

MOD. NO.	DESCRIPTION
278	Supports for Lines CF-1022 and CF-1023 at Personnel Entrances into Missile Silos, 3 Complexes
279	Interference of 3" Drain Pipe with LOX Crib in Missile Silos at 1A
280	Installation of Accessories for Engine Instrument Boards
281	Alterations to the C-2 Compressors, 3 Sites
282	Claim for Level Controllers for Pneumatic Valve LC-5V
283	Provide Required Drain Lines from Various Drip Pans in Powerhouse, 3 Complexes
284	Revised Authorization Provisions to Include Claims
285	Weld Neck Flanges in Lieu of Socket Flanges (C-6)
286	Accomplish Cleaning of RP-1 Fuel by Circulating thru Filters
287	Claim C-71 for Safety Valves for Government Furnished Fuel Oil Pumps P-15 and P-18
288	Delete Valve SOV-9 and Switch FLS-1 from C-2 Compressor 3 Sites
289	Claim C-83 for Additional Shock Flex Connections in Equipment Terminals
290	Claim C-152 for Support of 2-inch AA-703 in Propellant Terminals, 3 Complexes
291	Additional Revisions to Blast Valves at All Sites
292	Reposition Taper Holes in 48" Blast Valve Shaft, 3 Sites
293	Claim C-153 for Furnishing Recharger Oil (Nitrogen Vaporizer Rechargers 7D3741 and 7D3744)
294	Claim C-11 for Extra Handling and Transportation charges for Increased Size Ice-Banks
295	Repair Damages to Utility Alarm and Control Systems Caused by Other

MOD. NO. DESCRIPTION

- 296 Revise Connectors for Coaxial Cables Radiation Detection System, 3 Complexes
- 297 Rework Kieley-Mueller Valves, 3 Sites
- 298 Field Changes to Correct Deficiencies and Interferences at Complex 1B
- 299 Revise Size of Wire in Conduits at Grade, Relocate LS-206 in Missile Silo
- 300 Procure Fire Detectors - 3 Complexes
- 301 Replace Gland Nuts and Sleeves on FCV-603 and FCV-605 Valves
- 302 Field Changes to Eliminate Interferences and Conflicts at 3 Complexes
- 303 Reinstall G-F Fire Sensors in Missile Silos and TJ #12 and Install Guards, 3 Complexes
- 304 Revise Mounting of Instrument Tube Cap and Location of Radiation Detectors
- 305 Additional Hold-down Screws in Buchanan Terminal Block
- 306 Field Changes to Elim. Minor Interferences & Conflicts, 3 Comp.
- 307 Control Sta. for Flow Cont. Valves FCV-806 & FCV 807 PTs, 3 Comp.
- 308 Relocate Hydraulic Switch, Entry Portal Pers. Ent. at 1A & 1B
- 309 Delete Dismantling, Moving & Reerecting Bldg. No. T-345,
- 310 Field Changes to Elim. Minor Interferences & Conflicts, 3 Comp.
- 311 Color Coding Pipe Lines, 3 Complexes
- 312 Revisions to Piping for SOV-565
- 313 Delay of Government-Furnished Equipment
- 314 Required "Fixes" to Place RP-1 Fuel Systems in Operable Condition and P-10 Tests at 1C
- 315 Rotate Valve CV-702 Located on Tank TK-401-Propel. Terminals
- 316 Elimination of Addit'l. Interferences, Conf. & Damage by Others
- 317 Support for Flex Hose, Line CF-1023; Relocate Support on Line CF-1022

<u>MOD. NO.</u>	<u>DESCRIPTION</u>
1	Different Size Arch Pipe Culvert Under Access Road
2	Provide Evaporation Cooling in Room No. 100
3	Security Restriction Shutdown and Standby Time
4	Delete Ducts in Room No. 100 and Cover Opening in Wall
5	Extend Time to 15 July 1961

CONTRACT NO. DA-04-167-eng-2176

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MOD.
NO.

DESCRIPTION

1 Additional Guying Facilities,Electrical Distr. System

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MOD. NO.	DESCRIPTION
1	Revised Construction of Footings and Foundations of Guided Missile Assembly Building
2	Revise Nitrogen Storage Vessel (N-3) Pressure Requirements and Provide Conduit Between Telephone Cabinets
3	Revise Stainless Steel Piping in Nitrogen System
4	Import Select Material for Fill Under Building in lieu of Material from Borrow
5	Raise Ceiling, Add Light, and Relocate 8 Lights and 1 Panel
6	Revised Construction of Sidewalk Facilities
7	Hot Water Heater in Demineralized Water System
8	Paint Exposed Structural Steel; Delete Painting of Electrical Conduit, Metallic Tubing, Ducts and Piping in Concealed Areas
9	Complete Systems Test of Nitrogen Piping in Lieu of Hydrostatic Test of Each Sec.
10	Furnish and Install 150# Cast Steel Flanges in Lieu of 125# Cast Iron in Industrial Waste
11	Delete Pressure Regulating Valve in Demineralized Water System and Raise Existing Post Indicator Valve on Existing Sprinkler Line approximately 24 Inches
12	Accoustic Tile on Ceilings and Walls Rooms No. 204, 221 and 222; Miscellaneous Additional Work to Comply with 851 SMS on Final Inspection and Chip out Dry-Pack from Construction Joints and Refill with Mastic and Caulking
13	Claim C-2 - Paint Weld Burns-Roof Decking
14	Water Systems, Guided Missile Assembly Bldg. Revise Cleaning of Nitrogen & Demineralized.

CONTRACT NO. DA-04-167-eng-2230

MOD.
NO.

DESCRIPTION

1 Drill Holes, Add Anchors, Exterior Wiring, Extended Time

23. REASONS FOR INCREASED COSTS

The cost increase of the launcher Contract No. DA-04-167-eng-2140 with Peter Kiewit Sons' Co. was greater than that generally expected on a construction project of this size. The increased cost may be attributable to a large extent to the following:

1. Concurrency
2. Design Changes
3. Changed Conditions
4. Delay in getting cleaning plant into operation
5. Late Delivery of Government Furnished Equipment
6. Propellant Loading System Testing
7. Shock Mounting and Testing Equipment
8. Cleaning RP-1 Fuel
9. Joint Occupancy
10. Pipe Supports
11. Validation Tests

CONCURRENCY

The concept of concurrency was used in the development of the ICBM program. Simplified, this meant that some portions of the construction were being designed, developed and otherwise improved upon while the project was being built. This was one of the major factors that contributed to the cost growth. Due to the urgency of the program it was necessary to construct the project concurrently with development, manufacture and test of the missile itself. This resulted in the introduction of a great number of changes during construction, installation and checkout phases of the missile base, which resulted in numerous modifications to the contract. Also due to the urgency of the program

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the plans and specifications were hastily prepared and incomplete, necessitating numerous clarifications which also contributed to additional modifications.

DESIGN CHANGES

During the advertising period, 27 November 1959 to 12 January 1960, there were three addenda issued. The first addendum issued included four new drawings for the Gatehouse and Vehicle Storage Building and eighty three revised drawings. This addendum also revised many pages and added new sections to the specifications.

The added sections were:

Section 70 - Excavation, Filling and Backfilling
Gate House and Vehicle Storage Building

Section 71 - Concrete - Gatehouse and Vehicle
Storage Building

Section 72 - Prefabricated Steel Building, Gate House
and Vehicle Storage Building

Section 73 - Carpentry, Gate House and Vehicle
Storage Building

Section 74 - Gypsum - Wallboard (Dry Wall) Finish Gate
House and Vehicle Storage Building

Section 75 - Glass and Glazing, Gate House and
Vehicle Storage Building

Section 76 - Painting, Protective, on Metal, Gate House
and Vehicle Storage Building

Section 77 - Painting, General, Gate House and Vehicle
Storage Building

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Section 78 - Builders' Hardware, Gate House and
Vehicle Storage Building

Section 79 - Accessories, Toilet Metal, Gate House
and Vehicle Storage Building

Section 80 - Plumbing, General Purpose, Gate House
and Vehicle Storage Building

Section 81 - Heating and Ventilating, Gate House
and Vehicle Storage Building

Section 82 - Electrical Work, Gate House and Vehicle
Storage Building

The above sections and drawings for the Gate House were
later deleted from the contract.

One other section was added by this revision, Section 103A,
Double Bituminous Surface Treatment for Access Roads.

Addendum No. 2 revised Section 37, Cleaning, Propellant
Loading Systems.

Addendum No. 3 revised a few specifications and made only
two drawing revisions.

One of the first contractual changes revised seventy five
drawings, added six new drawings and deleted two drawings from
the contract; also revised several pages in the specifications.

The second contractual change, and one of the largest,
revised 103 drawings, added six new drawings and deleted two
drawings. This change included seven pages of revision to the
specifications.

One of the first design changes was the revision of the

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diesel engine block in the Power House. The standardized equipment which was government furnished, supplied Nordberg diesel engines and generators for power to the complexes. The contract drawings were based on the Worthington diesel engine and therefore the whole diesel foundation had to be redesigned to accommodate the Nordberg units. This resulted in the addition of four new sheets to the contract set and the revision of seven drawings. These structural changes caused a subsequent requirement for mechanical changes which were reflected in the Powerhouse piping and electrical drawings.

CHANGED CONDITIONS

Only one change order was issued by the Beale Area Office under Clause 4, "Changed Conditions".

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This change provided equitable adjustment to the Contractor for additional costs incurred in excavation of certain areas at Site 1A.

Briefly summarized, the changed conditions were:

1. During excavation of launchers Nos. 2 and 3, rock was encountered that would not stand without support. The Government's exploration data, design and administrative actions subsequent to award of the contract justified a conclusion that the rock would stand without supports.

2. In the Powerhouse area, rock requiring blasting and increased difficulty in removal, was encountered at elevations markedly above the elevation at which rock could have been expected, based on the Government's explanation data supplied the

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Contractor in the bidding documents.

These changed conditions increased the difficulty and additional cost to the Contractor by:

1. Increasing difficulty of excavation, and causing him to furnish and install additional steel rib supports, lagging and blocking throughout most of the silo shafts of launchers Nos. 2 and 3.

2. Excessive rock excavation requiring extensive drilling and blasting operation in the Powerhouse Area. The Powerhouse and Air Exhaust Structures were affected. Costly and time consuming loading and handling operations were required.

3. Payment of premium time operations required to get the work back on schedule after being delayed by 1 and 2 foregoing, the contractor having been advised by the Government representatives that additional construction time would not be allowed.

Cost increases associated with the foregoing are:

1. Government Estimate. A formal Government estimate was not prepared prior to or reflective of the final settlement. The price was negotiated by Sacramento District personnel on a detailed review and finding of the contractor's proposal as set forth in the Record of Determination and Findings. These findings were prepared by Sacramento District personnel pursuant to South Pacific Division 1st indorsement to CEBMCO basic letter of 21 January 1961.

2. The Contractor's original proposal dated 2 September 1960 in the amount of \$211,248 was withdrawn and his final proposal in the amount of \$296,392 was submitted 11 April 1961.

3. The final settlement was in the amount of \$246,087.

DELAY IN GETTING CLEANING PLANT INTO OPERATION

The contractor had originally scheduled to get his central cleaning plant at Beale Air Force Base for cleaning PLS components into operation during the month of July 1960. The mechanical subcontractor experienced considerable difficulty in getting the plant into operation and after he did get started it wasn't until December that the rate of production was considered adequate to meet the job requirements. This materially increased the congestion and problem of coordination of subcontractors' work during installation within the structures. There was a fairly high rate of rejection for cleanliness at the job site due to improper handling and storage. This problem was minimized after proper field procedures were established.

LATE DELIVERY OF GOVERNMENT FURNISHED EQUIPMENT

The standardized equipment for the Beale Project, costing in excess of \$5,000,000. was furnished to the contractor as Government Furnished Equipment. The shop drawings for this equipment were to be furnished to the contractor within 180 days after award of the contract. The Government was unable to meet this requirement in most instances, causing the contractor to be delayed in coordinating related work and placing orders for materials related to this equipment. The delivery of the equipment was also delayed. The principal items that were

received late were as follows:

PLS Vessels

Electrical Switchgear and Control Panels

PLS Valves

Pumps

In addition to the late delivery of the equipment, upon arrival, the PLS valves were found to be dirty, did not meet the cleanliness requirements, and had to be recleaned at the job site, causing additional delay.

The contractor's claim for the above delay was in excess of \$2,250,000. The Government's position had not been determined when this was written.

PROPELLANT LOADING SYSTEM TESTING

Preliminary revisions modifying the contract specifications for final acceptance testing of the Propellant Loading system were transmitted to the Contractor 9 August 1960. In requesting a preliminary proposal from the Contractor, it was noted that the changes were of a preliminary nature, clarifying the contract, and that an increase in Contract cost was not anticipated. The Contractor replied 12 October 1960 that, in his opinion, the work exceeded his contractual obligations and submitted a preliminary proposal in the amount of \$673,486. This was almost immediately withdrawn.

The Air Force on 16 December 1960 requested that negotiations be initiated modifying the Contract to include the revisions to the PLS acceptance testing. Detailed revisions to the PLS testing

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specifications were furnished the contractor on 25 January 1961, followed by a Memorandum Directive dated 27 January 1961, directing that PLS testing be accomplished in accordance with the revised specifications. Included were provisions for a Gaseous Nitrogen Purge for the Propellant Loading System. This was expanded to include the RP-1 System. The contractor submitted a proposal 31 March 1961 in excess of Eight Million Dollars for the proposed changes.

Many changes in the revised specifications were made, the final revision being dated 7 September 1961. The revision having the greatest impact on the change was that affecting the date for completion of the PLS testing at the various sites.

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This reaffirmed those dates established under the original contract, namely 1 December 1960, 1 January 1961 and 1 February 1961 at Sites 1A, 1B and 1C respectively.

The contractor originally contemplated testing with one test crew, working forty hours per week. He proposed starting at Site 1A the last of May 1960 and finishing at 1C by the first of February 1961. Due to delays, testing did not get under way at Site 1A until the last week of August 1961. Later starting dates were made at Sites 1B and 1C. Completion of the testing was accomplished at each site within the specified completion dates. To do this, the contractor worked several test crews on a two shift operation, working sixty hours per week per shift.

Negotiations to arrive at a common understanding in the scope of work contemplated under the change, and to reach bilateral

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agreement in price, started in the Beale Area Office in April 1961.

Unable to reach agreement at this level, a negotiation was held 4 and 5 January 1961 in the office of the Contracting Officer in CEBMCO Headquarters, Los Angeles, California. A bi-lateral agreement was not reached, the contractor standing at \$3,200,000. and the Government at something in excess of \$1,426,000.

A final negotiation held in the Beale Area Office 28 February 1961 did not produce an agreement in price and a unilateral change order was issued in the amount of \$1,824,007.

SHOCK MOUNTING AND TESTING OF EQUIPMENT

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Design criteria of the Titan I Launcher complexes contemplated construction of a "Hardend Complex" capable of withstanding the tremendous force generated by thermonuclear blasts and to initiate and complete retaliatory launch of their missiles.

Resolution of the shock effect of thermonuclear blast forces on the complex resulted in separation of the shock effect into zones designated "A", "B" and "C", which dictated design of the various structures and components. In general, zone "A" was assigned to structures in direct contact with the surrounding earth. Zone "B" was assigned to contain substructures in direct contact with the zone "A" components. Zone "C" was assigned to major structural components which were mounted with springs, spring beams and other devices so as to permit independent movement of these components.

The shock zone in which equipment was to be located

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determined the type of shock testing required. The magnitude of the tests was specified in the contract specifications which also provided that shock tests would not be required for equipment certified by the manufacturer and approved by the Contracting Officer as complying with the foregoing requirements.

Subsequent to award of the contract it was determined that the provisions for testing equipment to be installed in zone "C" were inadequate. Revisions to the shock testing specifications were made, correcting the deficiency. The principal change was regarding shock testing of all electrical and electronic equipment in zone "C" to specifications, requiring a shock test equal to a 3g, 0.165 sec. half sine wave input pulse (+10%) applied in both directions parallel to each of the 3 principal axes. Tests with power off and applied were required.

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The revised changes were incorporated into the contract by change orders priced in excess of \$300,000.

CLEANING RP-1 FUEL

The Government Air Force-furnished RP-1 fuel, supplied to the contractor, did not meet the cleanliness requirements, and to forestall contamination of the RP-1 fuel system at all three complexes, the fuel was cleaned by circulating through filters above ground prior to introduction into the systems. It was estimated that this delayed the delivery of fuel sixty days at Site A, thirty days at Site B and no delay at Site C.

WORK STOPPAGES

Work Stoppages due to labor problems were minor for a

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project of this magnitude and are shown in detail in Fig. 100.

JOINT OCCUPANCY

Beale Area Office and SATAF recognized the complications, increased costs and possible claims which would arise out of any joint occupancy situation. Both agencies continually exerted every effort to reduce the amount of joint occupancy occurrence by extensive coordination between the Beale Area Office and SATAF offices and by following through to keep the respective contractors informed of changing situations in their schedules. Additionally, every attempt was made to complete the various structures and transfer these facilities to the using agencies by or before actual associate contractor "need access" dates. In this manner joint occupancy problems were kept to a minimum and this established well defined dates when the custodial and maintenance responsibility would be assumed by the using agency. This procedure also established an effective control for permitting access to facilities. In brief, if a structure had not been transferred to the using agency, then access control to that structure rested with the Area Engineer and the Construction Contractor; conversely, if the structure had been transferred, access control was the responsibility of the SATAF and the USAF contractor. In effect this caused the construction contractor to exert material effort to meet the need dates.

The following joint occupancy problems were experienced:

1. Missile Silo Joint Occupancy - When silos were transferred to USAF the RP-1 fuel cribs and PLS cribs were

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excluded from the transfer. USAF contractors began operations in the transferred silo areas. Some of these operations such as opening and closing silo doors, removal of scaffolds and providing less adequate scaffolding denied the construction contractor free access to work in the crib areas. This disruptive influence resulted in the contractor's claim for delays.

2. Propellant Terminal Joint Occupancy - Before Propellant Terminals were transferred, USAF-SATF requested that a crew of approximately six people be allowed to work for about a one week period in each terminal. The available work area was small and even the addition of this small crew created a disruptive influence for which the contractor made claim for delays.

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3. Entry Portal Joint Occupancy - Both before and after the Entry Portal structure had been transferred to USAF, the associate contractors required men and material access through the portal structure to perform work elsewhere in the complex. Before the transfer this impeded the construction contractors' progress toward completing this structure and after transfer some denials of free access slowed the contractors' work on other features.

4. Above Ground Joint Occupancy - Prior to USAF contractors moving onto above-ground areas, the construction contractor had almost unrestricted use of the complex ground area for his operations. After USAF contractors began to arrive at the site certain areas were allocated for their uses, thus restricting the contractors' operations to some extent and creating a quas-joint occupancy condition. Additionally, the contractor was required

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to perform certain grading operations at a different time than originally scheduled and to install concrete pads as a modification to the contract.

5. PLS Testing Joint Occupancy - The fact that USAF contractors were conducting their operations in missile silos at the same time as both PLS and RP-1 testing was being accomplished created interference with the smooth conducting of these tests. These testing requirements increased modification costs due to joint occupancy interferences.

6. Power at Complex 1B - At Complex 1B the amount of commercial power was limited and when USAF contractors initially moved onto the job site there were several problems created by their joint occupancy because of the limited amount of power available.

The above discussion has applied to Contract No. DA-04-167-eng-2140, the principal construction contract. The other construction contract cost increases were not excessive or more than ordinarily anticipated on normal construction contracts. The total costs of these contracts are shown in Section 16.

PIPE SUPPORTS

Numerous changes to the pipe supports occurred during the construction period. Most of them were initiated after a substantial portion of the piping had been installed or fabricated, either with the original supports or temporary supports. This seriously affected the scheduling of not only the piping but other related work such as electrical, painting and testing. Several examples are as follows:

Pipe supports were added or revised in the PLS Propellant Terminal, LOX Tunnel Area and Missile Silos. A substantial number of these supports was of stainless steel. These changes were a result of the A. D. Little Company analysis of the Propellant Loading System.

Pipe supports for the Firewater, Utility and RP-1 systems on the Missile Silos were revised during the latter stages of the contract, due to inadequacies of the original plans and specifications.

The total cost of these changes was approximately \$2,500,000.

VALIDATION TESTS

In order to validate the design and to verify the function of the various facilities under operational conditions, a complete validation test of one complex, mechanically and electrically, was added to the contract. This was in addition to the validation testing required of all complexes under the original contract.

The contractor was furnished detailed procedures for accomplishing the additional tests well in advance of scheduled commencement.

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However, these procedures were revised by no less than nine addenda, thereby adding to the complexity and increasing the cost. A modification for an anticipated cost of \$500,000 will be issued for the additional tests. The contractor has taken exception to certain tests considered to be part of the original contract requirements and will submit a claim for these tests.

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24. TOTAL COST

ORIGINAL TOTAL COST ESTIMATE

The original total cost estimate including support facilities consisted of the following:

1. Basic Contract Cost	\$ 35,700,000.
2. Land	327,000.
3. Unawarded Work	600,000.
4. Contingencies	6,500,000.
5. Government Cost	<u>3,300,000.</u>
Total CCE	\$ 46,427,000.

FINAL TOTAL COST ESTIMATE

The final total cost estimate, as of 30 March 1962, comparable with the above, is as follows:

1. Basic Construction Cost	\$ 36,759,094.
2. Land	326,000.
3. Modifications	10,088,495.
4. Claims Settled & Validated	9,451,718.
5. Unawarded Work	778,000.
6. Contingencies	523,379.
7. Government Cost	<u>4,537,787.</u>
Total CCE	\$ 62,464,473.
Potential Claims	<u>5,000,000.</u>
Total Program	\$ 67,464,473.

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The final current cost estimate shown above contained a reserve for future work, claims, including potential claims, accrued costs and forecasted costs to completion of the project.

The large increase of CCE from the original estimate of \$46,427,000. to \$67,464,473. was almost completely attributable to the large number of modifications issued for changed and additional work due to the concurrency concept, the delays in receipt of Government furnished equipment and the minimum amount of time extensions granted so as not to delay or extend the final completion date.

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25. ADMINISTRATIVE PROBLEMS

There were no serious administrative problems at Beale Area Office. The major problem or problems occurred or were related to the change of supervision from the Sacramento District to CEBMCO.

The change of command was expected to cause some confusion and require a period of adjustment.

The strict compliance with the Area Organization Chart recommended by the Titan I Directorate required some time for adjustment.

The lack of clear cut operational procedures or policies from CEBMCO delayed the Area Office in assuming its back-to-normal operating procedures after takeover. The circulars and operating procedures issued by CEBMCO and the Titan I Directorate in some instances were not received until the latter part of the job.

The need for obtaining CEBMCO and SATAF approval for acceleration costs and particularly time extensions was a time consuming procedure. Obtaining this approval delayed the completion of some modifications as much as three months.

Due to the close surveillance and follow-up by CEBMCO and the urgency of this project, numerous special and one time reports were required, necessitating a large amount of additional work and overtime by the Area staff.

26. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the following recommendations are proposed:

It is recommended that the Contract Administration Branch be adequately staffed to take care of the large number of Modifications and Claims. Dependence should not be placed on key field personnel filling the need for additional personnel required for processing claims during the latter stages of the project. It was the experience on this project that the field personnel that did become available provided a substantial contribution to the claim effort, but should have arrived three to six months earlier.

Contract Administration Branch should maintain close liaison with the Resident Offices and the status of work in progress, in order to keep abreast of status of contract modifications.

It is recommended that the Contract Modifications Section establish a procedure for entering on a form, immediately after each modification is completed, pertinent data needed for numerous reports required as the job progresses. The form should include but not be limited to the following: Authority for change with date, brief description of change, date of notice to proceed, date proposal requested, Government estimate with date, contractor's proposal with date, date negotiations started and completed, amount of acceleration, hours of labor for each trade, overtime or premium time, time extension, etc. This information would provide a ready reference for the numerous special one-time reports that must be prepared generally on an overtime schedule and if this information were available, the reports could be prepared by the

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Reports Section without disturbing the modification personnel.

The responsibilities of the Area Office with regard to funds control and budgetary information have not been clearly defined. It is recommended that consideration be given this subject and a circular be published by the Directorate to the Areas, and a representative of the Directorate visit the Area Offices to clear up any questions.

It is recommended that a representative of the Contract Administration Branch attend the field change order conferences with the Using Agency, to provide liaison to the Contract Administration Branch and also advise the Area Representative regarding contract administration.

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PART IV

MISCELLANEOUS

The topics discussed in this Part are the following:

Government Costs

Project Visitors

Relationship with SATAF

General Problem Areas and Recommendations

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The Beale Area Office was under the Sacramento District from the start of the project in February 1960 to October 1960, the date of takeover by CEBMCO. A substantial amount of the work accomplished by Government personnel prior to takeover was accomplished in the District Office.

This work consisted of the functions normally taken care of in a District organization, such as personnel actions; supply actions for procurement; contract administration and expediting; construction, engineering, safety and legal surveillance and advice. In addition the District checked and approved shop drawings and accomplished considerable liaison work with other Government Agencies, etc. The Area Office strength, not including District Office personnel at the time of takeover was 91. The Government costs accumulated to the time of takeover was 7.5 percent of the construction costs for the equivalent period.

At the time of takeover, the District support functions were reduced to a minimum and wherever practicable, personnel performing these duties were transferred to the Area Office with the function. This increased the area strength but it did not provide sufficient increase to meet the Area requirements. Additional recruitment was necessary and a peak strength of 122 was reached in February 1961 and continued to May 1961, then gradually decreased to 100 in December 1961, and continued to decrease to final phase out. In order to accomplish critical work for which Government

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personnel could not be obtained, the services of estimators and testing personnel were obtained by contracts with private organizations. All of the Government surveying was accomplished with construction survey contract personnel. (See Section 21)

The close tolerances and cleanliness requirements dictated the need for more field inspection personnel than are normally required.

The large number and complexity of changes, the detailed reporting procedures and the close follow-up required on this project increased the personnel strength requirements. The duration of completing the paper work after completion of construction was prolonged due to the large number of claims and the submittal of a substantial number of these claims to the Area Office at such a late date. Transportation costs were higher than normal due to the frequent trips to CEBMCO (Los Angeles) required of Area personnel; training of PLS personnel at Denver and Vandenburg; and the transportation of new hires from outside sources for relatively short durations. The overtime costs were excessive due to the critical nature and urgency of the work, both in the field and office.

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The total Government costs are anticipated to be \$4,537,787 but this figure may be exceeded due to the apparent increase in time required for settlement of claims, and subsequent delay of phase out. The total estimated Government cost of \$4,537,787 represents 7 percent of the estimated total project cost of \$67,464,473 which compares favorably with construction projects of this magnitude.

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28. PROJECT VISITORS

CEBMCO BEALE AREA

6 Sep 1960	S.P.Div	Mr. John E. Ott	Inspect Concrete
6 Sep 1960	S.P.Div	Mr. D. A. Leslie	Inspect Concrete
6 Sep 1960	S.P.Div	Mr. R. D. Geahbeard	Inspect Concrete
6 Sep 1960	O.C.E.	Lt. Col. R. Shreder	Inspect Concrete
6 Sep 1960	O.C.E.	Mr. W. P. Waugh	Inspect Concrete
6 Sep 1960	O.C.E.	Mr. J. P. Sale	Inspect Concrete
6 Sep 1960	W.E.S.	Mr. T. B. Kennedy	Inspect Concrete
4 Mar 1961	McClellan Committee	Mr. Paul J. Tierney	Labor Investigation
4 Mar 1961	McClellan Committee	Major Charles Counts	Labor Investigation
30 Mar 1961	Sheppard Committee	Mr. James Kendall	General Inspection
30 Mar 1961	Sheppard Committee	Mr. Ben Gillas	General Inspection
30 Mar 1961	Sheppard Committee	Major James Bower	General Inspection
30 Jun 1961		Mr. Koski	Foundation Validation
19 Jul 1961	State Assemblyman	Mr. Edwin Z' Berg	Orientation of Construction
19 Jul 1961	State Senator	Mr. Ronald G. Cameron	Orientation of Construction

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19 Jul 1961	State Senator	Mr. Albert S. Rodda	Orientation of Construction
24 Jul 1961	Defense Dept.	Mr. Thomas D. Morris	General Inspection Missile Sites
24 Jul 1961	Defense Dept.	Mr. Davis	General Inspection Missile Sites
24 Jul 1961	OSAF	Mr. Alan I. McCone	General Inspection Missile Sites
24 Jul 1961	AFOCE	Maj. Gen. A. M. Minton	General Inspection Missile Sites
24 Jul 1961	AFBSD	Maj. Gen. T. P. Gerrity	General Inspection Missile Sites
24 Jul 1961	AFBSD	Brig. Gen. A. C. Welling	General Inspection Missile Sites
24 Jul 1961	OCE	Brig. Gen. J. B. Lampert	General Inspection Missile Sites
24 Jul 1961		Brig. Gen. Curtis	General Inspection Missile Sites
27 Jul 1961	CEBMCO	Mr. G. Brunstad	Power Plant Testing
7 Aug 1961	CEBMCO	Mr. G. Branzuela	Powerhouse Test Monitoring
7 Aug 1961	CEBMCO	Mr. L. Zingmond	Powerhouse Test Monitoring
7 Aug 1961	CEBMCO	Mr. E. M. Glass	Claims Data
8 Aug 1961	CEBMCO	Mr. Miles E. Robertson	Staff Internal Review of
11 Aug 1961			Financial Operations
11 Aug 1961	CEBMCO	Miss Marie Parlante	Inspection of Files
11 Aug 1961	CEBMCO	Miss Ann Davis	Inspection of Files

11 Aug 1961	Sacto.Dist.	Mr. George Rivera	Inspection of Files
4 Oct 1961	CEBMCO	Mr. William Koidal	Facility Transfer Operations
4 Oct 1961	CEBMCO	Mr. Charles Tiersch, Jr.	Facility Transfer Operations
11 Oct 1961	CEBMCO	W.O. R. D. Lucas	Security
30 Jan 1962	Dept.Defense	L. D. Leeper, C.F.Braun & Co.	Audit C.O.
2 Feb 1962	Audit Team		
30 Jan 1962	Dept.Defense	A.E.Peterson, Arthur Anderson	Audit C.O.
2 Feb 1962	Audit Team	& Company	
30 Jan 1962	Dept.Defense	J. Depauw, Arthur Anderson & Co.	Audit C.O.
2 Feb 1962	Audit Team		
13 Feb 1962	Eng.Insp.Gen. S.F.Fld.Off.	Col. E. L. Grider	Annual I.G.Inspection
13 Feb.1962	Eng.Insp.Gen. S.F.Fld.Off.	Mr. A. H. Mangelson	Annual I.G.Inspection
13 Feb 1962	CEBMCO,I.G.	Mr. M. E. Robertson	Annual I.G.Inspection
13 Feb 1962	I.G. Los Angeles	Col. H. R. Howell	Annual I.G.Inspection
11 Apr 1962	Titan II CEBMCO	Mr. F. J. Geiger	Electrical Inspection

29. RELATIONSHIP WITH SATAF

RELATIONSHIP

Relationships between the Area Engineer Office and SATAF were superior throughout the project. In general, both offices continually worked together on the interpretation of contract conditions, with SATAF recognizing that it was the Corps of Engineers' responsibility to interpret the contract. Both agencies recognized that facilities should be transferred at such time as they were complete, even though minor items remained as incomplete work. When a structure was ready for transfer the appropriate officials of the Area Engineer's office, SATAF, Base Civil Engineers office, the Prime Contractor and the Martin Company met in the field, inspected the facility to be transferred, agreed on items of work remaining and consummated the transfer, simultaneously transferring custodial and maintenance responsibility for the facility.

DEPUTY FOR CONSTRUCTION - DUTIES

1. The Area Engineer (Deputy for Construction, under SATAF) was responsible to the SATAF Commander for assuring the timely accomplishment of the construction operation for the site activation program.
2. Operated as the field representative of the Construction Director.
3. Administered construction contracts. Inspected work under his jurisdiction; gathered and recorded contract data; prepared reports and contractor's payment estimates.

4. Assured compliance with contract requirements, including modifications. Accomplished construction in accordance with approved progress schedules and contractual completion dates.

5. Recommended changes to drawings, mainly to conform with local conditions.

6. Enforced labor provisions of his construction contracts. Examined contractor's payroll data and took action with contractors to correct discrepancies, if required.

7. Issued change orders on approved changes and prepared cost estimates for modifications. As contracting officer's representative, negotiated costs of modifications and processed contractor's claims.

8. Enforced safety provisions of the contract. Cooperated with contractors' top supervisors in establishment of safety program and followed through during life of the contract to insure compliance therewith.

9. Provided the Deputy for Engineering with continual data reflecting actual field conditions for incorporation into as-built drawings.

10. In conjunction with the SATAF Commander, worked out joint occupancy agreements.

11. Scheduled pre-final and final acceptance inspections.

ORGANIZATION CHART

See Figure 4 for organization chart for the local SATAF with key personnel listed.

30. GENERAL PROBLEM AREAS AND RECOMMENDATIONS

Due to the concept of concurrency construction, development, manufacture and test of the missile were to be accomplished simultaneously and many unusual problems were anticipated. This concept generated major design changes and revisions to changes to a design that was already complex.

Specific major changes were the redesign of the Powerhouse floor slabs supporting the Diesel generators which resulted in extensive revisions to the electrical and mechanical work; the extensive changes to the PLS and RP-1 fuel system supports, etc; the delays in the work caused by the large number and complex design changes and the late delivery of Government furnished equipment. Notwithstanding the originally established tight work schedule and the addition of the large number of changes and delays, the objective of meeting the contract completion date was not changed.

The late arrival of Government furnished equipment, the failure of the Government furnished equipment to meet the cleanliness requirements of the specifications, and the discrepancies in the specifications presented more administrative problems than normally encountered in a construction contract.

By perseverance, determination and hard work the large number of modifications were processed individually as they would normally under sound, fixed price contract administration.

Recommendations developed from the experience gained during this project are as follows:

PROJECT STAFFING

The need for an Area Office for this type of project, to be properly staffed by qualified personnel, can not be over emphasized. In order to accomplish this, advance planning must be done to anticipate when the various types of personnel will be required. Personnel with the qualifications required are not always available; therefore, consideration should be given to selection of personnel that have qualifications for more than one phase of construction, then train the available personnel for future positions that will be difficult to fill by advance planning.

OBTAINING ADEQUATE INFORMATION FROM THE RESIDENCIES

The Resident offices should be staffed to be able to provide adequate information to the Area Office in a timely manner. Due to the urgency of the project, numerous records and reports on status of construction are required. The numerous changes and revisions to the contract and coordination of problems with the Air Force necessitate more detailed logs and records than are normally required on construction projects.

APPROVAL OF SHOP DRAWINGS

The services of the Architect Engineer were used to augment the Area staff in approving shop drawings. This service was generally good but became progressively poorer as the job progressed. This is attributed to the introduction by the construction contractor of mechanical layout drawings prepared by Huntoon Engineering Co. of Los Angeles, California. The Architect Engineer had originally agreed to check any and all shop drawings within

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five working days, but this agreement broke down when they were faced with the checking of the Huntoon drawings and thereafter more than half of the drawings required thirty calendar days or more. The need for the Beale Area Office Engineering Branch to review the Architect Engineer's checking became more pronounced as the work progressed. In some cases only 50% or less of the errors were discovered by the Architect Engineer prior to the Beale Engineering Branch recheck.

To improve progress by Huntoon and to obtain prompt and accurate checking by the Architect Engineer, it was necessary to arrange coordination meetings in Los Angeles between the Architect Engineer, Huntoon Engineering Co., Kiemech Inc. the mechanical subcontractor, and Corps of Engineers representatives. The Corps of Engineers retained, for approximately sixty days, the services of a mechanical engineer employed by the Architect Engineer. His job was that of coordinator and his duty station was the Huntoon office. His job was to ascertain current problems and resolve them, either through his own knowledge or by contacting his home office to obtain answers. Although this man was employed at the request of Kiemech Inc., their subcontractor, Huntoon Engineering Co., would not take any direction except from Kiemech, and therefore the value of this employee was questionable.

The first of the Huntoon drawings was received 29 June 1960 and the 139th and last transmittal was received 9 August 1961. These drawings were considered very poor in the majority of cases. They were often made as an overlay on a reproducible from some

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other Titan Base which did not meet Beale conditions. This office and the Architect-Engineer, Daniel-Mann-Johnson-Mendenhall and Associates, generally could not approve the Huntoon drawings until major changes were made. Kiemech Inc. terminated their contract with Huntoon and completed the submittal of mechanical transmittals, using their own forces. The contractor, Peter Kiewit Sons' Co., was generally prompt in furnishing all of their transmittals.

It is strongly recommended that the Area Office be staffed to accomplish as many of the shop drawing approvals as possible, and the services of Architect Engineers be kept to a minimum.

Consideration might also be given to staffing the Directorate's office to check shop drawings applicable to all Areas, thus avoiding duplication and allowing the Directorate first hand information on problem areas.

AREA OFFICE FUNCTIONS

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The establishment of the CEBMCO organization eliminated certain eschelons of the conventional Corps of Engineers organization. This also increased the responsibilities of the Area Office to approach that of a District Office. Individuals within the Area Office often overlook this and fail to properly document their activities commensurate with these responsibilities. Also, unless definite coordination responsibilities are assumed by key personnel in the Area staff, each branch will drift into an independent operation, causing unnecessary confusion and critical work being duplicated or overlooked.

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PROCESSING CLAIMS

The Area Office was not staffed to work on claims until construction was almost complete and the contractor was equally deficient in his organization; consequently the contractor would submit letters stating that he would make claim but the justification and amount of claim was not submitted until later. If the Area Office had been staffed earlier to work on claims, pressure could have been exerted on the contractor to make timely submittals of these claims with justification and subsequently processed so that the heavy work load on claims at the end of the job could have been alleviated.

CONCLUSION

The reflection on the past two years' experience reveals that a Missile project is complex, is constructed at an accelerated rate and generates numerous changes with subsequent modifications and claims. Notwithstanding all of the above, there is no reason why sound, fixed price, contract administration policies used on normal contracts can not be followed, provided the Area is staffed adequately for the duration of the project. Furthermore, if the Area Office is able to keep abreast of the work using normal procedures, many of the difficulties of crash or panic situations, with their inherent loss of efficiency, will be avoided.