

SUPPORT FACILITIES

<u>Title</u>	<u>Contr.No.</u>	<u>Orig. Amt.</u>	<u>Start</u>	<u>Comp.</u>	<u>Contractor</u>
Re-Entry Vehicle Facilities at Beale Air Force Base	Eng-2174	\$146,000.	3 Oct.60	None	Fullerton Constr. Co.

<u>Mod.No.</u>	<u>Date</u>	<u>84 No.</u>	<u>Description</u>	<u>Amount of Change</u>
1	6 Jan. 61	2	Arch Culvert in lieu of Circular Culvert	\$ 279.67
2	9 Jan. 61	1	Evaporative Cooling of Room 100	7,366.00
3	6 Feb. 61	4	Per Letter dated 19 Dec. '60. Extend Time by 2 Calendar Days	920.45
4	12 Apr. 61	5	Eliminate Duct Work in Room No. 100	475.00
5	14 Aug. 61	-	Extend Time to 15 July 1961	N.C.

Item 3	PCC Pavement	- 5 C.Y.@\$35.00	-\$ 175.00
Item 8	Roadway Excavation	+514 C.Y.@\$ 2.40	+ 1,233.60
Item 9	Borrow	+ 70 C.Y.@\$ 1.00	+ 70.00
Item 11	Select Material S.B.	+ 18 C.Y.@\$ 8.00	+ 144.00
Item 12	Stab. Aggregate Base	+ 7 Tons@\$ 5.00	+ 35.00
Item 13	Base for P.C.C.	- 2 C.Y.@\$ 8.00	- 16.00
Item 14	Liquid Asp. MC-1 Prime	-0.113Ton@100.00	- 11.30
Item 15	Paving Asphalt 85-100 Penn.	-0.184Ton@\$50.00	- 9.20
Item 16	Bituminous Surfacing	+6.85 Ton@\$10.00	+ 68.50
Item 18	Seeding	+0.899 AC@400.00	+ 359.60

+ \$1,699.20

SUPPORT FACILITY FOR  
WS-107 A-2 BASE T-5  
BEALE AIR FORCE BASE

Contract Number: DA-04-167-eng-2175  
Date of Contract: 26 September 1960  
Contractor: Harbison & Mahoney  
220 Sandburg Drive  
Sacramento 19, California  
Construction: Re-Entry Vehicle Facility  
at Beale Air Force Base  
Notice to Proceed: 29 September 1960  
Original Contract Amount: \$20,650.00  
Modifications: None  
Claims: None  
Final Contract Amount: \$20,650.00

SUPPORT FACILITIES

<u>Title</u>	<u>Contr.No.</u>	<u>Orig.Amt.</u>	<u>Start</u>	<u>Complete</u>	<u>Contractor</u>
Re-Entry Vehicle Facilities at Beale Air Force Base	Eng-2175	\$ 20,650.	11 Oct.60	16 Feb. 61	Harbison & Mahoney (Partnership)

120

Contract Number: DA-04-167-eng-2176  
Date of Contract: 3 October 1960  
Contractor: Baldwin Construction Co.Inc.  
Marysville, California  
Construction: Helium Unloading Facility  
Beale Air Force Base  
Notice to Proceed: 6 October 1960  
Original Contract Amount: \$13,500.00  
Modifications: One only modification  
was proposed:

1. \$367.00  
Claims: None  
Final Contract Amount: \$13,867.00

SUPPORT FACILITIES

<u>Title</u>	<u>Contr. No.</u>	<u>Orig. Amt.</u>	<u>Start</u>	<u>Comp.</u>	<u>Contractor</u>
Construction of Helium Unloading Facility, Beale Air Force Base, California	Eng. 2176	\$ 13,500.	24 Oct.60	5 Dec. 60	Baldwin Contr. Co. Inc.

122

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<u>Mod. No.</u>	<u>Date</u>	<u>84 No.</u>	<u>Description</u>	<u>Amount of Change</u>
1	2 Dec. 60	1	Additional Guying Facilities, Electrical Distribution System	\$ 367.00

122

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SUPPORT FACILITY FOR  
WS-107 A-2 BASE T-5  
BEALE AIR FORCE BASE

Contract Number: DA-04-167-eng-2177

Date of Contract: 10 October 1960

Contractor: Fruin-Colnon Contracting Co.  
Burlingame, California

Construction: Guided Missile Assembly, Technical  
Supply Facilities and Edison St..  
Extension, Beale Air Force Base

Notice to Proceed: 14 October 1960

Original Amount of Contract: \$694,000.00

Modifications: A total of 14 modifications was proposed:

1. \$ 669.10	6. \$ 202.47	11. \$ 118.00
2. 170.16	7. 1,205.86	12. 11,634.75
3. 16,220.00	8. 1,185.63	13. 717.91
4. 6,709.00	9. - 723.79	14. 31,235.00
5. 246.48	10. 3,584.00	

Claims: The Contractor submitted two claims,  
which were settled and paid for by  
Modifications 13 and 14.

Final Amount of Contract: \$ 767,174.57

SUPPORT FACILITIES

TITLE: Guided Missile Assembly, Technical Supply Facilities & Edison Street Extension at Beale Air Force Base

Contr.No.      Orig.Amt.      Start      Comp.      Contractor  
Eng-2177      \$ 694,000.      19 Oct.60      14 June 61      Fruin-Colnon

<u>Mod.</u>	<u>Date</u>	<u>84 No.</u>	<u>Description</u>	<u>Amount of Change</u>
1	27 Jan. 61	3	Rev. Const. Foundation Footings & Pipe Trench	\$ 669.10
2	13 Jan. 61	5 & 60	Clarify Press. of N <sub>2</sub> Tank & Larger Conduits	170.16
3	13 Jan. 61	4	Rev. Piping & Fittings in N <sub>2</sub> System	16,220.00
4	20 Feb. 61	1	Imported Select Fill Under Buildings	6,709.00
5	24 Mar. 61	9	Raise Ceiling; Add and Relocate Lights	246.48
6	27 Mar. 61	7	Rev. Const. of Side Walk Facilities	202.47
7	27 Mar. 61	8	Relocation of Hot Water Heater	1,205.86
8	6 May 61	11	Paint Exp. Int. Steel. Omit Painting	1,185.63
9	20 May 61	10	Delete Hydrostatic Testing of N <sub>2</sub> System	723.79
10	26 May 61	15	Steel Flanged Fittings in Lieu of Cast Iron	3,584.00
11	13 July 61	12 & 13	Delete Valves in H <sub>2</sub> O System, etc.	118.00
12	30 Aug.61	14	Accoustical Tile Ceilings Rooms 204, 221, 222;	
	30 Aug.61	16	Floor Tile Ladders; Fence & Walk	
	30 Aug.61	17	Remove Dry Pack & Re-Seal	11,634.75
13	8 Oct.61	18	Claim C-2 Paint Weld Burns	717.91
14	27 Nov.61	19	Claim C-3 Water System Demineralize	31,235.00



WATER-WELLS

<u>Location</u>	<u>Contractor</u>	<u>Start. Date</u>	<u>Contract No.</u>	<u>Compl. Date</u>	<u>Depth</u>	<u>Contract Amt.</u>
Buttes #1	Weeks Drlg. & Pump Co. Sebastopol, Calif.	17 Aug. 59	2097	17 Sept. 59	535 ft. 250 g.p.m.	\$ 40,005.
Buttes #2	Precision Drilling Co. Santa Rosa, Calif.	19 Nov. 59	2109	14 Dec. 59	401 ft. 250 g.p.m.	20,751.
Chico #1	Weeks Drilling & Pump Co. Sebastopol, Calif.	12 Sept. 59	2102	29 Sept. 59	530 ft. 300 g.p.m.	41,725.
Chico #2	Precision Drilling Co. Santa Rosa, Calif.	20 Dec. 59	2141	10 Jan. 60	400 ft. 250 g.p.m.	21,858.

COST ESTIMATES

In general, cost estimates for Contract 2140 and other contracts in the Titan I Program were prepared in accordance with applicable instructions contained in the following publications:

1. CEBMCO Manual - ENGMA-1180-2, dated 6 October 1961, entitled "Corps of Engineers Ballistic Missile Construction Office, Standing Operating Procedures for Modifications and Claims under CEBMCO Contracts".

2. Contract Modification Construction Manual issued by the U. S. Army Engineer District, Sacramento, California, dated June 1961.

3. Preparation of Cost Estimates, Military Construction, EM 1110-345-730 dated 2 March 1959.

4. Engineering Manual, Part CX111, Chapter II, dated March 1949, Cost Estimate of Fair and Reasonable Cost to the Contractor.

5. Instructions for Preparation of Cost Estimates for Military Work issued by the U. S. Army Engineer District, Sacramento, California.

6. Pertinent Notes Issued by CEBMCO Titan I entitled "Data for Computing Cost of Modifications, Acceleration, Impact, Effect and Markup".

Other pertinent data used in the preparation of cost estimates for this job are current material, labor and pricing manuals, some of which are listed herewith:

1. National Construction Estimator.
2. National Electrical Contractor's Association Manual.
3. The Market Report giving a current pricing of all types of materials.
4. Armco Materials and Data Book.
5. Sweets Catalog.
6. Electrical Trade Book edited by Biddles that gives prices for all electrical materials and some services.
7. MacMasters Catalog that prices and describes all sorts of fasteners, screws, bolts, nuts, boxes, and many other items.
8. Grinnell Catalog that has to do with piping, valves and fittings.
9. Crane Catalog that has to do with piping, valves and fittings giving methods of installation and pricing of materials.
10. Walworth Catalog that prices many items.
11. Thompson Diggs Company Catalog that prices materials of many items, and describes methods and practices for installation.
12. The Coast Equipment Company Catalog that describes all sorts of Construction Equipment.
13. The Caterpillar Handbook that prices all of Caterpillar equipment, giving specifications, methods for estimating, and capacities and specifications for this equipment.
14. Labor Agreements for Northern and Central California issued by the Associated General Contractor's of America.

15. Current Labor Agreements issued by the Department of Labor.
16. Ryerson Catalog listing prices of steel, and methods.
17. The Jorgenson Steel Company Catalog listing prices of steel.
18. Cla-Val Company Catalog that describes and prices different valves pertaining to control valves.
19. The Ladish Company Catalog that describes and prices stainless and carbon steel welding fittings.
20. Dresser Coupling Catalog that describes and prices dresser couplings.
21. Power's Regulator and Pneumatic Valves Catalog describes and prices pneumatic control systems.
22. Minneapolis Honeywell Catalog that describes and prices electric and pneumatic control systems.
23. Parker Tube Fittings that describes and prices special tubing connections.
24. Unistrut Catalog that describes and prices unistruts and supports of all kinds.
25. Carey Insulation Catalog that describes and prices all types of insulation.
26. C. M. Bailey Catalog that describes and prices Bailey Valves.
27. Current price book that describes and prices mechanical items of all types and services.

SUPPORT FACILITY FOR  
WS-107 A-2 BASE T-5  
BEALE AIR FORCE BASE

Contract Number:	DA-04-167-eng-2230
Date of Contract:	Classified
Contractor:	Slater Electric Company Folsom, California
Construction:	Classified
Notice to Proceed:	24 April 1961
Original Contract Amount:	\$3,980.00
Modifications:	One only modification was proposed: 1. \$710.75
Claims:	None
Final Contract Amount:	\$4,690.75

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28. Associated piping and Engineering that describes and prices special welding assemblies.

29. Carrier Air Conditioning Catalog that describes and prices air conditioning equipment, ducts, etc. of all types.

30. The Burk Company Catalog that describes and prices concrete construction specialties.

31. Pameco Metals and Supplies Catalog that describes and prices non-ferrous metals of all types.

The following publications are used as pertinent:

1. The Military Engineer Magazine.
2. The Engineering News Record Magazine.
3. The Constructor's Guide.
4. Southwest Builder and Contractor.
5. Handbook of Engineering Materials.
6. Civil Engineering Handbook by Urqhart.
7. The Machinery Handbook.
8. The Asphalt Handbook.
9. Handbook of California Standard Specifications.
10. The Steel Construction Handbook issued by AISC.
11. The Electrical Construction Cost Manual by  
Ralph E. Johnson.
12. Aviation Week and Space Technology Magazine.
13. Estimating General Construction Cost by Dallavia.
14. Construction Estimates and Cost by Pulver.
15. Estimating Construction Cost by Peurifoy.

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16. The Labor Handbook by the Electrical Estimator's Association of Los Angeles, California.

This office was extremely fortunate regarding estimators. Most of the estimators in the Beale Area Office came to this job from the Sacramento District, Corps of Engineers, with a good background in estimating. The average number of years of experience for each estimator was approximately ten years. However, the sections pertaining to electrical and mechanical were particularly strong, in that these estimators had approximately a fifteen year background in mechanical and electrical estimating.

Due to the nature of this job it was realized that new factors not heretofore experienced had to be introduced into the preparation of estimates as applicable to this particular job. Therefore, the above data and experience was supplemented by current on-the-job studies of all phases of the work with respect to the preparation of estimates, and within a very short time after the job began, these factors were introduced into the estimates when a good representative study could be obtained.

Field studies were made for comparison with Government estimates of the most complex change orders and these comparisons have reflected that Government estimates have been adequate, well prepared, fair and equitable.

It is pertinent to note that at the start of the job a meeting was held with representatives of the contractor and a mutual schedule was worked out whereby estimates, proposals, and the negotiations of modifications could be expeditiously scheduled

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and completed. On the more complex estimates and change orders a scope of work meeting was usually held and the general scope agreed to and a general format decided on. Coincident with the request for a proposal from the contractor, the Government started preparing the Government estimate. The Government estimate was scheduled to be completed before the suspense date for the Contractor's proposal and therefore was completed prior to the receipt of the contractor's proposal, thus meeting the established requirements and reflecting an unbiased estimate.

The services of Estimators Limited, a commercial firm specializing in estimating service, was utilized during the peak work load. Three estimators were used for eight months, two for four months and one for three months.

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#### TIME EXTENSIONS

During the period when the Area Office was under the Sacramento District, February 1960 to November 1960, it was the Government's understanding that no time extensions would be granted; justified time in a few instances was paid for in modifications. After take-over by CEBMCO in November 1960, to approximately April 1961, operating procedures were not clearly established. Therefore, time extensions were not included with the settlement and were of necessity deferred to a later date.

In July 1961 a modification was written extending the completion dates of the various structures and in effect bring the justified time extensions accumulated by the various modifications to date. The contractor did not agree with the amount of time

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provided by this modification and declared it an unilateral action.

Subsequent to that time, the Government attempted to negotiate time for each modification with the contractor. In most instances the contractor failed to agree and took exception to the time granted in the modification. He stated that he would prepare an overall time study for which he would file a claim. The claim had not been presented at the time of this writing.

#### NEGOTIATIONS

At the beginning of the job, January 1960, negotiations were fairly simple for the civil type work, such as excavation, backfill and concrete operations. As the job progressed and the changes began to involve the more complex mechanical and electrical work, the negotiations became more difficult. Changes compounded on changes and removal of completed work added to the complexity.

The very nature of the work involved new procedures such as purging of pipes, cleanliness requirements and welding of stainless steel pipe. An idea of the magnitude of the job, using rounded figures, may be gained by comparing the original contract amount of thirty million dollars with the addition of approximately 400 changes with a dollar value of approximately ten million.

Negotiations in the majority of cases, although sometimes lengthy and time consuming, were satisfactory. Some of the problems of negotiation and reaching an equitable adjustment were: effect of change on original work and delays to original work, joint occupancy to a minor degree, labor congestion, inefficiency, shift differential, material handling, loss of productivity,

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supervision and engineering, overhead and profit. Equitable adjustment of time was a constant problem and will not be resolved until the contractor submits his overall time study. The Government adjusted for time during the course of the job but the contractor took exception to those adjustments in most instances. Very little difficulty was experienced in negotiation for overtime or the cost of materials. The negotiations were conducted on an individual modification basis with no overall fixed factors being applied. The Government was prepared to negotiate as soon as the contractor submitted his proposal for the work. Multiple part change orders were issued so as to provide prompt payment for completed work.

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Impact and effect were difficult to evaluate but were considered with each modification. The contractor generally took exception to the amount allowed. In those instances where agreement could not be reached on certain modifications, rather than defer settlement, a unilateral modification was issued. The above actions kept the number of outstanding modifications to a satisfactory minimum throughout the life of the job and precluded a large number of modifications to be settled at the end of the job.

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18. LIST OF PRINCIPAL SUBCONTRACTORS, SCOPE OF WORK COST AND EFFECTIVENESS OF SUBCONTRACTORS' OPERATIONS

SUBCONTRACTORS

The principal contractor had approximately 10 first and second tier subcontractors. See Figure 101 for their names and the portion of the work performed by each. In addition to the subcontractors listed, there were numerous third and fourth tier subcontractors that performed specialty work and supplied materials and equipment.

The subcontractors performed approximately 80% of the total contract work.

CONTRACTOR-SUBCONTRACTOR WORKING RELATIONSHIP

Sub-contracts were awarded by Peter Kiewit Sons' Co. on the basis of competitive proposals offered upon invitation by the Prime Contractor. Management and supervision of the sub-contract work was a responsibility of the Prime Contractor. The sub-contract work was scheduled by the individual subcontractors, subject to approval by the Prime Contractor, based on overall job schedules as determined by the Prime Contractor.

Number of shifts, number of men and overtime requirements were generally the determination of the individual subcontractor. However, at times the Prime Contractor directed certain subcontractors to work additional personnel and overtime hours to pace certain critical phases of the job. During the earlier phases of the job, the Prime Contractor paid the premium portion of this directed overtime work. This payment of premium time was especially true with regard to the reinforcing steel subcontractor. In as much as the

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mechanical subcontractor was a subsidiary of the Prime Contractor, the management policies of this subcontractor were essentially the same as those of the Prime Contractor, and the number of men, hours of overtime and number of shifts were more closely controlled by the Prime Contractor. This close control of the mechanical work was especially true during the final phases of the work.

The close relationship between the Prime and mechanical subcontractor made possible a somewhat closer coordination of work by second tier mechanical subcontractors than might otherwise have occurred. Problem areas in subcontractor work developed as follows: structural steel work, when the subcontractor went into receivership, requiring the Prime Contractor to assume managerial responsibility; tunnels and tunnel junctions, when management and supervision problems of the subcontractor caused lack of progress and impeded overall job progress; electrical work, when progress was impeded by labor and labor supervision problems of the subcontractor, causing delays in job completion; and mechanical work, due to management and organizational problems of a newly formed subsidiary.

#### EFFECTIVENESS OF SUBCONTRACTORS' OPERATIONS

The extent of work accomplished by subcontractors was consistent with normal practices of most general contractors. With the exceptions noted above, the effect of sub-contracting was dependent upon the efficiency of the individual subcontractors. The bankruptcy of the structural steel installation subcontractor caused additional expense to the Prime Contractor in assuming management responsibility and also labor costs; however, job operation and

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FIRST AND SECOND TIER SUB-CONTRACTORS

<u>Name and Address</u>	<u>Extent &amp; Character of Work</u>	<u>Approx. % of Work</u>
1. Sacramento Roofing & Insulation Co., Inc. P. O. Box 2253 Sacramento 10, Calif.	Waterproofing, Dampproofing and Rock Bolt Sealant - Complexes 1A, 1B and 1C	0.2
2. Otis Elevator Company 1 Beach Street San Francisco 11, Calif.	Elevators Complexes 1A, 1B and 1C	1.5
3. The Justice Company 1260 59th Street Oakland 8, Calif.	Erosion Control Seeding Complexes 1A, 1B and 1C	0.1
4. John B. Duff 920 N. Miller Street Santa Maria, Calif.	Surveying Complexes 1A, 1B and 1C	0.5
5. Armco Drainage & Metal Products	Tunnels	5.
6. Parrish Bros. & Murphy Bros.	Excavation	20.
7. A.M. Van Valkenburg & Co. P. O. Box 1192 Sacramento, Calif.	Portion of Water Line Complex 1A only	0.1
8. Superior Electric Const. Co., Inc. 346 Brunswick Avenue Trenton, New Jersey	Electrical Work - Complexes 1A, 1B and 1C	6.
9. Kiemech, Inc. 126 South First Ave. Arcadia, Calif.	Mechanical Work - Complexes 1A, 1B and 1C	19.
10. Yuba Erectors Marysville, Calif.	Structural Steel and Misc. Iron	24.
11. Frank M. Booth Marysville, Calif.	Ductwork on Installation of Air Conditioning	3.6

The above subcontract work amounted to approximately 80% of the total contract.

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efficiency were not effected. The management and supervision problems of the subcontractor supplying and installing the tunnels and tunnel junctions caused temporary loss of job efficiency and considerable additional cost to the subcontractor. Costs to the Prime Contractor were incidental to delays to backfill and subsequent concrete operations, and were relatively minor in nature.

The labor, supervision and management problems of the electrical subcontractor caused considerable loss of efficiency and additional cost, and in some cases resulted in delay of final completion of individual structures. This particularly effected efficiency and caused considerable expense to the subcontractor and incidental losses to other subcontractors and the Prime Contractor.

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The relatively unusual occurrence of a major subcontractor being closely affiliated with the Prime Contractor did cause operational difficulties during the earlier phases of the mechanical work.

These operational difficulties resulted from the responsible party for the subcontractor operation also being the administrative supervisor of the job site personnel. This situation caused job site personnel considerable difficulty in obtaining desired progress in the mechanical work. Final completion of some structures was delayed due to lack of efficiency by the mechanical subcontractor and resulted in added costs to the subcontractor and to the Prime Contractor. In summary, during the early phases of the job, approximately the first half, sub-contracting beneficially effected operation, efficiency and cost of the work. However, the operation, efficiency and cost of the latter half of the work was adversely effected by certain

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subcontractors, due to their accomplishing a major portion of the  
work.

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19.- THE RACE AGAINST TIME-

SHOWING CONSTRUCTION PERIOD AND STATEMENT ON LIQUIDATED DAMAGES

CONTRACT NO. DA-04-167-eng-2140

<u>Site</u>	<u>Item</u>		<u>AF Directed</u>		<u>Contract</u>		<u>Beneficial</u>	
			<u>Completion Dates</u>		<u>Completion Dates</u>		<u>Occupancy Dates</u>	
			<u>ORIGINAL</u>	<u>REVISED</u>	<u>ORIGINAL</u>	<u>REVISED</u>	<u>SCHEDULED</u>	<u>ACTUAL</u>
1A	M.S.	No.1	2/1/62	10/1/61	2/1/62	12/1/61	5/22/61	5/23/61
1A	M.S.	No.2	2/1/62	10/1/61	2/1/62	12/1/61	5/22/61	6/3/61
1A	M.S.	No.3	2/1/62	10/1/61	2/1/62	12/1/61	5/22/61	5/31/61
1A	E.T.	No.1	7/1/61	6/1/61	7/1/61	6/1/61	6/1/61	5/24/61
1A	E.T.	No.2	7/1/61	6/1/61	7/1/61	6/1/61	6/1/61	5/31/61
1A	E.T.	No.3	7/1/61	6/1/61	7/1/61	6/6/61	6/1/61	6/6/61
1A	P.T.	No.1	2/1/62	10/1/61	2/1/62	12/1/61	10/1/61	11/9/61
1A	P.T.	No.2	2/1/62	10/1/61	2/1/62	12/1/61	10/1/61	11/21/61
1A	P.T.	No.3	2/1/62	10/1/61	2/1/62	12/1/61	10/1/61	12/1/61
1A	P.H.	No.1	9/15/61	7/1/61	9/15/61	7/18/61	7/1/61	8/17/61
1A	L.C.C.	No.1	10/15/61	4/22/61	10/15/61	4/19/61	4/22/61	4/27/61
1A	E.P.S.	No.1	9/15/61	7/25/61	9/15/61	7/18/61	7/25/61	7/17/61
1A	A.S.	No.1	7/1/61	5/20/61	7/1/61	5/20/61	5/20/61	5/22/61
1A	A.S.	No.2	7/1/61	6/6/61	7/1/61	6/6/61	6/6/61	6/5/61
1A	A.T.	No.1	7/1/61	5/20/61	7/1/61	5/1/61	5/20/61	6/6/61
1A	B.L.&Tunnels	-	6/1/61	5/1/61	8/15/61	5/15/61	5/1/61	6/15/61

\$50.00 Liquidated damages assessed for Late Completion of access road.



THE RACE AGAINST TIME--  
SHOWING CONSTRUCTION PERIOD AND STATEMENT ON LIQUIDATED DAMAGES  
CONTRACT NO. DA-04-167-eng-2140

Site	Item		AF Directed Completion Dates		Contract Completion Dates		Beneficial Occupancy Dates	
			ORIGINAL	REVISED	ORIGINAL	REVISED	SCHEDULED	ACTUAL
1B	M.S.	No.1	12/1/61	11/1/61	12/1/61	1/1/62	6/22/61	6/19/61
1B	M.S.	No.2	12/1/61	11/1/61	12/1/61	1/1/62	6/22/61	6/22/61
1B	M.S.	No.3	12/1/61	11/1/61	12/1/61	1/1/62	6/22/61	6/27/61
1B	E.T.	No.1	5/1/61	7/1/61	5/1/61	6/26/61	7/1/61	6/16/61
1B	E.T.	No.2	5/1/61	7/1/61	5/1/61	6/26/61	7/1/61	6/21/61
1B	E.T.	No.3	5/1/61	7/1/61	5/1/61	6/26/61	7/1/61	6/26/61
1B	P.T.	No.1	12/1/61	11/1/61	12/1/61	1/1/62	11/1/61	12/15/61
1B	P.T.	No.2	12/1/61	11/1/61	12/1/61	1/1/62	11/1/61	12/22/61
1B	P.T.	No.3	12/1/61	11/1/61	12/1/61	1/1/62	11/1/61	12/27/61
1B	P.H.	No.1	7/15/61	8/1/61	7/15/61	8/15/61	8/1/61	9/11/61
1B	L.C.C.	No.1	8/15/61	5/22/61	8/15/61	5/10/61	5/22/61	5/9/61
1B	E.P.S.	No.1	7/15/61	8/25/61	7/15/61	8/17/61	8/25/61	8/16/61
1B	A.S.	No.1	5/1/61	6/20/61	5/1/61	6/1/61	6/20/61	6/12/61
1B	A.S.	No.2	5/1/61	6/20/61	5/1/61	6/19/61	6/20/61	6/19/61
1B	A.T.	No.1	5/1/61	6/20/61	5/1/61	6/19/61	6/20/61	6/19/61
1B	B.L.& Tunnels	-	4/1/61	6/1/61	6/15/61	6/7/61	6/1/61	6/17/61

\$200.00 liquidated damages assessed for late completion of access road.

THE RACE AGAINST TIME-  
 SHOWING CONSTRUCTION PERIOD AND STATEMENT ON LIQUIDATED DAMAGES  
 CONTRACT NO. DA-04-167-eng-2140

Site	Item		AF Directed		Contract		Beneficial	
			Completion Dates		Completion Dates		Occupancy Dates	
			ORIGINAL	REVISED	ORIGINAL	REVISED	SCHEDULED	ACTUAL
1C	M.S.	No.1	1/1/62	12/1/61	1/1/62	2/1/62	7/22/61	7/15/61
1C	M.S.	No.2	1/1/62	12/1/61	1/1/62	2/1/62	7/22/61	7/25/61
1C	M.S.	No.3	1/1/62	12/1/61	1/1/62	2/1/62	7/22/61	7/24/61
1C	E.T.	No.1	6/1/61	8/1/61	6/1/61	7/21/61	8/1/61	7/18/61
1C	E.T.	No.2	6/1/61	8/1/61	6/1/61	7/21/61	8/1/61	7/21/61
1C	E.T.	No.3	6/1/61	8/1/61	6/1/61	7/21/61	8/1/61	7/25/61
1C	P.T.	No.1	1/1/62	12/1/61	1/1/62	2/1/62	12/1/61	1/3/62
1C	P.T.	No.2	1/1/62	12/1/61	1/1/62	2/1/62	12/1/61	1/22/62
1C	P.T.	No.3	1/1/62	12/1/61	1/1/62	2/1/62	12/1/61	1/22/62
1C	P.H.	No.1	8/15/61	9/1/61	8/15/61	8/31/61	9/1/61	10/9/61
1C	L.C.C.	No.1	9/15/61	6/22/61	9/15/61	6/1/61	6/22/61	6/9/61
1C	E.P.S.	No.1	8/15/61	9/25/61	8/15/61	9/19/61	9/25/61	9/18/61
1C	A.S.	No.1	6/1/61	7/20/61	6/1/61	7/1/61	7/20/61	7/17/61
1C	A.S.	No.2	6/1/61	7/20/61	6/1/61	7/1/61	7/20/61	7/10/61
1C	A.T.	No.1	6/1/61	7/20/61	6/1/61	6/1/61	7/20/61	7/14/61
1C	B.L.& Tunnels	-	5/1/61	7/1/61	7/15/61	7/8/61	7/1/61	8/4/61

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20. STANDARDIZED EQUIPMENT

In the interest of securing the same kind of equipment for all of the Titan I missile projects throughout the nation, nine separate schedules of items were established for central procurement. These schedules were advertised and bids on them were obtained by Omaha District. When supply contracts were awarded, the nine schedules were divided into fourths making a total of thirty six supply contracts. The thirty six supply contracts were then divided among three districts for four projects as follows:

1. Omaha District received nine contracts for items for the Ellsworth project.
2. Walla Walla District received nine contracts for the Larson project items.
3. Sacramento District received nine contracts for the Beale project items.
4. Walla Walla District received an additional nine contracts for the Mt. Home project.

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All districts with the exception of Sacramento then proceeded to assign their contracts to their respective prime construction contractors. Sacramento District elected to handle their contracts following procedures normally used for government furnished supply contracts; consequently the district had to deal with the eight suppliers for the nine schedules of items to be used on the Beale project. This proved to be a wise course of action because, as the projects developed throughout the nation, changes in connec-

tion with the supply contracts in all districts were forthcoming.

In order to negotiate these changes other districts, because they had assigned their supply contracts, would have been forced to deal with supply contractors through prime construction contractors. To alleviate this situation, Sacramento District accomplished negotiations, except for delivery schedules, with the supply contractors for the other districts.

It was necessary for all of the missile projects concerned to insure that equipment arrived at the various sites at the appropriate time; therefore, frequent meetings of supply personnel were held centrally to properly determine which projects were to receive certain supply items. These meetings were termed "Management Group Operations".

The Beale Area executed checks for damage at point of delivery on those items for use in the Beale project. If there was no damage to the item concerned, it was accepted by Area personnel and immediately transferred to the prime construction contractor at point of delivery.

The Sacramento District Engineer was the Contracting Officer for the following contracts:

<u>Contract Number</u>		<u>Basic Amount</u>
5927	Cryogenic Vessels	\$ 794,529.
5933	Air Conditioning & Refrigeration	147,516.
5939	Air Compressors	93,120.
5945	Alarm System Damage Control and Annunciator	88,170.
5951	Contaminated Waste, Booster & Fire Water Pumps	87,700.
5961	2.4 K V Switchgear	277,965.
5967	Electric Generating Equipment	1,098,726.
5977	PLS Pressure Vessels	992,838.
5984	PLS Valves & Related Equipment	<u>679,397.</u>
Total - - - - -		\$ 4,259,961

The Government procurement of standardized equipment by the Omaha District was proposed with the threefold purpose of:

- (a) accelerating delivery of certain long lead-time items, (b) effecting monetary savings through volume purchase, and (c) by standardizing types and makes of material procured in the interest of simplifying future care and maintenance.

In practice, the theoretical advantages of Government procurement were offset by some distinct disadvantages: (a) A different architect-engineer wrote the specification for the standardized equipment purchase than wrote the specification for the Beale T-5 site construction. As a result, there were numerous discrepancies that resulted in costly changes to the Beale construction contract to resolve the differences. (b) The increased cost of Government administration and inspection of the standardized equipment

contracts probably offset any saving in the initial procurement cost. This applied particularly to items requiring cleanliness inspection where there was divided responsibility between the Government and construction contractor in the inspection and handling from vendors' factories to completed site installation.

(c) Late delivery of some standardized equipment resulted in the construction contractor making claim for compensation in time and money because of the Government's failure to meet promised schedules.

An overall appraisal of the results obtained with Government furnished standardized equipment for the T-5 construction contract would indicate that the disadvantages outweigh the advantages. It is believed that the interests of the Government would have been better served by having the construction contractor furnish all equipment required for T-5 site construction.

A summary of the total cost of standardized equipment for the Beale Project follows:

TOTAL COST: STANDARDIZED EQUIPMENT CONTRACTS

Basic contract amount	\$ 4,259,961
Modifications over \$100,000	260,858
Modifications under \$100,000	651,835
Pending claims	188,986
	<hr/>
Total anticipated cost	\$ 5,361,640

A breakdown of modifications and claims follows:

Modifications over \$100,000

<u>Contract Number</u>	<u>Mod. No.</u>	<u>Description</u>	<u>Amount</u>
5984	11	Bench Tests of Safety Relief Valves	\$138,308
5984	13	Manufacturer's Representative Services	122,550
		TOTAL	<hr/> \$260,858

Modifications under \$100,000

<u>Contract Number</u>	<u>Total Mods.</u>	<u>Amount</u>
5927	20	\$ 98,235
5933	9	30,461
5939	5	4,853
5945	6	36,524
5951	8	39,007
5961	7	24,361
5967	7	53,070
5977	5	3,330
5984	14	361,994
	TOTAL	<hr/> \$651,835

Pending Claims

<u>Contract Number</u>	<u>Description of Claim</u>	<u>Amount of Claim</u>
5927	S. S. Vessel Cleaning	\$ 53,539
5927	Third Facility	29,261
5927	X-Ray	2,746
5927	Overtime - 3 Shifts	97,650
5927	Equipment List	690
TOTAL		<u>\$ 183,886</u>
5984	None	2,100
5984	None	2,500
5984	None	500
TOTAL		<u>\$ 5,100</u>



CONSTRUCTION CONTRACTS

<u>Contract Number</u>	<u>Description</u>	<u>Basic Amount</u>
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Active Contracts

2140	WS-107 A-2 Technical Facilities	\$ 30,157,150
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See Section 20 for list of Standardized Equipment contracts.

Completed Construction Contracts

2230	Protective Alarm Systems, Re-Entry Vehicle Facility	4,691
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2097	Water Wells	37,535
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2102	Water Wells	37,460
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2109	Water Wells	19,772
------	-------------	--------

2110	Area Office	25,550
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2141	Water Wells	20,803
------	-------------	--------

2174	Re-Entry Vehicle Facility	155,790
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2175	Re-Entry Vehicle Facility	20,650
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2176	Helium Unloading Facility	13,867
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2177	GMAB and Tech Supply	767,175
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PROCUREMENT

7378	Columbia-Geneva	48,263
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7379	Cosmodyne	36,252
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4520		17,624
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6623		12,415
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Contracts Misc.		20,010
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7609	Cleaning & Testing Rechargers	24,112
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<u>Contract Number</u>	<u>Description</u>	<u>Basic Amount</u>
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Procurement (Continued)

7738	ADSCO	1,200
7747	Accessory Product - Filter	4,000
7644	Air Products Co. (Overhaul & Recharge)	30,000
7677	Rehabilitate Helium Compressor	3,560
7383	Western Filter Company	2,870
P.O. 19-56358	General Air Equipment	3,633
P.O. 19-56065	General Air Equipment	1,109
P.O. 19-55992	CompuDyne	492
5886	Blast Detection	34,852

SURVEY CONTRACTS

2143		30,909
2144		73,730
2217		34,975
2218		82,710

ARCHITECT ENGINEER CONTRACTS

12	TEMCO	128,974
13	DMJM	684
16	Estimators Ltd	87,703
2148	Earl & Wright Inc.	550
2153	DMJM	119,000

<u>Contract Number</u>	<u>Description</u>	<u>Basic Amount</u>
Architect Engineer Contracts (Continued)		
5886	Ralph Parsons	509
7660	National Engineering	2,975
3598	Zep Aero	231,421
58	United Testing Laboratory	36,831

The above Construction Contracts were administered by the Beale Area Office with the exception of the water well contracts which were administered by the Sacramento District. The Procurement Contracts were administered by CEBMCO, Los Angeles. The Survey Contracts were administered by the Sacramento District.

The Architect Engineer contracts were administered by CEBMCO, Los Angeles with the exception of 2148 with Earl & Wright Inc. and 2153 with DMJM&A which were administered by the Sacramento District.

22. LIST OF MODIFICATION NUMBERS FOR EACH CONSTRUCTION CONTRACT

CONTRACT NO. DA-04-167-eng-2140

<u>MOD. NO.</u>	<u>DESCRIPTION</u>
1	Revised Revision Blocks
2	Reschedule of Completion Dates
3	Relocate & Enlarge Laboratory
4	Revised Contr. Operational Area
5	Revised Installation of Rock
6	Delete Segregated Magazine & Access
7	Miscellaneous Modifications
8	Liner Plates
9	Dimensional Errors on Drawings
10	Delete Interior Paint in Tank
11	Install Additional Unistruts
12	Conduit, Panel to Air Dryer
13	Pipe Sleeves thru Fire Wall
14	Seal Coat Certain Floors
15	Remove Unstable Material
16	Revise LOX Tank, Substitution of Rock Bolts and Modify MG Circuit Breaker
17	Changes re - Blast Valves
18	Delete Swage Nitro-Couplings
19	Electrical Changes
20	Modify Water Control Valves and Correct Dimensions
21	Relocate Targets
22	Correct Conflict Filter Box

MOD.  
NO. DESCRIPTION

- 23 Correct Water Distribution Main
- 24 Fabricate 36WF 260 Yoke and  
Modify Anchor Bolts & Air Cutouts
- 25 Changes External Process Connections
- 26 Install Swivel Lift Plates
- 27 Clarify & Correct Drawings
- 28 Large Weld Caps & Enlarge Tubes
- 29 Revise Deep Well Submersible Pumps
- 30 Revise Latch & Support Blocks
- 31 Revise Construction of Launcher #2, 1A
- 32 Revise Latch on Blast Doors
- 33 Revise Air Filters in Control Center
- 34 Revise Blast Door Opening Dimensions
- 35 Different Type Transformers in Sub-Station
- 36 Additional Support-Cable Hanger Antenna Silos
- 37 Revise Electrical Circuit Air Compressor Piping,  
Revise Instrument Air Compressor Piping,  
Modify Contaminated Waste Line
- 38 Contractor-Furnished Anchor Bolts
- 39 Enlarge Size Telephone Cabinets
- 40 Revise Blast Lock Doors & Frames
- 41 Add Swing Check Valves
- 42 Miscellaneous Mechanical & Electrical Changes
- 43 Revise Installation-Anchor Bolts
- 44 Reroute Conduit in Missile Silos
- 45 Revise Clovis Mounts

MOD. No.	DESCRIPTION
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- |    |  |
|----|--|
| 46 | Ground Well Complex 1  |
| 47 | Revise Wiring and Revise Location of Lights and Temporary Opening                      |
| 48 | Delete Anchor Bolts, Missile Silo  |
| 49 | Relocate Control, Anchor LOX Tanks and Relocate Pressure Devices                       |
| 50 | Government Inspection Facility at Beale  |
| 51 | Claim (Dampproofing Equipment Terminals)   |
| 52 | Larger Size Hydraulic Pipe   |
| 53 | Contractor Installed Pillow Blocks, etc.   |
| 54 | Revise Walls Room 402 Equipment Terminals  |
| 55 | Delete Heat Tubes in Antenna Silo  |
| 56 | Modification to Flex Hose  |
| 57 | Water Stops for C.C. & P.H. Domes at 1A  |
| 58 | Furnish Standard Hex Nuts & Washers  |
| 59 | Furnish & Install Flexible Conduit Ells, Equip.Terminals                               |
| 60 | Revise Shutoff Facility in Personnel Tunnels, P.T.                                     |
| 61 | Changes in Elevation in Specifications   |
| 62 | Labor and Material to Install 3 Vessels  |
| 63 | Revise Cooling Tower Elevation   |
| 64 | Install 1" Conduit Telephone Box to Tray and Waterproof Rolled Channel Junctions       |
| 65 | Revised Flanges for Process Piping   |
| 66 | Additional Benchmarks in Missile Silos   |
| 67 | Asphalt Tile & Rubber Hose and Revise Limit Switch Mounting Plates, Equipment Terminal |

<u>MOD. NO.</u>	<u>DESCRIPTION</u>
68	Delete Certain Valves and Relocate Boosters
69	Relocate LOX Tank in Propellant Terminals
70	Increase Size of Sleeves
71	Change Blast Locks & Air Intake Filtration
72	Furnish Labor and Material for Government Furnished Property Cleanliness Inspection
73	Revise Powerhouse Construction for Diesel Foundations
74	Miscellaneous Electrical Changes & Tunnels Drawings
75	LOX and Fuel Crib Changes
76	Change Dimensions Blast Locks
77	Install Color Coded Cable for Instrumentation in PLS
78	Delete Hardened Silo Antenna
79	Rehandling Ice Banks & Revise Beams in Equipment Terminal
80	Alternate Method Floor Panels
81	Assemble Contaminated Waste Pumps
82	Extend 1-2/o Soft Drawn Grounding Cable
83	Facility for Trailers-Power, Sanitary Water for 10 People
84	Dampproof Top-Sides of Blast Locks No. sl&2, 1B & 1C
85	Delete Item No. 114 contained in Mod. No. 47 for Temporary Openings
86	Revise Bellows Joints, PLS System
87	Delete Gate House All Sites
88	Revise Chilled and Chilled Return Line in Equipment Terminal and Delete Gimball Joints and Install Insert Spools
89	Change Size Curb Closure Angle in Powerhouses

MOD. NO.	DESCRIPTION
90	Delete Spring Support & Shock Isolator and Revise Pump Support for Deep Well Pumps
91	Revise Wiring in Control Center & Launchers
92	Delete Sht. 486c in its Entirety
93	Change Type Lighting Fixture in Equipment Terminals
94	Change Yokes from Semi-Steel to Steel on Control Valves
95	Revise Location of Tank T-401
96	Provide Painted Wainscot on Panels and Revise Drain Line to Tank T-204
97	Calk Channel Joints at LOX Tank and Air Filtration structures of 1A
98	Revise Permanent Type Air Filters, Utilize Excavated Rock Material and Delete Drain from Junction Boxes on Missile Silos
99	Revise Location of Anchor Bolts in Antenna Silos
100	Provide Framed Opening in Firewall of Utility Tunnels - All Sites
101	Pave Inverts of Fuel Tunnels
102	Design Changes to PLS System
103	Correct Terminal Strips to be used in Junction Boxes 1500, 1600, 1601, 1602
104	Modifications to Shock Test Equipment
105	Furnish and Install Exhaust Transition Pieces- Nordberg Generators - Powerhouses
106	Revised Piping-LOX Subcooler Tank T-401
107	Revise Connection of LOX Tunnels - Missile Silo
108	Recorder Controller-Powerhouse, Delete 3-2" Conduit Sleeves on Sheet 568 and Revise Dimension of Templates for Doors Missile Silo
109	Miscellaneous Change to Certain Drawings



<u>MOD. NO.</u>	<u>DESCRIPTION</u>
110	Extend 2-3" Conduits to Telephone Manhole
111	Revise Support of 12" Fire Water Lines
112	Provide Additional Resteel in Bottom Face of Missile Silo
113	Change Location and Size of Duct Cut-Outs in Antenna Terminal
114	Revise Installation of Lighting Fixtures in Communication Equipment Rooms
115	Contractor Request for Concrete Encasement of Yoke Beam in Tunnel Junctions
116	Revise P-10 Drains in Tunnel at 1A
117	Delete Reference on Contract Drawings
118	Fill Floor Block - Outs in Equipment Terminals with Mastic
119	Furnish and Install Different Type Gaskets in Certain Process Lines
120	Electrical Service to Test Control Station in Powerhouse
121	Structure Change to LOX Cribs
122	Revised Propellant Loading System Tunnel Supports
123	Relocate Horizontal Spring Mounts in Propellant Terminal
124	Cope Stairway Stringer - Propellant Terminal
125	Re-route lines in Propellant Terminal at 3 Complexes to clear wide flange Beam
126	Install 2 additional Conduit Sleeves through Control Center Domes
127	Required Revisions to Fuel Systems and Fire Water Supports in Missile Silo
128	Revise Installation of Tank T-510 to Tunnel Junction No. 12
129	Install Communications Conduit Sleeves through Walls of Blast Locks 1 and 2
130	Relocate Lighting Fixtures in Tunnel Section A, B and C, 3 complexes

<u>MOD. NO.</u>	<u>DESCRIPTION</u>
131	Install kits between water chillers and switchgear, 3 Sites
132	Lower Fuel Line Piping in certain Blast Lock Structures, 3 complexes
133	Furnishing and Installing Vibration Isolators for Air Compressors #C-4
134	Revise Neoprene Water Stops - Tunnels
135	Revise PLS Piping Supports in Missile Silo and Propellant Terminal Lox Cribbing
136	Relocate Firewater Rollout in Personnel Tunnel
137	Revised Testing Procedure of Propellant Loading System, 3 Complexes
138	Cancelled
139	Revise Security Fencing Facilities 3 Complexes
140	Stop Procurement of TV Surveillance System
141	Revise Sealing of Sleeves, Utility Tunnels Drains Missile Silo Complex 1A
142	Revise Installation of Ball Joints on Water Line
143	Revise Installation of Drains in Top of Antenna Silos, Testing with Liquid Nitrogen in lieu of LOX and Revise Installation of Bench Marks in Missile Silo Walls
144	Relocate Orientation Target No. 2 at Complex 1B, Furnish Pressure Switches (FH-15), and Delete Installation on Felt Between Tank and Supports in Propellant Terminal
145	Revise Communication System - All Sites
146	Install Spools in PLS Piping in lieu of Contaminated Valves, Replace with clean Valves
147	Segmentation of MCC and Additional Installation of Package Controls
148	Revise Water Supply Facilities in Tunnel Sections and Revise Piping Configuration in Fuel Lines to Diesel Generator

MOD. NO.	DESCRIPTION
149	Installing Two Hole Strap Supports for Conduit and Tubing
150	Install Additional Pipe Supports for all Piping, 2" or Smaller in Tunnel
151	Hardstands for Associate Contractor, Revise grading and Relocate Portion of Security Fencing at 1B
152	Revise Antenna Silos Elevators - all Sites
153	Revise Construction of Holes to Vaults in Control Center
154	Delete Neoprene Cork Pads from between Piping & Supports
155	Connect 4"-CSO-326 Line to 8" CSO-326 Line in lieu of to 11" CSO-326 Line
156	Extend Completion Dates for Powerhouses Complex 1A by 30, 1B-20, 1C-10 days
157	Furnish and Install Pressure Control Stations in HW, HWR, CH AND CHR Lines, CC and Antennas
158	Extend Completion dates for Control Center Complex 1A-18 days and 1B by 9 days
159	Revised Cable Tray Layout in Second Floor of Control Centers
160	Revised Installation of 36" Diameter Blast Valves in Blast Locks
161	Blow-down of Government Furnished Cryogenic Vessels & Tanks
162	Delete Air Supply Duct in Antenna Terminal and add top grill and Provide One Coat Paint on Edges Accoustical Baffles in Control Center
163	Install Additional Supports under Free End of Grating Antenna Silos
164	Overhaul Required to Provide Advanced Space for Martin Warehouse, Site 1A
165	Correction of Design Deficiencies to Steel Ladders in Equipment Terminals
166	Provide additional Pipe Supports for PLS Piping in Propellant Terminal and Interconnecting Tunnels - 3 Complexes

MOD. NO.	DESCRIPTION
167	Revised Fabrication of Cable Trays in Control Centers and Lower Fuel Piping Sleeves through Firewall in Tunnel Junction 12, Sites 1A and 1C
168	Relocate Piping and Install Nitrogen Check Valve in Propellant Terminals
169	Notch and Reinforce 8" Channel Platform Support in LOX Bay
170	Time Extension
171	250 PSI Gate Valves in 3" Plant Air Line in Equipment Terminal in lieu of 125 PSI Valve
172	Not Issued
173	Not Issued
174	Revise Termination of 4" Firewater Ring Header in Missile Silos 3 Complexes and 6" Flanged Steel Firewater Lines to Pipe Specified Fire Hydrants in lieu of Cast Iron
175	16 Gauge Aluminum Ducts in Interconnecting Tunnels in lieu of Galvanized Ducts, 3 Complexes
176	Revise Installation of Anchor Bolts for Accumulator, Antenna Silos
177	Extension of Completion Dates for Tunnel Junction No. 10 (16 days at each Complex)
178	Revise Seal Bearing Plates on East Leaf of Antenna Silo Doors Complexes 1B & 1C and Delete Flexible Connection from Plumbing Vent Lines in Toilet Rooms, CCL1A, 1B, 1C
179	Change Size of Door in Propellant Terminal leading to Personnel Tunnel from 7'0" to 6'6"
180	Install 2-4" Conduits through air Intake Structure to terminate 2' below Finish
181	Revise Specified and Add Additional Conduit Sleeves for Associate Contractor Cables
182	Correct Ground Water Leaks at Complex 1A
183	Revised Installation of CSN-572 Line, CSN-568 Line, OSH-613 Line and Valve SV-607 in Propellant Terminals

Contract: DA-04-167-eng-2140

Modification No. 104 84 No. 50

Date of Modification: 10 March 1961

Description of Work: Modification to shock test equipment. Furnishing equipment, labor and material required to shock test certain specified electrical and electronic equipment in Shock Zone C of all three complexes in accordance with revisions of the contract specifications. This is additional shock testing to that required by the contract.

Amount of Modification: \$195,436

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Contract: DA-04-167-eng-2140

Modification No. 109 84 No. 115

Date of Modification: 22 December 1960

Description of Work: Design changes of Process Piping, Process-piping fuel system, Air Conditioning, Cooling System, Diesel Generating Plant and Compressed Air System in the Powerhouse, Control Center and Tunnels. COC Nos. 268,270,271 and 275.

Amount of Modifications: \$793,847.00 (5 pts)

Contract: DA-04-167-eng-2140  
 Modification No. 122 84 No. 196  
 Date of Modification: 13 June 1961  
 Description of Work: Revision to Propellant Loading System  
 Pipe Supports and Anchors in the  
 Interconnecting Tunnels to Missile  
 Silos at all three Complexes.  
 Amount of Modification: \$211,292.00 (2 pts)

-----  
 Contract: DA-04-167-eng-2140  
 Modification No. 127 84 No. 211  
 Date of Modification: 4 August 1961  
 Description of Work: Design changes to the Fuel System Fire  
 Water Piping and Supports at all three  
 Complexes.  
 Amount of Modification: \$ 110,742.00

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 Contract: DA-04-167-eng-2140  
 Modification No. 135 84 No. 212  
 Date of Modification: 28 July 1961  
 Description of Work: Revision of Pipe Supports for PLS  
 Piping Lox Cribs, Missile Silos and  
 Propellant Terminals. Based on  
 A. D. Little stress analysis.  
 Amount of Modification: \$ 1,100,000.00(3 pts unilateral)

Contract: DA-04-167-eng-2140  
Modification No. 137 84 No. 94  
Date of Modification: 3 April 1962  
Description of Work: Revised Test Procedure for PLS System.  
Amount of Modification: \$1,824,007.00 (4 pts)

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Contract: DA-04-167-eng-2140  
Modification No. 147 84 No. 231  
Date of Modification: 10 March 1961  
Description of Work: Segmentation and Re-assembly of Motor  
Control Sections and Advance Delivery  
Date.

Amount of Modification: \$ 131,453.00

-----  
Contract: DA-04-167-eng-2140  
Modification No. 151 84 No. 233  
Date of Modification: 4 May 1961  
Description of Work: Advance Completion Dates of Site  
Grading, Paving of Access Roads,  
Security Fencing and Construct Hard  
Stands at all three Sites.

Amount of Modification: \$ 175,000.00 (2 pts)

Contract: DA-04-167-eng-2140

Modification No. 161 84 No. 236

Date of Modification: 19 June 1961

Description of Work: Additional Blow-downs required to clean Cryogenic Tanks and Pressure Vessels at all three Sites.

Amount of Modification: \$ 198,976.00 (3 pts)

Contract: DA-04-167-eng-2140

Modification No. 166 84 No. 250

Date of Modification: 18 July 1961

Description of Work: Furnish additional Pipe Supports for

PLS Piping at interconnecting Tunnels of the Propellant Terminal.

Amount of Modification: \$ 194,622.00 (3 pts)

Contract: DA-04-167-eng-2140

Modification No. 262 84 No. 323

Date of Modification: 19 January 1962

Description of Work: Revisions to Pipe Supports and RP-1 Fuel System Tunnel Junction 12.

Amount of Modification: \$ 162,852.00 (2 pts)



Contract: DA-04-167-eng-2140  
Modification No. 267 84 No. 341  
Date of Modification: 28 December 1961  
Description of Work: Procure and Store PLS Spare Parts  
Amount of Modification: \$ 101,387.00

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Contract: DA-04-167-eng-2140  
Modification No. 286 84 No. 333  
Date of Modification: 26 February 1962  
Description of Work: Re-circulate RP-1 fuel oil through  
filters above ground to insure  
cleanliness.

Amount of Modification: \$128,869.00

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Modifications Under \$100,000, excluding those Modifications  
 Derived from Claims

<u>Mod. No.</u>	<u>Amount</u>	<u>Mod. No.</u>	<u>Amount</u>
1	N/C	21	- 779
2	N/C	22	412
3	9,141	23	1,731
4	N/C	24	N/C
5	- 11,420	25	21,418
6	- 13,554	26	1,479
7	87,700	27	1,387
8	- 26,500	28	2,539
9	N/C	29	- 1,565
10	- 20	30	12,723
11	729	31	49,310
12	758	32	577
13	703	33	3,460
14	4,700	34	55
15	4,800	35	- 6,432
16	N/C	36	1,273
17	1,544	37	N/C
18	- 1,265	38	4,845
19	- 881	39	773
20	N/C	40	370
41	2,068	62	1,307
42	3,169	63	1,609
43	2,981	64	841

<u>Mod. No.</u>	<u>Amount</u>	<u>Mod. No.</u>	<u>Amount</u>
44	345	65	3,103
45	3,003	66	4,233
46	1,179	67	2,907
47	1,844	68	- 9,664
48	- 665	69	4,551
49	2,716	70	5,526
50	8,328	71	720
52	384	73	17,486
53	7,593	74	11,665
54	1,852	75	18,211
55	- 14,384	76	4,829
56	67,126	77	4,056
57	6,902	78	- 15,039
58	573	79	943
59	2,099	80	- 4,788
60	1,094	81	2,450
61	1,391	82	3,125
83	17,451	129	3,892
84	3,212	130	16,397
85	(- 1,844)	131	8,274
86	9,402	132	6,454
87	(- 92,571)	133	(- 4,737)
88	15,651	134	5,775
89	868	136	7,553
90	600	138	N/C

<u>Mod. No.</u>	<u>Amount</u>	<u>Mod. No.</u>	<u>Amount</u>
91	306	139	23,291
92	(- 1,043)	140	47,450
93	2,333	141	2,800
94	(- 341)	142	1,000
95	5,389	143	N/C
96	2,837	144	(- 639)
97	4,359	145	52,346
98	1,268	146	8,779
99	6,650	148	818
100	5,019	150	68,650
101	3,772	152	1,836
103	6,924	153	823
105	8,997	154	212
106	18,621	155	8,704
107	6,920	156	N/C
108	2,486	157	28,674
110	1,050	158	N/C
111	25,626	159	32,771
112	10,883	160	21,000
113	4,130	162	245
114	2,236	163	3,941
116	4,545	164	4,950
117	(- 660)	165	1,884
118	3,435	167	1,333
119	31,531	168	2,497

WWW.CHROMEHOOVES.NET

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<u>Mod. No.</u>	<u>Amount</u>	<u>Mod. No.</u>	<u>Amount</u>
120	3,030	169	1,242
121	27,977	170	N/C
123	2,924	171	5,843
124	850	172	N/C
125	10,566	173	N/C
126	2,090	174	816
128	1,814	175	1,682
176	3,500	221	730
177	N/C	222	(- 300)
178	1,022	223	3,141
179	2,722	224	1,490
180	1,038	225	577
181	16,493	226	1,140
182	50,189	227	60,451
183	16,590	228	21,785
184	3,459	229	26,824
185	1,925	230	3,135
186	6,056	231	18,916
187	5,119	232	2,882
188	5,592	233	1,466
189	5,956	234	1,120
190	11,420	235	33,982
191	24,261	236	13,554
192	12,230	237	950
193	8,016	238	(- 4,236)

WWW.CHROMEHOOVES.NET

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<u>Mod. No.</u>	<u>Amount</u>	<u>Mod. No.</u>	<u>Amount</u>
194	24,273	239	47,016
195	20,753	240	33,725
196	22,827	241	1,031
197	24,862	242	633
198	1,324	243	4,179
199	8,855	244	1,274
200	20,089	245	1,034
201	50,454	246	15,114
202	16,916	248	476
203	3,759	249	782
204	11,123	250	12,741
205	1,229	251	14,086
206	(- 1,818)	252	56,178
207	N/C	253	20,485
208	77,379	254	5,833
210	3,290	255	2,714
211	1,172	256	6,411
212	1,051	257	22,484
213	28,041	258	769
214	6,715	259	59,541
215	2,013	260	(- 350)
216	3,708	261	23,166
217	538	266	4,202
219	(- 652)	268	697
220	524	269	9,088

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<u>Mod.No.</u>	<u>Amount</u>	<u>Mod.No.</u>	<u>Amount</u>
270	52,000	307	12,423
271	(- 62,865)	308	700
272	11,280	309	(- 2,500)
275	27,006	310	4,666
276	15,735	314	49,181
277	81,055	316	4,143
278	8,076		
281	9,130	TOTAL	\$ 2,284,633
283	3,371		
288	2,868		
291	31,917		
292	12,785		
295	10,418		
296	1,330		
297	40,770		
298	3,498		
299	60,000		
300	8,461		
301	2,974		
302	4,141		
303	7,525		
304	4,892		
305	6,521		
306	4,674		

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Five Remaining Open Modifications:

84 No. 276 - Validation Tests in Addition to Contract Requirements  
at Complex 1A

The Government feels that the original contract provided for validating of all systems for the launcher complexes and its components for the entire job. The Government subsequently revised, clarified and refined the validation test plan for the above by this modification. The contractor claims the Government revamped the testing over and above the original contract requirement and therefore disagreement exists. Proposed Amount \$500,000.

84 No. 379 - Modification to Fire Water Systems, 3 Complexes

Design deficiencies required replacement of the fire water jockey pumps, conversion of fire water control valves and correction of electrical circuit systems. Therefore it was necessary to correct the above deficiencies. Proposed Amount \$55,000.

84 No. 385 - Modifications to Fire Water Control Facilities,  
3 Complexes and P 1, P 3 and P 5 Tests.

This modification includes the installation of piping and electrical controls in the Missile Silos to carry out the P-11 validation test which is designed to verify the function of the complete fire water protection system which replaces the P 1, P 3 and P 5 tests. Proposed Amount \$250,000.



MOD. NO.	DESCRIPTION
184	Revised Slide Plate between Pipe Chase Slab and Generator Slab in Powerhouse
185	Revised Installation of Bench Marks Provided for Mods. Nos. 97 and 143 in Missile Silos Walls, 3 Complexes
186	Revise Water Ring Header "E" through LOX Crib Elevation: 66In Missile Silos
187	Re-route 2" JSN-511 Line to Clear 3" GSN-522 Line and Ring Header E Missile Silos
188	Re-locate AC Duct in Missile Silos to Clear Conduits
189	Revise LOX Level Instrumentation on LOX Storage Tank, PLS, 3 Complexes
190	Resolve Conflicts Between PLS Piping Structural and Support Members, 3 Complexes
191	Revise Installation of Cylinder Shock Mounts in the Antenna Silos, 3 Complexes
192	Reverse or Rebuild Doors to East Antenna Silo -Complex 1A
193	Miscellaneous Electrical Changes in Control Center and Powerhouse
194	Revised Installation of PLS Piping Supports and Braces in Tunnel Junction No. 12
195	Additional Supports in Air Intake Tunnel and Add Neoprene Seals 1A and 1C
196	Revise Installation of Air Conditioning Ducts in Antenna Silos, 3 Sites and Air Duct Support, Antenna Silos
197	Relocate Vertical Domestic Water, Waste and Vent Lines in Equipment Terminals
198	Install 1½ inch Check Valve and a 3 inch Gate Valve in RW Line in Powerhouse
199	Revise Meter for Fuel Oil Consumption of Diesel Generators in Powerhouse
200	Revised Installation of Supports for Fog Nozzles in Missile Silos
201	Remove, Clean and Reinstall Diesel Engine Lub Oil Piping

MOD. NO.      DESCRIPTION

- 202 Relocate Diesel Engine Crankcase Blowers
- 203 Revise Framing for PLS Piping Guide G-320-57 in Propellant Terminal - 3 Complexes
- 204 Clean at Job Site Installed Tank T-110
- 205 1/2" Checkered Splice Plate at Entrance to Entry Portal from Personnel Tunnel in Lieu 5/8" Plate, 3 complexes
- 206 Delete Plugging of Access Hole to Equipment Terminal and Sand Backfill. Place Plug 30' from Opening
- 207 Extension of Time - Portion of Structure All Sites
- 208 Changes to Installed Facilities in Antenna Silos to Conform to Associate Contractor Equipment
- 209 Formerly Claim No. C-2-Reimbursement for Latent Conditions
- 210 Revise Pump Base Bed Plates in Powerhouse
- 211 Revise Location of J-Box for Weather Instrument Indicator-Control Centers and Revise Sub-Floor Ladders in Powerhouse Air Intake
- 212 Revise Cable Supports of F.P.E. Switchgear to Handle 2-3 Conductor Cables instead of 3 Conductors
- 213 Relocate Vertical Drain Lines at El 85 in Missile Silo and Relocate 6" Contaminated Waste and 4" Firing Seal Drain Lines in Missile Silo
- 214 Clean the Diesel Engine Lube Oil Supply and Return Line in Powerhouse
- 215 Filter Screens over Air Intake Filters for Diesel Generators in Powerhouse, 3 Complexes
- 216 Revise Supports for Lines to AC-1 and 2 A.T.; Revise Support 730-51 and Rack #3, Propellant Terminal
- 217 Revised Certain Floor Cutouts in Antenna Terminal
- 218 Validation Testing
- 219 Revise Fuel Transfer Pumps in Powerhouse
- 220 Add Anchor Bolts to Communication Covers

MOD. NO.	DESCRIPTION
221	Pull Additional Wires in Conduit for Fire Water Control in Missile Silos and Personnel Tunnel
222	Paint Checkered Floor Plate in Air Filtration Structures in Lieu of Galvanizing
223	Add Four Dowels to Each Portal Silo Door Clevis Plate
224	Increase Width of Partition at Elevator Gates in Antenna Silos
225	Relocate Fuel Sensor from Fuel Storage to Tunnel Junction #12
226	Miscellaneous Changes in Specified Structures Exclusive of Antenna Silo
227	Labor, Material and Equipment to Adjust Nordberg Generators and F.P. Switchgear
228	Resolve Minor PLS System Interferences - 3 Complexes
229	Revise Routing of 3/4" JSH-610 Line in the Propellant Terminals, 3 Complexes
230	Additional Relays for Waste Pumps and Revise Level Controller in M.S.
231	Add Sealer over Insulation in the LOX Tunnel and Stacks
232	Add Bracing to Platform for Accumulators in Entry Portal
233	Iron Guards Around Diesel Generator Concrete Pads, Powerhouse 1A
234	Install IR Detector-3 Sites
235	Radiologically Examine all Welds of the Entry Portal Hydraulic Piping Subject to 1000 psi or more
236	Add Drip Pan Above Switchgear in Powerhouse
237	Drill Holes in Powerhouse 1A for Bench Marks and Temperature Facilities
238	Above ground Radiation Detectors w/range 0-5000 in lieu of .01 to 10,000 roentgens

<u>MOD. NO.</u>	<u>DESCRIPTION</u>
239	Change Procurement and Delivery of Testing Media
240	Pickle All Fuel Oil Piping, 3 Complexes
241	Install Auxiliary Drain Pump Between Lines in B.L.#1B
242	Correction of Interference Encountered During Construction, All Sites
243	Revise PLS Guide G-326-54 at all 3 Complexes, P.Terminals
244	Change to Liquid Level Indicator Facilities in PLS Instrumentation
245	Radiologically Examine PLS Line Field Welds
246	Air Eliminator in Cooling Tower Pump Suction Line High Point in Powerhouse, 3 Sites
247	Protective Coating T-110 Tanks
248	Annunciator Alarm Panel Windows in Powerhouses-3 Complexes
249	Procure 27 Additional General Duty Fire Sensors - E.T.
250	Reinforce Neoprene Seal at the Fan Housing, Air Intake Structure
251	Revise LOX Tank Bay Pipe Support, 3 Complexes
252	Reimbursement to Contractor for notice to Suspend Work on Entry Portal Facilities and Revise Entry Portal Facilities to Forestall Dropping Door and to Insure Proper Door Operation
253	Additional Test Requirements for PLS(Fuel System) Low Pressure Nitrogen Blanket Piping
254	Revise Diagonal Bracing in LOX Crib in Missile Silos
255	Relocate Electrical Facilities due to Interference with Pipe Supports in Missile Silo
256	Revise Explosion Defecting Blast Valves Circuits and Over-ride Interlock Panels
257	Relocations to Pipe, Conduit and other Facilities to Eliminate Conflicts

MOD. NO.	DESCRIPTION
258	Wheel on Security Fencing Sliding Gate All Sites
259	Add New Pipe Supports on PLS System Piping -3 Complexes
260	Delete Sandfill in Propellant Terminal Roof Access Shafts, All Sites
261	Revise Pipe Supports-PLS
262	Revise Pipe Supports, Tunnel Junction #12, Revise RP-1 Fuel Systems, 3 Complexes
263	Vermiculite Concrete Fill-Tunnel Invert at Connections to Structures, 3 Complexes
264	Additional Painting
265	LOX and Fuel Crib Field Changes
266	Field Changes to Eliminate Interference and Conflicts
267	Provide for Contractor Purchasing RPIE Spare Parts for Use During PLS Testing
268	Relocate Control Panel in Air Filtration Structure
269	Install Terminal Strips in Junction Boxes Nos. 1500, 1600, 1601, 1602, 3 Complexes
270	Revise Blast Valves, All Complexes
271	Government to Furnish all Diesel Oil for Tests and Initial Fill of Tanks
272	Revise Pipeline Color Coding in Propellant Terminal, All Sites
273	Relocate Doors 11/13 in Control Centers, 3 Sites
274	Flush RP-1 Fuel Systems; 3 Complexes on Weekends
275	Reclean Tanks T-201, Site 1B and 1C
276	Clean RP-1, T-110 Tank, Site 1A
277	Clean Instrument Air Lines in Propellant Terminal, All Sites