PROCUREMENT OF UNIT SUBSTATIONS

REPORT TO STANFORD LINEAR ACCELERATOR CENTER - ABA NO. 100
STANFORD UNIVERSITY SUBCONTRACT S-136
UNDER AEC CONTRACT AT(04-3)-400

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September 1964

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INTRODUCTION

The project 12.47 kv electrical distribution system will use some 31 unit substations located throughout the Accelerator Site. These unit substations will transform the power from the distribution voltage of 12.47 kv to the various voltage levels required for facility operation. At present, three of the unit substations are in service in completed Campus Area buildings; 22 substations are on order with the first deliveries and installations recently made; and the remainder will be procured under one or more forthcoming contracts for the Target Area construction.

This report describes the procurement policies and practices followed by ABA in obtaining the unit substations. Procurement objectives and basic requirements for substation purchase are discussed, the alternate procurement methods considered and used are analyzed and evaluated, and conclusions and recommendations based on this experience are given.

OBJECTIVES AND BASIC REQUIREMENTS

Because of the nature of the Center's planned experimentation (24 hour accelerator operation, and the many temporary or development type connections required), the procurement of equipment of high standards of quality, dependability and safety is mandatory. It is also necessary to maintain schedule and budgetary requirements. The availability of qualified maintenance service and standard replacement parts are further procurement considerations.

Quality and dependability are of more than usual importance because of the large amount of electrical power which is required for the project and which must be handled safely by the substations in the event of a short circuit in the system. If the equipment fails to perform as specified, the hazard to personnel and property will be critical to the operation of the

accelerator. Since substantial set-up and operating costs will be incurred for the extensive research experiments contemplated, inordinate downtime of electrical equipment will result in costly delays to the Center's research program. Thus, in order to ensure insofar as possible that each substation, as a whole, will perform satisfactorily under the most extreme conditions, it is a specific requirement of the specifications that the major components (transformers and draw-out type circuit breakers) be manufactured and that all sections of the unit substations be completely coordinated, assembled and tested by the same contractor.

Safety is of concern because personnel will be working in the immediate vicinity of the substations. In the event that a substation is called upon to interrupt the flow of current under short circuit conditions, the enclosure must contain any resulting explosion. It is also felt that proper maintenance and safety of maintenance personnel can better be assured by uniformity of substations in regard to components, arrangement, methods of assembly and identification.

Schedules for delivery are also an unusual factor in this procurement because the required delivery dates of certain unit substations are known only in approximate terms and are subject to change as construction schedules for the facilities are developed. The substations having the longest delivery times are least definite as to required delivery dates.

Price is important to the extent that the funds available for the unit substations are budgeted by facility. The design of each substation and the procurement methods to be applied should ensure competitive bids in line with industry pricing standards for the equipment specified. Consideration was given to future maintenance and operating costs by specifying equipment that will hold these expenses to a practical minimum. It is felt that uniformity

of substation components will reduce the size of required spare parts inventory and promote more efficient inventory control.

ALTERNATE PROCUREMENT METHODS CONSIDERED

Three basic procurement methods were considered:

1. The purchase of the unit substations individually by ABA as required and as definitive specifications were developed and the furnishing of the substations to the facility contractor for installation.
2. The inclusion of the unit substations as an item to be furnished under the construction contracts for the various facilities they serve, thus causing the unit substation to be purchased and installed by the general contractor for the facility or by his electrical subcontractor.
3. ABA bulk purchase of a number of the unit substations under a single contract for the design, fabrication and delivery of substations to the site, over a period of time as required by the development of facility construction schedules, and their installation by the respective facility contractors or subcontractors. Under this method, one specification would cover all substations, sized to present knowledge of capacity requirements.

ADVANTAGES AND DISADVANTAGES

1. The first method has the advantage of purchasing each substation when the detailed specifications and delivery date are relatively certain. It gives no assurance of the desired uniformity of components and manufacture and, as a practical matter, insures a lack of uniformity since it is unreasonable to suppose that one manufacturer could consistently be low bidder on as many as 22 separate invitations for bids. This lack of uniformity adversely affects safety and cost to

the extent that it impairs the efficiency of maintenance and causes an increase in inventory costs.

2. The second method had the above advantage and also had the advantage of achieving better coordination of delivery and installation since the same contractor would control both the ordering of the unit substation and its installation. However, it is subject to the same serious disadvantages associated with lack of uniformity of components and manufacture.

3. The third method lacked the two advantages listed above but met the objectives and requirements of the procurement in the following respects:

   a. Dependability would be promoted in a bulk purchase by assuring uniformity and standardization of the substation components and their arrangement. With one firm responsible for all substations, better coordination and control of specified manufacturing standards and component reliability testing should ensue.

      Standardization would also result in fewer maintenance parts, with added flexibility and interchangeability, thus promoting dependability by facilitating optimum control of parts inventory and preventive and corrective maintenance.

   b. Safety would be promoted by the quality factors mentioned above. Also, uniformity and standardization in regard to components, arrangement, methods of assembly and identification would contribute to the safety of maintenance personnel in that they would more quickly become familiar with the substations and also avoid the human errors which often occur when people work with several pieces of equipment which appear to be the same and are not.

c. Schedule requirements would more likely be satisfied by a bulk purchase. A contractor with a large contract tends to be more responsive to changes of schedule because a large order represents a significant amount of work in his own production schedules. Thus he will be more sensitive to the delivery requirements of a large order than he will to those of a smaller order.

d. Budgetary considerations are favorably affected by the bulk purchase method for several reasons.

The sales, estimating and scheduling costs to the contractor are likely to be less per unit substation under the bulk purchase than under individual purchase. Some of this cost saving should be reflected in the bids.

Uniformity of the unit substations should effect efficiency of maintenance, allow a lower dollar amount of inventory, promote effective inventory control and attendant purchasing economies by ordering parts in optimum quantities.

A bulk purchase would reduce engineering and procurement expense since there would be one set of drawings, one specification, one bid opening, etc. rather than separate procurement activity for each substation.

The bulk purchase method presented several problems:

a. Delivery would be required over a period of nearly two years; thus, the invitation for bids would have to provide for the risk of cost increase during the period of the contract.

b. The capacity requirements of every substation were not definitely known but were subject to change as design criteria for the facilities

to be served were further developed and refined. Load requirements could, however, be forecast with sufficient accuracy to warrant basic component specifications. Therefore, it would be necessary to provide a contractual method for increasing or decreasing the designed capacities of individual substations and for pre-determining corresponding price changes.

c. The need for flexibility in delivery and capacity presented a problem in structuring the Invitation for Bids in such a way that competitive, firm-price bids would result rather than offers to negotiate each unit substation order.

CONCLUSIONS AND RECOMMENDATIONS

It was concluded that the problems presented by bulk purchase method could be overcome by careful drafting of the Invitation for Bids and contract forms and that this method would best meet the basic requirements of the procurement.

The Invitation for Bids which was issued for 22 of the required substations contained two schedules which were prepared in such a way as to provide the required flexibility of delivery schedules and capacities, to allow for pricing the risk of future cost increases and to encourage competitive, fixed price, lump sum bids.

Schedule 1 lists each unit substation and a period during which delivery is required. A firm price was requested for each unit substation on the list. The addition of these prices was the lump sum amount of the bid. The individual unit substation prices are useful as a base price for changes and as an amount for invoicing and payment purposes. The individual prices combined with a stated delivery period allowed the bidders to price the risk of future cost increases for each substation and thus an escalator clause was not necessary.

Schedule 2 lists substation components such as potheads, switches, transforming sections, circuit breakers and motor starters which can be provided in different sizes to change the capacity of a unit substation. Since the amounts quoted for components are used to price changes, they did not become part of the lump sum bid. A single price for each item was requested to be used for either additions or deductions. This was done to discourage the bidder from unbalancing his bid. Since he could not predict whether the price would be used to increase or decrease his contract, he was encouraged to bid a reasonable price.

It was not known when these changes would occur so component prices were requested for deliveries to be made in 1964 and a separate price for deliveries to be made in 1965. Thus the bidder could use these prices to reflect his estimate of the risk of future price increases for these two years.

Project schedules required individual ABA procurement or contractor purchase of three of the unit substations for the first facilities completed. Design of the substations required for the Target Area was in the early planning stage, therefore, delivery and capacity could not be forecast with sufficient accuracy to allow procurement within the flexibility limits of the proposed contract. Thus, the bulk purchase finally consisted of 22 unit substations under a single lump sum contract, rather than all of the remaining units.

It is proposed and recommended that the remaining unit substations required be purchased under a single contract in this same manner at a time when their capacities and required delivery dates are known with sufficient certainty to be compatible with an Invitation for Bids similar to the one used for the 22 unit substations.