sf	10.08	283.7
Building Construction - Equipment				
Bridge Crane	1	ea	48827.00	48.8
Chain Hoists	19	ea	1912.00	36.3
Job Cranes	19	ea	4107.00	78.0
Coolant Recovery System	1	job	68156.00	68.1
Total Building Cost	28,144	sf	75.90	2,136.0
2. Support Facilities				
a. Removals				
Concrete Paving	2,500	sy	9.36	25.6
Asphalt and Base	700	sy	5.55	3.9
Storm Drains - 15" Conc.	140	lf	17.14	2.4
Water Line	350	lf	3.43	1.2
Poles and Hardware	4	ea	700.00	2.8
Conductors	1,080	lf	1.11	1.2
Sub-Total				37.0
b. Relocations				
Transformers	3	ea	300.00	.9
Shop Equipment	1	job	334823.00	334.8
Sub-Total				336.0
c. Paving				
10" Concrete	1,980	sy	49.21	97.4
Sub-Total				97.0
d. Drainage				
Pipe and Excavation	1	job	6668.00	6.7
Sub-Total				7.0
e. Water Lines				
8" Water Line and Valve	310	lf	25.16	7.8
2" Water Line, Valve and Box	14	lf	25.00	.3
Sub-Total				8.0
f. Sanitary Sewer				
8" Line	320	lf	12.71	4.2
6" Line	120	lf	10.83	1.3
Manhole	1	ea	852.00	.9
Sub-Total				6.0
g. Exterior Electrical				
Pad Mounted Transformer, Comp 167 KVA X 3 Each = 501 KVA	501	kva	36.11	18.1
Pad Mounted Transformer, Comp 100 KVA X 3 Each = 300 KVA	300	kva	39.40	11.8
Duct Bank, Complete	1,000	lf	36.20	36.2
Conductor - 500 MCM	3,060	lf	9.40	28.7
Conductor - 350 MCM	1,020	lf	6.89	7.0
Conductor - 1/0 CU	11,000	lf	1.59	17.5
Conductor - 4/0 Quad	275	lf	5.09	1.4
Poles, Hardware - Complete	7	ea	3286.00	23.0
Sub-Total				144.0

ENG FORM 1 MAY 78 3088 EDITION OF 1 OCT 71 MAY BE USED. (REVERSE SIDE MAY BE USED FOR REMARKS) [TRANSLUCENT]

BUDGET ESTIMATE DEVELOPMENT IN THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

James Vitagliano
Facilities Engineering Division
National Aeronautics and Space Administration

In the National Aeronautics and Space Administration (NASA), a preliminary engineering report (PER) provides the basis for the development of budget estimates for construction of facilities projects that are included in the agency's annual budget request to the Congress for fiscal year authorization and appropriation.

OBJECTIVES AND POLICY

Preliminary engineering reports have a three fold objective:

- To develop, early in the budget cycle, a project that embodies the most economical and technically sound method of fulfilling a functional requirement
- To provide data, including cost estimates, to support budget submissions
- To be the basis of final design and detailed specification if the project is approved.

NASA field installations are encouraged to use in-house personnel to prepare PERs; however, if necessary, installations can employ various other organizations to prepare them, including other government agencies, engineering consultants, architect-engineer (A-E) firms, and support contractors. PERs prepared by others are checked and validated by NASA personnel.

When an A-E firm is used to prepare a PER, the cost generally does not exceed 1.5 to 2.0 percent of NASA's initial estimate of the cost of construction. If a higher fee is required, a special justification defining

the major elements of work and an explanation of the basis of the costs must be submitted to NASA Headquarters for approval.

SCOPE AND CONTENT

The PER is the product of a detailed analysis of user requirements. It evaluates alternative solutions and determines the basis for design that will result in the lowest possible life-cycle cost for the facility work proposed. The PER also includes the basis for the requirements (project justification), an analysis that describes the functions of the facility, an evaluation of different approaches for the proposed work, and a description and justification of the solution.

Included is a detailed cost estimate with reasonable escalation and contingency factors; a detailed construction schedule that takes into account program requirements, the availability of funds, construction seasons, etc; and, as applicable, plot plan drawings, schematics and equipment lists, real estate requirements, foundation requirements, erosion and pollution control and other environmental concerns, fire and safety requirements and other similar requirements.

The PER is formatted as follows:

Section I, Requirement Statement and Justification
Section II, Descriptive Analysis
Section III, Budget Estimates
Section IV, Design and Construction Schedule
Section V, Appendices to the Report Including Implementation Plan

BUDGET ESTIMATES

The budget estimate in the PER is obtained by applying appropriate factors to the engineering estimate. It is computed from the following formula:

Budget Estimate = EE (1.00+CA) (1.00+C) (1.00+SIES)

where:

EE = An engineering estimate that represents the cost for materials, labor, services coupled with contractor overhead, profits, taxes,

insurance, etc. It is based on cost experience at a specific given point in time. Costs are developed from the drawings and draft specification prepared for the PER.

Estimates cover all labor and material costs for each item in the project, including building-type collateral equipment that would usually be furnished by a contractor and installed as a permanent part of the building. The cost for processing and installing government-furnished equipment also is included in the cost estimates. All other collateral equipment is listed or grouped and the costs made part of the facilities project or work package.

Estimates are based on current prices applicable to the site and preferably the latest price experience. Allowances for premium costs of an accelerated program, or for delays resulting from weather or strikes, are made when applicable. Not included in the engineering estimate are amounts for escalation, contingencies, and supervision, inspection and engineering services (SIES). These factors are included separately as discussed below.

Units of measure, quantities, and unit cost data are shown for each significant item that can be identified and quantified.

CA - Cost adjustment factor, which is a percentage factor to provide for anticipated cost escalation from the date of the estimate to the projected mid-point of the construction period. NASA headquarters provides field offices with cost adjustment factors to be used in estimating (see discussion of guidance and criteria below); however, field offices can use other escalation factors with justification.

C - Construction contingency percentage factor.

SIES - Supervision, Inspection and Engineering Services percentage factor.

GUIDANCE AND CRITERIA

NASA field installations are provided with the publications listed below to assist them in the preparation of budget estimates. These publications are intended to provide basic guidance and criteria for the various phases of the building process, which include planning, budgeting, design, and construction.

Budgeting Administration Manual (BAM), NHB 7400.1C. This manual, prepared by the NASA Comptroller, provides general guidance on budget formulation and execution. It is a compilation of instructions, procedures, and forms pertaining to the performance of the budget functions. The manual requires that project cost estimates be prepared on NASA Form 1510 which is used for the development of budgetary estimates.

Facility Project Implementation Handbook (FPIH), NHB 8220.2. This handbook, prepared by the NASA Facilities Engineering Division, provides a ready reference to pertinent policy and guidance for the management of the building process which includes facility planning, budgeting, design, and construction. It is used by facility project managers who have direct responsibility for organizing, managing, and directing the project work to ensure that the needed facility is completed on schedule and within the approved funds.

Facilities Engineering Handbook (FEH), NHB 7320.1B. This handbook, prepared by the Facilities Engineering Division, provides guidance, policy, criteria, and standards to be used by the designers of NASA facilities. It is intended to achieve a reasonable degree of uniformity for the essential features of all facilities.

Annual Cost Guidance. Each year NASA Facilities Engineering Division provides guidance to the NASA field installations on the cost escalation factor that is to be used in the development of their budget estimates of the forthcoming budget for submission to the Congress for authorization and appropriation.

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DEVELOPMENT OF BUDGET ESTIMATES FOR NEW CONSTRUCTION AND MAJOR RENOVATION PROJECTS AT THE NATIONAL INSTITUTES OF HEALTH

John Pavlides
National Institutes of Health
Department of Health and Human Services

Before a budget request for design and construction of new facilities or major renovation projects is submitted to the Office of Management and Budget, Public Health Service (PHS) policy requires the completion and approval of a Program of Requirements (POR). This document justifies the project and helps assure there is adequate consideration of programmatic, architectural, and engineering requirements. A project with a well defined scope is essential to the preparation of a cost estimate. The approach used by individual PHS programs to develop the budget cost estimate, based on the POR, varies. However, the procedures of the National Institutes of Health are fairly representative of the procedures of most PHS programs (including the Indian Health Service and the Food and Drug Administration).

The Facilities Engineering Branch of the Division of Engineering Services of the National Institutes of Health (NIH) is responsible for preparing budget estimates for major new construction and renovation projects for NIH in Bethesda, Maryland. The Division also has responsibility for new construction and for repair and improvement projects at NIH facilities in Montana, Florida, and North Carolina.

Programs of requirements, if available, for major new construction and renovation projects are first reviewed with respect to similarity to previous construction or renovation projects. Consequently, if there is great similarity, actual cost experience is the first comparison parameter. The Historical Cost Index in the Building Construction Cost Data Manual published by the R.S. Means Company (Kingston, Massachusetts) is

extrapolated to project the cost to the planned bid opening date. The City Cost Index in the same manual is used to adjust the construction cost estimate for geographic location. Other R.S. Means Company manuals (e.g. Site Work Cost Data and Square Foot Costs) are used to check estimates and as a source of additional cost data. Consideration is also given to cost trends in the Building Cost Index of the Engineering News Record, the Smith Hinchman & Grylls Building Cost Index, and Richardson Engineering Services' General Construction Estimating Standards. Finally, the cumulative professional experience and judgment of the consultants in the Facilities Engineering Branch focuses on the estimate. The Branch forwards its estimate of this project cost to NIH top level management.

BUDGET ESTIMATING PROCEDURES FOR NEW FACILITIES of the NAVAL FACILITIES ENGINEERING COMMAND

Get Moy and Dana Smith
Naval Facilities Engineering Command

BACKGROUND

The Naval Facilities Engineering Command (NAVFAC) manages the planning, design, and construction of facilities for U.S. Navy shore activities around the world. NAVFAC is responsible for facilities material acquisition and support. It manages and maintains public works, family housing, and public utilities for the Department of the Navy. While NAVFAC Headquarters provides overall direction for these responsibilities, the tasks are actually accomplished by the Command's field activities: Engineering Field Divisions, Construction Battalion Centers, and Public Works Centers.

The Engineering Field Divisions (EFD), of which there are six located across the United States, provide engineering support and services to the several hundred activities of the Navy shore establishment. The EFDs, working closely with NAVFAC Headquarters, are the site managers during the development and acquisition of new Navy facilities. NAVFAC's military construction business for FY 1986 is estimated at more than $2.5 billion. Virtually all of this work is in fixed price, competitively bid construction contracts awarded to private businesses.

The Navy uses a methodological process to acquire facilities. Although the acquisition process, which runs from the time a need is identified through occupancy, may seem to consist of simple, smoothly connected phases, in reality it is very complex. Figure 4 identifies the ideal steps of the acquisition process from the planning stage, when a need is identified and a set of facility requirements is developed, through construction and occupancy. The facility requirements provide the basis for design, which in turn identifies construction requirements.

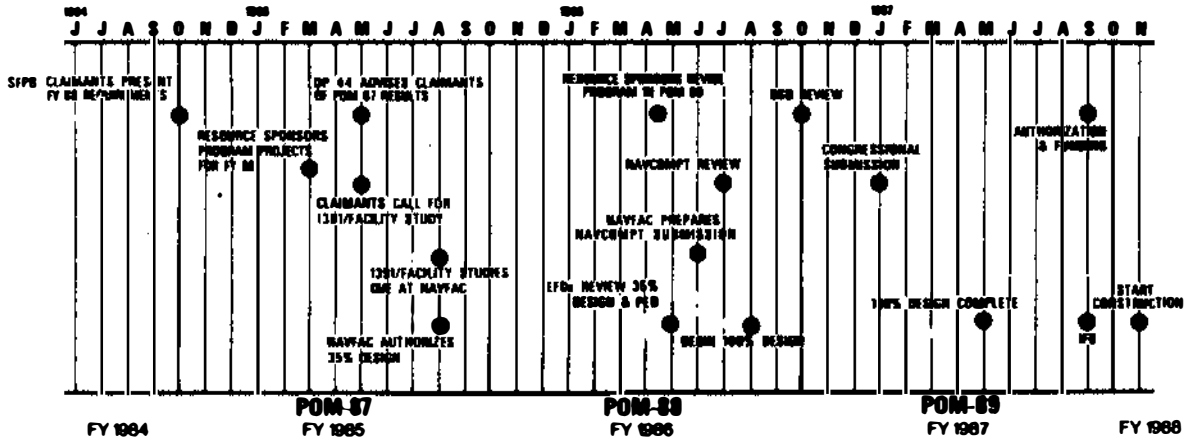

FIGURE 4 Program/Budget Cycle - FY 88 Military Construction Program-New Facilities

Budget estimating begins during the planning phase--early in the acquisition process--when facility deficiencies (which translate into project requirements) of the Navy are identified. The requirements for a facility must be identified prior to the start of the acquisition process. In addition, the planning process assures that the stated requirements for each project will satisfy the customer's needs and can be justified.

NAVFAC's budget estimating process is designed to: (1) develop the best estimate for a valid facility project using information available, (2) update that estimate as scope and design information becomes more refined, and (3) enhance cost-effective/cost-conscious facility designs throughout the acquisition process.

PRELIMINARY BUDGET ESTIMATE

The first step in developing an estimate for a project in the military construction program is preparation of a Preliminary DD Form 1391 (Figure 5) that states the project's requirements, scope, and cost. At this stage, the cost indicated on DD 1391 is only a preliminary figure that is used for planning purposes. It is not the final budget estimate that will be sent to the Congress. Sources of cost information used to prepare the preliminary estimate include:

- Annual Department of Defense (DoD) and NAVFAC cost guidance documents, which give unit costs and other cost information and definitions for "common" facilities like barracks, and warehouses. These guidance documents represent
  the policy statements of DoD and NAVFAC regarding construction investments.
- NAVFAC DM-10, Cost Engineering Criteria and Cost Data.
- NAVFAC Cost Engineering System and Historical Data Base.
- Commercial publications such as Dodge and Means.
- Recent actual bidding experience.

Generally, preliminary cost estimates are based on an assumed award date of April 1 of the proposed project fiscal year. Costs also are adjusted for location using DoD-approved area cost factors.

1 COMPONENT: ARMY	FY 1986 MILITARY CONSTRUCTION PROJECT DATA	2 DATE: 15 FEB 85
3 INSTALLATION AND LOCATION: Anniston Army Depot, Alabama	4 PROJECT TITLE: Machine Shop	
5 PROGRAM ELEMENT: 72007A	6 CATEGORY CODE: 214	7 PROJECT NUMBER: 103
8 PROJECT COST ($000): 3,150		

9 COST ESTIMATES

ITEM	U. M	QUANTITY	UNIT COST	COST ($000)
Primary Facility				2,136
Machine Shop	SF	28,144	75.90	(2,136)
Supporting Facilities				725
Electric Service	LS	-	-	(144)
Water, Sewer & Gas	LS	-	-	(14)
Steam, Chilled Water & Heat Distribution	LS	-	-	(46)
Paving, Walks, Curbs & Gutters	LS	-	-	(97)
Storm Drainage	LS	-	-	(7)
Site Improvement	LS	-	-	(37)
Communication	LS	-	-	(44)
Relocation	LS	-	-	(336)
Subtotal				2,861
Contingency (5.00%)				143
Total Contract Cost				3,004
Supervision, Inspection & Overhead (5.50%)				165
Total Request				3,169
Total Request (Rounded)				3,150
Installed Equipment - Other Appropriations				(5,200)

10 Description of Proposed Construction: Construction of permanent machine shop building plus mezzanine, to include operations area, shop space, computer equipment area, bridge cranes and jib booms. Work to include all required utilities services, fire protection and alarm/detection system, lighting, communications and site improvement. Heating to be provided by extension of existing central steam distribution system. Air conditioning (90 tons) will be provided by self-contained system.

11. REQUIREMENT: 1,064,198 SF ADEQUATE: 627,932 SF SUBSTANDARD: 14,496 SF
PROJECT: Construct a machine shop facility at Anniston Army Depot, Alabama.
REQUIREMENT: This project is required to provide state-of-the-art machining capabilities necessary to support the rebuild of new weapons systems now entering the Army's Arsenal.
CURRENT SITUATION: Present shop is located in a largely unimproved, artillery building. This facility is spatially and functionally unsuited for machining. The building has inadequate lighting and holding area and unsafe conditions due to generated noise and fumes. In addition, inadequate environmental controls do not afford the protection conditions necessary to accomodate state-of-the-art Numeric Control (NC) equipment. This expensive computer numeric controlled machinery offers increased speed, accuracy,

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FIGURE 5 Example of a Completed Form 1391

1 COMPONENT	FY 1986 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
ARMY		15 FEB 85

3 INSTALLATION AND LOCATION

Anniston Army Depot, Alabama

4 PROJECT TITLE	5 PROJECT NUMBER
Machine Shop	103

11. REQUIREMENT: (Continued)
CURRENT SITUATION: (Continued)
cost-efficiency, reduced inspection requirements and increased productivity. The majority of the conventional equipment on hand is old and inefficient and consequently, costs for producing, reclaiming or machining parts are much greater than they would be with sufficient NC capability. The required NC equipment to be installed in machine shop has been received. No other facilities exist at this installation to satisfy this requirement.
IMPACT IF NOT PROVIDED: Continued spatial and functional constraints in the existing machine shop will deny Anniston Army Depot (ANAD) the benefits of extensive use of NC equipment. The resulting decline in production capability due to facility and equipment degradation will adversely affect ANAD's mission of reclaiming/fabricating Army weapons parts.

12. SUPPLEMENTAL DATA:
A. Estimated Design Data:
(1) Status:
(a) Date Design Started ..... OCT 83
(b) Percent Complete As Of January 1985 60
(c) Percent Complete As Of October 1985 100
(d) Date Design Complete ..... SEP 85

(2) Basis:
(a) Standard or Definitive Design - Yes ___ No X
(b) Where Design Was Most Recently Used _____

(3) Total Cost (c) = (a)+(b) or (d)+(e): ($000)
(a) Production of Plans and Specifications 165
(b) All Other Design Costs 128
(c) Total Cost 293
(d) Contract 3
(e) In-house 290

(4) Construction Start ..... JAN 86
month & year

B. Equipment associated with this project which will be provided from other appropriations:

Equipment Nomenclature	Procuring Appropriation	Fiscal Year Appropriated Or Requested	Cost ($000)
EXISTING EQUIP	OPA	86	5000
COOL REC SYS	OPA	86	200
		TOTAL	5,200

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FIGURE 5 Continued

The basic methodology used in preparing the preliminary cost estimates shown on the DD 1391 forms involves: (1) defining the scope of the project in terms of some unit measure (square feet, square yards, kilowatts, etc.) and (2) identifying the unit costs of each unit measure used. The source of these unit costs are the references cited above. The product of the unit costs and unit measures are used to determine an estimated cost of the project. An example of these calculations on a completed form is shown in Figure 5. When unit measures or unit costs are not available, lump sum estimates are used. Site development and overhead costs are added to arrive at an estimate of the total cost of constructing the project.

The sum of the budget estimates for the projects to be carried out in a given fiscal year constitutes the Navy's military construction program (MCP) for that year. In order to provide time for various budget reviews and hearings, an MCP budget must be prepared approximately 20 months prior to the start of the year in which it will be carried out. Thus the preliminary estimates for the FY 1988 construction program were assembled in February 1986. With this lead time, changing market conditions can have a major impact on actual construction costs after budget estimates are submitted to Congress.

Once an overall MCP budget is established, it is, for practical purposes set. The estimates for individual project costs may change as a result of new requirements and new technical information (discussed below). NAVFAC tries to ensure that preliminary project estimates are as accurate as possible.

After the preliminary estimates are made, the requirements, priorities, and levels of investment for the projects in the program are reviewed by various organizations, including:

- Engineering Field Divisions
- The chains of command of the using activities
- The Navy Comptroller
- The DoD Comptroller
- Congressional committees

FINAL BUDGET ESTIMATES

The final budget estimate for a project is prepared when the design of the project is 35 percent complete. The final budget estimate is of critical importance because it is the estimate that goes into the President's budget, which is sent to Congress. In essence, when the Navy submits a final budget estimate it is stating that it can build the proposed facility for the estimated amount.

To minimize the chance of error in the final budget estimate, the Navy generally does not request funding for projects with design is less than 35 percent complete. The 35 percent design includes the basic features, materials, and systems needed to meet the functional requirements of a facility and their estimated costs.

Reference materials used to develop the 35 percent cost estimate include commercial publications, direct price quotes, and historical cost information.

Once Congressional approval is received, NAVFAC proceeds to final design and construction of the facility.

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EARLY BUDGET ESTIMATING in the VETERANS ADMINISTRATION

John J. Zamostny
Office of Facilities
Veterans Administration

The Veterans Administration (VA), unlike such agencies as the Army Corps of Engineers and the Naval Facilities Engineering Command, has no districts or divisions that develop cost estimates for major construction projects. The Cost Engineering Service in the VA's Office of Facilities is the sole preparer and reviewer of cost estimates for major VA construction projects. These estimates are subject to the approval of either the VA Project Directors or the VA Associate Director for Architecture. Since only one office handles VA cost estimates for major projects, no pricing guides or cost criteria are issued to field stations.

In the VA, the conceptual phase is the first construction planning and development effort by the Office of Facilities. During this phase the Office of Facilities coordinates with other VA departments to develop a data package that includes estimates of the project's scope, staffing, workloads, etc. These conceptual estimates generally are developed several years before construction is scheduled to begin. Usually three or more concepts and estimates are prepared. On medical projects the Department of Medicine and Surgery selects the concept to be developed through preliminary plans.

During the conceptual stage, designers (from either a private architect-engineer firm or the VA) prepare several alternative design concepts with block or schematic plans for each. The Estimating Service is asked to prepare a conceptual estimate for each alternative (see Table 1). The most the estimator can expect at this early stage of development is general information on the project scope; e.g., the probable gross area of new construction (or renovation work). The

Table 1 Conceptual Estimates for Seven Alternative Design Concepts for a VA Project

Concept	Estimated Cost	Area (gross square feet)	Sources of Space
A	$168,000,000	690,880	New Construction
		381,000	Renovation Work
		120,000	Unchanged Space
B	$176,000,000	690,880	New Construction
		440,900	Renovation Work
		60,000	Unchanged Space
C	$163,500,000	1,100,000	New Construction
D	$140,000,000	506,764	New Construction
		501,500	Renovation Work
E	$111,000,000	471,063	New Construction
		210,148	Renovation Work
		291,352	Unchanged Space
F	$247,500,000	1,500,000	New Construction
G	$ 91,500,000	393,266	New Construction
		150,000	Renovation Work
		351,000	Unchanged Space

estimate for each alternative usually is based on the computed gross areas and applicable historical unit costs. The unit costs are adjusted for time and location and for any known specific factors that could influence project costs, such as unique site conditions and special utility requirements.

Conceptual estimates form the basis of the Statement of Anticipated Project Cost Ranges (SOAPs), which are part of project submissions to the VA Administrator for his approval or disapproval. For the project mentioned in Table 1, for example, Concept D was selected and a cost range estimate of $133 million to $154 million was submitted. The Administrator's approval is required before preliminary design work can begin.

In January 1984, after the VA had experienced a number of "cost underruns" (that is, low bids being far below budget), the Director of the Office of Facilities directed the Cost Engineering Service to use "discount budgeting." This directive, which is still in force, requires the Estimating Service to establish construction project cost targets that are at least 10 percent below historical costs for similar projects. The primary objective of the directive is to ensure that new VA facilities are not too lavish. At about the same time, the Office of Management and Budget published new lower escalation rates, which the Estimating Service began using when estimating for future work. The use of lower escalation rates and discount budgeting has resulted in better alignment of budget estimates, government estimates, and contractor bids on recent projects. This situation could change, of course, if inflation rates increase.

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SUMMATION

The committee's workshop on budget estimating revealed that the construction project budgets that agencies submit to Congress usually are prepared after a significant amount of design work has been performed; consequently, they are fairly accurate. The military agencies, for example, ordinarily do not prepare a budget estimate until the design of a proposed facility is approximately 35 percent complete, at which point moderately firm decisions have been made regarding the nature and size of the facility to be constructed and the types of systems to be used. The designs of most DoE, NASA, and VA facilities are at a comparable point when budget estimates for their projects are prepared. Generally, estimates prepared after some preliminary design work has been completed are based on published data on the cost of the systems to be used, which are quite accurate.

Several of the agencies indicated that the really troublesome budget estimates are those prepared early in the preliminary planning process. Such estimates, which are sometimes referred to as preliminary estimates or planning estimates, are used for such purposes as preparing an agency's overall construction program budget, establishing the scope of a project, and performing economic analyses to determine the feasibility of a project, or to select a general design concept. Preliminary/planning estimates, therefore, can have a major impact on the overall construction program of an agency and on the viability and success of individual projects. Thus, even though they do not go to Congress, such estimates need to be as accurate as possible.

However, because they are prepared early in the planning process, a high degree of accuracy is difficult to achieve.

The presentations to the committee revealed both similarities and differences in the way agencies develop preliminary/planning estimates. The main similarity was that all agencies generally base such estimates on either unit costs (e.g., dollars per square foot) or parametric costs (e.g., dollars per bed for hospitals) using mostly historical data (i.e., information from previous projects for similar facilities). Among the differences found were the following:

- Agencies with small construction programs generally rely on published cost manuals for historical cost data, whereas agencies with large programs generally develop and use their own historical data; however, agencies with large programs also use the published manuals from time to time to develop estimates for facilities they do not regularly construct or as a check on their own data.
- The military agencies follow a highly structured procedure for developing preliminary/planning estimates; for example, their estimates must be reconciled with cost guidelines published by the Department of Defense. Other agencies do not have detailed procedures.
- In some agencies field organizations and/or user organizations have primary responsibility for the preparation of preliminary/planning estimates; in other agencies, responsibility is centralized in headquarters.
- Some agencies (notably the military agencies) use computers to help prepare preliminary/planning estimates; other agencies do not.
- One agency (DoE) sometimes uses a private estimating service to help prepare preliminary/planning estimates; other agencies do not. However, one agency (PHS) uses a cost guide that was prepared by a private firm.
- One agency (VA) sometimes presents preliminary/planning estimates in the form of a cost range; other agencies provide single value estimates.

Only one agency (the Air Force) reported on the results of any studies on the accuracy of estimating procedures. It is not known if the agencies failed to report on such studies because they had not undertaken any studies or because they were reticent to discuss the results.