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ADP SYSTEMS

Concerns About the Acquisition Plan for DOD's Composite Health Care System

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Comptroller General
of the United States

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To the President of the Senate and the
Speaker of the House of Representatives

The Department of Defense (DOD) Authorization Act of 1986 (Public Law 99-145) directs GAO to evaluate the process followed by DOD in selecting and awarding contracts for a state-of-the-art, worldwide medical computer system known as the Composite Health Care System (CHCS). The act also requires DOD and GAO to (1) evaluate DOD's test of the Veterans Administration's medical computer system (starting March 1, 1986) and (2) determine the cost and feasibility of using this system in DOD hospitals in lieu of CHCS before the final decision and contract award scheduled for July 1987. As required by the act, we will issue additional reports, prior to final contract award, covering the Veterans Administration's system demonstration projects and the competitive process followed to select a final CHCS vendor.

Although this report concentrates on acquisition activities associated with the award of contracts for an extended benchmark (or demonstration) test of CHCS,[1] it also addresses issues affecting the entire acquisition process. We found that DOD's acquisition strategy could limit the CHCS program's success. While changing the acquisition strategy could delay the CHCS project, the adverse effects of such a delay are, to some extent, mitigated by the availability of other non-integrated automated hospital systems.

DOD Efforts to Automate Its Medical Facilities

Since 1968, DOD has pursued the goal of providing computer support to its hospitals and clinics. The Tri-Service Medical Information System (TRIMIS) program office, as a field activity of the Assistant Secretary of Defense (Health Affairs), spearheads this effort. During fiscal years 1976-84, DOD spent about $222 million to acquire, implement, and operate various stand-alone and integrated health-care computer systems.[2]

In May 1985, the TRIMIS program office issued a Request for Proposals to acquire CHCS. CHCS is intended to be an integrated hospital computer

[1]The extended benchmark test requires vendors to demonstrate their ability to develop a portion of CHCS prior to final contract award.

[2]Stand-alone systems support individual hospital functions (such as pharmacy, laboratory, and patient appointment and scheduling). In an integrated system, hospital departments share a common data base so that they can share information.

system used in DOD's 167 hospitals, 577 clinics, and 20 other medical treatment facilities. The TRIMIS program office has estimated that CHCS hardware and software costs will be between $800 million and $1.1 billion, depending upon the configuration of the computers. CHCS deployment will begin in 1987 and is expected to be completed in 1995. In the interim, DOD relies on stand-alone medical computer systems and is deploying the non-integrated Automated Quality of Care Evaluation Support System, which incorporates all the functional capabilities that will be initially deployed with CHCS. This interim system will be replaced by CHCS and is being offered as "Government Furnished Equipment" in the CHCS acquisition process. Consequently, CHCS offerors can use this system's hardware and software in developing their CHCS designs. According to DOD schedule estimates, the interim system will be installed in all 167 DOD hospitals at least 9 months before CHCS is deployed. (See appendix II for a detailed discussion of this system.)

In response to growing congressional concerns about the risks associated with the acquisition of complex and costly medical automatic data processing (ADP) systems, the Assistant Secretary of Defense (Comptroller), in 1979, directed the TRIMIS program office to follow acquisition guidelines specified in Office of Management and Budget Circular A-109. This circular instructs federal agencies on how to conduct a major hardware and software system acquisition; its intentions are twofold: to improve the management process and to minimize risks of inadequate system performance and excessive cost.

In 1984 the House and Senate appropriations conferees gave similar direction to DOD regarding the use of the A-109 strategy. As a result, DOD has adopted a two-stage acquisition process for CHCS. During stage I, DOD will select up to three vendors who will develop and demonstrate a portion of the total CHCS hardware and software system during an extended benchmark test. Contracts for the extended benchmark test competition are expected to be awarded on or after June 1, 1986. Following this competition, DOD will evaluate the results of the extended benchmark and the Veterans Administration's system tests. In the event the Veterans Administration's system is not chosen, DOD's CHCS acquisition strategy calls for selection of a single vendor to simultaneously deploy the stage I portion of CHCS, develop the remaining software, and acquire and install additional hardware. Stage II occurs when DOD awards a final contract for full deployment of CHCS; this is expected to take place in July 1987.

CHCS' A-109 Acquisition Strategy Could Limit Program Success

Although our evaluation shows that DOD has implemented a sound methodology for selecting the stage I vendors to compete for CHCS contracts, we are concerned that other aspects of DOD's acquisition strategy might limit the CHCS program's success. We found, for example, that

- the extended benchmark test does not include many complex and beneficial functions,
- the final contract for CHCS will be awarded before the selected vendor demonstrates whether the proposed system can function in a military hospital,
- not all validated functional requirements were included in the Request for Proposals, and
- not all essential site preparation and hardware equipment requirements for military medical treatment facilities will be studied until after final contract award.

As a result, DOD will deploy costly hardware to military medical treatment facilities worldwide before it has reasonable assurance that the selected vendor can deliver the complex software needed for CHCS to perform according to specifications and at a reasonable cost. DOD's stage I selection methodology and each of the above concerns are summarized below; appendix II presents a more detailed discussion.

DOD's Vendor Selection Methodology Is Sound

As part of the CHCS acquisition strategy, DOD has implemented a methodology whereby up to three vendors are chosen to compete in the extended benchmark test. This process is intended to ensure that DOD chooses vendors whose proposals have the highest degree of credibility and whose performance can be expected to meet the government's requirements at an affordable cost. Under the CHCS source-selection process, vendor proposals are subjected to an in-depth two-step evaluation to determine how the offerors addressed five rating factors (contract management, technical approach, personnel qualifications, corporate experience, and cost). In step one, proposals are evaluated to determine the extent to which the offeror addressed the CHCS requirements specified in the Request for Proposals. Step two involves determining the quality of the proposal or, in other words, "how well" the offeror's proposal meets CHCS specifications. Once the evaluation process is completed, the results will be provided to the Assistant Secretary of Defense, Health Affairs, who will select those vendors that will participate in the extended benchmark test. According to CHCS program officials, the extended benchmark test vendors are expected to be identified

in mid-May 1986. (Appendix IV describes key CHCS acquisition events and dates through award of the extended benchmark test contracts.)

To date, DOD's implementation of the CHCS selection process conforms to the agency's original source selection plan and to the DOD guidance from which the plan was developed. As indicated in appendix IV, however, several significant CHCS acquisition events will take place after this report is issued. For example, DOD will not identify final vendors for the extended benchmark test until mid-May 1986. As a result, our evaluation of the CHCS selection process only addresses system implementation as of the date of this report. As part of our direction under the 1986 DOD Authorization Act, we will continue to evaluate the CHCS selection process and to report our findings when necessary.

Extended Benchmark Test Is Incomplete

The 1984 House and Senate appropriations conferees directed DOD to use an extended benchmark test, a key feature of ADP acquisitions employing the Circular A-109 acquisition strategy, in the CHCS procurement. One reason for conducting an extended benchmark test is to assure the government that the selected vendor's system will operate as expected within cost and schedule estimates. We found that, under the CHCS extended benchmark test plan, competing vendors will not demonstrate over 700 (or 40 percent) of the 1,800 approved functional requirements for CHCS. Nor will DOD adequately evaluate whether critical functions can be successfully integrated. Our analysis of the Request for Proposals, supplemented with supporting documentation and statements from agency officials, indicates that many complex functions were omitted. Also, according to several government and industry representatives, the need to fully integrate the systems and their functions poses the greatest risk to DOD. However, system integration is not being fully tested. For example, one of the key modules of the CHCS is the nursing module. An important function of this module is the capability to order various tests, diets, or therapeutic procedures provided by other hospital departments. Thus, the nursing order entry functions must be integrated with radiology, laboratory, dietetics, and other CHCS modules. Yet we found that 65 percent of the nursing module will not be evaluated during the benchmark test.

TRIMIS program officials told us that they chose not to include all functional requirements in the benchmark test in order to expedite CHCS deployment to DOD's medical facilities. They also noted that they are requiring the contractors to test the key requirements and that it will

not be difficult or excessively costly to develop the remaining requirements. DOD's cost estimates to develop those functions not included in the extended benchmark test are insignificant in relation to the total CHCS program cost of between $800 million and $1.1 billion. Previous DOD experience in developing or procuring complex ADP systems demonstrates, however, that thorough system testing is imperative before final production begins or selection decisions are made. To illustrate, testing program deficiencies for recently completed major ADP acquisitions in the Army and Air Force required both services to make significant upgrades to meet operational requirements.

Winning System Will Not Be Tested in a Military Hospital Before Full-Production Decision

Under Circular A-109 and DOD Regulation 5000.3, the winner of the CHCS extended benchmark competition would be required to further test a full-scale prototype in the "realistic" environment in which the system is expected to operate before a full-production contract is awarded. This procedure is known as a BETA test. The current CHCS acquisition strategy, however, does not require the winning vendor to demonstrate that the system will operate in a military hospital before DOD awards a full-production contract.

Following completion of the extended benchmark test, which is being conducted in the vendors' facilities, the selected vendor will be awarded a full-production contract that requires a BETA test of the prototype system in three DOD hospitals for 3 months. The BETA test will, however, address only a portion of the CHCS requirements; the remaining requirements will be tested later. While the BETA test must be passed before CHCS software is deployed, CHCS hardware deployment is not contingent upon successful completion of this test. CHCS hardware deliveries to hospitals worldwide are scheduled to begin 4 months following final contract award, whether or not the BETA software tests are completed or are successful. If the BETA test is unsuccessful, DOD may have to cancel the contract. Such action would result in the government's (1) forfeiting its substantial investment in the partially procured and installed hardware that would not be needed if the software does not meet test specifications and (2) facing substantial delays in planning and conducting a new acquisition. According to TRIMIS program officials, they chose the current BETA test approach and proposed CHCS contract award strategy in an attempt to maintain a rapid deployment schedule.

CHCS Requirements Not Modified to Reflect Valid System Change Requests

The CHCS requirements, as stated in the May 1985 Request for Proposals, do not include all the validated functional requirements identified by the services. In 1984, the House and Senate appropriations conferees directed DOD to validate and rank the CHCS functional requirements and to make sure that the concerns and the requirements of the services' three Surgeons General were resolved before the Request for Proposals was released. DOD's validation process resulted in 662 Surgeons General comments on the CHCS functional requirements. According to CHCS program officials, some of the comments were satisfied before the Request for Proposals was released. Action on most (470), however, was deferred. Even though these comments affect system functionality and the CHCS designs being proposed by vendors, program officials told us the comments would be handled as system change requests after the final CHCS contract is awarded.

In addition to the deferred Surgeons General comments, the TRIMIS program office has identified and processed many additional system change requests that could affect the functionality and cost of CHCS. None of these system change requests were included in the CHCS Request for Proposals. As of December 30, 1985, 487 system change requests had been processed. By DOD's own definition, approximately 308 of these "affect the functional, allocated, or technical configuration requirements. They may also affect project cost or delivery schedule." TRIMIS program officials said that the deferred Surgeons General comments are reflected in the above system change requests.

TRIMIS program officials told us they consulted the Surgeons General and decided not to include the system change requests until after the CHCS contract was awarded, to avoid delaying deployment of the system. In our opinion, this approach could prove costly to DOD and could result in considerable user dissatisfaction. None of these system change requests have been provided to CHCS vendors for consideration in developing their system designs or cost estimates. As a result, the system being designed does not reflect all validated user needs. Additionally, the impact of the system change requests on CHCS cost estimates could be significant. For example, one study summarizing experiences from several major ADP system development projects indicates that it is 100 times more expensive to implement changes during a system's operational phase than during its design.

Military Medical Facility Requirements Not Accurately Reflected in the Request for Proposals

Federal regulations indicate that, to ensure vendors design a computer system that not only meets the validated requirements of system users but also incorporates the best possible mix of existing hardware, software, and communications technology, government agencies should provide all relevant information describing the proposed system's operating environment. We found that (1) detailed site preparation information was not furnished to CHCS vendors and will not be developed until after final contract award and (2) system sizing information provided to vendors may result in estimates that significantly misrepresent actual needs. As a result, DOD may select a vendor's CHCS system design that (1) does not represent the best technical alternative and (2) may not operate in military hospitals without extensive modifications or new construction, which could cost significantly more than the estimated $800 million to $1.1 billion.

Prospective CHCS vendors are proposing system designs based on limited site information. They have not been provided complete site-specific information on the types and condition of existing medical facilities or the condition of existing communication, electrical power, air-conditioning, and available space capabilities at the 764 facilities scheduled to receive CHCS. Vendors need this information (1) to select the technology most appropriate for the conditions that exist in DOD facilities and (2) to determine how many modifications are required to install their proposed systems. This latter point is particularly important in the case of the CHCS acquisition. Under the terms of the CHCS Request for Proposals, DOD is responsible for making any facility modifications necessary to accommodate the selected system. Since site surveys will not be made until after the final CHCS contract is awarded, DOD will not know the extent or cost of modifications required or if, in fact, the winning design can be cost effectively implemented before system deployment begins. According to TRIMIS program officials, they chose to postpone collecting specific site data rather than delay release of the CHCS Request for Proposals.

We found that the information provided to prospective vendors for use in sizing their proposed CHCS system design may result in erroneous estimates. For example, vendors were provided formulas to determine the number of computer-related devices (such as printers) to use when sizing their proposed systems. A recent survey conducted in an Army hospital to determine the devices needed for a system with less functionality than CHCS indicated the hospital needed over 300 devices more than the CHCS formulas show for the same hospital. While we have not determined the impact of the increase in such devices on potential CHCS

system size, the impact on CHCS cost could be significant. If the Army survey is more accurate, CHCS costs for computer-related devices in this hospital will exceed current estimates by over $884,000. Similarly, the other 763 facilities scheduled to implement CHCS could also need more devices than currently called for.

In addition to the potential problems associated with the accuracy of the formulas provided to vendors, we are also concerned that the model used to classify medical treatment facilities may not accurately represent the operational environment in individual facilities. DOD has divided its medical treatment facility population into what it considers 22 "representative" categories. Information regarding the computer-related devices and work-load requirements for each of the 22 categories has been provided to vendors for sizing their proposed systems. We are concerned that the grouping of facilities within each category may be too large to accurately reflect operational differences and potential computer sizing requirements. For example, class I facilities include all hospitals containing between 216 and 1,000 beds. It would seem that computer-related devices and work-load requirements would vary significantly in hospitals within this range. If this is true, under the current CHCS acquisition strategy, DOD could buy computers with significantly more (or less) capability than that required for its hospitals.

Conclusions

The TRIMIS program has been active for at least 10 years, and DOD has spent over $222 million to test systems, develop capabilities, and define functional requirements for this program. While DOD has implemented a sound methodology for selecting the best vendors to compete for the CHCS contract, we are concerned that other aspects of the CHCS acquisition strategy may expose the government to unnecessary risk. Specifically, DOD may be allowed to select a final vendor and to deploy costly system hardware before fully testing software. DOD's acquisition strategy may not go far enough in ensuring that, after a large expenditure of funds, CHCS will provide adequate comprehensive medical ADP support to the military services. Providing additional time and money to the CHCS program so that the selected vendor can deliver a full and comprehensive system meeting all defined requirements is a prudent course of action. While such action may delay CHCS implementation, the significance of the delay would be mitigated, to some extent, by the availability of other non-integrated automated hospital systems.

Recommendations to the Secretary of Defense

To ensure that the CHCS acquisition selection process identifies the true capabilities of competing vendors and results in the development of a comprehensive medical ADP system that meets user needs at a reasonable cost, we recommend that the Secretary of Defense award the CHCS extended benchmark test contract only after the deficiencies discussed in this report are addressed. Specifically, DOD should take the following actions:

- Assess the risk of not including all functional requirements in the extended benchmark test compared with the cost of including them. Have the CHCS program systems engineering and technical assistance contractor certify that all complex CHCS functions, such as those in the nursing module, are addressed during the benchmark test.
- Analyze valid existing system change requests to determine their impact on CHCS vendor designs, incorporate critical changes into the CHCS specifications being addressed during the extended benchmark test, and require that these changes be addressed.
- Modify the CHCS Request for Proposals to require the winning vendor to successfully demonstrate the CHCS design in one or more military hospitals before DOD awards the full-production contract.
- Validate system sizing data to ensure that the data accurately reflect current needs and operating conditions found in the varying size hospitals existing within each class of medical treatment facility, and provide any necessary revisions to CHCS offerors.
- Make specific site information available to CHCS offerors for use in designing proposed systems and estimating site preparation requirements and costs. Further, require that site preparation costs be included as part of the evaluation used to select the winning vendor(s).

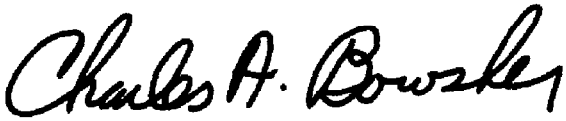
Agency Comments and Our Evaluation

DOD officials concluded that compliance with these recommendations will serve to strengthen the CHCS acquisition strategy and minimize the risk from this important procurement. (Additional comments are included in appendix II.) DOD believed that it had adequately constructed the extended benchmark test to include the more complex functional requirements and that it had appropriately handled the processing of system change requests. The agency acknowledged, however, that it could further reduce the risk of this procurement. DOD has already begun to correct the deficiencies we had brought to its attention during the audit and to implement all recommendations.

We disagree that the extended benchmark test was adequately structured because of the large number of functional requirements omitted

and because of statements from program office officials (supported by DOD documentation) that many functions omitted are complex requirements important to CHCS' overall value and effectiveness. We also believe that known system change requests should have been included in the Request for Proposals before it was released. However, if DOD completes all of its changes planned in response to our recommendations, then this action should substantially reduce the risks involved in acquiring CHCS.

We are sending copies of this report to the Chairmen, House and Senate Committees on Appropriations, on Armed Services, and on Veterans' Affairs, Senate Committee on Governmental Affairs, and House Committee on Government Operations; the Secretary of Defense; the Administrator of General Services; and the Director of the Office of Management and Budget; and will make copies available to other interested parties upon request.



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Contents

Abbreviations

ADP	automatic data processing
AQCESS	Automated Quality of Care Evaluation Support System
CHCS	Composite Health Care System
DOD	Department of Defense
GAO	General Accounting Office
TRIMIS	Tri-Service Medical Information System

Objectives, Scope, and Methodology

The DOD Authorization Act of 1986 (Public Law 99-145) directed GAO to evaluate the competitive acquisition process followed by DOD in selecting and awarding its CHCS contracts. The act also requires DOD and GAO to (1) evaluate DOD's test of the Veterans Administration's medical computer system (starting March 1, 1986) and (2) determine the cost and feasibility of using this system in DOD hospitals in lieu of CHCS before the final decision scheduled for July 1987.

This report satisfies the act's requirement for the Comptroller General to report on the competitive acquisition process prior to DOD's selecting the benchmark test vendors. Our objectives in this report were to

- review and evaluate the methodology followed by DOD in selecting CHCS vendors and
- analyze the CHCS acquisition strategy to ensure that it enables the government to obtain a cost-effective system on time.

As required by the act, prior to final contract award, we will issue additional reports covering the Veterans Administration's system demonstration projects and the competitive process followed to select a final CHCS vendor.

We conducted our work at DOD's Defense Medical Systems Support Center, the TRIMIS Program Office, and selected military treatment facilities. We reviewed and analyzed DOD's CHCS Request for Proposals and supporting documents to determine if the program office had included and followed all applicable acquisition directives and contract forms and had included all validated functional requirements. We interviewed TRIMIS program officials and consultants to assist in our evaluation of the source selection process. We also interviewed military medical personnel and conducted site visits to determine if the program office had solicited user comments during development of specifications. In addition, we reviewed past GAO reports that focused on system development or acquisition projects.

To evaluate the acquisition selection process, we analyzed DOD's acquisition strategy and documentation; monitored and evaluated the CHCS process for selecting vendors; reviewed ADP literature to identify information related to ADP development, acquisition, and deployment; analyzed the CHCS cost model; and reviewed Office of Management and Budget Circular A-109 and DOD system acquisition directives. We interviewed vendors who deal in automated health care systems to determine if the CHCS Request for Proposals had been disseminated industry-wide.

These interviews also provided insight into whether the Request for Proposals clearly stated DOD's requirements to industry. We also evaluated vendors' responses to the Request for Proposals to assess the vendors' understanding of the CHCS requirements and to find out whether their responses complied with the specifications.

Additionally, we analyzed DOD's process for reviewing and validating comments and concerns affecting functional requirements submitted by the three Surgeons General and by military users. We also reviewed and evaluated DOD's extended benchmark test plans, which require multiple vendor demonstration and testing of CHCS functionality. In evaluating the extended benchmark test, we relied on DOD and industry statements and supporting documents concerning functional requirement complexity.

We performed our review from August 1985 to March 1986 in accordance with generally accepted government auditing standards. We provided a draft of our report to DOD officials and obtained official oral comments on the findings, conclusions, and recommendations. These comments have been included in the report.

DOD's Strategy to Acquire an Advanced Hospital Computer System

Since 1968, DOD has pursued the goal of providing computer support to its hospitals and clinics. The TRIMIS program office, established in 1974, now spearheads this effort. In 1976, to strengthen the program's management, DOD established the program office as a field activity in the Office of the Assistant Secretary of Defense for Health Affairs. During fiscal years 1976-84, DOD spent about $222 million to acquire, implement, and operate various stand-alone and integrated health-care computer systems. Stand-alone systems support individual hospital functions (such as pharmacy, laboratory, and patient appointment and scheduling). In an integrated system, hospital departments share a common data base so that they can share information. For example, in an integrated system, once a patient is registered, the registration data may be accessed by other departments, such as pharmacy or radiology.

In May 1985, the TRIMIS program office issued a Request for Proposals to acquire CHCS, a state-of-the-art medical computer system. DOD plans to evaluate proposals submitted by vendors and then on or after June 1, 1986, select up to three finalists. These finalists are to (1) independently develop, in their proposed systems, a standardized set of functional requirements and (2) demonstrate these systems to DOD in an extended benchmark test to be completed by March 1987. Sometime between August 1986 and July 1987 DOD will evaluate these results with its test of the Veterans Administration's system.[3] Based upon submitted proposals and the results of the Veterans Administration's and extended benchmark tests, DOD plans to select a final vendor in July 1987 to deploy CHCS in 167 hospitals, 577 clinics, and 20 other medical facilities worldwide, over an 8-year period, beginning in September 1987. We will be reporting on the evaluation of the Veterans Administration's system test and the final CHCS contract selection process in 1987. DOD expects CHCS, once implemented, to provide a fully integrated hospital computer system to military medical treatment facilities worldwide. The program office has estimated that CHCS will cost between $800 million and $1.1 billion, depending on the configuration of the computers.

In response to growing congressional concerns about the risks associated with acquiring complex and costly medical ADP systems, the Assistant Secretary of Defense (Comptroller), in 1979, directed the TRIMIS program office to follow acquisition guidelines specified in Office of Management and Budget Circular A-109. The circular instructs federal agencies on

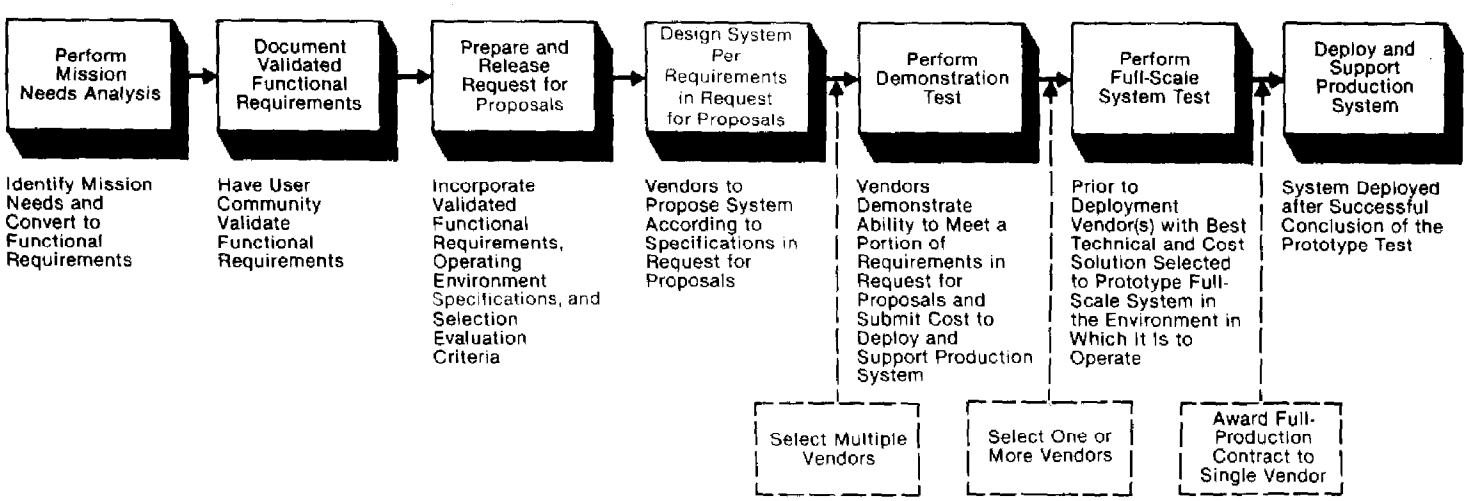
[3]The 1986 DOD Authorization Act (Public Law 99-145) requires DOD to test the Veterans Administration's medical system in two military hospitals; evaluate the test (starting March 1, 1986); and determine the cost and feasibility of using this system in DOD hospitals in lieu of CHCS before making the final decision and contract award scheduled for July 1987.

how to conduct a major system acquisition and is intended to improve the management process and minimize risks of inadequate system performance and excessive cost.

The Circular A-109 strategy uses demonstration tests between competing vendors to obtain system performance information before awarding the production contract, thereby allowing design and engineering changes to be made early and providing increased assurance that the system will operate as expected before large amounts of money are spent. According to the circular, awarding the production contract without adequate assurance that the system will meet performance requirements could lead to higher costs, schedule delays, or a deployed system that does not perform as required. Figure II.1 illustrates the key issues involved in the Circular A-109 acquisition process.

Under the A-109 strategy, the TRIMIS program office plans to conduct a two-stage procurement. First, in June 1986, it plans to select up to three vendors who will be required to develop systems to conform with the specifications as described in the CHCS Request for Proposals. Second, the program office, after an extended stage I benchmark test competition, plans to select, in July 1987, a single vendor to deploy, operate, and maintain CHCS.

Figure II.1: Circular A-109 Acquisition Process



CHCS' A-109 Acquisition Strategy Could Limit Program Success

DOD's approach to implementing the A-109 acquisition strategy could adversely affect the CHCS program's success: DOD may award the system deployment contract without adequate assurance that the winning vendor is capable of delivering the required system within the program office's estimated delivery schedule and at a reasonable cost. Specific problems noted in DOD's implementation of the A-109 acquisition strategy follow:

- The extended benchmark test competition among vendors, a key method of reducing project risk, will not demonstrate over 700 (or 40 percent) of the 1,800 CHCS functional specifications, omitting many complex and beneficial system requirements. Several government and industry representatives stated that the need to develop the system software, encompassing complex CHCS functions, and then to fully integrate these functions poses the greatest technical challenge to a system developer and the greatest risk to DOD.
- The final vendor contract to deploy CHCS hardware and software to all military hospitals and clinics worldwide is to be awarded before the vendor demonstrates that the chosen system will work in military medical treatment facilities.
- The functional capabilities to be developed by vendors during the extended benchmark test are incomplete. Many of the concerns raised by the Surgeons General in response to the requirements-validation process (directed by the House and Senate Appropriations Committees) are being addressed as part of the 487 system change requests approved by the TRIMIS program office. To date, none of these system change requests have been incorporated into the CHCS functional specifications provided to prospective vendors as part of the Request for Proposals.
- The site preparation and hardware requirements for all military medical treatment facilities to be served by CHCS will not be studied until after the final contract is awarded, thus making DOD's estimates of the size of systems needed and costs uncertain, and its evaluation of bidder proposals questionable.

These deficiencies raise questions about whether (1) the extended benchmark test, as currently planned for CHCS, will sufficiently reduce project risks as intended by the A-109 strategy and (2) the government will award a production contract to a vendor who can deliver an integrated, comprehensive CHCS system meeting all user needs at a reasonable cost within the schedule established by the TRIMIS program office.

According to TRIMIS officials, the primary reason the current acquisition strategy was adopted was to reduce risk while expediting deployment of the system at a reasonable cost.

Table II.1 compares and contrasts the major components of the typical A-109 acquisition strategy with the approach adopted by TRIMIS.

Table II.1: Comparison of Typical Circular A-109 Strategy With TRIMIS A-109 Approach

A-109 Components	Typical A-109 ADP Strategy	TRIMIS Compliance
A. Mission needs		
Define Requirements And Analyze Mission Needs	Define institutional ADP needs as driven by the agency's current and future mission.	Accomplished.
Develop Functional Specifications	Translate identified mission needs into a set of functional requirements.	Accomplished.
Validate Functional Requirements	Validate identified functional requirements through review by the user community; incorporate valid system change requests into the functional requirement document provided to vendors.	TRIMIS did not include all of the valid system change requests in the CHCS Request for Proposals. Of the 487 system change requests generated by the user community during the validation process (including Surgeons General comments) and approved by the program office, none were incorporated into the Request for Proposals.
B. System concept design		
Consider Operating Environment Develop System Sizing Data	Utilize validated functional requirements together with information about the characteristics of the operating environment to design an ADP system based on an optimal mix of hardware, software, and communications technology.	TRIMIS did not provide complete site information to CHCS bidders. Information related to site preparation and system sizing is needed if the vendor is to design an ADP system based on a cost-effective mix of available technology.
C. Test/evaluation and deployment		
Conduct Demonstration Test	Vendors judged technically competent demonstrate their solution at their own facility. While A-109 does not preclude a demonstration test between partially developed systems, the value of the test is diminished if many of the complex functions are not included.	TRIMIS plans to: —Test approximately 60 percent of the functional capabilities of the CHCS system, leaving out some of the more complex functional requirements.
Conduct Full-scale Prototype System Test	A single vendor who demonstrates the best technical solution is then allowed to prototype the system in a "live" environment.	—Award the final CHCS contract for all DOD hospitals before testing the CHCS prototype in a military hospital.

Extended Benchmark Test Incomplete

One reason for conducting an extended benchmark test under the A-109 acquisition strategy is to assure the government that the selected vendor's system will operate as expected within cost and schedule estimates. Under the TRIMIS program office's test plan, however, over 700 (or 40 percent) of the 1,800 approved functional requirements for CHCS

will not be demonstrated by competing vendors. Nor will DOD adequately evaluate whether critical functions can be successfully integrated. Also, many complex functions are omitted from the test. DOD's estimated cost of including all approved functions in the test is small compared to (1) the estimated total cost of CHCS and (2) the risk associated with deploying CHCS without assurance that the system can meet all performance requirements on schedule and at reasonable cost. The following shows the major CHCS functional capabilities and when they are scheduled to be deployed.

Table II.2: Major CHCS Functional Capabilities and Deployment Schedule

December 1987	June 1988	March 1990
Patient Registration	Patient Admission, Disposition, Transfer	Administrative Nursing
Patient Appointment and Scheduling	Business Office	Radiology-Anatomical Pathology Transcription
Verification of Patient Eligibility	Clinical Records	Clinical Dietetics
	Pharmacy (except Inventory Control)	Pharmacy Inventory Control
	Retrospective Quality Assurance	Pathology
	Personnel Scheduling	Interfaces to Other DOD Health-Care Systems
	Radiology/Order Entry/ Results Reporting	
	Laboratory and Blood Bank (except Pathology)	
	Clinical Nursing	

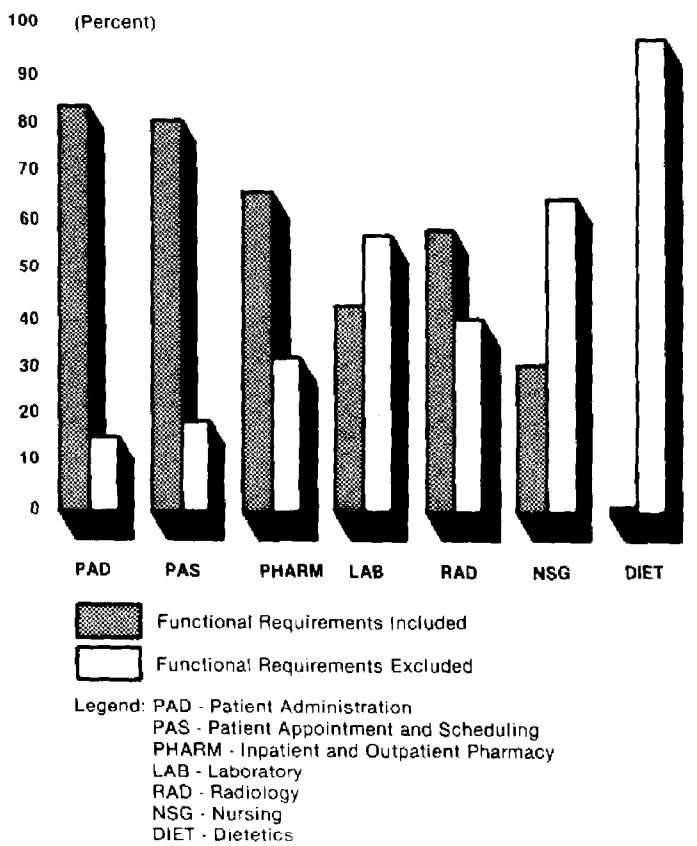
The CHCS Request for Proposals delineates these broad functional capabilities into more than 1,800 functional requirements—the features and capabilities that the program office has determined during many years of study as essential to meeting the ADP needs of DOD's medical facilities. The functional requirements have been further grouped into seven modules that represent broad hospital functions, such as patient administration and radiology (see figure II.2 on p. 21).

The extended benchmark test is the primary feature of stage I of the CHCS acquisition, and it is intended to demonstrate the competing vendor systems' capability to perform a portion of the functional requirements specified in the CHCS Request for Proposals. The TRIMIS program office has ranked the specific functional requirements to be addressed during each of the two CHCS contract stages and has assigned these requirements to one of four development phases (Phases I, II, IID, and III). The

designation "Phase IID" was assigned by the TRIMIS office to indicate those Phase II functions that would be developed after the stage II contract is awarded. Phases I and II functional requirements will be developed and demonstrated by all competing vendors during the stage I extended benchmark test. Those functional requirements in Phases IID and III are scheduled for development after the stage II contract is awarded, concurrent with CHCS deployment.

Of the approximately 1,800 functional requirements specified for the complete CHCS, about 1,090 (60 percent) are required to be demonstrated in the extended benchmark test. Figure II.2 shows a detailed breakdown, by module, of the percent of functional requirements included and excluded from the test.

Figure II.2: Percent of CHCS Functional Requirements Included and Excluded From Extended Benchmark Test



Even though 60 percent of the total functional requirements are included in the benchmark test, the percentage varies widely by individual system module. For example, 81 percent of the functional requirements comprising the patient appointment and scheduling module will be demonstrated in the extended benchmark test, while only 2 percent of the dietetics module requirements will be included.

Although we did not verify the complexity of each function omitted from the extended benchmark test, our analysis of the Request for Proposals, supplemented with supporting documentation and statements from agency officials, indicates that many of the features and functions omitted are complex requirements and are important to the overall value and effectiveness of CHCS. Several officials from the TRIMIS program office told us that the important Phase IID and Phase III functions are more complex and difficult to automate than the Phase I functions. The Request for Proposals and other documentation also support these statements. For example, the system decision paper states that, "Phase II will provide the foundation for the more complex requirements of Phase III and beyond." However, none of the Phase III CHCS functional requirements that provide significant support to physicians, nurses, and administrators will be tested. Phase III will provide more extensive, concurrent quality assurance, personnel scheduling, and inventory control and support to specific needs of nursing service, radiology, and clinical dietetics.

Although the program office's benchmark test is intended to test both functionality and integration, the test may not adequately address integration requirements since many complex functions will not be tested. For example, the nursing module, key to CHCS, has to be integrated with many other CHCS modules. One of the important functions in the nursing module is the capability to order various tests, diets, or therapeutic procedures provided by other departments. Thus, the nursing order entry functions must be integrated with radiology, laboratory, dietetics, and other CHCS modules. However, only 35 percent of the nursing functions will be evaluated during the benchmark test.

The complexity of the functional requirements excluded from the benchmark test was underscored by one of the CHCS offerors, who was relieved that the benchmark test did not include all of the CHCS nursing module. According to this vendor, the nursing module not only contains many complex functions, but it also requires that these functions be fully integrated with other CHCS applications. According to several government and industry representatives, the need to fully integrate the

systems and their functions poses the greatest technical challenge to a system developer and the greatest risk to DOD.

Examples of functions required to be integrated in the completed CHCS system, which either will not be tested or will be tested in only one of the seven required modules during the extended benchmark test and thereby not tested for integration, include features that would allow DOD medical personnel to

- document inpatient conditions and activities or develop and execute patient-care plans;
- control inventories of pharmacy, laboratory, and medical supplies for nursing;
- receive warnings against exceeding drug-dosage limits;
- create, update, or maintain patient dietary menus or orders;
- handle billing for patient services and other financial requirements; and
- submit secondary orders for laboratory tests and pharmacy prescriptions through the system.

Appendix III shows a more complete listing of CHCS functional requirements that either will not be tested or will be only partially tested as part of the planned extended benchmark test.

According to TRIMIS program office officials, a complex process was used to select the CHCS functions to be included in the extended benchmark test. However, DOD's analysis justifying those functions to be excluded from the test was not documented. The objectives of this selection process were to

- minimize functional risks by including all functions requiring integration in the test;
- minimize risk to benefits by ensuring that the functions representing the greatest benefit are demonstrated during the test;
- minimize technical risk by requiring the vendors to test those requirements that are not standard in health information systems or are not well-developed ADP capabilities;
- maximize competition by awarding the extended benchmark test stage to several vendors and by allowing them to compete for the final stage II contract; and
- minimize schedule risk by limiting the applications tested.

One example cited by a responsible TRIMIS program office official was the exclusion of the inventory control functions from all of the tested

CHCS applications. This official stated that these functions were demonstrated in the TRIMIS stand-alone pharmacy system. However, he could not identify any military hospital that had successfully implemented the inventory control functions in the pharmacy system.

Program office officials chose not to include all the functional requirements because, they said, they wanted to expedite CHCS deployment at DOD's medical facilities. These officials also said that they are requiring the contractors to test the key requirements and that it will not be difficult or excessively costly to develop the remaining requirements during the stage II deployment contract.

Cost of Including All Functional Requirements in Test

According to DOD estimates, the costs associated with developing and testing all the functional requirements omitted from the extended benchmark test are small in relation to the total cost of the CHCS procurement and the risk involved with excluding complex requirements that operate in an integrated environment. According to the TRIMIS program office's life-cycle cost model, DOD estimates the overall cost of CHCS at between $800 million and $1.1 billion.

The total cost of including all functional requirements in the extended benchmark test is affected by the number of vendors selected to develop prototype systems and to participate in the benchmark test competition. If software containing all CHCS functions were to be demonstrated as part of the benchmark test, all benchmark test vendors, rather than just the winning CHCS vendor, would develop the software and would be reimbursed by the government as part of a cost-plus-fixed-fee contract. If TRIMIS cost estimates are correct, all CHCS functional requirements can be demonstrated as part of the pre-award competition for a small, incremental cost of the total estimated CHCS cost. If it should turn out that TRIMIS has underestimated the costs of developing the complex functions included in Phases IID and III, inclusion of these functions in the extended benchmark test would provide TRIMIS with a far more realistic estimate of the actual cost of system development and the time required to implement the system. But the cost of having these vendors develop all the functions would be higher. (Since the actual cost estimates are procurement-sensitive and affect the vendor selection process, we have not included them in this report.)

By waiting to develop many complex functional requirements and to test their integration until after the CHCS production and deployment contract, DOD is increasing the risk that the government will select a

vendor who is not able to meet all performance requirements on schedule and at a reasonable cost.

Comprehensive System Testing Is Advisable

A test and demonstration of all functional requirements as part of the competitive vendor selection process are more consistent with provisions of Circular A-109 than with the current strategy. While Circular A-109 does not preclude holding a benchmark test competition between systems that are only partially developed, the purpose of the test can be compromised when many complex features and functions are omitted from the competition. The A-109 concept seeks to reduce the government's risk by demonstrating the winning vendor's ability to meet technical system requirements at a reasonable cost before awarding a full-production contract. Thus, while the TRIMIS pre-award competition among vendors is in line with Circular A-109 guidance, limiting competition to only Phase I and Phase II functions, while omitting the more complex functions in Phases IID and III, does not fully achieve the purposes envisioned by the circular.

The experience of other federal agencies in developing or procuring complex ADP systems demonstrates the desirability of thorough system testing before final production begins or selection decisions are made. For example, in 1984 we reported[4] that the Air Force made its production and selection decisions regarding the Phase IV Base Level Computer Replacement Program hardware and software without adequate testing. As a result, additional computer equipment is needed to handle anticipated work-load demands. The Air Force is now assessing how much it will cost to upgrade the system to meet operational requirements. According to the Air Force, these updates may increase the Phase IV life-cycle cost by almost $200 million.

Similarly, the Army Audit Agency reported[5] that the Army did not conduct representative work-load testing before awarding a contract to acquire hardware and software for its base operations. Current computer usage is over twice what was portrayed during testing. The Army indicated that this oversight has affected its ability to meet mission needs; computer capacity planned for mobilization contingencies must now be used to meet day-to-day requirements. Although the Army

[4] Air Force Progress in Implementing the Phase IV Base Level Computer Replacement Program (GAO/IMTEC-84-7, Jan. 18, 1984).

[5] Army Audit Agency Reports: HQ 80-204, Feb. 6, 1980; and SW 84-200, Feb. 10, 1984.

stated that additional computer capacity is required, the size and cost have not been determined.

Agency Comments and Our Evaluation

DOD officials stated that they believed they had appropriately addressed the functional requirement complexity issue in constructing the extended benchmark test. They stated that, in their opinion, the functional requirements in the benchmark test included all technical and performance requirements, all generic CHCS capabilities (such as the capacity to generate a pharmacy label), and all complex functions. They added that, in consideration of our concern, they had a consultant independently review the CHCS system specifications and those of the extended benchmark test and that the consultant stated, in writing, that all complex functions were contained in the test. However, the officials said they could not provide documentation to support their opinion, and they did not know what analysis the consultant conducted to reach its conclusion. They agreed, however, that the systems development risk could be reduced further and said they would consider the cost, risk, and schedule aspects of including all functional requirements in the extended benchmark test.

DOD's approach is in keeping with our recommendations and could lead to actions that would further reduce the risk. However, DOD's opinion that all complex and other important functions are included in the benchmark test conflicts with our analysis, DOD documentation, and statements from TRIMIS program office officials. Also, we cannot comment on the adequacy of the consultant's evaluation without information on the analysis conducted to support the resulting written statement.

Winning System Will Not Be Tested in a Military Hospital Before Full-Production Decision

In an attempt to maintain a rapid CHCS deployment schedule, program office officials made two major decisions. First, they decided to limit the number of functional requirements included in the benchmark test being conducted at the contractors' facilities. Second, they decided to not require the winning vendor to fully demonstrate that the system chosen would work in a military hospital before awarding a contract to implement the system in all DOD medical facilities. This approach is contrary to the requirements of DOD Directive 5000.3. The guidance calls for DOD activities to perform operational testing in the environment in which the system is expected to operate before making a full-production decision.

The House and Senate conferees on the fiscal year 1985 Appropriation Act agreed that DOD need not incur the added cost of conducting a benchmark test in a military hospital, as long as the vendor prototype could be tested using data to partially simulate the work loads typically found in DOD medical facilities. Since multiple vendors would be selected to compete in the benchmark test, the time, expense, and disruption associated with multiple hospital tests were considered unnecessary. The conferees did not comment, however, on the advisability of fully testing the winning system in a DOD hospital before awarding the full-production contract to the selected vendor and deploying it in all DOD facilities.

After the benchmark test is completed and a final vendor is selected, the A-109 strategy and DOD regulations require the selected vendor to further test the prototype system in the "realistic" environment in which the system is expected to operate for an agreed period of time before a final contract is awarded. Such a test is known as a BETA test. Under the present CHCS acquisition strategy, the selected prototype system is to be "BETA tested" in three DOD hospitals after the final contract is awarded and is scheduled to run concurrently at three sites for 3 months. However, these BETA tests will involve only Phase I functional requirements of CHCS. As shown in table II.3, BETA tests for CHCS Phase II, Phase IID, and Phase III capabilities are scheduled later in the contract cycle.

Table II.3: Phasing of the CHCS Project

Milestone dates	Contract event
Stage I	
May 1985	Request for Proposals released
June 1986	Contract awarded to three vendors
July 1987	Contract awarded to final vendor
Stage II	
September-November 1987	BETA test Phase I
October 1987	Begin hardware delivery to hospitals
December 1987	Start deployment of Phase I
March-May 1988	BETA test Phases II and IID
June 1988	Start deployment of Phases II and IID
December-February 1989-90	BETA test Phase III
March 1990	Start deployment of Phase III
December 1995	CHCS life cycle ends

The CHCS deployment contract will not be contingent upon successful testing in the three BETA-test hospitals. Under the proposed CHCS contract and deployment schedule, hardware deliveries to hospitals worldwide are to begin 4 months following final contract award, whether or not the BETA tests are completed or are successful. If the BETA test is unsuccessful, DOD may be faced with having to cancel the contract. Under this strategy, costly hardware will be bought and deployed in military hospitals before DOD has assurance that the selected vendor can deliver the complex software needed for CHCS to perform according to specifications.

Agency Comments and Our Evaluation

DOD officials agreed that the risk inherent in this aspect of the procurement should be reduced. Accordingly, they said they would expand the initial operational test to include all CHCS Phase I, Phase II, and Phase IID functions and modify the proposed CHCS stage II contract to require the winning vendor to successfully pass the initial operational test before DOD would award the full-production contract. They also agreed that the risk associated with the Phase III requirements should be reduced. According to these officials, they would assess various alternatives and, at a minimum, change the proposed CHCS final contract to require the winning vendor to successfully pass an operational test for Phase III functions before related hardware and software are purchased and installed.

This approach should eliminate the risk of awarding the full-production contract before the vendor successfully demonstrates the system's ability to function in a military hospital.

CHCS Requirements Not Modified to Reflect Valid System Change Requests

The CHCS requirements, as stated in the May 1985 Request for Proposals, do not include all the validated functional requirements identified by the services. In 1984, House and Senate conferees directed DOD to validate and rank the CHCS functional requirements and to ensure that the concerns and the requirements of the services' three Surgeons General were resolved before the Request for Proposals was released. While DOD incorporated some Surgeons General concerns in the Request for Proposals, the program office, to avoid delaying its procurement, deferred action on many concerns that may affect system functionality and cost. Instead, it decided to resolve these outstanding concerns after final contract award. In addition to the Surgeons General concerns, the program office has continued to identify and validate other requirements changes affecting CHCS functionality. As of January 27, 1986, it had not provided

any of the deferred Surgeons General concerns or new changes in the functional requirements to the CHCS vendors for consideration in their proposed designs.

Many Surgeons General Comments Not Addressed

The validation process, which was directed by the House and Senate, resulted in 662 Surgeons General comments on the CHCS functional requirements. Table II.4 summarizes the TRIMIS program office's response to the Surgeons General regarding the disposition of their comments.

Table II.4: DOD Validation of the Surgeons General's Comments

Included in proposal	92
No action required	63
Deferred action	470
Rejected	37
Total	**662**

According to TRIMIS officials, all comments identified as high-priority changes were included in the CHCS Request for Proposals. The program office determined that no action was required on 63 comments because they involved "unnecessary" changes. An additional 37 comments were rejected because they were inconsistent with CHCS design objectives. The remainder (470), which program office officials believe affect system functionality, are to be processed as system change requests after the selection of the winning vendor, in accordance with the program office's change control procedures.

These deferred requests include changes considered necessary by the Surgeons General. For example, a radiology change would require the radiology scheduling system to include conflicts, preparation delays, or previously scheduled patient procedures, and ensure that sufficient time is available to perform the procedure. Similarly, a laboratory change would require the laboratory system to identify and track a donor's blood for future use. Program office officials stated that the three Surgeons General agreed to allow the program office to resolve the deferred comments after the Request for Proposals had been released to avoid a 6-month delay in issuing the CHCS solicitation document.

Change Requests Not Included

In addition to the deferred Surgeons General comments, the program office has identified and processed many additional system change

requests that could affect the functionality and cost of CHCS. Table II.5 shows the program office's initial classification of all approved system change requests as of December 30, 1985. A final classification will be made after program office contractors analyze the functional impact of the proposed changes.

Table II.5: Classification of the TRIMIS Program Office's System Change Requests

Class I	308
Class II	177
Unclassified	2
Total	**487**

Note: The deferred Surgeons General comments are included in the table. However, there is no "one-for-one conversion" of comments to system change requests. For example, one comment may generate more than one change request or several comments may require only one change request.

As shown above, the program office has classified 308 of these requests as Class I changes that, by DOD's definition, represent changes that "affect the functional, allocated or technical configuration requirements. They may also affect project cost or delivery schedules." Class II changes are defined as editorial, grammatical, terminology, or explanatory changes to functional requirements. System change requests designated as unclassified have not yet been evaluated in the program office. According to responsible DOD officials, the above system change requests have not been included in the CHCS Request for Proposals; nor have these changes been provided to the vendors bidding on the system.

The system change requests DOD has identified to date represent changes it believes are needed in the CHCS functional requirements. Because the proposed systems are based on incomplete requirements, their design, development, and testing in the benchmark test will not address all validated user needs. DOD plans to incorporate these additional requirements as change requests to the system after final contract award.

Numerous studies show that the longer an organization waits to implement required system changes, the more significant the impact on system costs. For example, a study summarizing experiences from several major ADP system development projects states that it is 100 times more expensive to implement changes during a system's operational phase than during system design.[6] To avoid increased costs and schedule

[6]Barry W. Boehm, Director, Software Research and Technology, TRW, Inc., published this study in 1976 and included large software experiences of such major vendors as IBM, GTE, and TRW.

delays, DOD would need to implement these changes as soon as possible within the current acquisition strategy.

Agency Comments and Our Evaluation

DOD officials agreed with our position stating that offerors participating in the extended benchmark test should incorporate all critical changes into CHCS system specifications. Accordingly, they plan to incorporate all approved technical and functional changes, including those identified in this report, into the Request for Proposals and release it to the winning vendors in the extended benchmark test.

DOD's planned approach should eliminate the increased cost and schedule delays that could have resulted from excluding validated system change requests from the benchmark test.

Military Medical Facility Requirements Not Accurately Reflected in the Request for Proposals

Federal regulations, including the Federal Information Resource Management and Federal Acquisition Regulations, indicate that government agencies should provide to vendors all relevant information describing the proposed system's operating environment. This information will enable vendors to design a system that meets the validated requirements of system users and that incorporates the best possible mix of existing hardware, software, and communications technology. This information should include, among other things, work-load and computer-device requirements (such as the minimum number of terminals and printers needed at each site), as well as the condition of existing facilities and communications capabilities. The information is used to size proposed computer systems, to identify facility or communications deficiencies that would affect the selection of the most appropriate technology to satisfy design requirements, and to develop system life-cycle cost estimates. Two problem areas concerning the CHCS operational environment data provided to prospective vendors were that (1) detailed site preparation data were not furnished to the vendors and will not be developed until after final contract award and (2) the computer terminal devices required for each site may be significantly underestimated.

As a result, DOD may select a CHCS system design that (1) does not represent the best technical alternative and (2) may not operate in military hospitals without extensive modifications or new construction, which could cost significantly more to implement than the estimated $800 million to $1.1 billion.

Site Preparation Data Missing

Prospective CHCS vendors are proposing system designs for the stage I contract based on limited site information. They have not been provided complete site-specific information on the types and condition of the medical facilities and the condition of existing data communication, electrical power, air-conditioning, and available space capabilities at the approximately 764 medical facilities scheduled to receive the proposed CHCS system. According to various vendors and the CHCS stage I Request for Proposals, this information is needed so that vendors will know what technology is appropriate for the conditions that exist at DOD facilities and whether DOD will need to make major facility modifications to accommodate the chosen technology.

According to program office officials, rather than delay release of the CHCS Request for Proposals until site data could be collected, they chose to defer collection until the vendors competing in the extended benchmark test are selected. At that point, the competing vendors will be allowed to perform site surveys at the initial three installation sites. This newly collected data will be used by the vendors to make necessary design changes and to prepare final proposals for the entire CHCS system. Site surveys at all facilities will not be made until after the final CHCS contract is awarded to the winning vendor in July 1987. Until that time, DOD will not know the extent of modifications required to implement the winning design or if, in fact, the winning design can be cost effectively implemented.

The government, under terms stated in the Request for Proposals, will be obligated to pay for any and all facility modifications determined by the vendor to be needed to implement the system. Thus, because the actual cost of site preparation is not known during the final cost evaluation, the question arises as to whether the best system for the least cost will be selected.

Computer Terminal and Printer Device Requirements Are Not Realistic

Prospective vendors were provided formulas to determine the number of computer peripheral devices, such as terminals and printers, required at 22 "representative" facilities. According to the Request for Proposals, these data are to be used by vendors to determine the size of computer systems needed to support CHCS requirements at all facilities. If the data misrepresent actual requirements, it could lead vendors to erroneous conclusions regarding the appropriate size of computers needed to support CHCS. A recent Army assessment at Fitzsimons Army Medical Center, Aurora, Colorado, raises questions about whether the model

used to develop computer terminal and printer requirements accurately reflects current needs.

The Army TRIMIS team surveyed equipment needs required to support a comparable Veterans Administration medical ADP system being tested at Fitzsimons. The team estimated that 785 terminal and printer devices were needed. Even though CHCS is designed to offer more features than the Veterans Administration system, the CHCS model only shows 482 terminal and printer devices needed for users at such Class I facilities as Fitzsimons. This difference raises questions regarding the validity of user requirements provided to prospective CHCS vendors and the associated system costs. To illustrate, if the Army's estimate of Veterans Administration terminals and printers is a more accurate reflection of CHCS requirements at Fitzsimons, terminal, printer, and associated communications costs to install the more complex CHCS system at this hospital could exceed current estimates by over $884,000. Similar increases may result at many of the other 763 facilities scheduled to implement CHCS.

Further, the CHCS model may not accurately reflect the computer processing requirements needed within a given class of medical treatment facility. As mentioned previously, the model indicates that 482 terminals and printers are needed in all Class I hospitals. The size of hospitals within Class I, however, can vary widely. For example, hospitals containing between 216 and 1,000 beds are considered Class I. (Fitzsimons has 493 beds.) Vendors are using the device number, along with a representative work-load figure, to determine the appropriate computer size for each class hospital. This means that all Class I hospitals will require the same computer capability. If the operating work load of each Class I hospital varies as significantly as the number of beds, it could result in hospitals having more or less computer processing capability than actually needed.

Program office officials agreed that the work load and physical characteristics of each facility will influence the type and size of the required computer hardware. These officials stated that, to reduce the amount of effort, they used the model based upon surveys at 22 "representative" sites rather than identifying equipment needs at each hospital. They said they believed this model accurately represents site equipment requirements and that variations within the hospital class size are not significant.

Agency Comments and Our Evaluation

DOD stated that it believed its initial approach to addressing military medical facility requirements in its Request for Proposals was fundamentally sound. However, DOD agreed to take the corrective action we recommended. Specifically, DOD said it plans to

- create a smaller category (class) representing the largest hospitals;
- provide site-preparation and engineering data from all sites to the participants in the extended benchmark test;
- provide more representative work-load data on each category (class) to the extended benchmark test participants; and
- include, as part of its cost evaluation methodology used to select the winning vendor, the government's costs expected to be incurred as a result of the specific solution proposed by the offeror.

DOD's planned approach should provide the vendors with the more detailed information needed to adequately assess the cost of the system and provide DOD with a better estimate of related government costs.

CHCS Acquisition Delays Are Mitigated by Existing ADP Capabilities

We believe the deficiencies in the current CHCS acquisition strategy warrant correction before CHCS is deployed. While this course of action may result in delays and may not seem attractive to DOD, the potential adverse effects resulting from any such delays would be mitigated, to some extent, by the availability of existing military non-integrated automated hospital systems, including one system currently being deployed to all military hospitals worldwide.

Current Strategy Increases Risk

The current CHCS acquisition strategy exposes the government to the risk of selecting a final vendor and deploying a costly system before it is adequately developed and tested and the required cost and delivery time are known. This strategy may not go far enough in ensuring that, after large expenditures of funds, a satisfactory system fulfilling the promise of comprehensive medical ADP support will be made available to the military medical departments. Awarding the final vendor contract without having adequate assurance that the system will perform as required could lead to (1) higher costs and (2) deployment of a system that does not perform as required and may never fully realize the benefits required to justify the billion-dollar expenditure.

Indeed, one of the attractive features to DOD of the current acquisition strategy is that much delay is avoided by awarding the final contract

and beginning deployment of Phase I of CHCS while the vendor concurrently develops software for the remaining requirements. Moving additional requirements and additional testing to the pre-award period would effectively delay implementation of Phase I capabilities. However, by proceeding under the current strategy to select the final vendor, award the contract, and deploy CHCS Phase I capability, DOD is trading off its assurances that the remaining requirements will be completed satisfactorily and within reasonable time and cost. Since these requirements are complex and important to the overall utility of the system, this tradeoff may be a high price to pay for expediency in deploying Phase I.

Alternative Strategy Requires Delay

On the other hand, correcting the problems discussed in this report would delay the CHCS project since the Request for Proposals would need to be modified. The Request for Proposals would need to include all known requirements and more complete and realistic testing. Additionally, site-specific data would need to be gathered and made available to potential vendors as part of the Request for Proposals. Allowing time to revise and reissue the Request for Proposals and reconsider bids may be highly unattractive to DOD, which perceives the need to expeditiously deploy needed medical ADP support. The adverse effects of such a delay in the CHCS acquisition, however, are mitigated, to some extent, by the considerations discussed below.

The AQCESS System Is Being Deployed

DOD is currently deploying to all its hospitals an interim, non-integrated, quality assurance system known as AQCESS; this system incorporates all of the functional capabilities to be deployed during CHCS Phase I, as well as additional capabilities. As of January 4, 1986, the program office deployed 94 AQCESS systems; an additional 73 systems are scheduled to be deployed by June 1986. Thus, by June 1986, all 167 DOD hospitals worldwide are scheduled to receive the initial AQCESS. TRIMIS estimates the 5-year, life-cycle cost of AQCESS to be about $74.6 million. This amount includes $36.4 million for planned deployment of AQCESS outpatient quality assurance and scheduling enhancement to all 167 DOD hospitals. Under the CHCS acquisition strategy, AQCESS will be replaced by CHCS in 1989. However, the project office is budgeting for an additional 2 years of AQCESS operations in case the CHCS project experiences delays.

AQCESS provides functional capabilities that, in many ways, exceed those to be deployed during Phase I of CHCS. A comparison of functional capabilities of the Phase I CHCS system and the AQCESS system is shown in table II.6.

Table II.6: Comparison of Functional Capabilities of Phase I CHCS and AQCESS

Functional capability	AQCESS	CHCS
Patient Registration	YES	YES
Patient Appointment and Scheduling	YES	YES
DEERS[a] Interface	YES	YES
Patient Admission/Discharge/Transfer	YES	NO
Inpatient Quality Assurance	YES	NO
Clinical Records	YES	NO
MTF[b] Business Office (Accounting)	YES	NO
Outpatient Quality Assurance	YES	NO
Ad hoc Reporting	YES	NO

[a]Defense Eligibility Enrollment Reporting System

[b]Medical Treatment Facility

As shown in table II.6, AQCESS will provide a far broader set of functions than the Phase I CHCS system. All AQCESS capabilities, including enhancements, are scheduled to be available worldwide by June 1986, except for the patient appointment and scheduling and outpatient quality assurance enhancement, which is scheduled to be available at all 167 hospitals no later than March 1987. Thus, AQCESS will be fully deployed at least 9 months before DOD begins deploying Phase I of CHCS. (See table II.3 on page 27.)

Other Military Medical Computer Systems Are Available

Many military hospitals in the United States already have some medical ADP support. During its 12-year planning and development of programs, the TRIMIS program office installed numerous stand-alone medical computer systems in large hospitals. These systems, known as Interim Operating Capability, are designed to support a single type of function, such as patient appointment and scheduling, pharmacy, or radiology. The type and number of systems deployed in DOD hospitals at the end of calendar year 1985 are shown in table II.7.

Table II.7: Stand-alone Medical ADP Systems Operational at the End of Calendar Year 1985

Type of system	No. deployed
Pharmacy	21
Patient Appointment and Scheduling	13
Patient Administration	6
Laboratory	15
Radiology	16
Total	**71**

Furthermore, three military hospitals currently operate commercial hospital information systems. These systems were installed in 1984 to test the capabilities of "off-the-shelf" integrated medical ADP systems to meet military requirements.

Additional Time for Testing the Veterans Administration's System May Be Justified

If the CHCS acquisition is delayed, it would allow additional time to be spent on the congressionally mandated test and evaluation of the Veterans Administration's Decentralized Hospital Computer Program system under way at March Air Force Base in California and at Fitzsimons Army Hospital. These tests are scheduled to run from March 1 to September 1, 1986, to allow time for evaluation before a final CHCS decision and contract award in July 1987.

The fiscal year 1986 DOD Authorization Act directs DOD to test the Veterans Administration's medical system in two military hospitals, one at March Air Force Base and the other at a large non-Air Force military hospital to be designated by the Secretary of Defense. The Fitzsimons Army Hospital was later chosen as the second test site, and both projects are now under way. The legislation makes clear that the test of the Veterans Administration's system should be considered as an alternative to a vendor-developed CHCS system and that this alternative should be evaluated while the CHCS acquisition process continues. A final choice is to be made prior to July 1987, when the final CHCS contract is due to be awarded.

Given the need to procure and install all hardware, prepare the hospital sites, lay cabling to terminals and printers, and train users in how to operate the system, the tests are being conducted in a very short time frame. If the decision point for the CHCS vendor contract were moved back, the added time for testing and evaluating the Veterans Administration's system could be well spent to better ensure that the advantages and disadvantages of this alternative are fully explored.

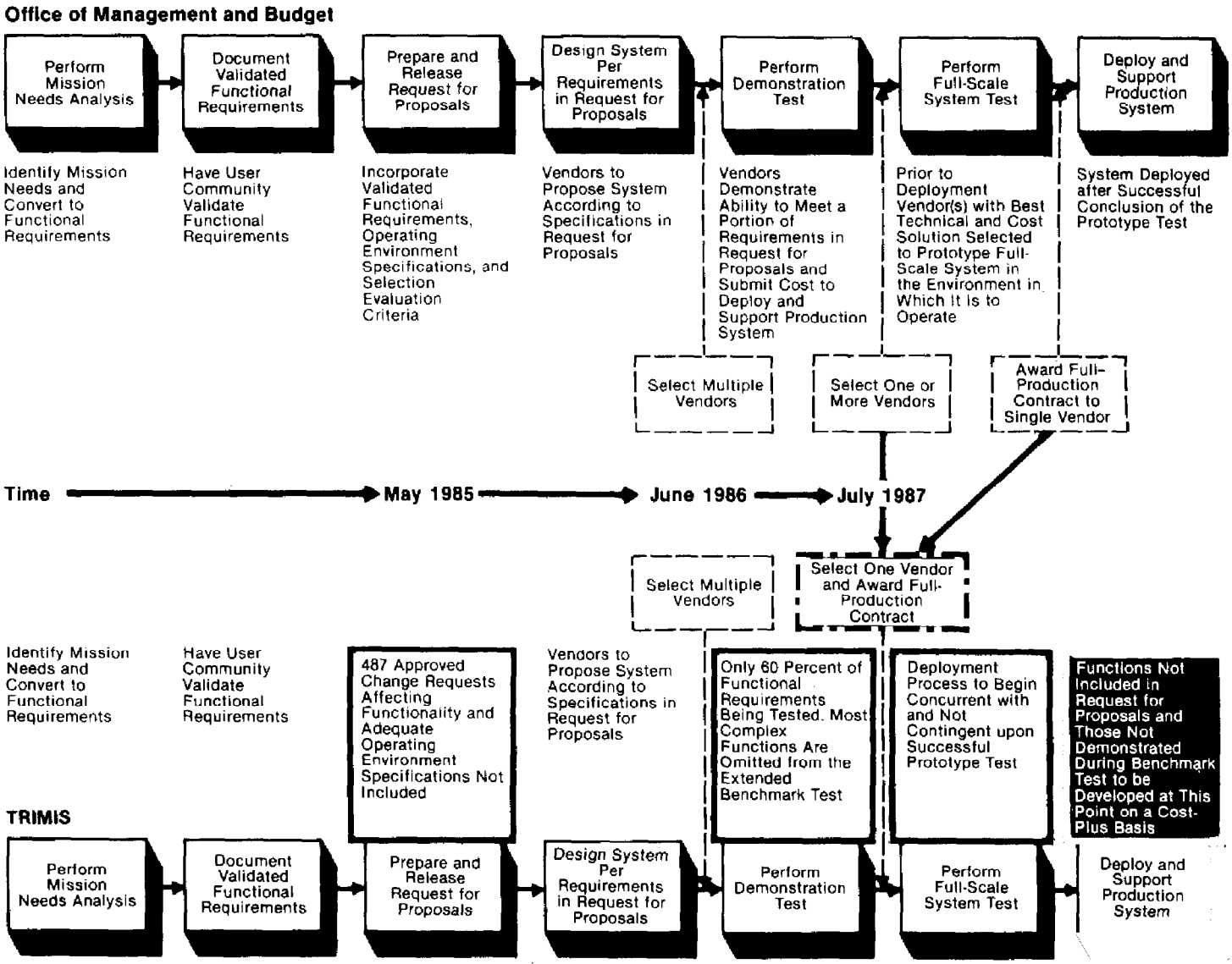
Summary

DOD's acquisition strategy raises several issues. Specifically:

- The extended benchmark test does not include many complex and beneficial validated functional requirements.
- The final vendor contract to deploy selected CHCS system to all military medical facilities is to be awarded before the vendor demonstrates that the system will work in a military hospital.
- Not all approved functional requirement changes are included in the Request for Proposals.
- Not all site preparation and hardware requirements for all military medical facilities will be studied until after the final contract is awarded.

The above issues represent deficiencies in DOD's application of Circular A-109's ADP acquisition process. If these deficiencies are not corrected, DOD could acquire a costly system that does not meet user needs, the same problems Circular A-109 is intended to prevent. The following table compares the Office of Management and Budget and TRIMIS A-109 acquisition processes; the highlighted areas demonstrate the collective potential impact the above issues could have on the CHCS acquisition.

Figure II.3: Circular A-109 and TRIMIS Acquisition Processes



CHCS Capabilities That Either Will Not Be Tested or Will Be Only Partially Tested During the Extended Benchmark Test

Scheduling	Order Entry/Results Reporting
Resources (rooms, equipment)	Secondary orders
Medical treatment facility beds	Nursing orders (selected)
Civilian/Military Health	Nursing and laboratory results (selected)
Care Contingency System beds	Radiology results entry (selected)
Health care personnel	

Resource Management	Document Control
Inventory of consumables	Medical record tracking
Medical service accounting	Inpatient record tracking
Personnel management	X-ray image control
Blood Bank management	Library control
Transfusion services	
Food service management	
Management reports	

Patient Scheduling	Interfaces To External Systems
Radiology/Patient scheduling	Food service
	Medical logistics
	Civilian/Military Health Care Contingency Systems
	Tactical systems
	Decentralized Hospital Computer Program
	Services administrative systems

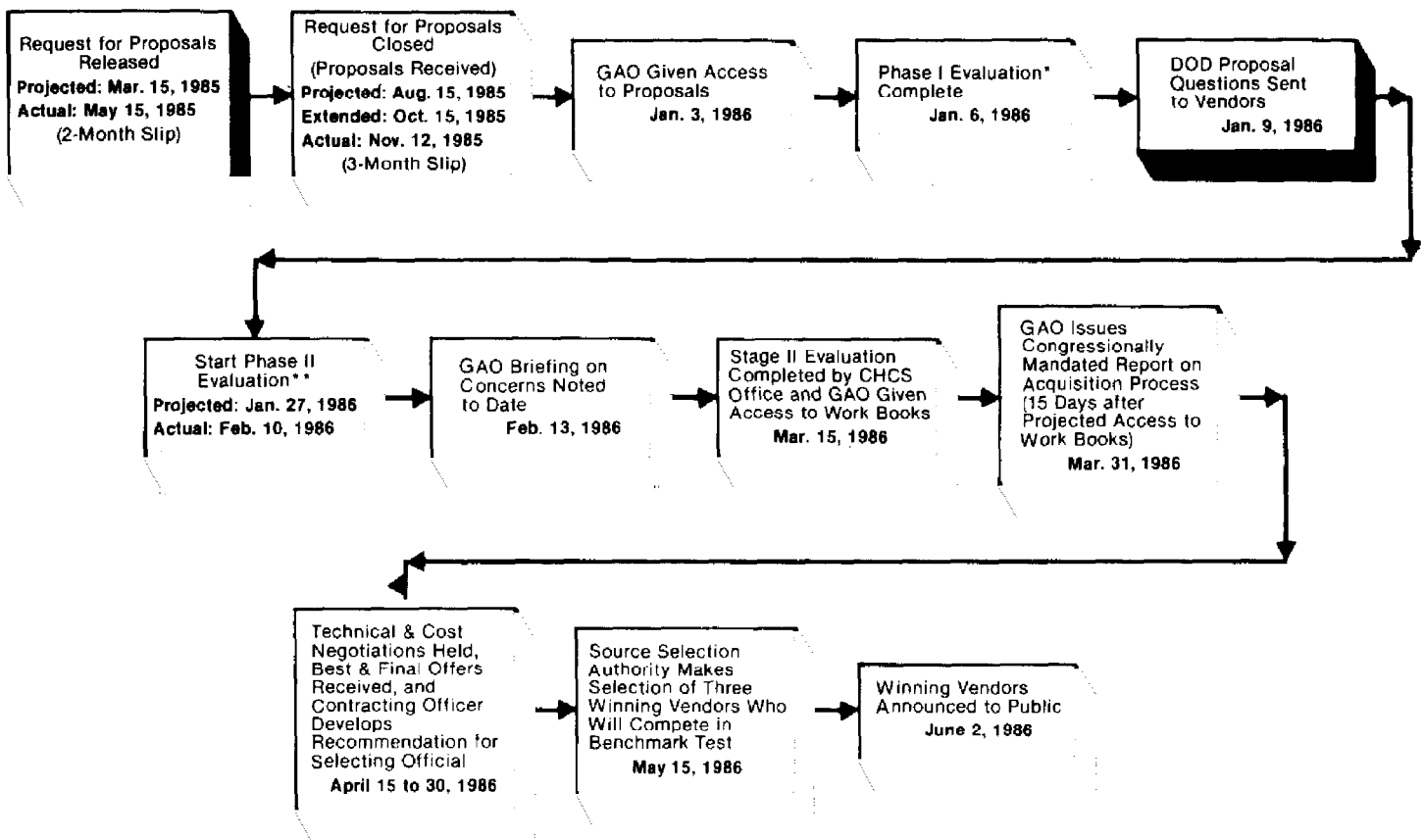
Patient Care	Data Archival and System Management
Outpatient history	Data archival
Inpatient history	Table maintenance
Patient needs profile	System calculations
Monitoring electrical activity	
Documenting patient condition	
Scheduling patient activities	
Documenting implementation of patient care	
Capability for outpatient encounter data entry	
Formulate diets	
Nursing care plans	

Diagnostic Aids	Quality Assurance
Drug-diet inquiry	Antomical pathology
Dosage limits/warnings	Radiology
Nursing care plans	Nursing

Diagnostic Aids	Quality Assurance
Patient assessment tools	
Tumor registry	
Drug testing program	
Anatomical pathology work document	
Laboratory labels	
Anatomical pathology labels	
Radiology flash cards	

	AD HOC Reports
	Laboratory
	Nursing
	Pharmacy
	Patient appointment and scheduling
	Patient administration
	Nursing

CHCS Acquisition Process and Key Events as of March 31, 1986



PHASE I EVALUATION *

The Evaluation Process Is a Two-Step Process. Step One Involves Assigning a Pass/Fail Rating to Each of the Following Factors:

- Contract Management
- Technical
- Personnel
- Corporate Experience
- Cost

Under Step Two, a Quality Assessment is Performed on How Well Vendors' Proposals Address Each Item in a Factor, and a Ranking of 0 to 19 Is Assigned.

PHASE II EVALUATION **

The Phase II Evaluation Duplicates Phase I but Uses New Information Provided by Vendors in Response to DOD Questions. This Evaluation Will Be Complete When DOD Prepares Final Proposal Rankings.

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