

COMPILING CONSTRUCTION
COST ESTIMATES,
SPECIFICATION FOR

ENGINEERING DEVELOPMENT DIRECTORATE

National Aeronautics and
Space Administration

John F. Kennedy Space Center



COMPILING CONSTRUCTION
COST ESTIMATES,
SPECIFICATION FOR

Approved:

A handwritten signature in cursive script, reading "James D. Phillips", is written over a solid horizontal line.

JAMES D. PHILLIPS
DIRECTOR OF ENGINEERING DEVELOPMENT

JOHN F. KENNEDY SPACE CENTER, NASA

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SPECIFICATION FOR
COMPILING CONSTRUCTION COST ESTIMATES

1. SCOPE

This specification has been approved by the Engineering Development Directorate of the John F. Kennedy Space Center (KSC) and is mandatory for use by KSC and associated contractors.

This specification covers preparation of cost estimates for NASA projects at KSC. Requirements and guidelines herein provide the details required for cost breakdown and uniformity of cost presentation in estimates compiled for each of the codes listed in paragraph 2.

2. CLASSIFICATION

Cost estimates shall be classified as follows:

- | | |
|---------------|--|
| a. Code A1 | Budget |
| b. Code A2 | Preliminary Engineering Report |
| c. Code B | Labor and Materials Unit |
| d. Code C | Detailed Construction |
| e. Code C-95 | Detailed Construction (incorporated comments and changes from a 90-percent design review) |
| f. Code C-100 | Final Construction (consists of the approved C-95 estimate and cost factors added by NASA/KSC) |
| g. Code D | Change Order |
| h. Code E | Government Cost Estimate for Arch/Engineer Work |
| i. Code F | Other |

3. REFERENCES

The following references (latest issue) provide materials for guidance in preparing cost estimates.

3.1 Federal Regulations.

- | | |
|--------|--------------------------------|
| a. FAR | Federal Acquisition Regulation |
|--------|--------------------------------|

3.2 Department of Defense.

- a. AR-415-17 Construction Empirical Cost Estimate for Military Construction and Cost Adjustment Factors (March 1980)
- b. TM-5-800-2 Department of Army Preparation of Cost Estimates, Military Construction, General Criteria (May 1966)

3.3 National Aeronautics and Space Administration.

3.3.1 Headquarters.

- a. NHB 5100.4 Federal Acquisition Regulation Supplement (NASA/FAR Supplement, April 1984)
- b. NHB 8820.2 Facility Project Implementation Handbook (March 1981)
- c. SPECSINTACT NASA Standard Construction Specification System. (October 1982)

3.3.2 Kennedy Space Center.

- a. DE-PD 5110.1 Government Estimates for Construction/Installation Procurements (February 10, 1977)
- b. KSC-SPEC-G-0003 Ground Support Equipment Cost Estimating (July 5, 1977)
- c. TR-1508 Budget Cost Data For Facility Construction Elements (November 18, 1985)
- d. TR-1511 KSC Monthly Facility Construction Cost Index (January 16, 1986)
- e. TR-1495 KSC - Estimating Orientation (November 2, 1976)

3.4 Department of Labor, Bureau of Labor Statistics.

- Bulletin 917 Handbook of Work and Output (June 1947)

3.5 Occupational Safety and Health Administration.

- Occupational Safety Construction Standards and Interpretations & Health Act, Vol. II. (May 31, 1985)

3.6 Other.

- a. American Association of Cost Engineers Annual Meeting Transactions - 1985
- b. Industrial Psychology and Its Social Foundation, Harper & Brothers

4. PRICING SOURCES

Estimators shall have ready access to reference books, catalogs, and other documents usable as sources of current price information. Source documents recommended for use in compiling cost estimates for NASA/KSC projects are provided in paragraphs 4.1 through 4.3.

4.1 General.

- a. Building Construction Cost Data, Robert Snow Means - 1986
- b. Building Cost File, Southern Edition, Construction Publishing Co., Inc. - 1985
- c. Compilation of Nationally Averaged Rental Rates for Construction Equipment, Associated Equipment Distributors - 1985
- d. Contractors' Equipment Ownership Expense, Associated General Contractors of America, Inc. - 1985
- e. McGraw-Hill Cost Information Systems/Dodge Cost Publications
 - 1985 Dodge Construction Systems Costs
 - 1985 Dodge Manual for Building Construction
 - 1985 Dodge Digest of Building Costs and Specifications
 - 1985 Dodge Guide to Public Works and Heavy Construction Costs
- f. Engineering News Record, McGraw-Hill, Inc. - 1986
- g. Estimators' Equipment and Installation Manhour Manual, John S. Page - 1978
- h. Estimators' General Construction Manhour Manual, John S. Page, Gulf Publishing Co. - 1977
- j. Net Prices Catalog, McMaster-Carr Supply Company - 1985
- k. Building Estimators Reference Book, Frank R. Walker Co. - 1986 (22nd ed).
- l. ORR System of Construction Cost Management Vol. I through IV - 1980-83

- m. Cost Engineering By AACE (monthly magazine)
- n. Cost and Optimization Engineering, Dr. S.C. Jelen - 1970

4.2 Mechanical.

- a. Cost Manual for Piping and Mechanical Construction, Herbert Herkimer, copyright: 1958, last printing: 1979. 1958 to 1986 units are the same.
- b. Estimators; Manhour Manual on Heating, Plumbing, Air Conditioning, and Ventilation, John S. Page, Gulf Publishing Company. Last printing: 1978
- c. Estimators' Piping Manhour Manual, Page and Nation, Gulf Publishing Company. Last printing: 1976
- d. Labor Calculator, National Association of Plumbing, heating, and Cooling Contractors. Last printing: 1971
- e. Mechanical Estimating Guidebook, John Gladstone, McGraw-Hill. Last printing: 1981
- f. Tool Rental Guide, Mechanical Contractors Association of America, Inc. - 1985
- g. Machine Shop Estimating, W.A. Nordhoff, McGraw-Hill. Last printing: 1976
- h. Manufacturing Cost Eng. Handbook, E. Malstrom, Marcel Dekker. Last printing: 1984

4.3 Electrical.

- a. General Cable, General Cable Corporation - 1985
- b. Estimators' Electrical Manhours Manual, Gulf Publishing Company. Last printing: 1979
- c. GESCO Estimator, The General Electric Supply Company - 1985
- d. Graybar Catalog, Graybar Electric Company, Inc. - 1985
- e. National Price Service Monitor, Henderson-Hazel Corporation - 1985
- f. Unistrut General Engineering Catalog and Prices - 1985
- g. NECA Manual of Labor Units, National Electrical Contractors Assoc. - September 1985

- h. Electronic Industry/Cost Eng. Data, Fred G. Hartmyer, Ronald Press Co. - 1964

5. ESTIMATE PREPARATION

5.1 General Requirements. Cost estimates shall be prepared on NASA/KSC furnished forms. Legible originals shall be submitted so that the estimate can be reproduced by quality photocopy process. The original and three copies of the estimate shall be provided to the lead design engineer.

Cost estimates for all codes shall be prepared in the same careful manner as if bidding in competition with an experienced, qualified contractor engaged in similar construction work, and shall be based on a normal 40-hour work week. When a project has more than one building/structure, or when different types of funding must be accounted for, the cost estimate must be prepared for each part of the project, respectively. The latest cost data available shall be used or noted why not used.

The estimator/cost engineer shall obtain the necessary design information to estimate the project in the detail required, especially when working with performance specifications and Preliminary Engineering Reports (PER's) that require but do not define systems and equipment, such as sprinkler and Halon systems, cranes, hoists, electrical/electronic control systems, and program-oriented ground support equipment.

Detail material quantity takeoff and labor hours with respective pricing shall be summarized for each of the work elements and will be related to their respective 16 divisions of SPECINTACT. These work elements shall be carried forward to an overall project summary, broken down in the following major work elements:

- a. I Site work
- b. II Building and/or structures to the 5-foot line, including all interior architectural/structural, interior mechanical and interior electrical work
- c. III Utilities outside the 5-foot line
- d. IV Any specialized construction

Estimates shall cover all work shown on the plans, specifications and other pertinent documents. The lead design engineer will be notified, in writing, of conflicts in the plans and specifications or other unclear areas.

Appendices A through G contain the degree of detail required for each type of estimate and the required format. One Coff project has been selected to serve as an example, and illustrates the increase in detail expected as the design progresses from concept through completion.

5.2 Special Requirements.

5.2.1 Budget Cost Estimate (Code A1). This estimate is used to prepare a prospectus or other request for project authorization. It is the initial determination of the project scope that can be completed for a stipulated amount, and serves as a basis for overall program planning and control, for establishing equitable fees in negotiations with A/E firms, and for comparative cost analyses. The cost estimate shall be prepared using NASA/KSC Form 1510 or another form as specified by NASA/KSC, and formatted for submittal in accordance with appendix A.

5.2.2 Per Cost Estimate (Code A2). This estimate is the product of detailed analyses of user requirements determining a design that should result in lowest possible life cycle cost for the proposed project. The PER incorporates all information needed to formulate a basis for design and includes the basis for requirements, analyses of facility functions or work, evaluation of different approaches and recommended solutions, a cost estimate that accommodates additional and reasonable cost escalation and contingency factors, construction schedules, plot plans, drawings, schematics, equipment lists, and peripheral considerations (real estate requirements, erosion control, pollution control, environmental factors), as applicable. Cost estimates for PER's shall be prepared in accordance with NHB 8820.2, using KSC Form 21-193. The estimates shall be formatted for submittal in accordance with appendix B.

An example of the detail required in PER estimates is provided in appendix E. Units of measure and descriptions used in the estimate shall be as listed in TM-5-800-2, Measurements and Checklist. The development of the estimated cost for design and engineering services shall also be included with the estimate.

5.2.3 Labor and Materials Cost Estimate (Code B). This estimate combines costs for labor and material into single unit costs and may be required for preliminary design concepts and cost tradeoffs to support a preliminary design review. Code B estimates, when required, shall be prepared using KSC Form 21-224, and shall be detailed with costs broken down in accordance with appendix C.

5.2.4 Detailed Construction Cost Estimate (Code C). This estimate shows separate costs for labor and materials associated with each divisional task estimated for the construction project. Unless otherwise specified, they will be prepared for each design review milestone through 100 percent design completion, and updated at the midpoint of the bidding period or as often as directed by the cognizant lead design engineer. All code C estimates shall indicate the degree of completion of the design review milestone (C-30, C-60, C-90, as applicable). Code C estimates shall be prepared using KSC Form 21-243 and be detailed to the extent that all work is identified and costs are listed. The estimate shall be summarized and formatted for submittal in accordance with appendices D and/or E, as applicable. The code C estimate shall be prepared for each item that NASA/KSC designates for the bid schedule.

Supporting data is required for all code C estimates and shall be prepared on KSC Form 19-75 (figures F-3 and F-4) or on other suitable estimating forms, as shown in figures F-1 and F-2 (KSC Form 21-471). The supporting data shall provide identification of:

- a. Detail material quantity takeoff, labor hours, and related price computations or quoted prices
- b. Price sources and direct quotations from at least three sources for all major material and equipment cost items to verify estimated cost (i.e., type, size, and quantity) and showing the date, source, address and the expected delivery time required for each item
- c. Government-furnished equipment value in today's dollars and related contractor handling costs, if applicable
- d. The estimator's review comments on the drawings and specifications related to value engineering cost reduction, exotic and costly material, or fabrication and erection methods, as applicable

Information in supporting data sheets shall be referenced to the estimating sheet number(s) where corresponding cost figures appear.

Items b, c, and d shall be submitted with each estimate (see appendix F for examples and required format). Item a, such as detail material, quantity takeoff, labor hours and related price calculations, minor price data and analysis, and minor cost studies, shall be retained by the contractor and submitted, if required, by the lead design engineer.

5.2.5 Construction Cost Estimate (Code C-95). This estimate represents the 100 percent design package and incorporates changes and comments approved during a 90 percent design review. It reflects the final estimate of project cost and may not include any special conditions. The special conditions will be included in the C-100 estimate. No contingencies other than the government contingency specified shall appear in the estimate. The C-95 estimate shall be formatted for submittal in accordance with appendix D.

5.2.6 Bid Cost Estimate (Code C-100). This estimate, often called the government estimate, is a refined C-95 cost estimate. It must reflect any amendments to the bid package, special conditions, or any other changes since the C-95 estimate was delivered to the government. The final estimate shall be based on all bid documents, including Invitation for Bid (IFB), Request for Proposal (RFP), and Solicitation Offer & Award (SOA). This estimate will be used as the government estimate. The estimate shall be summarized and formatted for submittal in accordance with appendix E and shall contain as backup the refined C-95 estimate. If the government estimate is 15 percent or more above or below the lowest bidder, the agency/firm responsible for the estimate shall provide written rationale, to the lead design engineer, including a revised government estimate for the variance between the bid and the government estimate.

When errors are uncovered, or when the scope of work changes subsequent to NASA/KSC approval, the estimate shall be revised. Portions of the estimate that undergo revision shall be identified as REVISED and shall indicate the date the revisions were incorporated.

5.2.7 Change Order Cost Estimates (Code D). These estimates are prepared for proposed changes to existing contracts, and are used to negotiate these changes in scope of work. Code D cost estimates require greater detail than estimates prepared for new construction and facilities modification projects. It may be desirable to organize the NASA/KSC estimate in accordance with the format used by the contractor to facilitate rapid resolution of cost differences existing between the two estimates. To the extent possible, code D cost estimates shall conform to format requirements specified in paragraph 5.3. The code designation shall indicate the review milestone (D-30, D-60, D-95), as applicable. When engineering releases a change showing the "WAS" and "IS" views, this does not necessarily mean the "WAS" condition was actually accomplished. The cost engineer/estimator shall verify the site condition.

Timing and issuance of contract change orders initiating preparation of code D cost estimates are important factors. All facets of the work shall be studied, including construction tasks, status of materials procurement by the contractor, change order impact on the contractor's work progress program, and others that influence overall project costs. Examples of cost elements to be evaluated are:

- a. Demolition or modification of work in place
- b. Salvage value and cancellation charges for material
- c. Abnormal work hours for which premium pay rate is paid
- d. Reworking drawings
- e. Reprogramming work schedule
- f. Temporary work to permit orderly progress in adjacent areas

5.2.8 Government Cost Estimate for Architect - Engineer Work (Code E). An independent government cost estimate for architect engineer services shall be prepared and furnished to the contracting officer before commencing negotiations for each proposed contract or contract modification expected to exceed \$25,000. The estimate shall be prepared on the basis of a detailed analysis of the required work as though the government were submitting a proposal. See figure B-4, A&E Design, Cost Estimate, Drawing and Manhour Cost, for sample detail breakdown of drawing and man-hour cost.

5.2.9 Other Cost Estimates (Code F). These estimates are compiled as specified by NASA/KSC to support special studies, surveys, program analyses, and effective project construction cost management. Format, item identification, pricing, organization and coverage shall be as specified by NASA/KSC.

5.2.10 Current Cost Estimate (CCE). This estimate is the cost that reflects the latest and best total project estimated cost available based on design or construction progress. The CCE constitutes the most realistic estimate of ultimate final project costs. It includes the engineering cost to build the project in today's dollars, plus contingencies; escalation to the midpoint of construction; and Supervision, Inspection, and Engineering Services (SI&ES). This is also related to the budget cost as we define it in studies and PER's.

5.2.11 Comparison of Budget and Estimate Costs. Differences in budgeted and estimated costs require early identification. In order to maintain continuous monitoring of costs, each code C estimate project summary shall be marked up to reflect escalation to the midpoint of construction, SI&ES, and government contingency in accordance with appendix G, so that a comparison of budget and estimated project costs can be assessed. This summary shall be included in each estimate over \$100,000. Form number: KSC Form 21-368

5.3 Format. Cost estimate submittals shall be formatted and contain the information specified in paragraphs 5.3.1 and 5.3.2.

5.3.1 Cover Sheet. This sheet shall identify the project title and location; drawing number, project control number (PCN), work order (WO) number and contract number as applicable; appropriate estimate code identification (see paragraph 1.2); and date of submittal. The preparing organization shall be identified by name, address, phone number, and signature of approving official (see appendices D and E for required format). Form number: KSC Form 21-565

5.3.2 Estimate Sheet Headings. The information on the cover sheet shall be inserted in the appropriate heading blocks of each sheet in the estimate. The name and position of the estimator(s) and checker(s) shall appear in the heading of each sheet. Headings in trades' summaries shall indicate the numbers of the drawing sheets used for takeoffs, as well as the drawing number and total sheets (see appendix D for required format).

5.3.3 Summaries.

5.3.3.1 Work Element Summary. This summary is required for all estimates and shall provide cost breakdown of labor, material, equipment, and markup for each work element of the cost estimate (see appendix D, figures D-4, D-5, D-6, D-7, and D-8 for required format).

5.3.3.2 Project Summary. This summary is required for all estimates and shall be summarized into the four major work elements reflecting building square foot costs and system cost by units of measure (cubic yards, tons, linear feet, square feet, pounds), as applicable (see appendix D, figure D-2 for required format).

5.3.3.3 General Conditions and Overhead Summary. This summary is required for all code C estimates and shall identify costs of prime contractor overhead items, such as field supervision, quality assurance, compliance with requirements of volume III of OSHA and home office administration (see appendix D, figure D-3 for required format).

5.3.3.4 Special Conditions Summary. This summary is required for all code C-100 estimates. It summarizes costs resulting from imposition of bid documents and conditions under which the project work will be performed (see appendix E, figure E-5).

5.3.3.5 System Summary. This summary recaps all summaries by work element according to the 16 divisions of SPECSINTACT. The system summaries, when required, shall list the respective division and related corresponding quantities and unit costs. Required for all estimates over \$100,000 with C-90, C-95 submittals (see appendix G, figure G-1 for required format). Form number: KSC Form 21-371

5.3.3.6 Labor Material Cost Summary. This summary, when required, shall list labor and material costs, marked up with taxes, insurance, contractor overhead, profit and bond for each work element of the cost estimate. Required for all estimates over \$100,000 with C-90, C-95 submittal (see appendix G, figure G-2 for required format). Form number: KSC Form 21-369

6. ACCEPTANCE CRITERIA

Cost estimates shall be prepared and formatted in accordance with paragraphs 5.1 through 5.3 and delivered to the lead design engineer. Written waivers to these requirements may be granted jointly by the NASA/KSC lead design engineer and lead cost engineer.

7. ESTIMATE PRACTICES

General estimating practices to be used for construction estimates are as follows:

- a. Cost Breakdowns. Estimates should be broken down in as much detail as possible. As design nears 100 percent, the greater the detail required in the cost breakdown. Cost breakdowns should indicate materials by individual type, kind, and size priced by units of measure listed in TM-5-800-2, Measurements and Checklist. For example, a structural concrete cost breakdown should show, as applicable, separate concrete costs for footings, columns, beams, walls, and slabs; the cost for each type of reinforcing steel; the cost for each type of formwork material; and costs for other associated tasks and materials.

- b. Price Comparisons. A comparison of all major labor and material prices should be made against current prices for similar features of work and adjusted for differences in site, local vendors, and subcontractor prices. The date and source of comparison should be noted on the estimate sheet. If quoted prices or studies of conditions in the geographical area show labor and material costs varying considerably from those in published pricing guides, costs resulting from specific evaluation of job site conditions should be used. Excessive price variations should be justified.
- c. Costs Summary. A summary consisting of the total accumulation of all like costs (i.e., material and labor) should be provided. Direct and indirect costs should be included as a part of the summary. Costs of subcontracted items should be separately identified.
- d. Mechanical and Electrical. Detailed mechanical and electrical estimates should have quantity of materials required and labor in man-hours, with total manhours multiplied by current pricing rates. This should be compared with the KSC cost index. The estimate should include a concise listing of all parts of a project to which units of material and labor costs are assigned.

Estimates for mechanical and electrical installation should be coordinated with other trades, so that all essential items or work are accounted for.

- e. Alternate Work. Estimated costs for alternate work, when applicable, should be identified and priced out. Each alternate should be summarized separately and should not be included in the basic project cost summary.
- f. Price Guides and Quotations. Prices obtained from pricing guides and direct quotation should be used solely to verify the estimator's prices for labor, materials, and equipment. The estimator should break down, in detail, prices obtained from pricing guides and quotes into labor, material, equipment, and other contractor costs (see structural steel price breakdown, (appendix F, figures F-2 and F-3). A specific quotation should supersede published prices and shall be identified as such. The latest cost data available shall be used in evaluation prices. TR 1508 and 1511 are normally more appropriate and current for KSC projects. A detailed cost analysis may be required when quotes appear to be too high or too low.
- g. Sales Tax. The current sales tax in the area local to the project site should be added to the material costs and, if applicable, to equipment rental costs.

- h. Payroll Taxes and Insurance. A percentage should be added to labor dollar totals to cover payroll taxes and insurance (PT&I) items, such as social security (FICA), unemployment insurance (state and federal), workman's compensation, public liability and property damage (including vehicles), and allowances for hazardous trades. TR-1508 and TR-1511 should be used for current percentage rates to be applied to the labor dollar totals.
- i. Labor Rates. Labor rates estimates should be based on information in the KSC construction cost index, latest issue, or other NASA-approved sources.
- j. Markups. Prime contractor and subcontractor costs should be separately identified. The percentage for prime contractor markup for subcontractor work should appear in the individual summary sheets, as applicable.
- k. Profit and Bond. Contractor profit and bond (bid, payment, performance) should be identified.
- l. Separation of Work. Estimates for work beyond the 5-foot line of the building/structure should be separately developed.
- m. The value of government furnished equipment (GFE) shall be estimated in accordance with figure F-4, Method 1, GFE Estimating, on KSC Form 19-75, in lieu of KSC Form 242. The GFE handling, insurance, and storage factor costs shall be included and summarized with the appropriate trades.

The value of GFE shall be listed on the project summary and system summary for funding and budget purposes, but not in project totals.

7.1 General Construction. Labor, material, equipment, (including mill cost, shop fabrication costs, and erection cost for structural steel), should be clearly identified. Applicable taxes, overhead, markup, subcontractor profit and bond associated with installation should be identified, as applicable. All labor costs should be estimated in manhours before converting to dollars.

7.2 Specialized Construction. Because of the specialized nature of NASA/KSC activities, facility projects often require construction of exotic systems, such as hypergolic fuel distribution, which are not normally encountered in routine construction projects. Such specialized construction tasks should be titled, sequenced, priced, and identified so as to be clearly defined in the estimate.

7.3 Facilities Modifications. For repair and modification of existing facilities, estimators should take into consideration existing conditions as determined through study of as-built drawings and visits to the job site. Inherent in this class of project are lost time for demolition prior to starting new work, and joint occupancy conditions which materially reduce labor productivity. These items should be considered when assigning labor costs. To estimate modification cost accurately, estimators shall address the following:

- a. What mechanical, electrical, or other systems and equipment are to be removed or relocated?
- b. At what point does the new work join the existing system?
- c. How will the new work be installed in terms of existing and proposed architectural and structural design?
- d. What restrictions are imposed as to working hours?
- e. What temporary work is required to keep certain areas and functions in operation during the course of the work?
- f. What disposition is to be made of materials and equipment scheduled to be removed, relocated, turned over to NASA/KSC, or become the property of the contractor?

Identification of demolition work required by contractors should be identified in estimates.

8. WITHHELD WORK ALLOWANCES

If a portion of the total project work is to be performed by a separate contract or other means and is to be withheld from the final design, request for bids, or contract award, the estimated cost of this portion of the work should be titled WITHHELD WORK ALLOWANCE in the cost estimate summary. Withheld work allowance costs shall not be included in the sum of project costs titled estimated construction bid cost, but should be identified separately below this title. Summary sheets, when required, shall be inserted at the end of the estimate.

9. SAFEGUARDING

Preparation of estimates for NASA/KSC shall be considered private data. Records, interdepartmental and interagency correspondence, or material that in any way relates to preparation of estimates for NASA/KSC shall be considered administratively confidential and accessible only to authorized NASA/KSC personnel or representatives. Codes C, D, and E -90, -95 and -100 cost estimates shall be stamped FOR OFFICIAL USE ONLY. Supporting data not

attached to the bid schedule estimates should be retained by KSC Engineering Development. After bid opening, a copy of the supporting data will be made available to the NASA/KSC Procurement Office.

9.1 Security of Government Estimates. Use new salmon-colored cost estimate cover sheet see (figures D-1 and E-1) on all original codes C, D, E, and G cost estimates. Order KSC Form 21-565 to cover all estimates.

Control of government estimates:

- a. Estimates distributed on a "need-to-know" basis, only.
- b. Limited copies - minimum required for: Lead Design Engineer (LDE), Lead Cost Engineer (LCE), Project Engineer (PE), System Engineers (SE), Construction Activation & Tests Office (DE-CAT), PROCUREMENT. Each copy should be numbered as required.
- c. C/G 90-95-100 shall be signed and handcarried.
- d. C/G 90-95-100 shall be kept in a secure manner.

9.2 Cancellation of Protective Markings. Protective markings on cost estimates may be cancelled with written permission from DD-FED immediately after the announcement of the successful bidder or at the completion of the project.

9.3 Estimates and Negotiations. Only the latest available NASA-approved cost estimates shall be used as aids in negotiations.

10. ABSTRACT AND STUDY DOCUMENTS

KSC abstract and study documents shall record NASA/KSC estimating performance and facility design costs, and shall be compiled and maintained by a NASA designee as follows:

- a. The KSC Abstract of Construction Bid Costs shall list all construction projects released for bid by NASA/KSC and shall record the project title, PCN, and work order number; bid opening date, number of bidders, name of awarded contractor, and amount of the low, average, and high bids; amount of NASA/KSC estimate, percentage difference between low bidder and NASA/KSC estimate, the position of the NASA/KSC estimate relative to all other bids, remarks concerning differences between the NASA/KSC estimates and amount of the bids; and other information as specified by NASA/KSC.

- b. A cost study to determine the actual design and estimating costs related to the construction costs, when requested, shall list for the projects under consideration the PCN number, work order number, job title, and description. The study results for design and estimating costs shall be summarized as follows:

(1) Design Costs:

- (a) The total manhours to achieve the design
- (b) The total number of design drawings
- (c) The average manhours per design drawing
- (d) The average cost per drawing
- (e) The average cost per manhour
- (f) The design cost as a percent of construction cost

(2) Estimating Costs:

The cost of estimating the project will be summarized in the same manner as design costs.

11. RESPONSIBILITY

When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:

NASA-John F. Kennedy Space Center
Kennedy Space Center, FL 32899

Preparing Activities:

John F. Kennedy Space Center
Engineering Development Directorate
Facilities Engineering Division

APPENDIX A
BUDGET COST ESTIMATE
(CODE A1)

 Facility Project Cost Estimate	
INSTALLATION/PROGRAM OFFICE KSC LC-39 Shuttle	DATE May 1, 1983
PROJECT TITLE Construct Ordnance Building (PSCL)	SUBMISSION/REVISION
BASIS OF COST ESTIMATE Previous Apollo Project	PROJECT CODE A-1
	PROJECT NO PCN 77406
I SUMMARY OF COST ESTIMATE	
DESCRIPTION	AMOUNT a
1 ENGINEERING ESTIMATE	\$1,038,200
2 COST ADJUSTMENT (Enter percentage of item 1a to right in col 2b)	\$ 355,300 34.22
3 SUBTOTAL (1 + 2)	1,393,500
4 CONTINGENCIES (Enter percentage of item 3 to right in col 4b)	139,400 10
5 SUPERVISION INSPECTION AND ENGINEERING SERVICES (Enter percentage of items 3a and 4a to right in col 5b)	153,300 10
6 OTHER BURDEN COSTS	
7 TOTAL BUDGET ESTIMATE (3 + 4 + 5 + 6)	\$1,686,200 62.43
8 IDENTIFICATION OF COST ADJUSTMENT (Item 2 above) AND OTHER BURDEN COSTS (Item 6 above) Based on Jan. 83 Cost with escalation 8-1/2% per year compounded annually from Jan. 83 to Aug 86 = 43 months (Mid Point Construction) Cost Adj Factor, use 34.22 $1.085 \times 1.085 \times 1.085 \times 1.0508 = 1.34217$ Use 1.3422 or 34.22	
II PLANNING AND DESIGN	
DESCRIPTION	STATUS
	NEEDED a
	IN-WORK b
	COMPLETE c
	IN HOUSE AE d
	COST e
1 PRELIMINARY ENGINEERING REPORT	
2 SPECIAL STUDIES (Specify)	
3 FINAL DESIGN	
4 SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES	
5 TOTAL PLANNING AND DESIGN COST	\$170,400
III RELATED COST DATA (Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)	
1 RELATED COSTS INVOLVE ☐ a YES (Identify in Items 2 through 10) ☐ b NONE	
2 PER (Amount) \$56,800	
3 DESIGN (Amount) \$113,600	
OTHER RELATED EQUIPMENT	
4 TO BE PURCHASED	5 ACTIVATION
6 TRANSFER TO EXCESS	9 OTHER REAL ESTATE
8 EXISTING	10 OTHER (Specify)
7 FUTURE FUNDING	

NASA FORM 1510 MAY 80 PREVIOUS EDITIONS ARE OBSOLETE
PAGE 1 OF 2 PAGES

Figure A-1. Project Cost Estimate, Summary (Sheet 1 of 2)

INSTALLATION/PROGRAM OFFICE KSC, LC-39 Shuttle		PROJECT CODE PCN 39143		DATE May 1, 1983			
IV FACILITY PROJECT COST ESTIMATE							
DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST		TOTAL COST	
				ENGNG (3)	BUDGET (4)	ENGNG (5)	BUDGET (6)
1 INTEREST IN REAL ESTATE							
2 SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE (Summary)	Site Work - Fill, Demol. Grass	CY	7,000	7.90	20.54	88,500	143,800
	Paving 1-1/2" Bitum. 6" L.R. Base	SY	3,300	10.00	16.30	33,000	53,600
	Utilities, Sew. Water HTHW	LF	2,500	30.00	48.72	75,000	121,800
3 BUILDING/STRUCTURE WITHIN 5 FOOT LINE (Summary)	Building - Arch. Struct.	SF	4,100	45.46	73.85	186,400	302,800
	Reinf. Concr. Frame Rebar	CY	220	110.00		24,200	
	Form Work	SFCA	7,000	2.30		16,400	
	Masonry Block 8X8X16	SF	10,000	2.50		25,000	
	Struct. St. Misc. & Bar Joist	TONS	10	25.00		25,000	
	Roofing Insulation & SM	SF	4,100	3.50		14,350	
	Doors, Window, Hardware	SF	300	30.00		9,000	
	Finishes - Paint, Floor, Ceiling etc	SF	4,100	3.65		14,950	
	Conveying System Bridge Crane	TON	15	2,500.00		37,500	
	Mechanical	SF	4,100	13.66	22.17	56,000	90,900
	Plumbing & Compress. Air	FIXTURES	16	1,000.00		16,000	
	Air Cond. Heat & Ventilation	TON	20	2,000.00		40,000	
* Electrical	SF	4,100	135.20	219.59	554,300	900,300	
Power Lights, Ground Mis	SF	4,100	23.00		94,300		
Exterior Sub Station M.H.	KVA	2,000	230.00		460,000		
Specialized-GN ₂ Pneu. Syst. S.S.	LF	50	200.00	324.00	10,000	16,200	
Equip & Solar Heat		A/R	350.00	56,800.00	35,000	56,800	
6 SOURCE OF COST DATA KSC Cost Index & Ordnance Fac. 1966		7 TOTALS				1,038,200	1,686,200
V RELATED ITEMS/ACTIONS (Explain as appropriate. Use extra sheets, as necessary, for this block and above.)							
***NO COLLATERAL EQUIP IS REQUIRED - FORM HAS BEEN MODIFIED TO ACCOMMODATE ADDITION LINE ITEMS FOR MORE ACCURATE EST.							
ESTIMATE OF THE BUDGET CONFIDENCE CONFIDENCE FACTOR				A. OFF-THE-SHELF +15 D. R&D +100 B. PREPRODUCTION +50 C. OTHER _____			

Figure A-1. Project Cost Estimate, Summary (Sheet 2 of 2)

APPENDIX B
PRELIMINARY ENGINEERING REPORT COST ESTIMATE
(CODE A2)

Preliminary Engineering Report. Code A-2

PCN: 39143

DATE: May 1, 1984

SECTION III - COST ESTIMATE SUMMARYA. Engineering Estimate:

The cost figures in the Engineering Estimate were arrived at by using KSC Cost Index TR-1511 and January 1984 cost data for building construction, including applicable taxes and insurance and Contractor's markup and bond.

B. Budget Estimate:

The cost figures in the Budget Estimate indicated on the following standard format pages were arrived at by applying the following formula as required by NMI 7330.2A:

$$\text{Budget estimate} = E (1+C) (1+F) (1+G)$$

E is the engineering estimate

C is the contingency factor = 10%

F is the cost-rise factor based on 9% for 1984, 9% for 1985, 8 months of 1986 @ 9% = 6% for 1986 compounded annually from January 1984 to the mid-point of construction, assumed to be August 1986 = $1.26 \times 1.09 \times 1.09 \times 1.06 = 1.259$ Use 1.26

G is the outside agency administrative cost factor-estimated cost for outside agency and/or AE firm contract supervision and inspection including any design required during construction phase = 10%

The Budget Estimate markup therefore is: $1.10 \times 1.26 \times 1.10 = 1.525$. Round to and use 1.53 on the Engineering Estimate.

C. Design and Engineering Services:

Total costs of the design phase including Professional Fees for the preparation of Plans and Specifications, the making of Surveys and Field Studies, and any outside Agency supervision of design are estimated to be \$97,200 (see figure B-4).

In the estimate, grand totals for categories are underlined, subtotals within the categories appear in brackets, and sub-subtotals within the categories appear in parentheses.

ESTIMATOR - VARDELLI, PRC-2421 CHECKER - WRIGHT, PRC-2421			May 1, 1984 PCN 77406				
CONSTRUCTION OF FACILITIES - ESTIMATE OF COST KSC SHUTTLE ORDNANCE BUILDING 1C-39							
1	2	3	4	5	6	7	8
CODE	DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT COST		ENGINEERING	BUDGET
				ENGINEERING	BUDGET		
a	Interest in Real Estate						
b	Site Development and Util. outside 5' line Special Const. GN ₂ line	6,700 SF	CY 14	90.60 .80	138.61 275.40	607,000 9,600	928,710 13,770
c	Building/Structure to 5' Line Arch Structural	SF SF	4,100 4,100	105.85 63.41	161.96	434,000 [260,000]	664,020
	Mechanical	SF	4,100	19.27		(79,000)	
	Plumbing	Fixture	14	864.29		(12,100)	
	Compressed Air	Outlet	5	5.50		(2,750)	
	Air Cond. Sys	Tons	20	3,207.50		(64,150)	
	Electrical	SF	4,100	23.17		(95,000)	
d	All other collateral EQ	EA	1	3,600.00	55,080.00	36,000	55,080
e	Special feature, Solar Heat	4,100 SF	SF	.98	1.49	4,000	6,120
f	TOTAL	SF	4,100	265.85	406.74	1,090,000	1,667,640

KSC FORM 21-193 (REV. 8/75)

Figure B-2. Construction of Facilities, Estimate of Cost, Engineering and Budget Costs

ESTIMATOR VARNDELL, PRC-2421

CHECKER WRIGHT, PRC-2421

May 1, 1984

PCN 77406

CONSTRUCTION OF FACILITIES - ESTIMATE OF COST

KSC SHUTTLE OPERANCY BUILDING, LC-39

1	2	3	4	5	6	7	8
CODE	DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT COST		TOTAL COST	
				ENGINEERING	BUDGET	ENGINEERING	BUDGET
a	Interest in Real Estate						
b	Site Development & Utilities Outside 5' Line	4,100	SF	148.05	226.51	607,000	928,710
	Site Work						
	Demolition - Paving	SF	4,100	25.37	38.81	[104,600]	[159,120]
	Earth Work - Fill	CY	610	3.80		2,320	
	Paving - 1-1/2" Bitum	SF	6,700	8.00		53,600	
	6" Rock Base	SF	3,100	5.65		17,510	
	Grassing	SF	3,100	9.08		28,150	
	Utilities	SF	5,600	1.85		10,360	
	Sewer Line 4" - 6"	LF	1,700	36.47	5,580.00	[62,000]	[94,860]
	Water Lines & Wet Tap 6" - 10"	LF	200	25.00	5,000.00		
	High Temp. Hot Water 1-1/2" Sup & Ret.	LF	1,000	32.00	3,200.00		
	Exterior Utilities	LF	500	50.00	2,500.00		
	Sub Station - Pad-Fence Ground, WP	KVA	2,000	220.50	337.37	[441,000]	[674,730]
	Manholes	KVA	2,000	120.00		240,000	
	Duct Bank - 4W4, 2W4, 2W3	EA	2	506.00		10,000	
	Power Lines 3C -4/0 P11(N) 15KV	LF	700	30.00		21,000	
	13.8 KV LB Switch	LF	1,000	2.50		2,500	
	3000A Secondary Mains	EA	2	10,000.00		20,000	
		EA	2	20,000.00		40,000	

KSC FORM 21-193 (REV. 8/75)

KSC FORM 21-193 (REV. 8/75)

Figure B-3. Construction of Facilities, Estimate of Cost, Quantities and Unit Costs (Sheet 1 of 6)

ESTIMATOR - VARNOFF, PRC-2421 CHECKER - WRIGHT, PRC-2421			CONSTRUCTION OF FACILITIES - ESTIMATE OF COST KSC SHUTTLE ORDNANCE BUILDING, I.C.-39					May 1, 1984 PCN 77406	
1	2	3	4	5	6	7	8		
CODE	DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT COST		ENGINEERING	TOTAL COST		
				ENGINEERING	BUDGET				
c	Exterior Utilities (cont) 3000A Tie Breaker 3000A Feeder Breaker 600A Feeder Breaker	EA	1	200,000.00		200,000			
		EA	3	12,500.00		37,500			
		EA	8	5,000.00		40,000			
		LF	50	180.00		9,000			
	Specialized Const. GN2 S.S	SF	4,100	105.85	161.96	434,000	664,020		
		SF	4,100	63.41		[260,000]	[397,800]		
	Building - Structural to 5' Line	CY	200	14.60		2,920			
		CY	32	90.00		2,880			
	Footings 3000#	CY	85	150.00		12,750			
		CY	10	165.00		1,650			
	Structural, Columns 1000 # Tie Beam 3000#	SFCA	900	2.50		2,250			
		SFCA	5,500	3.50		19,250			
		SFCA	350	3.50		1,225			
		LBS	9,000	.85		7,650			
	Form Work	SF	4,500	.45		2,025			
		SF	4,100	2.00		8,200			
	Rebar - Reinf. Steel MM6X6 6/6	SF	4,100	2.50		10,250			
		EA	11,000	2.10		23,100			

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KSC FORM 21-193 (REV. 8/75)

Figure B-3. Construction of Facilities, Estimate of Cost, Quantities and Unit Costs (Sheet 2 of 6)

ESTIMATOR CHECKER		VARDELL, PRC-2421 WRIGHT, PRC-2421		CONSTRUCTION OF FACILITIES - ESTIMATE OF COST KSC SHUTTLE ORDNANCE BUILDING, LC-39					May 1, 1984 PCN 77406	
1	2			3	4	5		6	7	8
CODE	DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT COST		TOTAL COST				
				ENGINEERING	BUDGET	ENGINEERING	BUDGET			
	Masonry, Conc Block Inter & Exter (cont)									
	Mortar	CY	22			86.00			1,892	
	Wall Reinforcing	LF	8,000			.15			1,200	
	Struct. Steel - Bar Joist Etc.	LBS	10,000			1.85			18,500	
	Beams, Columns & Misc.	LBS	11,000			1.85			20,350	
	Roofing - 5 Ply BUT & G	SF	4,100			1.70			6,970	
	Roofing Insulation	SF	4,100			1.60			6,560	
	Wall Insulation	SF	4,100			1.50			6,150	
	Membrane Waterproof 3 Ply Hot Mod	SF	4,100			1.50			6,150	
	Sheet Metal - Alum/Copper	SF	570			5.15			2,935	
	Caulking - Polysulfided	LF	2,000			2.20			4,400	
	Doors, Frame Hardware	EA	4			2,500.00			10,000	
	Special Vertical Lift - 3 Ea (H1")	SF	260			40.00			10,400	
	Inflatable Seals	LF	150			35.00			5,250	
	Painting - Ext Conc/Masonry	SF	7,500			.20			9,000	
	Exterior Conc/Masonry	SF	11,000			.35			3,850	
	Struct & Misc Steel	SF	10.5			345.24			3,625	
	Conveying Sys. OH Crane Bridge Stl.	LR	1,800			2.00			3,600	
	Hoist Drums - 10 HP & Trolley 5 HP	TON	15			3,000.00			45,000	

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Figure B-3. Construction of Facilities, Estimate of Cost, Quantities and Unit Costs (Sheet 3 of 6)

ESTIMATOR - VARDELL, PRC-2421 CHECKER - WRIGHT, PRC-2421		CONSTRUCTION OF FACILITIES - ESTIMATE OF COST KSC SHUTTLE ORDNANCE BUILDING, LC-39					May 1, 1984 PCN 77406	
1	2	3	4	5	6	7	8	
CODE	DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT COST		ENGINEERING	BUDGET	
				ENGINEERING	BUDGET			
	Mechanical Plumbing & Fixture Compressed Air Air Conditioning, Heating & Ventilation A/C Compressor 25 H.P. Air Cooled Condensor Air Handling Unit DX Coils Piping Fitting & Misc Ductwork Alum & Galv. Duct Insulation 1" Fiberglass Grills & Diffuser Misc. Test & Bal. Crane Power Roof Ventilator, 300 CFM	SF FIXTURES OUTLETS TUNS TON FA FA LF LRS SF EA HR FA	4,100 14 5 20 20 1 1 100 3,000 3,200 35 60 4	19.27 864.29 550.00 3,207.50 1,000.00 7,780.00 5,760.00 5.15 3.50 1.70 60.00 60.00 1,720.00	24.48	[79,000] (12,100) (2,750) (64,150) 20,000 7,780 5,760 515 10,500 5,440 3,675 3,600 6,880	[120,870]	
	Electrical Air Terminal 5/8" O X 24 Outlet Boxes & Control Switches Recpt. 3W, 2P, 120-EP Wire - #2-14 AWG 1C. #2-0 Conduit 3-3-1/2" Galv. Rigid & Fitting 1-1/2-2" Galv. Rigid & Fitting 1/2-1" Galv. Rigid & Fitting	SF EA EA EA EA LF LF LF LF	4,100 12 37 15 20 11,000 1,300 50 400 2,300	23.17 95.00 35.00 35.00 150.00 2.00 4.30 17.20 6.00 1.90	35.45	[95,000] 1,140 1,295 525 3,000 22,000 5,590 860 2,400 4,370	[145,350]	

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KSC FORM 21-193 (REV. 8/75)

Figure B-3. Construction of Facilities, Estimate of Cost, Quantities
and Unit Costs (Sheet 4 of 6)

ESTIMATOR VARDELL, PRC-2421 CHECKER WRIGHT, PRC-2421		CONSTRUCTION OF FACILITIES - ESTIMATE OF COST KSC SHUTTLE ORDNANCE BUILDING, LC-19						May 1, 1984 PCN 77406	
1	2	3	4	5	6	7	8		
CODE	DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT COST		ENGINEERING	BUDGET		
				ENGINEERING	BUDGET				
d	Light Fixtures 200W VGA Vapor 100W VGA-1HR 2x4 - 41P Fluor Mercury Vap 400W Emergency Bal.	EA EA EA EA EA	6 32 6 20 2	170.00 260.00 345.00 260.00 1,030.00		1,020 8,320 2,070 5,200 2,060			
	Panels, A/C, ITC, PCIA, FCP	EA	5	2,065.00		10,325			
	Misc. Lamps, Test & C/O	HR	200	20.00		4,000			
	Motor Control Center	EA	1	12,200.00		12,200			
	Grounding Sys. Rods Recp	EA	20	345.00		6,900			
	Flood Light Mounting Poles	EA	5	345.00		1,725			
e	All Other Collateral Equipment Not Included in Above								
	Data Processing Eq IBM 460	EA	1	36,000.00	55,905	36,000	55,905		
	Special Features	SF	4,100	.00	1.49	4,000	6,120		
f	Solar Water Sys - Collectors	SF	40	35.00		1,400			
	100 Gal Insul. Tank Galv.	EA	1	1,475.00		1,475			
	Piping & Misc	HR	25	45.00		1,125			
	TOTALS	SF	4,100	265.85	406.74	1,090,000	1,667,640		

KSC FORM 21-193 (REV. 8/75)

KSC FORM 21-193 (REV. 8/75)

Figure B-3. Construction of Facilities, Estimate of Cost, Quantities and Unit Costs (Sheet 5 of 6)

ESTIMATOR VARNDELL, PRC-2421 CHECKER WRIGHT, PRC-2421		CONSTRUCTION OF FACILITIES - ESTIMATE OF COST KSC SHUTTLE ORDNANCE BUILDING, LC-19						May 1, 1984 PCN 77406	
1	2	3	4	5	6	7	8		
CODE	DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT COST		TOTAL COST			
				ENGINEERING	BUDGET	ENGINEERING	BUDGET		
	Quotes: (1) 2,000 KVA substation Gx 2/1/85 Ms. Brown, Atlanta (2) Copper Wire - Anaconda 3/5/85 Mr. Ed Walters - Orlando, FL (3) IBM 460-4/3/85 Mrs. H. Marhino Jacksonville, FL (4) A/C Compressor Condensers, Air Handling Unit Trane 1/30/85 Mr. Walt Harris Miami, FL (5) 3000A Secondary Mains GF 4/21/85 Mr. Bill Mills, Tampa, FL								

KSC FORM 21-193 (REV. 8/75)

Figure B-3. Construction of Facilities, Estimate of Cost, Quantities and Unit Costs (Sheet 6 of 6)

COST ESTIMATE FOR A&E DESIGN

ESTIMATOR: Joe A. Brown

DATE: May 1, 1984

CHECKER:

PCN: 39143

TITLE: KSC SHUTTLE ORDNANCE BUILDING, LC-39

	<u>Estimated Drawings</u>	<u>Estimated Hours Per Drawing</u> ①	<u>Total Hours</u>
Civil	4	60	240
Architectural	8	60	480
Structural	6	70	420
Mechanical	6	80	480
Electrical	6	90	540
Utilities	6	90	250
Special Systems			
GN ₂ SS	2	95	190
Solar System	1	75	150
Total	39		2,800

Specifications 300 pages @ 1 hour 300

③ Special Field Studies 5 Man-week = 200 hr. 200

Cost Estimate - 30%, 60%, 90%, 100% & Final = 5 Estimates
60 Hr. ea x 5 Estimates = 300 Hrs

39 Dwg Sht's @ 7-1/2 Hrs per sheet = 292.5 Hrs

Therefore, use 300 hours to prepare cost estimates

300
3600 Hrs

④

3600 Hrs @ \$27.00 per hour = \$97,200 Estimated Cost. (Enter this cost in Section III C of PER Design and Engineering Services).

Project Budget Cost Estimated \$1,090,500 without Data Processing Equip (C.)

Cost per drawing = $\frac{97,200}{39} = 2492$ Design Cost as a Percentage of Budget Cost = $\frac{97,200}{1,667,640} = 5.8\%$ ②

- ① Hours/Drawing is total for Drafting Engineering, Printing, Conferencing and Local Travel.
- ② Percentage increase due to additional Design Engineering, on new and existing drawings, which also required additional Field Studies.
- ③ When special studies or other services are required they should be listed separately.
- ④ Submit breakdown of how M/H cost is developed.

Figure B-4. A&E Design, Cost Estimate, Drawing and Manhour Cost

APPENDIX C
LABOR AND MATERIALS COST ESTIMATE
(CODE B)

KSC PRELIMINARY COST ESTIMATE WORK SHEET					
W O NO 0299-0576	ECN 32009-39143	DATE PREPARED Nov 1, 1984	SHEET 17 of 17		
PROJECT ORDNANCE BUILDING					
LOCATION K4C LC 39					CODE B 30
ARCHITECT ENGINEER J.B. SMITH INC		1400 APOLLO BLVD. ROCKET CITY, UTAH		ESTIMATOR J.A. BROWN CCE	
DRAWING NO 79K67392-E1-5		CHECKED BY WMBARNDEN J.B. SMITH		APPROVED BY J.B. SMITH PRES	
ITEM NO	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE MATERIAL & LABOR	ESTIMATED AMOUNT
16 ELECTRICAL EXTERIOR					
A TRENCHING BACKFILL					
	EXCAV & BACK - HAND	18	CY	15.14	273
	CONC. PAD 4" 3000 PSI	100	SF	7.57	757
	FENCE 6" DIAM. 3 BARS WIRE	50	LF	10.00	500
B MED & HI-VOL POWER LINES					
	4" CONDUIT FEW 8 COMM	310	LF	10.00	3100
	4" CONDUIT EL & FITTINGS	10	EA	39.35	394
	3C 3/4" PILECNS 15KV CABLE	360	LF	7.22	2599
	PRIMARY CABLES PRICED TERM	3	EA	272.33	817
	GROUNDING SUB-STATION	20	SF	45.40	908
	C 300KVA POWER TR DBL ENDED	300	KVA	219.47	65,841
	225 & 1000 AMP CRMT BKRS	7	EA		QUOTE FROM GE
	METER & INSTRU PANEL	10			4.15-85
	300KVA X FORMER	2			GEQ EDITION
	HV AIR SWITCH (600 AMP)	1			OKL.
	X-FORMER 138/480	2	EA		No 3 41920
	TOTAL LAB & MATL				75,189
	TAXES & INSURANCE		7%		5263
				SUB TOTAL	80,452
	OVERHEAD		15%		12,068
				SUB TOTAL	92,520
	PROFIT		10%		9,252
				SUB TOTAL	101,772
	PRIME MARK UP		10%		10,177
				SUB TOTAL	111,949
	BOND		1%		1,119
	TOTAL EXTERIOR ELECTRICAL	TO SHEET 41004F	@ 25.58		113,068
OFFICIAL USE ONLY					

KSC FORM 21-224 10/74

NASA/KSC AUG/74

Figure C-1. KSC Preliminary Cost Estimate Work Sheet, Unit Cost

APPENDIX D
CONSTRUCTION COST ESTIMATE
(CODE C-95)

COST ESTIMATE COVER SHEET

GOVERNMENT ESTIMATES ARE ADMINISTRATIVELY CONFIDENTIAL
ACCESSIBLE TO AUTHORIZED NASA/KSC PERSONNEL OR REPRESENTATIVES ONLY

PROJECT ORDNANCE BUILDING 4100 SF
 LOCATION KSC - LC 39-VAB AREA
 IFB NO N/A
 BID DATE N/A
 AMENDMENT N/A
 ESTIMATE CODE C 95
 PCN 77406
 CONTRACT WO 6005

DRAWING NO 79K67392 SHT 80

PREPARED BY J.B. SMITH ABE REC KSC
1400 A POLLO BLVD.
 FIRM/ADDRESS ROCKET CITY, UTAH

LOCATION UTAH

MODEL NO. N/A

SUBMITTAL DATE MAY 1, 1985

NASA DD-FED-31
 LEAD DESIGNER ALICE JONES - / K. L. GEDDGE

ESTIMATED BY KOLB ABE VARDELL TRC

KSC COST ENGINEER JOE A. BROWN NASA

PHONE NO. 305-867-2725

NASA DD-FED-2
 PROJECT ENGINEER D.R. RAINWOOD / K.B. FRENCH

REVIEWED BY I. SEYMORE

APPROVED BY JUSTIN CASE

PHONE NO. 305-867-3994

Cost Estimating for procurement requires special handling in accordance with DE ID-1142.23, KSC SPEC-G-0002
 and KSC SPEC-G-0003 for GSE.

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KSC FORM 21-668 (3/83)

Figure D-1. Cost Estimate Cover Sheet

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☐ CONSTRUCTION			
CODE C-95	DATE COMPLETED MAY 1, 1985	SHEET <u>2</u> OF <u>42</u>		SHEET <u>2</u> OF <u>42</u>			
PROJECT/NO TITLE ORDNANCE BUILDING LC 39		DRAWING NO(S) 79K67392		SHEET NO C-1 THRU C-9			
STATION SET	LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.	PCN 77406		PD/CCBD			
ARCHITECT OR ENGINEER J.B. SMITH INC		WORK ORDER OR CONTRACT NO 6005					
ESTIMATOR VARDELL R C 2421	CHECKER WRIGHT R C 2421	APPROVED JUN 11 1985 OF J.B. SMITH					
PROJECT SUMMARY	QUANTITY		LABOR (\$)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	FIELD TOTAL PAB	PER UNIT	TOTAL FROM	
I SITE WORK							
2A DEMOLITION PAVING	610	CY	@	3.082		4	1,880
2E EARTH WORK	6500	CY	@	7.73		4	50,273
2P BIT PAVING	3100	SY	@	15.31		4	47,469
2T GRASSING	5600	SY	@	1.96		4	10,984
2V STORM DRAINAGE	132	LF	@	104.97		4	13,856
SUB TOTAL							124,467
II BLDG STRUCT. TO 5'-0" LINE							
21A ARCH STRUCT	4100	SF	@	74.34		15	304,780
-15 MECHANICAL (INT)	4100	SF	@	25.84		23	105,949
-16 ELECTRICAL (INT)	4100	SF	@	24.86		29	101,923
SUB TOTAL							512,652
III UTILITIES OUTSIDE 5'-0" LINE							
15F STEAM DISTRIBUTION	1,000	LF	@	34.72		35	34,715
15G SANITARY SEWERS	160	LF	@	36.50		35	5,846
15Y WATER SUPPLY	1014	LF	@	37.31		35	37,831
16A EXTERIOR ELEC	2,000	KVA	@	214.78		39	429,569
SUB TOTAL							507,961
IV SPECIALIZED CONSTRUCTION							
13F SPECIALIZED SYS. GN 2 4/304	50	LF	@	197.76		42	9,888
GFE-VALUE PANELS @ 50,000	150,000						
EST CONST. BID COST	4100	SF	@	281.70			1,154,963
SPECIAL COND. ESCALATION	14	MO	@	1% MO		14%	161,695
EST CONST BID COST W/ ESCALATION							1,316,658
SMA DURING CONSTRUCTION	10%						131,666
CONTINGENCIES	10%						144,835
CURRENT COST ESTIMATE							1,593,159

KSC FORM 21-245 (REV 4/80)

Figure D-2. Construction Cost Estimate, Project Summary

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 3 OF 52	
PROJECT/NO TITLE ORD NANCE BUILDING LC 39		DRAWING NO(S) 79K67392		SHEET NO C-1 THRU C-9	
STATION SET	LOCATION JOHN F. KENNEDY SPACE CENTER, FLA	PCN 77406		PD/CCBD	
ARCHITECT OR ENGINEER J. B. SMITH INC		WORK ORDER OR CONTRACT NO 6005			
ESTIMATOR VARDELL PC2501		CHECKER BLALOCK PC2421		APPROVED	

GENERAL CONDITIONS & OVERHEAD SUMMARY	QUANTITY		LABOR (IS ☐ FIELD ☐ TOTAL ☐ FAB)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT		PER UNIT	TOTAL	
SUPERINTENDENT	13	WK	600	7800	100	1,300	OFFICIAL USE ONLY
CONSTRUCTION ENGINEER	7	WK	500	3500	—	—	
QC-SAFETY ENGINEER	7	WK	300	2,100	—	—	
PAYROLL CLERK & TYPIST	13	WK	300	3,900	—	—	
OFFICE TRAILER	3	MO	—	—	125	375	
OFFICE SUPPLIES	4	MO	—	—	30	120	
METERED WATER	4	MO	—	—	40	160	
METERED ELECTRICITY	4	MO	—	—	60	240	
PORTO LETS	4	MO	—	—	50	200	
GENERAL CLEANING	120	HR	9.25	1,110	—	—	
CFM-UPDATE ACTIVITIES	100	EA	10.00	1,000	—	—	
HOME OFFICE	4	MO	—	—	500	2,000	
TOOL SHED	1	EA	—	—	200	200	
OSHA INSPECTION	50	HR	10.00	500	—	—	
HAUL DEBRIS	24	HR	10.00	240	—	—	
PROJECT SIGN		A/R	—	—	100	100	
MOB & DEMOB	100	HR	12.00	1,200	—	—	
TOOLS & EQUIPMENT		A/R	—	—	380	380	
TRAVEL-TO HOME OFFICE	3	% TRIP	—	—	200	600	
FIRST-AID EXPENSE	4	MO	—	—	30	120	
MISCELLANEOUS SUPPLIES		A/R	—	—	100	100	
TELEPHONES	4	MO	—	—	100	400	
SUBTOTAL				21,350		6,295	
P&I AND SALES TAX			20%	4,270	5	315	
				25,620		6,610	32,230
32,230 - 214,798 = 15% OVERHEAD SEE SHT 15							
TOTAL EXPENSE ÷ LABOR & MATERIAL COST = OVERHEAD							
* SEE SHT 15							

KSC FORM 21-243 (REV 4/80)

Figure D-3. Construction Cost Estimate, General Conditions and Overhead Summary

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 4 OF 42 SHEET C-1 OF 	
PROJECT/NO TITLE ORE NANCE BUILDING LC 39				DRAWING NO.: 79K67392	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				PCN 77406	
ARCHITECT OR ENGINEER J.B. SMITH INC.				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR VARDELL PRC 2501		CHECKER BLALOCK PRC 2421		APPROVED	

SITE WORK ELEMENTS SUMMARY	QUANTITY		LABOR (\$ HR)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAB	PER UNIT	TOTAL FROM	
2A DEMOLISH EXIST PAVMT.	610	SY	@	3.08		5HT	1880
2E EARTH WORK							
CLEAR & GRUB	3	AC					
EXCAVATION	2500	CY	6500	CY @	773	5	50,273
FILL (BORROW)	4,000	CY					
2P BITUMINOUS PAVING	4,350	SY	@	11.00		11	47,469
256 TON							
2T GRASSING	5600	SY	@	1.97		6	10,984
2V SITE STORM DRAINAGE	132	LF	@	104.97		7	13,856
TOTAL SITE WORK	4,350	SY	@	28.70			124,462
TOTAL TO 5HT 2							124,462
REF 5HTS 8 THRU 10							
FOR COMPUTATION							

OFFICIAL USE ONLY

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 1 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION			
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 5 OF 42 SHEET C-2 OF 			
PROJECT/NO TITLE ORD NANCE BUILDING LC 39				DRAWING NO IS 79K67392	SHEET NO C-1 THRU C-9		
STATION SET	LOCATION JOHN F KENNEDY SPACE CENTER, FLA	PCN 77406		PD/CCED			
ARCHITECT OR ENGINEER J.B. SMITH INC		OFFICIAL USE ONLY		WORK ORDER OR CONTRACT NO 6005			
ESTIMATOR VARDELL RC2501		CHECKER BLALOCK RC2421		APPROVED			
<u>SITE WORK</u> SUMMARY	QUANTITY		LABOR (\$ 1.00)		MATERIAL		TOTAL COST
	NO UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☒ TOTAL FAB	PER UNIT	TOTAL	
2A DEMOLISH EXIST PAVING	610	SY	1.25	763	.60	366	
PT&I AND SALES TAX			25%	191	5%	18	
SUBTOTAL				954		384	1,338
SUB CONTRACT OVERHEAD	15	%					20
						SUBTOTAL	1,539
SUB CONTRACT PROFIT	10	%					154
						SUBTOTAL	1,693
PRIME CONTRACT MARK-UP	10	%					169
						SUBTOTAL	1,862
BOND	1	%					19
TOTAL TO SHT 4	610	SY	@	308			1,880
2E EARTH WORK							
CLEAR & GRUB	3	ACR	945	2835	600	1,800	
EXCAVATION	2,500	CY	1.34	3,350	1.20	3,000	
FILL BORROW	4,000	CY	2.50	10,000	250	10,000	
SUBTOTAL				16,185		14,800	
PT&I AND SALES TAX			25%	4,046	5%	740	
SUBTOTAL				20,231		15,540	35,771
SUB CONTRACT OVERHEAD	15	%					5,366
						SUBTOTAL	41,137
SUB CONTRACT PROFIT	10	%					4,114
						SUBTOTAL	45,250
PRIME CONTRACT MARK UP	10	%					4,525
						SUBTOTAL	49,775
BOND	1	%					498
	2,500	CY	@	2011			50,273
TOTAL TO SHT 4							

KSC FORM 21-263 (REV 8/80)

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 2 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION				
CODE		DATE COMPLETED		SHEET				
C 95		MAY 1, 1985		SHEET 6 OF 42				
PROJECT/NO TITLE				DRAWING NO(S)				
ORDNANCE BUILDING LC39				79K67392				
STATION SET		LOCATION		PCN				
		JOHN F. KENNEDY SPACE CENTER, FLA		77406				
ARCHITECT OR ENGINEER				WORK ORDER OR CONTRACT NO				
J.B. SMITH INC.				6005				
ESTIMATOR		CHECKER		APPROVED				
VARDELL PRC 2501		BLALOCK PRC 2421						
SITE WORK CONT. SUMMARY		QUANTITY		LABOR (\$ 1.00)		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAB	PER UNIT	TOTAL	
2T GRASSING								
SOD		20	SY	1.91	38	1.40	28	
SEED		1500	SY	35	525	.15	225	
SEED & MULCH		5600	SY	.40	2240	.20	1,120	
2" MARL WORKED IN		500	SY	.20	1,120	4.50	1,420	
SUBTOTAL					3923		2,773	
FBI AND SALES TAX				25%	981	5%	139	
SUBTOTAL					4904		2912	7816
SUBCONTRACT OVERHEAD		15%						1,172
							SUBTOTAL	8988
SUBCONTRACT PROFIT		10%						899
							SUBTOTAL	9887
PRIME CONTRACT MARK-UP		10%						989
							SUBTOTAL	10,875
BOND		1%						109
TOTAL TO GWT. 4		5,600	SY	@	1.96			10,984
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Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 3 of 11)

FAC FORM 21-243 REV 4-80

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 4 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 8 OF 42 SHEET C-5 OF 	
PROJECT/WORK TITLE ORDNANCE BUILDING LC 39				DRAWING NO. 79K67392	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO. C-1 THRU C-9	
ARCHITECT OR ENGINEER J.B. SMITH INC.				PCN 77406	
ESTIMATOR VARNEDELL RC 2501				WORK ORDER OR CONTRACT NO. 6005	
CHECKER BLALOCK RC 2421				APPROVED 	

EARTH WORK SUMMARY	QUANTITY		LABOR (\$ PER HOUR)		MATERIAL		TOTAL COST
	NO UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAD	PER UNIT	TOTAL	
2E UNCLASSIFIED EXCAVATION							
A ASSUMPTIONS							
1. TOTAL EXCAVATION FOR THREE BUILDINGS SITES WILL BE USED TO ESTABLISH A UNIT COST.							
2. SUB CONTRACTORS WILL HAVE A MINIMUM OF 4- TO 10 HOUR DAY TO COMPLETE TOTAL EXCAVATION.							
3. SIX (6) CY SCRAPERS WILL BE USED WITH 2-D8 DOZERS ONE AS A PUSHER & ONE AS A SPREADER							
B EQUIPMENT							
1. FOR ECONOMICAL OPERATION USE 3- 6CY SCRAPERS							
2. SCRAPER CAP- ASSUME 600' HAIL CAP- 71CY/HR (REF R662TMS-252)							
3. TIME REQUIRED = $3720 / (3 \times 71 \times 10) = 1.75$ USE 2- DAYS							
C COST SUMMARY							
1. EQUIPMENT							
a. 3- 6CY SCRAPERS	60	HR	—	—	15.25	915	
b. 2-D8 DOZERS	40	HR	—	—	13.30	532	
c. 1- MAINT. TRUCK	30	HR	—	—	3.52	106	
2 LABOR							
a. SCRAPER OPERATOR	60	HR	15.85	951	—	—	
b. DOZER OPERATOR	40	HR	15.85	634	—	—	
c. OILER	20	HR	12.22	244	—	—	
3 MOB & DEMOB							
a. SCRAPERS	3	EA	—	—	100	300	
b. DOZERS	2	EA	—	—	125	250	
SUB TOTAL TO SHT.							
					1,829	2,103	

KSC FORM 21-243 (REV 4/80)

Figure D-4. Construction Cost Estimate, Site Work Elements Summary (Sheet 5 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C-95		DATE COMPLETED MAY 1, 1985		SHEET 9 OF 42 SHEET C-6 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO'S 79K67392	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO C-1 THRU C-9	
ARCHITECT OR ENGINEER J. B. SMITH INC				PCN 77406	
ESTIMATOR VARNDELL RC 2501				WORK ORDER OR CONTRACT NO 6005	
CHECKER BLALOCK PR 2421				APPROVED	

EARTHWORK SUMMARY	QUANTITY		LABOR (\$ PER HOUR)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS	PER UNIT	FIELD TOTAL PAD	PER UNIT	TOTAL	
2E BORROW (FILL)							
A ASSUMPTIONS							
1. 1-2 CY. DRAG LINE WILL BE USED AT THE BORROW PIT.							
2. HAUL DISTANCE = 5 MILE							
3. 12 CY. DUMP TRUCKS WILL BE USED FOR HAULING.							
4. TOTAL QUANTITY OF BORROW FOR 3-BLDG SITES WILL BE USED IN ESTABLISHING A UNIT PRICE.							
5. CONTRACTOR WILL WORK A- 10-HR-DAY.							
B EQUIPMENT							
1. DRAG LINE CAPACITY.							
ASSUME EFF FACTOR = .80							
BUCKET FACTOR = .80							
CYCLE TIME = 33 SEC							
CAPACITY $2 \times .80 \times .80 \times 3600 / 33 = 140 \text{ CY/HR}$ (140 X 10 HR DAY = 1400)							
2. NO. DAYS REQ'D = $10900 / 1400 = 7.8$ USE 8 DAYS							
3. NO TRUCKS REQ'D (ASSUME WORKING CAP = 11 CY.)							
a CYCLE TIME							
LOADING TIME = $(11/140) 60 = 5 \text{ MIN.}$							
TRAVEL TIME = $10 \text{ MI} @ 30 \text{ MPH} = 30 \text{ MIN}$							
LOADING TIME = 5 MIN							
TOTAL = 40 MIN.							
TRIPS/HR = $60 / 40 = 1.5$							
C NO TRUCKS = $140 / 1.5 \times 11 = 8.5$ USE 9 TRUCKS							
4. OTHER EQUIPMENT 1 D8 DOZER 1 ROLLER 1 MAINT TRUCK							
1 GRADER 1 SPRINKLER TRUCK							

KSC FORM 21-243 (REV. 4-80)

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 6 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION			
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 10 OF 42 SHEET C7 OF			
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO'S 79K67392			
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA		PCN 77406		SHEET NO PD/CCBC			
ARCHITECT OR ENGINEER J. B. SMITH INC.				WORK ORDER OR CONTRACT NO 6005			
ESTIMATOR VARDELL RC2501		CHECKER BLALOCK RC2421		APPROVED			
EARTH WORK SUMMARY	QUANTITY		LABOR (\$/HR)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAB	PER UNIT	TOTAL	
2E BORROW CONTINUED							
C COST SUMMARY							
1. EQUIPMENT							
A 1-2 CY DRAGLINE	80	HR	-	-	15.80	1264	
B 9-12 CY DUMP TRUCK	720	HR	-	-	10.35	7,452	
C 1-D8 DOZER	80	HR	-	-	13.35	1,068	
D 1-GRADER	80	HR	-	-	15.25	1,220	
E 1-ROLLER	80	HR	-	-	6.15	492	
F 1-MAINT. TRUCK	80	HR	-	-	3.51	281	
G 1-SPRINKLER TRUCK	80	HR	-	-	4.02	322	
2. LABOR							
A DRAGLINE OPERATOR	80	HR	17.57	1,390	-	-	
B DOZER	80	HR	15.85	1,268	-	-	
C GRADER	80	HR	15.85	1,268	-	-	
D ROLLER	80	HR	13.21	1,057	-	-	
E DUMP TRUCK	720	HR	15.18	10,930	-	-	
F TRUCK DRIVERS	160	HR	15.18	2,429	-	-	
G LABORERS	160	HR	10.20	1,632	-	-	
H OILER	80	HR	12.26	981	-	-	
I MECHANIC	80	HR	17.37	1,390	-	-	
J FOREMAN	80	HR	20.69	1,655	-	-	
3 MOB & DEMOB							
A DRAGLINE	1	EA	-	-	350	350	
B DOZER	1	EA	-	-	150	150	
C GRADER	1	EA	-	-	100	100	
D ROLLER	1	EA	-	-	150	150	
SUB TOTAL TO SHT.							
			24,000		12,849		

KSC FORM 21-243 (REV. 4-80)

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 7 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C-95		DATE COMPLETED MAY 1, 1985		SHEET 7 OF 42 SHEET C-8 OF 7	
PROJECT/NO TITLE ORDINANCE BUILDING LC 39				DRAWING NO/1 77K67392	
STATION SET LOCATION JOHN F KENNEDY SPACE CENTER, FLA.				PCN 77406	
ARCHITECT OR ENGINEER JOHN B SMITH, INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR VARWDELL PRC 2501		CHECKER BIALOCK PRC 2421		APPROVED	

FLEX PAVEMENT SUMMARY	QUANTITY		LABOR (\$)		MATERIAL		FROM SHEET
	NO UNITS	UNIT MEAS	PER UNIT	FIELD TOTAL TOTAL	PER UNIT	TOTAL	
2P BITUMINOUS PAVING							
A STABILIZATION							
1 MATERIAL	332	CY	-	-	12.50	4,150	2
2 PROCESSING	4,350	SF	.40	1,740	-	-	
B LIME ROCK BASE 6"	3,100	CY	.40	1,240	4.35	13,485	13
C BITUMINOUS PAVING							
1 BITUMINOUS CONC	256	TON	4.50	1,152	33.00	8,448	14
2 BITUMINOUS TACK COAT	930	GAL	.07	65	1.07	977	14
D TRAFFIC STRIPES	680	LF	.08	54	.04	27	14
TOTAL				4,251		27,107	
PT&I AND SALES TAX			25%	1,063	5%	1,355	
				5,314		28,462	33,776
OVERHEAD	15	%					5,066
						SUBTOTAL	38,842
PROFIT	10	%					3,884
						SUBTOTAL	42,726
PRIME MARK UP	10	%					4,273
						SUBTOTAL	46,999
BOND	1	%					470
TOTAL FLEXIBLE PAVEMENT	4,350	SF	@	11.00	TOTAL TO SHT-2		47,469

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KBC FORM 21-243 (REV 4 80)

7.

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 8 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 12 OF 42 SHEET C 9 OF	
PROJECT/NO TITLE ORDINANCE BUILDING LC 39				DRAWING NO: 79K67392 SHEET NO G-1 THRU G-9	
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA		PCN 77406		PD/CCBD	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR VARDELL PRC 2501		CHECKER BLALOCK PRC 2421		APPROVED	

FLEXIBLE PAVING SUMMARY	QUANTITY		LABOR (\$)		MATERIAL		TOTAL TO SHEET
	NO UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAD	PER UNIT	TOTAL	
FLEXIBLE PAVING							
BACK UP DATA							
1. OCALA LIME ROCK	1	CY	-	-	680	680	
2. TRUCK HAUL	25	MI	-	-	.20	500	
3. UNLOAD & SPREAD	1	CY	-	-	.20	.20	
4. COMPACT & SHAPE	1	CY	-	-	.50	.50	
[BASED ON 20 CY TRUCK]							
COST PER CY @ SITE	1	CY	-	-	-	12.50	11
STABILIZATION QUANTITY							
1. 3" UNDER ROADWAY			$\frac{3}{12} \times \frac{9}{1} \times \frac{3100 \text{ SY}}{27 \text{ CY}}$	=		258 CY	
2. 3" STABIL SHOULDERS			$\frac{3}{12} \times \frac{9}{1} \times \frac{1250}{27 \text{ CY}}$	=		104 CY	
			362	x	120%	COMPACTON	Loss = 435
TOTAL STABILIZATION	435	CY	-	-	12.50	5438	
TOTAL PROCESSING							
1250 + 3100	4350	SY	.40	1740	-	-	
SUB TOTAL				1740		5438	

KSC FORM 21-243 (REV 4 83)

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 9 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 96		DATE COMPLETED MAY 1, 1985		SHEET 13 OF 42 SHEET C-10 OF 	
PROJECT/NO TITLE ORDINANCE BUILDING LC 39				DRAWING NO: 79K67392 SHEET NO C1-THRU-C9	
STATION SET JOHN F KENNEDY SPACE CENTER, FLA		PCN 77406		PD/CCBD	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR VARDELL PRC 2501		CHECKER BLALOCK PRC 2421		APPROVED	

FLEXIBLE PAVEMENT SUMMARY	QUANTITY		LABOR (\$)		MATERIAL		TOTAL COST
	NO UNITS	UNIT MEAS	PER UNIT	FIELD TOTAL PAB	PER UNIT	TOTAL	
BI LIME ROCK BASE COST							
1. LIME ROCK FOR RT/TON					4.50	4.50	
2 FREIGHT TO TUSVILLE					3.70	3.70	
3. UNLOAD / TON					.30	.30	
4. TRUCK HAUL / TON	25	MI	-	-	.20	5.00	
TOTAL COST PER TON @ SITE						13.50	
BII LIME ROCK BASE-QUANTITY							
1. 6" BASE MATERIAL	$\frac{6}{12} \times \frac{9}{27}$		$\times 2,100$	$\times 125\%$	= 6.45 COMPACTION LBS		
2. COST PER SY	$\frac{6.45}{27}$		$\times 13.50$			4.35	
3 PROCESSING COST	1	SY			.40		
SUBTOTAL TO SHT. II	1	SY			.40	4.35	4.75
OFFICIAL USE ONLY							

KSC FORM 21-243 (REV 4-80)

Figure D-4. Construction Cost Estimate, Site Work Elements Summary
(Sheet 10 of 11)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 15 OF 42 SHEET 5-1 OF 	
PROJECT NO & TITLE ORDINANCE BUILDING LC 39				DRAWING NO'S 79K67392	
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA.		LOCATION 77406		PD/CCBD 6005	
ARCHITECT OR ENGINEER J.B. SMITH INC.				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR VARUDEL PRC 2501		CHECKER BLALOCK PRC 2421		APPROVED 	

ELEMENT SUMMARY	QUANTITY		LABOR (\$)		MATERIAL		TOTAL \$MT.
	NO UNITS	UNIT MEAS.	PER UNIT	FIELD TOTAL FAB	PER UNIT	TOTAL	
OF ARCH/STRUCT							
1. GENERAL REQUIREMENTS				SEE OVERHEAD FOR BACK UP DATA			16
2 SITE WORK	196	CY	11.01	2,158	9.80	1,921	16
3 CONCRETE	207	CY	102.73	21,265	109.95	22,759	16-17
4 BRICK & BLOCK MASON	9600	SF	1.28	12,324	1.03	9,894	17
5 METAL STRUCT. MISC.	20,753	LB	.60	12,496	.84	17,434	18
6 CARPENTRY	260	BF	.50	130	.40	104	19
7 MOISTURE PROTECTION	4100	SF	2.70	11,089	3.14	12,944	19
8 DOOR-WINDOW & GLASS	384	SF	11.37	4,366	18.89	7,255	20
9 FINISHES	21,343	SF	.28	5,927	.25	5,369	21
10 SPECIALTIES	NIC	-	-	-	-	-	-
11 EQUIPMENT	NIC	-	-	-	-	-	-
12 FURNISHINGS	NIC	-	-	-	-	-	-
13 SPECIAL CONSTRUCTION	NIC	-	-	-	-	-	-
14 CONVEYING SYS.	15	TON	1903.20	28,623	2159.87	32,398	22
SUBTOTAL				98,373		110,078	
P&M AND SALES TAX			25%	24,593	5%	5,504	
				122,966		115,582	238,548
OVERHEAD	15	%					35,782
							274,330
PROFIT	10	%					27,433
							301,763
BOND	1	%					3,017
SUBTOTAL	4,100	SF	@	7,434			304,780
OFFICIAL USE ONLY							

KSC FORM 21-243 (REV. 4-80)

Figure D-5. Construction Cost Estimate, Architectural/Structural Summary
(Sheet 1 of 8)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION				
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 16 OF 42 SHEET 52 OF 				
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67392				
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO C1-THRU-C9				
ARCHITECT OR ENGINEER J.B. SMITH INC				PCN 77406				
ESTIMATOR VARDELL PRC 2501				WORK ORDER OR CONTRACT NO 6005				
CHECKER BLALOCK PRC 2421				APPROVED 				
ARCH & STRUCT SUMMARY		QUANTITY		LABOR (\$ PER HOUR)		MATERIAL		TOTAL COST
		NO UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAD	PER UNIT	TOTAL	
1. GENERAL REQUIREMENTS								
C CLEAN UP								
D LAY OUT								
TOTAL		SEE OVERHEAD GHT FOR BACKUP DATA						SHT. 3
2. SITEWORK								
D EXCAVATION 1/2 HAND		89	CY	8.50	757	1.20	107	
BACKFILL-COMPACTION		107	CY	4.55	487	.60	64	
FILL-SELECT-UNDER SLAB		500	CY	1.50	750	3.50	1,750	
FINE GRADING		4,100	SF	.04	164	-	-	
SUBTOTAL					2,158		1,921	
3 CONCRETE								
A FORM WORK								
FOOTING FORMS		800	SF	1.55	1240	.78	624	
STRUCTURAL FORMS		5,450	SF	1.55	8,447	.78	4,251	
SLAB FORMS		80	SF	1.66	133	.78	62	
BOND BEAM FORMS		312	SF	1.80	562	1.14	356	
B REINF. MATERIALS								
REINF. BARS SIZE #3-6		8,850	LB	.25	2,213	.30	2,655	
MESH 6X6 #6		4,500	SF	.15	675	.12	540	
C CONCRETE								
EXPANSION JOINT 1/2X6		300	LF	.39	117	.45	135	
FOOTING 3,000*		32	CY	15.00	480	45.00	1,440	
STRUCTURAL 3,000*		85	CY	15.00	1,275	45.00	3,825	
FLOOR SLAB 3,000*		80	CY	15.00	1,200	45.00	3,600	
BOND BEAM 3,000*		10	CY	20.00	200	45.00	450	
CRANE, BUCKET OR PUMP		95	CY	5.00	475	10.00	950	
SUB TOTAL TO SHT 17					18,425		18,888	

KSC FORM 21-243 (REV. 4/80)

Figure D-5. Construction Cost Estimate, Architectural/Structural Summary
(Sheet 2 of 8)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C95		DATE COMPLETED MAY 1, 1985		SHEET 17 OF 46 SHEET 5-3 OF 46	
PROJECT NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO'S 79K67392	
STATION SET LOCATION JOHN F KENNEDY SPACE CENTER, FLA.				SHEET NO C-THRU C-9	
ARCHITECT OR ENGINEER J.B. SMITH INC				PCN 77406	
ESTIMATOR VARDELL PRC 2501				WORK ORDER OR CONTRACT NO 6009	
CHECKER BLALOCK PRC 2421				APPROVED	

ARCH STRUCT SUMMARY	QUANTITY		LABOR (\$ PER HOUR)		MATERIAL		TOTAL COST
	NO UNITS	UNIT MEAS.	PER UNIT	☐ FIELD TOTAL ☐ PAD	PER UNIT	TOTAL	
3 CONCRETE FROM GHT	16			18,425		18,888	
A FINISH SLABS							
SCREED	540	SF	.05	27	.05	27	
TROWEL	4,100	SF	.10	410	.05	205	
CURING	4,100	SF	.13	533	.10	410	
HARDNER	4,100	SF	.14	574	.10	410	
D PRECAST GYP ROOF DECK							
GYP GUM-ON-1" INSULFORM	3240	SF	.40	1296	.87	2819	EAST COAST
TO GHT 15 SUBTOTAL	207	CY	102.73	21,265	10995	22,759	
E BRICK-BLOCK MASONRY							
A. ERECT MASONRY WALLS							
8" x 8" x 16" CONC BLOCK	790	EA	1.10	869	.63	498	DIXIE CONC
* 4" x 8" x 16" CONC BLOCK	9742	"	.96	9352	.50	4871	DIXIE CONC
12" x 8" x 16" CONC BLOCK	374	EA	1.40	524	.92	344	DIXIE CONC
HORIZ. BLOCK REINF	7,300	LF	.05	365	.07	511	
MORTAR	31	CY	20.	620	.55	1705	
CLEAN & POINT	9600	SF	.05	480	.20	1920	
SPLASH BLOCK	3	EA	8.00	24	15.00	45	
TO GHT 15 SUBTOTAL	9600	SF	1.28	12,324	1.03	9,894	
OFFICIAL USE ONLY							
* LABOR ANALYSIS	4" x 8" x 16"						
BASED ON (1) CREW LAYING 600 BLOX PER DAY							
3 MASON @ 19.87	392.38						
2 HELPER @ 10.20	244.80						
TOTAL	577.18						
577.18 ÷ 600 = 96							

KSC FORM 21-263 (REV. 4-80)

Figure D-5. Construction Cost Estimate, Architectural/Structural Summary (Sheet 3 of 8)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 18 OF 42 SHEET 5-4 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67892	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO C1-THRU-C9	
ARCHITECT OR ENGINEER J.B. SMITH INC				PCN 77406	
ESTIMATOR VARNDOLL PRC 2501				WORK ORDER OR CONTRACT NO 6005	
CHECKER BLALOCK PRC 2421				APPROVED	

ARCH-STRUCT SUMMARY	QUANTITY		LABOR (\$ PER HOUR)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
5 METALS-STRU-MISC							
C-STEEL BAR JOIST MATERIAL	9,320	LB	-	-	.35	3262	
BAR JOIST FAB	9,320	LB	.25	2,330	.05	466	
BAR JOIST ERECT.	9,320	LB	.30	2,795	.15	1,398	
D-STRUCTURAL STEEL PURCHASE							
TRUSSES-MISC. WAREHOUSE	2,250	LB	-	-	.35	788	SEE STEEL
* BEAMS MILL	5,221	LB	-	-	.40	2,088	BREAKDOWN
COLUMNS MILL	2,610	LB	-	-	.35	914	F 5
** SHOP FABRICATION COST							
TRUSSES & MISC.	2,250	LB	.30	675	.15	338	
BEAMS	5,221	LB	.30	1,566	.25	1,305	
COLUMNS	2,610	LB	.30	783	.15	392	
ERECTION COST	10,081	LB	.30	3,024	.25	2,520	
CRANE RENTAL	40	HR	20.0	800	70.00	2,800	
** CONSISTS OF ENG'DWG'S							
EQUIP. SHOP LABOR & TRAVEL							
K-MISC. METALS							
FURN. & ERECT ASCE RAIL	142	LF	1.50	213	5.50	781	
FURN. & SET ANCHOR BOLTS	40	EA	1.50	60	.75	30	
FURN. & PLACE A.W. L'S	500	LB	.50	250	.70	350	
SUB TOTAL TO GNT. 15	20,753	LB	.60	12,496	.84	17,432	
* TYPICAL BREAK DOWN FOR BEAMS							
REF APPENDIX B FOR BREAK DOWN EACH ITEM.							

KSC FORM 21-243 (REV 4/80)

Figure D-5. Construction Cost Estimate, Architectural/Structural Summary (Sheet 4 of 8)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 14 OF 42 SHEET 2-5 OF	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67392	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO C1-THRU-C9	
ARCHITECT OR ENGINEER J.B. SMITH INC.				PCN 77406	
ESTIMATOR VARDELL PRC 2501				WORK ORDER OR CONTRACT NO 6005	
CHECKER BLALOCK PRC 2421				APPROVED	

ARCH-STRUCT SUMMARY	QUANTITY		LABOR (\$ HR)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD TOTAL ☐ FAB	PER UNIT	TOTAL	
6 CARPENTRY							
A ROUGH CARPENTRY							
BUILD & PLACE TREATED	260	BF	.50	130	.40	104	
SUB TOTAL				130		104	
7 MOISTURE-PROTECTION							
A BUILT UP ROOF							
BUILT UP 5-Ply T & G	38	SQ	40.00	1520	75.00	2850	WEIDMAN
INSUL. WALL 2" FIBERGLASS	4,100	SF	.20	820	.65	2665	EAST COAST
INSUL ROOF 1 1/2" RIGID FIBER	38	SQ	17.00	646	42.00	1,596	B.F. SUPPLY
B SHEET METAL							
MISC FLASHING COPPER 16oz	76	SF	.85	65	1.65	125	
LOW GRAVEL 4" TOP 4" ALUM	174	LF	1.13	196	2.70	470	
FACIA ALUM. .032	82	LF	1.22	100	3.10	254	
7X5 GUTTER ALUM	120	LF	1.37	164	1.00	120	
6X5 DOWN SPOUT ALUM	104	LF	1.60	166	1.50	156	
4X4 DOWN SPOUT	12	LF	1.17	14	1.12	13	
E MEMBRANE WATER PROOF							
VAPOR BARRIER - POLY	3,780	SF	.15	567	.25	945	WEIDMAN
MEMBRANE W.P 3-Ply FELT	4,100	SF	.35	1,435	.50	2,050	
BITUMEN V WALL BAR	4,100	SF	1.08	4,428	.06	246	
H CAULKING-SEALING							
NEOPRENE GASKET	620	LF	.82	508	1.90	1,178	MCMMASTER
POLYSULFIDE 1/2 X 1/4	400	LF	1.15	460	.69	276	MCMMASTER
SUB TOTAL TO SHT. 15							
	4,100	SF	2.70	11,089	3.14	12,944	

KSC FORM 21-243 (REV. 4/80)

Figure D-5. Construction Cost Estimate, Architectural/Structural Summary (Sheet 5 of 8)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 20 OF 42 SHEET 5-6 OF 	
PROJECT/WO TITLE ORDNANCE BUILDING LC39				DRAWING NO.S 79K 67392	
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA.		LOCATION 		PCN 77406	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6009	
ESTIMATOR VARDELL PRC 2501		CHECKER BLALOCK PRC 2421		APPROVED 	

ARCH-STRUCT SUMMARY	QUANTITY		LABOR (\$)		MATERIAL		TOTAL COST
	NO UNITS	UNIT MEAS.	PER UNIT	FIELD TOTAL ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
8 DOORS-WINDOWS-GLASS							
G ALUMINUM DOOR							
HM 6'X7' DOUBLE W/FRAME	1	PR	95.00	95	602	602	ENDURA LIFE
HM 3'X7' SINGLE W/FRAME	2	EA	60.00	120	325	650	
VERTICAL LIFT DR. 3(10'X10')	300	GF	6.50	1950	8.50	2550	MAHON
DOUBLE BUCK	1	EA	50.00	50	60	60	
SINGLE BUCK	2	EA	35.00	70	45	90	
F BUILDERS HARDWARE							
BUTTS T2152 U528	3	PR	10.00	30	24	72	
PANIC BOLTS 810K	2	EA	50	100	290	580	
CLOSER 300 IV	2	EA	18.50	37	55	110	
BUTTS T2112 U528	3	PR	10.	30	24	72	
LOCK SET 161 B4	1	EA	16.	16	50	50	
FOOT BOLT F1023 B6	1	EA	5.	5	5	5	
CHAIN BOLT F1023 A6	1	EA	6.	6	3	3	
CUT FACE WEATHER STRIP	20	LF	1.25	25	6.15	123	
SET THRESHOLD	6	LF	4.50	27	4.05	24	
INFLATABLE SEAL	150	LF	12.00	1800	15.00	2250	
PAD LOCKS EPC	3	EA	1.50	5	4.50	14	
SUBTOTAL TO GHT. 15	384	GF	11.37	4,366	18.89	7,255	

KSC FORM 21-245 (REV. 4/80)

Figure D-5. Construction Cost Estimate, Architectural/Structural Summary (Sheet 6 of 8)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 21 OF 42 SHEET 57 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67392	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO C1-THRU C9	
ARCH TECT OR ENGINEER J.B SMITH INC				PCN 77406	
ESTIMATOR VARDELL RC 2501				WORK ORDER OR CONTRACT NO 6005	
CHECKER BALOGK RC 2421				APPROVED 	

ARCH-STRUCT SUMMARY	QUANTITY		LABOR (\$ PER UNIT	MATERIAL		TOTAL COST
	NO UNITS	UNIT MEAS		PER UNIT	TOTAL	
9 FINISHES						
A PAINTING FINISHING						
METAL WORK	102	LF	.25	26	.95	97
EXT-BLOCK-CONCRETE	7376	SF	.22	1623	.12	885
INT-WALLS-CEILING	10,865	SF	.20	2173	.10	1087
STRUCT STEEL-INORG	1500	SF	.30	450	.50	750
ZINC 2-COAT						
BAR JOISTS-INORG	1500	SF	.30	450	.50	750
ZINC 2-COAT						
SAND BLAST						
STRUCT STEEL	1500	SF	.40	600	.60	900
BAR JOISTS	1500	SF	.40	600	.60	900
SUBTOTAL	21,343	SF	.28	5922	.25	5369
10 SPECIALTIES	NIC					
11 EQUIPMENT	NIC					
12 FINISHES	NIC					
13 SPECIAL CONST.	NIC					

KSC FORM 21-243 (REV 4 80)

Figure D-5. Construction Cost Estimate, Architectural/Structural Summary
(Sheet 7 of 8)

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KSC FORM 31-243 (REV 4/80)

Figure D-6. Construction Cost Estimate, Mechanical Interior Summary
(Sheet 1 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION				
CODE	C-95	DATE COMPLETED	MAY 1, 1985	SHEET	24 OF 42			
PROJECT/NO TITLE	ORDNANCE BUILDING LC39			DRAWING NO/1	79K67392			
STATION SET	LOCATION	JOHN F. KENNEDY SPACE CENTER, FLA.		PCN	77406			
ARCHITECT OR ENGINEER	J.B. SMITH INC			WORK ORDER OR CONTRACT NO	6005			
ESTIMATOR	KOLB J.B. SMITH INC	CHECKER	PURVIS J.B. SMITH INC	APPROVED	J.A. BROWN DD-FED			
MECHANICAL INTERIOR SUMMARY		QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	FIELD TOTAL	PER UNIT	TOTAL	
15 A PLUMBING								
3" C.I. SOIL PIPE		25	LF	.17	4.3	3.27	82	HUGHES
3" C.I. COMBINATION-Y		1	EA	2.0	2.0	11.92	12	
3" C.I. 1/8" BEND		2	EA	1.5	3.0	9.64	19	
3" C.I. P TRAP		2	EA	3.0	6.0	9.69	19	
3" C.I. FLOOR DRAIN		2	EA	2.0	4.0	54.94	110	
24" x 5' DRY WELL		1	EA	8.0	8.0	137.50	138	
ELEC. WATER COOLER 30 GAL		1	EA	6.0	6.0	568.70	569	
3/4" GALV. PIPE SCH. 40		60	LF	.19	11.4	1.10	66	
1" GALV. PIPE SCH. 40		170	LF	.20	34.0	1.47	250	
3/4" GALV. ELBOW		10	EA	.24	2.4	.96	10	
1" GALV. ELBOW		2	EA	.28	.6	1.96	4	
1" x 1" x 3/4" RED TEE		3	EA	.42	1.3	3.22	10	
081-0215 WATER CLOSET		6	EA	8.0	48.0	550.01	3304	
1-194 CRANE LAVATORY		4	EA	5.0	20.0	176.00	704	
161-1000 ELJER URINAL		2	EA	8.0	16.0	306.15	613	
242-DISS ELJER SERVICE SINK		1	EA	8.0	8.0	276.20	277	HUGHES
TOTAL					175.0		6187	843-9100
LABOR HOURS x RATE		175	HR	21.03	3689			ORL
PT & I AND SALES TAX			%	25	922	5	309	
TOTAL					4611		6496	11,107
OVERHEAD		15	%					4666
							SUBTOTAL	12,773
PROFIT & PRIME MARKUP		10-10	%					2682
							GRAND TOTAL	15,455
BOND		1	%					155
							SUBTOTAL	15,610
TOTAL PLUMBING TO SHEET 23		14	FIXT		1,115.00			15,610

KSC FORM 21-243 (REV 4/80)

Figure D-6. Construction Cost Estimate, Mechanical Interior Summary
(Sheet 2 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 25 OF 42 SHEET M-3 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67592	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA				PCN 77406	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR KOLB J.B. SMITH INC		CHECKER KURVIT J.B. SMITH		APPROVED J.A. BROWN DD-FED	

MECHANICAL INTERIOR SUMMARY	QUANTITY		LABOR (MH)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
15 C AIR CONDITIONING & HEATING							
A/C COMPRESSOR 20 TON	1	EA	24.0	24.0	6026	6026	MCQUAY
25 HP MOTOR	1	EA	8.0	8.0	1065	1065	
STARTER	1	EA	4.0	4.0	310	310	
LIQ. RECEIVER W/FREON	1	EA	16.0	16.0	1042	1042	
AIR COOLED CONDENSER	1	EA	16.0	16.0	8206	8206	
AIR HANDLING UNIT WITH HEATING & COOLING DX COILS	1	EA	40.0	40.0	4987	4987	MCQUAY
3/4" PIPE GALV SCH 40	40	LF	.19	7.6	1.10	44	HUGHES
1" PIPE GALV SCH 40	40	LF	.20	8.0	1.47	59	843-9100
1/2" COPPER TUBING	10	LF	.05	.5	.48	5	
3/4" ELL 90° SCH 40	4	EA	.24	1.0	.96	4	
1" ELL 90° SCH 40	4	EA	.28	1.1	1.96	8	HUGHES
1" GATE VALVE 150° BRONZE	1	EA	.96	1.0	59.73	60	SYSTEM COMPONENTS
3/4" GATE VALVE 150° BRONZE	1	EA	.96	1.0	53.17	53	783-1002
REFRIGERANT	1	BSL	8.0	8.0	594.59	596	423-0684
DUCT WORK - GALV.	2433	LF	.087	211.7	1.25	3041	CLEMENTS
DUCT WORK - ALUM	500	LF	.26	130.0	2.75	1375	AMERICAN METAL CO
DUCT - 1" FIBERGLASS/UGUL	3100	SF	.034	105.4	.356	1104	NORTH BEND
GRILLS W/VOL CONTROL							295-7221
10" X 24" ALUM	4	EA	1.0	4.0	37.11	148	R & R
6" X 18" ALUM	5	EA	.5	2.5	28.12	141	844-0660
4" X 12" ALUM	5	EA	.5	2.5	23.23	116	
CEILING DIFFUSERS W/VOL CONT							AMERICAN METAL CO
12" DIA ALUM	4	EA	1.0	4.0	15.40	62	254-7369
16" DIA ALUM	4	EA	1.0	4.0	65.45	262	
24" DIA ALUM	5	EA	1.0	5.0	115.50	578	
TOTALS TO SHT. 26				605.3		29,291	

KSC FORM 21-243 (REV. 4/80)

Figure D-6. Construction Cost Estimate, Mechanical Interior Summary
(Sheet 3 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 26 OF 42 SHEET M4 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 74K67392	
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA				SHEET NO M16 THRU M20	
ARCHITECT OR ENGINEER J.B. SMITH INC.				PCN 77406	
ESTIMATOR KOLB J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
CHECKER PURVIS J.B. SMITH INC				APPROVED J.A. BROWN DD-FED	

MECHANICAL INTERIOR SUMMARY	QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL	PER UNIT	TOTAL	
OFFICIAL USE ONLY							
15C 1/2" & HEATING CONTINUED							
24" x 36" R.A. GRILLS ALUM	4	EA	2.5	10.0	76.04	304	R & R
28" x 30" LOUV. M.O.PAL	1	EA	4.0	4.0	76.04	76	"
THERMOSTAT T-651A	2	EA	1.0	2.0	53.90	108	HONEYWELL
RELAY	4	EA	1.0	4.0	133.10	532	894-3131 ORL
MOTORIZED DAMPER 24"x10"	2	EA	1.5	3.0	269.50	539	R & R
CONTROL WIRE	600	LF	.02	12.0	.07	42	849-0660 ORL
1" INSUL. FIBERGLASS PIPE	40	LF	.09	3.6	.94	38	NORTH
3/4" INSUL. FIBERGLASS PIPE	40	LF	.09	3.6	.88	35	BROS
MISC. HARDWARE	100	EA	.15	15.0	2.09	209	295-9221
CRANE RENTAL 10 TON	1	EA	16.0	16.0	470.	470	ORL
TEST & ADJUST SYS.	1	EA	40.0	40.0	200.	200	
TOTAL THIS SHT.				113.2		2553	
TOTALS FROM SHT 25				605.3		29,291	
				718.5		31,844	
LABOR HOURS x RATE	718.5	HR	21.08	15,146			
PT & I AND SALES TAX		%	25	3,787	5	1,592	
				18,933		33,436	52,369
OVERHEAD	15	%					7,855
					SUBTOTAL		60,224
PROFIT	10	%					6,022
					SUBTOTAL		66,246
PRIME MARK-UP	10	%					6,625
					SUBTOTAL		72,871
BOND	1	%					729
TOTAL 1/2" & HEATING	20	TON		3,680	To SHT 23		73,600

KSC FORM 21-245 (REV 4/80)

Figure D-6. Construction Cost Estimate, Mechanical Interior Summary
(Sheet 4 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 27 OF 42 SHEET M-5 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO: 79K67392 SHEET NO M-21 M-23	
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA		LOCATION JOHN F. KENNEDY SPACE CENTER, FLA		PCN T1406 PD/CCBD 	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
OFFICIAL USE ONLY				APPROVED J.A. BROWN DD FED	
ESTIMATOR KOLB J.B. SMITH INC		CHECKER PURVIS J.B. SMITH INC			

MECHANICAL INTERIOR SUMMARY	QUANTITY		LABOR (MH)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAB	PER UNIT	TOTAL	
15 M COMPRESSOR AIR SYS.	1	EA	56.0	56.0	1576	1,376	WORTHINGTON
AIR COMPRESSOR W/20 GA RECEIVER							295-2641
CONTROLS & SAFETY DEVICES							ORL.
3/8" BRASS PIPE	10	LF	.19	1.9	.60	6	HUGHES
1/2" COPPER TUBE-TYPE L	90	LF	.12	10.8	.49	44	
1/2" CX 3/8" FIP TEE	2	EA	.39	.8	1.43	3	
1/2" CX 3/8" FIP ELL	1	EA	.28	.3	1.40	1	
1/2" CX C FIP ELL	10	EA	.28	2.8	1.54	15	
3/8" BRASS UNION	3	EA	.20	.6	1.32	4	
1/2" COPPER UNION	1	EA	.28	.3	1.53	2	
1/2" C X MID ADAPTER	1	EA	.25	.3	1.54	2	HUGHES
1/2" AIR VALVE	1	EA	.38	.4	62.21	62	SYSTEM
3/8" GLOBE VALVE	3	EA	.38	1.1	95.21	286	COMPANY
1/2" OUTLETS W/FILTERS	5	EA	.38	1.9	45.29	226	
1/2" CHECK VALVE	1	EA	.38	.4	58.08	58	
3/8" PRESS. RED. VALVE	1	EA	.38	.4	86.22	86	
1/2" HANGERS	10	EA	.25	2.5	1.25	13	785-1000
SUB TOTAL				80.5		2184	
LABOR HOURS x RATE	80.5	HR	21.08	1697			
PT & I AND SALES TAX		%	25	424	5	109	
SUB TOTAL				2121		2293	4414
OVERHEAD	15	%					662
							5076
PROFIT & PRIME MARK UP	10-10	%					1,066
							6,142
BOND	1	%					61
TOTAL COMP. AIR SYS.	5	OUTLETS	1240.60			TO SHIT 23	6,203

KSC FORM 21-243 (REV 4/80)

Figure D-6. Construction Cost Estimate, Mechanical Interior Summary
(Sheet 5 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION			
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 28 OF 42 SHEET M-6 OF 			
PROJECT/WO TITLE ORDNANCE BUILDING LC39				DRAWING NO(S) 79K67392	SHEET NO M24 M27		
STATION SET	LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.			PCN 77406	PD/CB/D 		
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005			
ESTIMATOR KOLB J.B. SMITH INC				CHECKER PURVIS J.B. SMITH INC			
OFFICIAL USE ONLY				APPROVED 			
MECHANICAL INTERIOR SUMMARY	QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
15 R VENTILATION							
250 CFM FRV 1/8" GRCENT	2	EA	8.0	16.0	985.06	1,970	Joe Mac
AL W/FIRE STAT & LOUVER							
850 CFM FRV 1/8" GRCENT	1	EA	10.0	10.0	1086.15	1,086	
AL W/FIRE STAT & LOUVER							
1500 CFM FRV EXCH 1/4" GP	1	EA	8.0	8.0	1194.75	1,195	
FAN W/BIRD SCREEN FIRE							
STAT. & LOUVER							
FLASHING	75	LBS	.15	11.3	1.94	146	
EXHAUST FAN 300 CFM W/MOTOR	1	EA	8.0	8.0	190.05	190	
RAINTITE LOUVER 24" X 10"	1	EA	6.0	6.0	284.41	284	
W/MOTORIZE DAMPER							
CEILING GRILL 12" X 8"	1	EA	1.5	1.5	43.00	43	Joe Mac
MISC. HARDWARE	10	EA	1.0	10.0	1.70	17	886-8405
CRANE RENTAL 10 TON	1	EA	8.0	8.0	232.00	232	OKL
TOTAL				78.8		5,163	
LABOR HOURS x RATE	78.8	HR	21.08	1,661			
PT & I AND SALES TAX		%	25	415	5	258	
TOTAL				2,076		5,421	7,497
OVERHEAD	15	%					1,125
						SUB-TOTAL	8,622
PROFIT	10	%					862
						SUB-TOTAL	9,484
PRIME MARK UP	10	%					948
						SUB-TOTAL	10,432
BOND	1	%					104
TOTAL TO SMT. 23	4	PRV		2,634			10,536

KSC FORM 21-263 (REV. 6-80)

Figure D-6. Construction Cost Estimate, Mechanical Interior Summary
(Sheet 6 of 6)

KSC FORM 21-243 (REV 4 80)

Figure D-7. Construction Cost Estimate, Electrical Interior Summary
(Sheet 1 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION					
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET <u>50</u> OF <u>42</u> SHEET <u>E-3</u> OF <u> </u>					
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67392					
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO E1-10					
ARCHITECT OR ENGINEER J.B. SMITH INC				PCN 77406					
ESTIMATOR BROWN J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005					
CHECKER KOLE J.B. SMITH INC				APPROVED J.B. SMITH PRES					
ELECTRICAL INTERIOR SUMMARY		QUANTITY		LABOR (MH)		MATERIAL		FROM	
		NO. UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	SHEET	
16 N LOW VOLTAGE WIRING					183.3		4984	31	
44 LIGHT FIXTURES					378.1		34,303	32	
16 S SWITCH BD & PANEL BOD					238.3		3,936	33	
TOTALS					799.7		43,223		
LABOR HOURS x RATE		799.7	HR	18.50	14,794				
PT & I AND SALES TAX			%	25	3,699	5	2,161		
TOTALS					18,493		45,384	63,877	
OVERHEAD		19	%					9,582	
							SUB TOTAL	73,459	
PROFIT		10	%					7,346	
							SUB TOTAL	80,805	
PRIME MARKUP		10	%					8,081	
							SUB TOTAL	88,886	
BOND		1	%					889	
TOTAL TO GINT 29		44	FIXT		2,040			89,775	
OFFICIAL USE ONLY									

Figure D-7. Construction Cost Estimate, Electrical Interior Summary
(Sheet 2 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION				
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 31 OF 42 SHEET E-3 OF				
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NOIS 79K67392				
STATION SET		LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.		PCN 77406				
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005				
ESTIMATOR KOLB J.B. SMITH INC		CHECKER PURVIS J.B. SMITH INC		APPROVED J.A. BROWN DD-FED				
ELECTRICAL INTERIOR SUMMARY		QUANTITY		LABOR ☒ MH		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
16. N-LOW VOLT WIRING & CONT DEVICE								
J-Box 4"x6"x6" E.P		3	EA	15	45	11130	334	NPS
AIR TERMINAL 5/8" x 24		12	EA	.5	6.0	1676	201	THOMPSON
AIR TERMINAL BASE & CLAMP		12	EA	1.0	12.0	10.50	126	THOMPSON
OUTLET BOX WP		14	EA	.8	11.2	860	120	
CONN CONTROL DEVICE		17	EA	1.0	17.0	5.00	85	
CONN ANNUNCIATOR ELEMENT		6	EA	1.0	6.0	550	33	
SPEAKER OUTLET		3	EA	1.0	3.0	450	14	
SWITCH 1P EP		2	EA	.5	1.0	5342	107	SQ"D"
SWITCH MO-CTC EP		2	EA	.8	1.6	125.08	250	SQ"D"
SWITCH SPST		2	EA	.35	.7	4.30	9	CES
SWITCH 3P, 100A, N/F EP		1	EA	4.0	4.0	610.00	610	SQ"D"
RECEPT 3W, 2P, 120V EP		10	EA	.8	8.0	157.09	1571	GRAYBAR
RECEPT 3W, 2P, 120V		3	EA	.35	1.1	435	13	CES
LIMIT SW GP, EP		3	EA	.8	2.4	108.12	324	SQ"D"
SWITCH 30A, 2P, N/F WP		3	EA	2.5	7.5	109.00	327	SQ"D"
THERMOSTAT WP		2	EA	.5	1.0	80.00	160	
THERMOSTAT		1	EA	.35	.4	26.00	26	NPS
CONDUIT FITTINGS GAL 1 1/2"		6	EA	.8	4.8	14.29	86	CES
1"		4	EA	.5	2.0	5.56	22	
3/4"		35	EA	.4	14.0	3.90	137	
1/2"		30	EA	.4	12.0	3.10	93	CES
SEALING FITTINGS GAL 2"		6	EA	3.0	18.0	18.65	112	HUGHES
1 1/2"		4	EA	2.4	9.6	14.34	57	
1"		2	EA	2.5	5.0	7.83	16	
3/4"		10	EA	1.25	12.5	6.06	61	
1/2"		14	EA	1.0	14.0	5.17	72	
SQUEEZE CONN 1/2"		10	EA	.4	4.0	1.20	12	HUGHES
SUBTOTAL TO GHT 30					183.3	4978		

Figure D-7. Construction Cost Estimate, Electrical Interior Summary
(Sheet 3 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 32 OF 42 SHEET E-4 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO: 79K67392 SHEET NO E 2-E 4	
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA		PCN 77406		PD/CCBD	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR KOLB J.B. SMITH INC		CHECKER PURVIS J.B. SMITH INC		APPROVED J.A. BROWN DD-FED	

ELECTRICAL INTERIOR SUMMARY		QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
16 N #2 AWG 1/2	WIRE	700	LF	.02	14.0	.50	350	GEN CABLE
#6 AWG 1/2	WIRE	200	LF	.01	2.0	.17	34	
#10 AWG 1/2	WIRE	210	LF	.007	1.5	.08	17	
#12 AWG 1/2	WIRE	8980	LF	.006	53.9	.06	539	
#14 AWG 1/2	WIRE	550	LF	.006	3.3	.03	17	
#2/0 B7D	WIRE	1000	LF	.03	30.0	.716	716	
#2 B7D	WIRE	250	LF	.02	5.0	.359	90	GEN CABLE
#12 GALV 500' WIRE		1	EA	.1	22.0	49.60	50	TRAVIS
#12 AWG 3/4 40 CURD		30	LF	.02	.6	.99	30	NPS
CABLE CLAMP #2/0 WIRE		45	EA	.20	9.0	6.69	301	NPS
BALLAST WIREWAY 6"x6"		1	EA	1.4	1.4	29.68	30	CN
200W FIXT. TYPE V6A VAPOR		6	EA	.6	3.6	35.28	212	NFS
100W FIXT. TYPE 1-3		8	EA	.5	4.0	27.10	217	
100W FIXT. TYPE MV		18	EA	2.0	36.0	50.38	907	
100W FIXT. TYPE 1-HB		6	EA	1.6	9.6	43.68	262	
2x4 4LP FIXT. TYPE FLUOR		5	EA	4.0	20.0	123.20	616	
200W FIXT. TYPE R5 ROTATING BEACON		1	EA	1.8	1.8	102.41	102	
LAMP INCAND 150W		6	EA	.02	.1	2.09	13	
200W		8	EA	.02	.2	2.89	23	
1000W		6	EA	.05	.3	15.62	94	
FLOODLIGHT MTG POLE		5	EA	5.0	25.0	88.40	442	
LAMPS MV 400 W		23	EA	.05	1.2	24.96	563	
BALLAST 400W MERC V		18	EA	2.0	36.0	81.54	1468	NFS
UNISTRUT FIXT. SUPPORT		250	EA	.06	15.0	1.56	390	UNISTRUT
EMERGENCY LIGHT		1	EA	1.5	1.5	164.64	165	GRAYBAR
EMERGENCY BATTERY SUPPLY		1	EA	4.5	4.5	94.00	94	
PHOTO CELL		1	EA	2.2	2.2	51.52	52	
MCC "AP"		1	EA	74.0	74.0	26.09	26.509	GY QUOTE
240 TOTALS TO SMT 30					378.1		34,503	

Figure D-7. Construction Cost Estimate, Electrical Interior Summary
(Sheet 4 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION				
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 33 OF 42 SHEET E-5 OF 				
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67392				
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO E5-E8				
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005				
ESTIMATOR KOLB J.B. SMITH INC				APPROVED J A BROWN DD-FED				
CHECKER PURVIS J.B. SMITH INC								
ELECTRICAL INTERIOR SUMMARY		QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
16 ELECTRICAL INTERIOR								
G SWITCH BOARD - PANEL BOARD								
PANEL AC-1 BKR4		1	EA	20.5	20.5	408.80	409	NPS
PANEL TTC 30X24X6 5/8		1	EA	4.5	4.5	190.40	190	HOFFMAN
PANEL PC 16X12X6 5/8		1	EA	1.8	1.8	67.20	67	
PANEL FA 24X24X6 5/8		1	EA	1.0	1.0	146.36	146	
2DR PANEL FL 72X48X18		1	EA	4.0	4.0	676.40	676	
CABINET DOOR OPR.		3	EA	2.5	7.5	51.52	155	
PUSH BUTTON & GUPP		3	EA	2.0	6.0	4.91	15	HOFFMAN
PRESSURE GAGE		3	EA	1.0	3.0	18.20	55	JOHNSON
CRANK		3	EA	.02	.1	1.12	3	JOHNSON
L LOW VOLTAGE BUSWAYS								
CONDUIT 3 1/2" GALV. RIGID		20	LF	.35	7.0	4.80	96	YOUNGSTOWN
CONDUIT 3" GALV. RIGID		20	LF	.23	4.6	3.825	77	STEEL TUBE
CONDUIT 2" GALV. RIGID		125	LF	.14	17.5	1.81	226	
CONDUIT 1 1/2" GALV. RIGID		220	LF	.11	24.2	1.33	293	
CONDUIT 1 1/4" GALV. RIGID		20	LF	.09	1.8	1.13	23	
CONDUIT 1" GALV. RIGID		170	LF	.07	11.9	.86	146	
CONDUIT 3/4" GALV. RIGID		870	LF	.05	43.5	.60	557	
CONDUIT 1/2" GALV. RIGID		1,230	LF	.04	49.2	.53	652	
CONDUIT ELLS 3 1/2"		2	EA	4.5	9.0	32.35	65	
CONDUIT ELLS 3"		2	EA	3.7	7.4	18.67	37	
CONDUIT ELLS 2"		4	EA	1.6	6.4	6.29	25	
CONDUIT ELLS 1 1/2"		3	EA	1.8	5.4	4.10	12	
CONDUIT ELLS 1 1/4"		2	EA	1.0	2.0	3.29	7	STEEL TUBE
TOTALS TO SMT. 30					238.3		3,936	

KSC FORM 21-243 (REV. 4/80)

Figure D-7. Construction Cost Estimate, Electrical Interior Summary
(Sheet 5 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION			
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 34 OF 42 SHEET E-6 OF 			
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO'S 79K67392			
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA				SHEET NO E9-E10			
ARCHITECT OR ENGINEER J.B. SMITH INC.				PCN 77406			
ESTIMATOR KOLB J.B. SMITH INC				PD/CCBD 			
CHECKER PURVIS J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005			
APPROVED J.A. BROWN DD-FED							
ELECTRICAL INTERIOR SUMMARY		QUANTITY		LABOR (MH)	MATERIAL		TOTAL COST
NO. UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☐ TOTAL	PER UNIT	TOTAL		
16 GROUNDING SYSTEM							
	GROUNDING RECEPTACLE	8	EA	1.0	8.0	25.09	201 NPS
	GROUND ROD 5/8"	18	EA	2.0	36.0	49.27	887 NPS
	MISC. GROUND CONN. WIRE		1/R	200.0	200.0	896.00	896
	CONN. SMALL MOTOR 1/3 HP	3	EA	2.5	7.5	7.62	23
	CONN. MED MOTOR 1/2 HP	2	EA	3.0	6.0	10.08	20
	CONN. MED. LG. MOTOR 1 HP	1	EA	4.0	4.0	12.21	12
	CONN. LARGE MOTOR 15 HP	1	EA	6.0	6.0	35.84	36
	CONN. DUCT HEATERS	1	EA	2.0	2.0	7.28	7
	CONN. HUMIDIFIER	1	EA	2.0	2.0	7.28	7
	FLA STA. MAIN WP	1	EA	1.0	1.0	12.54	13
	6" FA BELL W/ WP HOUSING	1	EA	.8	.8	37.63	38 SYS 4ER
	TEL OUTLET E & P	2	EA	.8	1.6	9.80	20 COOK
	TEL OUTLET	1	EA	.6	.6	4.79	5 COOK
SUBTOTAL					275.5		2165
LABOR HOURS x RATE		275.5	HR	18.50	5,097		
PT&I AND STATE TAX			%	25	1,274	5	108
					6,371		8,644
OVERHEAD		15	%				1,297
						SUBTOTAL	9,941
PROFIT		10	%				994
						SUBTOTAL	10,935
PRIME MARK-UP		10	%				1,093
						SUBTOTAL	12,028
BOND		1	%				120
TOTAL TO GHT. 29		18	ROD		675.00		12,148

RSC FORM 21-248 (REV 4/80)

Figure D-7. Construction Cost Estimate, Electrical Interior Summary
(Sheet 6 of 6)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 35 OF 42 SHEET EM-1 OF	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39		DRAWING NO/1 79K 67392		SHEET NO M-28-29-30	
STATION SET LOCATION JOHN F KENNEDY SPACE CENTER, FLA		PCN 77406		PD/CCBD	
ARCHITECT OR ENGINEER J B SMITH INC		WORK ORDER OR CONTRACT NO 6005			
ESTIMATOR KOLB J B SMITH INC		CHECKER PURVIS J B SMITH INC		APPROVED J A BROWN DD FED	
EXTERIOR UTILITIES		QUANTITY		LABOR (MMH)	
MECHANICAL SUMMARY		NO. UNITS		UNIT MEAS	
ELEMENT		PER UNIT		FIELD TOTAL PAB	
15F H.T.H.W DISTRIBUTION		1,000 LF		34.72	
G SANITARY SEWER		160 LF		36.54	
Y WATER SUPPLY LINES		1014 LF		37.309	
TOTAL EXTERIOR UTILITIES		2,174 LF		36.059	
				To GHT ?	
				78,392	
OFFICIAL USE ONLY					

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 36 OF 42 SHEET EM-2 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67392	
STATION SET LOCATION JOHN F KENNEDY SPACE CENTER, FLA.				SHEET NO M 28	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR KOLB J.B. SMITH INC.				APPROVED J.A. BROWN DDFED	
CHECKER PURVIS J.B. SMITH INC					
EXTERIOR UTILITIES		QUANTITY		LABOR (MM)	
MECHANICAL SUMMARY		NO UNITS		UNIT MEAS.	
		PER UNIT		FIELD TOTAL	
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☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION		
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 37 OF 42 SHEET EM-3 OF 		
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO(S) 79K67392		
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA		LOCATION 		SHEET NO M 29		
ARCHITECT OR ENGINEER J.B. SMITH INC		CHECKER PURVIS J.B. SMITH INC		WORK ORDER OR CONTRACT NO 6005		
ESTIMATOR KOLB J.B. SMITH INC		APPROVED J.A. BROWN DD-FED				
EXTERIOR UTILITIES MECHANICAL SUMMARY		QUANTITY		LABOR (MM)		
		NO. UNITS	UNIT MEAS.	PER UNIT	FIELD TOTAL FAB	
					PER UNIT	
					TOTAL	
					TOTAL COST	
15 G SANITARY SEWERS						
6" SOIL PIPE		100	LF	.40	40.0	5.63
6" COMBINATION Y "		1	EA	2.0	2.0	35.38
6" 1/4" BEND		1	EA	2.0	2.0	27.54
6" 1/8" BEND		2	EA	2.0	4.0	18.46
3" P" TRAP		2	EA	3.0	6.0	40.04
3" FLOOR DRAIN		2	EA	4.0	8.0	71.73
CAULKING		40	LB	—	—	1.41
OKUM		4	LB	—	—	8.58
LPGAS		4	LB	—	—	6.50
3" CHAULKING JOINTS		14	EA	.50	7.0	—
CONC. PIPE		1	EA	—	—	104.50
DRY WELL 24" x 5'		1	EA	8.0	8.0	286.00
4" ACID WASTE PIPE-PVC		60	LF	.30	18.0	3.07
					95.0	1,577
LABOR HOURS x RATE		95.0	HR	21.08	2,003	
FBI AND SALES TAX			%	25	501	5
					2,504	1,656
OVERHEAD		15	%			
						624
						4,784
PROFIT		10	%			
						478
						5,262
PRIME MARK-UP		10	%			
						526
						5,788
BOND		1	%			
						58
TOTAL SANITARY SEWERS TOTAL		35	160	LF	3654	
						5,846

KSC FORM 31-243 (REV 4/80)

Figure D-8. Construction Cost Estimate, Exterior Utilities - Mechanical Summary (Sheet 3 of 4)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION					
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 38 OF 42 SHEET EM-4 OF					
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO: 79K67397 SHEET NO M-30					
STATION SET LOCATION JOHN KENNEDY SPACE CENTER, FLA.		PCN 77406		PD/CCBD					
ARCHITECT OR ENGINEER J.B. SMITH INC.				WORK ORDER OR CONTRACT NO 6005					
ESTIMATOR KOLB J.B. SMITH INC		CHECKER PURVIS J.B. SMITH INC		APPROVED J.A. BROWN DD-FED					
EXTERIOR UTILITIES		QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST	
MECHANICAL SUMMARY		NO. UNITS	UNIT MEAS	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAD	PER UNIT	TOTAL		
15 Y WATER LINES-SUPPLY LINES									
10" TAPPING VALVE		1	EA	20.0	20.0	803.28	803	HUGHES	
10" TAPPING SLEEVE		1	EA	20.0	20.0	738.00	738		
2" GATE VALVE W/BOX		1	EA	.7	.7	171.91	172		
FIRE HYDRANT & EXT.		3	EA	12.0	36.0	924.53	2,773		
10" C.I. PIPE		475	LF	.28	133.0	13.75	6,531		
6" C.I. PIPE		336	LF	.17	57.1	9.37	3,148		
2" GALV STEEL PIPE		203	LF	.22	44.7	2.92	593		
10" C.I. TEE		2	EA	9.0	18.0	497.39	995		
6" C.I. TEE		2	EA	5.3	10.6	163.74	327		
2" GALV. TEE		4	EA	1.2	4.8	37.33	129		
10" X 6" C.I. REDUCER		1	EA	3.0	3.0	423.40	423		
10" PLUG		1	EA	2.5	2.5	18.38	18		
6" 1/4 BEND		1	EA	2.85	2.9	27.54	28		
6" 1/8 BEND		1	EA	2.85	2.9	18.46	18	HUGHES	
					356.2		16,696		
LABOR HOURS X RATE		356.2	HR	21.08	7,509				
PT&I AND SALES TAX			%	25	1877	5	835		
					9,586		17,531	26,917	
OVERHEAD		15	%					4,038	
								30,955	
PROFIT		10	%					3,096	
								34,051	
PRIME MARK-UP		10	%					3,405	
								37,456	
BOND		1	%					375	
WATER SUPPLY LINE TOTAL TO SHT. 35					1014	LF	37,809	37,831	

KSC FORM 21-243 (REV. 6-80)

Figure D-8. Construction Cost Estimate, Exterior Utilities - Mechanical Summary (Sheet 4 of 4)

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☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 40 OF 42 SHEET EE-2 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 89				DRAWING NO(S) 79K67392	
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA				SHEET NO E11-E13	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR KOLB J.B. SMITH INC				APPROVED J.A. BROWN DD-FED	
OFFICIAL USE ONLY					
CHECKER PURVIS J.B. SMITH INC					

ELECTRICAL SITEWORK SUMMARY	QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST
	NO UNITS	UNIT MEAS.	PER UNIT	FIELD TOTAL	PER UNIT	TOTAL	
16. A MANHOLE TYPE "C" POWER							
DEWATER HEADER	200	LF	3.77	754.0	22.17	4434	
EXCAVATION	767	CY	.06	46.02	.83	637	BREWER REG.
CONCRETE 3000 PSI	56	CY	.25	14.0	45.00	2520	RINKER
FORMWORK	2151	SFCA	.14	301.1	.83	1785	
REBAR	6255	LB	.01	62.6	.32	2002	
FRAME & COVER TRAFFIC	1	EA	12.2	12.2	350.00	350	BROOKS PROF
PULLING IRONS, STAIRS, ETC	95	LB	.1	9.5	.65	62	
BACK FILL & COMPACTION	607	CY	.2	121.4	.70	425	
INTERIOR RACKS W/ HOOKS	8	EA	1.25	10.0	31.00	248	HUGHES
INSULATORS	48	EA	.30	14.0	1.40	67	HUGHES
MANHOLE TYPE "D" COMM							
DEWATER	150	LF	4.03	604.5	22.17	3326	
EXCAVATION	194	CY	.101	19.5	1.22	237	
CONCRETE 3000 PSI	20	CY	.25	5.0	45.00	900	RINKER
FORMWORK	806	SFCA	.15	120.9	.83	669	
REBAR	2234	LB	.015	33.5	.32	715	
FRAME & COVER TRAFFIC	1	EA	12.2	12.2	350.00	350	BROOKS PROF
PULLING IRONS, STAIRS	60	LB	.1	6.0	.65	39	
BACK FILL & COMPACTION	166	CY	.2	33.2	.70	116	
INTERIOR RACKS	6	EA	.75	4.5	31.00	186	HUGHES
INSULATORS	18	EA	.08	1.4	1.40	25	HUGHES
FORMER PAD 10x20x1	8	CY	8.6	68.6	45.00	360	RINKER
GRAVEL LOOSE & COMPACT BASE	10	CY	.84	8.4	12.00	120	
GUARD CHAIN & HDW	1	EA	7.0	7.0	50.00	50	
4W4 DUCT & CONCEALED	500	LF	.6	300.0	13.50	6750	
2W4-2W3 DUCT CONC.	100	LF	.5	50.0	9.00	900	
2W3- " " "	80	LF	.4	32.0	8.50	680	
SITE WORK SUB TOTAL TO SHT 39				2451.6		27,953	

Figure D-9. Construction Cost Estimate, Electrical Exterior Summary
(Sheet 2 of 3)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION				
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 41 OF 42 SHEET EE-3 OF EE-3				
PROJECT/NO TITLE ORDNANCE BUILDING LC39				DRAWING NO. 79K67392				
STATION SET LOCATION JOHN F. KENNEDY SPACE CENTER, FLA.				SHEET NO E14-E15				
ARCHITECT OR ENGINEER J.B. SMITH INC.				PCN 77406				
ESTIMATOR KOLB J.B. SMITH INC.				WORK ORDER OR CONTRACT NO 6005				
CHECKER PURVIS J.B. SMITH INC.				APPROVED J.A. BROWN DD FED				
ELECTRICAL EXTERIOR SUMMARY		QUANTITY		LABOR (MM)		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
16 B MED & HI-VOLT POWER LINES								
CONDUIT RIGID ST 3 1/2"		140	LF	.35	49.0	4.55	637	CES
CONDUIT RIGID ST. 3/4"		70	LF	0.6	4.2	.62	43	
4" CONDUIT FLEX & EDBUM 4"		2	EA	5.8	11.6	90	180	
4" CONDUIT FLEX & END BUSH 3/4"		2	EA	4.5	9.0	82.00	164	
ADAPTOR 4" RIGID DUCT 4"		2	EA	1.3	2.6	4.50	9	
ADAPTOR 4" RIGID DUCT 3"		2	EA	1.0	2.0	3.80	8	CES
1/2-4" CILE NJ-15KV CABLE		950	LF	12	114.0	8.55	8123	ANIXTER
15KV FILE SLICE		2	EA	24.0	48.0	75.00	150	HUGHES
15KV FILE END TERM		2	EA	24.0	48.0	250.00	500	HUGHES
THHN 350 MCM - 1/2-600V-CU		650	LF	.11	71.5	1.78	1,157	CES
THHN 10 AWG - 1/2-600V-CU		250	LF	.02	5.0	.07	18	CES
3/4" x 30' CU-LAD GROUND ROD		6	EA	2.0	12.0	57.50	345	CES
#2/0 B&S WIRE GROUND		80	LF	.03	2.4	.648	52	HUGHES
GROUND CONN		1	EA	8.0	8.0	20.00	20	
2000KVA DOUBLE END SUBSTA								
2000KVA TRANSFORMER TRANS		2	EA	50.0	100.0	250.00	50,000	MARK
138KV LB SWITCH W/ FUSES		2	EA	12.0	24.0	11,000	22,000	HATFIELD
3000A SECONDARY MAINS		2	EA	15.0	30.0	13,600	27,200	WEST.
3000A TIE BREAKER		1	EA	16.0	16.0	13,600	13,600	
800A FEEDER BREAKER		3	EA	8.0	24.0	382.5	11,475	
600A FEEDER BREAKER		8	EA	8.0	64.0	382.5	30,600	
TRANSITION SECTION		2	EA	8.0	16.0	380.0	7,600	
CURRENT TRANSFORMER		8	EA	5.0	40.0	42.5	3,400	
POWER TRANSFORMER		4	EA	5.0	20.0	59.5	2,380	
AMMETER-VOLTMETER		4	EA	2.0	8.0	85.0	3,400	
AMMETER-VOLTMETER SWITCH		4	EA	2.0	8.0	45.0	1,800	
WEATHER PROOFING		1	EA	100.0	100.0	144.5	1,445	
SUB TOTAL TO SHEET 39					837.3		186,306	

Figure D-9. Construction Cost Estimate, Electrical Exterior Summary
(Sheet 3 of 3)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C 95		DATE COMPLETED MAY 1, 1985		SHEET 42 OF 42 SHEET EE4 OF 	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO: 79K67392 SHEET NO M-31 M32	
STATION SET JOHN F. KENNEDY SPACE CENTER, FLA.		PCN 77406		PD/CCBD	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR KOLB J.B. SMITH INC.		CHECKER PURVIS J.B. SMITH INC		APPROVED J.A. BROWN DD-FED	

SPECIAL CONSTRUCTION SUMMARY	QUANTITY		LABOR (HR MM)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ PAD	PER UNIT	TOTAL	
13 F GASEOUS NITROGEN GNL							
1/2" SOLENOID VALVE 3/4"	1	EA	1.28	1.3	417.07	417	CIRCLE SEAL
1/2" GLOBE VALVE 3/4"	2	EA	1.28	2.6	154.29	309	CIRCLE SEAL
1/2" PRESS GAGE 3/4"	2	EA	1.28	2.6	60.96	122	
1/2" FILTER 10 MICRON	1	EA	1.28	1.3	25.45	25	GULF CONTROLS
1/2" PRESS REGULATOR	1	EA	1.28	1.3	266.00	266	GROVE VALVE
1/2" TUBING 0.72 WALL 304%	50	LF	1.80	90.0	4.18	209	WALL TUBE
KC103 SEAL RING	20	EA	.10	2.0	.40	8	NIABCO
KC107C8 TEE	4	EA	.48	1.9	26.58	106	
KC112C8 ADAPTER	6	EA	.32	1.9	5.85	35	
KC126C8 UNION	4	EA	.32	1.3	7.41	30	
KC142C8 NUT	20	EA	.16	3.2	1.51	30	
KC143C8 SLEEVE	20	EA	.16	3.2	1.54	31	
75M04185-2.8 BAND MARKER	10	EA	.10	1.0	.41	4	
CLEANING COMPONENTS	8	EA	3.0	24.0	3.85	31	SEE SHT 6
CLEAN TUBE 4444	10	EA	1.0	10.0	3.85	39	FOR DETAIL
GFE GNL 10000 SIG PANEL	4	EA	2.5	10.0	82.50	330	GFE VALVE
TEST & CHECK OUT	4	EA	7.5	30.0	-	-	\$150,000
LABOR HOURS x RATE	1876	HR	21.08	3955		1992	
PT & I AND SALES TAX		%	25	989	5	100	
SUBTOTAL				4944		2092	7036
OVERHEAD	15	%					1,055
SUBTOTAL							8,091
PROFIT	10	%					809
SUBTOTAL							8,900
PRIME MARK UP & BOND	10	%	+ 1%				988
TOTAL GNL TO SHT 2	50	LF	197.76				9,888

KSC FORM 21-243 (REV 4/80)

Figure D-10. Construction Cost Estimate, Special Construction Summary

APPENDIX E
BID COST ESTIMATE
(CODE C-100)

COST ESTIMATE COVER SHEET

GOVERNMENT ESTIMATES ARE ADMINISTRATIVELY CONFIDENTIAL
ACCESSIBLE TO AUTHORIZED NASA/KSC PERSONNEL OR REPRESENTATIVES ONLY

PROJECT ORDNANCE BUILDING 4100 SFLOCATION KSC-LC 39-VAB AREAIFB NO MADE UP 10-00-123-5BID DATE AUG 15, 1985AMENDMENT AMEND*1 DATED 6-2-85 AMEND*2 DATED 6-10-85ESTIMATE CODE C100PCN 77406CONTRACT W.O. 6005

FOR OFFICIAL USE ONLY

DRAWING NO 79K67302 SHT 80PREPARED BY J.B. SMITH & FRC KSC
1400 AFOLLO BLVD
FIRM/ADDRESS ROCKET CITY,LOCATION UTAH 42134MODEL NO N/A
NASA DD-FR03
LEAD DESIGNER ALICE JONES J.B. SMITHSUBMITTAL DATE JULY 22, 1985.ESTIMATED BY VARDELL PR2421KSC COST ENGINEER JOSE A BROWN NASAPHONE NO. 867-2725PROJECT ENGINEER DRAINWOOD J.B. SMITHREVIEWED BY L. SEYMOREAPPROVED BY R.V. SUREPHONE NO. 867-3994

Cost Estimating for procurement requires special handling in accordance with DE ID-1142.23, KSC SPEC-G-0002
and KSC SPEC-G-0003 for GSE.

OFFICIAL USE ONLY

KSC FORM 21-888 (3/83)

Figure E-1. Cost Estimate Cover Sheet

FOR OFFICIAL USE ONLY

SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)		1 SOLICITATION NO 10-00-123-5	2 TYPE OF SOLICITATION ☐ SEALED BID (IFB) ☐ NEGOTIATED (RFP)	3 DATE ISSUED 7-15-85	PAGE OF PAGES
IMPORTANT - The "offer" section on the reverse must be fully completed by offeror					
4 CONTRACT NO		5 REGISTRY/PURCHASE REQUEST NO 10-00-123-5	6 PROJECT NO 77406		
7 ISSUED BY JOHN F. KENNEDY SPACE CENTER, NASA PROCUREMENT OFFICE KENNEDY SPACE CENTER, FLORIDA 32899		8 ADDRESS OFFER TO JOHN F. KENNEDY SPACE CENTER, NASA PROCUREMENT OFFICE, CODE SI-PRO-A HEADQUARTERS BLDG., ROOM 2414 KENNEDY SPACE CENTER, FLORIDA 32899			
9 FOR INFORMATION CA...		10 NAME COPIES: ATS/PRO Questions: G. D. Fain		11 TELEPHONE NO (Include area code) (NO COLLECT CALLS) Copies: 305/867-2851 Quest: 305/867-7237	
12 SOLICITATION NOTE: In sealed bid solicitations offer and offeror mean bid and bidder. IF THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS FROM MONTHLY NO DATE					

ORDNANCE BUILDING KSC, FLA.

TASK I SITE WORK OUTSIDE 5' LINE

TASK II BUILDING STRUCTURE TO 5' LINE, INCLUDING STRUCTURAL - MECHANICAL - ELECTRICAL

TASK III UTILITIES OUTSIDE 5' LINE

TASK IV (OPTION) SPECIALIZED CONSTRUCTION GN₂ LINE

MAGNITUDE 1,000,000 TO 5,000,000

PRIORITY RATING (DMS REG #1)

OFFICIAL USE ONLY

11 The Contractor shall begin performance within <u>5</u> calendar days and complete it within <u>210</u> calendar days after receiving ☐ award ☒ notice to proceed. This performance period is ☒ mandatory ☐ negotiable (See _____)	
12A THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS: (If YES indicate within how many calendar days after award in Item 12B) ☒ YES ☐ NO	
12B CALENDAR DAYS Within 5 days after request	
13 ADDITIONAL SOLICITATION REQUIREMENTS	
A. Sealed offers in original and <u>2</u> copies to perform the work required are due at the place specified in Item 8 by <u>3:00 pm</u> (hour, local time) <u>8-15-85</u> (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.	
B. An offer guarantee ☒ is ☐ is not required.	
C. All offers are subject to the (1) work requirements and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.	
D. Offers providing less than <u>60</u> calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.	

NSN 7540-01-168-02 2

1442 201

STANDARD FORM 1442 (REV. 4-85)
Prescribed by GSA - KSC OP 12-86
FAR (48 CFR) 53.236-7(a)

Figure E-2. Bid Form, Construction Contract (Sheet 1 of 2)

14 NAME AND ADDRESS OF OFFEROR (Include ZIP Code)		15 TELEPHONE NO (Include area code)	
OFFICIAL GOVERNMENT ESTIMATE		N/A	
CODE		FACILITY CODE	
17 The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation. If this offer is accepted by the Government in writing within _____ calendar days after the date offers are due (this clause number equals 100 percent that the offer is not subject to modification in item 13D) (Delete to insert an alternate means of payment if it is not a percent of the maximum in item 14E)			
AMOUNTS	BID PRICE TASK	I	134,269
		II	564,329
		III	556,559
			1,251,157
		IV OPTION	10,667
18 The offeror agrees to furnish any required performance and payment bonds			
19 ACKNOWLEDGMENT OF AMENDMENTS (The offeror acknowledges receipt of amendments to the solicitation - Give number and date of each)			
AMENDMENT NO		DATE	
I II		7-23-82 8-2-82	
20A NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)		20B SIGNATURE	
AWARD (To be completed by Government)			
21 ITEMS ACCEPTED			
APPROVED BY		DE	
Justin Case		Alice Jones	
		DD-FED-82	
		CE J. A. Brown	
		DD-FED	
		Joe A. Brown, C.C.E	
A&E J. B. Smith			
22 ACCOUNTING AND APPROPRIATION DATA			
RECEIVED		DE-CAT-1	
24 SUBMIT INVOICES TO ADDRESS SHOWN		27 OTHER THAN FULL AND OPEN COMPETITION COMPLIANT	
14 copies unless otherwise specified		10 USC 2304(c) 41 USC 252(c)()	
26 ADMINISTERED BY		27 PAYMENT WILL BE MADE BY	
CODE S1-PRO-32			
JOHN F. KENNEDY SPACE CENTER, NASA CONTRACT ADMINISTRATION SECTION KENNEDY SPACE CENTER, FLORIDA 32899		JOHN F. KENNEDY SPACE CENTER, NASA COMMERCIAL ACCOUNTS & FUND CONTROL SECTION CODE: AC-FMO-23A KENNEDY SPACE CENTER, FLORIDA 32899	
CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE			
28 NEGOTIATE AGREEMENT (Contractor is required to sign this document and return _____ copies to issuing office. Contractor agrees to furnish and deliver a _____ copy of contract and work requirements incorporated on this form and any continuation sheets to the contractor in stated in this contract. The rights and obligation of the contractor in this contract shall be governed by (a) this contract award (b) the solicitation and (c) the clauses, recommendations, specifications and special conditions incorporated by reference in or attached to this contract)		29 AWARD (Contractor is not required to sign this document. If you offer of this solicitation is formally accepted as to the terms issued. This award constitutes the contract which consists of (a) the Government solicitation and (b) (c) and (d) this contract award. No further contractual document is necessary.	
30A NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)		31A NAME OF CONTRACTING OFFICER (Type or print)	
30B SIGNATURE		31B UNITED STATES OF AMERICA	
30C DATE		31C AWARD DATE	

FOR OFFICIAL USE ONLY

OFFICIAL USE ONLY

STANDARD FORM 1467 BACK (REV. 6-85)
 GPO FOR 48-486

Figure E-2. Bid Form, Construction Contract (Sheet 2 of 2)

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C100		DATE COMPLETED JULY 26, 1985		SHEET 4 OF 6 SHEET 4 OF 48	
PROJECT/NO TITLE ORDNANCE BUILDING				DRAWING NO/IS 79K67392	
STATION SET K4C LC39		PCN 39143		SHEET NO 1-86	
ARCHITECT OR ENGINEER J.B. SMITH INC				WORK ORDER OR CONTRACT NO 0576	
ESTIMATOR MIKE L BROWN JBS		CHECKER JOHN KOLE		APPROVED J.B. SMITH PRES	

BID FORM SUMMARY	QUANTITY		LABOR (\$ OR MM)		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	☐ FIELD ☐ TOTAL ☐ FAB	PER UNIT	TOTAL	
TASK							
I SITE WORK FROM SHTE						124,462	
PRO-RATA SPEC CONDITIONS				.0788%		9,807	
AMENDMENT #1 & #3						0,000	
TOTAL SITE WORK TASK I	4,100	SF	32,748.5				134,269
II BUILDING-STRUCT TO 5' LINE						512,652	
PRO-RATA SPEC CONDITIONS				.0788%		40,397	
AMENDMENT #1						11,280	
TOTAL BLDG TASK II	4,100	SF	137,642				564,329
III UTILITIES OUTSIDE 5' LINE						507,981	
PRO-RATA SPEC CONDITIONS				.0788%		40,028	
AMENDMENT #2						4,550	
TOTAL UTILITIES III	4,100	SF	134,705				552,559
TOTAL TASKS I-II-III	4,100	SF	305,160.2				1,251,157
IV SPECIALIZED CONSTRUCTION							
GN2 1/4 PIPELINE	50	LF	197.76			9,888	
PRO-RATA SPEC CONDITIONS				.0788%		719	
AMENDMENT #1						0,000	
OPTION TASK IV	50	LF	215.38			10,667	10,667
GFE VALUE \$150,000 NIC							
TO BID FORM E-6							
OFFICIAL USE ONLY							

KSC FORM 21-243 (REV 4/80)

Figure E-3. Bid Form Summary

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☒ CONSTRUCTION	
CODE C-100		DATE COMPLETED JULY 22, 1985		SHEET <u>5</u> OF <u>48</u> SHEET <u>2</u> OF <u>42</u>	
PROJECT/NO TITLE ORDNANCE BUILDING LC 39				DRAWING NO: 79K67392 SHEET NO C-1 THRU C-9	
STATION SET JOHN F KENNEDY SPACE CENTER, FLA		PCN 77406		PD/CCBD	
ARCHITECT OR ENGINEER J. B. SMITH INC				WORK ORDER OR CONTRACT NO 6005	
ESTIMATOR VARNDELL REC 2501		CHECKER WRIGHT REC 2421		APPROVED	

PROJECT SUMMARY	QUANTITY		LABOR (MM)	MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.		PER UNIT	PER UNIT	
I SITE WORK					SHT	
2A DEMOLITION PAVING	610	SY	@	3.08	4	1,880
2E EARTH WORK	6500	CY	@	7.73	4	50,273
2P BIT PAVING	3,100	SY	@	15.31	4	47,469
2T GRASSING	5,600	SY	@	1.96	4	10,984
2V STORM DRAINAGE	132	LF	@	104.97	4	13,856
SUBTOTAL						124,462
II BUILDING STRUCT. TO 5'-0" LINE						
2-14 ARCH. STRUCT	4,100	SF	@	74.34	15	304,780
15 MECHANICAL (INT.)	4,100	SF	@	25.84	23	105,449
16 ELECTRICAL (INT.)	4,100	SF	@	24.86	29	101,923
SUBTOTAL						512,652
III UTILITIES OUTSIDE 5'-0" LINE						
15F STEAM DISTRIBUTION	1,000	LF	@	34.72	35	34,715
15G SANITARY SEWERS	160	LF	@	36.54	35	5,846
15Y WATER SUPPLY	1,014	LF	@	37.31	35	37,831
16A EXTERIOR ELEC	2,000	KVA		214.78	39	429,569
SUBTOTAL						507,961
IV SPECIALIZED CONSTRUCTION						
13F SPECIALIZED SYS. GNS	SEE OPTION I			SHT.	42	
GFE VALUE 3-PANEL @ 50,000	150,100				49	=
EST. CONVT. BID COST	4,000	SF		281.70		1,145,075
SPECIAL CONDITIONS (NO D.T. ESCAL)						91,031
AMEND I FROM SHT 4					4	11,280
AMEND II FROM SHT 4					4	4,550
OPTION I SHT 42	50	LF	@	197.76	42	9,888
						=
BID COST ESTIMATE	4100	SF	@	307.76		1,261,824

KSC FORM 21-343 (REV 4/80)

Figure E-4. Project Summary

☐ GROUND SUPPORT EQUIPMENT		COST ESTIMATE		☐ CONSTRUCTION		
CODE C1002		DATE COMPLETED July 8, 1985		SHEET 6 OF 6 SHEET CF		
PROJECT/WO TITLE Ordnance Building				DRAWING NO'S 79K67392	SHEET NO	
STATION SET	LOCATION John F. Kennedy Space Center, KSC, FL			PCN 77406	PD/CBC	
ARCHITECT OR ENGINEER J. B. Smith, Inc.				WORK ORDER OR CONTRACT NO 6005		
ESTIMATOR John Kolb, J. B. Smith, Inc.		CHECKER/Reviewer Allen Purvis, J.B. Smith, Inc.		APPROVED J. A. Brown, DD-SED		
Special Conditions SUMMARY	QUANTITY		LABOR (\$ OR MH)		MATERIAL	TOTAL COST
	NO. UNITS	UNIT MEAS	PER UNIT	PER UNIT TOTAL PAGE	PER UNIT TOTAL	
JOINT OCCUPANCY:						
a) Total Length of Job from IFB - Cal. Days $210 \div 7 = 30$ Wks X 5 Days						
WK = 150 Days (b) Work Days 150 Days X 8 Hr/Day = 1200 Hrs.						
c) Total Labor Hrs. (See Sheet 5) 1200 - 120 = 10 Man Crew						
LOST PRODUCTIVITY:						
Elevator, Waiting Time & Congestion, (2%) Combustion Equip. (1.5%)						
Travel Distance, Vastness/Complexity (1.5%) Interference of						
Trades (2.0%) 7 Day Notice for Power Outage (2.0%)						
Work Congestion (1.5%)						
TOTAL LOSS PRODUCTIVITY:						
Labor Cost (From Sheet 4) Without Markups (\$256,972)						
Plus-Mark-ups P.T. 1. 25% OH 15%, Profit 10%, M.U. 10%, Bond 1%						
Use 10% of Total for Joint Occupancy 410,400 X 10%						
\$41,000						
SPECIFIED DOWN TIME						
20 Days Down Time - I.F.B. (Page 7)						
10 Man Crew X 20 Days X 8 Hrs. = 1600 Hrs X \$20. Hr = 32,000						
50% of Crew Used Elsewhere 32,000 X 50%						
\$16,000						
Lost Production of 50% Consists of (a) Launch Related						
Activities (b) Weather Cond. (c) Wages Paid Union Per Contract						
and No Productivity (Show Time)						
ESCALATION:						
I.F.B. requires 210 Days Job Duration or 105 Days to						
Mid-Pt, OR say 4 Mo. Material and Vendor Quotes						
Estimates Increased 5% Annually, Labor Increased						
Due to Labor Contract Expiration & Automatic Increases						
In Present Contracts Present Avg Increases are 11% a YR. Labor						
11% & Mat. 5% = 16% $\div 2 = 8\%$ VR Est Escalation 8%/12 MO = 2/3% per MO X 4 MO						
\$34,000						
= 2.7% of (ECBC) 1,261,824 X 2.7%						
TOTAL SPECIAL CONDITIONS TO SHEET 6						
\$91,000						

KSC FORM 21-243 (REV 4 80)

Figure E-5. Special Conditions Summary

APPENDIX F
SUPPORTING DATA

<u>REFERENCE</u>	<u>SHIFTS</u>	<u>COSTS</u>
BLOG ESTIMATOR'S REFERENCE BOOK, WALKER PP 93 THRU 96, 106	3 THRU 17	A/S - LABOR/MATERIAL
ENGINEERING NEWS RECORD, MAY 1985 PP 24 THRU 25	9/10	A/S - TURNWORK AND FINISHES LABOR
CONTRACTOR'S EQUIPMENT OWNERSHIP EXPENSE	2	SITE WORK - GRADER, D-9 OPERATION
KSC CONSTR. COST INDEX	5,7,9,10,12, 14,15,17,20,25	A/S, MECHANICAL, ELECTRICAL MARKUPS
COST MANUAL FOR PIPING AND MECHANICAL CONSTRUCTION	18 THRU 22	MECHANICAL LABOR/MATERIAL
NATIONAL PRICE SERVICE MONITOR	23 THRU 26	ELECTRICAL LABOR/MATERIAL
QUOTES, BROWNSVILLE, FLA, FIRMS R.L. BURGESS, ARM MANUFACTURING, 9/23/75	8	STEEL BAR JOISTS, MILL COSTS
AMERICAN STEEL FABRICATORS, T.O'NEAL, 9/27/75	8,9	STRUCTURAL STEEL SHOP COSTS
K. BROWN, TINKER CONCRETE, INC. 7/16/75	4	CONCRETE 8X12 BLOCK COSTS
<u>COMPUTATIONS</u>		
ATTACHMENT A, PAGE 2	2	SITE WORK, FILL DIRT
ATTACHMENT A, PAGE 3	19	SPECIALIZED CONSTRUCTION, LABOR FACTORS SUMMATION

Figure F-1. Quotes and Backup Data

CODE		BUDGET QUOTE FOR ESTIMATING		PAGE ____ OF ____	
C-95		KENNEDY SPACE CENTER (Vendor told for estimating VENDOR "QUOTE" FROM: purposes only). Yes COMPANY: ABC STEEL CO. ADDRESS: 4500 Pine Street Canaveral Groves, FL 32922 PERSONS NAME: Robert Steel POSITION/TITLE: Chief Estimator PHONE: 305-633-1234		DATE 4/30/85 / 6/30/85 ^{UPDATED} ORIGINATOR Varndell COSTS OBTAINED BY Wright DELIVERY SCHEDULE 4 WKS After Shop Dwg. FOB POINT Job Site, LC-39 Area TOTAL WEIGHT 10 Tons FREIGHT CHARGES 850	
		WORK ORDER # 0576 G-1.000		PHONE # 867-2725	
		PHONE # 867-2725		PCN # 77406	
ITEM	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Structural Steel, Warehouse Steel Beam Co.	5*	Tons	900	4,500
2	Shop Fabrication (includes shop dwg)	5	Tons	625	3,125
3	Sand Blast (SP10)	5	Tons	140	700
4	Inorganic Zinc (0001)	5	Tons	220	1,100
5	Erection labor	5	Tons	800	4,000
	Bar hoist - 40 L20-(30 ea) & Bridging				
6	Fabricated Delivered Job Site	4	Tons	1,785	7,140
7	Field erection labor & equipment	4	Tons	915	3,660
FOR OFFICIAL USE ONLY					
		9	Tons	3,112	17,550
REMARKS: (SPECS QUOTED, ETC.) (SPECS QUOTED ,ETC.) Spec Section 5 & 9L Read to ABC. DRAWINGS 100 %, DATE 7/21/85 Reference Sheets S1-5 1. These are and labor material prices, Taxes, ins., OH & profit must be added to these prices. 2. Field touch-up painting included in erection prices if by painting sub, delete \$40/ton. 3. Approximate quantities for obtaining vendor quote.					

KSC FORM 21-671 (3/80)

Figure F-2. Budget Quote for Estimating

TYPICAL BREAK DOWN STRUCT STEEL										
JOB NO.	DATE	COST ESTIMATE WORK SHEET	DATE	ESTIMATE BY	SHEET	OF	TOTAL			
6005 FEN 714067967392	C. 95	MAY 1, 1985	J. KOLEB & J.B. SMITH INC	40	42					
ORDNANCE BUILDING - KSC - OFFICIAL USE ONLY										
DESCRIPTION	QUANTITY	UNIT	UNIT MAT'L	UNIT LABOR	EQ. RENT	OWNER MATERIAL	CONTRACTOR MATERIAL	LABOR	EQUIP. RENTAL	TOTAL
BEAMS										
MAT'L FROM WAREHOUSE ASTM A572	1	TON	900				900			
GR 50 FABRICATION										
ENGINEERING SHOP DRAWINGS	1	TON	125							
FIELD MEASUREMENTS	1	TON	225							
SHOP FABRICATION PER TON	25	HR		25				OFF	10-16 HRS/TON	
SAND BLAST NEAR WHITE SP-10	300	SF	.20	234			80			
PAINT INORGANIC ZINC STD F0001	300	SF	.25	.50			75			
CONNECTIONS & WASTE 10%	200	LB	.40	45			90			
FREIGHT TO JOB	1	TON	45	35			40			
FIELD ERECTION										1785
UNLOAD, PACKING & TACK OR FLD BT	1	TON		400			265	400	(6.7 PC PER TON)	
FIELD WELDING 308 TON/1.5 HR	20	HR		20				400		
WELDING RODS 308	30	LB	.40				12			
WELDING MACHINE	20	HR			150				30	
CRANE 40 TON - 150' BOOM	1	HR			85				85	
TOTAL LABOR - MAT'L - EQUIP RENT	1	TON								
							1320	800	(115)	3412
							1177	To Labor Column		
							115			
							2612	(To Material Column)		
NOTE-1. TYPICAL BREAK DOWN TO BE MADE ON ALL										
STEEL, SUCH AS BEAMS, TRUSSES, COLUMNS, ETC.										
2. COMBINE EQUIP RENTAL & CONTRACTOR INTO										
FAB. MATERIAL COLUMN IN ORDER TO FIGURE										
YOUR SALES TAX.										
3. ALL QUOTES IN REGARD TO ERECTION, FORB. MCL. WAREHOUSE OR										
PAINTING ETC SHOULD INCLUDE VENDOR'S NAME PRICE & DATE.										
TOTAL 4-30-85										

Figure F-3. Cost Estimate Work Sheet, Typical Breakdown, Structural Steel

F-6

METHOD 1 GFE ESTIMATING									
A B C									
DESCRIPTION	QUANTITY	UNIT	UNIT MAT'L	LABOR	FACTOR	OWNER MATERIAL	CONTRACTOR MATERIAL	LABOR	RENTAL
C. PIERCE PRC 2421 (1) GN ₂ Panel, SS, 4' X 2', 6000-10,000 psi W.P., 5 valves, 4 meters, 5 outlets, and Electrical Connections (FIND NOS. A79553, A79554, A79555)	3 1 10 TOTAL	EA EA EA	\$ 5,000 1,000 13,400	MH 3.0 1.0 -	(2A) % 2.0 3.0 -	GFE 15,000 1,000 134,000	\$ 300 30 NIC	MH 9.0 1.0 NIC	Totals to Shts D-4, E-6, E-7 & D-44 10.0 (4)
GFE FACTORS 1. Handling - 0.5% 2. Insurance - 1.0% (2A) 3. Storage - 0.5% Total 2.0% per item									
GN ₂ Panel, SS, 6' X 6' X 8', 6000-10,000 psi W.P., 9 valves, 10 meters, 9 outlets (FIND NO. A76521)									
GFE FACTORS 1. Handling 1.0% (2B) 2. Insurance 1.5% 3. Storage 0.5% 3.0%									

1. When listing GFE, describe by noun, physical characteristics (size, shape), functional design characteristics, and KSC drawing find number(s).

2. GFE factors may vary from equipment item to equipment item. Therefore, list GFE factors used in the estimate of each equipment item.

3. Multiply owner material cost of GFE by the associated GFE factor percentage in column A to obtain the contractor material cost in column B (\$5,000 X 3.0 X 2% = \$300).

4. Carry forward prices in column B and C to the Mechanical Division Trades' Summary sheets for markups. Identify column B and C costs as GFE costs in the trades' summaries.

5. Summarize GFE and value and carry forward to project summary.

6. Total value of GFE \$150,000. Carry forward to project summary D-4, E-6, & E-7.

Figure F-4. Method 1, GFE Estimating

APPENDIX G
SPECIAL SUMMARIES

[illegible]

Figure G-1. System Summary of Government Estimate for Buildings

NY 100M 21-369 (9/76) - FBI file in 9/85

Figure 6-2. Labor and Material Cost Summary

APPENDIX H
GLOSSARY OF TERMS

APPENDIX H

A glossary is provided below to define terms commonly used in construction and construction cost management.

GLOSSARY OF GENERAL TERMS

ALLOWANCE - an item of cost or monetary significance, which has the following characteristics:

- a. Reasonableness
- b. May be of the "unit price" or "lump sum" variety
- c. Should be inclusive of all overhead, profit, and general conditions

CHECKER - responsible for checking math extensions totals. Check that all subtotals are brought to summary with page number noted on both sheets. See that summaries are complete and insure accuracy of transferred totals.

COST - any or all expenditures, including such items as hidden costs, profit, taxes, and interest associated with a construction project

COST ACCOUNTING - the historical reporting of disbursements and costs and expenditures on a project. When used in conjunction with CCE estimates, cost accounting can assist in giving the precise status of the project, to date.

COST ANALYSIS - a method using historical and planned project data to ascertain the most likely costs of future and on-going projects. Cost analysis may also be applied to escalation, as well as cost differentials between various localities, types of buildings, types of estimates, types of projects, and time of year.

COST ENGINEERING - the application of scientific principles and techniques to problems of cost estimation, cost control, and profitability dealing with the control, management, and manipulation of costs pertaining to a single project or a series of projects. The cost engineering discipline is involved in life cycle costing, conceptual cost estimating, cost escalation, cost index, bid strategy, analysis of cost data, cost analysis, cost prediction, cost control, and management of costs applicable to a project.

COST ESTIMATOR - responsible for take off of drawing specs and IFB. Apply established unit prices and labor rates to apply to basic construction/fabrication and installation costs. Apply appropriate overhead, profit, and burden rates. Apply special condition. Obtain quotes on major items. Review for completeness of drawing. Evaluate and comment on cost-saving construction; review bid documents for cost effectiveness.

CONTINGENCY - the allocation of a certain percentage or sum of money to compensate for unknown costs which may arise in the future. Contingencies are allocated on the basis of probability and past experience to assure that the total budgeted or bid sum is not exceeded by actual costs. Contingencies appear most frequently as:

- a. Design Contingency - an allocation for unknown design features and details. It is higher at the initial schematic design phases of a project and decreases as more finite planning details become known and working drawings are developed.
- b. Estimating Contingency - an allocation utilized by the cost engineer or estimator to compensate for uncertain, unknown, or fluctuating cost situations in order that actual costs will not exceed estimated costs.
- c. Construction or Field Contingency - an allocation established to compensate for unbid subcontractable items and unknown and unforeseeable field conditions.
- d. Change Order Contingency - an allocation for design refinements and the correction of design errors for which the contractors are entitled to additional and reasonable compensation.

CURRENT COST ESTIMATE (CCE) - The CCE is that cost that reflects the latest and best total project estimated cost available based on design or construction progress and constitutes the most realistic estimate of ultimate final project costs. It includes: the engineering cost to build the project in today's dollars plus contingencies; escalation to the mid-point of construction; and supervision, inspection, and engineering services. The CCE is also known as CWE current working EST by other government agencies.

ECBC C-95 - estimated construction bid cost based on completed design package. It is the final estimate before bid package has been released to potential bidders. The C-90 review changes have been incorporated at this level. Barring addenda/amendments, these drawings and specifications will be the same as those sent to prospective bidders.

This package should include all quotes from vendors, element summary, labor and material summary, system summary, general condition sheet, cover sheet, and list of government furnished equipment, including approximate cost of the material and cost of handling the equipment. All sheets must be stamped: For Official Use Only.

BID COST EST-C-100 - Estimated bid cost for complete bid package. It is the official government estimate and is based on the same package that was supplied to all prospective bidders. The C-100 may have special conditions added to total during bidding period. These special conditions calculations shall be included in C-100. They may be used by A&E and/or government.

The estimate should be treated as a bid for the government. It must include all the information supplied in the C-95 estimate and update, if necessary, and add special conditions determined by the IFB. Estimate should also include any amendment and a signed bid form found in the IFB. All sheets of the estimate must be stamped: For Official Use Only.

ENGINEERING COST - is the total estimated cost of labor, materials, equipment, and contractor's markup in today's dollars. This cost is used to develop the CCE. The engineering cost does not contain government contingencies, S&A, escalation, or design costs.

ESCALATION - an increase in costs of interest, labor, materials, or other factors which add to the total direct cost of a project, measured over time.

FIVE-FOOT LINE - an imaginary line outside of and conforming to the exterior wall of building. The 5-foot line is the traditional separation between interior (building) and exterior work.

FRINGE BENEFITS - the added costs normally associated with labor. Fringe benefits include profit sharing, health, welfare, pension, apprentice training, educational programs, union dues, vacation, holiday insurance premiums, and other similar items which are fringe to direct payroll costs.

GENERAL OVERHEAD - the fixed cost of operating a business. It includes office, plant, equipment, staffing, and expenses thereof maintained by a contractor for his general business operation.

JOB OVERHEAD - the expense of items such as trailer, toilets, telephone, superintendent, transportation, temporary heat, testing, power, water, clean-up. It may include the costs for bond and insurance associated with the particular project.

LIFE CYCLE COSTS (OR TOTAL COSTS) - includes all costs from inception through obsolescence of a part, subsystem, system, or an entire building project. This cost includes all construction and operational costs.

MARKUP - includes such percentage applications as general overhead, profit, and other indirect costs. When markup is applied to the bottom of a bid sheet for a particular item, system, or other construction price, any or all of the above items (or more) may be included, dependent on local practice.

MILESTONE - a particular event in a schedule sequence which has increased significance above and beyond the more common schedule activity or event. For example, building close-in or top-out would be a milestone event.

NASA/KSC LEAD COST ENGINEER - provides the management overview of KSC cost estimates with responsibility for standards and guidelines to be used by A/E firms, A/E support contractor, and in-house personnel for preparation of government cost estimates. Coordinates and reviews A/E, support contractor, and in-house cost estimates to assure accuracy of cost and conformity to established guidelines and standards.

NASA/KSC LEAD DESIGN ENGINEER - provides the project technical lead with responsibility for the work (preliminary engineering, design concepts, design, change to design, design analysis, cost estimating, and resolution of design problems) on his project within a framework of established project scope, milestone schedules, and cost controls. He is the single point of contact for systems engineers, cost engineers, cost estimators, and other personnel supporting his project.

NEGOTIATIONS - discussions between owner and/or contractor or vendor held to ascertain that all items of work are included and that a proper and reasonable price has been agreed upon by both parties.

OPERATIONAL COST - all fuel, lubricants, and normally scheduled parts changes necessary to keep a subsystem, system, particular item, or entire project functioning. Operational costs also include general building maintenance, energy, cleaning services, taxes, and similar items.

OWNER - the individual or company who pays the bills and for whose benefit the project is being constructed.

PRODUCTIVITY - the rate at which a given crew or mechanic accomplishes final in-place installation of an item or system within a project. Productivity must be assessed on an item-by-item basis to properly schedule project work.

PROFIT - the bottom line or anticipated reward for accomplishing work. Profit has three parts:

- a. Anticipated Profit - the profit projected from the beginning to the end of the project at time of bid
- b. Gross Profit - the total before-tax (and possibly before general overhead expense) profit associated with a particular project or company
- c. Net Profit - the after-tax, after disbursement bottom line figure of a particular company or individual or project

PROJECT SUMMARY - is a line item summary of construction bid costs by site-work; building/structures; architectural, mechanical, and electrical work; exterior utilities; and specialized construction. It also shows the current cost estimate with markups for escalation, contingencies, and S&A.

REVIEWER - responsible for complete estimates in regards to format and accuracy per KSC Specifications Management Overview for Cost Effective Design and Construction.

QUALITY SURVEY - the technique of listing all items and salient features of the work and the quantities thereof necessary to build a particular project. Quantity survey may be done with productivity in mind, but does not include pricing.

SCHEDULING - the method whereby sequence of events of administration, design, procurement, and erection of a facility or structure are organized in a logical manner to assure that all elements of the project are accomplished within the specified completion date. Scheduling may be by bar chart, or critical path method (CPM).

SITE DEVELOPMENT - all work associated with utilities, construction, excavation, clearing, grading, parking, and landscaping outside of the 5-foot line.

VALUE ENGINEERING - the systematic application of recognized techniques which identify the function(s) of a product or service, establish the worth of that function, and reliably provide the necessary function at the lowest overall cost (value engineering, value analysis, and other similar terms are considered to be synonymous).

WAGE RATE - the hourly, daily, or weekly cost, including statutory overburden (taxes) of a person who works for wages, such as mechanics, laborers, and steamfitters.