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Report to Sen. Quentin N. Burdick, Chairman, Senate Committee on Environment and Public Works: Regional and Community Development Subcommittee; by Robert F. Keller, Acting Comptroller General.

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The General Services Administration (GSA) used the "innovative building systems concept" in constructing three Social Security Administration (SSA) program centers at a cost of about $115 million. This was the pilot for the new concept, which emphasizes performance specifications--setting down what a building should do regardless of the materials used--rather than the traditional specifications, such as how to build and what materials to use. Bidders had to prepare acceptable technical proposals before bidding competitively on the entire package of seven individual systems to be included in each of the three SSA centers. Findings/Conclusions: Although GSA established adequate procedures to monitor contract compliance, they did not use them to assure that the building systems portion met the performance specifications. Despite GSA's project controls, the project goals were not fully met because the project was not complete in 3 years due to site, funding, design, and foundation problems. The project cost was more than $110.5 million due to additional fire protection, acoustical work, and the cost incident to schedule delays, and the project did not provide buildings with lower life-cycle costs such as energy conservation and reduced cost of maintenance and operation. The project has not stimulated innovative approaches to construction and precipitated demand for the building systems concept in the Government and private industry, since only a few firms that participated in the program centers project are participating in the GSA follow-on projects using the concept. (Author/SC)

REPORT OF THE COMPTROLLER GENERAL OF THE UNITED STATES

General Services Administration's Use Of New Construction Concept For Federal Buildings Not Yet Successful

General Services used the "innovative building systems concept" in constructing three Social Security Administration program centers at a cost of about $115 million. This was the pilot for the new concept which emphasizes performance specifications--setting down what a building should do regardless of materials used--rather than the traditional specifications (how to build and what materials to use). Bidders had to prepare acceptable technical proposals before bidding competitively on the entire package of seven individual systems to be included in each of the three centers.

However, the pilot project did not

- --meet estimated completion schedules and total costs;
- --meet life-cycle objectives, such as energy, conservation, and reduced cost of maintenance and operation; and
- --stimulate use of the systems concept by private industry or other public agencies.

LCD-77-322

OCTOBER 6, 1977

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-164031(4)

The Honorable Quentin N. Burdick, Chairman
Subcommittee on Regional and Community
Development
Committee on Environment and Public Works
United States Senate

Dear Mr. Chairman:

In response to the February 16, 1975, request from the Chairman, former Subcommittee on Buildings and Grounds, Senate Committee on Public Works, this report describes the General Services Administration's experience in its initial use of an unconventional design and construction technique--the building systems concept--to acquire three Social Security Administration's program centers. It discusses both the contracting and the adverse conditions encountered during actual application of the concept.

As arranged with your Committee, we are sending copies of this report to the Chairmen, Senate Committee on Environment and Public Works and House Committee on Public Works and Transportation; and the Administrator of General Services.

Sincerely yours,

Acting Comptroller General
of the United States

REPORT OF THE COMPTROLLER GENERAL OF THE UNITED STATES

GENERAL SERVICES ADMINISTRATION'S USE OF NEW CONSTRUCTION CONCEPT FOR FEDERAL BUILDINGS NOT YET SUCCESSFUL

D I G E S T

The General Services Administration used a new building systems concept in constructing three Social Security Administration's program centers. A single seven subsystem contract was awarded for structure, heating, ventilating and air conditioning, electricity, finished floor, finished ceiling, lighting, and space dividers to be constructed of any materials desired as long as what was being built met certain standards when completed. Although contracts are normally awarded for an entire building, in this case, other building parts were designed and contracted for separately. This pilot project did not meet the cost or performance goals set for it and did not result in a widespread adoption of the systems concept. The systems portion of the buildings made up about 28 percent of the $115 million total cost.

A further innovation was using the team approach for constructing the centers. General Services followed Federal procurement regulations in hiring its team members--the construction manager, the executive architect, the three regional architects, and the building systems contractor. (See p. 5.)

The building systems contract was awarded on the basis of performance specifications (setting down what the building should do, regardless of materials used) under the two-step, formal advertising method of contracting. The other 67 construction contracts were awarded on the basis of prescriptive specifications (how to build and what materials to use) under the formal advertising and competitive-bid method. On the building systems contract General Services

--obtained considerable competition in step one but only limited competition (only three of nine firms qualified) in step two.

The competition at each step may have been limited because no single firm could do the work, firms had to form consortiums, and specification interpretations and technical proposal preparations were complex and costly (see p. 15);

--did not properly include finance costs in its life-cycle cost analyses (see p. 22); and

--caused problems by including a 9-year obligation for maintenance in the award price (see pp. 23 and 38).

General Services established adequate procedures to monitor contract compliance but did not use them to assure that the building systems portion met performance specifications. For example,

--construction on the building systems began before prototype test approvals (see p. 27),

--General Services did not enforce strict compliance with the specification requirements (see p. 28), and

--compliance of certain items with the specifications could not be determined (see p. 29).

The lack of assurance regarding building systems initially meeting performance specifications could hinder establishing liability should any part of the centers systems fail.

Despite General Services' project controls, the project goals were not fully met because

--the project was not complete in 3 years due to site, funding, design, and foundation problems (see p. 33);

--the project cost was more than $110.5 million due to additional fire protection, and acoustical work, and the cost incident to schedule delays (see p. 34);

--the project did not provide buildings with lower life-cycle costs (the two centers which have been in operation for a while are high energy users and maintenance of the buildings has been unsatisfactory and costly) (see p. 38);

--the projects' inflexible water-cooled lights and the poor air flow have created problems in the operation and management of the buildings (see pp. 44 and 45); and

--the project has not stimulated innovative approaches to construction and precipitated demand for the building systems concept in the Government and private industry, since only a few firms that participated in the program centers project are participating in the General Services follow-on projects using the concept (see p. 47).

The building systems concept was responsible for the failure to meet the maintenance goals. GAO could not determine the extent to which the concept was responsible for failing to meet other project goals, because the concept was interrelated with other procurement concepts.

MERITS OF THE CONCEPT

GAO briefly looked into the General Services' building systems concept on the follow-on Social Security Administration's expansion project. (See p. 47). Although the project is in the early stages of construction, General Services

--has not reduced the development and design timeframe as expected, and

--will probably take over 4 years to complete building design and construction.

General Services was justified in experimenting with the building systems concept as a way to reduce acquisition costs and to increase operation and maintenance efficiency.

Tear Sheet.

Numerous problems arose on the pilot project after General Services awarded contracts and began construction on the follow-on building systems project. General Services appears to have rushed its follow-on project and may incur problems like those with the pilot project.

The declining competition for the systems contracts on the follow-on projects is a serious problem.

The construction industry needs to participate more if anticipated benefits are to materialize.

AGENCY COMMENTS

General Services generally agreed with GAO's findings and conclusions. It said that it has corrected some of the pilot project's shortcomings and is taking steps to correct other problems. (See app. II.)

General Services further stated that after the projects are constructed, it proposes to thoroughly evaluate the advantages and disadvantages of the systems approach for building acquisition.

Contents

ABBREVIATIONS

AE	architect engineer
Btu	British thermal units
CM	construction manager
HEW	Department of Health, Education, and Welfare
EAE	executive architect engineer
GAO	General Accounting Office
GSA	General Services Administration
HVAC	heating, ventilating, air conditioning
OMB	Office of Management and Budget
SSA	Social Security Administration

CHAPTER 1

INTRODUCTION

The Chairman of the former Subcommittee on Buildings and Grounds, Senate Committee on Public Works, in his letter to us (see app. I), expressed concern over the General Services Administration's (GSA's) proposed use of a new building systems concept in the construction of new Social Security Administration (SSA) facilities in the Baltimore metropolitan area. He questioned the further use of this concept since three similar SSA buildings (Program Centers 1/ in Philadelphia, Pennsylvania; Chicago, Illinois, and Richmond, California), previously authorized as pilot projects to demonstrate the experimental features of such a concept, were incomplete and had not progressed sufficiently to justify committing funds for the new facilities.

The Chairman stated that the Subcommittee, in fulfilling its assigned oversight responsibilities, desires to examine all facets of the building systems concept as applied in SSA's program centers and ascertain whether continued implementation on other projects should be considered. He requested us to (1) initiate an intensive review and submit a comprehensive report on all contract matters, from solicitation through award, with particular emphasis on aspects which could be construed as inhibiting competition, including the selection of principals and mandatory large scale procurement of material, (2) provide the Subcommittee with our observations regarding the degree of direct control GSA exercised over the projects, considering GSA's delegation of major responsibility by contract to the executive architect engineer (EAE) and construction manager (CM), and (3) comment on the superiority of the building systems concept over conventional construction and on any adverse conditions encountered during actual application of the building systems concept.

BACKGROUND

Prior to the 1970s GSA used the conventional lump-sum method of contracting for the construction of buildings. Under this method, GSA would contract with architects to

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1/Late in the project, SSA changed the name of these buildings from "payment center" to "program center." Since the latter term is the current usage, it has been used throughout this report.

completely design the buildings, including preparation of detailed prescriptive specifications. Construction contracts would then be formally advertised and would normally provide for the submission of lump-sum bids by general construction contractors for the entire buildings. The buildings would then be constructed in accordance with the architects' detailed prescriptive specifications.

In the late 1960s with costs escalating, Federal construction agencies encountered a serious cost-budgetary squeeze. Efforts were increased to find new and better ways to enhance the efficiency and effectiveness of the construction process. During this period, GSA's Public Buildings Service, which is responsible for the design and construction of most civilian Federal buildings, undertook the development of a new approach to Federal construction called the building systems concept in cooperation with the National Bureau of Standards.

GSA's 1970 study report on construction contracting procedures indicated that the Public Buildings Service was not following the practices of private industry and commercial builders who had attacked the problem of rising costs by adopting new practices to reduce design and construction time, and maximize other cost-saving techniques. The report also stated that GSA's sequential method of contracting took too long for design and construction of major building projects compared to similar projects in the private sector. The recommendations in the report included the early completion of building systems' performance specifications and the use of CM and phased construction of buildings.

BUILDING SYSTEMS CONCEPT

Essentially, GSA's building systems concept incorporates performance specifications that define the functional requirements of seven subsystems of an office building in lieu of the traditional prescriptive specifications that detail the specific requirements for the entire office building.

The building system for the three SSA program centers is a closed one of interrelated components designed to act only with one set of other components. Each closed system solution to a building design is unique, with subsystem interchanges or replacements not allowed. Therefore, selecting a system automatically includes selecting all its subsystems and their characteristics, performance, materials, and costs. In an open system, all components are interchangeable and can be coordinated with other subsystems.

In undertaking the procurement of the centers using the building systems concept, GSA expected to (1) deliver the buildings at a cost that would be equal to or lower than conventional construction cost (in this case, at about $110.5 million); (2) deliver the buildings in a shorter time (3 years) than under the conventional method (5 years); (3) consider cost and time factors together, provide that buildings have lower operating costs over time, or in other words, lower life-cycle costs; (4) deliver buildings of a higher-measured performance quality, principally in space flexibility, acoustics, illumination, and conditioned air; (5) stimulate new approaches to construction; and (6) precipitate a market demand for using the building systems concept in the Government and the private sector.

The Public Buildings Service's "Performance Specification for Office Buildings" includes the seven subsystems (often referred to as the insystem) described below for the typical office space.

1. Structure

This subsystem provides the structural frame and entire building framing above the foundations. It excludes the foundations, anchor bolts or dowels, keys in foundation concrete, recesses in foundation walls, finishes for areas outside the typical office space, and stairs in the core and stair wells.

2. Heating, ventilating, air conditioning

This subsystem provides for the conditioning, supplying, diffusing, controlling, and returning means in the floor-ceiling sandwich and mechanical spaces in the cores, and in specially designated mechanical rooms. It provides an appropriate atmospheric and thermal environment when used with out-of-system elements and processes. It excludes:

--The perimeter zone heating, ventilating, air conditioning (HVAC), i.e., the elements within an area extending 15 feet inward from the exterior wall.

--HVAC elements in the space between the ceiling and upper floor, installed by others.

--Smoke detectors, out-of-system room outlets, and HVAC elements for the core and core corridor.

3. Electrical distribution

This subsystem provides all power distribution raceways in the space between the ceiling and upper floor of the project building, between the interface boundaries in the usable floor space, excluding electrical conductors, switching devices, and terminal outlets unless specified.

4. Finished floor

This subsystem provides the uppermost part of the space between the ceiling and upper floor, means of access to the electrical distribution subsystem, if applicable, and floor outlets and door stops. It excludes finished flooring in the out-of-system rooms or floor outlets and door steps in the core corridor and out-of-system rooms.

5. Finished ceiling

This subsystem includes all parts of the uppermost finished surface, including access to the space above the finished surface, means of support, and fire stops, if required. It excludes the finished uppermost surface in the core corridor or out-of-system rooms.

6. Luminaires

This subsystem provides the illumination in conjunction with the electrical distribution subsystem and out-of-system electrical conductors, excluding connection of out-of-system electrical conductors to lighting service terminals, core corridor lighting, and out-of-system room lighting.

7. Space dividers

This subsystem provides the vertical partitions, service panels in partitions, and doors through the partitions, including all necessary door hardware, connection devices between out-of-system electrical subsystems in the service panels, and enclosures or finished surfaces of the structure subsystem's columns or hangers. It excludes partitions, enclosures, or doors in out-of-system rooms and spaces.

On the SSA program centers project, bidders were asked to submit technical proposals on the entire seven subsystems package, with a single contract being awarded for this portion of the project that represented about 25 percent of the total cost.

Competitive bids were requested, and 67 individual construction contracts were awarded for the out-of-system work,

including site preparation, foundation, building facade, electrical and mechanical equipment, and elevators. This differs from the traditional method of contracting where each building project is awarded to a single general contractor.

In addition to the three program centers, the building systems concept is being applied to two buildings near Baltimore to expand SSA's Administrative Headquarters facilities. In congressional testimony during February 1975 on the prospectus for that project, a GSA official stated that this second application of the building systems concept was necessary to get finalization and termination of the innovation already experienced on the program centers. The official added that after the expansion project, the concept will be used on relatively small projects (i.e., from $5 million to $20 million). GSA is currently using the building systems concept in constructing an estimated $14 million Federal office building in Norfolk.

TEAM APPROACH

According to GSA officials, there is little communication between key personnel involved under the traditional method of construction; architects design the buildings and contractors build them, each performing independently. GSA adopted the team approach in constructing the program centers to overcome this obstacle. The team consisted of GSA's project manager, EAE, three regional architect engineers (AEs), CM, and the building systems contractor.

GSA officials believe that the team approach created a cooperative working relationship between the owner, AEs, and contractors, making early formulation of critical project decisions possible by drawing on the experience and knowledge of AEs and CM under contract with the owner.

The primary responsibilities of each team member are summarized below.

Project manager

On July 30, 1971, the GSA Administrator issued an order governing the use of project management and setting forth the roles and responsibilities of project managers.

The use of project management was permitted when one or more of the following conditions existed:

--The estimated cost of the project exceeded $2 million.

--Concurrent design reviews and either phased or turnkey construction was contemplated.

--Unusual organizational complexity was involved, including extensive interoffice or interagency coordination and support.

--Significant technological problems were anticipated.

--Expeditious handling was needed to satisfy urgent requirements.

A GSA order states in part that project managers:

--Would operate under a charter that assigned him by name, defined the scope of the project, and described his authority, responsibility, operating relationship, and assignment and control of resources.

--Would be assigned full time to head a project.

--Must review and approve all major changes affecting plans, objectives, procurement, performance, schedules, or costs.

The manager's June 14, 1972, charter for SSA's program centers designated the manager the single source of decisionmaking within GSA and responsible for planning, directing, and controlling the definition, development, and execution of the project. He was also the contracting officer with final authority over all project funds.

The project manager operated with a small staff, relying on other GSA personnel for technical, administrative, budget, and legal procurement support. A GSA resident engineer represented the manager at each job site during construction of the program centers.

Executive architect/engineer

EAE was responsible for preparing design concepts, providing technical direction, coordinating and reviewing the three regional AEs work, providing postconstruction contract service, and assisting the project manager in requesting, reviewing, and evaluating building systems proposals and documentation.

EAE's role has been described as that of an integrator who aides and supports other team members to focus on the project's overall goals and objectives.

Regional architect/engineers

Each of the three regional AEs was responsible for developing the overall building configuration and design of the subsystems not included in the insystem portion of the respective buildings. They were also responsible for incorporating the insystem portion of their buildings into the total building design. Separate regional AEs were hired for diversity in building plans and exterior appearances, and compatibility of buildings with the surrounding environment.

Construction manager

Under the general direction of the project manager, the construction manager was responsible for (1) managing procurement, (2) furnishing the project manager and the AEs construction technique and market condition information to assure that the building design stayed within the budget, (3) supervising and inspecting the construction, and (4) providing advice on labor relations, construction estimating, and other problems.

Building systems contractor

The building systems contractor for the program centers was a joint venture of manufacturing, designing, and general contracting firms. The joint venture was responsible for designing, manufacturing, and installing the insystem portion of the project.

SCOPE OF REVIEW

Our review was performed primarily at GSA's headquarters office, where the project manager responsible for the construction of SSA's program centers was located. In addition to examining project records, we had many meetings with the project manager and his staff, the construction manager, and with EAE representatives. We also discussed the operation and maintenance of the two completed program centers with GSA regional officials.

Our review was primariy directed toward (1) evaluating GSA's contracting procedures for selecting principal project participants and for large purchases of materials, (2) reviewing the extent and adequacy of GSA's control over the project's expenditures and timeframe, and (3) identifying situations and conditions that were indicative of the superiority or inferiority of the building systems concept over the conventional construction method.

CHAPTER 2

SUBCOMMITTEE'S INTEREST IN GSA'S CONTRACTING PROCEDURES AND PROJECT CONTROLS

GSA generally complied with Federal procurement regulations in contracting for the principals' services on the program centers, obtained competition for the building systems contract, and had adequate controls over the contractors' obligations regarding costs and project schedules.

The principal problems we observed were:

--Two firms had a possible advantage over other firms in the selection process for regional A/Es.

--Exclusion of interest costs from the analysis of life-cycle costs.

--Complication of contract awards and administration by including a 9-year maintenance requirement in the building systems contracts.

--Poor control over the building systems contractor's compliance with performance specifications.

CONTRACTING PROCEDURES

The principals who received contracts for the program centers project were EAE, three regional AEs, CM, and the building systems contractor.

Architect engineers

The policy and procedures for obtaining the professional services of AEs are contained in the Federal Procurement Regulations. We also studied the selection of AE firms and contract awards by Federal agencies, including GSA. Our findings and recommendations are included in a report entitled "Greater Emphasis On Competition Is Needed In Selecting Architects And Engineers For Federal Projects," which was issued on July 21, 1976.

We did not attempt to perform an indepth evaluation of GSA's AE selection and contract award procedures in connection with the acquisition of the program centers since the procedures followed were the same as those for other GSA projects, and these procedures are also discussed in the above report.

GSA selected AEs for contract awards from lists of firms recommended by advisory panels on architecture. The panels consisted of three members selected by GSA's Administrator from a list of firms nominated by regional universities and architectural and engineering societies.

For each prospective award an advisory panel screened the qualifications of AE firms and examined in more depth those considered to have the required capabilities. The panel then recommended the best qualified firms to GSA's Administrator for selection.

In selecting the program centers, the panels recommended the following number of firms to GSA's Administrator.

	Number of firms	
	Considered	Recommended
EAE	31	7
AE:		
Philadelphia	35	5
Richmond	32	6
Chicago	39	10

In selecting regional AEs for the Philadelphia and Richmond program centers, regional advisory panel members may have had an advantage over other firms considered. Of the three members serving on the panel (drawn from the full regional panel) that recommended EAE, two members subsequently served on the panel drawn to select regional AE for the Philadelphia center. This panel recommended, as one of the final five firms, the third member of the former panel who participated in selecting EAE. This member was subsequently awarded the AE contract for the Philadelphia center by GSA's Administrator.

Also, a principal of one of the AE firms recommended for the Richmond center (subsequently awarded the contract by GSA's Administrator) was a member of the full regional advisory panel. The letter that forwarded the list of recommended firms to the Administrator said that the principal of the firm in question did not attend the meeting in which the decision was made as to the firms to recommend.

We were informed that GSA has revised its procedures to exclude from consideration those AE firms whose members are serving on any GSA advisory panel.

Construction manager

GSA procures the services of construction managers under sections 302(c)(10) and 307 of the Federal Property and Administrative Services Act of 1949. The former section permits contracts to be negotiated without advertising if it is impractical to secure competition for the property or services required. The latter section stipulates that the determinations and decisions made by GSA's Administrator concerning contracts negotiated pursuant to section 302 shall be final.

Selecting the construction manager was performed under a two-step competitive negotiation procedure. The first step consisted of determining which of the 30 offerors were most qualified based on preliminary proposals and management questionnaires. The second step consisted of the contract award based on the step-one rankings and the six bidders' step-two bid prices.

We are currently reviewing GSA's and other Federal agencies' construction management at the request of another congressional subcommittee. Our limited review of GSA's procedures in selecting and evaluating prospective construction managers and in awarding a construction manager's contract for the program centers disclosed no impropriety or preferential treatment.

Building systems contractor

The building systems contractor was awarded a contract under the two-step formal advertising contracting method. Under the prevailing conditions GSA was justified in using this method and had made sufficient effort to solicit proposals from all qualified sources. However, we believe that some of GSA's actions in approving technical proposals and in awarding the contract are questionable.

Solicitation for technical proposals

The program centers project was the pilot project for the building systems concept. By combining into a single project the construction of three buildings in widely dispersed locations, GSA hoped that it would be large enough to attract industry competition and innovative approaches to construction. A strenuous attempt was made to attract industry's interest in the concept and to foster competition.

GSA sent October 29, 1971, requests for technical proposals to about 640 firms and individuals, and advertised in the Commerce Business Daily. A questionnaire and a copy of the performance specifications was sent to each. Replies were received from 224 firms, most of which were interested in segments of the building systems rather than the entire system.

Recognizing that no one had the capability alone to undertake the building systems contract, GSA encouraged and assisted the interested firms to form consortiums during the 12 months it took for the preparation of technical proposals. To keep prospective offerors abreast of program developments, GSA's project manager distributed weekly or biweekly project reports. GSA held conferences in November 1971, January 1972, and March 1972 to brief interested firms on the building systems concept and related program aspects. Representatives of about 100 firms attended the January conference.

The initial request for technical proposals had a due date of March 30, 1972, but was later extended to June, August, September, and finally October 6, 1972.

One reason for the extensions was the delay in acquiring sites for the three centers, which meant preliminary drawings could not be issued while there was a possibility of a site shift. The preliminary drawings for the Philadelphia and Chicago centers were issued on June 22, 1972, and for the Richmond center on August 5, 1972. On August 5. 1972, a Chicago center design change eliminated the mezzanine level to reduce the amount of special design required.

Major changes in the performance specifications also required a delay in the date for submitting technical proposals.

During the development of technical proposals, the systems offerors required considerable assistance in interpreting the performance specifications and suggested numerous changes. GSA published nine amendments, some of which were based on requests of prospective systems offerors.

The first amendment, dated March 13, 1972, had 96 pages of changes including:

--An expanded heating, ventilating, and air conditioning subsystem.

--Life-cycle costing as the contract award basis.

--Nine-year optional maintenance.

--Core placement permitting open-office planning.

--Energy cost considerations.

--Acoustical criteria.

--A fire-protection-system evaluation mechanism.

The solicitation of technical proposals covered about one year. Nine offerors submitted proposals on the building systems portion of the project. While generally favoring building systems, officials of several offerors stated that developing the proposals was costly. A GSA official estimated that $250,000 to $500,000 was spent by each offeror in developing the proposal. Several of the offerors developing proposals, however, told us that their estimated costs were less than $200,000.

GSA followed Federal regulations and its contracting procedures in soliciting proposals for the building system from all qualified sources. Despite the high costs of preparing proposals, there was considerable competition in submitting technical proposals for the building systems portion of these buildings.

There were some aspects of this building systems application, however, that tended to limit competition, as follows:

--No existing firm had the capability to undertake the project, requiring consortiums to be formed for up to 9 years after construction was completed.

--Twelve months were required for discussion, explanation, and interpretation of the specifications for interested offerors, demonstrating the complexity of the specifications, which may have discouraged some firms from submitting proposals.

--The high cost of preparing technical proposals and bidding documents compared to normal construction contracting might have been an inhibiting factor.

--In the final round only three of the nine consortiums submitting technical proposals were qualified to bid, and only two submitted price proposals.

Small business participation

Small business firms showed considerable interest in the project. Five of the nine joint ventures submitting technical proposals for the building system contract included small firms. However, the development of technical proposals for such a project is very costly and we believe that few, if any, small business firms had the financial capability to bid on the entire contract. However, we feel that this situation differed little from small businesses' financial inability to bid on the construction contract for a typical multimillion dollar project under the lump-sum method of contracting.

Although small businesses may have been somewhat restricted from independently bidding on the building systems contract, small businesses could, as under a general contractor, participate as subcontractors to the building systems contractor. In this connection, we noted that the building systems contractor listed a number of small businesses that had participated in the construction of the building systems portion of the project.

Also, since the out-of-system portion of the project represented the majority of the construction costs and it was subdivided into 67 separate contract packages, small businesses were able to bid on these packages. This provided small businesses additional opportunities to bid competitively and independently.

Evaluation of technical proposals

Technical proposals for the building systems were evaluated in relation to the performance specifications. Each technical proposal had to show how the offeror's proposed building system complied with the performance specifications, how it would be tested, and how the development, testing, and construction would be managed.

GSA received eight technical proposals from seven firms by the deadline date of October 6, 1972, and proposals from two firms shortly after this date. The contracting officer determined that no unfair advantage had been gained by the late firms, because prices were not involved and GSA planned discussions with the offerors to clarify their proposals and correct any noted deficiencies.

For the evaluation, the project manager formed a technical proposal evaluation team of EAE, the construction manager, and GSA's Public Buildings Service. The following responsibilities were assigned.

--EAE to evaluate the technical aspects of construction and materials.

--Construction manager to evaluate the management plan and bid unit plan.

--Public Buildings Service to evaluate maintenance and fire safety in conjunction with EAE.

The evaluation team included the following professionals and disciplines:

--Architect.

--Structural, mechanical, and electrical engineers.

--Construction management.

--Acoustician.

--Illumination.

--Fire.

--Health and safety.

--Maintenance.

--Legal.

During the evaluation period, team members discussed proposal problems with the offerors to help them meet the various requirements of the performance specification. The offerors had until December 27, 1972, to correct their deficiencies. EAE said that "since time had been lost during the effort to obtain funds and to select sites, the evaluation of the technical proposals was condensed from 25 to 12 weeks."

After these opportunties to meet the specifications, a proposed system was considered to be unacceptable under the following conditions:

--The system did not meet criteria as verified by analysis (calculation tests).

--The system did not meet criteria which are verifiable by observation of drawings, specifications, written descriptions, or samples submitted as part of the technical proposal.

--System's structure subsystem could not be qualified by any of the codes specified in the performance specifications.

--The offeror's schedules were not compatible with the project schedules.

The evaluation team judged four proposals from three offerors to be acceptable. A project official told us that proposals from two joint ventures that included small businesses nearly qualified, and that with a little more time would likely have qualified.

Our review showed that each technical proposal was reviewed, and deficiencies were brought to the offerors' attention for corrective action.

On January 5, 1973, GSA notified each offeror of the results and gave each unacceptable offeror, who was not to be sent an invitation for bid, an opportunity to discuss his principal deficiencies during the week of February 5, 1973.

In our opinion, the reduction of the evaluation period by GSA from 25 weeks to 12 weeks may have limited the final competition, because two offerors may have qualified with a little more time. Only three offerors' technical proposals were accepted, and only two of them submitted bids. Since the sites were still being selected when technical proposals were due, and acquisition was not completed for another 7 months, there does not seem to have been any advantage gained by shortening the evaluation period.

Awarding of contract

On January 12, 1973, GSA invited the three acceptable offerors to bid, requiring a bid price for designing, manufacturing, and installing the system broken down into the various system components. Each offeror was also required to submit a bid on options for three successive 3-year periods of maintaining the system.

Only two of the three eligible firms submitted offers, which were opened on February 20, 1973. A project official said that the third eligible offeror did not bid because he could not meet the $28 million ceiling price established by GSA for the building system contract. Because each of the offeror's systems affected the cost of the out-of-system portions of the buildings, evaluation factors were established and applied to the total cost of each of the offeror's systems. The contract was awarded on the basis of a calculation composed of the following factors:

1. The system price--the total cost of all material to be furnished by the offeror as computed from the bid unit plan.

2. Bid equalization factors--a system of price adjustments established for each system to account for costs imposed by the insystem elements on out-of-system construction, such as affect on the costs of exterior walls and elevators due to offeror's planned thickness of the floor-ceiling sandwich.

3. The prorated bid price factor--a calculation that translated the equalized total price per building into equalized total price per usable square foot of office space, thus giving credit to a system with smaller columns which provided more usable floor space within the same size building.

4. The life-cycle cost factor--a computation of those life-cycle costs that could be objectively measured by calculation and confirmed by tests over the 40-year expected life of the system.

5. Nine-year optional maintenance cost--the bid of each offeror to provide the Government with an optional maintenance contract for the system for 3 years, with two renewable options (to maintain performance of the system, normal housekeeping of the system elements, and maintenance of the HVAC and luminaire subsystems). The bid unit was a firm fixed price only for the first 3-year period, with prices for successive periods to be adjusted according to the Consumer Price Index.

The system offeror having the lowest total of the net system price, 40-year life-cycle cost, and 9-year maintenance cost was ruled the low bidder.

The application of these factors in the award calculation is shown below. Although offeror "A" was low by about

$1.5 million excluding the optional maintenance factor, the offeror's proposal for this option was more than double offeror "B's" bid, bringing his total about $1.3 million over offeror "B's" total bid. Offeror "B" was awarded the contract on March 8, 1973.

SSA Program Centers Building Systems Project

Basis of Award Calculation

		A's bid		B's bid
Total system price		$24,647,100		$26,958,286
Bid equalization factors:				
FCS thickness	$ -324,000		$ -84,000	
Foundations	506,960		574,022	
HVAC	-1,147,554		-1,595,626	
Conductors	116,000		116,000	
Total factors		-848,594		-989,604
Equalized total price		23,798,506		25,968,682
Prorated bid price		23,906,241		26,132,155
Life cycle cost:				
HVAC operation cost	4,591,389		3,713,240	
Space adjustment cost	14,249		6,960	
Luminaire operation cost	4,119,320		4,235,997	
Total life-cycle cost		8,724,958		8,006,197
Basis of award without maintenance		32,631,199		34,138,352
9-year optional maintenance cost		5,544,926		2,700,000
Basis of award with maintenance		$38,176,125		$36,838,352

Our analyses of the factors used to weigh the bids is described below.

Bid equalization and prorated price factors

No objections were made by the industry or the system offerors to the inclusion of the bid equalization factor

and the prorated bid price factor. In our opinion, these factors appeared to have been applied uniformally to both systems offerors' proposals.

Life-cycle cost factors

Generally, life-cycle costing should include all ownership costs over the lifespan of the building, which GSA has determined to be 40 years for Federal office buildings. These costs are for site acquisition and preparation, financing, design, construction, operation, and maintenance. The life-cycle cost factors considered in the bid proposals for the building systems included only HVAC operation, alteration costs, and lighting operation. They omitted financing costs (i.e., interest costs for the systems costs discounted over 40 years to yield the present value of such costs) and all other building operation costs, such as heating and cooling plant costs.

EAE said that the offerors' proposed building systems' first costs were expected to be close; therefore, financing costs would not have made the final bid prices much different. When the bids of the two offerors came in about $2.5 million apart, EAE agreed that the difference discounted over 40 years would have affected the final bid price.

The project manager said that financing costs were excluded from the evaluation of the bid proposals because of project personnel having little experience in the use of life-cycle costing, problems in determining an appropriate discount rate, and too little time and higher-priority work to do.

GSA's Operations Division Director said that unless the total building, including heating and cooling plant operating efficiency, is included in the analysis, there is no assurance that all of the energy conservation opportunities will be used to provide the most efficient building.

Nine-year optional maintenance cost

The maintenance option requires that the building systems' contractor modify, repair, and replace system elements as necessary to meet the contract's performance requirements and to clean certain components. The Government exercised its option for the initial 3-year period in the systems contract awarded on March 8, 1973.

In a February 16, 1973, letter to GSA, the unsuccessful bidder objected to the use of the maintenance option as a basis for award because

--it did not contribute to achieving the design goals;

--potential bidders can unbalance their bids under the basis of award calculations;

--it sets up the possibility of potential claims for additional compensation resulting from the maintenance variables contained in the bid documents;

--it prevented the bidder from securing bondable bid prices from responsible building maintenance companies; and

--it precluded comparable evaluation of bids due to the variables in maintenance responsibilities over a 9-year period inherent in the bid documents.

During a meeting with GSA officials on March 15, 1973, the unsuccessful bidder again expressed his opposition to GSA's use of the maintenance option as well as the custodial services in making the award.

In its comments on our draft report (see app. II), GSA said that the technical proposal evaluation team determined that the unsuccessful bidder's objections were unfounded. However, during our review we found no record of such a determination; specifically, GSA's records did not show what action had been taken concerning the objections. A project official told us that the unsuccessful offeror's suggestion to eliminate the maintenance option was not accepted because GSA would have had to resolicit technical proposals without the maintenance option.

GSA CONTROLS PROJECT COSTS AND SCHEDULES

GSA exercised controls over the program center project cost and schedule, and the authority delegated to EAE and CM through the following system.

Management organization

One management technique for controlling project operations was the project manager who, under charter from the Public Buildings Service Commissioner, had overall responsibility to (1) keep the project on schedule and within

the budget; (2) be the contracting officer; (3) review progress reports; (4) approve all payment requests and project changes over $10,000, and time extensions; and (5) process claims and appeals.

All funds transferred to GSA for obligation on the project were assigned to the project manager and could not be obligated or expended without the manager's approval.

The project manager met periodically with members of the project team, the staff, and contractors to review project progress, resolve interface or systems-modification problems, and follow up on previous problems. The manager had the authority and responsibility to oversee the contractual responsibilities delegated to EAE and CM, who were responsible on behalf of GSA for many actions affecting costs, schedules, and performance. The GSA contracts awarded to EAE and CM delegated responsibilities and authority singularly and jointly with other team members.

Some of EAE's principal responsibilities included:

--Preparing a preliminary activity network and schedule.

--Amending, as appropriate, the performance specifications.

--Preparing design concepts.

--Directing the work of regional AEs to assure compatibility with the insystem.

--Developing the format for the insystem technical proposals.

--Participating in the evaluation of the technical proposals.

--Reviewing and recommending for approval the insystem documentation prepared by the building systems contractor.

--Reviewing and recommending for approval the foundation designs for the potential insystem, prepared by regional AEs.

--Reviewing and recommending for approval each out-of-system bid package.

Some of CM's principal responsibilities under the GSA contract were:

--Implement a construction management control system.

--Review plans of regional AEs and suggest economies, prepare estimates, and comment on construction feasibility.

--Recommend packaging of phased out-of-system bids and review the packages prepared.

--Assist the Project Manager; develop criteria for and evaluate technical proposals.

--Develop bid equalization factors for use in evaluating the technical proposals.

--Conduct value engineering workshop and studies.

--Provide general direction, inspection, and superintendence of construction.

--Establish procedures to coordinate the work of all project entities.

--Maintain jobsite records.

--Provide on a reimbursable basis such services as watchmen, fencing, first aid stations, temporary utilities, etc.

On-site controls

GSA resident engineers and inspection staff represented the Project Manager on each construction site for the following functions:

--administration of construction contracts;

--inspection of construction to assure compliance with requirements;

--review of contractors' cost claims submitted to the Project Manager for payment;

--monitoring the CM's inspection procedures, and scheduling and coordinating periodic and final inspections between the CM and GSA inspection teams; and

--reporting monthly progress of construction.

Construction management control system

A construction management control system implemented by C I provided the manager, CM, and EAE with the following monthly financial and construction information:

--Work done during the period, planned work, problem areas, critical paths, and analyses of schedule slippages.

--Summary and detailed reports on incurred cost, projected cost, and cost variances analyses.

--Financial status reports of commitments, expenditures, and uncommitted funds in the project manager's budget.

The project manager was also assisted by GSA's internal audit staff who examined CM's records to ensure propriety of charges made and reviewed his controls to ensure compliance with contractual obligations.

We believe that these controls were adequate to assure compliance with contractual cost and schedule obligations.

TESTING PROCEDURES

The building system contractor warranted that the entire system was free from defects and guaranteed its performance for 2 years.

The performance specifications consisted of performance requirements (e.g., control-conditioned air motion in the HVAC subsystem), criteria for meeting the requirements (e.g., provide air motion of 20 feet to 50 feet per minute in occupied areas), and tests to demonstrate that the requirements were fulfilled. From the tests, SSA was to be assured that equipment designed met its requirements. The insystem contractor was also required to construct and test a prototype of the building system. For the reasons described below, GSA and SSA do not have full assurance that the specifications were met.

Construction before prototype approval

The performance specifications state that, "With the successful completion of subsystem tests, and the construction and testing of the System prototype, the System is ready for installation and use." The program centers' activity chart shows that the system prototype tests and approvals were to have been accomplished before starting system construction.

The building systems contractor constructed a 30-by-30 foot mock-up of the systems considered to be representative of each center. On March 22, 1974, the system contractor submitted the certified prototype test results for approval. They were approved by EAE on May 13, 1974 and by the project manager on June 10, 1974. We found that insystem construction was being implemented at the Philadelphia and Richmond centers before the project manager approved the prototype test results. Also, most of the out-of-system construction contracts had been awarded and some completed before the test results were approved. If any prototype elements of the building system had failed to meet specifications, they would have had to be redesigned and installed elements pulled out at additional contract costs.

GSA, in commenting on our draft report, stated that these construction contracts were out-of-system contracts and not affected by the prototype test results. GSA also stated that the project manager had indicated that at the time test results were approved, no system components which would have been affected by the test results had been installed in the buildings.

We believe that any insystem construction and possibly out-of-system construction performed on the program centers prior to approval of the prototype tests, was subject to being affected by failure of the prototype. While insystem construction began with structural steel work, which may not have been likely to fail, failure of this or other subsystems could have caused redesign or refabrication of the structural steel subsystem. Therefore, in our opinion, the start of onsite construction prior to approval of the prototype exposed GSA to possible financial and schedule losses.

Specifications not enforced

Although the system contractor was required to submit test reports and certifications demonstrating compliance with the performance specifications, the contractor did not

do so during the first 6 months of construction. Structural steel work was started at Philadelphia in January 1974 and at Richmond in April 1974, but CM did not notify the system contractor of his delinquency until July.

The system contractor was also required to submit to GSA a list of independent testers/observers, subject to approval by the project manager, to certify that the systems complied with the performance specifications. The initial list approved in April 1973 contained a tester from a firm that participated in supplying the system's carpet. This required another list to be submitted for approval.

The "supplementary testers list" submitted later by the system contractor was not apparently approved by the project manager. By December 1975, about 5 months after the first two program centers were occupied, Executive AE had not received the independent testers/observers list from the system contractor. At that time, EAE told the contractor to develop a list and insert it after the supplementary testers list. Among other conditions, the approval of the contractor's testing plan was contingent upon the submission of this list.

The project manager was unable to find evidence that he had approved the contractor's testers/observers list and, as a result of our inquiry, requested the contractor to either demonstrate that the supplementary list had been approved or resubmit his list of independent testers/observers with their qualifications.

Some tests of the subsystems were not performed or observed by independent testers/observers. All structural steel calculations, for example, were certified by an engineer of the steel supplier rather than an independent tester/observer. According to the project manager, calculations may be performed by a registered professional engineer and do not have to be certified by an independent tester/observer. The manager felt that a registered professional engineer's seal was adequate proof of compliance with the performance specifications and stressed that the engineer is required to follow a stringent code of ethics.

In commenting on our draft report, GSA confirmed that all structural steel calculations were certified by an engineer of the steel supplier in lieu of an independent tester/observer. GSA cited the provisions of performance specifications 3c-1a as authority.

Performance specification 3c-1a is not the applicable provision since its sole purpose is to permit calculation as a method of testing. The proper provision 3c-4a is contained in the general requirements section governing testing-certification/approval rather than the "testing-methods" section where 3c-1a is located.

In our opinion, general requirement 3c-4a negates GSA's comments because it states:

> "Certification shall be by an independent Tester/ Observer who has previously been approved by the Project Manager."

Extent of compliance undeterminable

At the completion of construction of the insystem, the contractor was required to submit a notarized certification, to be subsequently approved by the project manager, that the building system complied with the specified performance requirements.

On November 25, 1975, the systems contractor submitted the required notarized certification to EAE stating that the building system complied with the specified performance requirements. Test reports and certifications for subsystem tests and system field tests were also included in this package for approval.

EAE made his final inspection of the Philadelphia building on November 24, 1975 and the Richmond building, on December 16, 1975. Based on the final inspections of the Philadelphia and Richmond buildings, EAE informed the project manager on December 19, 1975 that the buildings were acceptable and met the requirements except for the following:

Philadelphia building only.

--Excessive cracking in penthouse floor. These must be repaired.

--Random loose carpet tiles. The building should be inspected and the loose tiles reglued. This should be handled under the maintenance contract.

--Light fixture lens are dirty. These should be cleaned under the maintenance contract.

Philadelphia and Richmond buildings.

--The electrical outlet cover in use is not acceptable. We have informed the contractor that they present a clear danger to safety. This failure should be covered by the guarantee. We are waiting for a corrective proposal from the contractor.

--The testing results have been questioned on some minor items, but we cannot accept this until it is complete.

On December 11, 1975, EAE had rejected the system contractor's test schedule.

> "The majority of field tests referenced for each subsystem have been conducted only at the Philadelphia project building. These tests are required to also be performed at the Richmond and Chicago Program Centers."

On December 23, 1975, EAE told the contractor to disregard that comment because of the November 1973 understanding that field tests would most likely be performed only on the Philadelphia building. The report on the project team's meeting in November 1973 states that it was agreed that tests would be performed on only one building--"probably Philadelphia building." The systems contractor attended and participated in the discussions.

The data submitted by the systems contractor showed that field tests for the Chicago building had not been completed, and there are no plans to do so. Most of the field testing for each subsystem was conducted only at the Philadelphia project site. We could not determine the extent to which the system contractor corrected the performance deficiencies noted by EAE.

The project manager told us that in his opinion, all three program centers' subsystems, except for the HVAC subsystem, were generally the same. Although the manager believed that there was no need to field test all the Richmond and Chicago centers' subsystems, he said that because the HVAC design was different in each building, field tests for this subsystem would have to be performed for all three centers.

The deficiencies noted by EAE in his December 11, 1975, letter involved all seven subsystems of the system contract.

Some of the field tests not submitted for the structure subsystem included:

--Requirement 1d-7--control deflections. "This subsystem, when undergoing deflection due to any combination of specified loads, shall not damage or otherwise impair the performance of any other subsystem."

--Requirement 1d-12--provide protection against damage. "This subsystem's specified performance shall not be impaired by stresses due to volume change."

In commenting on our draft report, GSA informed us that the requirement for field tests was wrong. GSA stated that these tests, made by calculations in lieu of field testing, were submitted by the contractor and approved by the Government.

The Richmond building failed one of the HVAC tests, and other required tests were either not included or were incomplete as described below.

--Requirement 2a-3--control dry bulb temperature. "The rate of change of dry-bulb temperature at any point in the occupied zone shall not exceed 4 deg/hr if the peak to peak variation in the temperature cycle is two degrees or greater with the limits of 73° and 77° F." The test results as indicated by the system's report indicates that the Richmond building failed to meet this requirement.

--Requirement 2e-1d--conform to codes and standards. This requirement for the Richmond building is not complete and requires updating.

--The test results for the Richmond building did not include the following requirements:

  --Control maximum temperature deviation.
  --Control relative humidity.
  --Control mean radiant temperature.
  --Control fresh air quantity.
  --Control air mixture.

CHAPTER 3

OBSERVATIONS AND COMMENTS ON USING BUILDINGS SYSTEMS CONCEPT

GSA did not fully attain the goals it set for construction of the SSA program centers project through the building systems method. Generally, (1) the centers were not completed on schedule, (2) planned total construction costs were exceeded, (3) life-cycle cost objectives were not met, (4) claimed energy savings could not be verified, (5) serious and costly operation and maintenance problems have occurred, and (6) the building systems concept has not spread.

We were unable to determine the extent to which the building systems concept contributed to the failure to meet the project's goals because of its interrelatedness with the team approach, phasing, and the out-of-systems components.

PROJECT SCHEDULE

The schedule for the program centers was September 1971 to September 1972 for preconstruction and September 1972 to September 1974 for construction.

The preconstruction began on time but ended July 1973 (22 months). Construction began in July 1973 and ended July 1975 at the Richmond and Philadelphia centers, and in September 1976 at Chicago (24 and 38 months, respectively). The total time for the Richmond and Philadelphia centers was about 4 years, and for the Chicago center, about 5 years.

Preconstruction schedule

The preconstruction schedule slipped because of the following problems.

--Sites scheduled to be selected in February 1972 were not selected until 7 to 9 months later. The delay was due to lack of funds at the time to pay for options to buy and to disagreements between GSA and HEW on locations for the centers.

--Acquisition of the sites was also delayed 11 months longer than planned because of the unavailability of funds, legal problems, and eviction of occupants.

--The schedule for preparation of technical proposals allowed offerors 4 months, but this time had to be extended to almost a year because of the uncertainty of site conditions and the complexity of the specifications. Part of this delay was compensated for by reducing the planned 25 weeks for evaluation of proposals to only 12 weeks. (see p. 17).

Construction schedule

The Philadelphia and Richmond buildings were completed in the scheduled-24 months. Construction of the Chicago building took 14 months longer, primarily because most of the pilings for the foundation were damaged from earth movement and had to be replaced.

A consulting engineering firm retained by GSA attributed the foundation problems to the expedited excavation schedule required, CM's passive rather than active role in overseeing construction, and GSA's failure to provide for specialized engineering personnel for this work on the construction team.

PROJECT COSTS

OMB apportioned $6.1 million of the sites and expenses funds to HEW in January 1972 to be used only for design work from funds appropriated to HEW for the program centers. OMB stated that financing the balance of the project, including site acquisition and construction, would be obtained under pending purchase contract legislation. Legislation authorizing the purchase contract program was approved by the President in June 1972. 1/

Overall project costs

In February 1973 the Congress approved GSA's prospectus for the centers, showing the following estimates.

1/Public Buildings Amendments of 1972, Public Law 92-313, Section 5, 86 Statute 219 (1972) 40 U.S.C. Section 6022 (sub. 2 1972).

Program center	Gross sq. ft.	Prospectus estimated costs	Latest estimated costs
Chicago, Ill.	757,600	$ 46,318,254	$a/51,877,268
Philadelphia, Pa.	567,700	29,269,231	b/29,061,256
Richamond, Calif.	554,900	34,942,189	c/33,988,402
Total	1,880,200	$110,529,674	$ 114,926,926

a/Cost estimate as of 7/12/76.

b/Final cost report as of 3/22/76.

c/Final cost report as of 1/17/76.

The project was financed by the $6.1 million apportionment and the sale of $126 million in participation certificates. From the certificates sale $107,114,903 was budgeted for construction, sites, and inspection; $5,116,365 for real estate taxes during construction; and $13,768,732 for trustees' fees, legal fees, advertising, interest on the certificates, and other expenses. GSA budgeted $28 million for the building systems portion of the project, about 25 percent of total estimated costs.

In addition to the latest estimated overrun of $4.4 million, there may be additional contractors' claims, as well as possible recovery by GSA of remedial foundation costs under pending insurance claims.

About $3 million was paid to remedy the foundation problem as well as other contractors' costs at the Chicago center. The project manager told us that a claim had been filed with the insurer for reimbursement of this amount. Claims in excess of $1.7 million have been filed against GSA for delays imposed on contractors during remedy of the problem.

The use of the team concept on the project resulted in the award of five professional service contracts (EAE, CM, and three regional AEs). As of July 1976 the project professional services were estimated to cost about $7.5 million, as shown below.

Professional service cost

	Philadelphia (note a)	Chicago (note b)	Richmond (note c)	Total
EAE	$ 468,334	$ 890,538	$ 518,512	$1,877,384
Regional AE	1,023,196	1,662,082	1,139,714	3,824,992
CM	399,397	934,396	446,297	1,780,090
	$1,890,927	$3,486,916	$2,104,523	$7,482,366

a/Final cost report--3/22/76.

b/Cost report--7/12/76.

c/Final cost report--3/17/76.

Building systems costs

CM estimated that the building systems would cost $24.5 million if started in February 1973 using conventional construction. EAE increased the estimate to $28 million as the maximum for acceptance of bids for the building systems work.

In March 1973 the building systems contract was awarded for $26.96 million. The most recent estimate of July 1976 shows that the building systems work will cost about $5 million more, as shown below.

Geographic location	Original award	Latest estimate	Increase
Philadelphia, Pa.	$ 8,043,000	$ 8,981,235	$ 938,235
Richmond, Calif.	7,995,690	8,890,165	894,475
Chicago, Ill.	10,919,433	14,274,116	3,354,683
Total	$26,958,123	$32,145,516	$5,187,393

The cost increases were due primarily to added fire protection and acoustical work and transferring work from the out-of-system contractors to the systems contractor. For the Chicago center, costs also increased substantially from contractors' claims paid for delays. The transfer of work from the out-of-system contractors reduced their contract prices.

GSA cost comparison of SSA program centers

While construction of the Philadelphia, Richmond, and Chicago centers was managed as a single project using the building systems method, the Birmingham center was privately constructed to GSA prescriptive specifications and leased. GSA compared square foot construction costs of the Birmingham center to those of the Philadelphia and Richmond centers, which it considers to be functionally comparable. GSA's comparison, as noted below, indicates that construction costs were significantly lower for the Birmingham center.

Building construction costs

Building	Cost per square foot	
	Gross	Net
Philadelphia	$45.00	$62.00
Birmingham	a/30.00	35.00

a/Adjusted to Philadelphia construction prices. Actual cost in Birmingham was approximately $23.

Construction cost for mechanical system
(includes safety and all automated control systems)

Building	Cost per square foot
Birmingham	$5.00
Philadelphia	7.50
Richmond	8.91

Also, there is an additional indication that the program centers may have cost more to construct under the building systems concept than under the conventional system.

As previously stated, CM's estimate of $24.5 million for the project was based on construction costs using conventional methods. EAE increased this amount by $3.5 million to provide for the special design costs, test and prototype costs, and the general development costs applicable to the new building system. Assuming that CM's estimate is reasonable and EAE's reasons for increasing the estimate are justified, it appears to us that the Federal Government is expected to pay about $3.5 million more for the building systems portion of the project by using the performance specifications than by using prescriptive specifications under the conventional method of construction.

The project manager disagreed with our view. He said it was not reasonable to isolate the cost of the building systems without considering its effect on the project's overall costs. The manager believed that the increased costs of the building systems was a trade-off for a better total project at a cost equivalent to or below that estimated for a conventionally constructed project.

In support of his position, the manager cited two examples of improved construction techniques in the building systems--the combining of the fire-protection-sprinkler piping with the water-cooled lighting fixtures and the manner in which the space dividers meet the ceiling to give superior acoustical privacy while providing a very low fixture-space adjustment cost.

Based on GSA's experience with the building systems in operation, it is doubtful that the increased costs of the combined sprinkler and lighting system will be offset by reduced operating and maintenance costs.

OPERATION AND MAINTENANCE PROBLEMS

GSA's Office of Building Management has had serious problems operating and maintaining the Philadelphia and Richmond centers, as described below. Because the Chicago center was completed much later, GSA had no experience with its operation at the time of our review.

Contract awarded on negotiated basis

To avoid having two contractors responsible for the operation and maintenance at each center, the project manager requested award of a single contract to the system contractor or to his maintenance subcontractor, for the operation and maintenance of both the insystem and out-of-system components at the two completed centers, noting that:

--The system contractor's ability to assure proper performance of his equipment depends partly on maintenance and operation of out-of-system equipment. For example, if the out-of-systems equipment does not provide water at the right temperature and condition, certain units of the system contractor cannot meet performance specifications.

--The custodial requirements of the system contractor under the maintenance option (primarily for carpeting) would be awkward to perform if another contractor had responsibility for general cleaning of the buildings.

--In the opinion of GSA's Assistant General Counsel, there would be a greater possibility of labor disputes with two maintenance and custodial contractors on the premises, as well as of conflicts between contractors over work schedules and security.

For these reasons, the building systems contractor was requested to submit a price proposal for the operation, inspection, maintenance, and repair of the out-of-system mechanical equipment and janitorial services.

Because an agreement could not be reached with the system contractor, GSA negotiated a 1-year contract with its maintenance subcontractor on July 15, 1975 for these services. Thus, the system maintenance subcontractor was awarded two separate contracts, one for the insystem and the other for the out-of-system operation and maintenance work. The contract price at the Philadelphia center is $21,272.35 a month for mechanical maintenance and $29,583.32 a month for janitorial services, a total annual cost of $610,268.04 for out-of-systems operation and maintenance. The total cost of such services at this building during the first year of operation was over $863,000 ($610,268.04 plus insystem work at $253,170.00).

According to GSA's Office of Building Management, negotiated contracting for the maintenance and operation at the Philadelphia and Richmond centers resulted in much higher costs than normally experienced for these services. A GSA cost comparison of contracts for mechanical and electrical maintenance and operation at seven Federal buildings, including the Philadelphia and Richmond centers, shows the following differences in cost per square foot.

Building	Net square feet	Cost per square foot
Federal Building Richmond, Va.	252,690	$ .37
Wisconsin Building Bethesda, Md.	105,682	.42
11601 Roosevelt Boulevard Philadelphia, Pa.	348,551	.46
Federal Building Wilmington, Del.	161,197	.51
Federal Building and Courthouse Philadelphia, Pa.	244,519	.58
SSA Program Center Philadelphia, Pa.	425,414	.85
SSA Program Center Richmond, Calif.	465,889	.89

Unsatisfactory maintenance performance

In August 1975 the Regional Chief of GSA's Building Service Branch stated that the maintenance contractor was not complying with contract provisions at the Philadelphia center. The contractor was attempting to furnish all the sites' custodial service (insystem and out-of-system) under the out-of-system contract's minimum time requirement. The inspected maintenance work was unsatisfactory. The Regional Chief said he was proposing a substantial deduction from the contractor's payments.

GSA's San Francisco region was also dissatisfied with the performance of the maintenance contractor at the Richmond center. The region planned to do the work with its own personnel after the contract expired, but could not free the positions from other locations. By the time that was settled, the region did not have time to advertise for another contractor, and it negotiated a new maintenance contract with the same contractor.

Controls lacking over insystem maintenance

The insystem maintenance contract does not require the contractor to report to GSA on the work. To obtain some

control, GSA requested the contractor to either provide a maintenance schedule or to report when such work was performed. The contractor agreed to do so but only if his contract price was increased, which was unacceptable to GSA.

In May 1975 the Acting Director, Operations Division of GSA's Office of Building Management, in commenting on a draft inspection manual for the maintenance of the building systems, expressed concern over how tests would be financed and performed since the office did not have the required instrumentation or technical expertise.

In December 1975 the Director of GSA's Operations Division wrote the project manager about the lack of a systems design and operation manual, and stated that:

> "It was not surprising, therefore, that we would not find anyone in the building who completely understood all of the systems and their operation. We feel there should be a manual prepared by the designers which will have schematic diagrams of each system and the total building system explaining the operation. Without this type of document, information and possibly misinformation regarding the systems design and operation will be passed on from operator to operator, information will be lost or changed in the telling and no one will ever understand the designer's intention."

On February 11, 1976, the Director again wrote to the project manager about the urgent need for a building operations manual.

Conflict of building operation and maintenance responsibilities

GSA negotiated the out-of-system operation and maintenance contract with the insystem operation and maintenance contractor to avoid having separate contractors responsible for insystem and out-of-system operation and maintenance at each center. In spite of this, the first-year's operating experience has shown that the single contractor arrangement has not successfully avoided the problem of identifying maintenance and operation responsibilities.

In May 1975 the Assistant Commissioner for Building Management said it was difficult to determine maintenance and construction responsibilities in the insystem and out-of-system interface areas. He also stated that there were many such areas which will cause conflict. The following are examples.

"1. The main control center will start and stop all equipment. It will also reset the temperature controls throughout the building including the controls on the in-system air handlers. The in-system contractor, also has responsibility for the controls on the in-system air handlers, starting at the air handler control panels and is responsible for the temperature in the zones served by these air handlers. In this case, there are two contractors with the capability and responsibility for adjusting and controlling the same air handlers. The out-of-system chillers and boilers also supply hot water and chilled water to these air handlers, which are dependent on the amount and temperature of the water supplied to them. This divided responsibility for temperature control could result in one system trying to cool the load created by the other systems heating the adjacent space. This type of situation would affect utility consumption.

2. There is controversy between the in-system and out-of-system contractors over the interface of the electric feeders for the in-system equipment. The in-system contractors says if the fuses blow out in the fused disconnect switch serving a piece of in-system equipment, it is the responsibility of the group providing maintenance for the out-of-system work. The out-of-system contractor says it is the in-system contractor's responsibility.

3. We feel the responsibility for the electrical floor ducts is the in-system contractor's responsibility; however, the in-system contractor says it is the responsibility of the out-of-system contractor.

4. Maintenance and cleaning of the rugs in the in-system area are the responsibility of the in-system maintenance contractor. There is out-of-system cleaning responsibility for furniture and trash removal in the same areas."

The Assistant Commissioner recommended that in future maintenance options, both building maintenance and operation be included. In response to the Office of Buildings Management's concerns, the maintenance option in the projects following the program centers was modified as follows:

"1. The option only includes mechanical maintenance. All cleaning has been eliminated. (Elimination of the cleaning was made possible by strengthening the performance specification to control the quality of the finish materials provided in-system.)

2. The option can be exercised by the Government in two ways. The first results in the system contractor being a prime contractor to the government and would be desirable when in-house forces were used for the out-of-system maintenance and operation. When the out-of-system maintenance and operation will be procured by contract, the option can be exercised such that the in-system contractor becomes a subcontractor to the out-of-system maintenance contractor. This arrangement puts the Government in the position of only having to deal with one contractor for the maintenance and operation of the entire building."

High energy use

According to Executive AE, the contract for the building systems portion of the program centers was awarded on the basis of life costs, rather than first construction and equipping costs, a first in the building industry. Executive AE stated that the emphasis on energy use in life-cycle costing required energy-efficient designs even before the energy crisis occurred.

In December 1975 the Director of GSA's Operations Division wrote the project manager that he took exception to the claimed energy efficiency of the systems, based on a visit to the Philadelphia center.

"For example, the 'in system' lighting consists of water cooled three-tube fluorescent luminaire fixtures. This system collects a percentage of the heat of light by circulating water through the luminaires and rejecting it from the building through an evaporative cooler. The 'in systems' ventilation air and a percentage of 'out of system' air is also rejected from the building through this evaporative cooler. This collected heat could have been used to heat incoming ventilation air or in the perimeter system. Instead, this heating is being provided by steam from the building heating boilers."

The Director pointed out that contrary to a recent article in a heating and air conditioning trade magazine which claimed that heat from the lighting system was recovered and used, in reality, heat was being rejected from the building and wasted.

The Director also referred to: (1) the need for heating or cooling outside air to ventilate the restrooms, while room temperature air is exhausted from the insystems area and wasted and (2) the high energy use designed into the out-of-systems mechanical equipment, perimeter induction units, and cooling towers. The Director also objected to the inflexibility of the designed lighting system, which does not allow for removing some of the fluorescent tubes to reduce energy consumption. EAE disagreed with the Director that removal of flourescent tubes was the way to accomplish energy conservation, but agreed that there were areas where the level of light could be reduced. However, EAE stated that this would require a rebalancing of the air-water systems to maintain the mechanical balance.

Subsequent visits by GSA officials to Philadelphia resulted in the same findings of high energy use and the impossibility of taking certain conservation measures applied in other Federal buildings. They recommended changes to the lighting system to permit removal of some tubes and better computer control of the light switches. The recommended changes, approved by the project manager in July 1976, were estimated to cost about $195,000. A contract for the modifications had not been let by September 1976.

EAE stated that his calculations showed that the insystem design was 25 percent more energy efficient than

a conventionally designed system. In September 1976 an Office of Buildings Management official reported:

> "While low energy use was a factor in selecting the system in the SSA Payment Centers, the first year operating experience shows the two completed buildings are using approximately double the energy per net sq. ft. of building as our national average. The utilities distribution systems serving the system also serve the out of system equipment and lighting in the buildings and there is no way to determine the actual energy use of the system. Therefore the claims that the system is using 25% less energy than a standard design cannot be verified."

GSA calculated the national average energy use in Federal buildings to be about 300,000 Btus (British thermal units) per net square foot of raw source energy. GSA measured the energy use at the Philadelphia and Richmond centers to be 562,646 and 418,850 Btus, respectively. By comparison, it calculated that the conventionally constructed Birmingham program center used 342,278 Btus per square foot, or about 40 percent less than Philadelphia and 18 percent less than Richmond.

In September 1976 the Chief of the Program Branch, GSA's Operations Division stated:

> "Until all the mechanical equipment is included in the 'In System', there will never be a single design concept which will permit the designer to take full advantage of the energy used. As an example the designer of the Philadelphia Payment Center could have used the chillers for heat pumps, extracted the heat of light from the water cooled luminaire system and used it to heat the buildings. Instead we are rejecting this heat from the building in the winter and the designer of the 'Out of System' portion of the building installed boilers for heating the building perimeter."

Other operating problems

In addition to their concern over high energy use, GSA officials were also concerned with other operating problems, primarily, the airflow problems experienced by the Richmond and Philadelphia centers' occupants.

After a visit in April 1976 to the Philadelphia center, Buildings Management officials reported to the Public Buildings Service Commissioner a number of operational problems they attributed to malfunctioning equipment, design deficiencies and, inherent characteristics of an insystem- and out-of-system-type building project. They pointed out that the interface between the two systems had been a constant source of aggravation, citing the intermingling of air supplies which affected the heating and air conditioning systems.

The airflow problem was raised again in a June 1976 GSA task force report. This report pointed out that air movement in the Philadelphia center was a serious problem and that air movement was better in the out-of-system area than in the in-system areas.

As late as September 1976 GSA's Buildings Management was still experiencing inadequate air flow in the Philadelphia center. Although the insystem contractor tested the system and stated that it met the performance requirements, GSA's test indicated that the airflow did not meet the performance criteria. A GSA September 1976 fact sheet states that the architect recommended that GSA hire an independent company to test the system. However, GSA's construction management could not find a qualified company to make the tests. The systems contract performance specification for conditioned air specifically states the timing and methodology test requirements. The fact sheet concludes by stating that this problem seems to be unresolvable and building occupants continue to make complaints.

Also, an August 1976, report by GSA's Office of Building Management took exception to a June 30, 1976, GSA news release which stated that the buildings systems concept significantly reduces maintenance, operation, and alteration cost over the life of a building. The report stated that Buildings Management continued to have problems with the centers in Philadelphia and Richmond. After citing the problems experienced at these buildings, particularly with the high energy cost, malfunctioning of certain insystem elements, and maintenance performance and prices, the following statement was made:

> "Unfortunately, our experience in these buildings is at variance with the GSA News Release dated June 30, 1976, (copy attached), which announces the award of the contract for the new SSA

Building in Baltimore. The News Release states, in part, that 'this approach significantly reduces maintenance, operation, and alteration cost over the life of the building'".

DECLINING PARTICIPATION IN THE BUILDING SYSTEMS METHOD

One of GSA's goals in trying the building systems method was to stimulate use of the method both within the Government and in private industry. Response to solicitations for technical proposals for two subsequent systems projects, however, were disappointing.

GSA received only three technical proposals for the systems portion of the SSA headquarters expansion project in Baltimore. They were from the contractor for the building systems for the program centers, an unsuccessful offeror for that project, and a joint venture including CM for the centers. For a Federal Office building systems project in Norfolk, GSA received only two technical proposals, again including the same contractor for the centers project, as well as a joint venture consisting of firms that bid on the centers contract.

According to EAE, the building systems concept did not spread to the private sector for the following reasons.

--The process remains an innovative and new idea.

--Industry's cost to develop a technical proposal and the owner's cost for its evaluation currently precludes using the approach on most private projects.

--Many potential users are awaiting proof of user-acceptance of the system.

Although GSA informed the Congress that it would reduce the overall period for design and construction with each succeeding building systems project, its experience with the Baltimore SSA expansion project does not yet bear that out. Twenty-seven months elapsed from request for technical proposals to award of the building systems, compared to 16 months for the centers project. It seems apparent, therefore, that GSA will substantially overrun its scheduled 4 years for completion of the Baltimore project.

The Public Buildings Service Commissioner expressed the following concern about the time required to select building systems contractors.

> "The use of Building Systems in the design and construction of both the Social Security Administration's Program Centers and the Administrative Headquarters Expansion projects required an extended period of time for the development of Technical Proposals and for the evaluation of the proposals received. This requirement resulted in a discontinuity in the preparation of the Out-of-System design and retarded the start of construction. On these initial projects this condition was essential because of the time required by potential system offerors to evaluate the performance specification to determine what role they had in the development of a Building System; and to organize consortia and develop Technical Proposals for Building Systems. In addition, although the Building Systems developed would be transferable to future projects, the proposals where, requested within the context of specific projects and their preparation, were based on the preliminary design of the projects."

To overcome these problems GSA announced in July 1975 a program to qualify building syscems independent of specific projects. The program envisions a continuing qualification of building systems packages to enable offerors to prequalify for bidding on future projects. GSA plans to request technical proposals at least annually to permit maximum competition on future building systems projects. The annual solicitation will admit new offerors, give already qualified offerors an opportunity to submit improvements, and allow GSA to refine its requirements.

According to GSA, the technical proposals received by it for the Norfolk Federal Office Building will become the first qualified proposals under the prequalification program.

SUMMARY OBSERVATIONS

GSA was justified in experimenting with the innovative building systems concept for the program centers project as a possible way to reduce acquisition costs and increase building operation and maintenance efficiency.

After GSA awarded contracts and construction began for the follow-on building systems projects, it encountered many operating and maintenance problems at the Philadelphia and Richmond centers. These were due primarily to systems design problems and conflicting operating and maintenance responsibilities peculiar to the building systems method. One might conclude that GSA should have postponed any new systems projects until it had enough operating and maintenance experience on the initial projects to assess their problems and assure effective solutions.

The declining competition for the building systems contracts on the follow-on projects is a serious problem, limiting the number of technical proposals and price proposals to choose from. Unless more firms become serious participants in the concept, it is unlikely that GSA can do much to improve it on future applications.

CHAPTER 6

AGENCY COMMENTS AND OUR EVALUATION

GSA commented on a draft of our report in a June 29, 1977, letter. It generally agreed with our findings and conclusions, and advised us that some of the shortcomings we noted on the pilot project have been corrected and steps are being taken to correct others. GSA also said that, following completion of the projects now in construction using the building systems concept, it proposes to thoroughly evaluate the advantages and disadvantages of the systems approach for building acquisition.

Some of GSA's comments deemed pertinent appear in the body of the report, while all of them are listed in appendix II. Certain comments that we believe require clarification are discussed below.

GSA stated that the 1-year project delay was due primarily to a key project activity--congressional authorization for the project prospectus--on which approval action was not completed until February 1973. GSA added that this key activity had a controlling effect on its ability to obtain financing with which to complete design and construction.

We found that the program centers were initially proposed as direct Federal construction. In January 1972 the Office of Management and Budget, in apportioning part of about $18 million the Congress had approved for sites and expenses, stated that funding for the balance of the project was to be obtained under the then pending purchase contract legislation. The President approved the purchase contract program in June 1972. Because GSA was uncertain whether this method of procurement required a congressionally approved prospectus, one was not submitted to the Congress until October 20, 1972.

We believe that much of the delay GSA attributed to the congressional prospectus authorization process was actually the result of both the Office of Management and Budget's funding direction and GSA's indecision on the need for a prospectus. As we state in the report and GSA confirms, had congressional approval action on the prospectus been completed sooner, other technical aspects of the building systems approach would have, to some degree, delayed completion of the buildings.

In commenting on the project's cost overrun, GSA referred to our discussion on page 31 concerning the action taken to increase the estimated construction cost of the building systems work from $24.5 million to $28 million. It pointed out that under the conventional method of construction, AE would be responsible for designing the entire building in addition to design development costs. GSA argued that under the building systems concept, the system contractor accomplishes design development; therefore, the increased estimated cost ($3.5 million) of the systems work cannot be considered solely as a construction cost.

We agree that some of the $3.5 million may relate to design costs that AE would normally incur under conventional building procedures. Of this, however, the records indicate that most, if not all, was due to the special requirements envisioned by EAE as resulting from the building systems portion of the contract. CM's estimate of $24.5 million for the project was based on construction costs using conventional methods. Executive AE increased this amount by $3.5 million to provide for the special design costs, test and prototype costs, and the general development cost of the new building system. No mention was made by EAE of the AE's design development cost.

GSA, in commenting on our finding that the claimed energy savings could not be verified, stated that the procurement occurred prior to the increased emphasis on energy conservation. Accordingly, the building system was not designed to today's level of energy conservation. On the other hand, EAE stated that emphasis on energy use in life-cycle costing required energy-efficient designs even before the energy crisis occurred. EAE further stated that his calculations showed that the building systems design was 25 percent more energy efficient than a conventionally designed system. We found that this statement could not be verified by GSA and that its operating experience with the buildings shows them to be relatively high users of energy.

GSA also commented on a possible energy reduction of 100,000 Btus per square foot per year in both the Philadelphia and Richmond centers. Such a reduction would still leave the two centers higher energy users than GSA's average buildings.

GSA also stated that the mechanical maintenance costs for the Philadelphia center have been reduced from $.85 per square foot to $.64 per square foot. The reduction is commendable, but the cost per square foot still appears high when compared with GSA's normal cost.

APPENDIX I

United States Senate
COMMITTEE ON PUBLIC WORKS
WASHINGTON, D.C. 20510

February 16, 1975

Honorable Elmer B. Staats
Comptroller General
General Accounting Office
Washington, D.C.

Dear Mr. Staats:

A prospectus pending before this Subcommittee proposes construction of new Social Security Administration facilities in the Baltimore, Maryland metropolitan area at a cost of $161,000,000. These are intended to provide space for expansion and consolidation of existing headquarters operations there.

Social Security Administration and General Services Administration advocate construction by an unconventional method designated building systems concept, citing anticipated economic and technical advantages. Three similar SSA buildings were previously authorized as pilot projects, to demonstrate experimental features of such concept, but these are incomplete and progress has not sufficiently advanced to justify commitment on this basis.

GSA advises that consolidation of two or more projects under a single contract is essential, to reduce costs through large volume purchasing, and also effect more efficient coordination of technical expertise. The magnitude of such contracts necessitates joint-venture package bidding by consortiums comprising industrial, construction, and design liaisons, which could tend to minimize opportunities for competitive bidding in some instances. The significance of this, and the fact that design, construction, and supply firms throughout the country are experiencing economic problems, generates doubt regarding the propriety of encouraging or participating in such practice.

In fulfilling its assigned oversight responsibilities, the Subcommittee desires to explore all facets of the building systems concept, as applied to date in referenced construction now underway, and ascertain whether continued implementation on other projects should be considered.

Proceeding accordingly, I request that an intensive review be initiated, and a comprehensive report submitted at the earliest practicable time, supplemented by interim verbal reports as appropriate. This effort should focus upon all details relevant to contract matters, from solicitation through award, with particular emphasis given to aspects which could be construed as inhibiting competition in any manner, including selection of principals and mandatory large-scale procurement of materiel. Your observations regarding the degree of direct control that GSA now exercises over the projects are requested, considering their delegation of major responsibility by contract to the Executive Architect Engineer and Construction Manager. Any comments reflecting either superiority of the systems method over conventional construction, or adverse conditions encountered during actual application of the concept, will also be appreciated.

Sincerely,

Robert Morgan, Chairman
Subcommittee on
Buildings and Grounds

APPENDIX II

UNITED STATES OF AMERICA
GENERAL SERVICES ADMINISTRATION
WASHINGTON, DC 20405

June 29, 1977

Honorable Elmer B. Staats
Comptroller General of the United States
General Accounting Office
Washington, DC 20548

Dear Mr. Staats:

Thank you for the copies of your draft report to the Subcommittee on Buildings and Grounds on the General Services Administration's use of the Building Systems Concept in the construction of Federal Buildings, dated April 1977. We appreciate the opportunity to review the draft report and enclose our comments.

The building systems concept is new to GSA as well as to the entire construction industry. Consequently, the concept is not universally understood. Some of the building systems shortcomings cited in your summary observations have been corrected and we are taking steps to correct others.

Following the completion of the Social Security Administration Headquarters Expansion Project, Baltimore, Maryland, and the Norfolk Federal Building and Parking Facility, both of which are currently under construction, we propose to make a thorough evaluation of the advantages and disadvantages of the systems approach for building acquisition. We will evaluate each of the six completed buildings in terms of quality, completion time-frame, cost, operation and maintenance factors, industry participation and degree of acceptance by the private sector of the systems procurement approach, life-cycle costs and energy conservation factors.

We will be glad to supplement the enclosed comments with any additional data you may wish.

Sincerely,

Joel W. Solomon
Administrator

Enclosure

GSA COMMENTS ON
GAO DRAFT REPORT ON GSA USE OF THE BUILDING
SYSTEMS CONCEPT IN THE CONSTRUCTION OF FEDERAL BUILDINGS

The following comments are offered in response to findings and observations contained in the draft report entitled, "Use of Building Systems Concept in the Construction of Federal Buildings", dated April 1977, prepared by the staff of the General Accounting Office.

CHAPTER II

EXPRESSED INTEREST OF THE SUBCOMMITTEE IN GSA'S CONTRACTING PROCEDURES CONTROLS

We concur in the staff observation that GSA generally complied with Federal procurement regulations in contracting for the principals' services on the Program Centers, obtained competition for the building systems contract, and had adequate controls over the contractors' obligations regarding costs and project schedules. The principal problems observed by the GAO staff were:

1. Two firms had a possible advantage over other firms in the selection process for regional A/E's.

COMMENT: It is acknowledged that the Regional Public Advisory Panels on Architecture did recommend as highly qualified five (5) A/E firms for the Philadelphia Program Center, one of which had previously served on the advisory panel which had screened firms being considered for selection as the project Executive Architect-Engineer; and also recommended as highly qualified six (6) A/E firms for the Richmond Program Center, one of which had a principal who had served on the full regional advisory panel. The report accurately states that in the latter instance, the selection memorandum did point out that the principal in question did not attend the meeting in which the decision was made as to the firms judged highly qualified.

Although the two (2) firms were subsequently selected and awarded design contracts for the Philadelphia and Richmond projects, there is no evidence that their membership on regional advisory panels gave them any advantage over other firms being considered for selection. Recognizing, however, that such actions might possibly raise questions concerning the objectivity of GSA's A/E selection procedures, in November 1975, we modified the procedures to provide that members accepting service on the regional panels shall agree that their firms and their subsidiary or parent firms will not be eligible for GSA awards of any kind for the period of their appointment as panel members.

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2. Exclusion of interest costs from the analysis of life-cycle costs--- The study team members conclude that generally, life-cycle costing should have included all costs of ownership over the life span of the building, which GSA has determined to be 40 years for Federal Office Buildings. For the Social Security Administration Program Centers, life-cycle costs factors considered in the bid proposals for the building systems included only HVAC operation, alteration costs and lighting costs. Omitted as factors were financing costs (i.e. interest cost for the total systems costs discounted over 40 years to yield the present value of such costs) as well as total building operation costs.

COMMENT: At the time the Executive Architect-Engineer was developing the basis of award formulae, interest rates were fluctuating and the members of the Technical Proposal Evaluation team made a management decision that a representative interest rate could not be objectively selected. Also, since the first cost of the proposed systems bids were expected to be extremely close, it was felt that the cost of money would not affect the bids. This latter assumption proved to be erroneous since the first cost of the systems bids were not substantially the same. The 2.5 million difference, when discounted over 40 years would have had an effect on the bids.

However, the cost of money was included as a life-cycle cost factor in the basis of award formula for the Social Security Administration Headquarters Expansion Project, Baltimore, Maryland, and the Federal Building and Parking Facility, Norfolk, Virginia, both of which are Building Systems projects. In addition, the award formulas have included the anticipated accelerated appreciation in the cost of energy over the general rate of inflation. Since no objective method has been found to accurately determine the maintenance costs and related costs for equipment replacement during the expected lifetime of the buildings, past the nine year contract requirement, we consider the inclusion of only the bid price for the in-system equipment to be a reasonable life-cycle cost factor alternative.

3. Complication of contract awards and administration by including a 9-year maintenance requirement in the building systems contract -- As noted in the draft report the maintenance option required the building systems contractor to modify, repair and replace elements or components of the system as necessary to meet the performance requirements of the contract and to clean certain components.

COMMENT: It is suggested that this section (pp. 25 and 26) be expanded to show that the Technical Proposal Evaluation team determined the objections cited by the unsuccessful system bidder to the inclusion of maintenance option as a basis of award to be without merit. It was GSA's contention that the 9-year maintenance provision provided a further guarantee (beyond the physical, prototype, and field testing) that the building systems would meet required performance standards and placed the responsibility for reliable system component maintenance, repair and replacement on the system contractor. On the two follow-up building systems projects, the provisions of janitorial and custodial housekeeping function have been eliminated from the maintenance contracts.

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4. GAO concludes that GSA obtained competition, but competition was somewhat restricted because no single firm had the capability and consortium of firms had to be formed; interpreting the specifications and preparing technical proposals was extremely complex and very costly, and only three of nine firms submitting technical proposals were able to qualify to bid on the contract.

COMMENT: We concur in the audit team's finding that no single firm had the technical, professional and management expertise to accomplish the building systems work. Of the 640 firms and individuals receiving copies of the requests for technical proposals, most of them expressed interest only for specific segments of the building systems. Hence, it was necessary to encourage the formation of a consortium of firms to accomplish the entire system work. The cost of preparing technical proposals, estimates of which ranged from $100,000 to $500,000, can also be considered an inhibiting factor which limited the number of participating firms.

5. Poor control over the building systems contractor's compliance with performance specifications -- For the reasons set forth on pp. 30 - 36, the GAO study team concludes that GSA and SSA do not have full assurance that the performance specifications were met by systems contractors.

COMMENT: In view of the fact that over 500 separate calculations, production, prototype and field test were performed on the in-system portions of the buildings, the Project Manager, the Executive Architect-Engineer and the Construction Manager do believe that the performance specifications were met by the systems contractor. However, as a result of the audit team's in-depth analysis, we have made a further review of the project documentation in an attempt to account for and clarify some of the apparent test deficiencies noted in the draft report. Our findings are:

a. The referenced construction contracts (p. 31) which were awarded and completed or under way for the Philadelphia and Richmond Centers prior to approval of the system prototype test results were out-of-system construction contracts and thus were not affected by in-system prototype test results. The Project Manager had indicated that at the time the prototype test results were approved no in-system components which would have been affected by the test results had been installed in the buildings.

b. If any prototype elements of the building system had failed to meet performance specifications, they would have had to be redesigned and installed elements pulled out and all costs associated therewith borne by the systems contractor.

c. It has been confirmed that all structural steel calculations were certified by an engineer of the steel supplier in lieu of an independent tester/observer. We have verified that Requirement 3c - 1a on page F-37 of the Performance Specifications did not require these calculations to be made or certified by an independent tester/observer.

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d. Although the Construction Manager did illustrate the importance of the testing results by citing an incident of threaded studs which fell off one of the buildings (the Richmond Center), a review of this problem disclosed that only four (4) of the several hundred studs required to support the precast exterior wall on the Richmond project fell off the building. The general consensus is that they were dislodged in the course of placing a section of the precast wall. Upon replacement, no further problems were encountered in the erection of the exterior wall.

e. The project team decision to perform a portion of the field tests in only one building did apply only to the tests of system components which were identical in each building (p. 33). Where building systems components were different in the three buildings (largely in the HVAC sub-system) separate tests were performed in all three buildings.

f. The performance specifications which provided that field tests were to be used for Requirement 1d - 7 - Control Deflections and for Requirement 1d - 12 -- Provide Protection Against Damage -- were determined to be in error. These tests were made by calculations in lieu of field testing, and our review indicates that the calculations as submitted by the system contractor were approved by the Government.

g. As noted in the draft report (p. 34) the Richmond building did fail to pass the HVAC field tests identified as Requirement 2a - 3 -- Control Dry Bulb Temperature, and Requirement 2e - 1d -- Conform to Codes and Standards. The test results on the dry bulb temperature control were rejected since it indicated one unusually low temperature. Subsequently, this was determined to be due to a typographical error on the test report which was corrected, resubmitted by the contractor and approved by the Government. Certification of the Codes and Standards conformance tests were resubmitted and also approved by the Government.

h. We have verified that the five (5) test results listed on p. 34 and reported as not being submitted for the Richmond Project were submitted on March 26, 1976, and approved by the Government.

i. On review, we have found that the test for control of surface color stability (p. 34) was not waived on the Program Centers project. Rather, it was determined that the specification requirement was excessive and the criterion was reduced to a level consistent with prevailing industry standards.

CHAPTER III

OBSERVATIONS AND COMMENTS ON USE OF BUILDING SYSTEMS CONCEPT

The audit team concludes that GSA did not fully attain the goals it set for construction of the SSA Program Center project through the building systems

APPENDIX II

method. Generally, the Centers were not completed on schedule; planned total construction costs were exceeded; life-cycle cost objectives were not met; claimed energy savings could not be verified; serious and costly operation and maintenance problems have occurred; and the building systems concept has not spread. Each of these findings and conclusions are discussed in the order presented.

Project Schedule Over-run. We concur in the audit team's findings that the SSA Program Centers project was not completed on schedule. The Richmond and Philadelphia buildings were completed in approximately 4 years instead of 3, and the Chicago building experienced a delay of approximately 2 years. On analysis, however, we find that the one year delay on the Richmond and Philadelphia buildings was primarily due to one key critical path project process activity -- Congressional authorization of the project prospectus, on which approval action was not completed until February 1973. This key activity had a controlling ripple effect on GSA's ability to obtain purchase contract financing with which to complete the out-of-system design, award a systems contract, proceed with the acquisition of the selected sites, and award phased out-of-system construction contracts.

Hence, in this instance, we find that the use of building systems, even though the schedule for preparation and submission of technical proposals was extended from four (4) months to almost a year because of the uncertainty of site conditions and the need to amend and clarify the Performance Specifications, was not a controlling factor contributing to the one-year delay in the completion of the two buildings.

The key factors contributing to the two-year delay in the completion of the Chicago project was the aforementioned prospectus action and the slope failure and foundation damage during the project construction phase.

It must be admitted, however, that had Congressional approval action on the project prospectus been completed sooner, then the system offerors' technical proposal preparation, evaluation and qualification process actions would have contributed to some degree of delay in the completion of the buildings. As noted in the draft audit report it was necessary to make numerous amendments to the Performance Specifications for the seven sub-system elements, many of which resulted from feedback information furnished by potential systems offerors. By contrast, under GSA's current prototype building systems qualification program, the time frame for award of a systems contract for the Norfolk building systems project was completed in six (6) months.

We believe that the project schedule slippage time on the three buildings would have been greater but for the Project Manager's decision to reduce the planned 25 weeks allocated for evaluation of technical proposals to only 12 weeks. Though this action may have limited the final competition because two other offerors might have qualified if given additional time to modify their technical proposals, it expedited the award of the systems contract

and permitted the successful bidder to initiate design of the system components. We have since been advised that at least one of the two offerors was not interested in doing any further work on his proposal regardless of the amount of time available to make corrections to the technical proposal.

2. Project Cost Overrun. The audit-team estimated the total project cost overrun to be $4.4 million ($114.9 million as compared to the prospectus estimate of $110.5 million).

COMMENT: We believe that the initial building system project, in terms of total cost, compares favorably with conventional public buildings projects. About $3 million of the total project cost overrun was necessary to remedy the foundation problem experienced on the Chicago building. The balance has been set aside as a contingency reserve to settle possible additional contractor's claims. We consider it significant that the building system contract was relatively free of change orders resulting from design deficiencies. This can be attributed to the fact that the system contractor was responsible for the design of the building system, as well as its manufacture, installation and maintenance.

The audit team has made reference (p. 40) to the action taken by the Construction Manager in increasing the estimated construction cost of the building systems work by $3.5 million (from $24.5 million to $28 million). From this they concluded (p. 42) that the Federal Government expected to pay about $3.5 million more for the building systems portion of the project by using the performance specifications rather than by using prescriptive specifications under the conventional method of construction. We believe that the following factors should be considered in this matter. Under the conventional method of construction, the Architect-Engineer would be responsible for the design of the entire building including the structure, HVAC, electrical distribution, finished floor and ceiling, luminaires and space dividers, estimated to cost approximately $28 million, in addition to his design development costs. Under the building system concept, the design development is accomplished by the system contractor, hence the revised estimated total cost of the systems work cannot be considered solely as a construction cost item.

3. Life-cycle cost objectives were not met and claimed energy savings could not be verified.

COMMENT: The building system procurement was the first time GSA has ever considered estimated energy consumption as one of the factors in the award of a construction contract. This procurement occurred prior to the increased emphasis on energy conservation. Accordingly, the building system was designed to provide a level of performance based on the comfort of the building's occupants and not energy conservation as practiced today.

The audit team reports, and we agree, that it is impossible to take certain energy conservation measures in the system buildings that have been taken in

other Federal buildings. On the other hand, some of our energy conservation measures can be implemented by modifying the building systems' contract requirements to revised levels of performance. Some changes have already been made and additional changes are contemplated. Specifically, in the Philadelphia building, switching of the lighting from the building's central control panel in lieu of individual panels on each floor has been provided and similar changes are planned for the Richmond and Chicago buildings. In addition, it is planned that the lighting levels will be reduced in all three buildings through the removal of at least one fluorescent lamp from each lighting fixture. (As described above, the performance of the building system was based on the comfort of the building's occupants and not the conservation of energy. Accordingly, the required lighting level was 100 footcandles. Removal of one lamp from each fixture will reduce the level to approximately 70 footcandles which is more consistent with the lighting level required in order to conserve energy). The foregoing measures should reduce the raw source energy consumption of the Philadelphia and the Richmond buildings by approximately 100,000 BTU/sq. ft./yr., or to approximately 460,000 and 320,000 BTU/sq. ft./yr., respectively. In addition, the possibility of modifying the in-system and out-of-system mechanical systems in the Program Centers to function in greater harmony is also being considered. Any such changes should further reduce the energy consumption of the buildings.

The HVAC subsystem performance is based on three operating parameters. Two of these, dry bulb temperature and relative humidity, are easily measured with high accuracy and are usually the only ones specified in a performance contract such as the leased building in Birmingham, Alabama. The third requirement of air motion is difficult to measure at the low levels specified (20-50 feet per minute). This is the first time that we are aware that a minimum air motion has ever been specified in building construction. Because of the system procurement, GSA is able to obtain this (and all other) performance requirements over the 9-year life of the system maintenance option, whereas in conventional construction all guarantee requirements are satisfied 1 year after building acceptance. GSA is continuing to develop a methodology whereby this aspect of performance can be accurately and repetitively measured.

4. Serious and costly operation and maintenance problems have occurred.

COMMENT: Since the completion of the audit study, the mechanical maintenance costs for the Philadelphia Program Center have been reduced from $0.85 psf to $0.64 psf. This was accomplished by reducing some of the man hour requirements for staffing the out-of-systems central control panel and obtaining competitive bids on the out-of-systems maintenance requirements in lieu of negotiating with the systems contractor. Additional savings were realized for the cleaning maintenance using these procedures.

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The building system maintenance option is a nine-year warranty which we consider to be advantageous over the conventional one-year warranty guarantee. For example, if a piece of equipment requires major repairs or replacement, the cost is borne by the systems contractor in lieu of the Government.

5. The building systems concept has not spread.

COMMENT: We have found that the initial three building systems projects did not stimulate widespread industry commitment to the total system concept. On the other hand, selected sub-systems such as HVAC, finished ceiling, luminaires, and space dividers, all of which are commonly referred to as Integrated Ceiling and Sound Background System has gained widespread acceptance in the private sector. Therefore it can be concluded that the continued use of the building systems concept, modified to correct noted deficiencies, may generate greater industry interest as was initially envisioned.

GAO Note:

Page references in this appendix refer to the draft report and do not necessarily agree with the page numbers in the final report.

APPENDIX III

PRINCIPAL OFFICIALS

RESPONSIBLE FOR ADMINISTERING ACTIVITIES

DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
ADMINISTRATOR OF GENERAL SERVICES:		
Joel W. Solomon	May 1977	Present
Robert T. Griffin (acting)	Feb. 1977	Apr. 1977
Jack Eckerd	Nov. 1975	Feb. 1977
Arthur F. Sampson	June 1973	Oct. 1975
Arthur F. Sampson (acting)	June 1972	June 1973
Rod Kreger (acting)	Jan. 1972	June 1972
Robert L. Kunzig	Mar. 1969	Jan. 1972
COMMISSIONER, PUBLIC BUILDINGS SERVICE:		
James Shea	June 1977	Present
Tom L. Peyton (acting)	May 1977	June 1977
Nicholas A. Panuzio	Sept. 1975	Apr. 1977
Walter Meisen (acting)	Oct. 1974	Sept. 1975
Larry F. Roush	Aug. 1973	Oct. 1974
Larry F. Roush (acting)	Jan. 1973	Aug. 1973
John F. Galuardi (acting)	July 1972	Jan. 1973
Arthur F. Sampson	Mar. 1970	June 1972

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