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RESEARCH REPORT

A COST SAVINGS ANALYSIS OF THE STREAMLINED MILITARY CONSTRUCTION PROGRAM PROCESS

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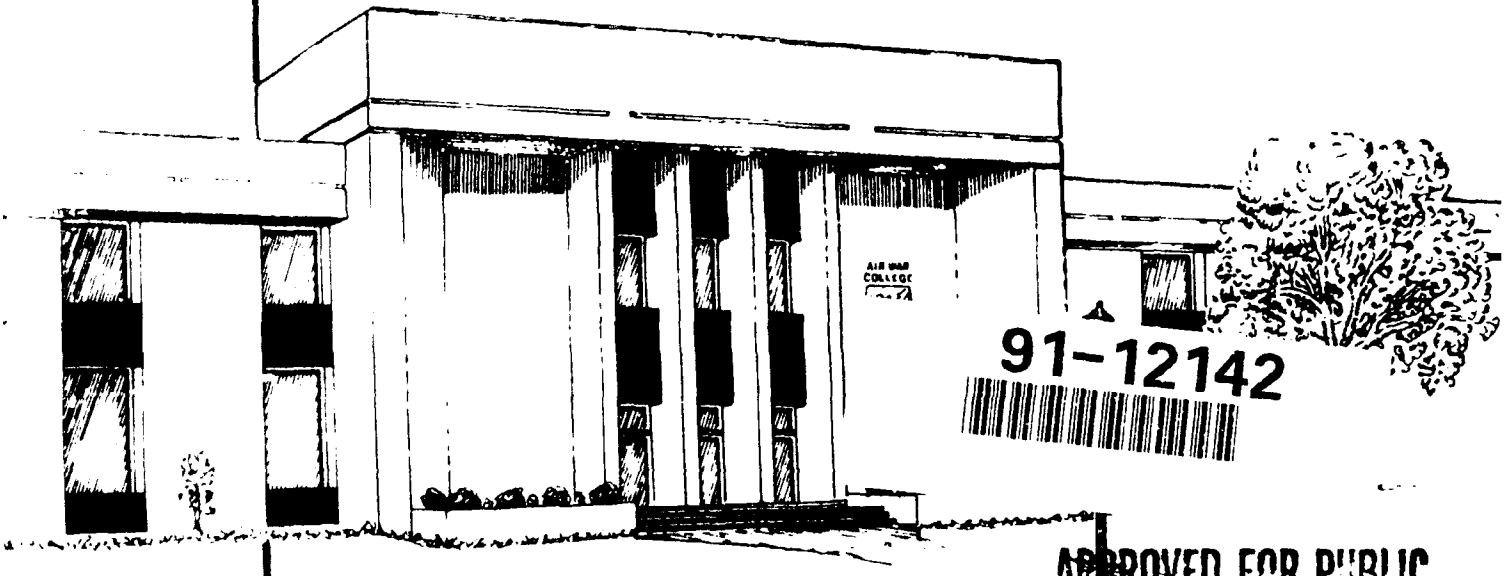
1990



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MAXWELL AIR FORCE BASE, ALABAMA

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A COST SAVINGS ANALYSIS

OF THE

STREAMLINED MILITARY CONSTRUCTION PROGRAM PROCESS

by

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Lieutenant Colonel, USAF

A DEFENSE ANALYTICAL STUDY SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE CURRICULUM

REQUIREMENT

Advisor: Colonel Richard A. Steeves

MAXWELL AIR FORCE BASE, ALABAMA

16 April 1990

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EXECUTIVE SUMMARY

This paper describes the problems with the current procedure used to program, design and plan Air Force Military Construction (MILCON) projects. The current system is expensive, is lengthy, places programming and design before planning, is not responsive to changes and frequently produces a less than high quality facility.

The proposed procedure would shorten the process by nearly fifty percent and place base and facility planning ahead of programming and design by initiating direct design at the time a project is submitted to Congress for authorization and appropriation. The shortened timeline will allow Air Force facility programmers to be more responsive to the changing environment and fluctuating budget conditions. The Air Force could potentially save $33 million dollars per year by adopting this procedure. The end result would be facilities that met the real need of the current user...improved quality.

BIOGRAPHICAL SKETCH

Lieutenant Colonel Thomas W. Olmstead (M.A., Central Michigan University) has been involved in construction programming and specifically the Military Construction Program (MILCON), since 1973. He has held programming jobs at base level as the Chief of Programs, at MAJCOM as the Chief, Construction Requirements Branch, HQ PACAF, and most recently as Chief, Military Construction Program Requirements Branch, Hq USAF. Colonel Olmstead chaired a special study group tasked with proposing a better way to design and construct major facilities in the Air Force. He is a graduate of Squadron Officer School and Armed Forces Staff College. Colonel Olmstead is a graduate of the Air War College class of 1990.

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CHAPTER I

INTRODUCTION

The purpose of this Defense Analytical Study is to answer the question, **"How can the Military Construction Program be streamlined and what cost savings could be anticipated by streamlining the process?"**

LIMITING PARAMETERS

This analysis is based on the Air Force Military Construction (MILCON) Program. While limited availability of information prevented an analysis of the entire Department of Defense (DoD) Military Construction Program, review of Army and Navy MILCON Programs indicate that similar streamlining and cost savings would result. In an effort to limit the scope of this Study, most of the data reviewed and analyzed were from Fiscal Years (FY) 1989 and 1990, the two most recent years containing full documentation from the time a project was initially in the MILCON program through Congressional action. Review of these two years allowed the biennial budget to be addressed from the perspective of the first year of a two-year budget [FY 90] and from the second year of a two-year budget [FY 89]. There is no reason to assume that these budget years are not representative of the immediate past and future years, especially as they relate to budget issues and the size of the budgets in the 1990s. This study assumes successful implementation of the proposal to give the management of the Planning and Design funds to the Major Commands (MAJCOMs).[1]

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[1]Hq USAF/LEE Message, Design Dollar Decentralization, 22 Sep 1989

The intent of this analysis is to provide an expanded definition and comparison of the current and proposed procedures to engineers, design and contracting agents and contractors. The main focus is a cost comparison analysis of potential savings.

BACKGROUND

The Department of Defense has been using the same basic process to develop and manage the MILCON program for nearly fifteen years. In simplified terms, this process has five major elements:

1) identification of the project by a user,

2) inclusion of the project in current budget submittal,

3) planning and design of the project,

4) authorization and appropriation by Congress,

5) construction of the project.

The timeframe to complete this cycle, is at best, five years and more likely seven to eight years. With the budget reductions the Services have experienced since FY 87, it would not be unrealistic to expect a project to take ten years or more to be completed.

This Study suggests a streamlined process that places the planning phase before programming and design. Consequently, under the streamlined process the five major elements of the proposal become:

1) identification of the project by a user,

2) planning of the project and the area of the installation in which it is to be constructed,

3) inclusion of the project in a current budget program,

4) design of the project after it has been submitted to Congress,

5) construction of the project.

The proposal initiates direct design after the project has been submitted to Congress, and after the project has been supported by all levels within the Air Force and the Office of the Secretary of Defense (OSD).

The primary focus of this Study is to address the potential cost savings associated with the proposed process in comparison to the current process. The primary areas of cost savings to be investigated are potential savings resulting from:

1) not designing projects that ultimately have a low potential for appropriation by Congress,

2) shortening the process and reducing re-design efforts,

3) placing facility and area planning before programming,

4) making the process more responsive to changes in missions, budget levels and user desires

5) improved quality of Air Force facilities.

In addition, cost savings in other areas will be identified, while most of these savings do not lend themselves to calculation of dollars saved they represent savings in the form of improved facility user/commander attitudes, reduced inefficiencies in the process, and increased credibility with Congress.

CHAPTER II

THE CURRENT PROCESS

How did the DoD Military Construction program get into such a situation? The credibility of the Service's MILCON estimates to the Congressional Committees had been so poor historically, that in 1977 Congress directed that design will be well underway before a project could be submitted to the Congress.[1] The number of cost overruns had been so excessive, that it was felt by the Committees that this would ensure a valid cost estimate. In 1979, the Senate Armed Services Committee reemphasized the design requirement. The Committee recognized that the Services would accrue some design "breakage"[2], but believed the accurate cost estimates outweighed any "breakage." The Senate report stated, "The committee would like to see every project be at least 35-50 percent designed at the time it is submitted to Congress."[3] Subsequent Congressional language in FY 79, FY 80, FY 83 and FY 84 required specific levels of design prior to submission to Congress.

Defining what became known as "35 percent design effort" was a major problem. Every military engineer and Architect-Engineer (A-E) contractor had his or her own definition. In 1981, Representative Bo

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[1]See Senate Authorization Report 94-856, 1977, p. 10

[2]Definition: breakage is design funds lost due to significant changes in the requirement or obsolete designs

[3]See Senate Authorization Report 95-125, 1978, p. 12-13

Ginn, Chairman of the Subcommittee on Military Construction Appropriation of the House of Representative Committee on Appropriations, asked for a definition of the characteristics of a project that is at the 35 percent design level.[4] The following is an excerpt from these Hearings:

> Mr. Ginn: Specifically describe the characteristics of a project that is at the 35 percent design level. You can answer that for the record.
> (The information follows:)
>
> 1. The 35 percent design submission shall include, as a minimum, the following:
>
> a. 35 percent preliminary drawings.
> b. 35 percent project specifications in outline form.
> c. Preliminary project design cost estimates.
> d. Back-up data as required by this Appendix.
>
> 2. The 35 percent preliminary drawing shall contain as a minimum the following documentation:
>
> a. Site plans showing all buildings in the project, access roads, parking, topography, survey control points, bench marks, drainage, roads and sidewalks and routing water, sewer, gas and other utilities.
>
> b. Architectural floor plans showing complete functional layout, room designations, all major dimensions, all critical dimension, all columns and all built-in equipment.
>
> c. Elevations showing all openings, type and extent of building finishes, sand finish grade at building.
>
> d. Building sections indicating relationship of various levels, floor to floor heights, construction systems, and materials.
>
> e. Preliminary finish schedule indicating proposed finishes.
>
> f. Tabulation of all net areas for spaces limited by criteria or program.
>
> g. Tabulations of gross building area by floors and total building. Delineate areas computed with small scale single line dimensioned drawings.
>
> h. Justifications for deviation from areas or requirements contained in criteria or program, or deviation from approved concept drawings.
>
> i. Preliminary furniture layouts showing that adequate wall space, circulation area, etc., are provided to accommodate the intended use of the space as follows:
>
> (1) Spaces requiring specific accommodations (example--200-seat assembly room.)
>
> (2) Typical Bachelor Enlisted Quarters (BEQ) bedroom, showing location of wardrobes, and providing optional single and

double bunking plans.

(3) Major spaces with multi-purpose use requirements which will require significantly different furniture arrangements for different uses.

(4) Where building design will dictate special design furniture, schematic details sufficient to define nature and extent of special items should be included. This applies whether special design furniture items will be included in plans and specifications or procured as collateral equipment.

(5) Repetitive spaces which form a major component of the design. (Show typical layout for BEQ bedrooms, school classrooms, etc.)

j. Interior mechanical/electrical documentations and/or data showing central heating/cooling plant and electrical distribution details to include:

(1) Design criteria.

(2) Heating/cooling source.

(3) Design analysis/energy studies.

(4) Location or major equipment (for plumbing, show fixture locations an basic riser diagrams).

(5) System diagrams, to include all ventilations systems.

(6) Control diagram for mechanical systems.

(7) Line diagram for electrical systems.

k. Exterior mechanical/electrical documentation and/or data showing central heating/cooling plant and electrical distribution details to include:

(1) Plant loads.

(2) Plant capacity.

(3) Plant Floor plan, general arrangement.

(4) System diagram.

(5) Fuel storage general arrangement.

(6) Route of existing exterior heat, power communication and fire alarm systems including capacities.

(7) Routing and capacities of new systems.

l. Civil/Structural details and data showing:

(1) Boring plans and logs.

(2) Type of foundation system planned. Allowable soil bearing if spread footings are to be used.

(3) Design loads (live load, wind, seismic, etc.).

(4) Explosive safety (identify threat and give distance or negative statement).

(5) Type of structural system and kind of materials to be used.

(6) Fallout shelter statement.

3. The 35 percent specification shall be in outline form and shall consist of a complete listing of all specification sections to be included in the project specification. The listing shall be arranged in the sixteen division format of the construction Specifications Institute (CSI) and sequentially by section number.

The number, title and date of the guide specification being used in preparing such project specifications section shall be listed under the appropriate division heading. The major materials or systems selected for each section, whether or not based on guide specification, shall be listed for each project specification section; however, detailed specifications are not required for the selected materials for systems. All sixteen divisions shall be listed for every project. Where there is not work required in a particular division a statement to that effect shall be included under the division heading. On small projects using on a few divisions, the listing of non-applicable divisions may be omitted.

4. The preliminary project design cost estimates are required with the 35 percent complete drawings and specifications and should reflect current costs as estimated from the preliminary drawing, design, computations, basis for design, and outline specifications. For these elements of the project where status of design does not permit a firm or reasonably accurate take-off of the quantities of firm pricing of individual items of work, lump sum costs based on available data may be included. The basis of these cost such as cost per square foot of building, per square yard of pavement, or per mechanical or electrical fixture shall be given. Lump sum cost should be kept at a minimum.

5. Economic analysis. The submissions must substantiate by economic analysis (life cycle costs) all alternatives examined and include brief statements of the rationale for the various selections.

6. Energy Conservation. Energy conservation aspects of design resulting from investigation of the complete energy system must be discussed. Brief statements shall be included that all cost effective systems/features are incorporated, such as heat recovery, sun shades, control devises, etc.[5]

This definition eventually evolved into Air Force Regulation 89-1, Design and Construction Management[6]. Many in the Air Force believe the

[4]See House Appropriations Hearings, 1982, p. 139-140

[5]Ibid.

[6]See AFR 89-1, Design and Construction Management, p. A19-22, 20 Jun 78

*The US Army uses the same definition, found in AR 415-15. The US Navy documents the definition in DM 6.

Regulation and specifications provided to the Architect-Engineer (A-E) are more detailed and consequently more confusing than the answer provided to the Congressional Committee.

CURRENT PROCESS - TIMELINE

A major issue with the current process is the length of time it takes to get a MILCON project authorized and appropriated by Congress even under the most ideal circumstances. The time period between identification of a project at Home AFB and approval by Congress is 28 months.[7] In addition, after approval, design must be completed, construction contracts awarded, and actual construction completed, adding 30 to 40 months to the total timeline. This process results in a total of 58-68 months elapsed from the identification of a need to an open door. Further, this optimistic timeline assumes away all problems such as budget reductions, Congressional challenges or denials, bad weather during construction, changes in priorities and/or delayed Congressional action. A pragmatic estimate would add an additional 12-36 months to the optimistic total.

How can it possibly take that long? In order to meet the 35 percent design criteria and the OSD Comptroller review dates (PBD cycle), the following timeline must be used.

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[7]See Figure 2-1, p 9-10

FY 92 MILCON PROJECT TIMELINE [8]

Item	Date	Actions
1.	Oct 87-Jun 88	Base identifies need for a new squadron operations facility.
2.	Jul-Oct 88	Determine scope of project, estimate cost, determine site.
3.	Nov 88	Submit project to MAJCOM for funding in MAJCOM PDPs.
4.	Decision Point	Project could be denied or deferred by MAJCOM: - lack of MAJCOM user support for facility. - lack of funds in MAJCOM PDP. - low priority. - future mission change - undecided requirement.
5.	Apr 89	MAJCOM submits MILCON program to Air Staff.
6.	Apr-May 89	Air Staff Review (by Board Structure): - User support? - PDP funds still available? - Valid requirement, now/future?
7.	Jun 89	Issue Design Instruction to 35% design level; Start 4-6 month A-E contractor selection/award process.
8.	Nov 89	A-E starts design. [if Congress has acted on budget and funds are available].
9.	Aug 90	35% design estimates due to Air Staff to balance MILCON budget and prepare documentation for OSD review.
10.	Decision Point	Project could be deferred if cost of projects increased and/or budget was reduced.
11.	Sep 90	Air Staff submits MILCON budget to OSD Comptroller for review and approval to submit to Congress.
12.	Decision Point	OSD can deny/defer a project - the Air Force would not be allowed to submit to Congress in the FY 92 budget.
13.	Jan 91	DOD budget (MILCON Annex) submitted to Congress. Proceed to 100% design.
14.	Feb-Jul 91	Congressional Review and Hearings.

15.	Decision Point	Congress can deny a project for: - No reason = can be resubmitted next year. - Lack of budget authority = can be resubmitted next year. - Cause = must resolve conflict before project can be resubmitted.
16.	Oct 91	Theoretical date all Bills are passed and signed by Congress and President. If not on schedule, project can not normally proceed until Conference Authorization and Appropriation Bills have been signed by President.
17.	Nov 91	Finish design - up to six months remaining Start advertising and award procedure for construction of Project - 6-8 months.
18.	Jun 92	Start construction - usually 18-24 months to reach beneficial occupancy (BOD).
19.	Mar 94	Facility ready for use.

Figure 2-1

Projects in the FY 93 MILCON follow steps 1-6 and 11-15, then go through he entire process the following year. This adds an additional year to the cycle when it is the second year of the biennial budget submission.

PROBLEMS

There are a number of problems that beset this process, but for the most part, the Services have ignored the problems and considered them as the cost of doing business. A study group was set up in June 1989 to take a look at the process.[9] Their tasking was to find a better way to

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[8]Ibid.

[9]Study Group established by AF/LEE

do business -- current restrictions did not have to be considered. The results of this group's efforts were summarized in a presentation to the Army, Air Force,Navy and Marine Corps chief engineers. A subsequent briefing was given to OSD and Congressional Committees responsible for the authorization and appropriation of the MILCON programs.

The study group identified five major problems with the current process: expense, length of process, placing programming ahead of planning, lack of responsive to change, and affect on quality.[10] In addition, the process is frustrating for base level users/commanders and A-E contractors.

Expense. The current process is too expensive, because it forces the Air Force to design, or partially design more projects than Congress appropriates. Frequently, a project design is started and held at the 35 percent level because it has been deferred from one program year to another. A project could stay at this design level for up to three or four years until it is authorized to complete [100 percent] design; this results in many hours and dollars of lost design effort (See Chapter V).

Length of Process. The long process does not provide the timely response that is needed by the current commander. It is not unusual for one wing commander to identify the need for a facility and then be succeeded by two or three more wing commanders before the facility is constructed and usable. Each subsequent commander may have different priorities, different siting desires, or different interior flow/design ideas, all which slow the process even more. In addition, all of these

[10]See "Improving the MILCON Process" briefing, Sep 1989

changes cost the Air Force and the taxpayer money. According to the Army Corps of Engineers, approximately 23 percent of the facility changes result from the user.[11] The longer process, the greater the potential number of users involved. Shortening this timeline should reduce the user changes and ultimately the project costs. Quality would be improved by adhering to the original design concept.

Planning before Programming. The current MILCON process often places facility programming ahead of in-depth planning. Under this system, most of the detail planning is accomplished during the design process, long after the base has initially programmed the project in the MILCON program. In most cases the extent of the planning before design consists of locating the facility on the Base Comprehensive Plan, determining basic scope or size of the facility and development of rudimentary justification to be included on the DD Form 1391, Military Construction Program. The size and cost of the facility is often determined by a junior officer with little Air Force or construction experience, resulting in a facility that does not provide the best solution to the problem for the money. The Air Force spends nearly $1.5 billion a year using the concept.[12]

In an effort to solve A-E design problems, changes in the MILCON process were made in 1980. According to testimony before the House Appropriations Committee, Subcommittee on Military Construction, "By allowing the design agencies to initiate design earlier in the

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[11]See House Appropriations Hearings, FY 80 MILCON, 1980, p. 138

[12]See "Military Construction History" report, May 1989

programming execution cycle, we will have more time to allow for review..."[13] This may have solved the problem of 37 percent of the changes on projects resulting from design deficiencies.[14] The long term effect was a longer process, and putting programming and design ahead of good thorough planning.

Lack of Responsiveness to Change. The length of the process does not give the necessary flexibility needed to accommodate mission changes, budget fluctuations, changing Air Force priorities and changing requirements. In these days of budget reductions, conventional forces reductions in overseas theaters, base closures and nuclear weapons reduction treaties, the MILCON budget must remain responsive. This process is not.

Affect on Quality. Under the current process, prices are often locked in before the real requirement is known. Therefore, facilities can be constructed that do not meet the real need of the user. A facility is designed to the programmed cost rather than the needs and desires of the user. Facilities have been completely design and appropriated by Congress at bases recently identified to be closed. For example, in the past, facilities have been designed for an F-4 simulator at a base that now has F-111's assigned without an adequate facility for it's simulator. The bottom line is that under the current process, quality suffers.

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[13]See House Appropriations Hearings, FY 80 MILCON, 1980, p. 138

[14]Ibid.

CHAPTER III

PROPOSED IMPROVEMENTS TO THE MILCON PROCESS

If a new procedure is to be effective, the problems of the current procedure must first be minimized. The study group[1] looked for a better way to plan, program, design and construct MILCON projects. An alternate process must eliminate or improve all of the five major problems of the current system (identified in Chapter II, pp. 11-13). If these are not addressed head-on, the chances are that a bigger problem will result.

REDUCE THE EXPENSE

The first problem to overcome is the expense incurred by designing all projects to 35 percent long before Congress appropriates money. A second concern is designing a project to an intermediate level (35 percent) and putting it on hold for several years before continuing with the design. This holding action allows the design to "grow whiskers"[2] and become stagnate.

Discussions with members of the Air Force design community indicate that if a project were stopped for intermediate review of less than two months, the entire design process on a majority of the MILCON projects could be completed in nine to twelve months.[3] Therefore, one

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[1]See Study Group results

[2]See Briefing to HASC/SASC staffers, 4 Feb 89

[3]See Study Group results

solution to these problems is to start later, but design directly to 100 percent.

However, two spin-off questions are now raised:

* What method can the Air Force use to provide a credible, valid and accepted estimate for OSD and Congressional consideration?
* How does the Air Force meet the OSD and Congressional requirement for 35 percent design cost estimate?

The answer to the first question is parametric estimating; that is the use of requirement criteria against historical cost data. For example, if there is a requirement to build a 200,000 square foot administrative facility, there are certain facility criteria that can be determined in the planning phase, such as: square footage; heating, ventilation and air conditioning loads; parking requirements; security requirements; landscaping; hardening; etc. It is possible to go back through completed facility projects and determine the incremental cost of each of these facility elements. By combining the elements and their costs in different cost of living areas, an accurate cost estimate can be developed. [More details on the development and validity of parametric estimating is provided in Chapter IV.]

The second of these questions must be solved outside of Air Force channels: Will OSD and Congress give relief to the "archaic" facility cost estimating system, that is 35 percent design status? The proposal was presented to OSD/PLI and the House Armed Services Committee, Subcommittee on Military Construction in the Summer and Fall of 1989. The resulting language appears in the Congressional Record:

> Parametric Facility Planning. The conferees are aware that the architecture profession has developed computer-assisted facility planning that can provide reliable cost estimating for construction projects. This parametric planning approach offers advantages in shorter planning and design times, lower costs, particularly in the early stages of the process and more timely and responsive final design products. The conferees reiterate the requirement that military construction projects under consideration for authorization be far enough along in the planning and design process, nominally 35 percent designed, that the Congress can have a high degree of confidence....conferees have no objection to the use of the technique [parametric estimating] as the basis of cost estimates for budget requests....[4]

Therefore, it seems possible to reduce the cost by starting later, going directly to 100 percent design, and adopting the industry standard for cost estimating.

SHORTEN THE PROCESS

The second major problem that must be overcome is the length of the process. There are several major milestones that must be met under the Biennial Planning, Programming, Budgeting System (BPPBS) process currently employed by DoD. The OSD/Comptroller staff reviews the Air Force budget starting 15 September of each year. During the first half of January of each year, DoD submits a budget to Congress for authorization and appropriation. Therefore, the MILCON program must have valid estimates on all projects they intend to submit to OSD, and ultimately to Congress, by 15 September. Prior to that, the projects must be reviewed by the Air Staff and MAJCOM. The base level engineers and users must have time to identify the needs and specific requirements that must be included in the facility. This problem does not seem too difficult to resolve by merely work backwards

[4]Congressional Record - Senate, Nov 6, 1989, p. S14998-9

from the "drop dead" date of 15 September. However, before this problem can be completely resolved, it must be integrated with another major issue.

FACILITY/SUB-AREA PLANNING, THEN PROGRAMMING

The hingepin to improving the process is to place planning before programming. While some of the other recommended steps may save money or improve efficiency, planning before programming will improve the process, improve the appearance and utility of each Air Force base, and ensure the construction of the right kind and size of facility. The planning process does take time, but not nearly as much time as re-designing a facility or constructing a facility that is too small or poorly organized. These mistakes require an addition or expansion in future years, resulting in more time expended and more money spent.

The proposed planning process consists of five integrated steps: First, meet with the user and determine needs, but not necessarily ideas, of what the facility should look like. Secondly, in conjunction with the entire base comprehensive plan, determine the facility site, how it is impacted by environmental issues, and what this specific area of the base will look like when it is completely developed. Third, determine the general types of materials that are to be used, both interior and exterior, and assure that the materials support the overall Base Comprehensive Plan. Fourth, locate all utility systems in the construction area and determine the current size and the increase in demand that the new facility will require. If this is the first facility to be in the area, but more construction is planned, consider future

expansion. Fifth, select the structural systems and develop a floor plan that is acceptable to all base level users.[5]

When this process is put into use in combination with parametric estimating it is defined as Project Definition. The project definition phase replaces the 35 percent design milestone.

Project definition development will only take two to three months to accomplish after the A-E contract is awarded, but the award process itself adds another two to three months.[6] If MILCON "on-call" A-E contracts could be written, this process could be cut by two months. An A-E contractor stated it took his company approximately three weeks to accomplish the equivalent of a Project Definition. If the user [U.S. Gov't] gave his company three months to complete Project Definition, he would normally do the work in the last three weeks. This allows him to minimize the multitude of user changes.[7] In addition, the cost for a project definition development will be approximately two percent of the projected cost of the facility, in comparison to 4 1/2 percent it now costs to reach the 35 percent design effort. This single innovation has put planning ahead of programming and greatly reduced the design timeline.

IMPROVE RESPONSIVENESS TO CHANGE

The lack of responsiveness to change is directly tied to the length of time it takes to complete the entire MILCON process and the

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[5]See "Improving the MILCON Process" briefing, Sep 1989

[6]See Study Group results

[7]See interview with John Chambless, 6 Apr 90

fact that considerable amounts of money are spent up front. While mission changes atbases have always been a reality, today's environment of base closures, consolidations, force structure reductions, and declining defense budgets results in widely changing priorities and changing requirements. If the design process is started later, and consequently funds are expended later in the process, changing priorities and requirements would be more easily accommodated. With proper planning, the impact of mission changes, and of added and reduced missions on facilities, could be better evaluated.

IMPROVE QUALITY

From the topics already addressed, it should be apparent that facilities are included in the budget based on the 35 percent design cost estimate. It should also be apparent that it is not unusual that the real user needs have not been completely determined at that time. Therefore, we lock in the price before the details are known resulting in a facility that is designed to a price, not to the requirements. This process has worked for many years, but the Air Force has had to accommodate these miscalculations in other ways. In fact, the proposal is a better way that will save money, shorten the process and improve the overall quality.

FY 92 MILCON TIMELINE - PROPOSED[8]

Item	Date	Actions
1.	Nov 88-Aug 89	Base identified need for a new squadron operations facility [started 12 mo later].
2.	Jul-Oct 89	Determine general scope and rough cost estimate.
3.	Nov 89-Feb 90	Submit Project to MAJCOM for validation, funding in MAJCOM PDP, and MAJCOM.
4.	Feb - Jul 90	Issue PLANNING INSTRUCTION.
5.	Decision Point	Project could be denied or deferred by MAJCOM: - lack of MAJCOM DO (user) support for facility. - lack of funds in MAJCOM PDP. - low priority. - future mission change - undecided requirement.
6.	Jul 90	MAJCOM submits MILCON program to Air Staff.
7.	Aug 90	Parametric estimates due to balance MILCON budget and prepare documentation for OSD review.
8.	Decision Point	Project could be deferred if cost of projects increased and/or budget was reduced.
9.	Sep 90	Air Staff submits MILCON budget to OSD Comptroller for review and approval to submit to Congress.
10.	Decision Point	OSD can deny/defer a project - the Air Force would not be allowed to submit to Congress in the FY 92 budget.
11.	Jan 91	DOD budget (MILCON Annex) submitted to Congress.
12.	Jan 91	MAJCOM issues DESIGN INSTRUCTION to start direct design to 100% [started 18 mo later].
13.	Feb-Jul 91	Congressional Review and Hearings.

14.	Decision Point	Congress can deny a project for: - No reason = can be resubmitted next year. - Lack of budget authority = can be resubmitted next year. - Cause = must resolve conflict before project can be resubmitted.
15.	Oct 91	Theoretical date all Bills are passed and by signed Congress and President. If not on schedule, project can not normally proceed until Conference Authorization and Appropriation Bills have been signed by President.
16.	Oct 91	Designs Finished. Start advertising and award procedure for construction of Project - 6-8 months.
17.	Apr 92	Start construction - usually 18-24 months to reach beneficial occupancy (BOD).
18.	Jan 94	Usable Facility [completed 4 mo early].

Figure 3-1

[8]See "Improving the MILCON" briefing and opinions of author

CHAPTER IV

PROJECT DEFINITION AND PARAMETRIC COST ESTIMATING

Parametric cost estimating is not a new innovation to the construction industry. Statistical and mathematical estimating based on common experience has been used by the private sector for years. The Air Force has used parametric cost estimating since the FY 89 MILCON program. Congress authorized the limited use of parametric cost estimating in the FY 88 Joint Conference Appropriations Conference Report.[1]

> The Air Force has developed a parametric cost modeling system that has the potential for providing cost estimates as an alternative to developing cost estimates based on 35 percent design status. The conferees have no objection to the Air Force including 5 projects in the fiscal year 1989 budget based on parametric modeling. For other projects, the conferees do not object to use of computer simulation to assist in fine tuning of project costs so long as none of the funds appropriated for military construction or family housing are used to pay for computer simulation.[2]

The Air Force Engineering and Services Center has analyzed MILCON projects from 1966 to the present. The projects were broken down to common types of facilities, common elements within these facilities and utility systems necessary for the facilities.[3] Along with this data, each military installation has an area cost factor (ACF), that discriminates the cost difference between constructing a facility in a low cost area verses a high cost area. All of this data has been

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[1]See Joint Conference Appropriations Conference Report, 22 Dec 1987

[2]Ibid.

[3]See Study Group results.

computerized in the Air Force Pricing Guide available at HQ USAF, all MAJCOMs and most installations, allowing anyone with elementary knowledge of the proposed facility to develop a good initial cost estimate. This cost estimate is not refined enough at this point to provide to OSD or Congress, but it does provide a fair estimation of facility costs.

To develop the parametric cost estimate that is credible enough to request Congressional appropriation, it is necessary to complete the project definition phase. The new streamline MILCON process uses parametric cost estimating as a more efficient approach to providing the concept design (previously defined as 35 percent design) required by Congress.

To estimate a project costs, first select a basic category code and the basic cost will be calculated using the scope of the facility

```
                          Category Code Type Search
          Enter 2 Digit Category Code Type to Search the Data Base: **
   10  VARIOUS FACILITIES                    11  AIRFIELD PAVEMENTS
   12  LIQ FUELING & DISPENSING FCLTY        13  COMM, NAVAIDS, ARFLD LIGHTIN
   14  LAND OPERATIONAL FACILITIES           15  WATERFRONT OPERATIONAL FAC
   16  HARBOR AND COASTAL OPS FAC            17  TRAINING FACILITIES
   21  MAINTENANCE FACILITIES                22  PRODUCTION FACILITIES
   30  RESEARCH DEVLOPMENT & TEST FAC        41  LIQ FUEL & NONPROPEL STORAGE
   42  AMMUNITION STORAGE                    43  COLD STORAGE
   44  COVERED STORAGE                       45  OPEN STORAGE
   50  MEDICAL FACILITIES                    61  ADMINISTRATIVE FACILITIES
   62  UNDERGROUND ADMIN STRUCTURES          69  OTHER ADMIN STRUCTURES
   71  FAMILY HOUSING                        72  DORMITORY
   73  PERSONNEL SUPPORT SVC FCLTYS          74  COMMUNITY/INTER
   75  EXT
   80  EC
   82  HE    1         2         3         4         5         6         7
   84  WA  1234567890123456789012345678901234567890123456789012345678901234567890123
   86  RA
   88  FI
   90  LA

                          Project Cost Estimate Worksheet
                               Primary Facility Data
                                  AJXF860804   O

     Cat    Type                                                  Unit        Tc
     Code   Work      Facility Description          UM  Scope     Cost        Co
   * 214-425 NEW  VEHICLE MAINTENANCE SHOP          SF   37200      78.00
   * 610-121 NEW  VEHICLE OPERATIONS ADMIN          SF    1400     130.00
```

Figure 4-1 [4]

[4]Screen from PDC Computer System, AF Pricing Guide

Add to the basic facility cost, the supporting facilities required. The first screen shows supporting facility cost from an actual facility, followed by the selection of various types of support that may be required. The final two screens depict the typical subelements of electric and pavement supporting facilities.

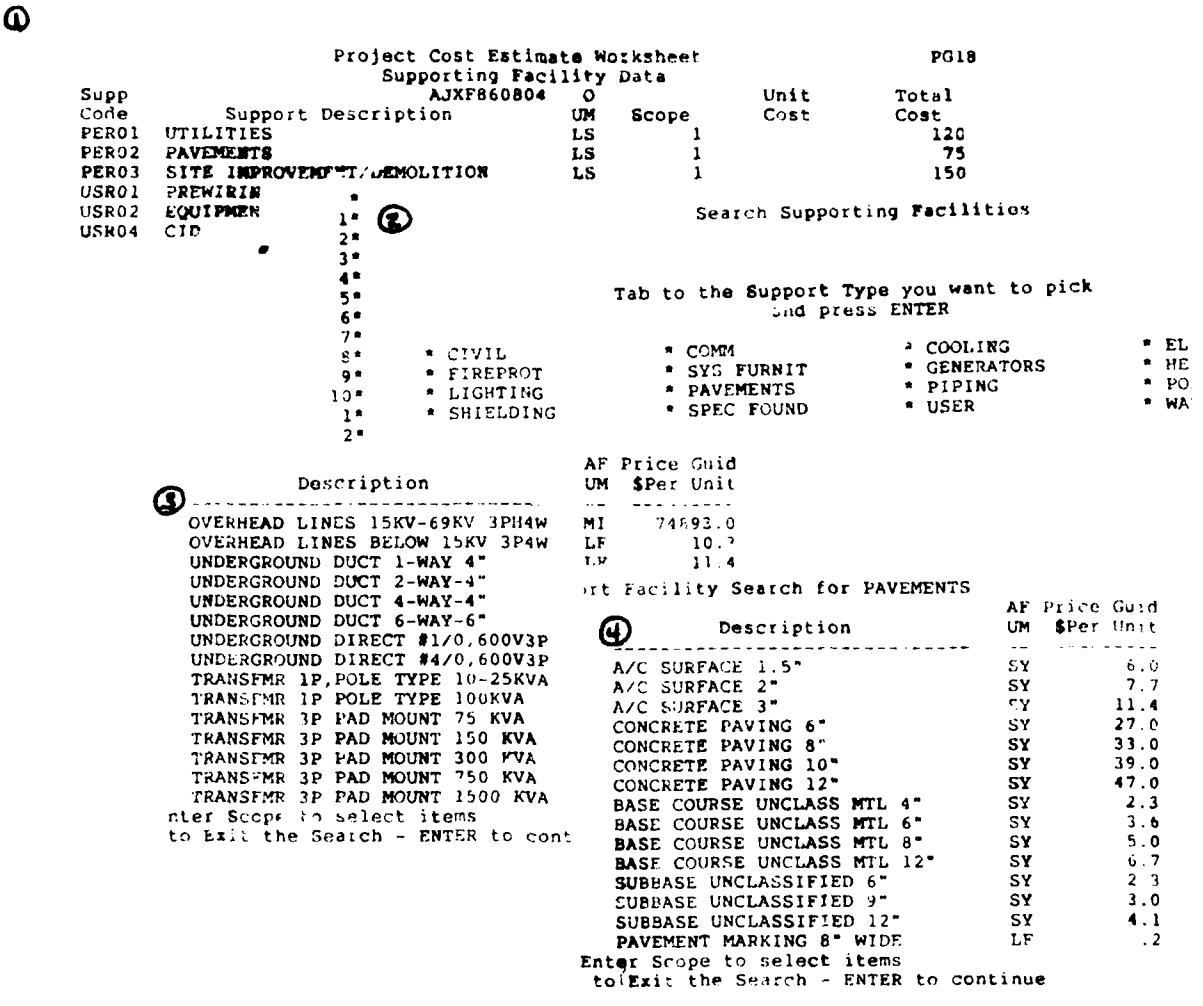

Figure 4-2 [5]

[5] Ibid.

The project definition is accomplished by a professional Architect-Engineer who fully defines the facility project by studying the user's processes and determining the user's functional requirements. From this analysis, important design criteria and considerations for each of the facility's subsystems (e.i. civil, structural, mechanical, electrical, security, survivability) are determined. The A-E specifies the type of subsystem best suited to meet the established design criteria, i.e. the general type of structural systems or type of mechanical systems. Once the project definition has been completed, its cost can be readily and accurately projected using parametric cost estimating techniques. This technique uses an automated data base of historical costs for various types of facility subsystems or components and updates these actual/historical costs to account for local area cost variations, inflation and special requirements.

Review of the FY 88-90 Air Force MILCON program reveals that 70 percent of the projects submitted to Congress could have been estimated using parametric cost estimating techniques available within the Air Force.[6] There will always be a few unique projects for which parametric estimates are inappropriate, such as projects that are one-of-a-kind, or that are extremely unique and for which no database has been developed. Examples include: adding blast doors to Tab-Vee aircraft shelters; building satellite launch facilities, and constructing unique facilities required by new weapon systems under development. Some projects are done

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[6]See Study Group results

many times but remain unique to the installation and the situation -- runway repair projects.

PROJECT DEFINITION

The project definition is be developed using some basic documents available at each installation. If these documents are not available or not current, they must be developed prior to or as part of the Project Definition. The key documents to be used to develop the Project Definition are:

+ Base Comprehensive Plan
+ Base Sub-Area Development Plan(s)
+ Site Plan
+ Environmental Assessment
+ Base Architectural Standards Plan
+ Base Landscape Plan
+ Base Utilities Plan
+ Initial Programming Document, DD Form 1391

From these basic documents and discussions with the user the A-E determines requirements on at least nine areas:

1. Site layouts showing all buildings in or proposed for the project area, access roads, parking, topography, survey control points, bench marks, drainage, roads, parking lots and sidewalks.

2. Utilities layout showing connection points, routes, sizes of electrical, gas, steam, water and other utilities.

3. **Architectural Floor Plan** showing the result of an in-depth professional A-E study of the user's processes and functional requirements.

4. **Elevations** of the building showing the architectural style, massing and compatibility with the urban design established in the Base Comprehensive Plan.

5. **Structural criteria** used in the basic structure of the building systems.

6. **Mechanical criteria** used in the mechanical subsystems that best suit the purpose of the building(s).

7. **Electrical criteria** used in the electrical subsystems that best suit the purpose of the building(s).

8. **Design features** showing unique requirements of security, hardening, communication, etc., and any other considerations required for the project that will significantly influence the cost or construction schedule along with recommended solutions.

9. **Finish schedule** showing complete interior finishes, when interior finished are a major cost factor.

If any of these elements are ignored, the final product will be less than desired. Conscientious, thorough and professional planning is essential to improve the quality while shortening the timeline and reducing the cost of Air Force MILCON projects.

Some may believe that the current requirement to design to 35 percent and project definition are identical. In fact, they are similar but far from the same. The table on the following page provides the summary comparison.

Current 35 Percent Requirement	Project Definition
1- Floor plans	Floor plans
2- Elevations	Elevations
3- Preliminary Finish Schedule	Final Finish Schedule
4- Line Drawings for Electrical/ Mechanical systems & building cross-sections	Building systems defined Structural/Electrical/ Mechanical
5- Unique Features	Design solution for Unique features
6- Site Plan	Site Plan done in tune with sub-area plan, Base Comprehensive Plan, landscape, environmental and architectural standards
7- 35% Specifications outline	-----
8- Tabulation of scope	-----
9- Quantity take-off Cost Estimate	Parametric cost estimate

CHAPTER V

COST ANALYSIS OF FY 89/90 MILCON

There is no point in changing a process or procedure just to change it. The previous chapters have identified problems with the current process, but there must be a concrete reason to actually change the way the Services have been doing business. Change is good, but change for change sake is a waste of resources. This analysis will show that there are a number of savings associated with the streamlined MILCON process.

The primary savings that can be realized are:

1) Reducing the number of projects that are designed but not appropriated by Congress.

2) Reducing the number of projects that are designed to 35 percent and put on hold for an indefinite time.

3) Reducing the number of projects that are re-designed because they grow old waiting for funds.

4) Reducing the frustration and dissatisfaction of commanders and users, thus allowing them to spend their time more productively (intangible).

5) Reducing the amount of overhead and oversight that goes into reviewing and validating projects; put that emphasis upfront on the planning
effort (intangible).

6) Reducing the effort A-E's must put forth to provide an estimate, allowing them to put this effort on actual design or possibly reduce the design costs (intangible).

PROJECT ANALYSIS

Every year, the Air Force starts design on 20 to 50 percent more projects than Congress will appropriate. The long, arduous process forces the Air Force to make decisions to start design on most project prior to the MAJCOM's developing their POM. As the budget process continues, the MILCON program must adjust to support the needs of the flying and support efforts of the Air Force. In an attempt to provide the level of change, the following charts for FY 89 and FY 90 depict the problem in real numbers.

NOTE: Unless otherwise noted, data included in this chapter are from the official records of the Department of Defense pertaining to the MILCON submission to Hq USAF, OSD and Congress. Primary source documents include DoD Budget for FY 89, FY 90, FY 91 Construction Programs (C-1). Additional data was taken from the Program, Design and Construction (PDC) data base available at all MAJCOMs and Hq USAF. Data was provided to the author by Hq USAF/LEEP.

FY 89 MILCON Results

Action	Date	Orig Proj	New Proj	Cost of Proj(Mil)	Remarks
MAJCOM/USAF POM to OSD[1]	Apr 86	469	--	2,121	
Budget to OSD (BES)[2]	Sep 86	404	--	1,648	Start Dsgn
Biennial PB to Congress[3]	Jan 87	344	24	1,739	See Note 1
2d subm to OSD (BES)[4]	Nov 87	254	62	1,381	See Note 2
Amended PB to Congr[5]	Feb 88	208	90	1,301	See Note 3
Appropriation[6]	Oct 88	179	87	1,226	See Note 4

NOTES:

1. FY 89 was the 2nd year of the two year budget, therefore, OSD and Congress did not require 35 percent on projects at that time. Increase in budget line and projects was added by OSD with appropriate amount of money.

2. Projects must be 35 percent designed. Significant reduction in overall DoD budget, due to Presidential/Congressional "Rose Garden Agreement" on level of DoD budget.

3. Further reductions by OSD, low appropriation level in FY 88 forced roll-over of many projects that were denied by Congress in FY 88 budget. More mission changes impacted MILCON budget.

4. End result of Congressional Appropriation. 179 of the original 469 projects were appropriated/31 projects were rolled-over from previous budgets/26 projects were required to support new missions/13 projects added due to changing priorities/14 projects added by Congress.

Figure 4-1

[1]See Dept of the AF, Military Construction Program, Apr 86, p. 1-18

[2]See DoD Budget for FY 89 (Est), Construction Prog (C-1), Sep 86

[3]See DoD Budget for FY 89, Construction Prog (C-1), Jan 87

[4]See DoD Budget for FY 89 (Est), Construction Prog (C-1), Nov 87

[5]See DoD Budget for FY 89, Construction Prog (C-1), Feb 88

[6]See FY 89 AF MILCON Report, Nov 88, p. 1-57

FY 90 MILCON Results

Action	Date	Orig Proj	Total Proj	Cost of Proj(Mil)	Remarks
MAJCOM/USAF POM to OSD[7]	Apr 88	368	368	2,000	See Note 1
Budget to OSD (BES)[8]	Sep 88	286	358	1,699	See Note 2
Biennial PB to Congress[9]	Jan 89	218	300	1,528	See Note 3
Revised subm OSD (ABES)[10]	Mar 89	242	298	1,386	See Note 4
Revised PB to Congr (Bush)[11]	Apr 89	205	283	1,393	See Note 5
Appropriation[12]	Nov 89	159	223	1,227	See Note 6

NOTES:

1. POM was submitted in Apr 88 but design was started on most projects in May-July 87. This was necessary to meet 35% design goals.
2. Major reduction directed by CSAF, large delta between appropriation in FY 87/88 compared to proposed FY 90 budget request.
3. Reagan Budget submitted and then returned by Congress for President Bush to make adjustments.
4. New directives from OSD and President Bush, re-instituted some programs and some projects previously deleted by OSD.
5. President Bush's budget submittal.
6. Congressional Appropriation approved 159 of the original 368 projects.

Figure 4-2

[7]See Dept of the AF, Military Construction Program, Apr 88, p. 1-18

[8]See DoD Budget for FY 90 (Est), Construction Prog (C-1), Sep 88

[9]See DoD Budget for FY 90, Construction Prog (C-1), Jan 89

[10]See DoD Budget for FY 90, Construction Prog (C-1) Amended, Mar 89

[11]See PDC Computer Report,FY 90 AF MILCON Report, Nov 89, p. 1-57

[12]Ibid.

From the time design was started on the FY 90 MILCON, the Air Force made the following changes to the program:

70 projects added
- 23 projects resulting from priority changes
- 47 projects resulting from mission changes

117 projects removed from the original program
- 89 projects resulting from priority changes
- 38 projects resulting from mission changes (most projects were canceled)

17 projects denied by OSD

89 projects denied by Congress (88 percent were overseas projects)

35 projects added by Congress

Of the seventy projects added to the original program by the Air Force 43 were denied by Congress. All of these were overseas. Of the 89 projects denied by Congress, 77 were at overseas locations.

The figures above present a dismal picture of the success rate of the MILCON program from Program Objective Memorandum (POM) through Congressional appropriation. In FY 89, only 44 percent of the projects on which design was initiated were actually appropriated in FY 89. In FY 90, the number of successful projects dropped to 43 percent. From this summary data, it seems clear that the budget will continue to change, most probably in the downward direction, during the budgeting process. These major adjustments force the expenditure of design money that is, for all purposes, wasted. It also presents less than a successful picture for customers that expect and need MILCON projects.

The argument can be used that both FY 89 and FY 90 were unusual years. In some respects they may have been unique, but every year has some unusual twist to it. FY 89 was the second year of a biennial

budget, but that situation will occur every two years until biennial budgets are eliminated or Congress acts on both years at the same time. Neither option seems apparent at the present time. The budget topline was fixed in FY 89 as a result of the "Rose Garden Agreement" between President Reagan and Congress. But again, something or someone always puts a cap on the budget. In FY 90, the CSAF directed the $2 billion MILCON budget figure be reduced. Over the last three years, the Air Force received less than $1.3 billion each year in MILCON appropriations. The initial budget cap was self-imposed to reduce this large delta. FY 90 was the year of two budgets, in January the Reagan budget was sent to Congress but it was rapidly returned for President Bush to resubmit his budget. Prior to this resubmittal, an agreement between the White House and Congress limited the overall DoD budget. As stand-alone years, both FY 89 and FY 90 may seem unique, but when place under the magnifying glass they seem pretty typical.

In FY 89 and 90, design was started on more than 400 projects that were not appropriated by Congress in those years.[13] The U.S. Congress appropriated $116,000,000 in FY 89[14] and $144,000,000 in FY 90 for "Planning and Design" of Air Force MILCON projects.[15] Although the Planning and Design money appropriated in FY 89 is not soley intended to design projects for FY 89, the sums for Planning and Design are relatively constant. A formula is used to determine the amount of design

[13]See FY 89 AF MILCON Report, Nov 88, p. 1-57

[14]See PDC Computer Report, FY 90 AF MILCON Report, Nov 89, p. 1-57

[15]See PDC Computer Report, FY 90 MILCON Marks, Nov 89, p. 56-57; plus $41 million shortfall currently being reprogrammed

money the Air Force requests each year, which is based on accomplishing future year designs to at least 35percent and design completion of current year projects. The formula is three percent the MILCON TOA in FY+1, plus four percent of the MILCON TOA in FY+2, plus one-half percent of FY+2 for value engineering.[16]

Even considering the total projects appropriated each year the degree of success is less than desirable. In FY 89, Congress approved 65 percent of the total number of projects on which design was originally initiated (179 original projects + 87 added projects = 266 projects approved). In FY 90, the figure rose to 69 percent (159 original projects + 64 added projects = 223 projects approved).

In an attempt to get a better picture of the volatile nature of the MILCON program, a deeper analysis is provided for the FY 90 MILCON program.

IN-DEPTH FY 90 MILCON ANALYSIS

Design Initiated		368 Projects
Projects Deleted (by USAF & OSD) from POM to PB		-163
Projects Added (by USAF & OSD) from POM to PB		+ 70*
AF Mission Changes	47	
Changing Priorities	23	
Projects Added by Congress		+ 35
Projects Denied by Congress		- 89
46 Original Projects Denied by Congress (45 were OCONUS)		
TOTAL PROJECTS APPROPRIATED		223

* 43 of these were denied by Congress

Figure 4-3

[16]See Interview with Larry Bridges, Hq USAF/LEEPR, 6 Feb 90

Of the 46 original projects that were denied by Congress, 45 were in overseas areas that had significant controversy prior to the Congressional submittal. Eighty-eight percent of all Congressional cuts in FY 90 were at overseas locations. In fact, if the Air Force had not been required to provide 35 percent design status to OSD and Congress, it is conceivable that all design effort could have been held up until the reaction of Congressional members was more clear. Projects for which design might have been held up were projects in the Philippines, since the base rights agreement is controversial in the U.S. as well as in the Philippines. The beddown of a new weapons system in Panama with existing treaties calling for U.S. withdrawal in less than 10 years could expect to take Congressional heat. Projects in Honduras are always at issue. With the announcement of a proposed Conventional Forces in Europe (CFE) reduction, Congress was leery of appropriating money for construction on bases that might soon be closed or turned over to another NATO country. Controversy on all of these projects could be, and was, foreseen. The current MILCON milestones did not allow for good management decisions.

The Air Force is a dynamic organization. Political decisions and actions throughout the world impact on the basing and force structure of the U.S. Air Force. From April 1988 to April 1989, 47 projects were added to the Air Force MILCON program to support mission changes, procurement adjustments, and other political decisions. The funds for these projects had to be absorbed from other MILCON projects; therefore, some of the 163 projects deleted from the program were deleted to find money for these. However, the design was already underway when the 163 projects were deferred. Mission changes are a fact of life, selected

reasons for the addition of the 47 projects are as follows:

+ Base Realignment due to Base Closure actions
+ Decision to move an F-16 Wing to Crotone AB, Italy
+ Drawdown and realignment of B-52 squadrons
+ B-2 program adjustments
+ C-17 program adjustments
+ Decision to locate Special Operations School at Kirtland AFB
+ Several degradation in utility system support space launches
+ CINCCENTCOM initiative for forward basing
+ Beddown of STOL aircraft at Howard AFB
+ CINCSOUTHCOM initiative to improve airfields in Honduras
+ Decision on F-15E beddown at Clark AB, PR
+ F-111/FB-111 rebasing decisions (also tied to Base Closure)

The results of these additions were not favorable. Thirty-two were denied by Congress, with 24 of these denials being in overseas locations. Changing priorities accounted for 23 project additions. Often the reason behind many of these adjustments was a new commander with new ideas on what should be constructed at Home AFB. Or a new user at MAJCOM decided to initiate a special program and upgrade a number of similar facilities throughout the MAJCOM in the current MILCON program rather than wait for a future year. Or, a new sponsor in the Pentagon decided his or her program was more important than another and took funds from an existing program to support a new initiative. Mission changes directly support a weapons system, operations plan or similar initiative.

The final category is Congressional inserts. The MILCON is a "porkbarrel account," that is, since each project is authorized and

appropriated by line item, rather in a lump sum account, Congressional members have the opportunity to selectively delete projects and insert projects from their district. Of the 35 projects inserted in the FY 90 program, five had been in the original FY 90 MILCON program. Those five projects were initially submitted by the MAJCOMs and deferred due to budget reductions and/or to pay for part of the 47 projects attributed to mission changes. The Air Force has little control over this category, and must react to the best of it's ability once the projects are added. In most cases, the negative impact is that projects important to the Air Force, for which design money has been expended are denied to support the Congressional inserts. Once a project is inserted, design must be started on the additional projects (35 in FY 90).

THEORETICAL DESIGN COST COMPARISON

CURRENT SYSTEM VS STREAMLINED PROCESS

The theoretical approach is taken to show the cost saving because the planning and design appropriation for any single fiscal year provides funds to design and partially design projects over a three to five year span. The most straight forward approach, that allows the design calculations for the same projects, is to calculate the cost using the differing decision points of the current system versus the streamlined process. This will show how the delay, in decision to start design, will save money. In order to initiate the project definition the MAJCOM would issue a "Planning Instruction." Some of the numbers for Planning Instruction cost are "best guess" figures based on discussions with senior Air Force engineers and A-E contractors. The cost comparison is

accomplished on the FY 90 MILCON because more detailed information is available than on other fiscal years.

Current Design Costs	6%
Misc Support Costs	3%
Cost to reach 35% -- (4.5%)	
Planning Instruction costs	2%
Direct Design Costs	5%
Misc Support costs	1%

[Project design is stopped at 35% or 100%, only]

On a project by project basis the costs (percentage of programmed amount) could be higher or lower than those shown above; however, the aggregate costs of all projects approximates these percentages.[17]

CURRENT SYSTEM DESIGN COST - (ESTIMATE)

($ in 000)

		NR PROJ	MILCON TOA	EST DSGN COST
Jul 87	Start 35% Dsgn	368	2,000,000	90,000
Sep 88	Stop Dsgn on deferred proj	-163	625,837	
	Start 35% Dsgn on Proj Add	70	194,320	8,744
	Cont to 100% on balance	205	1,198,680	53,941
Nov 89	Dsgn Proj added by Congress	35	141,383	12,724
				165,409

Figure 4-3

[17]See Interview with Larry Bridges, Hq USAF/LEEPR, 6 Feb 90

PROPOSED SYSTEM DESIGN COST - (ESTIMATE)

		NR PROJ	MILCON TOA ($ in 000)	EST DSGN COST ($ in 000)
Apr 88	Issue Plng Instr		1,686,000	33,720
Sep 88	Issue Plng Instr on AF Adds	70	194,320	3,886
Jan 89	Start Direct Dsgn	205	1,198,680	71,921
	Start Direct Dsgn on Adds	70	194,320	11,659
Nov 89	Issue Plng Instr on Congr Adds	35	141,380	2,827
	Start Dir Dsgn on Congr Adds	35	141,380	8,483
				132,496

Figure 4-4

SUMMARY OF COST ANALYSIS

	Current	Proposed
Overall Design Costs	$165.4 Mil	$132.5 Mil
Projects partially design-no program	163	0
Projects fully design- no program	89	0
Projects behind schedule due to late adds	105	35

Figure 4-5

As the figures show, the current process leads to wasted design money. Following the current process leads to many projects being held at 35 percent design or completed to 100 percent design but not identified for funding in a budget year. In fact, projects currently being held will not be funded before FY 93, and maybe later. According to John Chambless of Chambless and Associates, after a project is put on a hold

at the 35 percent design level for two years or at the 100 percent level for three to four years, expensive re-design is normally necessary. Up to 50 percent of the design effort or three or four weeks of addition design effort could be lost getting back on a project after it has set for a period of time.[18] It is not unusual for a project to be in and out of funded programs with design and re-design efforts starting and stopping over three to five years. For example:

> The Consolidated Fuel Control Facility at Tinker AFB was originally in the FY 86 MILCON and part of the AF POM in April 1984. Design was authorized to 35 percent in August 1984. In March 1985 the project was slipped to FY 87 MILCON. In February 1986, direction was given to hold the project at 35 percent design; the project had slipped to FY 88 and was outside the funding level for FY 88. In August 1986, the project was placed in the FY 89 MILCON. OSD directed design continue to 100 percent in November 1986. In February 1987, design was put on hold due to shortage of design funds. Authority to resume design was authorized in October 1987. The project scope was changed and design was back to 35 percent in March 1988. That same month, Hq AFLC placed the project in the FY 92 MILCON. By July 1988, the project was moved to the FY 90 MILCON, and by January 1989 it was back in the FY 92 MILCON. In January 1990, authorization to design to 100 percent was authorized since Congress directed the project cost be increased and inserted in the FY 91 MILCON. The project currently stands at 35 percent designed.[19]

DESIGN LOSSES - IDENTIFIED IN FY 88

Design breakage is defined as design funds lost due to canceled projects. Lost design is the cost to re-design a project, and could result from any of the following: a project being slipped through several years, resulting in obsolete design; change in scope; new

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[18]See Interview with John Chambless, 6 Apr 90

[19]See PDC data base data, 14 Feb 90.

equipment installation requiring adjustments to electrical and heating, ventilation and air conditioning systems; change in location on the installation; change in a facility to support a different weapons system (F-4s upgrading to F-16).[20]

According to data extracted from the Programming, Design and Construction (PDC) database, 31 projects worth an estimated $61,448,000 were canceled during FY 88. This represents the loss of $3,863,000 of design funds. This does not mean that the decision was made in FY 88 to put the project on hold, it merely means that the MAJCOM engineer/user decided the project was no longer required. Several of the projects had been in the FY 85 MILCON budget and some were future projects with minimal design effort having been expended.[21]

On a similar report from the PDC database, the Air Force identified 132 projects totaling $585,601,000 on which design money was lost.[22] This lost design represents $40,722,000 worth of design funds that were expended without resulting in a usable facility for the Air Force. The dynamics among the Air Force, Congressional "machinery," and world affairs will never allow the Air Force to eliminate all lost design. However, much of this could have been eliminated using the streamlined MILCON process.

The 163 [132 + 31] projects ranged from two percent designed (or only the preparation of initial paperwork being prepared) to 100 percent

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[20]See Interview with Larry Bridges, HQ USAF/LEEPR, 6 Feb 1990

[21]See PDC Computer Report, "Lost Design - Current Year," Nov 88

[22]Ibid.

designed (ready for construction) as follows:

Design Breakage/Lost Design[23]

3 projects	2% (or less) designed
23 projects	2% to 34% designed
49 projects	35% to 99% designed
87 projects	100% designed

Figure 4-6

An A-E contractor related the following story of an Air Force project he was involved in.

> The project was 100 percent designed for the FY 85 Air Force MILCON. The project fell out of the budget. It was inserted in the FY 90 MILCON at the original price. The project had to be resized from two buildings to one building because of inflation from 1985 to 1990. In addition, the users wanted a different exterior and interior. After the project was under re-design due to price problems the user increased the re-design effort by changing the interior colors and fabrics four times.[24]

The Air Force paid for the original design to 100 percent, then later paid for re-design to a lower scope. In addition, the Air Force paid for addition re-design because the user and the commanders changed the interior colors and fabrics four more times.

COSTS ASSOCIATED WITH THE LENGTHY PROCESS

Each time a project is held at some stage of design there is an expense, whether it is to make additions, corrections, modifications, or to revalidate the accuracy of the design. This cost can range from

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[23]Ibid.

[24]See Interview with John Chambless, 6 Apr 90

several thousand dollars to six percent of the project construction costs for complete re-design.

The process length is frequently extended as a result of budget reductions or other conditions outside the control of the local and MAJCOM engineers and commanders. However, the longer the time from the original idea to start of construction, the more commanders/users get involved each creating changes to the project. As an example:

> In 1973, a PACAF base identified that there was a need for a new Wing Headquarters facility. The original scope of the facility was approximately 15,000 square feet. Several years later, an operations/ intelligence facility was added to the construction "wish list", also approximately 15,000 square feet. Both facilities were subsequently sited on the base master plan. By 1982, the decision was made to combine the facilities and provide a degree of survivability (new requirement) by hardening the facility, now totaling 30,000 square feet. The project was submitted to HQ PACAF with new siting and included in the FY 83 MILCON proposal for the Air Force. Subsequently design was started. The original proposal called for the facility to be half underground and half aboveground. In 1983, a new wing commander decided the facility should face the flightline, cause a complete resiting which inturn resulted in some redesign. Over the course of successive wing commanders, the project slipped to the FY 85 MILCON and was approved by Congress. When the design was approximately 65% complete, it was determined that due to soil conditions and the high water table, the facility had to be completely above ground. The design regressed to approximately 20%. In 1984, a new wing commander decided the facility floor plan approved in 1983 was not correct (from his view point), thus resulting in some minor re-design. In 1985, new communications equipment made the command post area unacceptable and the successive commander wanted to rotate the facility floor plan by 90 degrees. Again more re-design. Finally, in early 1986 ground was broken and construction started on the facility. The 18 month construction time was lengthened to over three years, because all of the changes in floor plans and electrical and heating requirements had not been thoroughly debugged.[25]

The complete lack of planning, tied to a project that at worst

[26]See Personal notes of author

covered 17 years and at best covered nine years, resulted in a project that waspoorly executed and expensive for the Air Force. Sixteen wing commanders and their staffs worked on the project, using a facility that flooded every time it rained, lost power several times weekly and had a sewer system that regularly backed up into the facility. Each year there are a number of projects that resemble this project.

It difficult to tie down the exact dollar costs that results from projects like the wing headquarters. There is obviously a high frustration factor that leads to other inefficiencies, in addition to the inefficiency that results from working in badly deteriorated facilities for the time it takes to re-design and construct new ones. These costs are all added to the out-of-pocket costs actually paid to the A-E contractor and the change order costs that the Air Force has to pay to the construction contractor.

COSTS RESULTING FROM POOR PLANNING

The idea of a planning effort before a project is programmed and executed is not a new concept. The 35 percent milestones on the MILCON program have all but forced the Air Force to put a project in the MILCON program three years early and start design on the project soon after. This has resulted in the facility planning effort being combined with the design phase. Even when this works satisfactorily, it does leave a large margin for error. It has relegated detailed area or sub-area planning to be accomplished after the first facility in a new area is in the design stage. Frequently, only individual facility planning is ever formally accomplished and little or no concern is shown for what the surrounding

area will look like, and how it will be architectually compatible to everyone who uses and sees the area. Often, the thought of landscaping and hardscaping are not even thoroughly considered until after the project is constructed and the area looks totally unappealing. In order to demonstrate two extremes of how "not" and how "to" accomplish proper prior planning, I will relate two real world examples.

> Again at the same PACAF base, in 1983 the dormitory construction program took off like a shot with $20-50 million per year being funded for new dorms over a four year timeframe. The small contonment area of the base combined with a height limit of three stories (due to soil conditions) posed a serious planning problem. In an effort to meet the 35 percent design milestone and have facilities sited before the project was submitted to Congress, a small portion of the base was selected and the dorms arranged in an attractive, efficient, but congested manner. The solution was acceptable when one considered the two to three block area used for siting the dorms. The issue was forgotten until two years later when construction was to begin. Looking at the "big picture" of the base, two dormitories strattled the single traffic artery through the base. It forced all traffic to be routed to a flightline road and then back to the main road. The siting was satisfactory if no external conditions were considered, but totally unacceptable when the mission of the base and the flow of people and traffic was considered.[26]

[26]Ibid.

On the other hand, when the full spectrum of the immediate facility needs are blended with current and future architectural desires, and when landscaping and hardscaping of the area are considered, the result is simple, attractive, functional, efficient and economical.

> When the senior leaders of the Air Force decided to expand the AF Senior NCO Academy at Gunter AFB, there was an effort to start design and construction immediately. The addition had to provide additional classroom and auditorium space, double the amount of dormitory space and increase parking without disrupting the current course work or abandoning the existing facilities. A small O&M project followed by a $900,000 addition of classroom and computer support space in the first year allowed a thorough planning phase to be accomplished. During this phase the original concept developed by the users was shown to be somewhat inefficient and architectually and aesthetically unappealling. These problems would have probably been recognized before construction began but would have delayed the expanded academic program. By requiring the architect to develop a sub-area plan that set a theme and style for the academic area, the Air Force will receive the expanded academic facility it needs, and it will be accomplished in an efficient and attractive manner.[27]

Again, it is difficult to determine precisely how much money could have been saved on the dormitory project if it had been planned and designed correctly. It is also difficult to determine how much money was actually saved on the AFSNCOA facilities.

There are also savings in attitude, motivation, retention and enthusiastic employees. The Senior NCO Academy will be a pleasing place to attend school as well as an attractive complex for everyone that works and travels through Gunter AFB.

A new state house office building was recently completed in Montgomery, Alabama. The facility is elegant by Air Force standards. The facility was completed at a cost of $63 per square foot. The A-F

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[27]Ibid.

fully studied the requirement, proposed a versatile facility and provided the needs of the users. The user needs and concerns and architectual compatibility were all resolved before the design was complete and the construction started.[28] The Air Force pays over $100 per square foot for a facility that is utilized for the same functions.[29]

COST ASSOCIATED WITH LACK OF RESPONSIVENESS TO CHANGE

The budget changed from the lean Carter years to the robust Reagan era to budget that will likely reflect the drastically changing threat of the Warsaw Pact nations. There is no indication that rapid changes will soon subside. As has been previously noted, the lengthy process of the MILCON program does not readily adapt to changes without exacting a high cost.

The items listed on page 37 reflect some reasons for changes in the MILCON budget. In January 1990, Secretary of Defense Cheney announced that all moneys appropriated for FY 90 for design of MILCON projects approved and in the future and the award of all MILCON construction contracts would be held pending future actions by the Department of Defense.[30] Two years ago when the Base Closure Commission announced the closure of five Air Force bases, there was $47 million worth of projects for those installations in the Air Force FY 90 MILCON program.[31]

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[28]See Interview with John Chambless, 6 Apr 90

[29]See "Historical Air Force Facility Costs," AFESC, May 88

[30]See SECDEF ltr, Military Construction Moratorium and Review, 24 Jan 90

[31]See Dept of AF, Military Construction Programs, Apr 88

It is unrealistic to suggest that this situation will not recur. The current FY 92 MILCON budget contains nearly $2,300,000,000 worth of projects.[32] With the Air Force MILCON appropriation averaging less than $1.25 billion since FY 87, there is no reason to expect a 60 percent increase in FY 92, when the balance of the DoD budget is decreasing. However, if the Air Force is to meet the current 35 percent milestone for the projects that do survive and ultimately get submitted to Congress for FY 92, design should have been started in September 1989.

History has shown that the Air Force rate of success in a particular year compared to the projects that were designed for that year is not very good.

IMPACT OF LESS THAN HIGH QUALITY

One of the results of designing projects in 1989 that are intended to be constructed in 1992, but may not get appropriated until 1994, is that the Air Force frequently ends up designing a project to cost rather than to requirements. If great care is not taken, a project gets designed to 35 percent in 1989 and sits on a shelf at a pre-inflationary cost until 1993-94, at which time the project gets a high enough priority to be submitted to Congress. If the requirements have not been revalidated and the cost updated, the project could easily get approved by Congress at the wrong cost. Since projects are appropriated by line item, the Air Force would be forced to design and build a facility to the specific cost appropriated by Congress rather than the cost that supports the 1994 requirement. The end result is the Air Force gets a facility

[32]See PDC Computer database, FY 92 MILCON Rpt, Feb 90

that does not meet the needs of its users.

If planning is not placed before programming, the hardscape of a facility may not match the rest of the installation's architectural plan. One base in the southern U.S. has four new facilities within four blocks of each other. Each facility has a complete and contradictory architectural style and hardscape. This area of the base is unappealing even though the facilities are new and the Air Force has invested $45 million in facility construction.

OTHER SAVINGS

A number of users and commanders, from squadron commanders to MAJCOM commanders, have had unpleasant experiences attempting to solve a facility problem at their installation. From their perspective, it may seem that the engineers are not providing proper support. However, the problem may not be the engineers, but rather the process and procedure the engineers have been using. It must seem ridiculous to a wing commander that it will take an average of seven to eight years to get a new squadron operations or aircraft maintenance facility. In most cases, the third or fourth successive commander will see the needed facility. If the proposal could cut that timeframe by two or three years, some of the frustration would be eased.

By law, the Air Force must use the Army Corps of Engineers and the Navy Facility Command as design and construction agents. If the Air Force ceased to design 400 projects each year to 35 or 100 percent level and designed only 250 projects to the 100 percent, there could be a significant reduction in the number of personnel required by the Army and

the Navy to monitor these additional 150 project designs. In addition, if the Army and the Navy, whose MILCON budget figures are nearly equal to those of the Air Force, adopted the proposed process, the manpower savings recognized by not partially designing 400 to 500 projects each year should be substantial. I do not propose that the manpower savings could be straight-lined in comparison to the current program, but it does appear that a significant savings could be realized.

If the Air Force could reduce the amount of projects and dollars on the lost design report that must be submitted to Congress, it seems likely that the respect and reputation of the Air Force would improve on the Hill. If the Air Force could reduce the number of cost overruns and requests for addition authorization and appropriation authority for these overruns, again the Air Force reputation on the Hill should improve.

Savings could result from properly improving facilities on a base the first time, and making these facilities efficient and attractive. The attitude and moral of the personnel assigned would improve, resulting in increased efficiencies in their specific areas. According to General Creech, the attitude and moral of TAC improved as the appearance of the facilities improved.[33] Most of TAC's efforts were minor cleanup, paint up projects, not the complete new facilities or complex that is accomplished through the MILCON program. Improvement in facilities will realize improvements in daily productivity.

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[33]Gen Creech's presentation to AWC, Sep 89

CHAPTER VI

CONCLUSIONS

The current procedure for design of the MILCON program is slow, lengthy and expensive. It accomplished the original objectives of DoD and Congress in the mid-1970's, but has been overcome by budget reductions, technological increases of computer aided design and parametric project cost estimating.

As this paper has pointed out, it is time for a change to streamline the MILCON design process. The process can be made shorter, less expensive, more responsive, with better planning and ultimately provide a higher quality product for the Air Force.

The proposed process would shorten the design process from 28 months to 16-20 months. Project definition would begin 6 months before Congressional submittal and direct design would be started with the MILCON is submitted to Congress. This shortened process would save approximately $33 million per year for the Air Force. If the same savings is straight-lined extrapolated for the Army and Navy MILCON programs the savings could be as high as $90 million. In addition, the Army Corps of Engineers and Navy Facilities Command, the Air Force design agents could reduce their in-house design work force thus saving additional money. The timing is excellent since the Army is looking at a 25 percent force reduction.[1]

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[1]See Montgomery Advertiser article, 15 Apr 90

A side benefit is the responsiveness of the proposed process. Over 400 projects in the original Air Force FY 89/90 MILCON program did not make the Congressional submittal due to higher priorities and/or budget reductions. Four hundred users expected a new facility and did not see that promise materialize. High priority projects that are identified within five *to six months of the Congressional submittal, can meet all the required gates to allow proper architectural-engineering analysis and cost estimating.

The best benefit is this process puts planning before design by making the A-E accomplish a complete project definition with the assistance of the user before the Air Force commits to full design. If the project can not be completed for the originally estimated price, the project can be adjusted or deferred before it is reviewed by Congress.

The Air should fully implement the proposed streamlined process effective with the next budget cycle, the FY 92 MILCON program. It will result in a more efficient, more timely design process and result in a higher quality product for Air Force users

NOTES

CHAPTER I(Pages 1-3)

1. Message, AF/LEE to all MAJCOM/DE, 221940ZSEP89, subject: Design Dollar Decentralization. 22 Sep 1989.

CHAPTER II (Pages 4-13)

1. "Senate Authorization Report 94-856" on the DoD Military Construction Program for FY 77, 1977, p. 10.

2. Design Breakage [definition]: Design funds lost due to significant changes in the requirement or obsolete designs.

3. "Senate Authorization Report 95-125" on the DoD Military Construction Program for FY 78, 1978, p. 12-13.

4. Hearings before the House Appropriations Committee, House of Representatives, 97th Congress, Subcommittee on Military Construction Appropriations, Part 6, 1982, p. 139-140.

5. Ibid.

6. Design and Construction Management, Air Force Regulation 89-1, 20 June 1978, p. A19-22. [Same data found in Army Regulation 415-5 and Navy Design Manual 6.]

7. Timeline developed from PBBS Primer and experience of author managing the FY 87 through FY 91 Air Force MILCON program at Hq USAF.

8. Ibid.

9. Study Group was established by Maj Gen Ahearn, AF/LEE, to study the MILCON design problems and recommend a solution to streamline the process and improve the quality of the resulting facilities. Members were: LtCol Olmstead (Chrmn)-AF/LEEPR, Mr. David Nichols - AF/LEED, Mr. Gary Lynn, - AFRCE Central Region, Mr. James Calfee - Hq TAC/DEF, Mr. Edward Bakunas - AF/LEED, Mr. Paul Parker - Dep BCE Tyndall AFB, Ms. Rita Gregory - Hq AFESC/DEC.

10. "Improving the MILCON Process" briefing slides used by USAF, USA, USN, and USMC engineering chiefs to present the proposal to DoD and selected Congressional members, Sep 1989.

11. Hearings before the House Appropriations Committee, House of Representatives, 96th Congress, Subcommittee on Military Construction Appropriations, Part 6, 1980, p. 138.

12. "Military Construction History" report. This report was compiled by Hq USAF/LEEPD and provides the historical MILCON data as the projects moved through the process. Data dates from FY 74 to present, May 1989.

13. Hearings before the House Appropriations Committee, House of Representatives, 96th Congress, Subcommittee on Military Construction Appropriations, Part 6, 1980, p. 138.

14. Ibid.

CHAPTER III (Pages 14-21)

1. Study Group was established by Maj Gen Ahearn, AF/LEE, to study the MILCON design problems and recommend a solution to streamline the process and improve the quality of the resulting facilities. Members were: LtCol Olmstead (Chrmn)-AF/LEEPR, Mr. David Nichols - AF/LEED, Mr. Gary Lynn, - AFRCE Central Region, Mr. James Calfee - Hq TAC/DEE, Mr. Edward Bakunas - AF/LEED, Mr. Paul Parker - Dep BCE Tyndall AFB, Ms. Rita Gregory - Hq AFESC/DEC.

2. Briefing presented to House Armed Services Committee, Subcommittee on Military Construction staffers and Senate Armed Services Committee, Subcommittee on Installations and Military Construction, 4 Feb 1989.

3. Study Group was established by Maj Gen Ahearn, AF/LEE, to study the MILCON design problems and recommend a solution to streamline the process and improve the quality of the resulting facilities. Members were: LtCol Olmstead (Chrmn)-AF/LEEPR, Mr. David Nichols - AF/LEED, Mr. Gary Lynn, - AFRCE Central Region, Mr. James Calfee - Hq TAC/DEE, Mr. Edward Bakunas - AF/LEED, Mr. Paul Parker - Dep BCE Tyndall AFB, Ms. Rita Gregory - Hq AFESC/DEC.

4. "U.S. Congressional Record - Senate." Subject: DoD Military Construction Program language, 6 Nov 1989, p. S14998-9.

5. "Improving the MILCON Process" briefing slides used by USAF, USA, USN, and USMC engineering chiefs to present the proposal to DoD and selected Congressional members, Sep 1989.

6. Study Group was established by Maj Gen Ahearn, AF/LEE, to study the MILCON design problems and recommend a solution to streamline the process and improve the quality of the resulting facilities. Members were: LtCol Olmstead (Chrmn)-AF/LEEPR, Mr. David Nichols - AF/LEED, Mr. Gary Lynn, - AFRCE Central Region, Mr. James Calfee - Hq TAC/DEE, Mr. Edward Bakunas - AF/LEED, Mr. Paul Parker - Dep BCE Tyndall AFB, Ms. Rita Gregory - Hq AFESC/DEC.

7. Interview with Mr. John Chambless, Chambless and Associates - Architects, Montgomery, Alabama. Subject: experiences constructing the Alabama State House office building, problems dealing with military (Air Force) design needs and time tables, 6 April 1990.

8. "Improving the MILCON Process" briefing slides used by USAF, USA, USN, and USMC engineering chiefs to present the proposal to DoD and selected Congressional members. Sep 1989. In addition, author's view are incorporated in the dates and the action to be taken.

CHAPTER IV (Pages 22-28)

1. "FY 88 Joint [House-Senate] Conference Appropriations Conference Report" on DoD Military Construction Program for FY 88, 100th Congress, 22 Dec 1987.

2. Ibid.

3. Study Group was established by Maj Gen Ahearn, AF/LEE, to study the MILCON design problems and recommend a solution to streamline the process and improve the quality of the resulting facilities. Members were: LtCol Olmstead (Chrmn)-AF/LEEPR, Mr. David Nichols - AF/LEED, Mr. Gary Lynn, - AFRCE Central Region, Mr. James Calfee - Hq TAC/DEE, Mr. Edward Bakunas - AF/LEED, Mr. Paul Parker - Dep BCE Tyndall AFB, Ms. Rita Gregory - Hq AFESC/DEC.

4. Programming, Design and Construction (PDC) automated database used by the USAF at Hq USAF, MAJCOM's and base level to monitor/manage the Air Force MILCON (and other) construction program. Specific screens shown are from the Automated Air Force Pricing Guide subsystem that provides project cost estimates using parametric cost estimating techniques.

5. Ibid.

6. Study Group was established by Maj Gen Ahearn, AF/LEE, to study the MILCON design problems and recommend a solution to streamline the process and improve the quality of the resulting facilities. Members were: LtCol Olmstead (Chrmn)-AF/LEEPR, Mr. David Nichols - AF/LEED, Mr. Gary Lynn, - AFRCE Central Region, Mr. James Calfee - Hq TAC/DEE, Mr. Edward Bakunas - AF/LEED, Mr. Paul Parker - Dep BCE Tyndall AFB, Ms. Rita Gregory - Hq AFESC/DEC.

CHAPTER V (Pages 29-50)

1. "Department of the Air Force, Military Construction Program." This document includes the Air Force MILCON annex to the Air Force Program Objective Memorandum (POM) submitted to OSD for the FY 87 to FY 91 FYDP, April 1986, p. 1-18.

2. "Department of Defense Budget for FY 89 (Estimate), Construction Program (C-1)." DoD document includes the service's MILCON submittal to OSD for the Program Budget Decision (PBD) review cycle. FY 89 was the second year of this first biennial submittal, Sep 1986.

3. "Department of Defense Budget for FY 89, Construction Program (C-1)." DoD document includes the entire DoD MILCON submittal to Congress for authorization and appropriation. FY 89 was the second year of this first biennial submittal, Congress did not take action on the FY 89 program when it was submitted as the second year of the biennial budget, Jan 1987.

4. "Department of Defense Budget for FY 89 (Estimate), Construction Program (C-1)." DoD document includes the service's MILCON submittal to OSD for the Program Budget Decision (PBD) review cycle. FY 89 became the primary year, Nov 1987.

5. "Department of Defense Budget for FY 89, Construction Program (C-1)." DoD document includes the entire DoD MILCON submittal to Congress for authorization and appropriation, Feb 1988.

6. "FY 89 Air Force MILCON Report", is a report retrieved from the Programming, Design and Construction (PDC) database system showing the outcome of Congressional action for the Air Force FY 89 MILCON, Nov 1988, p. 1-57.

7. "Department of the Air Force, Military Construction Program." This document includes the Air Force MILCON annex to the Air Force Program Objective Memorandum (POM) submitted to OSD for the FY 88 to FY 92 FYDP, Apr 1988, p. 1-18.

8. "Department of Defense Budget for FY 90 (Estimate), Construction Program (C-1)." DoD document includes the service's MILCON submittal to OSD for the Program Budget Decision (PBD) review cycle. FY 90 was the first year of this biennial submittal, Sep 1988.

9. "Department of Defense Budget for FY 90, Construction Program (C-1)." DoD document includes the entire DoD MILCON submittal to Congress for authorization and appropriation, Jan 1989.

10. "Department of Defense Budget for FY 90, Construction Program (C-1) Amended." DoD document includes the entire DoD MILCON submittal to Congress for authorization and appropriation of the Amended DoD budget submitted by President Bush, Mar 1989.

11. "FY 90 Air Force MILCON Report", is a report retrieved from the Programming, Design and Construction (PDC) database system showing the outcome of Congressional action for the Air Force FY 90 MILCON, Nov 1989, p. 1-57.

12. Ibid.

13. "FY 89 Air Force MILCON Report", is a report retrieved from the Programming, Design and Construction (PDC) database system showing the outcome of Congressional action for the Air Force FY 89 MILCON, Nov 1988, p. 1-57.

14. "FY 90 Air Force MILCON Report", is a report retrieved from the Programming, Design and Construction (PDC) database system showing the outcome of Congressional action for the Air Force FY 90 MILCON, Nov 1989, p. 1-57.

15. "FY 90 Air Force MILCON Report", is a report retrieved from the Programming, Design and Construction (PDC) database system showing the outcome of Congressional action for the Air Force FY 90 MILCON, Nov 1989, p. 56-57. Plus $41 million shortfall currently being reprogrammed per Hq USAF/LEEP.

16. Interview with Mr. Larry Bridges, Senior Programmer, Hq USAF/LEEPR, 6 Feb 1990.

17. Ibid.

18. Interview with Mr. John Chambless, Chambless and Associates - Architects, Montgomery, Alabama. Subject: experiences constructing the Alabama State House office building, problems dealing with military (Air Force) design needs and time tables, 6 April 1990.

19. Data collected from the Programming Design and Construction (PDC) database used by Hq USAF, MAJCOM's and base level to monitor/manage the MILCON program. Data was collected by direct inquiries into the historical database records, 14 Feb 1990.

20. Interview with Mr. Larry Bridges, Senior Programmer, Hq USAF/LEEPR, 6 Feb 1990.

21. "Lost Design - Current Year", a Programming Design and Construction database report generated to show the lost design on the books as of the date of the inquiry, Nov 1988.

22. Ibid.

23. Ibid.

24. Interview with Mr. John Chambless, Chambless and Associates - Architects, Montgomery, Alabama. Subject: experiences constructing the Alabama State House office building, problems dealing with military (Air Force) design needs and time tables, 6 April 1990.

25. Personal notes of the author. Author was assigned to the base from 1972-73 as a programmer, later managed the PACAF MILCON program. In 1985 he was the Base Civil Engineering Commander and later managed the MILCON program at Hq USAF. Data was also collected from Programming, Design and Construction (PDC) database inquiries.

26. Ibid.

27. Personal notes of the author. Author managed the MILCON program at Hq USAF. Data was also collected from Programming, Design and Construction (PDC) database inquiries.

28. Interview with Mr. John Chambless, Chambless and Associates - Architects, Montgomery, Alabama. Subject: experiences constructing the Alabama State House office building, problems dealing with military (Air Force) design needs and time tables, 6 April 1990.

29. "Historical Air Force Facility Costs," Air Force Engineering and Services Center, Tyndall AFB, FL, May 1988.

30. Letter, Secretary of Defense to Service Chiefs, subject: Military Construction Moratorium and Review, 24 Jan 1990.

31. "Department of the Air Force, Military Construction Program." This document includes the Air Force MILCON annex to the Air Force Program Objective Memorandum (POM) submitted to OSD for the FY 90 to FY 94 FYDP, April 1988, p. 1-18.

32. "FY 92 MILCON Report", from Programming, Design and Construction (PDC) database. Inquiry made to compare projects that had been in previous years MILCON programs and are now in the FY 92 Air Force MILCON, Feb 1990.

33. Presentation by General Creech to the Air War College Sep 1989.

CONCLUSION (Pages 51-52)

1. "Army Agrees to Cut Troops One Quarter", Sunday Montgomery Advertiser, No. 88, 15 Apr 1990.

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Design Dollar Decentralization. Message, 221940ZSep89, AF/LEE to all MAJCOM. 22 Sep 1989.

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